INVESTIGATIVE REPORT CONCERNING FOOTBALLS USED DURING THE AFC CHAMPIONSHIP GAME ON JANUARY 18, 2015

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EXECUTIVE SUMMARY

On January 18, 2015, the New England Patriots and Indianapolis Colts played in the AFC Championship Game at Gillette Stadium in Foxborough, Massachusetts to determine which team would advance to Super Bowl XLIX. During the first half of the game, a question was raised by the Colts concerning the inflation level of the footballs being used by the Patriots. As a result, at halftime, members of the officiating crew assigned to the game, overseen by a senior officiating supervisor from the National Football League (the "NFL" or the "League"), tested the air pressure of footballs being used by each of the Patriots and the Colts. All eleven of the Patriots game balls tested measured below the minimum pressure level of 12.5 pounds per square inch ("psi") allowed by Rule 2 of the Official Playing Rules of the National Football League (the "Playing Rules") on both of two air pressure gauges used to test the balls. The four Colts balls tested each measured within the 12.5 to 13.5 psi range permitted under the Playing Rules on at least one of the gauges used for the tests.

On January 23, 2015, the NFL publicly announced that it had retained Theodore V. Wells, Jr. and the law firm Paul, Weiss, Rifkind, Wharton & Garrison ("Paul, Weiss") to conduct an investigation, together with NFL Executive Vice President Jeff Pash, into the footballs used by the Patriots during the AFC Championship Game. The investigation was conducted pursuant to the Policy on Integrity of the Game & Enforcement of Competitive Rules. That Policy provides that "[a]ctual or suspected competitive violations will be thoroughly and promptly investigated."[1] This Report is the product of that investigation. It was prepared entirely by the Paul, Weiss investigative team and presents the independent opinions of Mr. Wells and his colleagues.

[1] Under the Policy, the "standard of proof required to find that a violation of the competitive rules has occurred" is a "Preponderance of the Evidence," meaning that "as a whole, the fact sought to be proved is more probable than not."

The primary topic of the investigation has been the circumstances surrounding the use by the Patriots of footballs inflated at below-regulation air pressure levels during the AFC Championship Game, including whether Patriots personnel were involved in deliberate efforts to circumvent the Playing Rules. The investigation also has involved an assessment of the circumstances surrounding a possible attempt by the Patriots to introduce to the playing field a non-approved kicking ball during the AFC Championship Game.

For the reasons described in this Report, and after a comprehensive investigation, we have concluded that, in connection with the AFC Championship Game, it is more probable than not that New England Patriots personnel participated in violations of the Playing Rules and were involved in a deliberate effort to circumvent the rules. In particular, we have concluded that it is more probable than not that Jim McNally (the Officials Locker Room attendant for the Patriots) and John Jastremski (an equipment assistant for the Patriots) participated in a deliberate effort to release air from Patriots game balls after the balls were examined by the referee. Based on the evidence, it also is our view that it is more probable than not that Tom Brady (the quarterback for the Patriots) was at least generally aware of the inappropriate activities of McNally and Jastremski involving the release of air from Patriots game balls.

Based on the evidence, the investigation has further concluded that that there was no deliberate attempt by the Patriots to introduce to the playing field a non-approved kicking ball during the AFC Championship Game. Although Patriots personnel provided a kicking ball to game officials that did not have the distinctive inspection mark of the referee, we find that the Patriots personnel involved believed the ball to be authentic and appropriate. We do not believe that there was any attempt by Patriots personnel, including Patriots kicker Stephen Gostkowski, to deliberately circumvent the rules by offering the kicking ball for play.

We do not believe that the evidence establishes that any other Patriots personnel participated in or had knowledge of the violation of the Playing Rules or the deliberate effort to circumvent the rules described in this Report. In particular, we do not believe there was any wrongdoing or knowledge of wrongdoing by Patriots ownership, Patriots Head Coach Bill Belichick or any other Patriots coach in the matters investigated. We also do not believe there was any wrongdoing or knowledge of wrongdoing by Patriots Head Equipment Manager Dave Schoenfeld.

In reaching these conclusions, we have considered, among other things, the following facts that we believe are established by the evidence for the reasons detailed in this Report:

1. Rule 2 of the Official Playing Rules of the NFL requires that footballs used during NFL games must be inflated to between 12.5 and 13.5 psi. In particular, the rule states that "[t]he ball shall be made up of an inflated (12½ to 13½ pounds) urethane bladder enclosed in a pebble grained, leather case (natural tan color) without corrugations of any kind."

2. Several hours before the AFC Championship Game, Jim McNally, the Patriots employee responsible for delivering the Patriots game balls to the game officials for pre-game inspection, brought the balls into the Officials Locker Room at Gillette Stadium. At or around that time, McNally told the referee, Walt Anderson, that Tom Brady, the Patriots quarterback, wanted the game balls inflated at 12.5 psi. McNally has been employed by the Patriots as a seasonal or part-time employee for the past 32 years. His work for the Patriots during the 2014-15 NFL season took place only on a part-time/hourly basis on days on which the Patriots had home games. His legitimate job responsibilities as Officials Locker Room attendant did not involve the preparation, inflation or deflation of Patriots game balls.

3. During the pre-game inspection, Anderson determined that all but two of the Patriots game balls delivered by McNally were properly inflated. Most of them measured 12.5 psi. Two tested below 12.5 psi and Anderson directed another game official to further inflate those two game balls, which Anderson then adjusted to 12.5 psi using a pressure gauge. Most of the Colts game balls tested by Anderson prior to the game measured 13.0 or 13.1 psi. Although one or two footballs may have registered 12.8 or 12.9 psi, it was evident to Anderson that the Colts' inflation target for the game balls was 13.0 psi. No air was added to or

released from the Colts game balls pre-game because they were all within the permissible range.

4. When Anderson and other members of the officiating crew were preparing to leave the Officials Locker Room to head to the field for the start of the game, the game balls could not be located. It was the first time in Anderson's nineteen years as an NFL official that he could not locate the game balls at the start of a game. Unknown to Anderson, and without Anderson's permission or the permission of any other member of the officiating crew, McNally had taken the balls from the Officials Locker Room towards the playing field. According to Anderson and other members of the officiating crew for the AFC Championship Game, the removal of the game balls from the Officials Locker Room by McNally without the permission of the referee or another game official was a breach of standard operating pre-game procedure. According to Anderson, other members of the officiating crew for the AFC Championship Game and other game officials with recent experience at Gillette Stadium, McNally had not previously removed game balls from the Officials Locker Room and taken them to the field without either receiving permission from the game officials or being accompanied by one or more officials.

5. Based on videotape evidence and witness interviews, it has been determined that McNally removed the game balls from the Officials Locker Room at approximately 6:30 p.m. After leaving the Officials Locker Room carrying two large bags of game balls (Patriots balls and Colts balls), McNally turned left and then turned left again to walk down a corridor referred to by Patriots personnel as the "center tunnel" heading to the playing field. At the end of the center tunnel on the left-hand side, approximately three feet from the doors that lead to the playing field, is a bathroom. McNally entered that bathroom with the game balls, locked the door, and remained in the bathroom with the game balls for approximately one minute and forty seconds. He then left the bathroom and took the bags of game balls to the field.

6. In the weeks and months before the AFC Championship Game, McNally periodically exchanged text messages with the Patriots equipment assistant primarily responsible for the preparation of the Patriots game balls, John Jastremski. In a number of those text messages, McNally and Jastremski discussed the air pressure of Patriots game balls, Tom Brady's unhappiness with the inflation level of Patriots game balls, Jastremski's plan to provide McNally with a "needle" for use by McNally, and McNally's requests for "cash" and sneakers together with the "needle" to be provided by Jastremski. A sports ball inflation needle is a device that can be used to inflate a football (if attached to an air pump) or release air from a football (if inserted alone into a ball).

   For example, on October 17, 2014, following a Thursday night game between the Patriots and the New York Jets during which Tom Brady complained angrily about the inflation level of the game balls, McNally and Jastremski exchanged the following text messages:

McNally: Tom sucks...im going make that next ball a fuckin balloon

Jastremski: Talked to him last night. He actually brought you up and said you must have a lot of stress trying to get them done...

Jastremski: I told him it was. He was right though...

Jastremski: I checked some of the balls this morn... The refs fucked us...a few of then were at almost 16

Jastremski: They didnt recheck then after they put air in them

McNally: Fuck tom ...16 is nothing...wait till next sunday

Jastremski: Omg! Spaz

On October 21, 2014, McNally and Jastremski exchanged the following text messages:

McNally: Make sure you blow up the ball to look like a rugby ball so tom can get used to it before sunday

Jastremski: Omg

On October 23, 2014, three days before a Sunday game against the Chicago Bears, Jastremski and McNally exchanged the following messages:

Jastremski: Can't wait to give you your needle this week :)

McNally: Fuck tom....make sure the pump is attached to the needle.....fuckin watermelons coming

Jastremski: So angry

McNally: The only thing deflating sun..is his passing rating

The next day, October 24, 2014, Jastremski and McNally exchanged the following messages:

Jastremski: I have a big needle for u this week

McNally: Better be surrounded by cash and newkicks....or its a rugby sunday

McNally: Fuck tom

Jastremski: Maybe u will have some nice size 11s in ur locker

McNally: Tom must really be working your balls hard this week

On October 25, 2014, McNally and Jastremski exchanged the following messages:

Jastremski: Size 11?

Jastremski: 2 or 3X?

McNally: Tom must really be on you

McNally: 11 0r 11 half.....2x unless its tight fitting

Jastremski: Nah. Hasn't even mentioned it, figured u should get something since he gives u nothing

On January 7, 2015, eleven days before the AFC Championship Game, McNally and Jastremski discussed how McNally would have a "big autograph day" and receive items autographed by Brady the following weekend, before the playoff game against the Baltimore Ravens. McNally and Jastremski exchanged the following text messages:

McNally: Remember to put a couple sweet pig skins ready for tom to sign

Jastremski: U got it kid...big autograph day for you

McNally: Nice throw some kicks in and make it real special

Jastremski: It ur lucky. 11?

McNally: 11 or 11 and half kid

On January 10, 2015, immediately prior to the game between the Patriots and the Ravens, in the Patriots equipment room with both Brady and Jastremski present, McNally received two footballs autographed by Brady and also had Brady autograph a game-worn Patriots jersey that McNally previously had obtained.

7. In addition to the messages described above, before the start of the 2014-15 season, McNally referred to himself as "the deflator" and stated that he was "not going to espn……..yet." On May 9, 2014, McNally and Jastremski exchanged the following text messages:

McNally: You working

Jastremski: Yup

McNally: Nice dude....jimmy needs some kicks....lets make a deal.....come on help the deflator

McNally: Chill buddy im just fuckin with you ....im not going to espn.....yet

8. During the second quarter of the AFC Championship Game, a ball thrown by Tom Brady was intercepted by a player for the Colts and the ball was taken to the Colts sideline. On the sideline, Colts equipment personnel used a pressure gauge to measure the inflation level of the ball, determined that it was below the minimum 12.5 psi level and informed a game official and other NFL personnel. Prior to the game, Colts personnel had notified the NFL that they suspected that the Patriots might be deflating game balls below the minimum level permissible under the Playing Rules, although they did not support their suspicions with any specific factual information. In response to the pre-game concerns raised by the Colts, NFL Football Operations staff had notified the head of the NFL Officiating Department, Dean Blandino, and a senior officiating supervisor who would be attending the game, Alberto Riveron. During a pre-game conversation concerning various game-day topics, Riveron told referee Walt Anderson that a concern had been raised about the air pressure of the game balls. Anderson told Riveron that he would be sure to follow his usual ball inspection procedure to ensure that the balls were properly inflated.

9. After being informed during the second quarter of the AFC Championship Game that the Colts had measured a Patriots game ball and found it to be under-inflated, and having previously been advised of the Colts' suspicions, Riveron decided that the game balls for both teams should be inspected at halftime by the game officials. Two other senior NFL personnel present at the game, Troy Vincent and Mike Kensil, independently reached the same conclusion.

10. At halftime, under Riveron's supervision, two alternate game officials (Clete Blakeman and Dyrol Prioleau) tested eleven Patriots game balls and four Colts game balls. The Patriots ball intercepted by the Colts was not among the eleven Patriots balls tested. Each official used a separate air pressure gauge provided by referee Anderson that Anderson had brought with him to the game, one of which also had been used by Anderson for his pre-game inspection. Each of the eleven Patriots balls tested at halftime measured below the minimum 12.5 psi level established by the Playing Rules on both gauges. Each of the four Colts balls tested measured within the permissible 12.5 to 13.5 psi range on at least one of the gauges. The measurements were recorded in writing by Richard Farley, an NFL security official who has been assigned to the Patriots and Gillette Stadium for approximately twelve years. Only four Colts balls were tested because the officials were running out of time before the start of the second half.

Farley recorded the halftime pressure measurements taken by the game officials as follows:

Patriots Ball	Blakeman	Prioleau
1	11.50	11.80
2	10.85	11.20
3	11.15	11.50
4	10.70	11.00
5	11.10	11.45
6	11.60	11.95
7	11.85	12.30
8	11.10	11.55
9	10.95	11.35
10	10.50	10.90
11	10.90	11.35

Colts Ball	Blakeman	Prioleau
1	12.70	12.35
2	12.75	12.30
3	12.50	12.95
4	12.55	12.15

Before halftime ended, all eleven Patriots balls were inflated and set to a permissible pressure level. The four Colts balls tested were not inflated because they measured within the permissible range on at least one of the gauges used at halftime. The fifteen footballs tested, and the balance of the Colts balls collected at halftime, were returned to the field for use in the second half.

The pressure of the Patriots ball that had been intercepted by the Colts was separately tested three times, and the measurements, all of which were below 12.5

psi, were written on athletic tape that had been placed on the ball for identification. The intercepted ball was retained by the NFL and not returned to the field for use in the second half.

11. Following the game, before he left the stadium, McNally was interviewed by members of NFL Security. During that interview, McNally did not mention that he had taken the game balls into the bathroom. Instead, he stated that he walked directly to the field and that nothing unusual occurred during the walk from the locker room to the field. In subsequent interviews, McNally provided varying explanations for the bathroom stop and his decision not to utilize readily available bathroom facilities in the Officials Locker Room and adjacent Chain Gang Locker Room.

As part of the investigation, scientific consultants were engaged to assist the investigative team. These consultants included Exponent, one of the leading scientific and engineering consulting firms in the country, and Dr. Daniel R. Marlow, the Evans Crawford 1911 Professor of Physics at Princeton University and former Chairman of the Princeton University Physics Department, who served as a special scientific consultant, coordinated with Exponent on its testing and analytical work, and advised the investigative team.

Among the issues discussed with our expert consultants was the magnitude of the reduction in air pressure of the Patriots footballs and the apparent greater drop in air pressure of the Patriots balls as compared to the Colts balls when tested at halftime. All of the game balls tested at halftime measured at lower pressure levels as compared to the pressure levels measured prior to the game. Our consultants confirmed that a reduction in air pressure is a natural result of footballs moving from a relatively warm environment such as a locker room to a colder environment such as a playing field. According to our scientific consultants, however, the reduction in pressure of the Patriots game balls cannot be explained completely by basic scientific principles, such as the Ideal Gas Law, based on the circumstances and conditions likely to have been present on the day of the AFC Championship Game. In addition, the average pressure drop of the Patriots game balls exceeded the average pressure drop of the Colts balls by

0.45 to 1.02 psi, depending on various possible assumptions regarding the gauges used, and assuming an initial pressure of 12.5 psi for the Patriots balls and 13.0 psi for the Colts balls.

We asked Exponent to evaluate, among other things, the data collected at halftime and consider whether the data provided a basis to reach any conclusions about the likelihood that Patriots personnel had or had not tampered with the game balls. In particular, we asked Exponent to consider the reliability of the gauges used by the game officials, the potential impact of game-day use and other physical factors that might reasonably be expected to affect the internal air pressure of footballs, and the potential impact of environmental factors that were present on the day of the AFC Championship Game. As part of its evaluation and assessment Exponent: (1) conducted a thorough statistical analysis of the data recorded at halftime of the AFC Championship Game; (2) conducted a comprehensive examination, both physical and statistical, of the gauges used to measure the air pressure of the footballs pre-game and at halftime and (3) evaluated the effects that various usage, physical and environmental factors present on game day would have had on the measured pressure of a football.

According to Exponent, regardless of the assumptions made with respect to the gauges used pre-game and at halftime, the measurements recorded for the Patriots game balls at halftime cannot be entirely explained by the Ideal Gas Law (or variations thereof) when applied to the most likely game conditions and circumstances. Exponent also concluded that the difference in the magnitude of the reduction in air pressure between the Patriots and Colts footballs based on the halftime measurements is statistically significant. Dr. Marlow agreed with Exponent's conclusions.

In addition, Exponent found that the gauges used on the day of the AFC Championship Game appear to have worked reliably and consistently. Exponent further

concluded that the difference in the pressure drops between the teams was not caused by a malfunction of either gauge or by "human factors" (*i.e.*, variability caused by the particular individual who used the gauge). Based on extensive testing, Exponent determined that the gauges would have read consistently and with good repeatability when used in the range of temperatures to which they were exposed in the Officials Locker Room and when used to measure a range of pressures that includes those measured on game day.

Based on tests designed to evaluate the impact of a variety of physical factors on the air pressure of footballs, Exponent ruled out as factors that impacted the pressure levels measured at halftime variations in the way a football is used (*i.e.*, the amount of impact a football has sustained) and differences in ball preparation—including the vigorous rubbing described by Coach Belichick during his January 24, 2015 press conference. Among other things, Exponent also ruled out as factors that impact air pressure levels the repeated insertion of an inflation needle or gauge, the natural leak rate of properly functioning footballs and the relative humidity of the air in the rooms in which the footballs were inflated. None of the physical factors tested by Exponent, at the levels applicable on the day of the AFC Championship Game, were found to contribute in any material way to changes in the internal pressure of footballs or to the difference in the observed pressure drops between the Patriots and Colts balls when measured at halftime.

Exponent also conducted a series of experiments to evaluate the impact of environmental conditions on the air pressure of footballs. Among other things, these experiments attempted to replicate the likely conditions and circumstances on game day and the results recorded by the game officials at halftime. In these experiments, the Colts footballs and the Colts halftime measurements were used as a "control" group because there was no plausible basis on which to believe there had been tampering with the Colts balls. According to Exponent,

the environmental conditions with the most significant impact on the pressure measurements recorded at halftime were the temperature in the Officials Locker Room when the game balls were tested prior to the game and at halftime, the temperature on the field during the first half of the game, the amount of time elapsed between when the game balls were brought back to the Officials Locker Room at halftime and when they were tested, and whether the game balls were wet or dry when they were tested at halftime. Based on these experiments, Exponent concluded that the average pressures recorded for the Patriots game balls during halftime of the AFC Championship Game were lower than the lowest average pressures attained by the simulations. In other words, when tests were run using the most likely game-day conditions and circumstances, the Patriots halftime measurements could not be replicated, and the pressures observed for the Patriots footballs by Exponent during its experiments were all higher.

Finally, Exponent was asked to investigate how quickly an individual can partially deflate thirteen footballs in a ball bag using a sports ball inflation needle, if that individual is reasonably experienced in performing that task. Based on a series of simulations, Exponent determined that the air pressure in thirteen footballs could be readily released using a needle in well under one minute and forty seconds.

Our scientific consultants informed us that the data alone did not provide a basis for them to determine with absolute certainty whether there was or was not tampering, as the analysis of such data is ultimately dependent upon assumptions and information that is uncertain. Based on the testing and analysis, however, Exponent concluded that, within the range of likely game conditions and circumstances studied, they could identify no set of credible environmental or physical factors that completely accounts for the Patriots halftime measurements or for the additional loss in air pressure exhibited by the Patriots game balls, as compared to the loss in air

pressure exhibited by the Colts game balls. Dr. Marlow agreed with this and all of Exponent's conclusions. This absence of a credible scientific explanation for the Patriots halftime measurements tends to support a finding that human intervention may account for the additional loss of pressure exhibited by the Patriots balls.

In reaching the conclusions set forth in this Report, we are mindful that the analyses performed by our scientific consultants necessarily rely on reasoned assumptions and that varying the applicable assumptions can have a material impact on the ultimate conclusions. We therefore have been careful not to give undue weight to the experimental results and have instead relied on the totality of the evidence developed during the investigation. Even putting aside the experimental results, we believe that our conclusions are supported by the evidence in its entirety.

Our conclusion that it is more probable than not that McNally and Jastremski participated in a deliberate effort to release air from Patriots game balls after the balls were tested by the game officials is significantly influenced by the substantial number of communications and events consistent with such a finding, including that the *same person* (Jim McNally) referred to himself as the "deflator" and stated that he was "not going to espn……..yet," was involved in a series of communications about his impact on the inflation-level of Patriots game balls and using a "needle" surrounded by cash and sneakers (when his legitimate responsibilities as a locker room attendant did not involve the preparation, inflation or deflation of footballs), violated standard pre-game procedure by removing the game balls from the Officials Locker Room without permission of the game officials, brought the game balls into a bathroom before the game (for a period long enough to deflate them), and received valuable items autographed by Tom Brady the week before the AFC Championship Game. Similarly, the evidence establishes

that John Jastremski knew that McNally had referred to himself as the "deflator" and stated that he was "not going to espn……..yet," was involved personally in a series of communications with McNally about the inflation and deflation of footballs using a "needle" and providing McNally with a "needle," was involved in providing McNally with items of value, and had himself received a particularly valuable autograph from Brady earlier in the season. In addition, Jastremski spoke with McNally almost immediately when suspicions first arose (speaking by telephone three times in the hours after the game for a total of 37 minutes and 11 seconds) and communicated with Brady by telephone or text message with significantly increased frequency in the following days, as described below.

The confluence of communications and events considered included:

- The text messages between McNally and Jastremski discussing:
    - The inflation level of Patriots footballs and McNally's impact on the inflation level of the balls ("im going make that next ball a fuckin balloon"; "Make sure you blow up the ball to look like a rugby ball so tom can get used to it before Sunday"; "16 is nothing...wait till next sunday");
    - Jastremski's plan to provide McNally with a "needle" for use by McNally ("Can't wait to give you your needle this week :)"; "Fuck tom....make sure the pump is attached to the needle.....fuckin watermelons coming");
    - McNally's request that the "needle" be surrounded by cash and new sneakers and other items of value to be received by McNally ("Better be surrounded by cash and newkicks....or its a rugby sunday"; "Maybe u will have some nice size 11s in ur locker"; "Remember to put a couple sweet pig skins ready for tom to sign"; "U got it kid...big autograph day for you"; "Nice throw some kicks in and make it real special");
    - McNally's references to Brady as the catalyst for Jastremski's offers of sneakers and clothing ("Tom must really be working your balls hard this week"; "Tom must really be on you"); and

- That game balls for a Sunday game would not be deflated because of anger at Brady ("The only thing deflating sun..is his passing rating").

- Text messages most plausibly read as describing a conversation between Jastremski and Brady during which Brady mentioned McNally and said that McNally must have "a lot of stress" trying to get the footballs "done" ("Talked to him last night. He actually brought you up and said you must have a lot of stress trying to get them done...").

- Text messages from McNally referring to himself as the "deflator" and suggesting that he might contact the media ("jimmy needs some kicks....lets make a deal.....come on help the deflator"; "Chill buddy im just fuckin with you ....im not going to espn.....yet").

- McNally's knowledge that Brady prefers footballs inflated at the low end of the permissible range and his express request that the referee set the balls at a 12.5 psi level.

- Referee Walt Anderson's inability to locate the game balls at the start of the game (for the first time in nineteen years) and the breach in standard pre-game procedure when McNally removed the game balls from the Officials Locker Room without the permission of the referee or other game officials.

- McNally bringing the game balls into the bathroom during his walk from the Officials Locker Room to the field, locking the door and remaining inside the bathroom with the game balls for approximately one minute and forty seconds, an amount of time sufficient to deflate thirteen footballs using a needle.

- McNally's failure to mention taking the balls into the bathroom in his initial interview with NFL Security and his subsequent varying explanations for the bathroom stop and decision not to utilize readily available bathroom facilities in the Officials Locker Room and the adjacent Chain Gang Room.

- McNally's receipt on January 10, 2015, in the Patriots equipment room with both Brady and Jastremski present, of two footballs autographed by Brady and Brady's autograph on a game-worn jersey, and Jastremski's receipt earlier in the season of a particularly valuable autograph from Brady.

- The timing and frequency of the telephone communications between Jastremski and McNally, as well as Jastremski and Brady, immediately after suspicions of ball tampering were raised by NFL Security and in media reports.

Indeed, in our view, a contrary conclusion requires the acceptance of an implausible number of communications and events as benign coincidences. Although we believe that a number of the communications between Jastremski and McNally were attempts at humor, based on the evidence and the communications in their entirety, we believe that McNally and Jastremski were joking about events in which they were actually participating that involved the deflation of footballs in violation of the Playing Rules.

When interviewed, McNally claimed, among other things, that he brings game balls to the field when he deems fit, that he generally does not receive permission from or inform the game officials before leaving the Officials Locker Room and taking game balls to the field and that he often has taken game balls into the tunnel bathroom near the entrance to the playing field. We do not find these claims plausible and they were contradicted by other evidence developed during the investigation. Counsel for the Patriots also contended that the text messages between McNally and Jastremski referring to the inflation levels of footballs and related topics were not serious and should be seen as nothing more than attempts at humor and hyperbole. We also find these claims not plausible. As noted above and described more fully in the Report, we believe that although a number of the communications between McNally and Jastremski were attempts at humor, McNally and Jastremski were making jokes based on actual events.

Our conclusions with respect to Tom Brady also are based on an analysis of the substantial and credible evidence. The evidence does not allow us to reach conclusions as to when McNally and Jastremski began their efforts to release air from Patriots game balls on game day (although McNally referred to himself as "the deflator" prior to the start of the 2014-15 season), exactly how long those efforts have been ongoing, how frequently they occurred, how

the idea originated or the full scope of communications related to those efforts. We also note that there is less direct evidence linking Brady to tampering activities than either McNally or Jastremski. We nevertheless believe, based on the totality of the evidence, that it is more probable than not that Brady was at least generally aware of the inappropriate activities of McNally and Jastremski involving the release of air from Patriots game balls. Evidence of Brady's awareness appears in text communications between McNally and Jastremski. For example, in text messages exchanged with McNally in October 2014 discussing Brady's unhappiness with the inflation level of Patriots game balls, Jastremski told McNally that "[h]e actually brought you up" and "said you must have a lot of stress trying to get them done." In relevant part, the text message exchange stated:

> McNally: Tom sucks...im going make that next ball a fuckin balloon
>
> Jastremski: Talked to him last night. He actually brought you up and said you must have a lot of stress trying to get them done...
>
> Jastremski: I told him it was. He was right though...
>
> Jastremski: I checked some of the balls this morn... The refs fucked us...a few of then were at almost 16

We believe that the most plausible reading of this exchange, based on the context and the evidence, is that Brady "brought up" McNally, told Jastremski that McNally "must have a lot of stress trying" to get the footballs "done" and that Jastremski told Brady that it was stressful for McNally. Jastremski's text message thus attributes to Brady knowledge of McNally's efforts to get the footballs "done" and the stress involved. We reject as implausible the reading offered by Jastremski, McNally and counsel for the Patriots that certain portions of this exchange refer to a person other than Brady.

Moreover, taking the text messages as a whole, Brady is a constant reference point in the discussions between McNally and Jastremski about inflation, deflation, needles and

items to be received by McNally. In response to Jastremski's offers of sneakers and clothing, for example, McNally identifies Brady as the catalyst for those offers ("Tom must really be working your balls hard this week"; "Tom must really be on you"). And unhappiness with Brady is referenced by McNally as a reason for using the "needle" to inflate rather than deflate footballs ("Fuck tom....make sure the pump is attached to the needle.....fuckin watermelons coming"). Brady is thus central to the discussions of inflation and deflation in the text messages.

Additional evidence of Brady's awareness includes a material increase in the frequency of telephone and text communications between Brady and Jastremski shortly after suspicions of ball tampering became public on January 19. After not communicating by telephone or text message for more than six months (based on data retrieved from Jastremski's cell phone), Brady and Jastremski spoke by telephone at least twice on January 19 (calls lasting a total of 25 minutes and 2 seconds), twice on January 20 (calls lasting a total of 9 minutes and 55 seconds) and twice on January 21 (calls lasting a total of 20 minutes and 52 seconds) before Jastremski surrendered his cell phone to the Patriots later that day for forensic imaging. These calls included conversations relatively early during the mornings of January 19 (7:26 a.m. for 13 minutes and 4 seconds), January 20 (8:22 a.m. for 6 minutes and 21 seconds) and January 21 (7:38 a.m. for 13 minutes and 47 seconds). Brady also took the unprecedented step of inviting Jastremski to the QB room (essentially Brady's office) in Gillette Stadium on January 19 for the first and only time that Jastremski can recall during his twenty-year career with the Patriots, and Brady sent Jastremski text messages seemingly designed to calm Jastremski ("You good Jonny boy?"; "You doing good?"). For his part, Jastremski sent Brady text messages confirming that he was okay ("Still nervous; so far so good though") and cautioning Brady about questioning

("FYI...Dave will be picking your brain later about it. He's not accusing me, or anyone...trying to get to bottom of it. He knows it's unrealistic you did it yourself...").

In addition, we believe it is unlikely that an equipment assistant and a locker room attendant would deflate game balls without Brady's knowledge and approval. Based on our interviews and assessment of McNally and Jastremski, we also do not believe that they would personally and unilaterally engage in such conduct in the absence of Brady's awareness and consent.

Brady has also acknowledged publicly that he likes game balls inflated at the low end of the permissible range. The inflation level of game balls clearly is important to Brady, as demonstrated by his reaction when he believed that game balls were inflated at an undesirable level. In addition, Brady personally was involved in the 2006 rule change that allowed visiting teams to prepare game balls in accordance with the preferences of their quarterbacks. During the process of advocating that rule change, it is reasonable to infer that Brady was likely to be (or become) familiar with the NFL rules regarding game balls, including the 12.5 psi minimum inflation level, although Brady denies having been aware of Rule 2 or the minimum inflation level until 2014 (despite approximately fourteen years as an NFL quarterback).

During his interview, Brady denied any knowledge of or involvement in any efforts to deflate game balls after the pre-game inspection by the game officials. He claimed that prior to the events surrounding the AFC Championship Game, he did not know McNally's name or anything about McNally's game-day responsibilities, including whether McNally had any role relating to game balls or the game officials. We found these claims not plausible and contradicted by other evidence. In fact, during his interview, Jastremski acknowledged that Brady knew McNally and McNally's role as Officials Locker Room attendant. Similarly,

McNally told NFL Security that he had been personally told by Brady of Brady's inflation level preference.

In sum, with respect to all of our conclusions regarding the Patriots, McNally, Jastremski and Brady, we believe that the totality of the evidence, including the text communications, McNally's breach of pre-game procedure, McNally's disappearance into a locked bathroom with the game balls for a period of time sufficient to deflate the Patriots game balls using a needle, the post-game communications between Jastremski and McNally, the increase in the frequency of text and telephone communications between Jastremski and Brady post-game, the halftime data showing a larger reduction in air pressure in the Patriots balls as compared to the Colts game balls, which our scientific consultants inform us is statistically significant, together with other facts developed during the investigation and set forth in this Report support our conclusions.

* * *

The Patriots provided cooperation throughout the investigation, including by making personnel and information available to us upon request. Counsel for the Patriots, however, refused to make Jim McNally available for a follow-up interview requested by our investigative team on what we believed were important topics, despite our offer to meet at any time and location that would be convenient for McNally. Counsel for the Patriots apparently refused even to inform McNally of our request. We believe the failure by the Patriots and its counsel to produce McNally for the requested follow-up interview violated the club's obligations to cooperate with the investigation under the Policy on Integrity of the Game & Enforcement of League Rules and was inconsistent with public statements made by the Patriots pledging full cooperation with the investigation.

Similarly, although Tom Brady appeared for a requested interview and answered questions voluntarily, he declined to make available any documents or electronic information (including text messages and emails) that we requested, even though those requests were limited to the subject matter of our investigation (such as messages concerning the preparation of game balls, air pressure of balls, inflation of balls or deflation of balls) and we offered to allow Brady's counsel to screen and control the production so that it would be limited strictly to responsive materials and would not involve our taking possession of Brady's telephone or other electronic devices. Our inability to review contemporaneous communications and other documents in Brady's possession and control related to the matters under review potentially limited the discovery of relevant evidence and was not helpful to the investigation.

At various points in the investigation, counsel for the Patriots questioned the integrity and objectivity of game officials, various NFL executives and certain NFL Security representatives present at the AFC Championship Game or otherwise involved in the investigative process. We found no evidence to substantiate the questions raised by counsel. Specifically, we identified no evidence of any bias or unfairness. We believe that the game officials, NFL executives, NFL Security representatives and other members of the NFL staff who participated in the testing of the footballs and the subsequent investigative process acted fairly, properly and responsibly.

I. Investigative Activities

A. Scope of Investigation

On January 23, 2015, NFL Commissioner Roger Goodell publicly announced that the NFL had retained Theodore V. Wells, Jr. and Paul, Weiss to conduct an investigation, together with NFL Executive Vice President Jeff Pash, into whether the footballs used in the AFC Championship Game complied with the specifications set forth in the NFL's Playing Rules. As described by the League, the "goals of the investigation will be to determine the explanation for why footballs used in the game were not in compliance with the playing rules and specifically whether any noncompliance was the result of deliberate action." On January 26, 2015, Mr. Wells issued a statement making clear that the investigation would follow customary investigative procedures and that the results would be shared publicly.

Shortly thereafter, Paul, Weiss retained the Exponent consulting firm ("Exponent") and Dr. Daniel R. Marlow to provide scientific support for the investigation and work under its direction. Neither Exponent nor Dr. Marlow has any pre-existing professional relationship with the NFL, the New England Patriots, the Indianapolis Colts or their employees.

The investigation was conducted pursuant to the Policy on Integrity of the Game & Enforcement of Competitive Rules. In particular, Section 2 of the Policy provides that:

> Actual or suspected competitive violations will be thoroughly and promptly investigated. Any club identifying a violation is required promptly to report the violation, and give its full support and cooperation in any investigation. Failure to cooperate in an investigation shall be considered conduct detrimental to the League and will subject the offending club and responsible individual(s) to appropriate discipline.

Section 4 of the Policy provides that "[t]he standard of proof required to find that a violation of the competitive rules has occurred shall be a Preponderance of the Evidence." As the Policy

makes clear, that "means that, as a whole, the fact sought to be proved is more probable than not."

The NFL did not impose any constraints on the investigation, and provided its full cooperation. League employees, NFL game officials, and representatives of the Indianapolis Colts, the Baltimore Ravens, Wilson Sporting Goods Company ("Wilson") and the unions that represent NFL players and NFL game officials also cooperated in the investigation. The NFL, the Colts and Wilson provided access to various documents and materials.

In addition, the Patriots provided substantial cooperation throughout the investigation, making personnel, documents and other information available to us upon request. As noted herein, this cooperation was subject to an important exception—the refusal by counsel for the Patriots to arrange a requested follow-up interview of Jim McNally by our investigative team. Over the course of the investigation, we maintained close and regular contact with counsel for the Patriots, who also provided us with their views on various aspects of the evidence and suggested certain lines of inquiry. Indeed, counsel for the Patriots sent us dozens of emails, including extensive commentary on witness testimony, video footage, theories of intent, applicable evidentiary standards, scientific data, interpretation of text messages and other topics. Counsel for the Patriots accompanied us on walk-throughs of facilities at Gillette Stadium, suggested witnesses to be interviewed, asked questions of Patriots personnel (and other witnesses they produced for interviews), and presented us with videotaped material and analysis. We incorporated the input and suggestions made by counsel for the Patriots in our interview questioning and analysis as appropriate. We also provided counsel for the Patriots with an overview of the views expressed by our scientific consultants so that they could provide us with

their views on whether there were additional issues or considerations that should be reviewed or analyzed by our consultants.

This Report was prepared entirely by the Paul, Weiss investigative team and presents the independent opinions of Mr. Wells and his colleagues.[2] The conclusions set forth herein were reached only at the end of an extensive and thorough investigation, and are based on the totality of the evidence collected and reviewed. We investigated all matters that we believe were relevant to reaching our conclusions.

B. Witnesses Interviewed

In connection with the investigation, representatives from either Paul, Weiss or NFL Security interviewed the following individuals (some of them more than once), either in person or by telephone:

Person Interviewed	Title
Brad Allen	Referee
Walt Anderson	Referee
Bill Belichick	Head Coach, New England Patriots
Jeff Bergman	Line Judge
Clete Blakeman	Referee
Dean Blandino	VP of Officiating, NFL
Jerome Boger	Referee
Tom Brady	Quarterback, New England Patriots
Mark Briggs	Director of Security, New England Patriots
Milton Britton	Kicking Ball Coordinator for Gillette Stadium, NFL

[2] In addition to Mr. Wells, the Paul, Weiss team included the following attorneys: Brad S. Karp, Lorin L. Reisner, Douglas M. Burns, Amy E. Gold, H. Bola George and Rebecca L. Orel.

Person Interviewed	Title
David Brocher	Ball Boy, New England Patriots
Rita Callendar	Gillette Stadium Game Day Security, Team Ops LLC (Security services affiliate of the New England Patriots)
Gary Cavaletto	Field Judge
Akil Coad	Director of Football Operations and Compliance, NFL
Tony Corrente	Referee
James Daniel	Director of Game Operations, NFL
Scott Edwards	Side Judge
Richard Farley	Security Representative for the New England Patriots, NFL
Keith Ferguson	Back Judge
Paul Galanis	Gillette Stadium Game Day Security, Team Ops LLC
T. David Gardi	SVP of Football Operations, NFL
Brandon Gobbi	Ball Boy, New England Patriots
Corey Goldstein	Ball Boy, New England Patriots
Stephen Gostkowski	Kicker, New England Patriots
Johnny Grier	Northeast Regional Supervisor of Officials, NFL
Ryan Grigson	General Manager, Indianapolis Colts
Dan Grossi	Director of Event Security, NFL
Danny Harlow	Ball Boy, Indianapolis Colts
Kyle James	Ball Boy, Indianapolis Colts
John Jastremski	Equipment Assistant, New England Patriots
Mike Kensil	Vice President of Football Operations, NFL

Person Interviewed	Title
Eric Kerzner	Senior Director of Labor Operations, NFL Management Council
Kevin Krysiak	Global Director of Innovation for Football, Basketball, Soccer and Volleyball, Wilson Sporting Goods Company
Bill Leavy	Referee
Danielle Lee	Former Employee, Game Operations, NFL
Wayne Mackie	Head Linesman
Terry McAulay	Referee
Phil McKinnely	Head Linesman
Jim McNally	Officials Locker Room Attendant, New England Patriots
Greg Meyer	Side Judge
Scott Miller	Former Manager, NFL Auctions
Pete Morelli	Referee
Brenden Murphy	Equipment Assistant and Ball Boy, New England Patriots
Kevin Murphy	General Manager, American Football, Wilson Sporting Goods Company
Berj Najarian	Director of Football/Head Coach Administration, New England Patriots
Scott Novak	Side Judge
Jack Osborne	Security Representative for the Indianapolis Colts, NFL
Carl Paganelli	Umpire
John Parry	Referee
Dean Pees	Defensive Coordinator, Baltimore Ravens
Dyrol Prioleau	Field Judge

Person Interviewed	Title
John Raucci	Director of Investigative Services, NFL
Alberto Riveron	Senior Director of Officiating, NFL
Jerry Rosburg	Special Teams Coordinator/Assistant Head Coach, Baltimore Ravens
Doug Rosenbaum	Field Judge
Dave Schoenfeld	Head Equipment Manager, New England Patriots
Brian Seabrooks	Assistant Equipment Manager, Indianapolis Colts
Jon Scott	Vice President of Equipment Operations, Indianapolis Colts
Steve Stelljes	Head Linesman
Jason Stone	Head of Facilities, New England Patriots
Zach Struck	Equipment Assistant, New England Patriots
Sean Sullivan	Equipment Manager, Indianapolis Colts
Tony Veteri	Head Linesman
Troy Vincent	Executive VP of Football Operations, NFL
Bill Vinovich	Referee
Greg Yette	Back Judge

In addition, we interviewed by telephone, with counsel for the Patriots participating, a close personal friend of John Jastremski's, who, according to the Patriots, would only speak with us on the condition that we not identify him by name. Although we resisted this condition, we ultimately agreed so that we could gain access to this witness. This individual is referred to herein as "Jastremski's Friend" or "JF."

Counsel for the Patriots participated in all interviews of Patriots personnel conducted by Paul, Weiss. Counsel for the Colts likewise participated in all interviews of Colts

personnel by Paul, Weiss, and counsel for the Ravens participated in our interview of a Ravens coach. No other witnesses were separately represented by counsel during their interviews, although agents and lawyers for Tom Brady attended his interview and a representative from the National Football League Players Association attended our interview of Stephen Gostkowski. No limits were placed on the questions that could be raised during the interviews.

As noted, there was a significant exception to the cooperation provided by the Patriots. Although we requested a follow-up interview of Jim McNally after our initial interview, counsel for the Patriots refused our request. We offered to conduct the interview at any time or location that would be convenient for McNally, and explained—both in writing and in-person during other meetings—that our follow-up questions would be limited to subject matter directly relevant to the investigation that was developed following our initial interview with McNally. McNally was one of the earliest Patriots personnel interviewed by our investigative team and a number of important follow-up questions had arisen based on subsequent interviews and information discovered after our initial interview of McNally. Counsel for the Patriots, however, declined to produce McNally, and communicated an unwillingness even to advise McNally of our request for a follow-up interview. We do not know definitively whether McNally was, in fact, informed of our request. The investigative process would have benefited from further questioning of McNally on certain topics, and we believe that the actions of the Patriots and their counsel in this regard are inconsistent both with the club's public pronouncements of full cooperation with the investigation and its obligations under Section 2 of the Policy on Integrity of the Game & Enforcement of Competitive Rules.[3] The

[3] We made written requests to counsel for the Patriots on February 28, March 2, 3, 9 and 17 for a follow-up interview with McNally. Counsel for the Patriots repeatedly refused to make McNally available for a re-interview claiming, among other things, that McNally lived more than an hour away and already had missed work at his full-time job to attend earlier interviews. In addition, counsel for the Patriots asked that we provide

findings set forth herein are nevertheless supported firmly and thoroughly by the evidence and information available to us during the course of our work.

C. Materials Reviewed

In addition to witness interviews, we collected and reviewed a broad range of materials during the course of our investigation, including the following:

- Air Pressure Data. We analyzed data concerning the air pressure levels of footballs used by the Patriots and the Colts during the AFC Championship Game.

- Footballs, Gauges and Other Equipment. We examined many of the footballs used during the AFC Championship Game, as well as the gauges used to test the air pressure of those balls on the day of the game. We also examined air pumps and other game equipment provided to us by the Patriots and NFL game officials.

- Security and Game Footage. We received certain game and sideline footage of the AFC Championship Game from the NFL. In addition, we received from the Patriots video footage from January 18, 2015 captured by security cameras at Gillette Stadium.[4]

- Text Messages and Call Logs. The NFL retained Renaissance Associates, an investigative firm with extensive forensic expertise, to retrieve data (including text messages, contact information and telephone call logs) from the Patriots-provided mobile phones of certain Patriots personnel. These mobile phones were provided directly to Renaissance Associates by

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in advance the subjects we proposed to cover, submit written interrogatories, and stated that "you have given me very little incentive or basis to try to get him back once more." As noted above, we offered to meet with McNally at any time and any location that was convenient and explained that it would not be appropriate from an investigative standpoint to disclose in advance the specific subjects we intended to cover. We cautioned counsel for the Patriots in writing that: the "refusal to make Mr. McNally available for a brief follow-up interview raises serious concerns and is inconsistent with the obligations of the Patriots under the League Rules to provide 'full support and cooperation' in the investigation. We also believe it is inconsistent with the public expressions of cooperation by the Patriots." Counsel for the Patriots continued to refuse to make McNally available as requested.

[4] The security footage collected from inside Gillette Stadium proved helpful in establishing the timing of certain events on the day of the AFC Championship Game. Our ability to rely on this footage, however, was limited in a number of ways. First, because the footage was recorded by a camera that rotates among different angles, certain events were not recorded or were only partially captured on video. Second, the security cameras trained on the field were located at a distance that made it difficult to ascertain various events taking place on the field. Finally, Patriots personnel explained that the footage captured by security cameras in Gillette Stadium is overwritten every 10 days as a regular practice. We were, therefore, unable to review footage filmed during prior Patriots home games, which may have proved useful.

the Patriots.[5] The Patriots also provided copies of select text messages and a call log retrieved from Jim McNally's personal mobile phone, which had not been provided to Renaissance Associates.

- Emails. The NFL, the Patriots and the Colts provided copies of various email communications in their custody, control and possession.

- League Rules and Policies. We reviewed relevant portions of the NFL's Official Playing Rules and Policy Manual for Member Clubs (Game Operations), as well as various policy memoranda and guidelines distributed by the NFL to its employees and member clubs.

- Weather Data. We, together with Exponent, analyzed weather data collected at Gillette Stadium on the day of the AFC Championship Game.

- Internal Temperature Data. We, together with Exponent, analyzed the parameters of the heating and cooling system at Gillette Stadium, as well as temperature data collected from various locations inside the stadium.

- Emails Received from the Public. Given the widespread media coverage of the AFC Championship Game and the issues under investigation, we received dozens of unsolicited emails from members of the general public, including numerous scientists. To the extent those emails addressed issues relevant to our scientific analysis, they also were reviewed by our experts.

- Other Materials. We reviewed pertinent news articles and commentary, as well as the transcripts of press conferences and interviews that have taken place since the AFC Championship Game, among other materials.

We did not receive, and were therefore unable to review, all of the materials we requested or deemed relevant. In particular, we requested electronically stored information, including emails and text messages, from several individuals who declined our request. Of note, Tom Brady was asked to provide emails and text messages in response to narrowly tailored requests pertinent to the subject of our investigation. Brady declined our request. Stephen

[5] On January 21 and 22, 2015, Renaissance Associates collected from counsel for the Patriots the Patriots-provided mobile phones used by John Jastremski, Brenden Murphy, Zach Struck, Dave Schoenfeld and Berj Najarian. Renaissance created forensic images of the phones for the purpose of extracting data concerning electronic communications made or received using those phones. Unless otherwise indicated, the information about text messages and phone calls presented in this Report consists of data retrieved from Jastremski's phone. In certain instances, the information concerning the timing of text messages or length of phone calls retrieved from Jastremski's phone, as cited in this Report, differed by up to 30 seconds from information provided by the Patriots regarding Jim McNally's phone. We do not view these differences as material to this Report and do not list them herein.

Gostkowski declined a similar request for pertinent electronic communications, but, unlike Brady, we did not press our request to him because his communications were not viewed as central to our work. Jastremski's Friend also declined our request to review text messages he exchanged with Jastremski during the relevant time period concerning the matters under investigation.

D. Expert Consultation

As noted above, Paul, Weiss retained Exponent to assist with our investigation. Exponent is one of the leading scientific and engineering consulting firms in the country. It has approximately 900 scientists, physicians, engineers, and regulatory consultants on staff in twenty offices throughout the United States as well as five offices overseas. The Exponent team was led by Dr. Robert Caligiuri, who was assisted by Dr. Gabriel Ganot, Dr. John Pye and Dr. Duane Steffey. Dr. Caligiuri has a background in both materials science and mechanical engineering. He specializes in analyzing the mechanical and metallurgical causes of failures in structures and engineered systems, including consumer products, and has been qualified as a testifying witness in more than thirty legal proceedings and retained as a consultant in hundreds of matters. Team members with expertise in statistics, experimental testing, and data analysis supported Dr. Caligiuri in his work.

Exponent analyzed pressure data collected at halftime on the day of the AFC Championship Game, and conducted a series of experiments designed to evaluate the impact of environmental and other conditions on the air pressure levels of footballs to determine whether the reduction in air pressure levels recorded during the AFC Championship Game was more likely the result of environmental and natural factors as opposed to human intervention. A summary of the work performed and conclusions reached by Exponent is set forth in Section VII below, and Exponent's full reports are attached as Appendices 1 and 2.

Paul, Weiss also retained Dr. Daniel R. Marlow, a tenured professor of Physics at Princeton University and former Chairman of the Physics Department. Dr. Marlow served as a special scientific consultant, reviewing and advising on the analysis and experimental work performed by Exponent. Dr. Marlow has more than 35 years of experience in experimental research and teaching experimental physics. He has published more than 400 papers in refereed scientific journals.

II. Background

A. Rules and Practices Regarding Footballs Used in NFL Games

1. Playing Rule 2

NFL Playing Rule 2, Section 1, establishes requirements for the shape, dimensions, pressure level and component materials of game balls. Under the rule, footballs used during NFL games must be inflated to between 12.5 and 13.5 psi. The rule states, in pertinent part:

> The Ball must be a "Wilson," hand selected, bearing the signature of the Commissioner of the League …. The ball shall be made up of an inflated (12½ to 13½ pounds) urethane bladder enclosed in a pebble grained, leather case (natural tan color) without corrugations of any kind.

These provisions have remained relatively consistent since at least 1940.

In addition, Rule 2 provides that the "Referee shall be the sole judge as to whether all balls offered for play comply with these specifications . . . and the balls shall remain under the supervision of the Referee until they are delivered to the ball attendant just prior to the start of the game." Although the term "ball attendant" is not defined in the rule, each NFL game official asked about the rule during the investigation reported that he understood the term to refer to the ball boys who are responsible for providing balls for play during the course of a game. This

interpretation is consistent with a subsequent reference to "attendants" in Rule 2, and was confirmed by Dean Blandino, the most senior member of the NFL Officiating Department.[6]

Rule 2, Section 2 also establishes the following procedures for the supply and testing of footballs prior to use in games:

> Each team will make 12 primary balls available for testing by the Referee two hours and 15 minutes prior to the starting time of the game to meet League requirements. The home team will also make 12 backup balls available for testing in all stadiums. In addition, the visitors, at their discretion, may bring 12 backup balls to be tested by the Referee for games held in outdoor stadiums. For all games, six new footballs, sealed in a special box and shipped by the manufacturer to the Referee, will be opened in the officials' locker room two hours and 15 minutes prior to the starting time of the game. These balls are to be specially marked by the Referee and used exclusively for the kicking game.

Apart from changes to the number of kicking balls provided for each game, this section of Rule 2 has remained unchanged since 2007.

2. Guidelines Concerning the Preparation of Footballs

Prior to the start of each season, the NFL generally supplements the provisions of Rule 2 with more detailed guidelines concerning the "proper preparation" of footballs for use in League games. The guidelines, now incorporated into the Policy Manual for Member Clubs (Game Operations), prohibit certain activities, such as altering the "fundamental structure or surface characteristics of the footballs," "defacing or reshaping the footballs," or placing footballs "on or inside heated benches or in front of heaters." The guidelines otherwise direct club equipment managers to Wilson for "appropriate directions and supplies." Although the guidelines note that "proper preparation includes brushing the footballs and wiping them down with a damp towel," and, at times, have included a brief set of instructions from Wilson, they do not expressly limit preparation techniques to those listed as long as the preparation process

[6] Specifically, the supplemental note at the end of Rule 2 states that "[i]t is the responsibility of the home team to furnish playable balls at all times by attendants from either side of the playing field."

otherwise conforms to the guidelines and Rule 2. As discussed below, many NFL teams have developed their own individual practices with respect to the preparation of game balls.

Although the guidelines have remained relatively constant for at least a decade, those distributed just before the start of the 2006-07 season differed from those governing prior seasons in one significant respect—they allowed both the home and visiting teams to prepare their own game balls to accommodate the preferences of their individual quarterbacks. This change was the result of a lobbying effort undertaken by a number of NFL quarterbacks, including Patriots quarterback Tom Brady.

Before the 2006-07 season, all game balls used during NFL games were supplied and prepared by the home team. The visiting team was dependent on the home team with respect to the preparation of game balls, a situation that Brady described in contemporaneous media reports as having led to sleepless nights.[7] According to Brady, he and then-Colts quarterback Peyton Manning had, on occasion, discussed how it would be better if all quarterbacks could prepare footballs to fit their individual preferences. As Brady stated in a 2006 media interview, the existing policy did not account for the fact that "every quarterback likes [footballs] a little bit different. Some like them blown up a little bit more, some like them a little more thin, some like them a little more new, some like them really broken in."[8]

To address these concerns, Manning and Brady introduced a proposal to change the rule, which they circulated to quarterbacks across the League. Receiving approval from "basically everyone," according to Brady, the proposal and the signatures gathered were

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[7] Peter King, Gripping Story, Sports Illustrated (Sept. 11, 2006), http://www.si.com/vault/2006/09/11/8386248/the-nfl ("I can tell you there've been nights before road games when I have had trouble sleeping because I'm thinking about what kind of footballs I'll be throwing the next day.")

[8] Abe Rakov, Qbs Get On The Ball, Reach Goal, Sun Sentinel (Nov. 28, 2006), http://articles.sun-sentinel.com/2006-11-28/sports/0611270475_1_new-football-new-england-quarterback-competition-committee.

presented to the NFL during the 2006 offseason. In March 2006, the NFL Competition Committee unanimously recommended that "each team's offense be permitted to use its own footballs, prepared by its equipment personnel, for its non-kicking snaps from scrimmage."[9]

Prior to the start of the next season, the NFL revised the guidelines to extend to visiting quarterbacks the requirement that "[a]ll game footballs must be prepared properly and consistently for use on game day, especially to the satisfaction of quarterbacks." The new guidelines also provided:

> Each club (home and visitor) shall have available for inspection by the Referee a total of twelve (12), new Wilson Official NFL Footballs for all stadia (domed and outdoor) two hours and fifteen minutes before game time. Home clubs should have twelve (12) additional balls as backup for inclement weather or other reasons.[10]

In addition, the 2006 guidelines reiterated the provisions of Rule 2 concerning the pre-game testing and approval by the referee of game and kicking balls.[11] The guidelines retained the following disciplinary warning, which remains applicable:

> Once the balls have left the locker room, no one, including players, equipment managers and coaches are allowed to alter the footballs in any way. If any individual alters the footballs, or if a non-approved ball is used in the game, the person responsible and, if appropriate, the head coach or other club personnel will be subject to discipline, including but not limited to, a fine of $25,000.

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9 2006 Competition Committee Report 96 (Mar. 26, 2006).

10 Rule 2, Section 2 also was revised to track this change, replacing the requirement that, with respect to the 24 primary balls to be used on offense, the "home club shall have 24 balls available . . . for testing with a pressure gauge by the Referee," with the requirement that "[e]ach team will make 12 primary balls available for testing by the Referee."

11 The guidelines stated that: "Prior to each game, a team's equipment manager will prepare 12 footballs to be used for non-kicking downs. The footballs will have the prior approval of the team's quarterback, who can briefly test them the preceding week, but the balls cannot be used during midweek or pregame practice sessions. These footballs will be delivered to the officials' locker room two hours and 15 minutes prior to game time. The Referee will insure that they are properly inflated and give final approval for their use. Game balls approved for a previous game can be submitted, provided they meet the standards of a new ball. The home team will prepare another 12 balls in the event of inclement weather or other reasons." Under the current guidelines, a referee also may reject footballs in the course of a game if he determines that they are in "unsatisfactory condition."

3. Pre-Game Review of Footballs by NFL Game Officials

Section 15 of the 2014 NFL Referee Manual describes in greater detail the process for the delivery and inspection of footballs prior to an NFL game:

> Each team is allowed to use their own footballs on normal scrimmage downs. At 2 hours and 15 minutes prior to kickoff, each team will deliver 12 prepared game balls. There is no limit to the number of previous marks by other referees as long as the ball has the qualities of a new or nearly new ball. The balls should be checked for proper inflation and marked with your stamp/mark. If the footballs are delivered to you with a pressure between 12 ½ and 13 ½ pounds, you should not adjust the pressure, as that is the preference of that team's QB. If the pressure is below 12 ½, inflate the ball to 12 ½ and if above 13 ½ deflate the ball to that pressure. Best to mark each team's balls with a different colored pen on the laces so that they may be easily identified on the field. Do not mark the 12 reserve game balls unless they become needed later in the game.[12]

This procedure is, in all material respects, consistent with the provisions of Rule 2 and the football preparation guidelines described above. It also is generally consistent with information concerning customary practices obtained during interviews of game officials and League officiating supervisors. Specifically, prior to each game, a member of the officiating crew tests each football with an air pressure gauge to ensure that it is inflated to a pressure within the permissible range. The game balls are then marked to indicate their compliance with the Playing Rules, and placed back in the ball bags supplied by each team until all of the game balls are brought to the field shortly before kickoff.

The details of each officiating crew's pre-game inspection process nevertheless may vary. For example, on referee Walt Anderson's crew, Anderson personally checks the inflation level of each football, although another crew member may help him organize the balls prior to the inspection and re-pack them afterwards. On other crews, the responsibility for testing or "gauging" the balls may be delegated to another official so that the referee has more

[12] 2014 Referee Manual 13.

time to attend to other pre-game responsibilities.[13] Many game officials bring their own air pressure gauges with them to each game. Others may rely on a gauge provided by the home team. Most officials reported that they use digital gauges supplied by Wilson to the NFL. Others have used gauges that they have purchased or otherwise obtained on their own. In addition, some officiating crews adjust the air pressure in a game ball only if they determine that it has been set outside of the permissible range, while others may set the pressure of each football to 13.0 psi, regardless of where the balls are initially set by the team, to provide consistency.[14]

B. Ball Preparation Process Used by the New England Patriots

The Patriots have developed a process for the preparation of game balls in accordance with the preferences of Tom Brady, who has been the team's starting quarterback for over thirteen years. During a press conference on January 22, 2015, Brady described certain of his preferences with respect to the preparation of game balls. In particular, he stated that he prefers game balls that are inflated to 12.5 psi, the low end of the permissible range. Brady stated: "I like them at the way that I like them, which is at 12.5. To me, that's a perfect grip for the football."[15] When interviewed by our investigative team, Brady explained that he prefers footballs that are more broken in and that he is primarily focused on the "feel" of the ball, citing the texture, grip or tackiness of the ball's surface. Brady told us that when he selects footballs for games, he examines the laces, the leather and the "nubs" or dimples on the surface of each ball, and ultimately picks footballs that "feel best" to him. Dave Schoenfeld, the Equipment

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[13] Throughout this Report, the term "gauging" will be used to mean testing the footballs with a gauge or adjusting them with a gauge in order to set them to a desired pressure.

[14] The home team also provides an air pump that can be used to inflate game and kicking balls if necessary.

[15] Brady made public statements concerning his preference for a "deflated" ball at least as early as 2011. Specifically, during a November 14, 2011 interview on Boston's WEEI radio, Brady praised Patriots tight end Rob Gronkowski for powerfully spiking footballs after scoring touchdowns because of its impact on the ball. Brady stated that "I love that, because I like the deflated ball."

Manager for the Patriots, stated during his interview that it is "known throughout the equipment room" that Brady likes footballs inflated "at the low end" of the permissible range, meaning, according to Schoenfeld, footballs inflated at 12.5 or 12.6 psi. Schoenfeld said that, as a result, that is the range that the Patriots "target" for game day.

1. Preparing the Shape and Surface

John Jastremski is the principal "game ball maker" for the Patriots.[16] Although Jastremski has been employed with the Patriots in a part-time or full-time capacity for the entirety of Brady's career, Jastremski began working more closely with Brady when Jastremski took over primary responsibility for preparing game balls approximately three years ago. Jastremski described a close professional relationship with Brady. They see each other daily during the season and interact extensively with regard to Jastremski's preparation of footballs for use in games, but have never socialized outside of a work setting. Brady described Jastremski as a "friend."

Although Jastremski occasionally receives assistance from other members of the equipment staff, he is responsible for the ball preparation process from start to finish. Jastremski and others explained in detail how the Patriots prepare footballs in accordance with Brady's preferences. Among other things, to prepare the game balls, Jastremski uses a wet towel to remove the preservative coating or film that Wilson uses to treat the surface of NFL footballs, brushes the balls using brushes supplied by Wilson, treats the balls with dirt, and will generally apply a leather conditioner to the balls.[17] The prepared footballs may be used during practices to

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[16] Jastremski has been employed by the Patriots since 1994, when he began working as one of the team's ball boys. He became an equipment assistant and full-time member of the equipment staff approximately 14 years ago.

[17] Under a contract with the NFL, Wilson Sporting Goods provides each team with 780 official game footballs each season. Wilson pre-marks the footballs delivered to each team with the team name (*i.e.*, footballs sent to New England are imprinted with the word "Patriots").

help further break them in. Depending on the state of the particular ball, they also may be treated with additional rounds of conditioner, dirt or brushing as games approach.[18]

Multiple witnesses described the overall process as "extensive" and commented on the amount of time and effort spent preparing game balls. When asked, Jastremski said that the time spent per football varies, but that it probably takes about an hour to initially break in a new football to the desired level and that he prepares between 20 and 35 footballs for each game. He noted, however, that the process occurs in stages over the course of the week prior to a game.[19] Schoenfeld commented that Jastremski will prepare footballs "pretty much all week" and provide the finishing touches on game day.

2. Setting the Inflation Level

During this process, the inflation level is set at least two times, once prior to footballs being used in practice and once at the very end, on game day, just prior to Brady's selection of footballs for use in a game. When interviewed, Brady claimed to have known nothing about the permissible inflation range set by the NFL Playing Rules or the inflation range targeted by the Patriots until after the Patriots game against the New York Jets on October 16, 2014. Similarly, Jastremski claimed to have never read Rule 2 prior to that game, although he acknowledged being generally aware of the permissible inflation range and of Brady's preference for footballs set "closer to 12.5 than 13." According to Jastremski, before the October 2014 game against the Jets, it had been his practice to inflate Patriots game balls to a level

[18] At the request of the Patriots, this Report will not describe details of the ball preparation process that have not been publicly discussed by the Patriots. None of the preparation methods used by the Patriots had an impact on the relevant pressure measurements for the reasons described below and in Appendix 1.

[19] Jastremski also explained that if particular footballs have been prepared for or used in prior games, they are generally not prepared again before being used again in later games. He indicated that it is relatively common for game balls to be used in multiple games.

between 12.75 and 12.85 psi without thinking much about it, simply because, according to Jastremski, that had been the range targeted by his predecessor.[20]

According to Brady, Jastremski and other Patriots personnel, during the October 2014 Jets game, Brady complained angrily about the feel and inflation level of the game balls. He told Jastremski between drives that the balls felt "like bricks" and were heavier and harder to grip than they had been when he approved them prior to the game. Although Jastremski believed during the game that Brady was simply being competitive, he tested the air pressure of the game balls the next morning, discovered that many of them were over-inflated, and told Brady that he was right.

Following the Jets game, Brady and Jastremski had a number of conversations concerning the inflation level of game balls. According to Brady, at some point after the Jets game and before the game against the Chicago Bears the following weekend, he asked to see a copy of the applicable Playing Rule, learned for the first time that the permissible inflation range was 12.5 to 13.5 psi, and was told that the Patriots typically inflated game balls slightly above 12.5 psi. Brady also stated that, at some point, he felt a football that was inflated to 12.5 psi, and decided that should be the target for all future games because he did "not ever want to get near the upper range again." In addition, Brady stated that he suggested that the Patriots give the game officials a copy of Rule 2 when they delivered game balls prior to each game, so that the officials would know that it was not necessary to inflate them further. He claimed that doing so would help ensure that the officials did not alter the footballs he had approved. Jastremski stated that, starting with the October 26, 2014 game against the Bears, he set all game balls to 12.6 psi

[20] We do not credit these statements and believe they are contradicted by other evidence including McNally's reference to himself as "the deflator" in a text message to Jastremski before the 2014-15 season and Brady's personal involvement in the 2006 rule change and apparent longstanding preference for footballs inflated at the low end of the permissible range.

(leaving 0.1 psi as a cushion in case air escaped when the officials checked the balls prior to the game).

3. Selecting Footballs For Game Use

The final selection of Patriots game balls takes place during a brief meeting between Brady and Jastremski on the day of each game. The exact timing of the meeting varies depending on the scheduled kickoff time. Jastremski typically finishes preparing the footballs about an hour before Brady selects them, which is typically around three or four hours before a scheduled kickoff time. By the time Brady arrives to select game balls, Jastremski has finished treating the surface and generally has set and checked the inflation level of each football using an air pressure gauge. For home games, the finished footballs are laid out on trunks in the back of the Patriots equipment room, where Brady will come to inspect them. Brady explained that there is "kind of an art" to selecting balls, and that once he feels each football, he will "go for balls that feel the best on that particular day." He generally designates twelve as game balls, and, depending on the expected game conditions, between two and twelve as back-up balls. Jastremski sorts the game balls and back-up balls into two different bags and leaves the bags in the back of the equipment room for delivery to the Officials Locker Room.[21]

[21] During our investigation, we also obtained information concerning the football preparation process used by the Colts. Colts personnel informed us that, like the Patriots, they take new footballs and rub them with a wet or warm towel to remove the outer preservative, followed by brushing with the same brushes provided by Wilson. Footballs are then used during practice, with the expectation that normal wear and tear on the footballs, and their interaction with players' sweat, will help break in the balls. Sean Sullivan, the Colts Equipment Manager, explained that, in his view, the best way to soften the leather is for the footballs to interact with sweat during practice and then get baked in the sun. The Colts repeat the brushing and baking process, and continue to practice with the footballs as they are broken in, until they reach a certain point, when they will be set aside for potential game use. The footballs will be inflated to a pressure between 12.9 and 13.05 psi prior to being inspected by Colts quarterback Andrew Luck, who typically selects his game balls two days before each game. The designated balls are placed into ball bags and kept locked in the Colts equipment room until their pressure is checked again shortly before being delivered to the game officials.

C. Role of Jim McNally

Jim McNally is the Officials Locker Room attendant for the Patriots. He has been employed by the Patriots as a seasonal or part-time employee for the past 32 years and during the 2014-15 season worked for the Patriots on a part-time/hourly basis only on the days on which the Patriots had home games.[22] He first worked as a ball boy, and explained that his role evolved over time to supporting the equipment staff and helping with the game officials. He has held his current title since approximately 2007.

McNally's primary responsibility is to prepare the Officials Locker Room for the game officials, and attend to their needs both before and during the game. McNally considers himself a "liaison" for the officials, and is there to provide or help with "whatever they need." In this role, he is responsible for bringing items like towels, toiletries, time sheets and game programs to the locker room prior to the game. He also is responsible for bringing an air pump and pressure gauge from the Patriots equipment room to the Officials Locker Room in case they are needed by the officials during their pre-game examination of game balls. McNally explained that he obtains the air pump and pressure gauge from the equipment room after Jastremski has finished inflating and adjusting the pressure in the Patriots game balls.

In addition, McNally plays a role in the transport of game balls on game day at Gillette Stadium. After Jastremski has completed the ball preparation process and Brady has completed his selection of game balls, McNally carries the Patriots game balls from the Patriots equipment room to the Officials Locker Room a few hours prior to the game. McNally also generally brings the balls into and out of the locker room at halftime, and carries the game balls back to the Patriots equipment room after a game has ended. Further, McNally generally carries

[22] McNally's schedule has been limited to home games for the past two or three seasons. Prior to that, he would travel with the team to certain road games. He explained that he stopped traveling with the team when additional full-time personnel were added to the equipment staff.

the game balls for both teams from the Officials Locker Room to the field shortly before the start of the game. Although the precise timing may vary slightly, based on our interviews with game officials with recent experience at Gillette Stadium, it is our understanding that McNally generally carries the game balls to the field approximately 8-10 minutes prior to the start of the game. According to the game officials interviewed, McNally does not remove the game balls from the Officials Locker Room and take them to the field prior to the start of a game without either receiving permission from the game officials or being accompanied by one or more game officials. McNally stands on the Patriots sideline during most home games, and, according to McNally and other Patriots personnel, helps keep the bench area clean and organized. All of the Patriots witnesses interviewed stated that McNally has no role in the process of preparing footballs for use on game day.

Most of the game officials interviewed during the course of the investigation said that they are familiar with McNally and know him either by face or name. The officials generally praised McNally for his work as a locker room attendant, describing him as professional, attentive, and cordial.

McNally's responsibilities with the Patriots previously came under review by the NFL in connection with an incident involving game balls in 2004. According to a letter dated November 2, 2004, from then-NFL Director of Game Operations Peter Hadhazy and a memorandum dated October 25, 2004, from Richard Farley, the NFL Security Representative assigned to New England, that incident involved Patriots ball boys relaying supposed "approved" game balls that actually were non-approved practice balls to a game official during an October 25, 2004 regular season game.

In an obvious reference to McNally, the Farley memorandum and the Hadhazy letter describe "Jim McNulty" as the individual "in charge of game day footballs" for the Patriots. In relevant part, the Farley memorandum states:

> James McNulty, who is in charge of game day footballs and oversees ball boys for the Patriots, was interviewed concerning instant matter. Mr McNulty advised that he had no idea how Patriot's practice balls could have gotten into the hands of the game day sideline ball boys and or how they could have been handed to the referee by a ball boy for insertion into the game. He did note that there are approximately a dozen practice balls on the sideline at any given time during the game and it is probable that one of the ball boys accidentally picked up the practice balls during the game. He also noted that it was raining during the entire second half and "we were trying to keep a dry ball in the game at all times." He concluded that during that process, practice ball[s] could have accidentally found their way to the ball boy, and subsequently the paying [*sic*] field.

The then-Equipment Manager of the Patriots described the incident as "just an honest mistake." The Hadhazy letter stated, however, that "the Patriots have not provided a reasonable explanation for this incident," and warned that disciplinary action against the Patriots could result if a similar incident occurred in the future because it could be interpreted as a competitive violation. Although included for background and completeness, this 2004 incident does not form any basis for the findings and conclusions set forth in this Report.

III. Events Surrounding the AFC Championship Game

A. Pre-Game Events

1. The Colts Communicate Concerns about Patriots Game Balls Prior to the AFC Championship Game

On January 17, 2015, the day before the AFC Championship Game, Colts General Manager Ryan Grigson sent an email to the NFL raising concerns about the air pressure of game balls used by the Patriots. Grigson sent his email to David Gardi and Mike Kensil, both senior

members of the NFL Football Operations Department.[23] The email from Grigson attached a message from Sean Sullivan, the Colts Equipment Manager, describing these concerns. The Grigson email described the Sullivan message as an "FYI" and stated: "all the Indianapolis Colts want is a completely level playing field. Thank you for being vigilant stewards of that not only for us but for the shield and overall integrity of our game." In relevant part, the attached message from Sullivan stated:

> As far as the gameballs are concerned it is well known around the league that after the Patriots gameballs are checked by the officials and brought out for game usage the ballboys for the patriots will let out some air with a ball needle because their quarterback likes a smaller football so he can grip it better, it would be great if someone would be able to check the air in the game balls as the game goes on so that they don't get an illegal advantage.[24]

Shortly after receiving Grigson's email, Gardi sent an email in response stating that Kensil would be at the game and would speak with the game officials about Grigson's concerns. Kensil forwarded Grigson's email without comment to James Daniel, Director of Game Operations at the NFL, who in turn forwarded it to other Game Operations personnel who would be at the game as an "FYI." Kensil also forwarded Grigson's email to Dean Blandino and Alberto Riveron, both senior members of the NFL Officiating Department, with the message "see below." Both Riveron and Blandino decided that they would raise the issue with Walt Anderson, who had been assigned as the referee for the game. The Grigson email did not contain any

[23] Grigson told us that he sent the message to Gardi because Gardi was the member of the Football Operations Department with whom he was most familiar, and that he included Kensil because he understood that Kensil would be attending the AFC Championship Game.

[24] The message from Sullivan also included an express request that the Colts be permitted during the AFC Championship Game to use kicking balls that Sullivan would break in. The email referenced as the basis for the request information said to come from the Baltimore Ravens that Ravens players had not been provided with Ravens-prepared kicking balls during the divisional playoff game. As discussed in Section IX, it was ultimately agreed that the Patriots would use kicking balls prepared by Jastremski and the Colts would use kicking balls prepared by Sullivan.

factual support for the suspicions raised, and the NFL was unaware of any factual support prior to the game.[25]

During interviews, when asked to explain the source of their concerns about the Patriots game balls, Grigson, Sullivan, and other members of the Colts equipment staff referenced the Colts Week 11 game against the Patriots in Indianapolis. During that game, Colts strong safety Mike Adams intercepted two passes thrown by Tom Brady. On both occasions, Adams handed the footballs to Brian Seabrooks, an Assistant Equipment Manager for the Colts, on the sideline. Sullivan also examined the footballs because, as he described it, he always checks to see how other teams prepare their balls to "make sure no one is doing a better job." Sullivan and Seabrooks said that the intercepted footballs appeared to be coated in a tacky substance and seemed spongy or soft when squeezed. They explained that even though they did not test the air pressure of the intercepted footballs at the time, based on their years of experience, the softness of the balls raised suspicions. They also cited unspecified chatter throughout the League that the Patriots prefer their footballs softer than other teams and that visiting teams should be on guard when playing at Gillette Stadium. They could not identify a specific source for this information or reference particular conversations.

2. The Officials Prepare for the AFC Championship Game

The officiating crew for the AFC Championship Game began arriving in New England on Friday afternoon, January 16. The crew was led by referee Walt Anderson.

[25] Because Sullivan's email did not provide specific factual support for the Colts' concerns, NFL officials determined that it was not necessary to ask the game officials preemptively to check the air pressure in the Patriots game balls during the game, as Sullivan had requested. They reported during interviews that, without additional specific information that might raise further concern, they believed that the referee's standard pre-game inspection of the game balls would be sufficient, and that a change in the standard inspection protocols was not necessary. In particular, prior to the game, there was no plan to check the air pressure of the balls at halftime or any other time during the game. There was no "sting" operation, no plan for a "sting" operation and no discussion of a "sting" operation.

Anderson has served as an NFL game official for nineteen years. He began his NFL officiating career as a line judge for seven seasons and has been a referee for the past twelve seasons. Anderson is one of the most well-respected referees in the NFL. It is obvious that he approaches his responsibilities with a high level of professionalism and integrity. He is thoroughly familiar with the Playing Rules and the Referee Manual, and is widely recognized as exceedingly meticulous, diligent and careful. Multiple witnesses noted that Anderson is one of the few referees who personally tests the inflation levels of game balls prior to the game, rather than delegating that responsibility to another member of his officiating crew. Anderson has worked many Patriots home games during his career and is familiar with Gillette Stadium, its Officials Locker Room and stadium procedures.

Anderson's first formal responsibility with respect to the AFC Championship Game was a routine status call with Dean Blandino on Saturday afternoon. Both Anderson and Blandino recall that their primary topic of discussion was the unusual substitution issue that had arisen during the Patriots playoff game against the Ravens the prior weekend. Blandino also reported that during the call he mentioned that the Colts had raised certain concerns about playing at Gillette Stadium. Although Grigson's email was not the focus of the conversation, and may not have been specifically referenced, Blandino reminded Anderson to ensure that proper protocols concerning the footballs were followed.

The other members of the officiating crew arrived in New England on Saturday and the crew had dinner together on Saturday evening. As with all playoff games, the crew was comprised of a mix of experienced officials who do not generally work together during the regular season. For the AFC Championship Game, the roster included Carl Paganelli (Umpire), Tony Veteri (Head Linesman), Jeff Bergman (Line Judge), Gary Cavaletto (Field Judge), Greg

Meyer (Side Judge) and Keith Ferguson (Back Judge). In addition to the normal six-man crew, the NFL assigns three experienced officials as alternates for each playoff game, in this case, Clete Blakeman (Alternate Referee), Dyrol Prioleau (Senior Alternate Official and Field Communicator) and Greg Yette (Junior Alternate Official and Kicking Ball Coordinator).

Around 10 a.m. on Sunday morning, the crew held its first official meeting, which lasted approximately two hours. Among other topics, the officials discussed administrative items (*e.g.*, the bus schedule and coordination of transport of the kicking balls), the protocols for a game played in wet weather, and the division of responsibilities once the crew arrived at Gillette Stadium. They also watched game film of both teams and discussed plays, formations and general tendencies that might arise during the game.

At some point on Sunday morning, Anderson also had a brief conversation with Alberto Riveron. Without explaining the concerns raised by the Colts in detail, Riveron mentioned that concerns had been raised about the game balls, and that Anderson should be sure to follow proper pre-game procedures. Riveron recalls that Anderson responded that he had things covered and may have mentioned that he had already discussed the issue with Blandino. When interviewed, Anderson said that the issue had been raised with him, but that he had not been overly concerned because he knew that he would check the footballs himself prior to the game, as was his usual practice, and expected that the footballs would remain secure until game time. Anderson does not appear to have highlighted the concerns raised about the game balls during the crew meeting, although he believes that the issue may have been mentioned casually.

Based on security footage from the corridor outside the Officials Locker Room, the officials arrived at the locker room at approximately 3:20 p.m. The footage shows that Jim McNally and John Jastremski were waiting just outside the door of the locker room at that

time—McNally to welcome the officials and assist with anything they might need and Jastremski to receive and begin preparing the kicking balls (*see* Section IX.B). The officials entered the locker room, set up their individual lockers and began carrying out their pre-game responsibilities.

3. The Patriots Prepare and Select Game Balls

Approximately three hours before the officials arrived at Gillette Stadium, the Patriots were finalizing the preparation of the footballs that would be used during the AFC Championship Game. According to Jastremski, over the course of the preceding week, he had prepared the Patriots game balls following the routine described above, and on the afternoon before the game, Brady asked to see them. Although Brady reportedly was pleased by the footballs, he asked Jastremski to prepare another ball using a different process. Specifically, according to Jastremski, Brady asked for a ball that was not treated with the leather conditioner typically used by the Patriots, but instead was rubbed vigorously with leather-palmed gloves similar to those worn by Patriots wide receivers. Brady told us that he asked to see a ball prepared this way because the weather forecast called for rain, and he knew from prior experiences using footballs treated with leather conditioner in "weather games" that they might become oily and hard to grip.

According to Jastremski, Brady liked the sample ball that had been "gloved" more than the conditioner-treated balls, and asked how many similarly prepared footballs Jastremski could prepare by game time. Jastremski told us that he decided to prepare another full set of game balls, and that, by mid-Sunday morning, he had removed the initial preservative from 24 new footballs, brushed them and treated them with dirt. He and other members of the equipment staff then "gloved" the footballs, spending between 7 and 15 minutes vigorously rubbing each ball. According to Brady, this created a set of game balls "where most of the tack on the ball

ended up coming from the leather receiver gloves." Jastremski told us that he set the pressure level to 12.6 psi after each ball was gloved and then placed the ball on a trunk in the equipment room for Brady to review.[26]

Based on information from Brady, Jastremski and contemporaneous text communications, it appears that Brady first came to review the footballs as Jastremski was finishing this process, at or around 12:00 or 12:30 p.m. Brady gave his preliminary approval for most of the footballs, but asked Jastremski to continue working to smooth the surface on several of them. Brady returned to the equipment room around 2:30 p.m. and made his final selection of both game and back-up balls. Jastremski packed the game balls in one bag and the back-up balls in another, leaving them in the equipment room for McNally to bring to the Officials Locker Room, which he did around 2:50 p.m., as can be seen on security footage from the corridor outside the Officials Locker Room.

4. Inspection of Game Balls by Referee Anderson

After completion of his League-mandated drug test—the first thing he did upon arrival in the Officials Locker Room—Walt Anderson recalls noticing that the game and back-up balls for both the Patriots and the Colts had been delivered.[27] Shortly thereafter, at approximately 3:45 p.m., Anderson, with the assistance of Greg Yette, began preparing the footballs for inspection. Anderson and Yette took the balls out of the bags and laid them out in

[26] Coach Belichick explained during his press conference on January 24, 2015, that the Patriots believe that this gloving process impacted the air pressure levels and internal equilibrium of the game balls in a way that contributed to the reduction in pressure observed at halftime. As discussed in Section VII.C, our experts disagree with Coach Belichick's conclusions. Based on the timeline of events and the pressure data collected on the day of the AFC Championship Game, this explanation for the reduction in air pressure levels measured at halftime has been ruled out based on scientific principles and testing.

[27] Security footage shows McNally delivering the Patriots game balls to the Officials Locker Room at approximately 2:50 p.m. We were unable to locate clear footage of the Colts game balls being delivered to the Officials Locker Room, but understand that McNally may have brought them when he escorted Sean Sullivan to the locker room to prepare the Colts kicking balls shortly after the officials arrived at 3:20 p.m.

four separate areas within the locker room shower area, making sure to separate them by team and designation (*i.e.*, game balls and back-up balls).[28]

Anderson typically gauges all of the game balls for one team, and then all of the game balls for the other team, before testing the back-up balls. He does not remember whether he began with the Patriots or the Colts game balls on the day of the AFC Championship Game. He does recall that he gauged all of the footballs in the shower area of the locker room prior to the game.

Anderson travels with two pressure gauges. He acquired both from the League within the past few seasons, and both are battery-powered digital gauges.[29] The gauges appear similar, but one has the word "ON" on its face to indicate the on/off button and has a red Wilson logo on the back, while the other gauge has a red on/off button with no lettering and does not have the Wilson logo on the back. These gauges will be referred to herein as the "Logo Gauge" and the "Non-Logo Gauge," respectively. Anderson is certain that he checked the footballs prior to the AFC Championship Game with one of the two gauges that he brought with him to Gillette

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[28] The Officials Locker Room at Gillette Stadium is located off a large corridor that tracks the shape of the stadium. The locker room has two primary chambers. Just inside the door from the corridor is a large sitting room with couches and tables. A television and a countdown clock are mounted on the front wall. When standing in the doorway from the corridor and facing into the Officials Locker Room, there is a doorway on the right that leads to the adjacent Chain Gang Locker Room, and a door at the far end of the sitting room that leads to the inner chamber of the locker room, which contains the dressing area, shower area and bathrooms.

When standing in the doorway that separates the dressing area from the sitting area and facing into the inner chamber, the right portion of the dressing area contains a number of lockers and chairs. There is a mini-refrigerator along the left wall where McNally typically leaves the pressure gauge and air pump made available for the game officials. To the left is the bathroom area. There are two stalls and two urinals at one end of the bathroom area, and a square shower area at the other. The two areas are separated by a counter with a number of sinks.

The Chain Gang Locker Room is smaller than the Officials Locker Room and is lined with lockers and stools. There is an adjacent bathroom that contains two urinals and two stalls.

[29] Anderson believes that he acquired one of his gauges last season, and the other approximately three or four seasons ago. Anderson also travels with extra sports ball inflation needles that attach to the end of gauges. In addition to being used as part of a gauge, an inflation needle can be used to inflate a football (if attached to a pump) or release air from a football (if inserted alone into a ball).

Stadium. Although Anderson's best recollection is that he used the Logo Gauge, he said that it is certainly possible that he used the Non-Logo Gauge.[30]

When tested, all of the Patriots footballs—both game balls and back-up balls—registered on the lower-end of the permissible inflation range. Anderson recalls that most of the Patriots footballs measured 12.5 psi, though there may have been one or two that measured 12.6 psi. No air was added to or released from these balls because they were within the permissible range. According to Anderson, two of the game balls provided by the Patriots measured below the 12.5 psi threshold. Yette used the air pump provided by the Patriots to inflate those footballs, explaining that he "purposefully overshot" the range (because it is hard to be precise when adding air), and then gave the footballs back to Anderson, who used the air release valve on his gauge to reduce the pressure down to 12.5 psi.

According to Anderson, when tested, most of the Colts footballs measured 13.0 or 13.1 psi. Anderson believes that there may have been one or two footballs that registered 12.8 or 12.9 psi, but recalls that it was "pretty evident that their target was 13." Because the Colts balls all measured within the permissible range, no air was added to or released from the footballs.

NFL game officials are not required to, and do not as a matter of standard practice, record in writing the pressure measurements taken during their pre-game inspections of game balls. We credit Anderson's recollection of the pre-game measurements taken on the day of the AFC Championship Game based on both the level of confidence Anderson expressed in his recollection and the consistency of his recollection with information provided by each of the Patriots and Colts regarding their target inflation levels. As described above, Jastremski told us that he aimed to set the Patriots footballs at 12.6 psi, and Brady stated that he had asked for the

[30] For the reasons described in Section VII.B, we believe it is more probable that Anderson used the Non-Logo Gauge for his pre-game measurements.

footballs to be set at 12.5 psi. Similarly, Sean Sullivan of the Colts explained that 13.0 psi is typically—and was on the day of the AFC Championship Game—targeted by the Colts when inflating game balls, although he said that the Colts consider any pressure within a range of 12.9-13.05 psi to be acceptable.

After using his gauge to test the pressure of each football, Anderson marked the footballs (starting, again, with each team's game balls) with a paint pen. Anderson uses a gold, metallic color because it is easier to see, particularly on footballs that have been "roughed up" by teams during the preparation process or on balls in bad weather. All NFL referees have a preferred spot on the football for the placement of their mark. Anderson marks his footballs with a stylized "WA" above the words "THE DUKE," which appear on the ball to the left of the NFL logo. Anderson recalls that the testing and marking of the footballs took approximately 20-25 minutes, and that he and Yette left the balls out so that his mark could dry for at least another 15 minutes.[31]

At some point during the process of gauging and marking the footballs, Jim McNally, who came and went from the Officials Locker Room over the course of the afternoon, requested that Anderson make sure that the Patriots footballs were set at 12.5 psi. According to Anderson, McNally said something to the effect of "remember, Walt, Tom likes them at 12.5," though he could not recall McNally's precise wording. A number of other game officials heard McNally make this request. Anderson said that he did not think much of the request at the time because he had heard McNally make similar requests in the past. In particular, Anderson believes that McNally may have made the same request when Anderson had most recently

[31] Anderson does not ordinarily mark back-up balls before the game because he does not like to preemptively mark more footballs than are likely to be needed. However, because Anderson and the rest of the crew had been warned about inclement weather, he asked and received Alberto Riveron's permission to mark the back-up balls for both teams prior to the game, in case the officials decided to use a completely new set of footballs for the second half.

officiated at Gillette Stadium for the Patriots game against the Denver Broncos on November 2, 2014.

After Anderson's marks dried, Yette packed each set of balls into its appropriate bag, and left the two bags with the game balls next to a full-size refrigerator that stands between the shower area and the dressing area of the locker room. According to Anderson, although the precise location may vary by stadium, once the game balls have been examined and marked, they are kept nearby in the locker room while he carries out his remaining pre-game duties. At times, however, his duties require him to leave the locker room before the start of the game. On the day of the AFC Championship Game, for example, Anderson attended a meeting with the broadcast team at the "TV Truck," as well as the 100 Minute and 90 Minute pre-game security and operations meetings that occurred in or in close proximity to the Officials Locker Room. At approximately 5:50 p.m., Anderson and the rest of the officiating crew took the field to supervise the teams' walk-through or warm-up on the field. According to Anderson, and as discussed in Section IX.B, he was also involved in inspecting, gauging and marking the kicking balls once he returned to the locker room after the walk-through. Based on prior experiences at Gillette Stadium, it was the expectation of Anderson and other members of the officiating crew that the bags of game balls would remain in the Officials Locker Room until shortly before kickoff, when Anderson, as referee, would walk with them to the field.

5. Anderson and Other Officials Cannot Locate the Game Balls

On the day of the AFC Championship Game, the Officials Locker Room was more crowded than usual. A number of extra NFL personnel, including security and operations personnel, were present in addition to the three alternate game officials. A number of witnesses also explained that the layout of the Officials Locker Room at Gillette Stadium—with a large sitting room separated from the officials' more private dressing room—as well as the

refreshments available there, encourage people with credentials to congregate in the locker room prior to a game. One official said that it "felt like Grand Central Station" in the sitting room because once the pre-game meetings and the team warm-ups were complete, NFL personnel, game officials and others gathered there to watch the conclusion of the NFC Championship Game on television.

At approximately 6:25 p.m., Anderson announced that kickoff for the AFC Championship Game was being delayed 10 minutes, from 6:40 to 6:50 p.m., to allow for the conclusion of the NFC Championship Game, and that the rest of the pre-game schedule would be adjusted accordingly. According to Richard Farley, the NFL Security Representative assigned to New England, at the time of Anderson's announcement, Jim McNally was sitting on a trunk pushed against the back wall of the sitting room of the Officials Locker Room, with the bags of game balls in close proximity. Farley recalls seeing the bags in the dressing room area earlier in the afternoon, and understood that at some point they must have been moved to the front sitting room. Anderson also recalls that McNally, with Anderson's permission, had moved the ball bags from the dressing room area towards the sitting room area shortly after the officials returned from the players' walk-through. Anderson understood that McNally was moving the balls to the sitting room area of the locker room, so that it would be more convenient for the officials to pick them up on their way out to the field. Anderson said that it is typical for locker room attendants throughout the League to help move the game balls towards the front of the locker room, but that the footballs do not leave the locker room until the officials give express permission for them to be brought to the field at or near the time the officials also walk to the field. Numerous other game officials described a similar practice.

Shortly after the revised schedule was sorted out, members of the officiating crew began to leave the Officials Locker Room to give each team its two-minute warning and escort the players to the field. Various NFL personnel also began to leave the locker room and make their way to the field or other areas of the stadium. By 6:35 p.m., all of the members of the officiating crew other than Anderson, Veteri, Blakeman and Yette had left the Officials Locker Room. When the remaining officials walked into the sitting room area on their way to the field, all four were surprised to find that the ball bags were not there. Both Anderson and Veteri immediately asked Farley where the footballs were. Farley checked for the ball bags in the back part of the locker room (where he saw the bags of back-up balls) and in the adjacent Chain Gang Locker Room, but could not find them. When it was suggested that McNally had or may have taken them to the field, Anderson responded that "he's not supposed to do that." Anderson also stated that "we have to find the footballs." Blakeman recalls that although Anderson is usually calm and composed leading up to a game, Anderson was visibly concerned and uncharacteristically used an expletive when the game balls could not be located. The other officials were similarly surprised and concerned. None of the officials in the locker room at the time realized that the game balls had been removed from the locker room until they were ready to go to the field for the start of the game, and all expected that the balls would not leave the locker room until it was time for them to take the field.

Although the officials were concerned about the situation, with kickoff approaching, they decided to take the field. Farley and the officials left the Officials Locker Room and walked to the field at approximately 6:36 p.m. As seen on the security footage, Farley walked approximately 10 seconds ahead of the officials because, as he explained, he was in a hurry to reach the field to look for the footballs. As soon as he reached the field, Farley looked

for McNally by the instant replay booth, where McNally regularly arrives with the game balls, but did not see him. He did, however, see John Raucci, Director of Investigative Services at the NFL, shortly after stepping onto the field and asked if Raucci had seen either McNally or the game balls. Raucci said that he had seen neither. In an effort to ensure that the teams had footballs on the field for the start of the game, Farley headed back toward the Officials Locker Room to get the back-up balls. He is seen on the security footage at approximately 6:42 p.m. walking back down the tunnel leading to the field with the bags of back-up balls. Farley reported that prior to the AFC Championship Game, he has never been in a situation where the game balls could not be located or where he had to retrieve the back-up balls from the Officials Locker Room prior to kickoff.

Shortly after taking the field, after Farley had returned to the Officials Locker Room for the back-up balls, Anderson and the other officials noticed that McNally and the game balls were on the field. When Farley returned to the field with the back-up balls, he learned the same thing. He returned the back-up balls to the Officials Locker Room shortly before kickoff, and the game began at approximately 6:50 p.m. with the proper set of game balls.

6. The Game Balls are Taken to the Field by McNally

What the officials and Farley did not realize at the time was that at approximately 6:30 p.m.—twenty minutes prior to kickoff—Jim McNally removed the two bags of game balls from the Officials Locker Room. He is seen on the security footage at 6:30:35 p.m. walking away from the locker room and turning left into the center tunnel that leads towards the field. At the end of that tunnel on the left-hand side, just before reaching the doors that lead to the field, is a relatively large, single-toilet bathroom that locks from the inside.[32] McNally entered that

[32] The bathroom measures approximately 9 feet by 9 feet. It has a single toilet near the back right corner (if one is standing in the doorway and facing into the bathroom), and a single sink directly across from the door. It

bathroom with the game balls, locked the door, and remained in the bathroom with the game balls for approximately one minute and forty seconds. He exited the bathroom at approximately 6:32:27 p.m., and took the bags of game balls to the field. McNally did all of this without the knowledge or permission of Walt Anderson or the other members of the officiating crew.

According to Anderson, other members of the officiating crew for the AFC Championship Game, and other game officials interviewed during the investigation, the removal of the game balls from the Officials Locker Room by McNally without the permission of the referee or another game official was a breach of the standard operating pre-game procedure. No official could recall another time that McNally had removed game balls from the Officials Locker Room and taken them to the field without either receiving permission from a game official or being accompanied by one or more game officials.

Following the AFC Championship Game, McNally was asked to explain his actions on a number of occasions, including during three interviews with NFL Security. The substance of these interviews was recorded in written interview reports prepared by NFL Security personnel and reviewed by Paul, Weiss during the course of the investigation. According to a report of the interview with McNally on the night of January 18, McNally told NFL Security representatives that he "decided to walk the balls out to the field," and was "not certain why [he] chose to go out to the field at this time or without an escort." McNally also told NFL Security during this interview that he walked directly to the field and that nothing unusual occurred during the walk from the locker room to the field. According to the interview report from a telephone interview with NFL Security on January 19, McNally stated that he stopped to use the bathroom on the way to the field and took the game balls with him into the bathroom.

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contains no other fixtures or structural stalls, and therefore has a significant amount (approximately 60 sq. ft.) of open floor space. As noted, the door to the bathroom locks from the inside.

During this interview, he explained that he did not use the bathroom in the Officials Locker Room because he did not want to disturb the officials. He claimed that he had left the Officials Locker Room with game balls but without a game official on a few occasions over the years, but could not identify any particular games where that had occurred. According to the interview report from an NFL Security interview of McNally on January 21, McNally said that he did not know why he would leave the locker room with the game balls without being accompanied by game officials, and "just decided to leave the locker room at that time to go to the field." He said that no one had ever told him that he was required to wait for the officials. He also claimed that he went into the bathroom with the game balls because when he got to the end of the tunnel, he realized that he suddenly had to use the bathroom.

On February 12, 2015, we interviewed McNally on these topics as well. He explained to us that he told the game officials that he was moving the game balls to the sitting room, where he watched the end of the NFC Championship Game for up to ten minutes. He estimated that there were twenty people in the sitting room at the time. According to McNally, when the NFC Championship Game ended shortly after the start of the overtime period, an unidentified NFL official said something like "we're back on again," so he picked up the balls and began to walk out of the Officials Locker Room.

With respect to his decision to use the bathroom, McNally claimed that he has used the bathroom near the field entrance while in possession of the game balls many times. He said that on the day of the AFC Championship Game, he entered the bathroom, dropped the ball bags to his left, and used the urinal to his right. That bathroom, however, does not contain a urinal. Upon further questioning, McNally claimed that he did not pay attention to what type of fixture he used. He also acknowledged that the bathroom areas in both the Officials Locker

Room and the Chain Gang Room each contain two or three urinals and two or three toilets in separate stalls, and that he had used the facilities in those rooms many times. When asked why he did not use the bathrooms available in the Officials Locker Room or the Chain Gang Room on the day of the AFC Championship Game, McNally claimed that the officials often ask for time to themselves prior to the game, though he did not mention anyone making such a request that day. Walt Anderson and most other officials interviewed said that it would have been ordinary and customary for McNally to use the bathrooms in the Officials Locker Room and that, in their opinion, McNally appeared to feel very comfortable in the locker room. McNally claimed that he did not use the facilities in the Chain Gang Room because it was crowded and it would have been hard to maneuver with the bulky ball bags.

With respect to his decision to leave the locker room unaccompanied, McNally claimed that his actions on the day of the AFC Championship Game were not unusual. In his account, the game balls remain in the locker room until he believes it is time to take them to the field. According to McNally, he brings the game balls to the field when he deems fit. He said that he generally asks permission or alerts the officials before he moves the game balls from the dressing room to the sitting room, but does not ask or alert them again before leaving the locker room and taking the balls to the field. McNally also claimed that it is not his customary or typical practice to walk to the field with game officials. He estimated that he walks to the field with other people—game officials, security personnel or others—only half of the time.

The Patriots produced two game-day security guards employed by Team Ops, a security and guest services company affiliated with the Patriots, to support McNally's account. Rita Callendar, who was stationed just outside the Officials Locker Room on game day, said that she estimates that McNally takes the game balls to the field by himself roughly 50% of the time,

and that the other times he walks with or in close proximity to Richard Farley. Paul Galanis, who was stationed just outside the entrance to the Patriots locker room, across the corridor from the top of the center tunnel, said that it was routine for McNally to walk to the field with the game balls unaccompanied. He estimated that McNally goes to the field approximately 10% of the time with game officials and approximately 25-30% of the time with Richard Farley, and the other times he is walking by himself.

Richard Farley, who has been the NFL Security Representative for New England for approximately twelve years and is present in the Officials Locker Room before and during every Patriots home game, said that he considers it part of his job description to accompany the referee to the field and that he is generally in close proximity to McNally and the game balls when he walks to the field with the referee. According to Farley, he often opens the door to allow McNally to exit easily with the ball bags, and then McNally, Farley, the referee and the head linesman will walk to the field together or in close proximity to each other. Farley cannot recall McNally previously bringing game balls to the field prior to the start of a game without being accompanied by or in close proximity to one or more game officials.

Numerous game officials, including those assigned to the AFC Championship Game, told us that McNally generally does not remove the game balls from the Officials Locker Room without express permission or without being accompanied by one or more game officials. Walt Anderson said that in his experience, McNally has not removed, and is not permitted to remove, the game balls from the Officials Locker Room without his permission. Anderson also said that if McNally had asked to take the footballs to the field before he was ready to leave, he would have told McNally to wait. Anderson has always denied requests by ball boys and locker

room attendants in other stadiums to take the game balls out before he was ready to go to the field.[33]

Similarly, Clete Blakeman—a referee on another officiating crew during the regular season—could not recall a previous instance where McNally took the game balls to the field on his own and without express permission. What happened on the day of the AFC Championship Game was, in his view, a "break in our normal protocol." Tony Veteri and Greg Yette agreed. It was their view that McNally, who has served as locker room attendant at Gillette Stadium for many years, would be well aware of the standard practice and would have understood that the game balls are to remain in the locker room with the officials until permission to bring them to the field is given.

Indeed, all of the officials interviewed disagreed with McNally's description of the standard practice at Gillette Stadium. A representative from each officiating crew that worked at Gillette Stadium during the 2014-15 season confirmed that the game balls only left the locker room with the permission of a game official and that the footballs moved to the field either at the same time as the referee or shortly before.[34]

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[33] Steve Stelljes, the head linesman on Anderson's officiating crew during the regular season confirmed Anderson's account of standard procedure.

[34] Whether McNally frequently, infrequently or never leaves the Officials Locker Room before the game officials depart for the field is not determinative of whether there has been an opportunity to tamper with game balls during the regular season. The game officials we interviewed—when considering the potential for tampering with the game balls—almost uniformly expressed greater concern that a locker room attendant generally has up to fifteen or twenty minutes alone with the game balls when the game officials are on the field for the pre-game walk-through approximately fifty minutes before kickoff (and after the balls have been inspected). The physical configuration of the Officials Locker Room at Gillette Stadium, with a back dressing area separated by a door from a sitting room area, would provide complete privacy during this time period. Indeed, even the sitting area is generally quiet at that time during the regular season, unlike the busy scene during a playoff game. Milton Britton, the regular season k-ball coordinator for the Patriots, reported that he regularly watches ESPN in the sitting room area while everyone else is on the field and stated that "nine out of ten times" the sitting room is otherwise empty, apart from McNally. On the night of the AFC Championship Game, however, the Officials Locker Room was crowded and McNally is unlikely to have had an opportunity to tamper with the balls in the locker room without being detected.

B. Events During the First Half

At approximately 7:47 p.m., during the second quarter of the AFC Championship Game, Colts linebacker D'Qwell Jackson intercepted a pass thrown by Tom Brady. Following the interception upon reaching the sideline, Jackson handed the ball to David Thornton, the Colts Director of Player Engagement, near the Colts bench and Thornton immediately handed the ball to Assistant Equipment Manager Brian Seabrooks. According to Seabrooks, he believed that the ball felt similar to the footballs intercepted by Mike Adams during the Colts game against the Patriots earlier in the season, so he asked one of the team's equipment interns to locate a pressure gauge and test the inflation level of the intercepted ball. The intern used a digital pressure gauge similar to the gauge used by the Colts to set their footballs before the game, and reported that the pressure measured approximately 11 psi. Seabrooks then walked with the intercepted football to Equipment Manager Sean Sullivan, who squeezed the ball and agreed that it felt soft.

These concerns were brought by Colts equipment personnel to the attention of a game official on the Colts sideline who was not responsive. Indeed, Clete Blakeman recalls that someone from the Colts raised a concern with him but his initial reaction was that it was a matter outside his jurisdiction. Sullivan also alerted Danielle Lee, an NFL Game Operations representative stationed on the Colts sideline, and asked her to contact NFL personnel and have them come to the sideline because there was a problem with the footballs. Lee used the Game Operations radio system to alert Akil Coad, James Daniel and Mike Kensil and pass on Sullivan's request. Daniel responded that he would come to the sideline and speak with the Colts.

Once Lee confirmed that additional League representatives were on their way, Sullivan notified Jon Scott, the Colts VP of Equipment Operations. Scott then contacted Colts General Manager Ryan Grigson, who was sitting upstairs in the press box, and alerted him to the

situation. Grigson recalls that as soon as he got off the phone with Scott, he and Pete Ward, the Colts Chief Operating Officer, left the press box and headed toward the NFL control booth. By the time they got there, Mike Kensil and Troy Vincent, the NFL's Executive Vice President of Football Operations, were already putting their jackets on to go down to the field, and Grigson understood that they already had been informed of the situation. In fact, Kensil already had told Daniel and Coad over the radio system that the game balls should be collected, and he and Vincent already had decided that the footballs for both teams should be checked at halftime. Grigson said that he made clear to Kensil and Vincent that he understood that there was a problem with the inflation level of a Patriots football—the precise issue the Colts had raised prior to the game—and that he was not happy about the situation. Kensil and Vincent told Grigson that they were on their way to look into the issue. Grigson returned to the press box and did not hear anything further until after the game.

Daniel arrived on the Colts sideline a few minutes later, and spoke with Seabrooks. Daniel told Seabrooks that he and other League representatives would test the ball, and, with Sullivan's permission, Seabrooks handed the ball to Daniel. At approximately 8:00 p.m., roughly 13 minutes after the interception, Daniel walked the intercepted ball inside the stadium and toward the Officials Locker Room.

Alberto Riveron, who had been sitting in the NFL replay booth during the first half, learned about the issue with the Patriots game balls from Game Supervisor Johnny Grier. He went to the Officials Locker Room, arriving a few minutes after Daniel, who recounted the report he had received from Seabrooks. Remembering Grigson's email, Riveron contacted Grier and instructed him to tell Blakeman and the other officials to bring the game balls in at halftime so that they could be tested. Riveron told us that it was his call to collect the game balls for

testing at halftime and that he did not consult with anyone else.[35] Riveron believed that the combination of the pre-game concerns raised by the Colts and the information received about the intercepted ball made testing the game balls essential. At Riveron's request, Daniel retrieved a gauge that was near the air pump in the dressing area of the Locker Room, and they tested the intercepted ball three times before the balance of the game balls were brought back to the Officials Locker Room.[36] All three measurements were below 12.0 psi. A few minutes later, the game officials and other NFL representatives started arriving in the Officials Locker Room for halftime. Riveron took the intercepted ball from Daniel and walked into the dressing room area of the locker room.

While Daniel and Riveron were testing the intercepted ball, the first half was coming to an end. Vincent and Kensil arrived at the Patriots sideline shortly before the end of the first half to supervise the collection of the game balls. Vincent stood behind the Patriots bench and watched as the balls were put into the appropriate ball bags. Eric Kerzner, who assisted the Game Operations staff that day, reported that he walked over to the replay booth at the end of the first half and watched the ball boys put the game balls into each team's bag. Kerzner picked up one bag, and McNally picked up the other two (the third containing kicking balls) and they walked together towards the locker room. McNally, Kerzner and Vincent can be seen in the security footage at 8:28:41 p.m. turning the corner at the top of the center tunnel and heading towards the Officials Locker Room. Kerzner stayed in close proximity to the balls as they were walked inside.

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[35] Our best understanding, given the accounts received from various witnesses, is that upon receiving similar information on different radio frequencies, personnel from both the Officiating and Game Operations Departments independently made parallel decisions to test all of the game balls at halftime.

[36] We believe that Daniel located and used the pressure gauge supplied by the Patriots. We further believe that this is the gauge that John Jastremski considers his normal gauge. It has not been located since the day of the AFC Championship Game. It should be noted that we have not relied upon the air pressure measurements of the intercepted ball in any respect in reaching any conclusions set forth in this Report.

Kensil lost sight of the Patriots game balls at the beginning of halftime, so he walked to the Patriots locker room to make sure they were not there. He asked Berj Najarian, a Patriots employee who functions as Coach Belichick's chief of staff, to check inside the Patriots locker room for the balls. After Najarian went inside the locker room to look for the balls, Kensil saw McNally carrying them in from the field and told the Patriots security representative stationed at the door of the Patriots locker room to inform Najarian that he had found what he needed. This is consistent with security footage that shows Kensil near the door that leads to the Patriots locker room at 8:28:25 p.m. and McNally turning the corner at the top of the tunnel and heading towards the Officials Locker Room with the ball bags approximately 15 seconds later.

C. Events During and Following Halftime

Alberto Riveron took primary responsibility for organizing a process for testing the game balls in the dressing area of the Officials Locker Room at halftime. Riveron told Walt Anderson to tend to his halftime responsibilities and instructed alternate officials Clete Blakeman and Dyrol Prioleau to test the air pressure of the Patriots and Colts game balls using gauges provided by Anderson. Dan Grossi, the NFL's Director of Event Security, participated as an observer of the process, as did Troy Vincent. Richard Farley observed the testing process and recorded the measurements in writing. Other game officials, including Greg Yette, and NFL officials, including Mike Kensil, observed portions of the testing as they moved back and forth from the dressing room area. Apart from providing his two gauges, Anderson did not participate in the testing. The dressing room area was closed to everyone but game officials and NFL staff.

Once inside the Officials Locker Room, the game balls for both teams were brought to the back corner of the dressing area. Blakeman sat on a chair placed against the back wall of the dressing area next to the ball bags (facing into the dressing room with the bags to his right), and Prioleau sat on a second chair to Blakeman's left (facing the same way). Blakeman

and Prioleau were each given one of Anderson's two pressure gauges, one of which had also been used to test the footballs before the game.[37] Riveron stood next to the officials with Vincent, Grossi, and Farley observing nearby. Each ball was checked first by Blakeman and then by Prioleau, with each official calling out the pressure measurement for each ball tested and Farley writing down the measurement announced by each official before moving to the next ball. Prioleau set each ball down on the floor to his left after it was checked. Both Blakeman and Prioleau explained that, based on their years of officiating experience, they were very familiar with the type of gauges provided, and fully confident in their ability to use the gauges properly and generate accurate readings. They reported no difficulties in using the gauges.[38]

[37] We have not been able to determine with certainty based on the witness interviews which game official used the Logo Gauge and which used the Non-Logo Gauge. For the reasons stated in Section VII.B and described in detail in Appendix 1, based on Exponent's conclusion that the Logo Gauge generally reports a measurement that is approximately 0.3-0.45 psi higher than the measurement reported by the Non-Logo Gauge, we believe that Blakeman used the Non-Logo Gauge and Prioleau used the Logo Gauge to test the Patriots game balls at halftime. As noted above, we also believe that Walt Anderson most likely used the Non-Logo Gauge prior to the game.

[38] It should be noted that one or more days after the game, based on conversations with Patriots personnel, Richard Farley incorrectly assumed that one of the gauges used by the officials belonged to John Jastremski and he made a written notation to that effect on the documents he was keeping. It is our view, based on the evidence, that this assumption was inaccurate and based solely on information provided by a person without first-hand knowledge of the testing.

The Patriots game balls were tested first. Each of the eleven Patriots balls tested measured below the minimum allowable pressure of 12.5 psi on both of the two gauges used.[39] The halftime measurements of the Patriots game balls were recorded as follows:

Patriots Ball	Blakeman	Prioleau
1	11.50	11.80
2	10.85	11.20
3	11.15	11.50
4	10.70	11.00
5	11.10	11.45
6	11.60	11.95
7	11.85	12.30
8	11.10	11.55
9	10.95	11.35
10	10.50	10.90
11	10.90	11.35

Blakeman and Prioleau also tested four Colts game balls. Riveron, Vincent and others explained that only a sample of the Colts balls were tested because of time constraints. Halftime for the game was scheduled to last thirteen minutes and time was running short before

[39] As noted, eleven different Patriots game balls were tested by the game officials during halftime, with each ball tested by each of two officials. The football intercepted by the Colts was not included in the group of eleven Patriots footballs tested. Nor was a football that Patriots fullback James Develin had caught for a touchdown in the first half, which the Patriots set aside for him to retain as a memento. Based on the evidence, we believe that the Patriots game ball bag initially contained thirteen footballs, rather than twelve. In fact, when interviewed by NFL Security on the night of the AFC Championship Game, Jim McNally volunteered that the Patriots game ball bag may have included thirteen footballs. McNally's statement—which we were unable to discuss with McNally because the Patriots refused to make McNally available for a follow-up interview—was consistent with information from Walt Anderson, who said that it was "certainly possible" that the Patriots provided a thirteenth ball because teams often include an extra ball or two when inclement weather is expected. Subtracting the intercepted ball and the Develin touchdown ball results in a total of eleven Patriots game balls available for halftime testing.

the scheduled start of the second half.[40] Each of the Colts footballs tested measured between 12.5 and 13.5 psi on at least one of the two gauges, as set forth below: [41]

Colts Ball	Blakeman	Prioleau
1	12.70	12.35
2	12.75	12.30
3	12.50	12.95
4	12.55	12.15

The officials also inflated and re-adjusted each of the Patriots game balls tested. Riveron instructed that footballs registering below the permissible range should be inflated and set to 13.0 psi. Using the air pump provided by the Patriots, Blakeman inflated each Patriots ball, and handed each to Prioleau, who used the air release valve on a pressure gauge to ensure that the balls were set to a pressure level within the permissible 12.5 to 13.5 psi range. No air was added to the Colts balls tested because they each registered within the permissible inflation range on at least one of the two gauges used.

[40] In fact, the game balls were not returned to the field until shortly after the second half began. Both Patriots personnel and game officials explained that after the second-half kickoff by the Colts, the officials could not locate a game ball for the Patriots' first offensive play of the half. Walt Anderson offered to allow Tom Brady to use a kicking ball, but Brady declined the offer. A Patriots ball boy arrived with a Patriots game ball shortly thereafter, and it was put into play. Television footage of the game depicts the delay in play.

[41] For the reasons stated in Section VII.B and described in detail in Appendix 1, based on Exponent's conclusion that the Logo Gauge generally reports a measurement that is approximately 0.3-0.45 psi higher than the measurement reported by the Non-Logo Gauge and never produced a reading lower than the Non-Logo Gauge during Exponent's testing, it appears most likely that the two officials switched gauges in between measuring each team's footballs, meaning that Blakeman most likely used the Logo Gauge and Prioleau most likely used the Non-Logo Gauge to test the Colts balls at halftime. Further, Exponent believes that the results recorded for the third Colts ball tested reflect an anomaly in that, unlike the other Colts balls tested, the reading made by Prioleau is higher than the reading made by Blakeman. Exponent believes that this anomaly may be the result of a transcription error where the measurements recorded were attributed to the opposite game official (*i.e.*, on game day, Blakeman measured 12.95 psi and Prioleau measured 12.50 psi) or a recording error where the pressure measured by one of the officials was incorrectly recorded. Exponent controlled for this anomaly in its analysis of the data.

The pressure of the Patriots ball that had been intercepted by the Colts was separately tested three times and the measurements—11.45, 11.35 and 11.75 psi, respectively—were written on athletic tape that had been placed on the ball for identification. League personnel retained possession of the intercepted ball and it was not reintroduced to the game after halftime. The football intercepted by Jackson was provided to Paul, Weiss for examination in connection with the investigation.

Based on the information provided by various witnesses to the halftime measurements, we believe that it took approximately two to four minutes after the balls were returned to the Officials Locker Room to devise, organize and begin implementing the testing protocol. Based on information provided from Blakeman and Prioleau in particular, we estimate that it took approximately four to five minutes to test the pressure of the eleven Patriots balls. The testing of the four Colts balls took less time. Inflation of the Patriots balls and resetting them within the permissible pressure range is estimated to have taken approximately two to five minutes. Riveron described the process as organized and deliberate despite the time-pressured environment, and Blakeman said that the testing was carried out carefully and in an orderly, yet expeditious, manner. Other witnesses described the halftime testing in similar terms. Based on the security footage, which shows the game balls being taken into the Officials Locker Room at approximately 8:29 p.m. and back to the field at approximately 8:42:30 p.m., it is estimated that the footballs were inside the locker room for approximately 13 minutes and 30 seconds.[42]

Once both sets of game balls were placed back into their respective ball bags, they were run out to the field. Blakeman and Prioleau then returned to the field for the second half.

[42] It is clear that the halftime testing undertaken by the game officials and other NFL personnel was not performed in a laboratory setting or under ideal circumstances for forensic data collection and examination. We nevertheless conclude that the game officials and other NFL personnel participating in the halftime measurements acted responsibly and created a reasonably reliable record of the measurements.

Farley remained behind in the Officials Locker Room to review and prepare written statements based on the notes he took during the testing process. After the game, Farley asked each individual who had participated in or witnessed the halftime tests—Blakeman, Prioleau, Riveron, Vincent, and Grossi—to sign the written statements with the testing results, which Farley signed as well. We reviewed Farley's original notes and the written statements he prepared, and have confirmed that the pressure measurements transcribed on the original notes and the written statements are identical.

As the second half began, the various NFL officials who had observed the testing or been inside the Officials Locker Room returned to their assigned posts. As he passed the Patriots sideline, Mike Kensil spoke with Patriots Equipment Manager Dave Schoenfeld. Although they have different recollections of the precise sequence and content of the conversation, it is clear that Kensil told Schoenfeld that the NFL had tested the Patriots game balls at halftime, found that they were all under-inflated, and had re-inflated them back to a pressure level within the permissible range. Kensil cautioned Schoenfeld that the footballs should remain properly inflated and subsequently left the field.[43]

According to Schoenfeld, he immediately approached Jastremski, who he considers the point person for any football related-issues, and told him that the NFL suspected that the Patriots had deflated game balls because the balls had been tested at halftime and were found to be under-inflated. Schoenfeld asked if Jastremski had anything to do with this situation, and Jastremski said that he did not. Schoenfeld also asked Brenden Murphy, one of the team's equipment assistants and ball boys, the same question. Murphy said that he had no involvement and would never do anything to the footballs. Schoenfeld recalls asking Jastremski a second

[43] Kensil and Schoenfeld also discussed the kicking ball issue described in Section IX.

time if he had any knowledge of this issue or if he had done anything to the game balls, and Jastremski again denied any knowledge or involvement. When interviewed, McNally told us that he heard Schoenfeld mention on the sideline that some of the game balls were "down," but that he did not say anything to Schoenfeld.

D. Post-Game Testing of Game Balls

At the two minute warning in the second half, Johnny Grier contacted alternate officials Blakeman and Prioleau by radio, and asked them to gather both teams' game balls at the end of the game and bring them to the Officials Locker Room. Blakeman and Prioleau coordinated the collection of the game balls with the ball boys, who they then escorted toward the locker room.

Once the game balls were brought into the dressing room area, four Colts and four Patriots game balls were randomly selected for testing. Using the same gauges used at halftime (which were retrieved from Anderson's locker, where Blakeman had left them), Blakeman and Prioleau measured the game balls in the same manner as at halftime. Blakeman recorded the measurements, and the officials signed a document with the recorded measurements once the testing was complete.

The post-game measurements were recorded as follows:[44]

Patriots Ball	Recorded PSI	Recorded PSI
1	13.50	13.15
2	13.35	12.95
3	13.35	12.95
4	13.65	13.25

Colts Ball	Recorded PSI	Recorded PSI
1	12.90	12.50
2	12.45	12.10
3	12.80	12.45
4	12.70	12.35

Before leaving the stadium, Blakeman gave the record of the post-game measurements to Farley. The notes and other documents setting forth the measurements recorded at halftime were all provided to Paul, Weiss in connection with this investigation. Walt Anderson also gave Alberto Riveron his two gauges so that they could be preserved as part of any investigation. As discussed in Section VII.B, the gauges were obtained by Paul, Weiss and have been examined and tested by Exponent.

[44] Although these measurements were recorded in conditions similar to those present during halftime, information concerning the timing of these measurements, the pressure levels at which these eight footballs started the second half and the identity of the four Colts footballs tested after the game (specifically, whether they were the same footballs that had been tested at halftime) is significantly less certain than the information about similar issues concerning the pre-game or halftime periods. As a result, our experts concluded that that the post-game measurements did not provide a scientifically reasonable basis on which to conduct a comparative analysis similar to that performed using the pre-game and halftime measurements.

At various points in the investigation, counsel for the Patriots questioned the integrity and objectivity of game officials, various NFL executives and certain NFL Security representatives present at the AFC Championship Game or otherwise involved in the investigative process. We found no evidence to substantiate the questions raised by counsel. Specifically, we identified no evidence of any bias or unfairness. We believe that the NFL staff and game officials who participated in the testing of the footballs and the subsequent investigative process acted fairly, properly and responsibly.

IV. Communications between Jastremski and McNally Prior to the AFC Championship Game

Jastremski and McNally have both been employed by the Patriots for over 20 years. Jastremski is currently 35 years old and McNally is 48 years old. Each considers the other to be a "good friend." They see each other on game days, but generally do not otherwise socialize due, in part, to the distance between their homes. Jastremski generally refers to McNally by his nickname, "Bird," and McNally at times refers to Jastremski as "JJ" or "Johnny." Based on our review of data collected from Jastremski's cell phone, it appears that Jastremski and McNally communicate regularly by phone and text message. Jastremski and McNally exchanged hundreds of text messages in the weeks and months leading up to the AFC Championship Game.[45]

[45] As noted above, NFL Security retained Renaissance Associates to collect data from the Patriots-issued cell phones of five Patriots employees, including Jastremski, that were provided by the Patriots to Renaissance on January 21 and 22, 2015. During interviews, Jastremski confirmed that the text message and call log information retrieved from his phone appeared to be accurate.

A. McNally Labels Himself the Deflator

On May 9, 2014, during the NFL offseason, McNally and Jastremski exchanged the following text messages:

Date and Time	Sender	Recipient	Message
05/09/2014 16:37:16 EDT	Bird[46] (603) 321-xxxx	John Jastremski (508) 958-xxxx	You working
05/09/2014 16:37:53 EDT	John Jastremski (508) 958-xxxx	Bird (603) 321-xxxx	Yup
05/09/2014 16:39:40 EDT	Bird (603) 321-xxxx	John Jastremski (508) 958-xxxx	Nice dude....jimmy needs some kicks....lets make a deal.....come on help the deflator

There is no record of a response from Jastremski to McNally's message at 16:39:40. Approximately eight minutes later, McNally sent the following message:

Date and Time	Sender	Recipient	Message
05/09/2014 16:47:15 EDT	Bird (603) 321-xxxx	John Jastremski (508) 958-xxxx	Chill buddy im just fuckin with you ....im not going to espn.....yet

These text messages were among those we were unable to discuss with McNally due to the refusal of counsel for the Patriots to arrange a follow-up interview of McNally.[47]

B. Communications About Inflation and Deflation

1. Brady's Dissatisfaction with Game Balls During the Jets Game

As described in Section II.B.2, during the game between the Patriots and the Jets on October 16, 2014, Tom Brady complained about the feel and inflation level of the game balls.

[46] Jastremski confirmed that the name "Bird" in his list of contacts refers to Jim McNally. McNally confirmed that the telephone number listed for "Bird" in Jastremski's phone data is his own cell phone number. Complete telephone numbers are not reproduced in this Report. The last four digits have been replaced with "xxxx."

[47] Our investigation did not discover these messages until after our initial interview with McNally. In response to our request for a follow-up interview, rather than producing McNally, counsel for the Patriots tried to negotiate terms, requested that interview topics be provided in advance and offered to "consider" the use of written interrogatories, all of which we declined as inappropriate and inconsistent with our reliance on traditional investigative methods. We reiterated our offer to conduct our follow-up interview of McNally at any time or location convenient to McNally, but counsel for the Patriots refused.

According to Jastremski, while complaining about the balls on the sidelines during the game, Brady made a comment about McNally and referred to the testing of the game balls by the game officials prior to the game. Jastremski explained that Brady "knows that Jim is the referees locker room attendant," and recalls that Brady said something like, "isn't he in there to make sure the balls are staying where they should be?" Jastremski said that he mentioned Brady's comment to McNally on the sideline, and that McNally responded "f— Tom." McNally also recalls Brady being angry about the footballs during the game and expressing frustration about the game officials and their examination of the game balls. McNally claimed that he viewed Brady's comments as "an attack on me" because McNally was responsible for bringing the game balls to the Officials Locker Room, and interpreted Brady's statements as criticism.

When interviewed, Brady claimed that, prior to the events surrounding the AFC Championship Game, he did not know McNally's name or anything about McNally's game-day responsibilities, including whether McNally had any responsibilities relating to game balls or the game officials. When asked specifically whether he had spoken with Jastremski about McNally on the night of the Jets game, he stated: "I didn't know who Jim McNally was so I find it hard to believe I could bring that up." On this point, Brady's statement is inconsistent with Jastremski's statements that Brady knew McNally and made a comment about McNally during the Jets game when complaining about the game balls. With respect to his complaints about the footballs during the Jets game, Brady remembers being angry and expressing frustration about the balls. Brady recalls telling Jastremski that the game balls "f-ing suck" to express his unhappiness, although he also acknowledged that the game officials were the more appropriate target of his frustration.

During halftime of the Jets game, Jastremski exchanged text messages with an unidentified recipient concerning Brady's complaints about the game balls.

Date and Time	Sender	Recipient	Message
10/16/2014 21:51:22 EDT	John Jastremski (508) 958-xxxx	[recovered-19][48]	Tom is acting crazy about balls
10/16/2014 21:51:27 EDT	John Jastremski (508) 958-xxxx	[recovered-19]	Ready to vomit!
10/16/2014 21:53:04 EDT	[recovered-19]	John Jastremski (508) 958-xxxx	K
10/16/2014 21:53:04 EDT	[recovered-19]	John Jastremski (508) 958-xxxx	He saying there not good enough??
10/16/2014 21:53:58 EDT	John Jastremski (508) 958-xxxx	[recovered-19]	Tell later

The following morning, Friday October 17, 2014, McNally and Jastremski exchanged the following text messages:

Date and Time	Sender	Recipient	Message
10/17/2014[49] 09:05:45 EDT	Bird (603) 321-xxxx	John Jastremski (508) 958-xxxx	Tom sucks...im going make that next ball a fuckin balloon
10/17/2014 09:07:08 EDT	John Jastremski (508) 958-xxxx	Bird (603) 321-xxxx	Talked to him last night. He actually brought you up and said you must have a lot of stress trying to get them done...
10/17/2014 09:07:37 EDT	John Jastremski (508) 958-xxxx	Bird (603) 321-xxxx	I told him it was. He was right though...
10/17/2014 09:08:07 EDT	John Jastremski (508) 958-xxxx	Bird (603) 321-xxxx	I checked some of the balls this morn... The refs fucked us...a few of then were at almost 16

[48] According to Renaissance, the recipient cannot be identified (and is referenced as recovered-19) because these messages had been deleted, but were still partially recoverable by the forensic tools used to image Jastremski's cell phone. Although Renaissance was able to retrieve limited information about certain deleted messages from Jastremski's phone, the contact information could not be fully recovered. In addition, Renaissance was unable to determine with certainty when the recovered messages were deleted or whether there were other relevant deleted messages (*i.e.*, deleted messages that left no recoverable information at all).

[49] Based on the data collected from Jastremski's phone, McNally's 9:05 a.m. text was the first text message exchange between them in twelve days. The cell phone data retrieved from Jastremski's phone by Renaissance does not reflect any telephone conversations between Jastremski and McNally during that period.

Date and Time	Sender	Recipient	Message
10/17/2014 09:08:29 EDT	John Jastremski (508) 958-xxxx	Bird (603) 321-xxxx	They didnt recheck then after they put air in them
10/17/2014 09:16:31 EDT	Bird (603) 321-xxxx	John Jastremski (508) 958-xxxx	Fuck tom ...16 is nothing...wait till next sunday
10/17/2014 09:16:52 EDT	John Jastremski (508) 958-xxxx	Bird (603) 321-xxxx	Omg! Spaz

When interviewed, both Jastremski and McNally stated that McNally's message "Tom sucks...im going make that next ball a fuckin balloon" referenced Brady's conduct during the Jets game. McNally acknowledged that his use of the word "balloon" referred to a heavily inflated football, but described the message as him "busting nuts on Johnny" because McNally has "no control over those things."

Although McNally's message at 9:05:45 ("Tom sucks...im going make that next ball a fuckin balloon") was obviously a comment about Brady, both Jastremski and McNally claimed that the "him" referenced in Jastremski's 9:07:08 response ("Talked to him last night. He actually brought you up and said you must have a lot of stress trying to get them done...") referred not to Brady but to Jastremski's Friend, and that the subject matter of the communication was McNally's resale of Patriots game tickets.[50] Jastremski and McNally made the same claim regarding the "him" referenced in Jastremski's 9:07:37 message ("I told him it was. He was right though..."). For the reasons described below, we believe that these claims are implausible and cannot be accepted.

[50] According to McNally, his family has held season tickets for Patriots home games for approximately thirty years. We understand the seats to be located approximately 15-20 rows up from the field, on or around the fifty-yard line behind the Patriots bench. When interviewed, McNally said that his sister, who controlled the tickets for the 2014 season, has been diagnosed with an illness, and, as a result, was attending fewer games. He claimed that she also was failing to arrange for other people to use the tickets, and that he noticed at times during the season that no one was sitting in the seats. McNally claimed that, in relation to this issue, he and Jastremski discussed Jastremski's Friend, who McNally thought could help him sell his tickets.

In our view, the most plausible reading of the text messages exchanged between 9:05:45 and 9:16:52 is that the entire message string relates to Brady's complaints about the game balls, McNally's suggestion that future game balls would be over-inflated, conversations between Jastremski and Brady about the game balls, and Jastremski's confirmation that Brady "was right" that the game balls used during the Jets game were over-inflated. In other words, we believe that the most plausible reading of Jastremski's messages to McNally at 9:07:08 and 9:07:37 is that Jastremski talked to Brady the night of the Jets game, that Brady brought McNally up and said that McNally "must have a lot of stress trying to get them done," and that Jastremski told Brady that "it was" stressful for McNally. Similarly, we believe that the most plausible reading of the messages exchanged between 9:08:07 and 9:16:31 is that Jastremski had checked some of the game balls the morning after the Jets game, that some of the balls were over-inflated, and that McNally's response was, in substance, that Brady should expect the balls to be at an even higher inflation level for the next home game the following Sunday.

We also find implausible the claim by Jastremski and McNally that the statement "He was right" in Jastremski's 9:07:37 message refers to Jastremski's Friend, and not Brady, given the context and Jastremski's text messages earlier that morning to another person that "Tom was right" that game balls used during the Jets game were over-inflated. A further discussion of these messages appears below in Section IV.B.2.

Four days later, on Tuesday, October 21, 2014, McNally and Jastremski exchanged the following messages:

Date and Time	Sender	Recipient	Message
10/21/2014 13:56:13 EDT	Bird (603) 321-xxxx	John Jastremski (508) 958-xxxx	Make sure you blow up the ball to look like a rugby ball so tom can get used to it before sunday
10/21/2014 14:05:21 EDT	John Jastremski (508) 958-xxxx	Bird (603) 321-xxxx	Omg

When interviewed, McNally acknowledged that his reference to "a rugby ball" meant a heavily-inflated football.

On Thursday, October 23, 2014, three days before the Patriots home game that Sunday against the Chicago Bears, Jastremski and McNally exchanged the following messages:

Date and Time	Sender	Recipient	Message
10/23/2014 18:47:21 EDT	John Jastremski (508) 958-xxxx	Bird (603) 321-xxxx	Can't wait to give you your needle this week :)
10/23/2014 18:54:40 EDT	Bird (603) 321-xxxx	John Jastremski (508) 958-xxxx	Fuck tom....make sure the pump is attached to the needle.....fuckin watermelons coming
10/23/2014 18:56:13 EDT	John Jastremski (508) 958-xxxx	Bird (603) 321-xxxx	So angry
10/23/2014 19:04:42 EDT	Bird (603) 321-xxxx	John Jastremski (508) 958-xxxx	The only thing deflating sun..is his passing rating

When shown these messages, and asked about the reference to giving McNally his "needle" this week, Jastremski claimed that he was "joking around" with McNally and "busting his balls" because McNally had complained a few times earlier in the season that the air pump and pressure gauge he delivered to the Officials Locker Room only had one needle for the two devices. According to both McNally and Jastremski, McNally had asked Jastremski to provide two needles so that the officials would not need to switch the needle back and forth between the gauge and pump when they inspected the game balls prior to the game. In response to questions, Jastremski said that the joke was that he finally would provide a needle for both the gauge and the pump, and that his text message had nothing to do with the deflation of footballs using a needle. We do not view these explanations as plausible or consistent with common sense. We believe that the most plausible reading of the messages between 18:47:21 and 18:54:40 is a

reference by Jastremski to a "needle" that he will provide to McNally, followed by a response by McNally that he will use the needle to inflate rather than deflate the game balls.

McNally and Jastremski both stated that McNally's comment that "the only thing deflating sun…is his passing rating" also was a joke related to McNally's bruised feelings towards Brady from the Jets game. We believe that the most plausible interpretation of McNally's message at 19:04:42 is a threat, in the form of a joke, that the game balls for the upcoming game on Sunday against the Bears would not be deflated and only Brady's passer rating would be deflated. Both McNally and Jastremski rejected this interpretation of the message. They offered no reasonable alternate explanation for the statement that the "only thing deflating" on Sunday would be Brady's passing rating.

The next day, Friday, October 24, 2014, McNally and Jastremski exchanged the following messages:

Date and Time	Sender	Recipient	Message
10/24/2014 16:47:53 EDT	John Jastremski (508) 958-xxxx	Bird (603) 321-xxxx	I have a big needle for u this week
10/24/2014 17:00:59 EDT	Bird (603) 321-xxxx	John Jastremski (508) 958-xxxx	Better be surrounded by cash and newkicks....or its a rugby sunday
10/24/2014 17:13:40 EDT	Bird (603) 321-xxxx	John Jastremski (508) 958-xxxx	Fuck tom
10/24/2014 17:15:52 EDT	John Jastremski (508) 958-xxxx	Bird (603) 321-xxxx	Maybe u will have some nice size 11s in ur locker
10/24/2014 17:31:07 EDT	Bird (603) 321-xxxx	John Jastremski (508) 958-xxxx	Tom must really be working your balls hard this week

Jastremski characterized his reference to a "big needle" as another joke. He claimed that there are two sizes of needles and that McNally had made fun of him earlier in the season for providing a smaller needle. McNally provided a similar explanation. Jastremski also stated that McNally's references to "cash" and sneakers ("new kicks" and "size 11s") were jokes.

Jastremski said that McNally had frequently "busted his chops" asking for sneakers. McNally acknowledged that the reference to "rugby sunday" was a reference to over-inflated footballs.

In our view, the most plausible reading of this exchange, which clearly was made in a joking tone, is that Jastremski was referring to a "needle" that would be given to McNally for him to use to deflate footballs, followed by McNally's response that unless the needle was "surrounded by cash" and new sneakers, the balls would not be deflated and, instead, would feel like over-inflated "rugby" balls. McNally and Jastremski denied that their exchange referred, even as a joke, to McNally being provided with a needle by Jastremski so that McNally could deflate Patriots game balls after they were examined by the officials.

On Saturday, October 25, 2014, Jastremski and McNally exchanged the following messages:

Date and Time	Sender	Recipient	Message
10/25/2014 15:14:43 EDT	John Jastremski (508) 958-xxxx	Bird (603) 321-xxxx	Size 11?
10/25/2014 15:14:54 EDT	John Jastremski (508) 958-xxxx	Bird (603) 321-xxxx	2 or 3X?
10/25/2014 16:05:34 EDT	Bird (603) 321-xxxx	John Jastremski (508) 958-xxxx	Tom must really be on you
10/25/2014 16:05:39 EDT	Bird (603) 321-xxxx	John Jastremski (508) 958-xxxx	11 0r 11half.....2x unless its tight fitting
10/25/2014 16:06:39 EDT	John Jastremski (508) 958-xxxx	Bird (603) 321-xxxx	Nah. Hasn't even mentioned it, figured u should get something since he gives u nothing
10/25/2014 16:07:12 EDT	John Jastremski (508) 958-xxxx	Bird (603) 321-xxxx	Granted I already left stadium so unless Dave leaves room tomorrow then it'll wait till next week
10/25/2014 16:09:10 EDT	Bird (603) 321-xxxx	John Jastremski (508) 958-xxxx	No prob

In their interviews, both Jastremski and McNally confirmed that the messages referenced footwear ("Size 11") and clothing sizes ("2 or 3X"). When asked who he was referencing and

what he meant by "Nah. Hasn't even mentioned it," Jastremski said that he was referring to Brady and asking the game officials to keep the Patriots footballs set to 12.5 psi. McNally said that he understood Jastremski to be referring to Brady and the "big" footballs used during the Jets game.

Jastremski claimed that "he gives u nothing" referred to Dave Schoenfeld, the Equipment Manager for the Patriots, rather than Brady. We find that explanation implausible. McNally himself acknowledged that he understood "he gives u nothing" to refer to Brady providing "nothing" to McNally, while Brady had provided items of value to others. McNally also said that he understood the later reference to "unless Dave leaves the room" to mean that Jastremski did not want Schoenfeld to see Jastremski provide McNally with clothing and sneakers. Jastremski believes that he gave McNally the requested gear—a hooded sweatshirt and a pair of sneakers—sometime around January 7, 2015, shortly before the divisional playoff game between the Patriots and the Baltimore Ravens.

2. The "Alternate" Explanation Offered by Jastremski and McNally for the October 17 Messages

As noted above, both Jastremski and McNally claimed that Jastremski was referring to Jastremski's Friend and McNally's resale of Patriots tickets when Jastremski responded to McNally's text concerning Brady at 9:07:08 a.m. on October 17, 2014, and wrote "Talked to him last night. He actually brought you up and said you must have a lot of stress trying to get them done...." McNally said the "stress" referred to his efforts to get the tickets sold in order to recover his expenses for the seats, a topic that, according to McNally, he and Jastremski talked about a lot.

Jastremski claimed that he and McNally spoke about the resale of tickets on the sidelines during the Jets game, and that Jastremski offered to find out whether JF could help

because he previously had sold Patriots tickets. When asked what he meant in the message sent at 9:07:37 that "[h]e was right though," Jastremski said that JF told him that it is relatively easy to sell tickets on eBay or StubHub but if the buyer "acts like a total ass, you can lose your season tickets."

At the suggestion of counsel for the Patriots, a telephone interview of JF took place on March 5, 2015. Although we requested that the interview take place in person, counsel for the Patriots informed us that JF was only able to speak by telephone and would only speak with us on the condition that his identity not be revealed in this Report. Although we were reluctant to conduct an interview subject to these limitations, we ultimately agreed because it was the only basis on which to obtain access to JF as a witness.

The interview took place during a conference call at Gillette Stadium with counsel for the Patriots participating. JF stated that he was at his home in Quincy, Massachusetts during the call. He said that he has known Jastremski since middle school and that they are close friends. JF said that he had spoken with McNally on one or more occasions and met him at least once. According to JF, he saw McNally at the Super Bowl in Indianapolis (in February 2012) when they had dinner together with Jastremski, but had not seen or spoken to McNally since that time. JF said that he slept at Jastremski's house the night of the October 2014 Jets game, and that they spoke for thirty to forty-five minutes after midnight when Jastremski arrived home. According to JF, Jastremski knew that JF had another friend who has Patriots season tickets and asked what that friend did if he wanted to sell the tickets. JF said that he told Jastremski that the friend ordinarily does not give away or sell his tickets, but that if he does, he gives them to family members. JF said that if the people sitting in the seats cause problems, the season ticket-holder can lose the seats permanently and his friend does not want to take that risk. JF also said

that it was "not a detailed conversation," but that Jastremski mentioned that McNally had tickets and was concerned that they were not always used. When asked for his understanding of Jastremski's text message to McNally at 9:07:08 on October 17, 2014 ("He actually brought you up and said you must have a lot of stress trying to get them done"), JF stated that he did not have any understanding of the message or to whom it referred. In response to our requests, JF refused to provide us with any text messages, emails or records of phone calls with Jastremski regarding Patriots game balls or the sale of tickets to Patriots games.

We do not find the information provided by JF about his alleged conversation with Jastremski credible and we do not think it has any bearing on the proper understanding of the October 17 text messages between Jastremski and McNally. As noted above, we believe that the entire message string between 9:05:45 and 9:16:52 relates to Brady's complaints about the game balls, McNally's suggestion that future game balls would be over-inflated, conversations between Jastremski and Brady about the game balls and Jastremski's confirmation that Brady "was right" that the balls were over-inflated. Taken in context, we believe that the references to "talked to him," "[h]e actually brought you up and said you must have a lot of stress trying to get them done," "I told him it was," and "[h]e was right though," all refer to Brady. There is no reference to JF by name or otherwise in these messages. Further, JF's explanation that his "advice" was sought based on a friend's experience is inconsistent with statements by Jastremski and McNally that JF had personal experience selling tickets and that JF said it was "relatively easy" to sell tickets.

In addition, approximately one hour before the text message exchange with McNally, Jastremski used almost identical language—"Tom was right"—to describe Jastremski's determination that the footballs used during the Jets game were over-inflated, as

Brady had said during the game. Jastremski exchanged the following messages with his fiancée beginning at 8:04:56 on October 17:

Date and Time	Sender	Recipient	Message
10/17/2014 08:04:56 EDT	John Jastremski (508) 958-xxxx	Panda[51] (508) 265-xxxx	Ugh...Tom was right.
10/17/2014 08:05:23 EDT	John Jastremski (508) 958-xxxx	Panda (508) 265-xxxx	I just measured some of the balls. They supposed to be 13 lbs... They were like 16. Felt like bricks

The likelihood of McNally experiencing stress about the resale of tickets also is contradicted by other text messages from McNally that describe the possible sale of his tickets and reflect no stress whatsoever. On September 30, 2014, McNally exchanged the following messages with Jastremski about the sale of his Patriots tickets:

Date and Time	Sender	Recipient	Message
09/30/2014 18:36:17 EDT	Bird (603) 321-xxxx	John Jastremski (508) 958-xxxx	Not sure if your interested in buying my 50 yard line seats for your women sunday...just asking....i can just sell them back to the team if not....by the way ....shitty k balls last night
09/30/2014 18:46:09 EDT	John Jastremski (508) 958-xxxx	Bird (603) 321-xxxx	I probably won't, but I can ask around and let you know
09/30/2014 18:48:53 EDT	Bird (603) 321-xxxx	John Jastremski (508) 958-xxxx	No prob bud....i can just sell them back and save you any hassle

McNally's own words, and the fact that the Patriots offer a ticket exchange through which season ticketholders may permissibly sell their seats to others, is another reason that we find it implausible that Jastremski was referring to the stress of selling 50-yard line seats to Patriots games when, in response to a message from McNally expressing anger at Brady and threatening that McNally would "make" future game balls used by Brady over-inflated like "a fuckin

[51] Jastremski confirmed that "Panda" is the contact name listed in his phone's address book for his fiancée.

balloon," Jastremski responded: "Talked to him last night. He actually brought you up and said you must have a lot of stress trying to get them done."[52]

C. Additional Deflation Reference by McNally

A text message sent by McNally to Jastremski during a Patriots road game against the Green Bay Packers on November 30, 2014, includes a possible suggestion to "deflate" footballs. As recovered from Jastremski's cell phone, the message states:

Date and Time	Sender	Recipient	Message
11/30/2014 18:01:08 EST	Bird (603) 321-xxxx	John Jastremski (508) 958-xxxx	Deflate and give somebody that jkt

Kickoff for the game was scheduled for 4:25 p.m. EST, so it is likely that the text message was sent at or around halftime. We planned to discuss this message with McNally during our requested follow-up interview. As noted above, we were unable to do so because counsel for the Patriots refused to make McNally available.

D. McNally Requests and Receives Items Autographed by Brady, Sneakers and Apparel

As described above, in January 2015, Jastremski provided McNally with sneakers and certain items of apparel in response to requests from McNally. Text messages from McNally to Jastremski also reflect requests by McNally for other items or comments that he had not received certain items. For example, in December 2014, Jastremski and McNally exchanged the following text messages:

[52] As noted above, when asked if he spoke with Jastremski about McNally the night of the Jets game, Brady stated: "I didn't know who Jim McNally was so I find it hard to believe I could bring that up." Brady's statement is contradicted by Jastremski's statement during his interview that Brady knew McNally and made a comment about McNally during the Jets game when complaining about the game balls.

Date and Time	Sender	Recipient	Message
12/5/2014 19:37:25 EST	John Jastremski (508) 958-xxxx	Bird (603) 321-xxxx	Big game tonight
12/5/2014 19:39:25 EST	Bird (603) 321-xxxx	John Jastremski (508) 958-xxxx	Tell tom i need courtside
12/10/2014 19:55:42 EST	Bird (603) 321-xxxx	John Jastremski (508) 958-xxxx	Im sure tom put my fresh new uggs in my locker

McNally described these texts as jokes, which we think is likely the case. Specifically, on December 5, 2014, the Boston Celtics were playing the Los Angeles Lakers in Boston and McNally had been asking Jastremski to get them tickets to a Celtics-Lakers game for years. McNally said the joke was that Brady should get them courtside seats for the game. With regard to the Uggs, McNally said that around the holidays each year Brady gives Uggs footwear to certain Patriots staff members, but that McNally has never received them. He explained that his message was a humorous response to a news report on Brady's distribution of Uggs in 2014.

On Saturday, January 10, 2015, in the Patriots equipment room prior to the divisional playoff game between the Patriots and the Ravens, McNally did receive certain items autographed by Brady. Leading up to that game, McNally and Jastremski discussed that McNally would receive footballs autographed by Brady and other items of value. On January 7, they exchanged the following text messages:

Date and Time	Sender	Recipient	Message
01/07/2015 09:48:03 EST	Bird (603) 321-xxxx	John Jastremski (508) 958-xxxx	Remember to put a couple sweet pig skins ready for tom to sign
01/07/2015 09:48:26 EST	John Jastremski (508) 958-xxxx	Bird (603) 321-xxxx	U got it kid...big autograph day for you
01/07/2015 09:51:19 EST	Bird (603) 321-xxxx	John Jastremski (508) 958-xxxx	Nice throw some kicks in and make it real special

Date and Time	Sender	Recipient	Message
01/07/2015 09:51:44 EST	John Jastremski (508) 958-xxxx	Bird (603) 321-xxxx	It ur lucky. 11?
01/07/2015 10:10:11 EST	Bird (603) 321-xxxx	John Jastremski (508) 958-xxxx	11 or 11 and half kid

Three days later, in the Patriots equipment room and with Jastremski present, Brady autographed two footballs supplied by Jastremski and handed the balls to McNally. McNally understood the balls to be Patriots practice balls. At that time, Brady also signed a Tom Brady game-worn jersey for McNally. According to McNally, he had received the jersey years earlier from a former Patriots Equipment Manager. Jastremski confirmed that Brady autographed the items for McNally around the time that Brady was selecting the game balls to be used during the game against the Ravens.

According to McNally, the jersey autographed by Brady has been framed and now hangs in his house, and the footballs autographed by Brady were placed in display cases and given by McNally to family members as gifts. McNally claims to have made no efforts to sell the autographed items.

E. Items of Value Received by Jastremski from Brady

Jastremski also has received various items of value from Brady, including in the months before the AFC Championship Game. Over the years, Brady has recognized Jastremski for his work with occasional tips and other gifts. In addition to receiving money from a holiday pool organized by Patriots players, Jastremski believes that he received a supplemental tip of $1,500 from Brady during the 2014 holiday season and has received $500 in cash or gift cards from Brady in previous years.

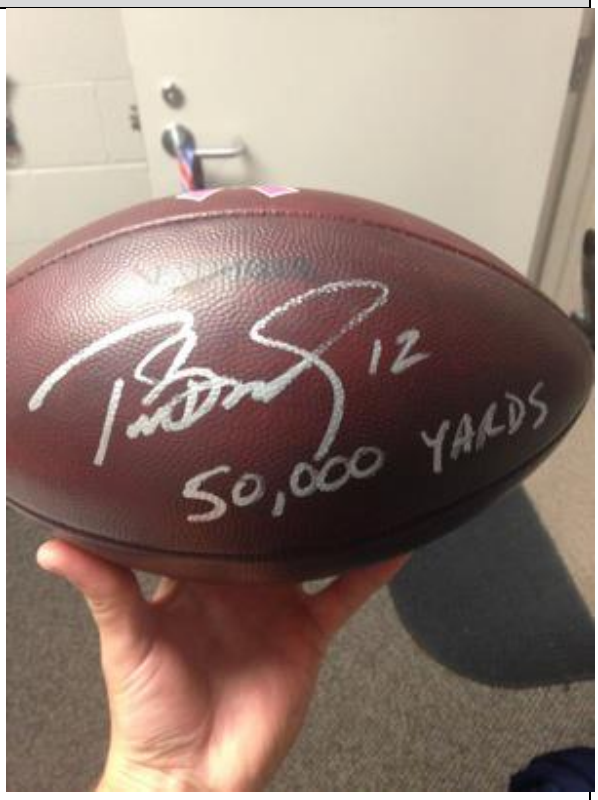
According to Jastremski, he also received from Brady two tickets to a Los Angeles Lakers game when Jastremski visited Los Angeles a few years ago. Brady vaguely

recalls sending Jastremski "in the right direction" through "a contact of a contact of a contact" for the Lakers tickets, and said that he may have been able to arrange for the tickets for free.

In addition, Brady provided Jastremski with a particularly noteworthy and valuable autograph on or about October 5, 2014, following the Patriots game against the Cincinnati Bengals during which Brady became the sixth quarterback in NFL history to exceed 50,000 career passing yards. In text messages, Jastremski described a ball autographed for him by Brady after the game as "the ball that was used in the game on the play when he passed" the 50,000 yard mark. Specifically, Jastremski exchanged the following text messages with his mother on October 8, 2014:

Date and Time	**Sender**	**Recipient**	**Message**
10/08/2014 10:23:39 EDT	John Jastremski (508) 958-xxxx	Mom Cell[53] (508) 340-xxxx	Brady passed for 50,000 yards on Sunday for his career...
10/08/2014 10:24:10 EDT	John Jastremski (508) 958-xxxx	Mom Cell (508) 340-xxxx	I took the ball when it happened and had him sign it...looks awesome...

[53] Jastremski confirmed that "Mom Cell" is the contact name listed in his phone's address book for his mother.

Date and Time	Sender	Recipient	Message
10/08/2014 10:26:20 EDT	John Jastremski (508) 958-xxxx	Mom Cell (508) 340-xxxx	
10/08/2014 11:19:28 EDT	Mom Cell (508) 340-xxxx	John Jastremski (508) 958-xxxx	I'm sure he will want to keep that one!!
10/08/2014 11:21:36 EDT	Mom Cell (508) 340-xxxx	John Jastremski (508) 958-xxxx	He doesn't want it?
10/08/2014 11:22:38 EDT	John Jastremski (508) 958-xxxx	Mom Cell (508) 340-xxxx	Nope. Told him I took it for myself and asked him to sign it for me
10/08/2014 11:25:52 EDT	Mom Cell (508) 340-xxxx	John Jastremski (508) 958-xxxx	I thought I saw a picture of him on my Facebook getting the game all from belichick after the game?
10/08/2014 11:25:52 EDT	Mom Cell (508) 340-xxxx	John Jastremski (508) 958-xxxx	You better consider that your Christmas present!!!!
10/08/2014 11:28:25 EDT	John Jastremski (508) 958-xxxx	Mom Cell (508) 340-xxxx	Nope. The balls given after the game are usually not actual game used balls...Kraft grabbed a random one that was in the equipment room bc the game balls were still on the field...
10/08/2014 11:28:45 EDT	John Jastremski (508) 958-xxxx	Mom Cell (508) 340-xxxx	This was the ball that was used in the game on the play when he passed it
10/08/2014 11:29:07 EDT	Mom Cell (508) 340-xxxx	John Jastremski (508) 958-xxxx	HOLY MOLY!!!!!

Date and Time	Sender	Recipient	Message
10/08/2014 11:30:36 EDT	Mom Cell (508) 340-xxxx	John Jastremski (508) 958-xxxx	I would put it in a safe deposit box :-)

Jastremski sent similar text messages that day to his sister, writing that only five other NFL quarterbacks had passed for 50,000 yards and that he "took the ball that [Brady] did it with on that play :)." His sister responded that selling the football could help pay for Jastremski's upcoming honeymoon.

Three days later, on October 11, 2014, the Patriots posted an article on the patriots.com website entitled "Game ball used by Tom Brady when he surpassed 50,000 yards is on display at The Hall." The article stated that "[t]he ball used to surpass the 50,000-yards mark along with the game jersey Brady wore that day are now on display at The Hall at Patriot Place presented by Raytheon." The article also quoted a comment made by Brady during an October 7, 2014 interview on WEEI radio that the ball "should be for Patriots fans to enjoy. It goes down as an individual award, but everyone I've ever played with plays a part of that. That should go to the Patriots Hall of Fame. That should be for the fans to be able to see because we accomplish everything together."[54]

That afternoon, Jastremski exchanged the following text messages with family members:

Date and Time	Sender	Recipient	Message
10/11/2014 14:04:33 EDT	John Jastremski (508) 958-xxxx	Jen Cell[55] (508) 612-xxxx	Funny...go to patriots.com. They have an article about the 50,000 yard ball...if they only knew :)

[54] Game ball used by Tom Brady when he surpassed 50,000 yards is on display at The Hall, Patriots.com (Oct. 11, 2014), http://www.patriots.com/news/2014/10/11/game-ball-used-tom-brady-when-he-surpassed-50000-yards-display-hall.

[55] Jastremski confirmed that "Jen Cell" is the contact name listed in his phone's address book for his sister.

Date and Time	Sender	Recipient	Message
10/11/2014 14:05:31 EDT	John Jastremski (508) 958-xxxx	Mom Cell (508) 340-xxxx	If u go to patriots.com you should see the article about the 50,000 yard ball. If they only knew :)

It appears that Jastremski also sent a similar message—subsequently deleted from his phone—to another person, who responded:

Date and Time	Sender	Recipient	Message
10/11/2014 14:04:55 EDT	[recovered-19]	John Jastremski (508) 958-xxxx	Haha....That is funny! I like how Brady lied on WEEI as well. Ha. Is that the actual Jersey?
10/11/2014 14:05:52 EDT	John Jastremski (508) 958-xxxx	[recovered-19]	Yup, that's the jersey

When interviewed, Jastremski appeared evasive in response to questions about receiving autographed items from Brady.[56] Jastremski acknowledged that he asked Brady to autograph a football for him this past season, but when asked whether it was a particular or special football, Jastremski said that it was "just a general" football. In response to further questions, Jastremski said that he was only guessing that the football had been used in a game, that he did not recall the game in which the football was used, and that the football did "not really" have any special significance. When asked specifically whether he recalled that Brady crossed the 50,000 yard career milestone in October 2014, Jastremski then acknowledged that the autographed ball "was the 50,000 passing yard ball" and that it was intended to be a "mini-collection item for myself." When asked to confirm that the ball Brady autographed for him was the actual ball used by Brady to reach the 50,000 yard mark, Jastremski said that it was not the actual ball, but rather another ball used in that game, and that the Director of Security for the

[56] According to Jastremski, although he would like Brady to sign a jersey, he has never asked Brady to do so and does not think people "understand the awkwardness" of asking someone at work for an autograph. In contrast, Brady said that he signs multiple autographs a day, and did not think that he had ever turned down an autograph request from anyone associated with the Patriots.

Patriots retrieved the actual milestone ball at the game. When confronted with the messages referenced above, Jastremski said that his statements that the autographed ball was the actual 50,000 yard football were not truthful. Jastremski said that he could not recall telling Brady that it was the actual 50,000 yard football, but wanted Brady to sign the football "as a 50,000 yard memory."

During his interview, Brady said that he did not recall whether he had signed a ball of significance for Jastremski following the game during which he reached the 50,000 yard milestone. Brady confirmed, however, that the signature, the number "12," and the inscription "50,000 yards" depicted in the photograph of the ball (as reproduced above) appear to be written in his handwriting. Brady said that he had "no idea" if that football was the actual milestone football. Brady also said that he "absolutely" would write "50,000 yards" on a football "if someone asked me to do it," even if it was not the football used to reach the milestone. According to Brady, he will generally include on an autographed item anything requested by the person seeking the autograph.

Although we reach no conclusion on whether the football signed by Brady for Jastremski is the actual football used by Brady to cross the 50,000 yard milestone, it is indisputable that Brady provided Jastremski with a valuable autographed football containing the legend "50,000 yards."[57] According to Jastremski, he has the autographed and inscribed football at his home, has not attempted to sell the football and has no plans to sell the football.

[57] At the time of this Report, the NFL Shop website offered for sale licensed footballs autographed by Brady, and inscribed by him with "3x SB MVP," "4x Champ," or "SB 49 MVP" for $1,199.95. *See* http://www.nflshop.com/Tom_Brady_Gear.

V. Initial Investigative Steps and Post-Game Events

A. NFL Security Interviews McNally

Shortly after the AFC Championship Game ended, and following the post-game pressure measurements described above, members of NFL Security began to consider steps to further investigate the issues that had arisen during the game. Richard Farley suggested that NFL Security interview McNally because he was believed to be the last person with possession of the game balls before they were distributed to the ball boys. NFL Director of Investigations John Raucci approached McNally and asked to schedule time to speak the following day, Monday, January 19. McNally responded that he would be unavailable because he was employed full-time, lived in New Hampshire and would not be back at Gillette Stadium until August 2015 for the first pre-season game. Following further discussion, McNally agreed to be interviewed that night. Raucci, Farley and Dan Grossi decided that Farley should not participate in the interview because McNally and Farley had been friendly for many years. Raucci and Grossi then interviewed McNally in the Officials Locker Room for approximately thirty to forty-five minutes.[58]

Among other things, and as set forth in an NFL Security interview report, McNally told Raucci and Grossi that he was uncertain about why he decided to take the game balls to the field when he did or without an escort. According to the report, McNally stated that he walked directly to the field and that nothing unusual occurred during the walk from the locker room to the field. McNally also stated that he knows that Brady prefers game balls inflated to

[58] John Raucci joined the NFL as Director of Investigations in 2012 after a distinguished twenty-five year career with the Federal Bureau of Investigation ("FBI") during which he served as, among other things, Assistant Director, Special Agent in Charge of an FBI Field Office and Section Chief of Security Operations in the Security Division at FBI Headquarters. Dan Grossi joined the NFL as Director of Event Security in 2011 following a twenty-three year career with the Tampa (Florida) Police Department where he worked as a sergeant and detective.

12.5 psi, because Brady personally told McNally of his preference. In addition, McNally told Raucci and Grossi that he had never heard anyone even joke about deflating game balls.

When interviewed in February 2015 by the Paul, Weiss team, McNally denied that he made any of these statements during the interview with Raucci and Grossi, and stated that any report of the interview that included such statements was incorrect and inaccurate. McNally claimed that the primary topic discussed during the interview was the role of the Patriots ball boys. In separate interviews with us, Raucci and Grossi each confirmed the accuracy of the statements attributed to McNally in the report of the interview. We do not credit McNally's claim that he did not make the statements and we fully credit the recollections of Raucci and Grossi.

B. McNally Speaks with Schoenfeld and Jastremski

Around 11:45 p.m., after being interviewed by Raucci and Grossi, McNally spoke briefly with Patriots Equipment Manager Dave Schoenfeld in Schoenfeld's office. McNally told Schoenfeld that he had spoken with NFL representatives and that they would be contacting Schoenfeld as well. McNally claimed that he did not tell Schoenfeld what had been discussed during his interview. Schoenfeld recalls that McNally told him that he had been questioned about his knowledge of or involvement in issues concerning the inflation of Patriots game balls. Schoenfeld also recalls that McNally told him that he had nothing to do with the inflation or deflation of Patriots game balls and had no idea why the issue had been raised.

McNally left Gillette Stadium shortly after his conversation with Schoenfeld and drove to his home in New Hampshire, a trip that takes approximately 90 minutes. Based on data extracted from Jastremski's phone, during McNally's drive home, at 12:15 a.m., McNally called Jastremski and had a telephone conversation that lasted 30 minutes and 50 seconds. Following that phone call, Jastremski exchanged text messages with Brenden Murphy, who had learned

from McNally that his name had been given to NFL Security. Jastremski then called McNally at 12:57 a.m. and had a call lasting 37 seconds. McNally called Jastremski again at 1:06 a.m. and had another call that lasted 5 minutes and 44 seconds.

When asked about these phone calls, both McNally and Jastremski said that McNally had called to congratulate Jastremski on the Patriots' victory. McNally said that he did not recall anything further about what they discussed, including whether he told Jastremski about his meeting with NFL Security. Jastremski told us that McNally mentioned that he had spoken with NFL personnel for thirty minutes. According to Jastremski, McNally explained that the conversation "partly" concerned the inflation level of footballs and that NFL Security personnel had also asked about the Patriots ball boys.

C. Media Reports

At 9:55 p.m. on January 18, mid-way through the second half of the AFC Championship Game, Bob Kravitz, a columnist for the website for Indiana television station WTHR, published the following on Twitter: "Breaking: A league source tells me the NFL is investigating the possibility the Patriots deflated footballs Sunday night. More to come." Two minutes later, he wrote: "I'm told at one point the officials took a ball out of play and weighed it. Should hear more tomorrow on this subject." At 11:22 p.m., Kravitz posted a link on Twitter that directed viewers to an article on the WTHR website concerning the issue.[59]

Social media spread these reports across the Internet, where they soon came to the attention of the Patriots. At approximately 1:45 a.m., Berj Najarian, the Patriots Director of Football/Head Coach Administrator, sent Schoenfeld a text message asking if Schoenfeld was

[59] Bob Kravitz, Twitter post, Jan. 18, 2015, 11:22 p.m., https://twitter.com/bkravitz/status/557075486825017344 (linking to Bob Kravitz, "Kravitz: Source says NFL investigating if Patriots deflated footballs in DeflateGate scandal," WTHR.com, updated Jan. 19, 2015, 1:15 a.m., http://www.wthr.com/story/27881499/source-tells-bob-kravitz-that-patriots-may-have-deflated-footballs-against-colts).

still awake. When Schoenfeld responded immediately, Najarian called Schoenfeld and asked if he had seen the coverage on Twitter. Because both individuals were still at Gillette Stadium, Schoenfeld went to Najarian's office to discuss the issue. They spoke for approximately five minutes. Schoenfeld told Najarian that he had no knowledge that the Patriots game balls were deflated. Schoenfeld also told Najarian that the game balls had not been available at the start of the third quarter, and described his post-halftime conversations with Kensil and Jastremski. Schoenfeld did not recall whether he told Najarian that McNally had been questioned by NFL Security.[60]

Media coverage of the story intensified over the course of the morning of January 19. At 2:19 a.m., the NBC Sports Pro Football Talk website posted a story about the Kravitz tweets entitled "Report: NFL looking into whether Patriots 'deflated footballs' in AFC title game."[61] By 4:00 a.m., Newsday had reported that the NFL was investigating the issue.[62] These, and other stories, were quickly picked up on Twitter and other social media sites.

When Brady was interviewed early the next morning on the Dennis & Callahan show on WEEI radio—a pre-scheduled, weekly post-game appearance—he was asked to comment on reports that the NFL was investigating whether the Patriots had deflated game balls. Brady responded that he had not heard about the story and knew nothing about the topic. He

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[60] After the meeting, Schoenfeld sent a text message to Jastremski at approximately 1:55 a.m. and asked if he was still awake. Jastremski did not respond until the following morning. Najarian decided not to call Coach Belichick because the reports were merely Internet stories at that point in time.

[61] Morris Wilkening, "Report: NFL looking into whether Patriots 'deflated footballs' in AFC title game," ProFootballTalk, Jan. 19, 2015, http://profootballtalk.nbcsports.com/2015/01/19/report-nfl-looking-into-whether-patriots-deflated-footballs-in-afc-title-game/.

[62] Bob Glauber, Twitter post, January 19, 2015, 4:05 AM, https://twitter.com/bobglauber/status/557146827565584384 ("NFL spokesman Michael Signora confirms the NFL is looking into whether footballs were properly inflated in Patriots-Colts game"); *see also* Newsday Sports, Twitter post, Jan. 19, 2015, 6:25 a.m., https://twitter.com/NewsdaySports/status/557181939866943488 (linking to Bob Glauber, "NFL investigating Patriots for possible deflation of footballs," updated Jan. 20, 2015, 10:29 a.m.).

laughed off the allegations, remarking that "I think I've heard it all at this point" and "god, it's ridiculous." Brady later told the national media—and us—that the WEEI interview was the first time he learned that questions had been raised about the inflation level of the Patriots game balls.

Coach Belichick also said that he did not know that questions had been raised prior to hearing reports on the radio during his drive to the stadium on the morning of January 19. Belichick stated that he did not pay attention to the reports until the story continued to grow throughout the day. By that afternoon, Belichick told reporters on a conference call that he had only learned about the issue that day and that he and the Patriots would cooperate with the NFL's investigation.

D. Patriots Personnel Begin Asking Questions

After the media reports surfaced and intensified, Schoenfeld and Belichick questioned their direct reports most involved with ball preparation—Jastremski and Brady, respectively—about what each knew and whether either had acted improperly.

Schoenfeld, having already questioned Jastremski during the second half of the AFC Championship Game, questioned Jastremski again on the morning of January 19. Schoenfeld emphasized that the issue was now public and that he therefore needed to know if Jastremski or anyone he knew had deflated the footballs used during the game. Jastremski denied any involvement or knowledge.

On Thursday, January 22, Belichick reportedly discussed these issues for the first time with Brady, shortly before a team meeting. Belichick asked Brady directly whether he had any knowledge about any of the issues raised by the press since the AFC Championship Game. According to Belichick, Brady said "absolutely not." Belichick stated that he then asked if Brady or anyone Brady knew had tampered with or in any way altered the footballs. Brady again denied any knowledge or involvement. Belichick recalled that Brady also explained that once he

inspects and approves game balls, those balls are exactly as he likes them and that he would not want anyone to do anything to them after that point. Belichick believed Brady. Belichick and Brady attended the team meeting, and Belichick told the team that there was "not one shred of truth" to the deflation allegations. When given the floor, Brady repeated what he had told Belichick about wanting game balls to be exactly as he approved them.

E. The NFL Commences a Formal Investigation and Notifies the Patriots

Shortly after the conclusion of the AFC Championship Game, based on preliminary reports from League personnel who had attended the game and participated in the halftime testing described above, senior League officials concluded that it was necessary and appropriate to conduct a more formal investigation into the circumstances surrounding the use by the Patriots of footballs inflated at below-regulation air pressure levels. In an effort to notify the Patriots of this decision as soon as possible, Senior Vice President of Football Operations David Gardi prepared a letter that was sent by email to Patriots Owner Robert Kraft, with copies to Patriots President Jonathan Kraft, Coach Belichick, Commissioner Goodell and other League officials, at 11:54 a.m. on January 19.

The letter set forth the applicable provisions of Rule 2 and the 2014 Game Operations Manual and presented a summary of facts that had been gathered by NFL Security and other League personnel the night before, including that the game balls had been inspected at halftime. The letter stated, in part:

> The inspection, which involved each ball being inspected twice with different gauges, revealed that none of the Patriots' game balls were inflated to the specifications required under Rule 2, Section 1. In fact, one of the game balls was inflated to 10.1 psi, far below the requirement of 12½ to 13½ psi. In contrast, each of the Colts' game balls that was inspected met the requirements set forth above.

Gardi did not personally attend the AFC Championship Game (he had been in Seattle for the NFC Championship Game), and drafted the letter based on communications with colleagues with first-hand knowledge of events that had taken place at Gillette Stadium.

In fact, none of the Patriots game balls measured 10.1 psi when they were tested at halftime. We believe that there was an inadvertent error in communication of the results to Gardi. The NFL personnel providing the air pressure information to Gardi at the time did not have copies of the documents on which the measurements had been recorded by Richard Farley and were relying on memory alone. We do not believe that this error raises any doubt about the accuracy of the measurements recorded by Farley or any other relevant issue. We also note that the statement in the letter about the Colts measurements did not make clear that the Colts game balls inspected met the requirements on at least one of the two gauges used to measure the balls. In any event, with the knowledge and approval of League staff, we subsequently provided all of the air pressure data to counsel for the Patriots during the course of the investigation subject to a confidentiality commitment.

VI. Communications Following the AFC Championship Game

John Jastremski's cell phone records reflect that he stayed in close contact with both McNally and Brady in the days following the AFC Championship Game. All three claimed during their interviews with us that their communications did not involve (or only briefly touched on) the deflation issues. The sequence, length and timing of the conversations and text message exchanges raise questions concerning the plausibility of these claims.

A. January 19, 2015

Jastremski and Brady spoke to each other on the telephone four times on January 19, for a total of 25 minutes and 2 seconds. They also exchanged a total of twelve text messages. Jastremski and McNally spoke to each other on the telephone five times after 7:00 a.m. on

January 19, for a total of 57 minutes and 59 seconds. McNally also sent Jastremski a text message that day.

1. Jastremski Learns of Early Media Reports and Contacts Brady

Based on his cell phone records, at 7:04 a.m. on January 19, Jastremski visited the NBC Sports Pro Football Talk website and accessed the story that had been posted at 2:19 a.m. concerning the NFL's investigation of the deflation issue. Although Jastremski did not recall reading the story, he stated that he visited the website often and that his fiancée had mentioned that morning that she had heard about the allegations on either television or the radio. At 7:25 a.m., after exchanging text messages with Dave Schoenfeld, Jastremski sent Brady a text message asking Brady to call him:

Date and Time	Sender	Recipient	Message
01/19/2015 07:25:18 EST	John Jastremski (508) 958-xxxx	Tom Brady2[63] (917) 704-xxxx	Call me when you get a second

Brady called Jastremski less than a minute later, and they spoke for 13 minutes and 4 seconds.

Although Jastremski told NFL Security investigators on January 20, 2015—the day after this phone call with Brady—that he had not discussed the deflation issue with anyone other than McNally, Jastremski acknowledged during his February interview with Paul, Weiss that he discussed the issue with Brady during this call. Jastremski also said that this was "probably" the only conversation he had with Brady, by phone or in-person, concerning the deflation issue.

[63] Jastremski confirmed that "TomBrady2" is the contact name listed in his phone's address book for Patriots quarterback Tom Brady. Brady also confirmed the accuracy of his cell phone number in Jastremski's cell phone data.

According to Jastremski, his conversation with Brady on the morning of January 19 was not "overly serious." Jastremski recalls that he was "curious" about the story because he is the individual most responsible for "making" Patriots footballs. He also explained during his interview that he used the conversation as an opportunity for "semi-busting [Brady's] chops" about Brady's WEEI radio interview that morning, although Jastremski later said that he had not listened to Brady's interview and only heard about it after their conversation. Jastremski said that McNally's name did not come up during the conversation.

Brady recalls speaking with Jastremski on the morning of January 19, but did not remember "any specifics" of what was discussed beyond that they were trying to figure out the extent of the media coverage and the facts relating to the allegations against the Patriots. He does not recall what Jastremski told him about what he knew. The communications between Jastremski and Brady on January 19 appear to be their first cell phone-based communications (phone conversations or text messages) in six months.[64]

2. Jastremski Calls McNally after Brady

Less than six minutes after Jastremski finished his telephone conversation with Brady, he called McNally at 7:45 a.m. on January 19. This call between McNally and Jastremski lasted 9 minutes and 12 seconds. Jastremski described this conversation as similar to his call with Brady, stating it was more tied to his "curiosity" about "what the heck is going on." Jastremski recalls McNally again describing his late night interview with NFL Security and

[64] The most recent previous text message exchange between Jastremski and Brady retrieved from Jastremski's cell phone occurred on July 4, 2014 and Jastremski's call log, which captured telephone calls between Jastremski and others dating back to August 2014, did not include any earlier calls with Brady. As previously noted, Brady declined to make his cell phone records available for our review. When interviewed, Jastremski was not sure if he had communicated by phone or text with Brady between July 2014 and December 2014, and estimated that at most they had done so fewer than three times. Brady did not recall if he had communicated by phone or text message with Jastremski in 2014.

mentioning how it had required him to stay at the stadium a lot longer than he expected after the AFC Championship Game. Jastremski recalls telling McNally that he had spoken to Brady.

3. Brady Checks in on Jastremski and Asks to Meet in QB Room

Approximately two and a half hours after they first spoke on the morning of January 19, Brady followed-up with Jastremski by text message:

Date and Time	Sender	Recipient	Message
01/19/2015 09:51:54 EST	Tom Brady2 (917) 704-xxxx	John Jastremski (508) 958-xxxx	You good Jonny boy?
01/19/2015 09:53:27 EST	John Jastremski (508) 958-xxxx	Tom Brady2 (917) 704-xxxx	Still nervous; so far so good though. I'll be alright
01/19/2015 09:54:16 EST	Tom Brady2 (917) 704-xxxx	John Jastremski (508) 958-xxxx	You didn't do anything wrong bud.
01/19/2015 09:55:01 EST	John Jastremski (508) 958-xxxx	Tom Brady2 (917) 704-xxxx	I know; I'll be all good

When interviewed, Brady recalled that Jastremski had been worried earlier that morning because he was responsible for the preparation of Patriots footballs. Brady stated that he believed at the time that Jastremski would be asked a lot of questions from within the organization, so he sent these messages to Jastremski to show his support.

Jastremski said that his reference to being "nervous" was "more in the sense of me bustin' [Brady's] balls since I'm associated with making game balls" and being concerned that people would give him "googly eyes" because they thought he was involved in the alleged deflation. Jastremski said that he was not, in fact, genuinely nervous when he sent these messages. When asked what he meant by "so far so good," Jastremski stated that "no one had yet been bustin' my balls or giving me looks."

The text message exchange between Jastremski and Brady continued about one hour later:

Date and Time	Sender	Recipient	Message
01/19/2015 10:54:40 EST	John Jastremski (508) 958-xxxx	Tom Brady2 (917) 704-xxxx	FYI...Dave will be picking your brain later about it. He's not accusing me, or anyone...trying to get to bottom of it. He knows it's unrealistic you did it yourself...
01/19/2015 10:55:32 EST	John Jastremski (508) 958-xxxx	Tom Brady2 (917) 704-xxxx	Just a heads up
01/19/2015 10:59:32 EST	Tom Brady2 (917) 704-xxxx	John Jastremski (508) 958-xxxx	No worries bud. We are all good

When asked about his comment that Schoenfeld "knows it's unrealistic you did it yourself," Jastremski claimed that it was a joke because Brady has cameras focused on him during the game. Jastremski denied that the "it" he was referring to in his 10:54:40 message was the deflation of footballs.[65]

Later that day, shortly after 2:30 p.m., Brady sent Jastremski a text message requesting that they meet:

Date and Time	Sender	Recipient	Message
01/19/2015 14:38:09 EST	Tom Brady2 (917) 704-xxxx	John Jastremski (508) 958-xxxx	Jj are you here?
01/19/2015 14:38:17 EST	John Jastremski (508) 958-xxxx	Tom Brady2 (917) 704-xxxx	Yup
01/19/2015 14:38:34 EST	Tom Brady2 (917) 704-xxxx	John Jastremski (508) 958-xxxx	Come to qb room

Jastremski acknowledged that in his twenty-year career with the Patriots he had never before met with Brady in the "qb room," which is a room that, according to Brady, serves as his "quasi-office." Jastremski reported that the meeting lasted only a few minutes and that he "walked out a

[65] Schoenfeld reported that Brady called him later that day to say that the story would pass, not to worry about it, and that nothing had happened.

very happy man" because Brady had praised and thanked Jastremski for the preparation of the footballs for the AFC Championship Game. Jastremski said that they did not discuss anything relating to the deflation of game balls during the meeting.

Brady recalls requesting that Jastremski visit the "qb room" because he was busy preparing for the Super Bowl and wanted to discuss how the game balls would be prepared. He said that he "loved" the game balls Jastremski prepared for the AFC Championship Game, and that because he was aware that Jastremski would have to prepare many more footballs for the Super Bowl than usual, he wanted to give him sufficient lead time. He acknowledged that the deflation allegations may have come up during their meeting.

4. Jastremski Speaks Again with Both McNally and Brady

At 3:21 p.m., McNally sent Jastremski the following text message:

Date and Time	Sender	Recipient	Message
01/19/2015 15:21:25 EST	Bird (603) 321-xxxx	John Jastremski (508) 958-xxxx	Give me call.....I've got a question about your wedding

Jastremski called McNally less than three minutes later, and they spoke for 7 minutes and 55 seconds. According to McNally, the conversation involved only planning for Jastremski's upcoming wedding. McNally claimed that they did not discuss the deflation allegations during this call. Approximately one hour later, Jastremski called McNally again, and they spoke for 27 minutes and 18 seconds. McNally acknowledged that the "stuff blowing up" in the media about the AFC Championship Game may have been discussed during this call.

At 5:21 p.m., Brady sent Jastremski the following text message:

Date and Time	Sender	Recipient	Message
01/19/2015 17:21:23 EST	Tom Brady2 (917) 704-xxxx	John Jastremski (508) 958-xxxx	If you get a sec give me a call

Jastremski called Brady eleven seconds later, and over the course of three calls, they were on the telephone for 11 minutes and 58 seconds:

Date and Time	Caller	Recipient	Call Duration
01/19/2015 17:21:34 EST	John Jastremski (508) 958-xxxx	Tom Brady2 (917) 704-xxxx	00:00:28
01/19/2015 17:27:06 EST	John Jastremski (508) 958-xxxx	Tom Brady2 (917) 704-xxxx	00:00:29
01/19/2015 17:30:03 EST	Tom Brady2 (917) 704-xxxx	John Jastremski (508) 958-xxxx	00:11:01

Brady does not recall what he discussed with Jastremski during these calls, but stated that he was in "Super Bowl mode" and wanted Jastremski to focus on the Super Bowl as well. Brady said that it was "possible" that they also discussed issues relating to the deflation allegations. Jastremski, too, said that these calls concerned Super Bowl football preparation issues, even though he generally discusses ball preparation issues with Brady in person. Jastremski said that there was no discussion of issues relating to the deflation allegations during these calls.

Later that evening, McNally called Jastremski twice and they spoke for 13 minutes and 34 seconds:

Date and Time	Caller	Recipient	Phone Call Duration
01/19/2015 19:30:07 EST	Bird (603) 321-xxxx	John Jastremski (508) 958-xxxx	00:08:24
01/19/2015 20:26:14 EST	Bird (603) 321-xxxx	John Jastremski (508) 958-xxxx	00:05:10

Jastremski recalls that McNally gave him a "head's up" that Jastremski's name had come up during McNally's second interview with NFL Security. McNally told us that while he was not

sure what he discussed with Jastremski during these calls, they "probably" were talking about media coverage of the deflation issues.

B. January 20, 2015

Jastremski and Brady spoke to each other twice by telephone on January 20, 2015, for a total of 9 minutes and 55 seconds. They also exchanged two text messages. Jastremski and McNally spoke to each other on the telephone once on January 20, for a total of 5 minutes and 27 seconds. McNally and Jastremski did not exchange text messages that day.

1. Jastremski and Brady Continue to Speak by Phone

On the morning of January 20, 2015, Jastremski sent Brady a text message at 7:24 a.m. and again asked Brady to call:

Date and Time	Sender	Recipient	Message
01/20/2015 07:24:47 EST	John Jastremski (508) 958-xxxx	Tom Brady2 (917) 704-xxxx	Call me when you get a second

Brady called Jastremski within the hour and they spoke for 6 minutes and 21 seconds. According to Jastremski, this conversation concerned the number of footballs Brady wanted prepared for the Super Bowl, and did not include a discussion of deflation issues. Brady did not recall what was discussed during this conversation, reporting only that he was generally focused on the Super Bowl and that he was trying to keep Jastremski, who he knew was stressed, similarly focused.

At 5:13 p.m. on January 20, Brady again checked in with Jastremski by text message:

Date and Time	Sender	Recipient	Message
01/20/2015 17:13:38 EST	Tom Brady2 (917) 704-xxxx	John Jastremski (508) 958-xxxx	You doing good?

Jastremski called Brady less than fifteen minutes later and they spoke for 3 minutes and 34 seconds. Jastremski said that he did not understand Brady's text message to be a reference to the NFL's investigation of the circumstances surrounding the AFC Championship Game, even though Jastremski had been interviewed by NFL Security that afternoon. Instead, Jastremski said that he understood Brady to be checking in because Brady knew that "it's a pain in the butt" to prepare over fifty footballs for the Super Bowl. When asked if he told Brady anything about his interview that day, Jastremski said that he mentioned that he had met with two NFL representatives for two hours. Jastremski said that they did not discuss the substance of his interview. Brady does not recall what he discussed with Jastremski on this call.

2. Jastremski Calls McNally

Approximately forty minutes later, at 6:11 p.m., Jastremski called McNally and they spoke for 5 minutes and 27 seconds. Jastremski did not recall what they discussed during this call, but speculated that it may have concerned his wedding. McNally similarly did not recall the discussion, but thought it "probably" concerned media coverage of the investigation into the footballs used during the AFC Championship Game.

C. January 21, 2015

On Wednesday, January 21, 2015, Brady sent Jastremski a text message at 7:27 a.m. asking Jastremski to call him.

Date and Time	Sender	Recipient	Message
01/21/2015 07:27:48 EST	Tom Brady2 (917) 704-xxxx	John Jastremski (508) 958-xxxx	Hey bud give me a call when you get a sec

For the third straight morning, Jastremski and Brady spoke by phone, this time for 13 minutes and 47 seconds, starting at 7:38 a.m. They spoke again for 7 minutes and 5 seconds at 11:45:16 a.m.

Jastremski said that he recalled two topics discussed during the first call—how the footballs prepared for the Super Bowl would be used in practice, and Jastremski's wedding. Jastremski said that he was certain they did not discuss the NFL investigation or anything else concerning the deflation issues. Jastremski did not recall what they discussed during the second call. When asked if he remembered discussing the investigation or issues relating to deflated footballs with Brady at any point on January 21, Jastremski remarked that any comments would have been "probably lighthearted humor."

Brady did not remember the specifics of these calls, but similarly thought the first conversation may have concerned the preparation of Super Bowl footballs, including whether to incorporate those balls into practice the following day. He did not have a specific recollection of what was discussed during the second call.

VII. Scientific Evidence and Analysis

As noted above, scientific consultants were engaged to assist the investigative team. These consultants included a team from Exponent, one of the leading scientific and engineering consulting firms in the country, and Dr. Daniel R. Marlow, a tenured professor of Physics at Princeton University and former Chairman of the Physics Department. Among other things, we asked our expert consultants to evaluate the data collected on the day of the AFC Championship Game and consider whether it provided a basis to reach any conclusions about the likelihood that the Patriots had or had not tampered with the game balls.

Over the course of their work, our expert consultants:

- Conducted a thorough statistical analysis of the data recorded at halftime of the AFC Championship Game;

- Conducted a comprehensive examination, both physical and statistical, of the gauges used to measure the air pressure of the footballs pre-game and at halftime; and

- Evaluated the effects that various usage, physical and environmental factors present on game day would have had on the measured pressure of a football.

Based on their analyses and experiments, our consultants reached the following conclusions, among others:

- The gauges used on the day of the AFC Championship Game appear to have worked reliably and consistently on game day, and the difference in the pressure drops between the teams was not caused by a malfunction of either gauge.

- Basic thermodynamics, including principles such as the Ideal Gas Law, predict that the temperature and pressure inside a football will drop when it is brought from a warmer environment into a colder environment and rise when brought back into a warmer environment. Such principles, however, cannot account entirely for the magnitude of the drop in air pressure observed in the Patriots game balls when measured at halftime. Specifically, all but three of the Patriots footballs, as measured by both gauges, registered pressure levels lower than the range predicted by the Ideal Gas Law, when applied to the conditions considered most likely to have been present on the day of the AFC Championship Game.

- Based on the starting pressures reported by representatives of each team and by referee Walt Anderson, the Patriots game balls exhibited a greater average pressure drop than did the Colts game balls. This difference was determined to be statistically significant, regardless of which air pressure gauge was used to test the footballs prior to the game and at halftime.

- When measured at halftime, the Patriots game balls also exhibited a greater standard deviation (or variability) than did the Colts game balls. Subject to the discovery of an as yet unidentified and unexamined factor, the most plausible explanation for the variability of the Patriots halftime measurements is that the eleven footballs measured by the officials at halftime did not all start the game at or near the same pressure, even though they all measured at or near 12.5 psi when inspected by the referee prior to the game.

- None of the physical factors tested—including variations in the way a football is used during a game and differences in ball preparation—were found to contribute in any material way to changes in the internal pressure of footballs or the difference in the observed pressure drops between the Patriots and Colts balls when measured at halftime. In particular, the vigorous rubbing described by Coach Belichick during a January 24 press conference does not explain the reduction in air pressure in the Patriots game balls measured at halftime because the impact such rubbing dissipates within 15-30 minutes, and the rubbing of Patriots game balls was complete more than thirty minutes before they were inspected by the referee prior to the game.

- Based on tests using the most likely game-day conditions and circumstances, and, where possible, setting the experimental parameters to levels that would maximize the possibility of replicating the Patriots halftime measurements, the experiments and simulations failed to explain the halftime measurements recorded for the Patriots game balls. The only way to reconcile the Patriots halftime measurements with both the Colts halftime measurements and the range of physically plausible pressure levels predicted by the experiments was to set certain experimental parameters—particularly the timing of the halftime testing and the surface condition of the game balls—at levels believed to be unrealistic and unlikely to have been present on the day of the AFC Championship Game.

Our scientific consultants ultimately informed us that the data alone did not provide a basis for them to determine with absolute certainty whether there was or was not tampering. Based on extensive testing and analysis, however, Exponent concluded that, within the range of game conditions and circumstances most likely to have occurred on game day, they could identify no set of credible physical or environmental factors that completely accounts for the magnitude of the reduction in air pressure of the Patriots footballs or the additional drop in air pressure exhibited by the Patriots game balls, as compared to the drop in air pressure exhibited by the Colts game balls. Dr. Marlow agreed with this conclusion. This absence of an explanation based on natural factors tends to support a finding that human intervention may have been a factor. A summary of the work performed and conclusions reached by the Exponent team is set forth below, and Exponent's full reports on these issues are attached as Appendices 1 and 2.

A. Analysis of the Halftime Data

As a result of exposure to the colder temperature on the field during the first half, the air pressure of all of the game balls tested at halftime decreased from the levels measured prior to the game. This result is consistent with basic scientific principles, including the Ideal Gas Law, which predicts the proportional change in pressure that is caused by a change in temperature of the gas inside a pressure vessel of fixed volume (such as a football). According to Exponent, based on the most likely pressure and temperature values for the Patriots game balls on the day of the AFC Championship Game (*i.e.*, a starting pressure of 12.5 psi, a starting temperature of between 67 and 71 degrees and a final temperature of 48 degrees), the Ideal Gas Law predicts that the Patriots balls should have measured between 11.52 and 11.32 psi at the end of the first half, just before they were brought back into the Officials Locker Room. Most of the individual Patriots measurements recorded at halftime, however, were lower than the range predicted by the Ideal Gas Law. Indeed, once Exponent converted the game day measurements recorded for each gauge into a corresponding "Master Gauge" pressure (in order to provide for a direct comparison with the results predicted by the calculations), the measurements for all but three of the Patriots game balls, as measured by both gauges, were lower than the range predicted by the Ideal Gas Law.[66] As a result, Exponent concluded that application of the Ideal Gas Law within the context of the most likely game day conditions cannot account entirely for the pressure drops observed in the Patriots halftime measurements.[67]

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[66] In contrast, if one were to use the most likely pressure and temperature values for the Colts game balls on the day of the AFC Championship Game (*i.e.*, a starting pressure of 13.0 psi, a starting temperature of between 67 and 71 degrees and a final temperature of 48 degrees), the Ideal Gas Law predicts that the Colts balls should have measured between 12.00 and 11.80 psi at the end of the first half, just before they were brought back into the Officials Locker Room. All of the Colts measurements recorded at halftime were above this range, once converted into a corresponding "Master Gauge" pressure, and therefore can be explained by the applicable scientific principles.

[67] According to Exponent, when applied to the events at issue, the Ideal Gas Law effectively predicts the minimum pressure that would have been achieved once the game balls reached equilibrium with the colder field

During its analysis of the halftime data, Exponent also identified an apparent difference in the magnitude of the reduction in average air pressure between the Patriots and Colts game balls when measured at halftime. When compared to the reported pre-game pressures of 12.5 psi and 13.0 psi, respectively, the average pressure drop of the Patriots game balls exceeded the average pressure drop of the Colts balls by 0.45 to 1.02 psi, depending on various assumptions regarding the gauges used. According to both Exponent and Dr. Marlow, the difference in the average pressure drops between the Patriots and Colts footballs is statistically significant.[68] This conclusion was consistent regardless of the assumptions made as to which of the two gauges was used to measure the game balls prior to the game and at halftime. In all scenarios considered, Exponent determined that the additional reduction in air pressure exhibited by the Patriots game balls was unlikely to have occurred by chance. In fact, when the halftime measurements are attributed to the gauges most likely to have generated those measurements, there is only a 0.4% likelihood—a fraction of one percent—that the difference in average pressure drops between the teams occurred by chance.[69]

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temperature. While measurements above the predicted levels can be accounted for by basic thermodynamics (because the halftime measurements were taken inside the Officials Locker Room at a temperature above the 48 degree equilibrium temperature used for the calculations, and the pressure of each ball would have risen as the balls warmed up), measurements below those levels cannot be explained by the Ideal Gas Law alone. In addition, the Ideal Gas Law fails to account for the transient nature of the halftime testing, which took place after the game balls had been moved back into the warmer Officials Locker Room but before they equilibrated with the locker room temperature.

[68] As discussed in Appendix 1, the data analysis conducted to reach this conclusion took into account the difference in the sample size of measurements recorded for each team (22 measurements for the Patriots and 8 or 6 measurements for the Colts, depending on the scenario analyzed).

[69] Exponent's conclusion was also consistent if the initial starting pressure for the Colts balls was assumed to be 13.1 psi rather than 13.0 psi. In the interests of completeness, Exponent conducted the same statistical analysis using a starting pressure of 13.1 psi for the Colts balls, and reached the same conclusion as to statistical significance. For example, when the halftime measurements are attributed to the gauges most likely to have generated those measurements and assuming the increased Colts starting pressure, there was only a 1% likelihood that the difference in average pressure drops between the teams occurred by chance. The details of Exponent's statistical analysis are set forth in Appendix 1.

Exponent and Dr. Marlow also observed a difference in the variability of the measurements taken at halftime. Specifically, the standard deviation for the Patriots measurements from the average Patriots measurement was 0.41 psi and 0.40 psi and the standard deviation for the Colts measurements from the average Colts measurement was 0.16 psi and 0.14 psi, when measured with the Logo and Non-Logo Gauges, respectively. Although our experts determined that the difference between the variability of the halftime measurements of the Patriots and Colts footballs was not statistically significant, they drew certain conclusions on variability when the data was considered in the context of the experimental results. Specifically, the fluctuations observed between the halftime measurements of Patriots game balls taken in close time proximity to each other (*e.g.*, the difference between the pressures measured for the first and second football tested, the second and third football tested, etc.) exceeded in magnitude the fluctuations between measurements observed during their experiments. Exponent concluded that, subject to the discovery of an as yet unidentified and unexamined factor, the most plausible explanation for the variability of the Patriots halftime measurements is that the eleven footballs measured by the officials at halftime did not all start the game at or near the same pressure, even though they all measured at or near 12.5 psi when inspected by the referee prior to the game.

B. Experiments and Game Day Simulations

Having determined that the difference in average pressure drops between the Patriots and Colts footballs was statistically significant, Exponent designed a series of tests to determine whether that difference could be explained by physical or environmental factors, or whether there was a basis to conclude that it was more likely that human intervention was a contributing factor. Exponent also designed tests to evaluate the reliability of the gauges used by the game officials.

Based on extensive testing, Exponent concluded that the gauges used on the day of the AFC Championship Game appear to have worked reliably and consistently, and that the difference in the pressure drops between the teams was not caused by a malfunction of either gauge. In particular, Exponent determined that both gauges would have read consistently and with good repeatability when used in the range of temperatures to which they were exposed in the Officials Locker Room and when used to measure a range of pressures that includes those measured on the day of the AFC Championship Game. Exponent concluded that it was unlikely that the measurements recorded at halftime—and therefore the measured differences in pressure drops between the Patriots and Colts balls—were affected by the battery charge on either gauge or by "human factors" (*i.e.*, variability caused by the particular individual who used the gauge).

In addition, Exponent determined that when the Logo and Non-Logo Gauges measure an identical pressure, different readings are produced. According to Exponent, the Logo Gauge produced readings that were generally in the range of 0.3-0.4 psi higher than the Non-Logo Gauge. However, for a given set of measurements, the differential between the gauges generally remained consistent when compared to a calibrated gauge. In other words, in the short term, both the Logo Gauge and Non-Logo Gauge read consistently, though differently from each other. Exponent's experimental results were aligned with the measurements recorded at halftime, which indicated a consistent gauge-to-gauge differential of 0.3-0.45 psi. Exponent relied upon this information, as well as the fact that during the testing the Non-Logo Gauge never produced a reading higher than the Logo Gauge, to conclude that Walt Anderson most likely used the Non-Logo Gauge to inspect the game balls prior to the game, that Clete Blakeman most likely used the Non-Logo Gauge and Dyrol Prioleau most likely used the Logo

Gauge to test the Patriots game balls at halftime, and that the game officials most likely switched gauges before measuring the Colts balls at halftime (with the one anomaly described above).

On the basis of experiments designed to evaluate the impact of a variety of physical factors on the air pressure of footballs, Exponent ruled out as factors that contributed to the difference in the observed pressure drops variations in the way a football is used (*i.e.*, the amount of impact a football has sustained) and differences in ball preparation, as discussed below. Among other things, Exponent also ruled out as factors that impact air pressure levels the repeated insertion of an inflation needle or gauge, the natural leak rate of properly functioning footballs and the relative humidity of the air in the rooms in which the footballs were inflated. None of the physical factors tested by Exponent, at the levels applicable on the day of the AFC Championship Game, were found to contribute in any material way to changes in the internal pressure of footballs or the difference in the observed pressure drops between the Patriots and Colts balls when measured at halftime.

Exponent also conducted experiments and game-day simulations to evaluate the impact of certain environmental factors on the air pressure of footballs. In these experiments, the Colts footballs and the Colts halftime measurements were used as a "control" group because there was no plausible basis on which to believe there had been tampering with the Colts balls. Based on the assumption that the Colts halftime measurements were the result only of natural conditions, Exponent could align the parameters of the experiments to achieve measurements for the Colts balls that were consistent with those taken on the day of the AFC Championship Game and concurrently assess what the Patriots measurements would be under the same conditions. Doing so allowed Exponent to assess the physical plausibility of the Patriots measurements recorded on game day.

According to Exponent, the environmental conditions with the most significant impact on the halftime measurements were the temperature in the Officials Locker Room when the game balls were tested prior to the game and at halftime, the temperature on the field during the first half of the game, the amount of time elapsed between when the game balls were brought back to the Officials Locker Room at halftime and when they were tested, and whether the game balls were wet or dry when they were tested. Within the range of conditions most likely to have occurred on game day, and, where possible, setting the experimental parameters to levels that would maximize the possibility of replicating the Patriots halftime measurements, Exponent concluded that the Colts halftime measurements were explainable by physical and environmental factors alone, but that the experiments and simulations failed to explain the halftime measurements recorded for the Patriots game balls. When tests were run using the most likely game-day conditions and circumstances, the average Patriots measurements recorded at halftime were lower than the lowest average pressures attained by the simulations.[70] The only way that Exponent could reconcile the Patriots halftime measurements with both the Colts halftime measurements and the range of physically plausible pressure levels predicted by the experiments was to set certain experimental parameters—particularly the timing of the halftime testing and

[70] In reaching these conclusions, Exponent attempted to control for variations in the thermal histories, and thus pressures, of the Patriots and Colts footballs. Specifically, Exponent recognized that differences in the way each team's footballs were used or handled on the sideline during the game might affect the halftime measurements. To evaluate the potential impact of these factors, and based on information developed by Paul, Weiss during the investigation regarding the procedures used by each team's ball boys during the game, Exponent performed a simulation in which individuals acted as "ball boys," and followed the described procedures while concurrently using a telecast of the AFC Championship Game to guide a complete reenactment of the first half. The entire "ball boy simulation" took place inside a temperature-controlled chamber set to field conditions. Exponent concluded that there was no observable difference in the results generated by this simulation and those simulations that were performed without "ball boys," a finding consistent with the conclusion discussed above that variations in game use do not affect the internal pressure of footballs. In addition, the Patriots have suggested that the proximity of Colts ball boys to sideline heaters used during the AFC Championship Game may have impacted the temperature, and thus the pressure, of the Colts game balls when tested at halftime. We determined, however, that the Colts ball boys were not standing in close proximity to the heaters during the first half, and therefore the footballs in their possession were not likely to have been affected by the heaters.

the surface condition of the game balls—at levels believed to be unrealistic and unlikely to have been present on the day of the AFC Championship Game.

C. Consideration of Statements Made and Experiments Conducted by the Patriots

Exponent also was asked to consider explanations offered by the Patriots for the pressure drop in the Patriots game balls observed at halftime, particularly the impact of vigorous rubbing or "gloving" on the internal air pressure of footballs.

The potential impact of "gloving" was discussed publicly by the Patriots during a press conference given by Coach Belichick on January 24, 2015. During that press conference, Belichick explained that the Patriots believe that the "gloving" process used to prepare their game balls prior to the AFC Championship Game impacted the air pressure and internal equilibrium of the footballs in a way that contributed to the reduction in pressure measured at halftime. Specifically, he described the results of an experiment conducted by Patriots equipment personnel after the AFC Championship Game to simulate game day conditions, including "gloving" footballs and placing them in cold temperatures, and then testing the impact of those conditions on air pressure.

According to Belichick, the Patriots found that the rubbing process "raises the PSI approximately one pound," and affects the internal equilibrium of the footballs. He estimated that once the footballs returned to their equilibrium state, the pressure decreased approximately 1.0 psi. Based on the results of the Patriots' experiment, Belichick concluded that "[i]f there's activity in the football relative to the rubbing process, I think that explains why when we gave them to the officials and the officials put it at, let's say 12.5, if that's in fact what they did, that once the football reached its equilibrium state, it was probably closer to 11.5."

To test these assertions, Exponent rubbed footballs vigorously using gloves similar to those reportedly used by the Patriots pre-game. After about 20 minutes of rubbing, the pressure increased in a given ball by approximately 0.7 psi. Exponent observed, however, that the impact on air pressure dissipated between fifteen and thirty minutes after the cessation of the rubbing, when the football returned to its starting pressure. A "rubbed" football would, therefore, generate the "artificially high" reading described by Belichick only within the fifteen-minute to thirty-minute window after the cessation of the rubbing. However, on the day of the AFC Championship Game, the rubbing of Patriots game balls was complete prior to 2:50 p.m., when Jim McNally delivered the game balls to the Officials Locker Room. (Indeed, the preparation of most of the Patriots game balls was complete by approximately 12:30 p.m., when Tom Brady first inspected them, and the preparation of the balance of the game balls was complete by approximately 2:30 p.m., when Brady provided his final approval.) Walt Anderson did not inspect the Patriots game balls until approximately 3:45 p.m., more than thirty minutes after the balls were delivered to the Officials Locker Room, and when he did, he found them to be set at or near 12.5 psi, neither artificially high (as they would have been if still subject to the effects of gloving) nor artificially low (as they would have been once, according to Belichick, they reached equilibrium after the gloving). Accordingly, based on the chronology of events on the day of the AFC Championship Game, Exponent ruled out the impact of vigorous rubbing as an explanation for the reduction in air pressure in the Patriots game balls measured at halftime.[71]

[71] As part of its work, Exponent also considered other elements of the football preparation process used by both the Patriots and the Colts, including the potential impact of those processes on a given football's pressure level. Exponent concluded that none of the preparatory steps taken by either team (apart from vigorous rubbing, which has a temporary effect only) significantly affects air pressure levels or a football's response to temperature changes. Nevertheless, to eliminate the chance (however small) that differences in preparation methods might affect the results of their experiments, or might have affected the integrity or permeability of the footballs used during the AFC Championship Game, Exponent primarily used footballs prepared by the Patriots and Colts in conducting its experiments.

D. Tests on the Time Needed to Deflate Footballs with a Needle

Exponent also was asked to investigate how quickly an individual can partially deflate thirteen footballs in a ball bag using a sports ball inflation needle, if that individual has some experience performing that task. Exponent's full report on this issue is attached as Appendix 2.

Based on a series of simulations, Exponent determined that thirteen footballs could be readily deflated using a needle in well under one minute and forty seconds.[72] Specifically, Exponent concluded that with only a single practice run, it is possible for an individual using a standard sports ball inflation needle to perform the following tasks in approximately 60-70 seconds: open a door and enter a room, close the door, open a zippered ball bag similar to that used by the Patriots on the day of the AFC Championship Game filled with thirteen footballs, insert the needle into each football in order to release a small amount of air, close the bag, and exit the room through the door.

Based on Exponent's results, we conclude that the time Jim McNally spent in the tunnel bathroom during his walk from the Officials Locker Room to the field on the day of the AFC Championship Game was a sufficient period to deflate thirteen footballs using a needle.

VIII. Conclusions Regarding the Game Balls Used by the Patriots in the AFC Championship Game

Based on the evidence developed in connection with the investigation and summarized in this Report, we have concluded that it is more probable than not that New England Patriots personnel participated in violations of the NFL Playing Rules and were involved in a deliberate attempt to circumvent those rules. In particular, we conclude that it is

[72] Exponent was asked to conduct this experiment using thirteen footballs because, as described above in Section III.C, we believe that the Patriots game ball bag initially contained thirteen footballs on the day of the AFC Championship Game.

more probable than not that Jim McNally and John Jastremski participated in a deliberate plan to circumvent the rules by releasing air from Patriots game balls after the examination of the footballs by NFL game officials at the AFC Championship Game. We believe that McNally and Jastremski were aware that the inflation level of the Patriots game balls following pre-game inspection by the game officials would be approximately 12.5 psi and planned for McNally to deflate the balls below that level following the pre-game inspection using a needle provided by Jastremski. Based on the evidence, we also have concluded that it is more probable than not that Tom Brady was at least generally aware of the inappropriate activities of McNally and Jastremski involving the release of air from Patriots game balls.[73]

We do not believe that the evidence establishes that any other Patriots personnel participated in or had knowledge of the violation of the Playing Rules or the deliberate effort to circumvent the rules described above. In particular, we do not believe there was any wrongdoing or knowledge of wrongdoing by Patriots ownership, Head Coach Belichick or any other Patriots coach in the matters investigated. We also do not believe there was any wrongdoing or knowledge of wrongdoing by Patriots Head Equipment Manager Dave Schoenfeld.

In reaching these conclusions, we have relied on, among other things, the following:

- The text messages between McNally and Jastremski discussing:
    - The inflation level of Patriots footballs and McNally's impact on the inflation level of the balls ("im going make that next ball a fuckin balloon"; "Make sure you blow up the ball to look like a

[73] We were not asked by the NFL to investigate the potential competitive impact of the deflation of Patriots game balls and, therefore, do not make any findings or reach any conclusions on that issue. Nevertheless, we note that Brady's performance in the second half of the AFC Championship Game—after the Patriots game balls were re-inflated—improved as compared to his performance in the first half. Specifically, in the first half, he completed 11 of 21 passes for 95 yards and one touchdown, and in the second half, he completed 12 of 14 passes for 131 yards and two touchdowns.

rugby ball so tom can get used to it before Sunday"; "16 is nothing...wait till next sunday");

- Jastremski's plan to provide McNally with a "needle" for use by McNally ("Can't wait to give you your needle this week :)"; "Fuck tom....make sure the pump is attached to the needle.....fuckin watermelons coming");

- McNally's request that the "needle" be surrounded by cash and new sneakers and other items of value to be received by McNally ("Better be surrounded by cash and newkicks....or its a rugby sunday"; "Maybe u will have some nice size 11s in ur locker"; "Remember to put a couple sweet pig skins ready for tom to sign"; "U got it kid...big autograph day for you"; "Nice throw some kicks in and make it real special");

- McNally's references to Brady as the catalyst for Jastremski's offers of sneakers and clothing ("Tom must really be working your balls hard this week"; "Tom must really be on you"); and

- That game balls for a Sunday game would not be deflated because of anger at Brady ("The only thing deflating sun..is his passing rating").

- Text messages most plausibly read as describing a conversation between Jastremski and Brady during which Brady mentioned McNally and said that McNally must have "a lot of stress" trying to get the footballs "done" ("Talked to him last night. He actually brought you up and said you must have a lot of stress trying to get them done...").

- Text messages from McNally referring to himself as the "deflator" and stating that he was "not going to espn……..yet" ("jimmy needs some kicks....lets make a deal.....come on help the deflator"; "Chill buddy im just fuckin with you ....im not going to espn.....yet").

- McNally's knowledge that Brady prefers footballs inflated at the low end of the permissible range and his express request that the referee set the balls at a 12.5 psi level.

- Referee Walt Anderson's inability to locate the game balls at the start of the game (for the first time in nineteen years) and the breach in standard pre-game procedure when McNally removed the game balls from the Officials Locker Room without the permission of the referee or other game officials.

- The crowded state of the Officials Locker Room on the day of the AFC Championship Game, limiting the opportunity for McNally to be alone

with the game balls in the Officials Locker Room while the game officials were on the field for pre-game warm-ups.

- McNally bringing the game balls into the bathroom during his walk from the Officials Locker Room to the field, locking the door and remaining inside the bathroom with the game balls for approximately one minute and forty seconds, an amount of time sufficient to deflate thirteen footballs using a needle.

- McNally's failure to mention taking the balls into the bathroom in his initial interview with NFL Security and his subsequent varying explanations for the bathroom stop and decision not to utilize readily available bathroom facilities in the Officials Locker Room and the adjacent Chain Gang Room.

- McNally's receipt on January 10, 2015, in the Patriots equipment room with both Brady and Jastremski present, of two footballs autographed by Brady and Brady's autograph on a game-worn jersey, and Jastremski's receipt earlier in the season of a particularly valuable autograph from Brady.

- The timing and frequency of the telephone communications between Jastremski and McNally, as well as Jastremski and Brady immediately after suspicions of ball tampering were raised by NFL Security and in media reports.

Our conclusion that it is more probable than not that McNally and Jastremski participated in a deliberate effort to release air from Patriots game balls after the balls were tested by the game officials is significantly influenced by the substantial number of communications and events consistent with such a finding, including that the *same person* (McNally) referred to himself as the "deflator" and stated that he was "not going to espn……..yet," was involved in a series of communications about his impact on the inflation-level of Patriots game balls and using a "needle" surrounded by cash and sneakers (when his legitimate responsibilities as a locker room attendant did not involve the preparation, inflation or deflation of footballs), violated standard pre-game procedure by removing the game balls from the Officials Locker Room without permission of the game officials, brought the game balls into a bathroom before the game (for a period long enough to deflate them), and received valuable items autographed by

Tom Brady the week before the AFC Championship Game. Similarly, the evidence establishes that John Jastremski knew that McNally had referred to himself as the "deflator" and stated that he was "not going to espn……..yet," was involved personally in a series of communications with McNally about the inflation and deflation of footballs using a "needle" and providing McNally with a "needle," was involved in providing McNally with items of value, and had himself received a particularly valuable autograph from Brady earlier in the season. In addition, Jastremski spoke with McNally almost immediately when suspicions first arose (speaking by telephone three times in the hours after the game for a total of 37 minutes and 11 seconds) and communicated with Brady by telephone or text message with significantly increased frequency in the following days, as described below.

Indeed, in our view, a contrary conclusion requires the acceptance of an implausible number of communications and events as benign coincidences. Although we believe that a number of the communications between Jastremski and McNally were attempts at humor, based on the evidence and the communications in their entirety, we believe that McNally and Jastremski were joking about events in which they were actually participating that involved the deflation of footballs in violation of the Playing Rules.

When interviewed, McNally claimed, among other things, that he brings game balls to the field when he deems fit, that he generally does not receive permission from or inform the game officials before leaving the Officials Locker Room and taking game balls to the field and that he often has taken game balls into the tunnel bathroom near the entrance to the playing field. We do not find these claims plausible and they were contradicted by other evidence developed during the investigation. Counsel for the Patriots also contended that the text messages between McNally and Jastremski referring to the inflation levels of footballs and

related topics were not serious and should be seen as nothing more than attempts at humor and hyperbole. We also find these claims not plausible. As noted above, we believe that although a number of the communications between McNally and Jastremski were attempts at humor, McNally and Jastremski were making jokes based on actual events.

Our conclusions with respect to Tom Brady also are based on an analysis of the substantial and credible evidence. The evidence does not allow us to reach conclusions as to when McNally and Jastremski began their efforts to release air from Patriots game balls on game day (although McNally referred to himself as "the deflator" prior to the start of the 2014-15 season), exactly how long those efforts have been ongoing, how frequently they occurred, how the idea originated or the full scope of communications related to those efforts. We also note that there is less direct evidence linking Brady to tampering activities than either McNally or Jastremski. We nevertheless believe, based on the totality of the evidence, that it is more probable than not that Brady was at least generally aware of the inappropriate activities of McNally and Jastremski involving the release of air from Patriots game balls. Evidence of Brady's awareness appears in text communications between McNally and Jastremski. For example, in text messages exchanged with McNally in October 2014 discussing Brady's unhappiness with the inflation level of Patriots game balls, Jastremski told McNally that "[h]e actually brought you up" and "said you must have a lot of stress trying to get them done." In relevant part, the text message exchange stated:

McNally:	Tom sucks...im going make that next ball a fuckin balloon
Jastremski:	Talked to him last night. He actually brought you up and said you must have a lot of stress trying to get them done...
Jastremski:	I told him it was. He was right though...
Jastremski:	I checked some of the balls this morn... The refs fucked us...a few of then were at almost 16

As discussed above, we believe that the most plausible reading of this exchange, based on context and the evidence, is that Brady "brought up" McNally, told Jastremski that McNally "must have a lot of stress trying" to get the footballs "done" and that Jastremski told Brady that it was stressful for McNally. Jastremski's text message thus attributes to Brady knowledge of McNally's efforts to get the footballs "done" and the stress involved.[74] We reject as implausible the reading offered by Jastremski, McNally and counsel for the Patriots that portions of this exchange refer to Jastremski's Friend rather than to Brady.

Moreover, taking the text messages as a whole, Brady is a constant reference point in the discussions between McNally and Jastremski about inflation, deflation, needles and items to be received by McNally. In response to Jastremski's offers of sneakers and clothing, for example, McNally identifies Brady as the catalyst for those offers ("Tom must really be working your balls hard this week"; "Tom must really be on you"). And unhappiness with Brady is referenced by McNally as a reason for using the "needle" to inflate rather than deflate footballs ("Fuck tom....make sure the pump is attached to the needle.....fuckin watermelons coming"). Brady is thus central to the discussions of inflation and deflation in the text messages.

Additional evidence of Brady's awareness includes a material increase in the frequency of telephone and text communications between Brady and Jastremski shortly after suspicions of ball tampering became public on January 19 suggests that Brady was closely monitoring Jastremski. After not communicating by telephone or text for more than six months (according to data retrieved from Jastremski's cell phone), Brady and Jastremski spoke twice by telephone on January 19 (calls lasting a total of 25 minutes and 2 seconds), twice on January 20 (calls lasting a total of 9 minutes and 55 seconds) and twice on January 21 (calls lasting a total of

[74] We note that Jastremski's statements to McNally concerning Brady are in the nature of statements made by a co-conspirator during and in furtherance of a conspiracy, which would be admissible under Rule 801(d)(2)(E) of the Federal Rules of Evidence.

20 minutes and 52 seconds) before Jastremski surrendered his cell phone to the Patriots later that day for forensic imaging. These calls included conversations relatively early during the mornings of January 19 (7:26 a.m. for 13 minutes and 4 seconds), January 20 (8:22 a.m. for 6 minutes and 21 seconds) and January 21 (7:38 a.m. for 13 minutes and 47 seconds). Brady also took the unprecedented step of inviting Jastremski to the QB room in Gillette Stadium on January 19 for the first and only time that Jastremski can recall during his twenty-year career with the Patriots, and Brady sent Jastremski text messages seemingly designed to calm Jastremski ("You good Jonny boy?"; "You doing good?"). For his part, Jastremski sent Brady text messages confirming that he was okay ("Still nervous; so far so good though") and cautioning Brady about questioning ("FYI...Dave will be picking your brain later about it. He's not accusing me, or anyone...trying to get to bottom of it. He knows it's unrealistic you did it yourself...").

In addition, we believe it is unlikely that an equipment assistant and a locker room attendant would deflate game balls without Brady's knowledge and approval. Based on our interviews and assessment of McNally and Jastremski, we also do not believe that they would personally and unilaterally engage in such conduct in the absence of Brady's awareness and consent. Brady himself appeared to recognize during a nationally-televised interview that it was unlikely that equipment personnel or others would deflate footballs unless they believed it was what Brady wanted. A transcript of an interview of Brady by Bob Costas telecast on February 1, 2015 contains the following exchange:

> Costas: Another question frequently asked, whether it be an equipment guy, a ball boy — whatever — hard to believe that that person wouldn't deflate the ball beneath 12.5, the minimum allowable, without at least having the notion that that's how Tom Brady wants it, whether you told him that or not. Is that a fair assumption?

> Brady: Absolutely, I think that's — absolutely — you know, I could understand why people feel that way. You know, there's an investigation going on. I'm sure all the things will come out. It's been a lot of speculation. And I think that's what led to my hurt feelings. You know, hopefully the facts come out. And — you know, we understand that — you know, whatever happened, happened. And you know, it's not going to have an effect on this game. And you know, we can move forward.

Further, Brady has acknowledged publicly that he likes game balls inflated at the low end of the permissible range. The inflation level of game balls clearly is important to Brady as demonstrated by his reactions when he believed that game balls were inflated at an undesirable level. Brady personally was involved in the 2006 rule change that allowed each visiting team to supply its own game balls in accordance with the preferences of its quarterback, and it is reasonable to infer that during the process of advocating that rule change, Brady was likely to be (or become) familiar with the NFL rules regarding game balls, including the 12.5 psi minimum inflation level, although Brady denies having been aware of Rule 2 or the minimum inflation level until 2014 (despite approximately fourteen years as an NFL quarterback).

During his interview, Brady denied any knowledge of or involvement in any efforts to deflate game balls after the pre-game inspection by the game officials. He claimed that prior to the events surrounding the AFC Championship Game, he did not know McNally's name or anything about McNally's game-day responsibilities, including whether McNally had any role relating to game balls or the game officials. We found these claims not plausible and contradicted by other evidence. In fact, during his interview, Jastremski acknowledged that Brady knew McNally and McNally's role as Officials Locker Room attendant. Similarly, McNally told NFL Security that he had been personally told by Brady of Brady's inflation level preference.

As discussed above, Brady's refusal to provide us with his own emails, text messages and phone records on relevant topics, in response to our narrowly tailored requests, limited the evidence available for our review and analysis. We believe that our findings are nevertheless supported by the evidence and information available to us during the course of our work.

We further believe that our conclusions are supported by and consistent with the data recorded during halftime of the AFC Championship Game and the scientific analysis of that data. It is clear that all of the game balls tested at halftime experienced a reduction in air pressure as compared to the levels measured pre-game. This reduction was, at least in part, the natural result of having been moved from the relatively warm locker room to the colder playing field (before being brought back into the locker room). According to our scientific consultants, however, the reduction in pressure of the Patriots game balls cannot be explained completely by basic scientific principles, such as the Ideal Gas Law, based on the circumstances and conditions likely to have been present on the day of the AFC Championship Game. In addition, the Patriots game balls exhibited a greater drop in average pressure than the Colts balls. Exponent and Dr. Marlow agreed that the difference in the magnitude of the average pressure drops between the Patriots and Colts footballs is statistically significant, regardless of which of the two gauges was used to set the balls pre-game and test them at halftime and regardless of whether the starting pressure for the Colts game balls is assumed to be 13.0 or 13.1 psi. Exponent and Dr. Marlow further advised us that the variability in the Patriots halftime measurements suggests that the game balls did not start the game at or near the same pressure, even though they all measured at or near 12.5 psi when inspected by the referee. Exponent ruled out inconsistencies in the gauges used on the day of the AFC Championship Game (which appear to have worked reliably and

consistently under the conditions in which they were used), "human factors" (*i.e.*, variability caused by the particular individual who used the gauge), variations in the way a football is used or handled (*i.e.*, the amount of impact a football has sustained or the way a football is held by a ball boy on the sideline) and differences in ball preparation (including the vigorous rubbing described by Coach Belichick during his January 24, 2015 press conference) as factors that impact inflation levels. Dr. Marlow agreed with that assessment.

Our scientific consultants informed us that the data alone did not provide a basis for them to determine with absolute certainty whether there was or was not tampering, as the analysis of such data is ultimately dependent upon assumptions and information that is uncertain. Based on the testing and analysis, however, Exponent concluded that, within the range of likely game conditions and circumstances studied, they could identify no set of credible environmental or physical factors that completely accounts for the Patriots halftime measurements or for the additional loss in air pressure exhibited by the Patriots game balls, as compared to the loss in air pressure exhibited by the Colts game balls. Dr. Marlow agreed with this conclusion. This absence of a credible scientific explanation for the Patriots halftime measurements tends to support a finding that human intervention may account for the additional loss of pressure exhibited by the Patriots balls.

In reaching the conclusions set forth in this Report, we are mindful that the analyses performed by our scientific consultants necessarily rely on reasoned assumptions and that varying the applicable assumptions can have a material impact on the ultimate conclusions. We therefore have been careful not to give undue weight to the experimental results and have instead relied on the totality of the evidence developed during the investigation. Even putting

aside the experimental results, we believe that our conclusions are supported by the evidence in its entirety.

IX. The Kicking Ball Issue

Separate and apart from the issues that arose during the AFC Championship Game with respect to the inflation of Patriots game balls, questions were raised during the game with respect to the authenticity of one of the kicking balls (or "k-balls" as they are commonly known) used by the Patriots. We conclude that there is no evidence to support any finding of wrongdoing with respect to this kicking ball.

A. Preparation of Kicking Balls

Under the Playing Rules, kicking balls are prepared differently than game balls. Instead of allowing each team to select its own k-balls, the League has arranged for Wilson Sporting Goods to send a set of k-balls each week directly to the referee assigned to each game. To better track the kicking balls for a particular game, Wilson generally pre-marks each k-ball with information about the week in which the ball will be used (*i.e.*, 1-17) and a number (1-6).[75] The referee or his designee brings the k-balls to the stadium in a sealed box, and each team designates one representative to prepare the k-balls once they arrive at the stadium. Both teams prepare the footballs in the same location (at Gillette Stadium, k-balls are prepared in the Chain Gang Locker Room), the balls may only be rubbed with a wet towel, a brush and/or a tacky sponge (a "Tac Cube") provided by Wilson, and the preparation process may take no more than forty-five minutes in total.

[75] These notations are used for each week of the regular season, and for the first two weeks of the postseason. According to Wilson representatives, however, kicking balls for the conference championship games are inscribed only with a "K." They are not pre-numbered and there is no mark indicating their connection to either the AFC or NFC Championship Games.

For the past several seasons, the NFL has hired a local game-day employee for each stadium to handle kicking ball responsibilities at regular season games.[76] This "k-ball coordinator" supervises the preparation of the kicking balls each week. As with game balls, each team may have its own approach to preparing k-balls to suit its kicker and punter, who generally prefer to use balls prepared by their own teams. Accordingly, it is customary for the k-ball coordinator to split the k-balls sent by Wilson between the teams. The home team typically prepares the odd numbered balls, and the visiting team typically prepares the even numbered balls. Because the NFL Referee Manual states that only K-Ball #1 and K-Ball #2 will be used in the game unless one is permanently removed from play (*e.g.*, held on the sideline by a team after a special teams touchdown or kicked into the stands and deemed irretrievable), it is common for each team's representative to spend the majority of his time working to prepare K-Ball #1 or K-Ball #2, respectively. K-Balls #3-6 are generally prepared to a far lesser extent.

B. Pre-game Activities at the AFC Championship Game

Approximately two and a half hours before kickoff, Game Supervisor Johnny Grier introduced Scott Miller of NFL Auctions to Greg Yette, who was acting as k-ball coordinator for the game. Grier explained that the NFL had authorized the kicking balls used for the opening kickoff of each half to be auctioned for charity during the week of the Super Bowl. Yette agreed that Miller could take possession of these balls from Yette on the sideline after each kick.

Based on his experiences in six AFC Championship Games, Patriots kicker Stephen Gostkowski anticipated that the NFL was likely to remove, and ultimately auction for charity, the kicking ball used for the opening kickoff in the AFC Championship Game.

[76] In the playoffs, when NFL officiating crews are expanded to include alternates, the junior-most alternate official generally assumes the role of "k-ball coordinator."

According to Gostkowski, he asked Jastremski—who prepares Patriots kicking balls on game days—to find out which ball the NFL planned to collect and make sure that it was not the ball that Jastremski prepared most extensively. It does not appear that Jastremski asked League officials any questions concerning the removal of kicking balls from the game.

Jastremski and Sean Sullivan, who prepared the Colts k-balls, met Yette in the bathroom of the Chain Gang Locker Room to prepare the kicking balls shortly after the balls arrived at Gillette Stadium with the game officials. Wilson provided eight kicking balls for this game, and Yette gave each team representative four balls to prepare. Although he checked on the preparations from time to time, Yette did not remain in the room for the entire time Jastremski and Sullivan were working with the k-balls. At some point, Jastremski and Sullivan proposed to Yette that the Patriots use the odd-numbered balls during the game and the Colts use the even-numbered balls. Yette did not think it was a "big deal" and agreed to the proposal. As noted, kicking balls provided for the AFC and NFC Championship Games are not pre-numbered, so Jastremski handwrote and circled "1" using a black Sharpie marker in three locations on the ball he had prepared most extensively.

After Jastremski and Sullivan finished preparing the kicking balls, the balls were moved to the dressing room area in the Officials Locker Room. After returning from supervising the teams' warm-ups, Walt Anderson checked that the k-balls were properly inflated and marked them with the same pen he had used to mark the game balls. Anderson recalls that K-Ball #1 measured below 12.5 psi when tested and needed to be inflated further. While Anderson marked and re-packed the other k-balls, he asked Dyrol Prioleau to add air to K-Ball #1. When interviewed, Anderson said that because K-Ball #1 had been separated from the other kicking balls, it is possible that it was placed into the kicking ball bag without being marked. Although

Anderson acknowledged that he may not have placed his mark on K-Ball #1, Yette believes that he saw Anderson's mark on K-Ball #1 before he handed it to back judge Keith Ferguson just prior to the game. None of the other witnesses interviewed recall whether Anderson's mark was on or missing from K-Ball #1.[77]

C. The Removal and Retrieval of "K-Ball #1"

Gostkowski kicked off to begin the AFC Championship Game with what he believed to be K-Ball #1. Joshua Cribbs, a return specialist for the Colts, received and returned the ball to the Colts 21 yard line. Side judge Jeff Bergman took possession of the ball, without checking to see if it was marked or numbered, and passed it to Yette on the sideline. Yette covered the ball with a towel, and handed it to Scott Miller, who, as arranged before the game, was waiting to take possession of the ball. Miller put the football and towel in a plastic bag that he was carrying and went upstairs to the Club level at Gillette Stadium to meet acquaintances.

The next offensive series for the Patriots ended with a punt, and, because the Patriots had asked to use the odd numbered balls prior to the game, Yette provided Punter Ryan Allen with K-Ball #3. Allen punted the ball to Cribbs, who fumbled, allowing the Patriots to recover the ball. Gostkowski, who was unaware that K-Ball #1 had been removed from the game, noticed that the ball used on the punt looked more pink than the dark brown football with which he had kicked off. As the special teams players came to the sideline, Gostkowski asked about the quality of the ball and was told, in effect, that the ball was "crappy" and "brand new." The Patriots scored a touchdown six plays later, Gostkowski converted the extra point, and as he took possession of the ball to place it on the tee for his next kickoff, he noticed that the ball was, in his opinion, insufficiently broken in.

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[77] Specifically, Ferguson, who handed the ball to Gostkowski for kickoff, stated that that he did not notice whether the ball had Anderson's mark. Gostkowski did not inspect the ball for its number or mark, but believed that it was a ball prepared by Jastremski based on its dark color and feel.

Gostkowski was upset when he came off the field and asked Jastremski why the best-prepared kicking ball appeared to have been removed from the game. Jastremski approached Yette and asked about K-Ball #1. Yette responded that the ball had been taken by the League and reminded Jastremski that he had agreed prior to the game to use only the odd-numbered balls, meaning that K-Ball #3 would be used if K-Ball #1 was unavailable. Gostkowski also approached Yette. He complained forcefully about the removal of K-Ball #1, and demanded that K-Ball #1 be returned for the remainder of the game. Dave Schoenfeld, having witnessed what he perceived to be an animated discussion, told Gostkowski to calm down and said that he would try to get the ball back.

Both Schoenfeld and Jim McNally saw Eric Kerzner (who was at the game to assist Football Operations) on the sideline and approached him to ask about the whereabouts of K-Ball #1. Kerzner knew that Miller was at the game and explained to Schoenfeld and McNally the general practice of taking the opening kickoff ball for auction purposes. Kerzner recalls that they responded forcefully, arguing that they did not know that the ball would be removed from the game and that they needed it back because it was the best prepared. Kerzner said that he would try to retrieve the ball. According to McNally, he also made a similar request of Akil Coad, the NFL's Director of Football Operations and Compliance.

Kerzner contacted NFL Director of Football Operations Mike Kensil and informed him of the situation. Kensil agreed that Kerzner should attempt to retrieve the ball and instructed Kerzner to assure Miller that he would be given the ball back after the game. After several unsuccessful efforts by Kerzner and others to find Miller, Kensil located Miller and instructed him to meet Kerzner by one of the access tunnels to the field. Kerzner took possession

of the ball from Miller there and ran it to the Patriots bench where McNally motioned for Kerzner to throw him the ball, which he did.

D. The Attempted Reintroduction of "K-Ball #1"

According to Yette, McNally then approached him with the ball and said that the Patriots had retrieved K-Ball #1 from the League representative who had taken it, and that the Patriots could continue using the ball. Yette took the ball from McNally, but when he looked at the ball, he noticed that although the ball had a circled "1," it was missing Anderson's distinctive gold mark. Yette walked over to Dyrol Prioleau and explained the situation. Prioleau, the designated field communicator for the game, relayed the information to Johnny Grier, who instructed that they take possession of the ball and bring it into the Officials Locker Room at halftime. Yette did so, and began using K-Ball #2 for both teams.

At the end of the first half, Yette showed Walt Anderson the ball at issue. Anderson decided that the Patriots should not be permitted to use the ball because it was missing his mark. It appears that the ball was left on a couch in the sitting room area of the Officials Locker Room after halftime.

As the Colts kicked off to begin the second half, Coad entered the field by the Patriots sideline, where he encountered Dave Schoenfeld, who again complained that the Patriots did not have K-Ball #1. Coad responded that he recalled seeing a football on a couch in the Officials Locker Room at halftime, and that it might be the ball Schoenfeld wanted. He returned to the Officials Locker Room and found the ball with the circled "1" on it. He ran the ball back to the field, and handed it to Schoenfeld. Schoenfeld approached Yette again, this time with the ball, and said that the Patriots had again retrieved K-Ball #1 and that NFL official Akil Coad had said that they could use it. Because the ball did not have Anderson's mark, Yette responded that it was not an approved k-ball and refused to take possession of the ball.

Schoenfeld followed Yette down the sideline in what both agree was a heated exchange. Coad tried to intervene on Schoenfeld's behalf, stating that he understood that the ball had been used in the first half, but Yette repeated that the ball would not be allowed into the game because it was missing Anderson's mark. Prioleau also intervened, taking possession of the ball and siding with Yette. According to Coad, at this point he saw Kensil approaching the field and waved him over. Schoenfeld attempted to plead his case to Kensil, but Prioleau interjected, explained his view of the situation, and handed Kensil the ball. Kensil told Schoenfeld that this was a decision for the game officials—not him—and that was the end of the discussion. Kensil ultimately brought the ball back to the Officials Locker Room, where he gave it back to Miller.[78] The ball was subsequently provided to Paul, Weiss in connection with this investigation.

E. Conclusions

We do not believe that the evidence supports a conclusion that there was any deliberate effort by the Patriots to circumvent the NFL's Playing Rules with respect to the kicking balls used during the AFC Championship Game. We have reached this conclusion for a number of reasons.

First, based on the information from and recollection of referee Walt Anderson, we find that it is plausible that K-Ball #1 was not marked with Anderson's initials prior to the game. Second, we were unable to determine conclusively whether the football identified as K-

[78] We note that Miller's employment with the NFL was terminated shortly after the AFC Championship Game, after Miller admitted to selling to a private collector certain game-worn jerseys that were intended for the NFL's auction site. Miller stated during his interview with Paul, Weiss that he had never sold, attempted to sell, or intended to sell any other items that he had obtained in connection with an official NFL auction. In response to questions, he stated that he did not keep for himself or do anything inappropriate with the kicking ball removed from the AFC Championship Game shortly after kickoff. He also said that he did not alter the kicking ball in any manner while it was in his possession. Nevertheless, given the circumstances, we decline to rely on information provided by Miller.

Ball #1 was or was not one of the k-balls shipped by Wilson for use during the AFC Championship Game. The ball was stamped with a "K," which we understand to be consistent with Wilson's practice for conference championship footballs, and Jastremski identified the numbers drawn on the ball as the ones he had drawn. The ball did not have any additional markings that allow Wilson to determine with certainty whether it was one of the k-balls it delivered for the game. Third, we find credible the explanations from Schoenfeld, Gostkowksi and other Patriots personnel that they believed the kicking ball to be authentic and appropriate for use in the game when attempts were made to reintroduce the ball into play. We also believe that Miller's involvement in the chain of custody of this football counsels against making any conclusive adverse findings.

In addition, we believe that it was not inappropriate for the game officials to disallow a ball of questionable authenticity into the game. We also note that the use of K-Ball #2 in the second half had no apparent adverse effect. When interviewed, Gostkowski inaccurately believed "100%" that K-Ball #1 was returned to play during the game because he recalled kicking the ball out of the end zone several times and playing with a well-prepared ball in the second half.

Appendix 1

Exponent™

The Effect of Various Environmental and Physical Factors on the Measured Internal Pressure of NFL Footballs

May 6, 2015

Exponent®

The Effect of Various Environmental and Physical Factors on the Measured Internal Pressure of NFL Footballs

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May 6, 2015

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LIMITATIONS

The findings presented herein are made to a reasonable degree of scientific certainty. Where information or data used in this report have been provided by others, including Paul, Weiss, Rifkind, Wharton & Garrison, LLP, the source has been noted and has not been independently verified by Exponent.

EXECUTIVE SUMMARY

On January 18, 2015, the American Football Conference (AFC) Championship Game between the New England Patriots and Indianapolis Colts was played at Gillette Stadium in Foxborough, Massachusetts. The Patriots won the game by a score of 45–7 and subsequently went on to win Super Bowl XLIX two weeks later, beating the Seattle Seahawks 28–24.

After the conclusion of the AFC Championship Game, media reports surfaced claiming that footballs used by the Patriots during the game had been found to be underinflated, and questions were raised as to possible deliberate tampering by the Patriots. Shortly thereafter, Exponent was retained by Paul, Weiss, Rifkind, Wharton & Garrison, LLP (hereafter referred to as "Paul, Weiss") to provide advice and scientific support during its investigation of issues relating to the footballs used during the AFC Championship Game.

Based on information from Paul, Weiss, we learned that two digital air pressure gauges had been used to measure both the Patriots and the Colts footballs at halftime, one identified herein as the Non-Logo Gauge and the other identified as the Logo Gauge. One of these gauges had also been used to check (and in a few cases, set) the pressure of the footballs prior to the game. We have been told by Paul, Weiss that there remains some uncertainty as to which of the two gauges was used prior to the game. We have also been told by Paul, Weiss that the pressures of the Patriots balls were set at or near 12.5 psig[1] following pre-game inspection by the game officials, and the pressures of the Colts balls were set at or near 13.0 psig following pre-game inspection by the game officials.[2] When tested at halftime, the air pressure in the Patriots balls measured between 10.50 psig and 11.80 psig, and 10.90 psig and 12.30 psig, depending on the gauge used. Four of the Colts footballs were also measured and found to have dropped in pressure from their reported pre-game pressure levels, to between 12.50 psig and 12.75 psig, and 12.15 psig and 12.95 psig, depending on the gauge used. What is most significant about the halftime measurements is that *the magnitude of the reduction in average pressure was greater for the Patriots footballs when compared to that of the Colts footballs*. The question then becomes: what factor(s) could explain this difference?

As noted, Paul, Weiss retained Exponent to provide scientific and analytical support for its investigation and help determine, based on the available data, whether it is likely that there had or had not been tampering with the Patriots footballs. Specifically, Exponent conducted a science-and-engineering-based investigation to: (1) analyze the data collected at halftime, particularly to determine whether the difference in the decrease in pressure exhibited by the footballs of the two teams was statistically significant; and (2) identify and evaluate any physical or environmental factors present on the day of the AFC Championship Game ("Game Day") that might account for the difference in the magnitude of the reduction in air pressure between the footballs of the two teams measured at halftime.

1 In this report, we will use the convention whereby "psig" is used to indicate gauge pressure in pounds per square inch (psi). Gauge pressure is defined as the excess of the measured pressure over atmospheric pressure.

2 According to Paul, Weiss, most of the Patriots footballs measured at 12.5 psig, though there may have been one or two that measured at 12.6 psig. In addition, two game balls initially measured below 12.5 psig and were inflated and adjusted to 12.5 psig. Furthermore, most of the Colts balls measured at 13.0 psig or 13.1 psig when tested pre-game, although there may have been one or two that registered 12.8 or 12.9 psig. We understand that witnesses reported that the Colts target inflation level was 13.0 psig.

In order to accomplish these objectives, Exponent's investigation was divided into three main activities:

1. Thorough statistical analysis of the data recorded during halftime of the AFC Championship Game.

2. Comprehensive examination, both physical and statistical, of the gauges used to measure the pressure inside the footballs before the game and during halftime.

3. Evaluation of the effects that various usage, physical, and environmental factors present on Game Day could have on the measured pressure of a football.

The investigations we undertook to complete these three activities and our findings are discussed in detail in this report. Briefly, we found that:

1. According to basic thermodynamics, it is completely expected that the temperature and pressure inside a football drop when it is brought from a warmer environment into a colder environment and rise when brought back into a warmer environment. It is important to note, however, that these variations in temperature and pressure are time-dependent (in the time ranges at issue in the present investigation).

2. As a result of being exposed to relatively colder temperatures when brought outside to the field for the first half, the pressure inside the footballs for both teams was lower at halftime when compared with the reported pre-game levels. This is consistent with the Ideal Gas Law, which predicts, among other things, the change in pressure that is caused by a change in temperature. Based on information regarding actual conditions on the day of the AFC Championship Game, however, the application of the Ideal Gas Law (assuming equilibrium conditions) cannot account entirely for the pressure drops observed in the Patriots halftime measurements. Most of the individual Patriots measurements recorded at halftime were lower than the range predicted by the Ideal Gas Law. Indeed, all but three of the footballs, as measured by both gauges, registered pressure levels lower than the range predicted by the Ideal Gas Law, assuming an initial pressure of 12.5 psig and temperature conditions that we understand were present on Game Day. In addition, applying the Ideal Gas Law while assuming equilibrium conditions fails to account for the transient nature of the halftime testing, as described in detail herein.

   It also appears that the Patriots game balls exhibited a greater average pressure drop than did the Colts game balls. This difference in the magnitude of the decrease in average pressure between the Patriots and the Colts footballs, as measured at halftime, was determined to be statistically significant, regardless of which gauges were used pre-game and at halftime. Therefore, the reasons for this difference were an appropriate subject for further investigation.

3. The Logo and Non-Logo Gauges appear to have worked reliably and consistently on Game Day, and the difference in the pressure drops between the teams was not caused by a malfunction of either gauge. Based on our experimental results, both gauges would have read consistently and with good repeatability when used in the range of temperatures to which they were exposed in the Officials Locker Room (approximately 67 to 74°F) and when used to measure a range of pressures that includes those measured on Game Day (approximately 10 psig to 14 psig). Further, it is unlikely that the battery on either gauge was

below the voltage level required to induce battery-related reading and measurement errors, or that the measurements recorded on Game Day were affected by issues relating to the human factors of how the measurements were made.

4. When the Logo and Non-Logo Gauges measure an identical pressure, different readings are produced: the Logo Gauge reads higher than the Non-Logo Gauge. However, for a given set of measurements, the error for either gauge remains consistent compared to a calibrated gauge. In other words, in the short term, both gauges (as well as the other model gauges used by Exponent during our experiments) will read consistently, but differently from each other. Thus, the short-term *repeatability or precision* of the two gauges used at halftime is not a factor that contributed to the difference in the magnitude of the pressure drops between the game balls of the two teams, although their apparent difference in *accuracy* must be taken into account.

5. Information provided by Paul, Weiss to Exponent indicates that the Patriots and the Colts inflated the game balls for the AFC Championship Game at or near 12.5 psig and 13.0 psig, respectively. Information from Walt Anderson (which was also provided by Paul, Weiss), the referee who checked the pressure of the game balls prior to the game, indicates that the game balls measured at or near 12.5 psig and 13.0 psig, respectively, when measured. Although there remains some uncertainty about which gauge was used to measure or set the game balls prior to the game, because we found the Logo Gauge to read at least 0.35 psig high in our experiments, while the Non-Logo Gauge reads closer to a calibrated gauge and most of the other gauges tested during the investigation, and because we found during our testing that the Non-Logo Gauge never produced a reading higher than the Logo Gauge, we conclude that it is more likely that the Non-Logo Gauge was used to measure the balls prior to the game. This conclusion is based on data provided to us by Paul, Weiss and data generated by our experiments. It also is consistent with the pressure readings reported by the Patriots, the Colts, and Walt Anderson.

6. A series of physical factors were evaluated for their potential contribution(s) to the difference in the observed pressure drops at halftime. These included:

    a. The impact of game use.

    b. The impact of repeated insertions of an inflation needle into the football.

    c. The natural leak rate and permeability of properly functioning footballs.

    d. The relative humidity of the air in the room(s) in which the footballs were inflated.

    e. The variation of volume of the footballs.

    f. The different treatments used by the Patriots and the Colts to condition the surface of the balls prior to the game (including the vigorous rubbing described by the Patriots as a step in the process used to break in their footballs).

    Notably, the potential differences in the amount and type of use by each team during the game as well as the ball preparation methods used prior to the game, including vigorous rubbing taking place more than 30 minutes prior to pre-game inspection, were found to have little to no impact on the recorded pressures. None of the above physical factors, at the levels we understand were applicable on Game Day, were found to contribute in any material way to changes in the internal pressure of the footballs, and do not, therefore, explain the relative difference in the pressure drops measured at halftime.

7. A series of environmental factors were evaluated for their potential contribution(s) to the difference in the observed pressure drops at halftime. These included:
    a. The effect of external temperature on the pressure inside the football:
        i. The likely temperature of the room when the pressures of the footballs were measured prior to the game (67–71°F).
        ii. The likely temperatures on the field during the first half (48–50°F).
        iii. The likely temperature of the room when the pressures of the footballs were measured at halftime (71–74°F).
    b. The impact of timing on the halftime measurements (i.e., when and in which sequence the measurements were made during the period of time in which the balls were inside the Officials Locker Room at halftime (the "Locker Room Period"), which we have been told by Paul, Weiss was approximately 13.5 minutes).
    c. The effect of ball surface conditions on the pressure of the footballs (i.e., wet vs. dry ball).
    d. The impact of which gauge was used prior to the game (Non-Logo or Logo).

    The ranges listed above were based either on weather reports, measurements made by Exponent, or information provided by Paul, Weiss, and represent the lower and upper bounds for the realistic ranges of these factors.

    All of these factors were found to contribute in varying degrees to changes in the internal pressure of footballs. However, given the magnitude of the temperature change that would have affected the footballs at halftime when they were brought from the field to the locker room, a key factor in explaining the difference in measurements between the Patriots and Colts footballs is timing; that is, the change in pressure with time as the footballs were brought from a colder environment (the field) to a warmer environment (the Officials Locker Room) at halftime.

8. For the purpose of the experiments, Paul, Weiss informed Exponent that there was no plausible basis to believe that there had been tampering with the Colts footballs; therefore, the Colts footballs were used as a "control" group when evaluating and determining test parameters for the pertinent experiments. In other words, because we could reasonably assume that the Colts measurements collected at halftime on Game Day were the result only of natural causes, a combination of environmental and timing factors was identified (within the realistic ranges provided by Paul, Weiss) for the purpose of our experiments that resulted in measurements for the Colts balls that matched the Game Day measurements. Aligning our experiment in such a way confirmed that the test conditions were a good approximation of the environmental factors present on Game Day, and allowed us to concurrently assess what the Patriots measurements would be under the same conditions. We could then assess the physical plausibility of the Patriots measurements recorded on Game Day.

9. A series of transient experiments were run to quantify the time-dependent pressure behavior of footballs and to understand how such behavior might help explain the difference in the magnitude of the pressure drops measured at halftime. The objective of these transient experiments was to identify how the pressure inside a football varies with time after that football is moved from a cold environment to a warmer one. These transient experiments

were used to determine the range of pressures at specific times within a simulated locker room period that were theoretically possible to have been achieved on Game Day. We then sought to determine whether any combination of the factors listed in 7a through 7d above (within ranges defined as realistic by Paul, Weiss) suggested pressure levels that matched those recorded on Game Day. If those factors could be set in such a way that the pressures suggested by the transient experiments matched the Game Day measurements, then we could conclude that the Game Day measurements could be explained by physical or environmental factors.

10. Overall, we determined that there was a small window in which it was theoretically possible to combine the factors listed in 7a through 7d above to achieve pressure levels that matched those recorded for both the Colts and the Patriots on Game Day, regardless of which gauge was used to measure the footballs pre-game, test them at halftime, or set them prior to our experiments. However, as described below, the precise combination of factors required for the Patriots halftime measurements to fall within the range predicted by the transient experiments while also matching the Colts halftime measurements to the predicted range required setting certain parameters—particularly the timing of the halftime testing and the surface condition of the footballs—at levels believed to be unrealistic and unlikely to have been present on Game Day. In particular:

    a. If the Non-Logo Gauge was used pre-game, the Patriots average halftime measurement from Game Day is always lower than the pressures predicted by the transient curves. If one allows for the standard error associated with the Game Day measurements, the Patriots halftime measurements will overlap with the pressures predicted by the transient curves (with the Colts halftime measurements also matching the predicted range), but only in the outer range of the error band, and only if testing of the Patriots balls began immediately once the footballs arrived in the Officials Locker Room at halftime and took no more than 4 minutes. Based on information provided by Paul, Weiss, however, we understand that testing is likely to have begun no sooner than 2 minutes after the balls were returned to the locker room and is likely to have taken approximately 4 to 5 minutes.

    b. If the Logo Gauge was used pre-game, the Patriots average halftime measurement will match the pressures predicted by the transient curves (with the Colts halftime measurements also matching the predicted range), but only if the testing of the Patriots balls began immediately once the footballs arrived in the Officials Locker Room at halftime and took no more than 4 minutes, and only if the majority of the Patriots game balls were wet. As noted, testing of the Patriots balls is likely to have begun no sooner than 2 minutes and is likely to have taken approximately 4 to 5 minutes. Further, based on statements made to Paul, Weiss (and subsequently conveyed to Exponent) by Patriots ballboys and game officials, we understand that some of the Patriots game balls may have been damp when tested at halftime, but none were waterlogged.

Accordingly, within the range of game conditions and circumstances most likely to have occurred on Game Day (based on information provided by Paul, Weiss), including the timing of various events that are understood to have occurred in the Officials Locker Room during halftime, we have identified no combination of the environmental factors listed above that could reconcile the Patriots halftime measurements with both the results predicted by our transient experiments and the measurements of the Colts balls taken at halftime on Game Day.

11. A series of experimental game day simulations were also run under conditions intended to be as realistic as possible based on videotape of the game and information collected by Paul, Weiss during interviews. The experimental simulations produced results that agree with the results predicted by the transient curves. They also produced average pressure measurements for the Colts footballs similar to those recorded for the Colts at halftime on Game Day. However, the experimental simulations failed to explain the measurements recorded for the Patriots on Game Day. Specifically, the averages of the Patriots measurements recorded during each of the experimental simulations using the Non-Logo Gauge to set the footballs were higher than the average of the Patriots Game Day halftime measurements. The averages of the Patriots measurements recorded during each of the experimental simulations using the Logo Gauge to set the footballs were also generally higher than the average of the Patriots Game Day halftime measurements, and the only way to achieve measurements for the Patriots balls similar to those recorded on Game Day in experimental simulations using the Logo Gauge was to start the simulated halftime testing immediately once the footballs arrived in the simulated Locker Room, which is earlier than we are told is realistic. In fact, the average Patriots measurements from Game Day are lower than the lowest average attained by the Exponent simulations.

12. In addition to noting the difference in average pressure drops between the Colts and Patriots footballs when measured at halftime, we observed that there appears to be a difference in the variability of the measurements recorded for each team. Although we found the difference between the variability in halftime pressure measurements of the Patriots and the Colts footballs not to be statistically significant, we can draw certain conclusions on variability when these data are reconsidered in the context of our experimental results. Specifically, the fluctuations in the halftime pressures of Patriots footballs exceed in magnitude the fluctuations that can be attributed to the combined effects of the various physical, usage, and environmental factors we examined. Therefore, subject to discovery of an as yet unidentified and unexamined factor, it is our view that the most plausible explanation for the variability in the Patriots measurements recorded at halftime is that the 11 Patriots footballs measured by the officials at halftime did not all start the game at or near the same pressure.

13. In sum, the data did not provide a basis for us to determine with absolute certainty whether there was or was not tampering as the analysis of such data ultimately is dependent upon assumptions and information that is not certain. However, based on all of the information provided to us, particularly regarding the timing and sequencing of the measurements conducted by the game officials at halftime, and on our testing and analyses, we conclude that within the range of game characteristics most likely to have occurred on Game Day, we have identified no set of credible environmental or physical factors that completely accounts for the additional loss in air pressure exhibited by the Patriots game balls as compared to the loss in air pressure exhibited by the Colts game balls measured during halftime of the AFC Championship Game.

INTRODUCTION AND BACKGROUND

Introduction

On January 18, 2015, the American Football Conference (AFC) Championship Game between the New England Patriots and Indianapolis Colts was played at Gillette Stadium in Foxborough, Massachusetts. The Patriots won the game by a score of 45–7, and subsequently went on to win Super Bowl XLIX two weeks later, beating the Seattle Seahawks 28–24.

After the conclusion of the AFC Championship Game, media reports surfaced claiming that footballs used by the Patriots during the game had been found to be underinflated, and questions were raised as to possible deliberate tampering by the Patriots. Shortly thereafter, Exponent was retained by Paul, Weiss, Rifkind, Wharton & Garrison, LLP (hereafter referred to as "Paul, Weiss") to provide advice and scientific support during its investigation of issues relating to the footballs used during the AFC Championship Game. According to information provided by Paul, Weiss, footballs from both teams were measured at halftime and found to have dropped in pressure from their reported pre-game levels. As will be discussed in greater detail later in this report, the crux of this issue is that the *magnitude of the reduction in average pressure between the pre-game and halftime measurements was greater for the Patriots footballs when compared to that of the Colts footballs*. At the request of Paul, Weiss, Exponent conducted a science-and-engineering-based investigation to determine what, if any, explanations could be provided to account for the difference in the decrease in pressure exhibited by the footballs of the two teams. The report below summarizes our findings on this matter.

Background

We understand that the Paul, Weiss report will include a detailed account of the events leading up to and including Game Day. However, a summary of the pertinent details that relate to Exponent's work is presented below.

On the afternoon of January 18th, at least three hours prior to kickoff, the footballs from the respective teams arrived at the Officials Locker Room at Gillette Stadium. Each team provided at least 24 balls: at least 12 primary balls and 12 backup balls (each team uses its own footballs when they are on offense).[3] At approximately 3:45 pm, referee Walt Anderson measured the air pressure in all of the balls, which had been laid out on the floor of the shower area that is adjacent to the dressing area of the Officials Locker Room. With regard to the pressure inside the ball, the NFL Playing Rules specify that the football must be "made up of an inflated (12½ to 13½ pounds) urethane bladder" that also meets other size and shape requirements.[4] Walt Anderson later recalled that when tested pre-game, most of the Patriots footballs measured at 12.5 pounds per square inch-gauge (psig), though there may have been one or two that measured at 12.6 psig. In addition, two game balls initially measured below 12.5 psig and were inflated and adjusted to

3 According to information provided by Paul, Weiss, we understand that the Patriots may have delivered 13 primary balls prior to the game, but it is clear that only 11 were measured at halftime.

4 National Football League (NFL) Playing Rules, Rule 2, Section 1.

12.5 psig. Furthermore, most of the Colts balls measured at 13.0 or 13.1 psig when tested pre-game, although there may have been one or two that registered 12.8 or 12.9 psig.[5] The footballs remained in bags in various parts of the Officials Locker Room until they were brought out to the field at approximately 6:30 pm.

The temperature at the time of the opening kickoff, at approximately 6:50 pm, was reported as 50.7°F, with winds between 10 and 15 miles per hour (mph). Temperatures dropped slightly to 49.3°F at 8:00 pm and then to 47.2°F at 9:00 pm.[6] Halftime began shortly before 8:30 pm. According to telecast data of the game, precipitation was falling on the field at kickoff and was intermittent throughout the first half.

During the second quarter, a member of the Colts defense, D'Qwell Jackson, intercepted a pass thrown by Patriots quarterback Tom Brady and took the football to the Colts sideline. At this time, a member of the Colts organization measured the pressure level inside the football and reported it to be below regulation.[7]

The Patriots sustained a lengthy scoring drive towards the end of the first half, and the final play of the half was a kneel-down by the Colts. As halftime began, the balls from both teams were simultaneously brought back inside the Officials Locker Room. According to Paul, Weiss, security footage from Gillette Stadium indicates that the balls arrived in the Officials Locker Room at approximately 8:29 pm.

According to information provided by Paul, Weiss, during the halftime period, three events pertaining to the footballs are known to have occurred:

1. The air pressure measurements of 11 Patriots footballs were taken and recorded.
2. The air pressure measurements of four Colts footballs were taken and recorded.
3. The reinflation and regauging of 11 Patriots footballs to a level within the 12.5–13.5 psig range was performed.[8]

According to information provided by Paul, Weiss, it is clear that of the three events listed above, the measuring of the Patriots balls occurred first. Although there remains some uncertainty about the exact order and timing of the other two events, it appears likely the reinflation and regauging occurred last. According to security footage, the footballs were taken back to the field for the second half at approximately 8:42:30 pm, meaning that they were inside the Officials Locker Room for no more than 13 minutes and 30 seconds. Therefore, all three of the above listed events must have taken no longer than 13.5 minutes to complete.

A transcription of the data, as recorded during halftime, is presented in Table 1.[9] As can be seen in the table, 11 Patriots balls were each measured twice by two different officials each using a different pressure gauge. The procedure for measurement was as follows:[10]

5 For the purpose of this report, the ranges recalled by Anderson will be considered "at or near 12.5 psig" for the Patriots footballs and "at or near 13.0 psig" for the Colts footballs.
6 This data was recorded by the weather station located on top of the southern scoreboard at Gillette Stadium and was provided to Exponent by Paul, Weiss.
7 Based on information collected during interviews conducted by Paul, Weiss and provided to Exponent.
8 Throughout this report, the term "gauging" will be used to mean reading the pressure and/or adjusting footballs with a gauge in order to set them at a desired pressure.
9 The data in Table 1 are a transcription of handwritten notes taken by Richard Farley (the NFL security representative to New England) while the measurements were being made. These handwritten notes were provided to Exponent by Paul, Weiss.
10 Based on information collected during interviews conducted by Paul, Weiss and provided to Exponent.

- A ball was picked up and measured by the first official and the pressure reading was recorded.
- The ball was then immediately handed to the next official, who measured it again and his pressure reading was then also recorded.
- The next football was then picked up, and the process repeated iteratively.

This procedure was followed for each of the 11 Patriots footballs and the four Colts footballs that were measured during halftime. It is apparent from the data in Table 1 that every measurement made of the Patriots footballs is below the 12.5 psig minimum specified by the NFL Playing Rules on both gauges. Each of the Colts balls measured was within the permissible 12.5–13.5 psig range on at least one of the gauges used.[11] Three of the eight Colts measurements were under 12.5 psig. These three measurements were taken with the same gauge.

Table 1. The pressure readings taken of footballs during halftime of the AFC Championship Game on January 18, 2015 (pressures are listed in psig).

Team	Ball	Tested by Clete Blakeman	Tested by Dyrol Prioleau
Patriots	1	11.50	11.80
	2	10.85	11.20
	3	11.15	11.50
	4	10.70	11.00
	5	11.10	11.45
	6	11.60	11.95
	7	11.85	12.30
	8	11.10	11.55
	9	10.95	11.35
	10	10.50	10.90
	11	10.90	11.35
Colts	1	12.70	12.35
	2	12.75	12.30
	3	12.50	12.95
	4	12.55	12.15

11 Based on information from Paul, Weiss, we understand that shortly after the end of the AFC Championship Game, four Patriots footballs and four Colts footballs were also measured by the two game officials who had conducted the halftime tests, using the same two gauges used at halftime. Although we understand that these measurements were also recorded in writing, information concerning the timing of these measurements, the pressure levels at which these eight footballs started the second half and the identity of the four Colts footballs tested after the game (specifically, whether they were the same footballs that had been tested at halftime) was significantly less certain, especially as compared with the information about similar issues concerning the pre-game period. As a result, we did not believe that the post-game measurements provided a scientifically reasonable basis on which to conduct further analysis.

Investigation Approach

The purpose of Exponent's investigation was: (1) to analyze the data collected at halftime, particularly to determine whether the difference in the decrease in pressure exhibited by the footballs of the two teams was statistically significant; and (2) to identify and evaluate any environmental or process factors that might account for the difference in the magnitude of the pressure drops between the two teams.

In order to accomplish this, Exponent's investigation was divided into three main activities:

1. A statistical analysis of the data recorded during halftime of the AFC Championship Game.
2. An investigation into the gauges used to measure the pressure inside the footballs before the game and during halftime.
3. An investigation into the usage, physical, environmental, and process factors present on Game Day that could affect the measured pressure of a football.

Naturally, there is some overlap and inter-relation between the items listed above. In general, the remainder of this report is divided into three main sections that summarize the results and conclusions of the aforementioned primary investigation areas.

ANALYSIS OF DATA COLLECTED AT HALFTIME

At the start of halftime, the game balls from each team were brought into the Officials Locker Room, each team's balls in their own respective bags. During the halftime period, the air pressure of 11 Patriots footballs and four Colts footballs were measured. The measurements were taken by Clete Blakeman and Dyrol Prioleau, and were recorded by Richard Farley (Mr. Blakeman was the alternate referee designated for the game, Mr. Prioleau was an alternate line judge for the game, and Mr. Farley is the NFL security representative to New England). Mr. Blakeman and Mr. Prioleau each used a separate gauge to measure the pressure inside each respective football. One of the gauges had been used by Walt Anderson to measure or set the pressure in the balls prior to the game, and both gauges belonged to Walt Anderson.

To generate the data in Table 1, the following sequence of events took place:[12]

1. A ball was removed from the respective team's equipment bag.
2. This ball was measured by the first official with his gauge and the pressure reading was recorded.
3. The same ball was handed to the next official, who made a second pressure reading with the second gauge, which was then also recorded.
4. The next ball was removed from the equipment bag and the process repeated from Step 1.

Before an analysis of the data is discussed, a few observations and nomenclature definitions are needed. First, note that for a given set of measurements, one gauge consistently reads higher than the other (with the exception of the third Colts ball, which will be discussed below), with the magnitude of the difference being relatively constant. In the Patriots measurements, the gauge used by Mr. Prioleau reads higher, whereas in the Colts measurements, the gauge used by Mr. Blakeman reads higher. Given what Exponent has learned in the subsequent analysis of the two gauges (as will be discussed in the next section), it appears most likely that the two officials switched gauges in between measuring each team's footballs.

According to information provided by Paul, Weiss, it is most likely that both of the gauges belonged to Walt Anderson, the referee for the AFC Championship Game. For the remainder of this report, the gauge that reads consistently higher, as mentioned above, will be referred to as the "Logo Gauge" (in reference to the Wilson "W" logo present on the back of the gauge), whereas the gauge that reads consistently lower will be referred to as the "Non-Logo Gauge" (which has no equivalent "W" marking on the gauge back). The differences in these gauges will take on increased significance later in this report.

12 Based on information collected during interviews conducted by Paul, Weiss and provided to Exponent.

Game Day Data – As Recorded

Mr. Blakeman was the first to gauge the balls in the above sequence, with Mr. Prioleau following for the second measurement. The measurements as recorded on Game Day and the computed average pressure measurements are shown in Table 2. The measurements listed in the table were taken in chronological order, i.e., Ball 1 was measured first, Ball 2 measured second, and so on.

Table 2. Pressure measurements of the footballs as recorded on Game Day.

Team	Ball	Tested by Clete Blakeman	Tested by Dyrol Prioleau
Patriots	1	11.50	11.80
	2	10.85	11.20
	3	11.15	11.50
	4	10.70	11.00
	5	11.10	11.45
	6	11.60	11.95
	7	11.85	12.30
	8	11.10	11.55
	9	10.95	11.35
	10	10.50	10.90
	11	10.90	11.35
Patriots Average		*11.11*	*11.49*
Colts	1	12.70	12.35
	2	12.75	12.30
	3	12.50	12.95
	4	12.55	12.15
Colts Average		*12.63*	*12.44*

Compiling the averages for the data shown in Table 2 yields the data shown in Table 3.

Table 3. Averages from measurements from each official of the as-recorded data taken during halftime of the AFC Championship Game, with pressure drops calculated.

Official	Patriots Average	Average Pressure Drop (based on initial reading of 12.50 psig)	Colts Average	Average Pressure Drop (based on initial reading of 13.00 psig)	Difference in Pressure Drops between Colts and Patriots (psig)
Blakeman	11.11	1.39	12.63	0.38	1.02
Prioleau	11.49	1.01	12.44	0.56	0.45

Based on information from the Patriots and the Colts that suggests that they set their pre-game pressures at or near 12.5 psig and 13.0 psig, respectively, it is apparent that the measurements taken by each official indicate that there was a greater pressure drop on average in the Patriots balls than there was in the Colts balls.[13] According to Mr. Blakeman's halftime measurements, the average pressure drop in the Patriots balls was 1.02 psig more than that in the Colts balls. According to Mr. Prioleau's halftime measurements, the average pressure drop in the Patriots balls was 0.45 psig more than that in the Colts balls.

Game Day Data – Gauge Switch between Measuring Patriots and Colts Footballs

Using the assumption that the officials switched gauges in between measuring the Patriots and Colts balls, the pressure drops for each team are summarized in Table 4.

Table 4. Averages from measurements assuming the officials switched gauges between measuring the Patriots and Colts balls, with pressure drops calculated.

Gauge	Patriots Average	Average Pressure Drop (based on initial reading of 12.50 psig)	Colts Average	Average Pressure Drop (based on initial reading of 13.00 psig)	Difference in Pressure Drops between Colts and Patriots (psig)
Non-Logo Gauge	11.11	1.39	12.44	0.56	0.83
Logo Gauge	11.49	1.01	12.63	0.37	0.64

13 According to Paul, Weiss, the majority of the Patriots balls measured 12.5 psig when tested pre-game, and most of the Colts balls measured 13.0 or 13.1 psig. Paul, Weiss also provided information that suggests that the Colts targeted 13.0 psig when inflating their game balls. As a result, the analysis in this section and throughout this report uses 12.5 and 13.0 psig as starting pressures, respectively. However, as noted below, using a starting pressure for the Colts footballs of 13.1 psig does not alter our conclusion about the statistical significance of the difference between the average pressure drops of the teams.

Under this assumption, and based on information from the Patriots and the Colts (provided by Paul, Weiss) that suggests that they set their pressures at or near 12.5 psig and 13.0 psig, respectively, it is apparent that the measurements recorded by each gauge indicate that there was a greater pressure drop on average in the Patriots balls than there was in the Colts balls. According to the measurements taken with the Non-Logo Gauge, the average pressure drop in the Patriots balls was 0.83 psig more than that in the Colts balls. According to the measurements taken with the Logo Gauge, the average pressure drop in the Patriots balls was 0.64 psig more than that in the Colts balls.

Game Day Data – Colts Third Measurement Switch

The next aspect that must be noted from the data recorded on Game Day is the *single* halftime measurement in which it appears that the Non-Logo Gauge reads higher than the Logo Gauge. Specifically, this corresponds to Ball 3 of the Colts, where Mr. Blakeman's measurement is listed as 12.50 and Mr. Prioleau's measurement is listed as 12.95. In the case of the other three Colts footballs, Mr. Blakeman's readings are all higher than Mr. Prioleau's. With regard to the measurements of the 11 Patriots footballs, no such anomaly is observed. In addition, when used by Exponent during the course of this investigation, the Non-Logo Gauge has *never* read higher than the Logo Gauge when both are used to measure the same pressure. Therefore, it is possible that the 12.95 psig measurement may correspond to the other "higher" measurements for the Colts footballs, and the 12.50 psig measurement may correspond to the other "lower" measurements for the Colts footballs, meaning that the readings were switched when they were written down at halftime. Data reflecting a switch in the measurements for Colts Ball 3 (highlighted in gray), and the assumption that the officials switched gauges in between measuring the Patriots and Colts balls, is presented in Table 5.

Table 5. Data taken during halftime with Colts Measurement 3 adjusted and attributed to the two different gauges.

Team	Ball	Non-Logo Gauge	Logo-Gauge
Patriots	1	11.50	11.80
	2	10.85	11.20
	3	11.15	11.50
	4	10.70	11.00
	5	11.10	11.45
	6	11.60	11.95
	7	11.85	12.30
	8	11.10	11.55
	9	10.95	11.35
	10	10.50	10.90
	11	10.90	11.35
Patriots Average		*11.11*	*11.49*
Colts	1	12.35	12.70
	2	12.30	12.75
	3	12.50	12.95
	4	12.15	12.55
Colts Average		*12.33*	*12.74*

Compiling the averages for the data in Table 5 yields the information seen in Table 6.

Table 6. Averages from both Logo and Non-Logo Gauges, assuming the gauge switch between measurements for each team and the reversal of the Colts third measurement, with pressure drops calculated.

Gauge	Patriots Average	Average Pressure Drop (based on initial reading of 12.50 psig)	Colts Average	Average Pressure Drop (based on initial reading of 13.00 psig)	Difference in Pressure Drops between Colts and Patriots (psig)
Non-Logo Gauge	11.11	1.39	12.33	0.67	0.72
Logo Gauge	11.49	1.01	12.74	0.26	0.75

Based on information from the Patriots and the Colts that suggests that they set their pressures at or near 12.5 psig and 13.0 psig, respectively, it is apparent that the measurements recorded by each gauge indicate that there was a greater average pressure drop in the Patriots balls than there was in the Colts balls. According to the measurements taken with the Non-Logo Gauge, the average pressure drop in the Patriots balls was 0.72 psig more than that in the Colts balls. According to the measurements taken with the Logo Gauge, the average pressure drop in the Patriots balls was 0.75 psig more than that in the Colts balls.

Game Day Data – Discarding Colts Third Measurement

Rather than assuming that the measurements recorded for Colts Ball 3 were switched, we have also conducted this analysis excluding those measurements altogether. Excluding the data recorded for Colts Ball 3, and assuming that the officials switched gauges in between measuring the Patriots and Colts balls, produces the data seen in Table 7.

Table 7. Averages from Logo and Non-Logo Gauges, assuming the gauge switch between measurements for each team and discarding the Colts third measurement, with pressure drops calculated.

Gauge	Patriots Average	Average Pressure Drop (based on initial reading of 12.50 psig)	Colts Average	Average Pressure Drop (based on initial reading of 13.00 psig)	Difference in Pressure Drops between Colts and Patriots (psig)
Non-Logo Gauge	11.11	1.39	12.27	0.73	0.66
Logo Gauge	11.49	1.01	12.67	0.33	0.68

Based on information from the Patriots and the Colts that suggests that they set their pressures at or near 12.5 psig and 13.0 psig, respectively, it is apparent that the measurements taken with each gauge indicate that there was a greater average pressure drop in the Patriots balls than there was in the Colts balls. According to the measurements taken with the Non-Logo Gauge, the average pressure drop in the Patriots balls was 0.66 psig more than that in the Colts balls. According to the measurements taken with the Logo Gauge, the average pressure drop in the Patriots balls was 0.68 psig more than that in the Colts balls.

Thus, a logical next step before proceeding further is to answer the following question for each of the above four scenarios:

Is the difference in the magnitude of the average pressure drops between the Patriots and the Colts statistically significant?

Exponent's analysis of this question is presented in the next section.

Statistical Model

We developed and used a statistical model to assess the observed variation in football pressure measurements and to determine whether or not the drop in pressure, on average, measured for Patriots footballs after the first half of play was statistically significantly greater than the corresponding average drop in pressure measured for Colts footballs.[14] (Note that all the halftime measurements were below the reported starting pressures, a change predicted by basic thermodynamics given that the footballs spent approximately 2 hours in a colder environment before being brought into the warmer environment of the Officials Locker Room for a relatively short time. An illustration of this fact is shown in Figure 1, which depicts the data described in Scenario 3 above.)

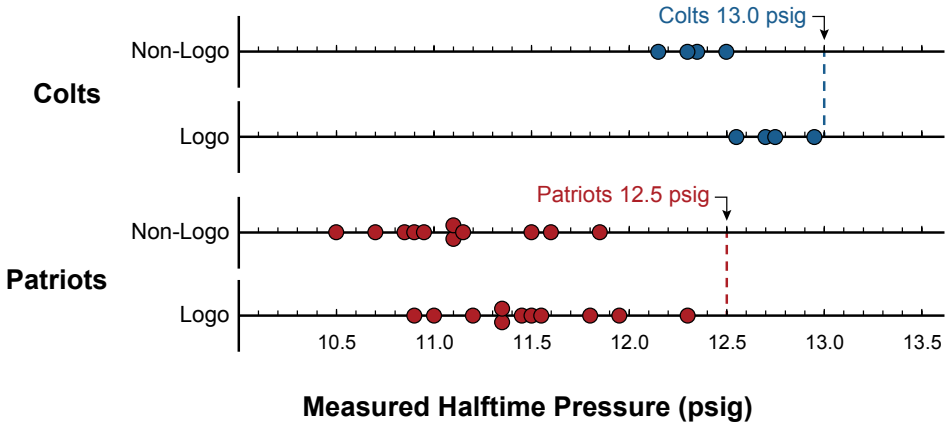

Figure 1. Measured halftime pressure and reported pre-game pressure of Colts and Patriots footballs, AFC Championship Game, January 18, 2015.

14 See the Appendix for discussion regarding the effect of measurement order.

We used this model to evaluate four different scenarios described in the previous section:

1. The data exactly as listed on the handwritten notes from Game Day.
2. Assuming the "switch" of the gauges in between measuring the Patriots and Colts footballs.
3. Assuming Scenario 2 while concurrently assuming that the readings for the third Colts ball tested were recorded in the wrong column.
4. Assuming Scenario 2 while fully discarding the readings for the third Colts ball tested.

The full details of our statistical model can be found in the Appendix to this report. Presented below is a summary of the relevant findings regarding statistical significance.

Results and Discussion

The convention in statistical applications is to declare a finding significant if the p-value is less than 0.05—i.e., there is less than a 5% probability of observing a finding of that magnitude by chance. In other words, if the p-value is less than 0.05, there is a statistically significant difference between the average decrease in pressure of the Patriots footballs when compared with the average decrease in pressure of the Colts footballs. Using our statistical model for each data scenario outlined above, we calculate a p-value for the difference between the two teams with respect to the average pressure drop of their footballs.[15] The p-value for each of the four scenarios is shown in Table 8. As discussed in the Appendix to this report, our data analyses took into account the difference in sample size between the two teams (22 measurements for the Patriots, and 8 for the Colts [or 6 for Scenario 4]).

Table 8. The p-values calculated using Exponent's statistical model for each of the four Game Day halftime data scenarios.

Scenario	p-value
1	0.004
2	0.004
3	0.004
4	0.017

As shown in Table 8, the p-value for *all* of the above scenarios is less than 0.05. This indicates that regardless of which of the above four sets of assumptions are made about the gauges used to generate the Game Day data, the difference between the average pressure drop of the Patriots and Colts footballs is statistically significant. In other words, in all cases studied, the additional pressure drop exhibited by the Patriots footballs is unlikely to have occurred by chance.[16]

15 For details on the calculation of p-values, see Appendix.

16 As noted above, according to Paul, Weiss, some of the Colts footballs measured 13.1 psig when tested prior to the game. In the interest of completeness, we conducted the same statistical analysis using a starting pressure of 13.1 psig for the Colts, and our conclusion with respect to statistical significance remains the same. Specifically, assuming a starting pressure of 13.1 psig, all of the p-values for Scenarios 1–4 are less than 0.05; 0.010 for Scenarios 1–3 and 0.037 for Scenario 4. These results indicate that even with the increased starting pressure for the Colts, the difference between the average pressure drops of the two teams is statistically significant.

It should also be noted that the variability of the halftime measurements recorded for each team was analyzed, and it was found that the variability in the measured pressure of Patriots footballs was greater than the corresponding variability of the Colts footballs.[17] Specifically, assuming Scenario 3, the respective standard deviations for measurements taken with the Logo Gauge were 0.41 psig for the Patriots footballs and 0.16 psig for the Colts footballs, whereas the respective standard deviations for the measurements taken with the Non-Logo Gauge were 0.40 psig for the Patriots footballs and 0.14 psig for the Colts footballs. Although these differences between the teams' standard deviations are not statistically significant,[18] the lack of statistical significance may be attributable to the relatively few Colts footballs measured. We comment later on the physical significance of observed fluctuations in the Patriots data based on the findings from our experimental work.

Note that for the remainder of this report, when the Game Day data are discussed, it should be taken to mean that the data from Scenario 3 are the data being referenced.

Conclusions

Using the pressure measurements recorded at halftime of the AFC Championship Game and the reported pre-game pressure levels of each team's footballs (12.5 and 13.0 psig, respectively), Exponent applied a statistical model and calculated a p-value for four different scenarios that reflected different assumptions about the Game Day data. We found that regardless of which assumption is made about the gauges used to generate the Game Day data, there is a statistically significant difference between the average pressure drops exhibited by the two teams. This finding holds true under each of the four different scenarios described above. The mathematical and statistical justifications for the above conclusions can be found in the Appendix.

17 By variability, we mean the standard deviation of each individual measurement from the average measurement, which we calculate separately for the data collected using each gauge.

18 To compare the standard deviations—or, equivalently, the variances—of Colts and Patriots football pressures at halftime, we used two standard statistical tests: the F test (which assumes that pressures have a "bell-shaped" or normal distribution) and Levene's test (which does not make such an assumption). For measurements taken with the Logo Gauge, the p-values of the F test and Levene's test were 0.16 and 0.20, respectively. For measurements taken with the Non-Logo Gauge, the corresponding p-values were 0.12 and 0.15.

ANALYSIS OF GAUGE MEASUREMENT ERROR AND ACCURACY EFFECTS

Introduction

As was discussed previously, two different gauges (the Logo Gauge and Non-Logo Gauge) were used on Game Day to generate the halftime data. Collectively, the Logo and Non-Logo Gauges will be referred to as the "Game Day Gauges" throughout this report. A thorough understanding of the measurement error and accuracy associated with these gauges is necessary to more fully understand the implications of the halftime data. Exponent's analysis with regard to the gauges was divided into several main areas:

- Analysis of how each gauge functions and any physical differences between the two gauges.
- A measure of how much variation in pressure readings exists between the two gauges, as well as between the Game Day Gauges and a sample of Exemplar Gauges.
- The effects of pressure on gauge accuracy; i.e., are the gauges more or less accurate at lower or higher pressures?
- The effects of temperature on gauge accuracy; i.e., are the gauges more or less accurate at lower or higher temperatures?
- The effect, if any, of the battery level on gauge accuracy.
- The effect, if any, of a human factor on gauge accuracy; i.e., are the gauges more or less accurate depending on the individual taking the measurement?
- Long-term drift effects.

The results of our investigation into each of the above areas, including the experimental methods used and subsequent analysis, are presented in the sections that follow.

Equipment Definitions

Before discussing our findings, it is necessary to first define or explain some of the terms used below:

Game Day Gauges	Collectively, the two gauges used on Game Day; the Non-Logo Gauge and the Logo Gauge.
Exemplar Gauge	A gauge that is thought to be nearly identical to the Non-Logo Gauge. Specifically, Model CJ-01 with the description "Electronic Ball Pressure Gauge." Exponent obtained multiple dozens of Exemplar Gauges from both Wilson Sporting Goods (via Paul, Weiss) and other sports equipment retailers.

It should be noted that the exemplar gauges tested are apparently identical to the Non-Logo Gauge only. The Logo Gauge and Non-Logo Gauge, although similar, are not identical. Neither Exponent nor Paul, Weiss was able to procure exemplar gauges identical to the Logo Gauge.

Master Gauge	A calibrated pressure gauge.
Prepared Footballs	Footballs that were prepared by either the Patriots or the Colts prior to their use in practice or games.
Exemplar Football	An official "out of the box" football provided by Wilson that meets all NFL specifications, but has not been prepared by any team.

General Gauge Function

The Game Day Gauges are shown in Figure 2. There are external physical differences between the two gauges when viewed from the front and the back. When viewed from the front, as seen in Figure 2, the power button of the Logo Gauge has the word "ON" printed on it, whereas the power button of the Non-Logo Gauge has no lettering on it, and instead is a red button. Additionally, the Logo Gauge has indications on the front regarding the graduations of the gauge and the pressure range. The ball inflation needle on the Logo Gauge is noticeably longer than the needle on the Non-Logo Gauge and both needles appear bent, as seen in Figure 3. Neither the needles being bent nor the needle length appears to have any observable effect on the pressure readings taken by the gauges. When viewing the back of the gauges, as seen in Figure 4, the Logo Gauge has a large red sticker with a Wilson logo on it and what appears to be handwriting. The Non-Logo Gauge has no such sticker or handwriting.

Internally, both gauges function in a similar fashion with a few subtle differences discussed below.

Figure 2. Image showing the front of the Non-Logo Gauge (left) and Logo Gauge (right).

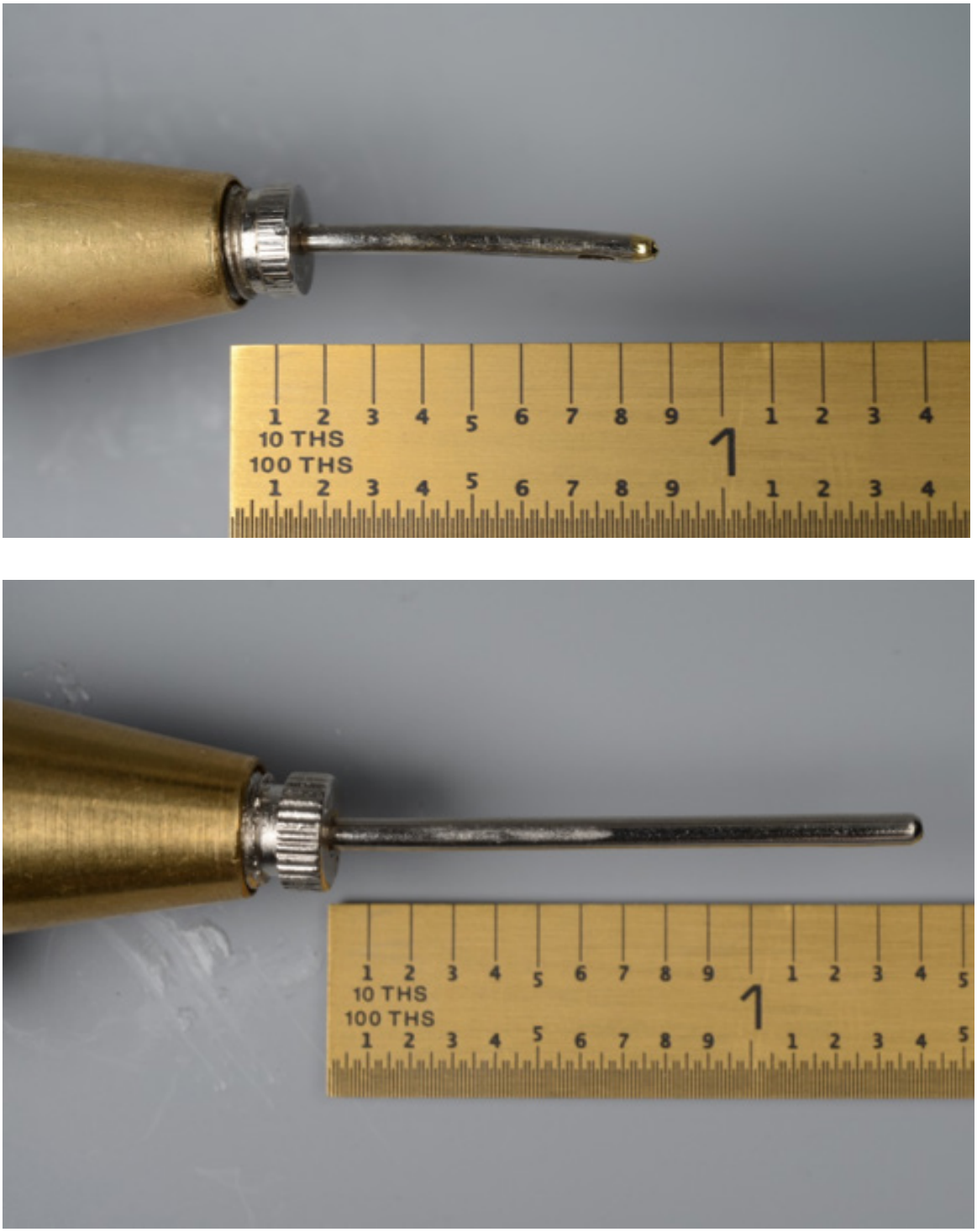

Figure 3. Image of the inflation needles attached to their respective gauges. The Non-Logo Gauge has a noticeably smaller needle when compared to the Logo Gauge. Both needles are slightly bent.

Figure 4. Image showing the back of the Non-Logo Gauge (left) and Logo Gauge (right).

Needle

In order to take a measurement of the pressure inside a football, a needle is used to penetrate a specially designed gland that allows a needle to pass through without damaging the pressure seal of the football. The gland is located inside the pressure bladder, and only the portion where the needle enters is visible on the surface of the football. When the needle is in place, the gland seals around the perimeter of the needle; when the needle is removed, the gland seals upon itself. The air being measured enters the needle through one of two paths: a hole at the tip or a hole near the tip along the side of the needle. Air entering the needle passes up the hollow center of the needle to the brass gauge stem. The needle is attached to the gauge through a threaded connection on the conical portion of the gauge stem. An O-ring is used in this connection.

Gauge Stem

A second threaded connection is made between the conical and cylindrical sections of the gauge stem. At this connection, the two Game Day Gauges have different constructions: the Logo Gauge includes a fine mesh screen in the airway, whereas the Non-Logo Gauge has no screen. The Non-Logo Gauge was easily separated at this joint, and upon separation, fine particulate debris was found in this connection region (the same region where the Logo Gauge has a mesh screen). We did not attempt to separate the Logo Gauge because it appeared that the conical and cylindrical sections of the valve stem were locked together with what appeared to be a thread bonding agent.

The cylindrical portion of the gauge stem on both gauges has a small button on the side. Pressing this button opens a vent path between the main airway up the center of the gauge stem to the outside environment. In practice, this button is used to release pressure from the pressure vessel to which the gauge is attached.

At the end of the cylindrical section of the gauge stem, the stem is attached to the plastic gauge body. This joint was not separated in Exponent's analysis of the Game Day Gauges, but in examining similar gauges, this joint is sealed with thread sealer.

Gauge Body

The body of each Game Day Gauge is an unpressurized compartment with a removable back that contains the pressure sensor, electronics, battery, LCD display, and power button. The body is surrounded by a removable rubber cover. It should be noted that the electronics appear to be different between the Logo and Non-Logo Gauges. No attempt was made to reverse engineer the electronics of either Game Day Gauge because this would have potentially permanently damaged the gauges.

Based on a review of Exemplar Gauges, it appears that the pressure sensor is directly mounted to the plastic threaded connection between the gauge body and gauge stem.

The electronics of both devices are powered by a single coin-cell battery of type CR2032.

Gauge User Interface

During operation of the Game Day Gauges, the following aspects of the gauge user interface were noted:

- Upon pressing power, both Game Day Gauges appear to go through an internal routine whereby whatever pressure the gauge is exposed to during the power on event is used to set the zero pressure reference.
- The Logo Gauge has an auto-off function that powers off the gauge after a prescribed elapsed time.
- The Non-Logo Gauge also has an auto-off function, but so long as non-zero pressure is applied to the gauge, the gauge remains powered on. When pressure is removed, the gauge automatically turns off after a prescribed elapsed time that is shorter than that for the Logo Gauge.
- The Logo Gauge has a measurement range of up to an indicated 15.00 psig.
- The Non-Logo Gauge has a measurement range of up to an indicated 19.95 psig.
- Both gauges have a reading resolution of 0.05 psig.

Gauge-to-Gauge Variability and Accuracy

The following set of experiments was performed to address the following two questions:

1. If multiple gauges, including the Game Day Gauges, are used to measure an identical pressure, what is the variability of readings among all of the gauges? Another way of posing this question is "What is the *precision* of these gauges?"

2. If the Game Day and Exemplar Gauges are used to measure a pressure for which the true value is known, how close do their readings come to the true pressure? That is, how *accurate* (or true) are these gauges?[19]

Experimental Procedure

To determine both the precision and accuracy of the gauges, a fixture with a common manifold was constructed that allowed for multiple Exemplar Gauges to simultaneously be exposed to common temperature and pressure conditions. A single high-accuracy gauge (Omega DPG4000-30) with NIST (National Institute of Standards and Technology) traceable calibration was also connected to the manifold to record actual pressure data (for the remainder of this report, this will be referred to as the "Master Gauge"). The test fixture with Exemplar Gauges and the Master Gauge attached to the manifold is shown in Figure 5.

19 The usage of precision, accuracy, and true in this context are in accordance with the terminology of ISO Standard 5725-1.

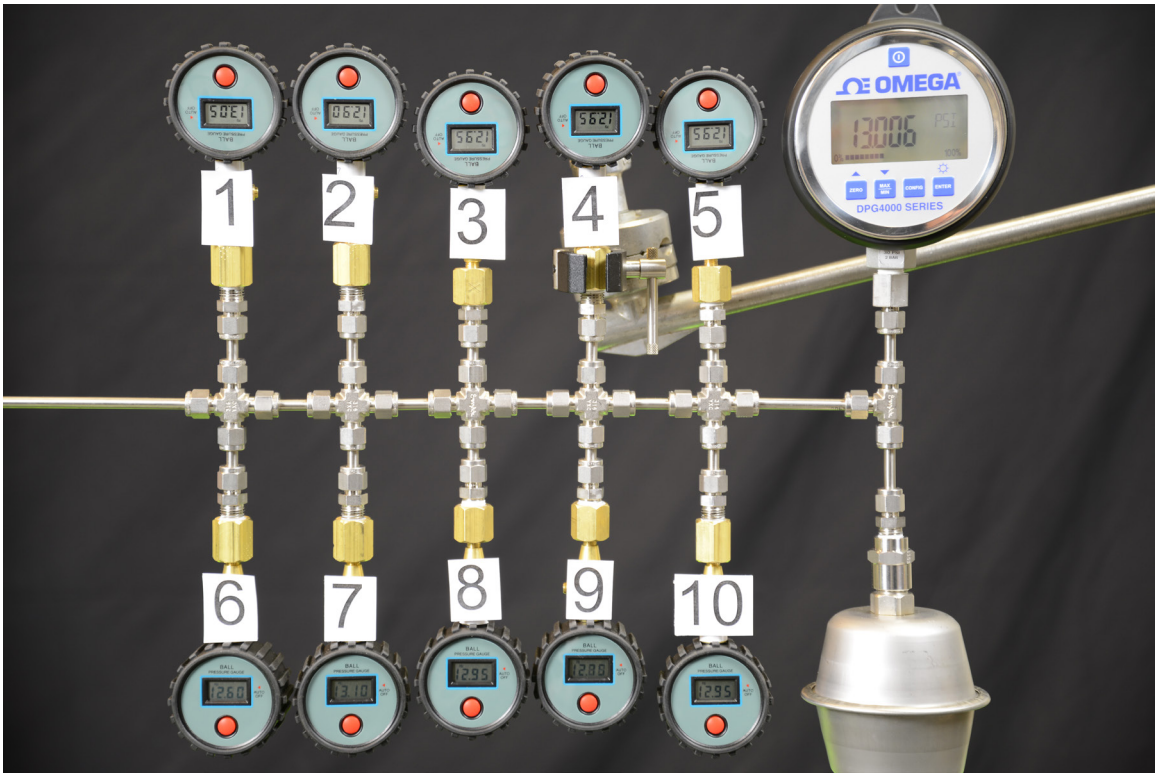

Figure 5. The gauge-to-gauge repeatability experiment setup with multiple Exemplar Gauges, Game Day Gauges (not shown), and a Master Gauge connected to a manifold such that all gauges are exposed to identical pressures.

A computer controlled regulator was used to adjust the air pressure within the manifold. The manifold was pressurized to a nominal pressure of 13.00 psig, and held for several seconds until the pressure readings on all gauges settled to their final respective values. Once the readings remained constant, the values for each gauge were recorded. The pressure was then vented, and all Exemplar Gauges were power cycled and the Master Gauge re-zeroed. The manifold was then re-pressurized to 13.00 psig and the above procedure was repeated. Each set of 10 gauges went through 10 pressurization and recording cycles. Overall, 50 Exemplar Gauges were analyzed using this method, in five sets of ten gauges. The Game Day Gauges were also subjected to this analysis.

Results and Discussion

The data in Figure 6 show the results of the above experiments. The plot on the left shows the variation in average readings generated when the Exemplar Gauges were compared to the Master Gauge. On the right, the variation within a gauge (i.e., gauge repeatability) is shown. The data indicate that although the gauges tended to over- or underestimate the true pressure, the measurements recorded by an individual gauge were self-consistent. In other words, an individual gauge may read slightly incorrectly as compared to the Master Gauge, but that error is consistent

for all readings taken by that particular gauge.[20] This held true for the Game Day Gauges: the Logo Gauge generally overestimated the Master Gauge by ~0.3-0.4 psig and the Non-Logo Gauge generally read slightly below the Master Gauge by ~0.07 psig, but both gauges were self-consistent.[21, 22]

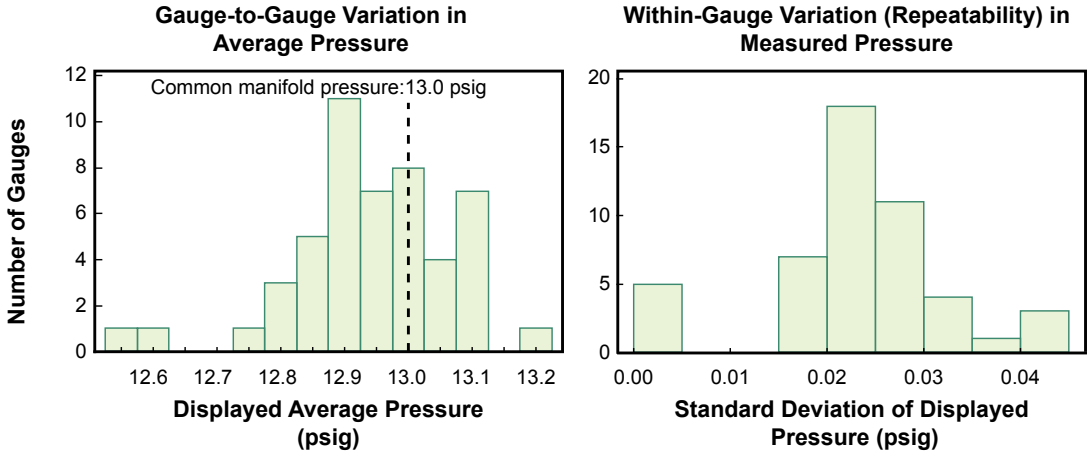

Figure 6. The gauge-to-gauge variation in average pressure (left) and the within-gauge variation in measured pressure (right).

Gauge Accuracy across the Measured Pressure Range

Given that the Playing Rules specify a range of acceptable pressure values, it is important to characterize how accurate and repeatable the gauge measurements are over a range of pressures that is representative of the pressures to which an NFL football may be inflated, including the NFL-specified 12.5–13.5 psig acceptable range.

Experimental Procedure

Using the same test fixture described in the previous section, eight Exemplar Gauges and the two Game Day Gauges were attached to the variable pressure manifold, all at room temperature. The pressure was adjusted from a nominal 8.00 psig to 14.50 psig in approximate 0.5 psig increments, and back down from 14.50 to 8.00 psig in similar increments. At each increment, the pressure in the manifold and the gauge readings were allowed to settle, and the measurements were recorded.

20 There was an observed tendency for the gauges to read slightly low: the Exemplar Gauges underestimated the Master Gauge pressure by an average of 0.07 psig. Differences between gauges accounted for 96 percent of the total variation in exemplar gauge measurements, with the remaining 4 percent attributable to differences in repeated measurements from the same gauge.

21 These values correspond to the initial condition in which Exponent received the gauges. The effect of long-term drift is discussed later in this section.

22 One data point is excluded from this analysis because during testing an Exemplar Gauge was improperly re-zeroed when a non-zero pressure was being applied.

Results and Discussion

For the Game Day Gauges and all of the Exemplar Gauges tested, measurements increased approximately linearly as the Master Gauge pressure was increased. Tendencies of individual gauges to read systematically higher or lower than the Master Gauge were generally consistent over the range of pressures tested, as shown in Figure 7. In the pressure range of the Game Day measurements (approximately 10 psig to 14 psig), both Game Day Gauges remain reasonably reliable.

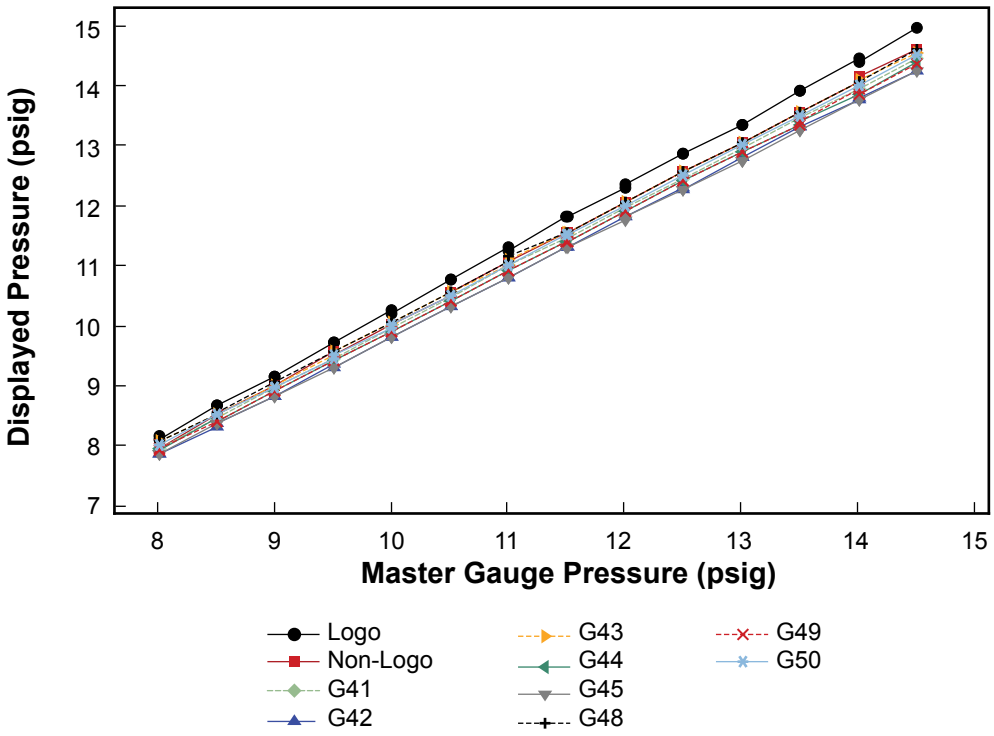

Figure 7. Pressure measurements taken by Logo, Non-Logo, and Exemplar Gauges at varying Master Gauge pressures.

It was observed that the variation of measurements from different gauges increased as the Master Gauge pressure was increased. To confirm this characteristic, suggested by examination of Figure 7, we calculated the standard deviation of pressures measured by the Non-Logo and Exemplar Gauges. (The Logo Gauge was noticeably different in manufacture and therefore omitted from this part of the data analysis.) An increasing trend in variability with increasing pressure is suggested by the results in Figure 8, the statistical significance of which was confirmed by linear regression analysis.

However, because the Game Day Gauges remain reasonably reliable in the pressure range of the Game Day measurements, it is not believed that the variation in measurement reading as a function of pressure is a source of error in the Game Day data or a factor that contributed to the difference in the average pressure drops between the two teams.

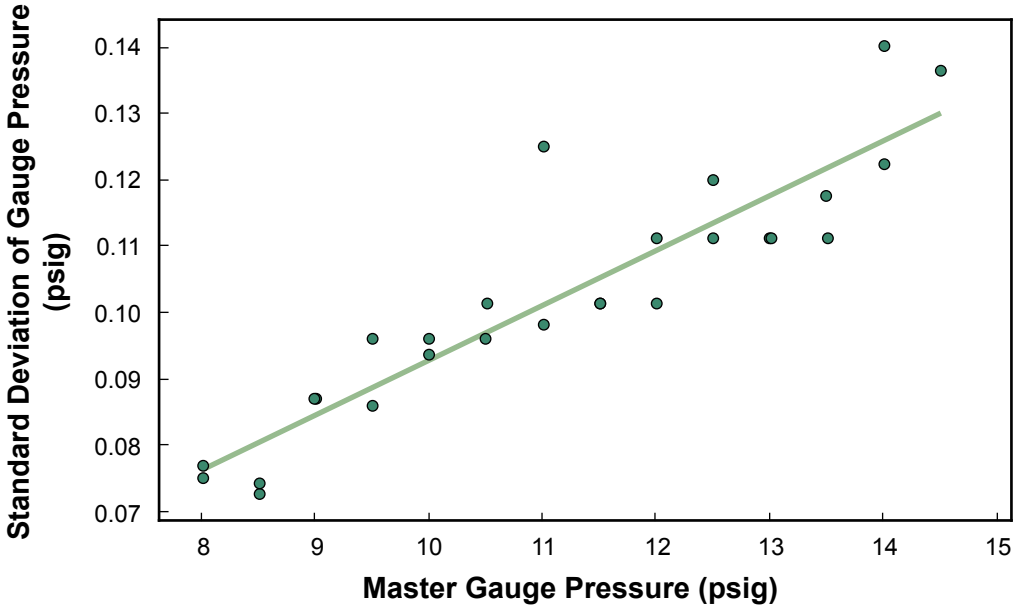

Figure 8. Standard deviation of pressure measurements taken by Logo, Non-Logo, and Exemplar gauges at varying Master Gauge pressures.

Temperature Effects on Accuracy

Based on information provided by Paul, Weiss, the pre-game measurements were performed at a relatively constant temperature, as were the halftime measurements, though we believe that the two temperatures may have differed by approximately 4°F. The pre-game measurements were taken on the floor of the shower area adjacent to the dressing area of the Officials Locker Room, where there is no active heating or cooling. The halftime measurements were taken in the dressing area of the Officials Locker Room, which is temperature controlled.

Experimental Procedure

The same test fixture as described previously was utilized. Four Exemplar Gauges were affixed to the pressure manifold, and the entire apparatus was placed inside a temperature and humidity controlled chamber. The pressure was nominally held constant while the temperature was varied. The temperature inside the chamber was varied from approximately 60°F to 80°F. As the temperature increased, the pressure readings from all four gauges were recorded.

Results and Discussion

According to information provided by Paul, Weiss, both gauges stayed inside the Officials Locker Room from the time when the game officials arrived at Gillette Stadium (approximately 3:20 pm) through the first half of the AFC Championship Game. This means that they remained at a relatively constant temperature (i.e., within approximately 4°F) throughout the entire period in which they were used.

The eight Exemplar and the two Game Day Gauges tested by Exponent showed varied sensitivity to changes in ambient temperature, as seen in Figure 9. The measured pressure for the two Game Day Gauges decreases slightly, approximately 0.01 psig per degree Fahrenheit, as the temperature increases from 60°F to 80°F. For example, a change from 68°F to 72°F would cause the pressure readings of a constant pressure source to drop by approximately 0.04 psig. As will be discussed later, the likely maximum temperature difference that the gauges were exposed to on Game Day was on the order of 4°F. According to Figure 9, this would lower the measured pressure by only ~0.04 psig, which is within the reading resolution of the gauge. Therefore, it is not anticipated that changes in ambient temperature that the Game Day Gauges experienced on Game Day would have materially changed the readings generated.

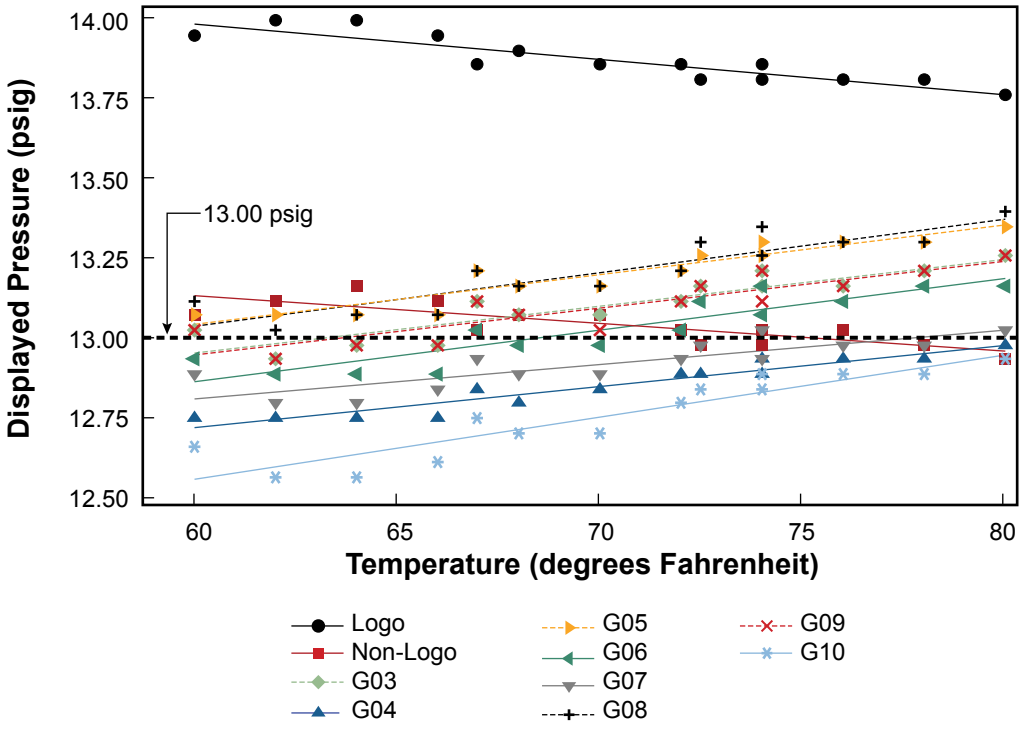

Figure 9. Effect of changes in ambient temperature (approximately 60°F to 80°F) on pressure measurements taken by Exemplar and Game Day Gauges.

Battery Level Impact on Accuracy

The precise levels of battery charge that existed in the Logo and Non-Logo Gauges on the day of the AFC Championship Game are unknown. To that end, it is necessary to determine what errors could have been induced by potentially low battery levels that may have been present when the measurements at issue were taken. This test was conducted on an Exemplar Gauge only (Model: CJ-01, description: Electronic Ball Pressure Gauge). In physical appearance, this gauge closely resembles the Non-Logo Gauge. Only this exemplar was used because: (1) the test entailed

altering the gauge under test by replacing the removable coin cell battery with extension wires soldered directly to the circuit board and attached to an external power supply; and (2) we were unable to find a second exemplar that was representative of the Logo Gauge.

Experimental Procedure

Both of the Game Day Gauges are powered by a coin cell battery of type CR2032. This type of battery provides a nominal 3V to its attached circuit. An Exemplar Gauge of model CJ-01 was modified so that the gauge could be operated with the coin-cell battery removed and an external power supply added. This modification consisted of removing the back of the gauge and soldering power wires directly to the battery terminals on the electronics board. These wires were subsequently led to an adjustable power supply capable of replicating the CR2032 battery voltage and current range. The gauge was connected through a manifold to a constant, regulated supply pressure of nominally 13.00 psig and monitored with the Master Gauge for stability while the supply voltage was reduced in a stepwise manner. At each step, the supply voltage (as measured by a calibrated multi-meter) and the corresponding gauge and reference pressure readings were noted. For convenience, the testing was conducted in an environmental chamber controlling humidity (18% RH) and temperature (68°F).

Results and Discussion

The reference pressure was held at an average of 13.02 psig throughout the entire test. At the nominal supply voltage of 3V (representative of a fresh CR2032 battery), the Exemplar Gauge read 12.80 psig. At an approximate supply voltage of 2.6V a low battery indicator symbol appeared on the gauge display, as seen in Figure 10. No change in the pressure displayed on the Exemplar Gauge was seen until the voltage was reduced from 3V to approximately 2.4V. Below 2.4V, the indicated pressure dropped rapidly until reaching 7.90 psig at a supply voltage of approximately 1.9V. The Exemplar Gauge did not function at voltages below 1.9V.

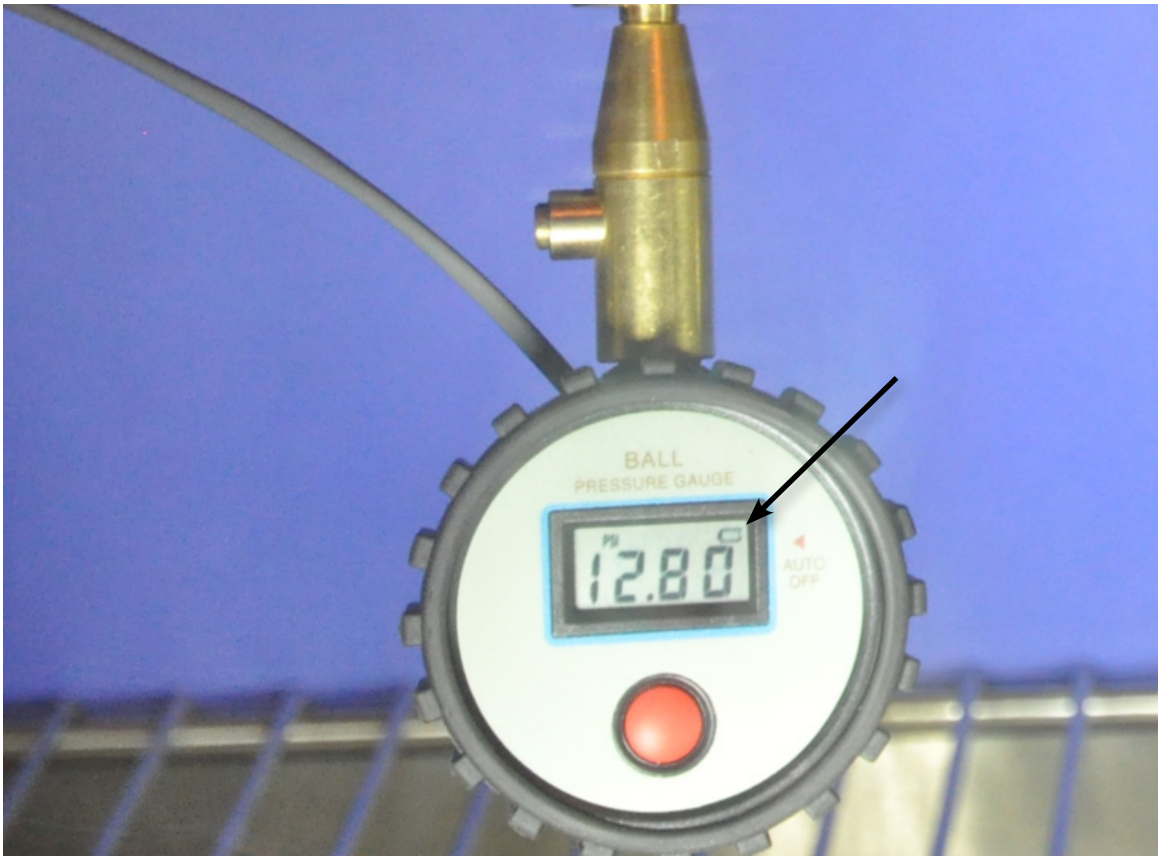

Figure 10. Close-up image of the Exemplar Gauge showing battery indicator (indicated by the arrow) on the LCD screen. The battery indicator is illuminated when the applied voltage is approximately 2.6V or less.

Although the Game Day Gauges were not tested directly, the behavior exhibited by the Exemplar Gauge tested is indicative of other pressure sensors of this type, and indeed other battery powered sensor recorders in general. A typical battery powered sensor meter incorporates onboard circuitry to mitigate the effect of gradually dropping battery supply voltage until just before a point where it can no longer do so, when a user warning of the low battery condition is displayed. The user then typically needs to change the battery or suffer degradation in the reported readings.

Neither the Logo Gauge nor the Non-Logo Gauge displayed a low battery indication when initially received by Exponent. In the process of subsequent and extended testing with these two gauges, both gauges did eventually exhibit a low battery warning (an identical graphic as the exemplar is displayed in the case of the Non-Logo Gauge, and a text display of "L.o.B" appears in the case of the Logo Gauge). When these indications were seen, Exponent removed the battery from the respective gauge and replaced the battery with a fresh CR2032.

Because neither Game Day Gauge displayed a low battery indication when received, and because the accuracy of measurements is affected only once the indication appears, the measurements recorded on Game Day were unlikely to have been affected by battery issues.

The Effect of Human Factors on Gauge Accuracy

In order to evaluate whether there was a human factors effect (i.e., "operator variability") on the reading taken by a particular gauge (that is, whether a reading generated by a gauge was impacted by the individual taking the reading), Exponent constructed a set of trials during which five individuals were asked to use the Non-Logo Gauge to measure 11 footballs inflated to the same pressure, as measured by the Master Gauge. Each individual was allowed to familiarize himself with the operation of the gauge using a practice ball, and was then asked to measure the 11 test footballs and announce the reading, which was logged by the test operator. The pressure inside each football was reset with the Master Gauge prior to each trial and temperature conditions were monitored within the test environment to control for any pressure change resulting from changes in the room temperature.

All of the readings generated by all five individuals and all 11 footballs were within 0.05 psig of each other, which is equivalent to the reading resolution of the Non-Logo Gauge (as well as the Logo Gauge).

Because the variability of measurement readings seen in the human factors testing was within the reading resolution of the Game Day Gauges, the measurements on Game Day were unlikely to have been affected by issues relating to the human factors of how the gauges were read or handled to make the measurements.

Long Term Repeatability

During the course of testing over several weeks, it was observed that when measuring an identical pressure, the difference between the readings generated by the Logo Gauge and the Non-Logo Gauge increased as compared to what was first observed upon Exponent's receipt of the gauges (approximately ~0.35 psi). This is thought to have been caused by heavy continuous usage, including the thousands of measurements taken with these gauges in the span of a few weeks. We believe that this is a long-term effect and that the readings taken on the day of the AFC Championship Game (fewer than 75 measurements during a time span of several hours) are all considered to be self-consistent (i.e., there is no expected "drift" over the course of the Game Day time period). We also note that the relatively consistent differential measured between the two gauges on Game Day indicates that this long-term drift was not an issue.

Nevertheless, because of the above observation of an increase in the difference between the two gauges, a test to re-characterize the repeatability and accuracy of the Game Day Gauges was conducted near the end of Exponent's investigation in order to evaluate what long-term drift effects may be present and account for them in the analysis of our experimental results.

Experimental Procedure

The procedure to investigate the gauge repeatability and gauge-to-gauge variation is identical to that presented in the Experimental section of the Gauge-to-Gauge Variability and Accuracy section of this report.

Results and Discussion

A second gauge repeatability study was performed using eight Exemplar Gauges, as well as the Logo and Non-Logo Gauges. Using the Master Gauge, manifold pressure was controlled at effectively 13.00 psig (between 12.99 and 13.00 psig for the duration of the experiment), and a sequence of ten pressure readings were taken from each gauge. Figure 11 presents the results, which are similar to the first repeatability study in showing strong repeatability in multiple measurements using the same gauge and considerable differences between gauges. The study shows evidence of drift in both the Logo and Non-Logo Gauge. The Logo Gauge, which had been reading between 0.3 to 0.4 psig higher than the Master Gauge in early experiments, consistently recorded a value 0.75 psig higher than the Master Gauge pressure during the second series of tests. The Non-Logo Gauge, which had been well calibrated to the Master Gauge, recorded values between 0.05 and 0.10 psig lower than the Master Gauge pressure during the second series of tests.

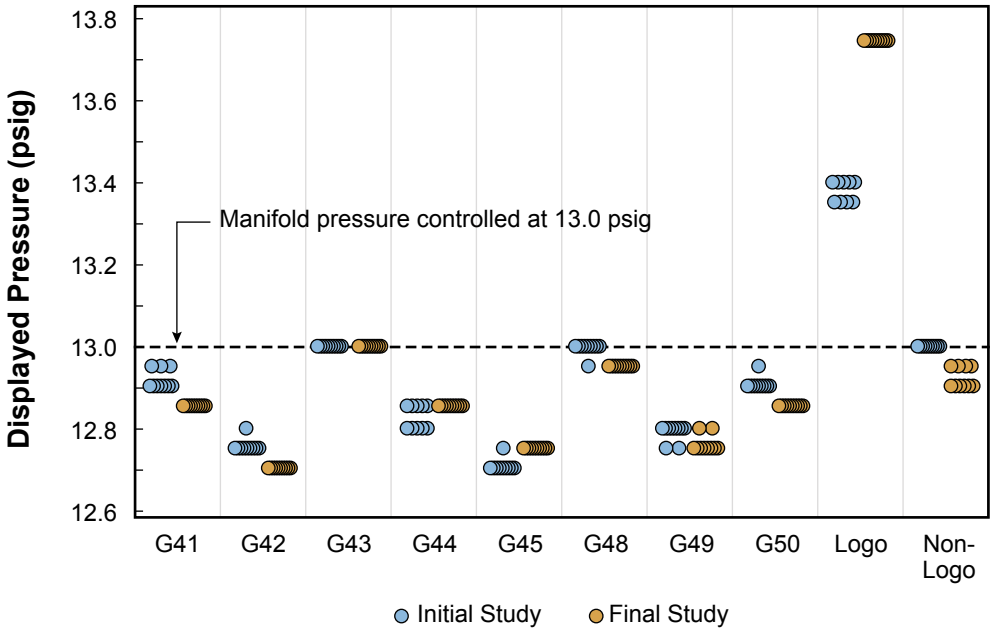

Figure 11. Comparison of gauge repeatability studies, showing long term drift effect in the Logo and Non-Logo gauges.

Further evidence of long-term drift in the Game Day Gauges is found by comparing the results of two experimental studies of pressure effects on gauge accuracy performed several days apart. In each study, manifold pressure was increased from approximately 8.0 psig to 14.5 psig and then decreased back to 8.0 psig. Figure 12 displays the results in terms of the difference between the pressure measured by each Game Day Gauge and the manifold pressure as measured by the Master Gauge. Consistent with the findings of the second repeatability study, at pressures of 4 psig or greater the Logo Gauge readings in the second pressure study were higher than those in the first, with the difference between readings increasing with pressure. In the second pressure study,

at pressures of 4 psig or greater the Non-Logo Gauge readings were consistently lower than those in the first pressure study, as well as being lower than the Master Gauge pressure.

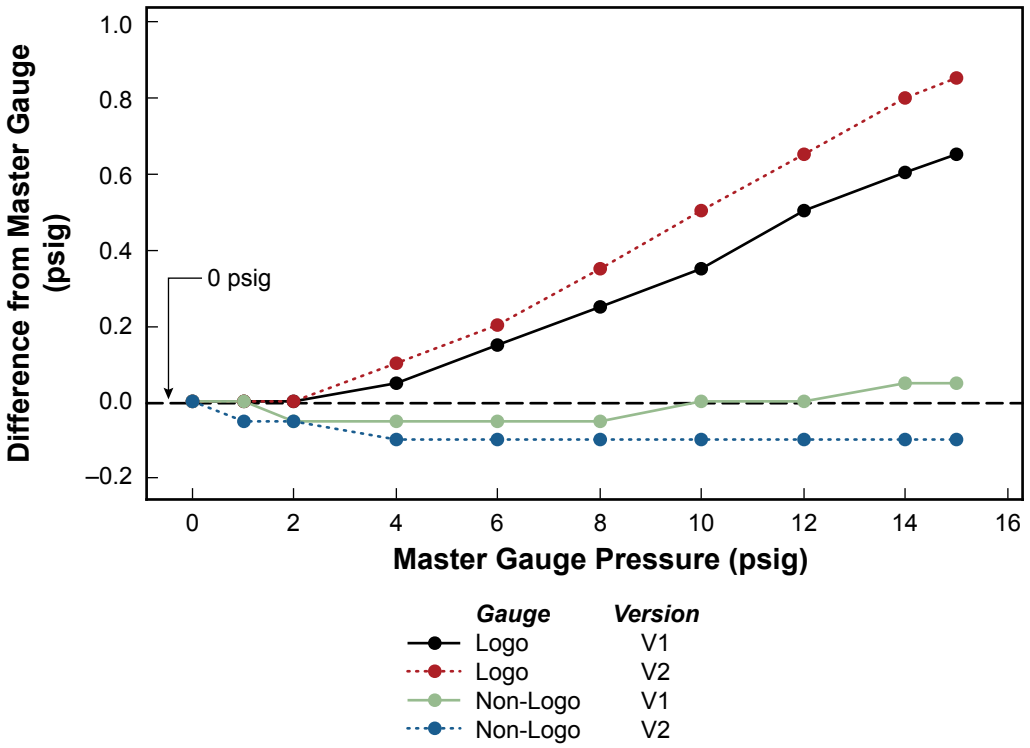

Figure 12. Pressure calibration of Game Day Gauges, showing drift of both gauges between initial test and final tests. ("V1" corresponds to the initial test and "V2" corresponds to the final test.)

As noted, we do not believe that the measurements recorded on Game Day were affected by the long term drift observed towards the end of our investigation. However, to account for these effects and any impact they had on our experiments, and place the experimental results on a common, reproducible scale, calibration formulas were derived for the Logo and Non-Logo Gauges relating their readings to those of the Master Gauge at varying pressure levels. All subsequent calculations made or relied upon in this report were adjusted using the formulas that follow. Simple linear regression analysis of data from an early pressure study produced the calibration equations displayed in Figure 13.[23] These equations can be inverted to obtain the estimated Master Gauge pressure corresponding to readings from either gauge:[24]

$$Master = \frac{Logo + 0.2836\ psi}{1.050} \quad and\ Master = \frac{Non\text{-}Logo + 0.1444\ psi}{1.015}$$

23 The pressure study was conducted on February 27th, 2015.
24 The Master Gauge is a calibrated reference. Converting a pressure measured using one of the Game Day Gauges to its equivalent Master Gauge reading is the best approximation of converting a Game Day Gauge reading to the true pressure the gauge is measuring.

Using these formulas, it is possible to convert the average pressure measurements for each team generated on Game Day into the analogous Master Gauge readings. The specific values of these conversions are discussed later in this report.

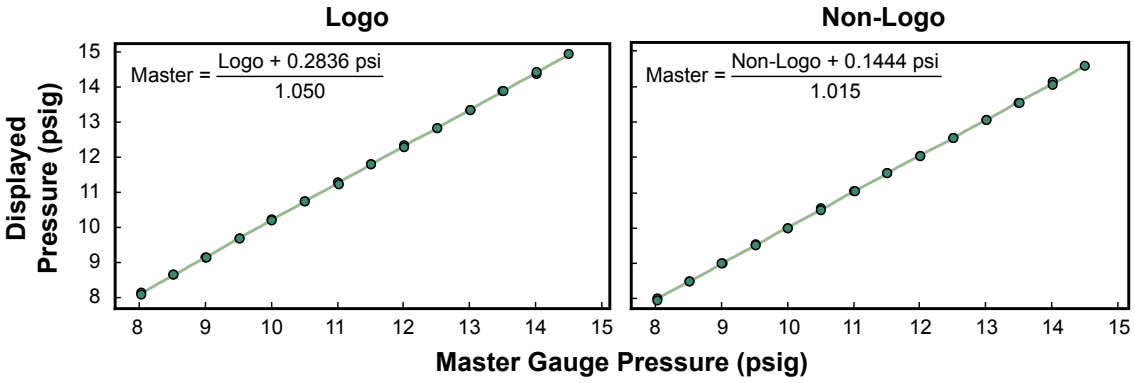

Figure 13. Calibration lines for the Game Day Gauges determined from linear regression analysis of gauge data.

Conclusions

It appears that when used to measure pressures between 10.00 and 14.00 psig (a range that includes the pressures measured on Game Day) the Game Day Gauges read fairly consistently and with good repeatability. Assuming that the gauges stayed at a relatively constant temperature throughout their use period (i.e., within approximately 4°F), the temperature-induced errors were negligible. Also, it is unlikely that the battery on either gauge was below the voltage level required to induce reading and measurement errors, or that the measurements recorded on Game Day were affected by issues relating to the human factors of how the measurements were made.

Based on the experiments and analysis described above, it is also clear that when the Logo and Non-Logo Gauges are exposed to an identical pressure, different readings are produced. Generally speaking, the Logo Gauge reads higher (between 0.35 and 0.75 psig) than the Non-Logo Gauge. However, for a given set of measurements, the errors remain consistent. In other words, in the short term, both gauges (as well as the Exemplar Gauges) will read consistently, though differently from each other. This conclusion, while based on extensive post-game testing of the Game Day Gauges, is consistent with the measurements recorded on Game Day.

The fact that the Logo Gauge reads higher than the Non-Logo Gauge (by ~0.35 psig on Game Day) will take on increased importance in the following section, namely how the pressure inside a football varies with changing environmental conditions.

Introduction and Background

It is well-known that when the temperature of a gas of constant composition and fixed mass inside a pressure vessel of constant volume varies, the pressure of this gas also varies.[25] This pressure-temperature relationship is known as Gay-Lussac's Law, which is a specialized case of the more general Ideal Gas Law. In the matter at hand, the footballs from both teams were initially measured indoors in a relatively warm environment, brought outside to a colder (and periodically wet) environment, and then brought back inside to the warm environment again. Thus, making the assumption of a constant volume football[26] and unchanging gas mixture within the football, it is completely expected that as the temperature of the footballs decreased after they were brought to the field, the pressure inside the footballs also decreased. It is also expected that when the footballs were brought back into the warmer locker room at halftime, both the temperature and the pressure rose again as the footballs warmed up. This phenomenon is easily observed and confirmed experimentally, as shown in Figure 14.[27]

25 *Thermodynamics: An Engineering Approach*, 3rd Edition, 1998.
26 This assumption is later shown to be valid.
27 It should be noted that the data presented in Figure 14 are measured *experimental* data, not calculations based on theory. A more thorough discussion of how these data were generated will be presented later, but is briefly mentioned here to illustrate to the reader the general effect of external temperature variations on the internal pressure of a football.

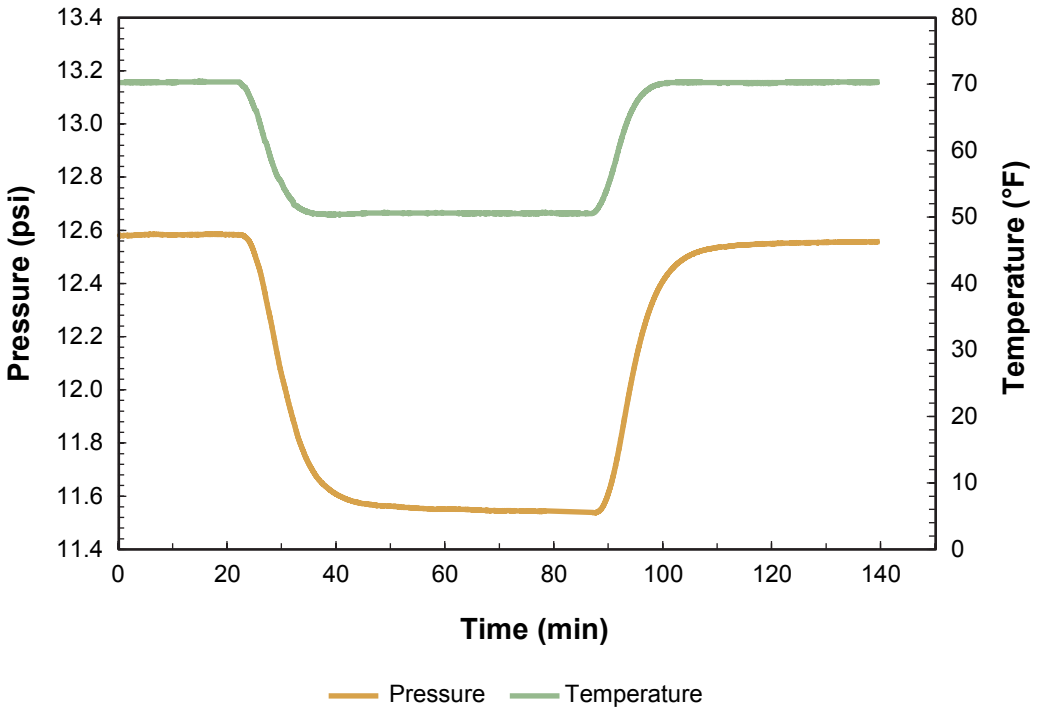

Figure 14. The variation of internal pressure of a football as the external temperature is varied.

However, the main issue in the present situation is not that the pressure inside the Patriots and Colts footballs dropped (which is expected given the temperature transitions); rather, that the Patriots balls exhibited a larger pressure drop when compared to the Colts balls. Therefore, the analyses discussed in this section were conducted to examine the extent to which the various physical, usage, and environmental factors that may have been present on Game Day could potentially explain such a disparity.

Specifically, Exponent investigated the following factors:

Physical and Usage

- The impact of game use on pressure.
- The natural leak rate and permeability of the footballs.
- The impact of vigorous rubbing of the football surface on pressure.
- The impact on pressure of gauging the same football multiple times.
- The impact of the humidity of the air used to fill a football on pressure.
- The variation of volume of the football with respect to pressure.

Environmental

- The effect of external temperature on the pressure inside the football (i.e., temperatures in the Officials Locker Room prior to the game and at halftime, and the temperature on the field during the first half).
- The impact of measurement timing on the recorded pressures (i.e., when and in what sequence the measurements were made during halftime).
- The effect of ball conditions on the pressure (wet vs. dry ball, footballs conditioned by the Patriots vs. the Colts).
- The effect of ambient relative humidity of the room in which the balls were inflated on pressure.
- The dependence of the measured pressure on the gauge used prior to the game (Non-Logo vs. Logo).

Several of these factors will be shown to have minimal to no impact on the internal pressure, whereas others have significant impact. Furthermore, certain environmental factors that have significant impact, such as the halftime temperature, would have affected the Patriots and Colts balls consistently, meaning that they are unlikely contributors to the *difference* in the measured pressure drop between the two teams. Others, such as the timing of when the halftime measurements were made, can potentially vary between the teams. This potential variability between the teams is taken into account in our analyses.

Physical and Usage Factors

Game Use

It is unlikely that each football used during the AFC Championship Game was used the same way or experienced a consistent degree of game action. Accordingly, we analyzed whether a ball that is heavily used in the game experiences a larger pressure drop when compared to one that is not as heavily used. To simulate heavy game use, Exponent subjected a football pressurized within the specifications of the NFL Playing Rules to loading cycles of 650 pounds every 1 second for 1,000 cycles at room temperature. A picture of the football under the maximum load is shown in Figure 15. It was found that the pressure before and after loading was unchanged. This result was the same both for Exemplar Footballs and footballs prepared in the same manner as the Patriots prepared their game balls for the AFC Championship Game.[28] Based on this experiment, it appears that variations in game use do not have an impact on pressure.

28 For this test, Exponent prepared a new football in the same way as we understand the Patriots do prior to games, based on information from Paul, Weiss. We did not use an actual football used during the AFC Championship Game because the test could have potentially damaged the football permanently.

Figure 15. A photograph of the football being subjected to 650 pound cyclic loading. Note the overall deformation of the football.

Natural Leak Rate

The materials that comprise the bladder of the football were analyzed using standard testing methods to obtain their permeability characteristics.[29] The permeability constants of each of the individual layers of the bladder were found to be extremely low. Thus, it can be assumed that the natural leak rate through the materials of the bladder, in the time scales of interest for the matter at hand, is negligible; thus, leaking did not have an impact on the pressure of the footballs used during the AFC Championship Game.

Vigorous Rubbing

According to Paul, Weiss, part of the preparation procedure used by the Patriots for the game balls used during the AFC Championship Game involved rubbing by an individual wearing gloves similar, if not identical, to the type worn by wide receivers. Patriots head coach Bill Belichick suggested during a press conference on January 24th, 2015 that the gloving process impacted the pressure level of Patriots footballs and contributed to the reduction in pressure observed at halftime.

29 The materials were tested in accordance with ASTM D1434 – 82(2009)e1 – Standard Test Method for Determining Gas Permeability Characteristics of Plastic Film and Sheeting.

To evaluate what effects, if any, this procedure has on the pressure inside the ball, Exponent performed a test whereby an individual wearing wide-receiver gloves vigorously rubbed a football for 20 minutes (starting 10 minutes into the test). The pressure and temperature inside the football was continuously monitored. Additionally, an infrared (IR) camera was used to observe the change in exterior temperature of the football throughout the rubbing process. It was found that although the rubbing can cause a rise in the pressure inside the football due to the heating created by the friction from rubbing, the pressure returns to its initial state approximately 30 minutes after the cessation of the rubbing.

The pressure inside the ball subjected to the rubbing is shown in Figure 16. It can be seen that the pressure inside the football rises throughout the rubbing process. (The non-linear nature of the rise in pressure is presumably due to variations in the operator's rubbing throughout the period.) It can be seen that the maximum rise in pressure was approximately 0.7 psig, which occurred at the end of the rubbing process (t = 30 minutes on the plot below). An IR image of the football taken just prior to the cessation of rubbing is shown in Figure 17, along with the corresponding IR image taken 15 minutes later.

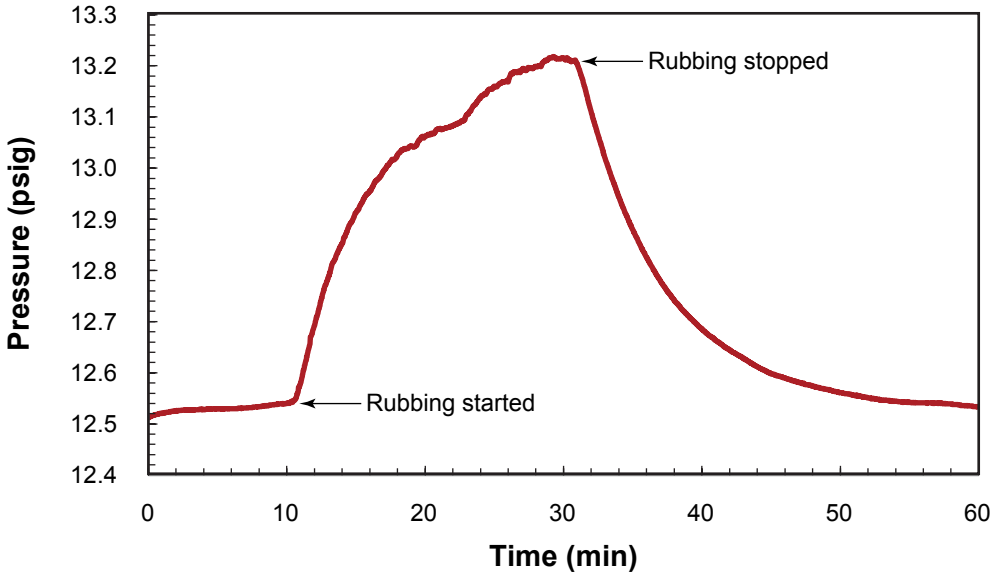

Figure 16. The pressure as a function of time while a football is being vigorously rubbed.

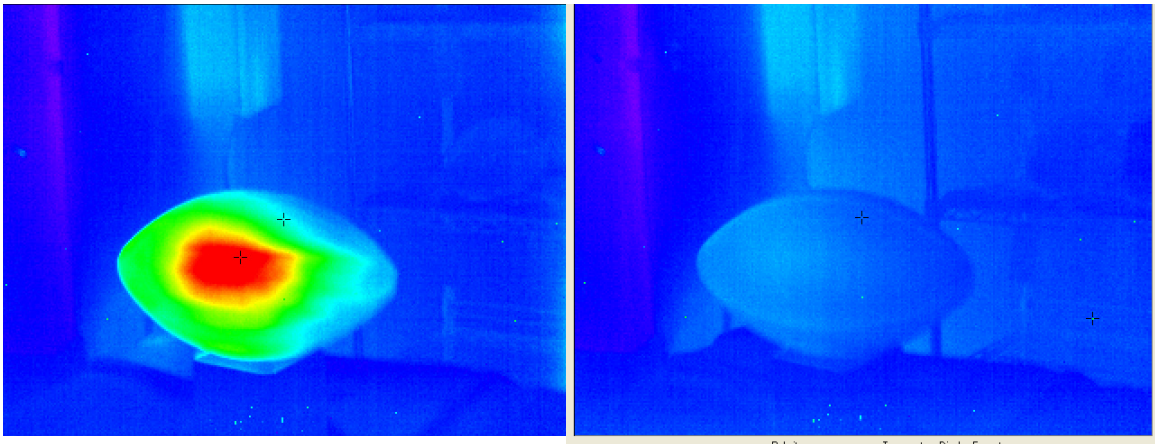

Figure 17. Infrared (IR) camera images of the exterior of the football at the end of rubbing (left) and 15 minutes after rubbing stopped (right).

As can be seen in the above two figures, although the pressure does indeed rise due to the rubbing, it comes back to its original, "pre-rub" pressure level in 15 to 30 minutes. Therefore, a "rubbed" football would generate an artificially high pressure reading only within the 15–30 minute window directly after the cessation of the rubbing. According to information provided by Paul, Weiss, the Patriots game balls were rubbed on the morning of the AFC Championship Game and all of the rubbing was complete more than 30 minutes before the footballs were inspected by the game officials. As a result, the pressures measured pre-game cannot be considered artificially high as a result of rubbing, and the vigorous rubbing described by Patriots personnel does not appear to have had an impact on the pressures measured in the Patriots footballs either prior to the game or at halftime.[30]

Multiple Gaugings

When the pressure of a football is measured using a needle style gauge, a small amount of air from inside the football enters the needle and the valve stem. This air, along with any air that escapes between the needle and the football gland as it is inserted or withdrawn is lost during each pressure measurement that is made. As described below, if the number of needle insertions for a given football is fewer than five, no discernible difference in the recorded pressure would be observed.

Exponent performed a test to characterize this leakage in terms of pressure lost within the football during the repeated insertion of a needle style gauge. Using the Non-Logo Gauge as the gauge/needle combination of interest, an Exemplar Football was inflated to a starting reading of 13.00 psig on the gauge. The needle was then inserted and removed multiple times, with the observed pressure reading noted on every fifth insertion cycle. This was repeated for a total of 50 cycles.

30 As part of its work, Exponent considered other elements of the football preparation process used by both the Patriots and the Colts, including the potential impact of those processes on the pressure level of a given football. Although it does not appear that any part of the preparation process (other than rubbing, which has a temporary effect only) used by either team significantly affects air pressure levels or a football's response to temperature changes, to control for any impact (however small), we used footballs prepared by the Patriots and Colts for the remainder of our experiments, unless otherwise noted.

The results from this experiment are presented in Table 9. No damage to the sealing capability of the gland was detected, even though the needle was not lubricated and the needle was inserted quickly.[31]

Table 9. The effect of multiple needle insertions on the pressure reading.

Insertion Count	Pressure Recorded by Gauge (psig)
1	13.00
6	12.95
11	12.90
16	12.85
21	12.80
26	12.75
31	12.70
36	12.65
41	12.60
46	12.55
51	12.50

From the table above, it can be seen that taking repeated measurements with the Non-Logo Gauge causes a football to lose approximately 0.01 psig per measurement (or one reading increment of 0.05 psig every five measurements).

Based on information provided by Paul, Weiss, we understand that each of the Patriots and Colts footballs tested on game day was most likely tested three times by the game officials by the end of halftime (once pre-game and twice at halftime). This number of tests would not have materially impacted the pressures measured. Furthermore, if each ball tested at halftime was subjected to the same number of tests, any impact on air pressure would be consistent. Thus, it does not appear that the impact of multiple gauging actions is likely to have contributed to the *difference* in pressure drop between the two teams.

Humidity of Air Used to Fill the Football

Although all of the footballs used during the AFC Championship Game were manufactured and thus initially inflated by Wilson Sporting Goods, it is possible that the relative humidity of the rooms in which the footballs were filled or subsequently reinflated may have been different between the two teams. In order to evaluate what impact, if any, the ambient relative humidity has on the magnitude of the pressure decrease that accompanies a drop in environmental temperature,

31 This conclusion applies consistently to all of the tests conducted during the course of our work, during which Exponent tested dozens of footballs and took thousands of pressure readings. When the gauges are used correctly, neither the needle lubrication (or lack thereof) nor the speed or care with which measurements are taken affects the readings or damages the football in any way. In other words, none of the footballs examined "sprung a leak" or otherwise lost pressure, other than as described in this section, due to the condition of the needle or the forcefulness of the gauging.

Exponent performed an experiment whereby footballs were filled in rooms of different humidity and then subjected to the same temperature transitions. It was found that for the range of temperatures, fill pressure, and humidity of the filling room tested, the relative humidity difference had a negligible effect on the magnitude of the pressure drop.

Three footballs were initially fully deflated and then each separately inflated in environmental chambers where the relative humidity (RH) was controlled to 20%, 60%, and 80%, respectively. This process was then repeated twice more (deflation followed by inflation in a controlled humidity environment) to account for any small amount of air that might have remained during the deflation process. The footballs were inflated to a starting pressure of 13.00 psig and allowed to sit in a chamber at 70°F for approximately 20 minutes. The temperature in the chamber was then rapidly decreased to 48°F, and the footballs were held at this temperature for 1 hour. The pressure inside the footballs was continuously recorded throughout the entire test. It was found that at the end of 1 hour, all three footballs were at pressures within 0.02 psig of one another—i.e., the difference was below the reading resolution of the Game Day Gauges.

Thus, variations in relative humidity of the rooms in which each respective team inflated their footballs do not appear to have a significant impact on pressure and are unlikely to have had an impact on the pressure measurements recorded at halftime on Game Day.

Football Volume Changes

One of the main assumptions of Gay-Lussac's Law (which is discussed in the following section) is that the volume of the gas under consideration is fixed, which is equivalent to the gas being contained in a "rigid" pressure vessel.[32] Since the gas under consideration in an NFL football is constrained by the bladder and the skin of the football, if the volume of the football changes, then: (1) the pressure inside will commensurately change; (2) Gay-Lussac's Law no longer applies; and (3) the more general Ideal Gas Law must be used in order to account for this change. In order to determine if the football bladder and skin can be considered a "rigid" pressure vessel of fixed volume, Exponent directly measured the volume of the football as a function of pressure over a range of pressures.

High-resolution laser scans of footballs, including footballs prepared by the Patriots and the Colts, at various pressures (from 10.50 to 13.50 psig) and at various moisture conditions were performed. Each scan produced a digital 3-dimensional model, an example of which is seen in Figure 18, which was subsequently analyzed with computer-aided-drafting (CAD) software. Using this methodology, it was found that within the ranges tested, the volume remained constant to within the accuracy of our measurement technique regardless of pressure, level of wetness or dryness of the football, and the teams' individual "preparation" of the football leather skin. Thus, in the pressure range of the present investigation, the football can be approximated as a fixed-volume container.[33]

32 *General Chemistry,* J. Hill and R. Petrucci, 2nd Edition, 1999.

33 In a related experiment, Exponent removed the bladder from the football and inflated it such that it was unconstrained by the leather skin. It was found that even at relatively low pressures (~4.0 psig) the volume of the bladder was much greater than that of the fully assembled football. Therefore, it can be assumed that when the bladder is inside the leather skin, it is fully constrained by the leather and the volume of the leather container determines the volume of internal air.

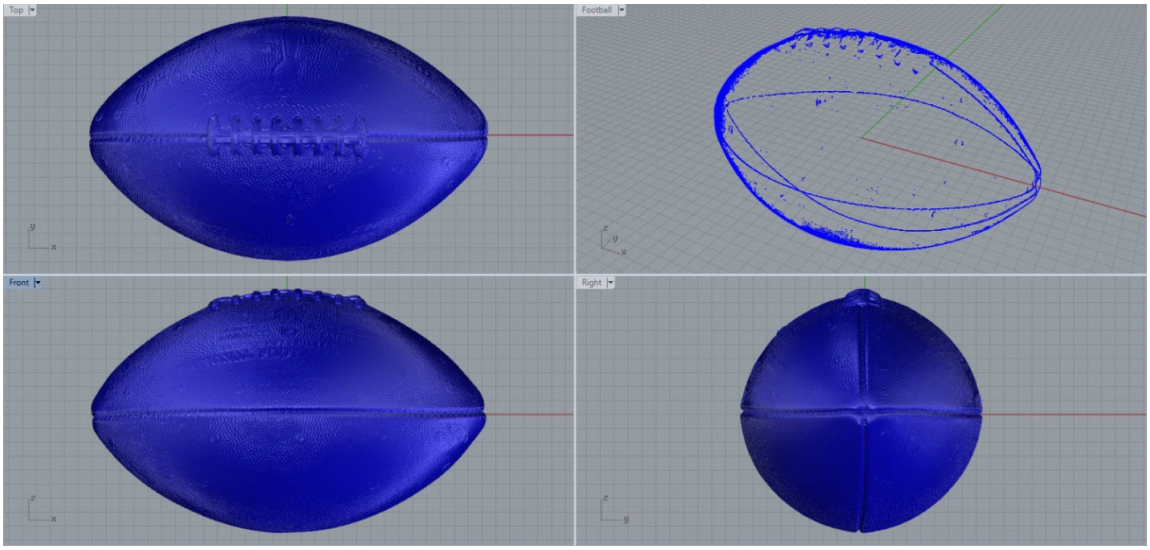

Figure 18. Screen capture images of the digital 3-dimensional model of the football, which was obtained by high-resolution laser scans and used to calculate the volume of the football.

Conclusions

Based on the above, we conclude that game use, short-term natural leak rate, the relative humidity of the air used to fill the football, and variation of pressure due to volume change have a negligible role in varying the pressure inside of a football. Although variables such as vigorous rubbing and multiple gaugings were shown to have a measurable effect on pressure, based on information provided by Paul, Weiss, they did not impact the measurements recorded on Game Day. Thus, all of these factors have been excluded as potential variables in the subsequent analyses and tests.[34]

Transient Measurement Tests

Ideal Gas Law

The Ideal Gas Law predicts, among other things, the change in pressure that is caused by a change in temperature. The ideal gas law in its most common form is:

$$PV = nRT$$

where P is the absolute pressure, V is the volume, n is the number of moles of the gas (i.e., a measure of the number of gas molecules in the volume), R is the ideal gas constant, and T is absolute temperature.

34 We also note that none of these tests appeared to permanently affect the fundamental structural integrity of the footballs tested. The footballs did not begin to leak air or lose pressure as a result of the tests. Nor did the footballs appear to become any more or less susceptible to the environmentally-induced pressure changes discussed later in this report.

If one considers that the number of moles of gas is constant (i.e., gas is not leaking from the football and the composition of gas is not changing within the football), then the Ideal Gas Law can be used to derive what is known as the combined gas law:

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$$

where the variables are the same as listed above, and the subscripts 1 and 2 denote initial and final conditions of the gas, respectively. Furthermore, if the volume of the football is also constant, as we have shown, then the combined gas law reduces to the previously mentioned Gay-Lussac's Law:

$$\frac{P_1}{T_1} = \frac{P_2}{T_2}$$

Based on the above equation, it can readily be seen that if a constant-volume pressure vessel (e.g., a football) is initially at a relatively higher temperature at a given pressure and then cooled to a lower temperature, there will be an associated pressure drop. The magnitude of the temperature drop is directly proportional to the magnitude of the pressure drop. The data in Table 10 were generated using Gay-Lussac's Law. The final equilibrium temperature of 48°F was chosen because this represents the approximate field temperature at the conclusion of the first half.

Table 10. The pressure drop associated with a change in temperature as calculated by Gay-Lussac's Law.

Initial Equilibrium Temperature (°F)	Initial Pressure (psig)	Final Equilibrium Temperature (°F)	Final Pressure (psig)	Pressure Drop (Initial – Final) (psi)
60	12.50	48	11.87	0.63
65	12.50	48	11.62	0.88
70	12.50	48	11.37	1.13
75	12.50	48	11.13	1.37
80	12.50	48	10.89	1.61
60	13.00	48	12.36	0.64
65	13.00	48	12.10	0.90
70	13.00	48	11.85	1.15
75	13.00	48	11.60	1.40
80	13.00	48	11.36	1.64

In this table, one can see the effect that varying the initial equilibrium temperature at which a starting pressure is recorded has on the final pressure reached after a football is subjected to a temperature change and is allowed to come to a new equilibrium. In other words, using the Ideal Gas Law, or variations thereof, different calculations can be generated on the basis of different assumptions about the starting pressure, and starting and ending temperatures of a football.

For example, using the most likely pressure and temperature values for the Patriots game balls on the day of the AFC Championship Game (i.e., a starting pressure of 12.5 psig, a starting temperature of between 67 and 71°F and a final temperature of 48°F prior to the balls being taken back into the Officials Locker Room), these equations predict that the Patriots balls should have measured between 11.52 and 11.32 psig at the end of the first half, just before they were brought back into the Officials Locker Room. Most of the individual Patriots measurements recorded at halftime, however, were lower than the range predicted by the Ideal Gas Law. Once the game day measurements are converted into their corresponding Master Gauge pressures (in order to provide for a direct comparison with the results predicted by the calculations), the measurements for all but three of the footballs, as measured by both gauges, were lower than the range predicted by the Ideal Gas Law.[35]

While measurements above the predicted levels can be accounted for by basic thermodynamics (because the halftime measurements were taken inside the Officials Locker Room at a temperature above the 48°F equilibrium temperature used for the calculations, and the pressure of each ball would have risen as the balls warmed up), those below the predicted levels cannot be explained by application of the Ideal Gas Law (assuming equilibrium conditions) alone. Accordingly, based on information regarding actual game day conditions, the application of the Ideal Gas Law cannot account entirely for the pressure drops observed in the Patriots halftime measurements.

In addition, the equations listed above are applicable only to the gas conditions inside the football. Given that the footballs are undergoing temperature *transitions* as they are taken from the relatively warm locker room to the colder field and back into the warm locker room, it takes some time for the internal gas temperature within the football to reach equilibrium with the environment in which the football is sitting. It is important, therefore, to understand not only the magnitude of the temperature/pressure changes once the football comes to equilibrium with its environment, but also the *amount of time* it takes for temperature inside the football to reach equilibrium.

Transient Analysis

To measure the internal transient pressure and temperature changes of a football while being transferred between environments of varying temperatures, Exponent fabricated test equipment that allowed for continuous monitoring and recording of the pressure and temperature *inside* the football. A precision fine wire thermocouple (36 gage K-type thermocouple, Omega Part No. 5TC-TT-K-36-72) was inserted into a modified inflating pin. The pin was attached to a section of plastic tubing that was connected to the Master Gauge. The modified pin and the plastic tubing are shown in Figure 19 and a photograph of the pin inserted into the football is shown in Figure 20. Extensive leak testing was performed to ensure that no air was lost from the football while the pin was inserted. The internal pressure and temperature data were digitally recorded continuously in 1 second intervals. Concurrently, ambient temperature and relative humidity conditions were also monitored.

35 In contrast, if one were to use the most likely pressure and temperature values for the Colts game balls on the day of the AFC Championship Game (i.e., a starting pressure of 13.0 psig, a starting temperature of between 67 and 71°F and a final temperature of 48°F), the Ideal Gas Law predicts that the Colts balls should have measured between 12.00 and 11.80 psig at the end of the first half, just before they were brought back into the Officials Locker Room. All of the Colts measurements recorded at halftime were above this range, once converted into a corresponding Master Gauge pressure, and therefore can be explained by the applicable scientific principles.

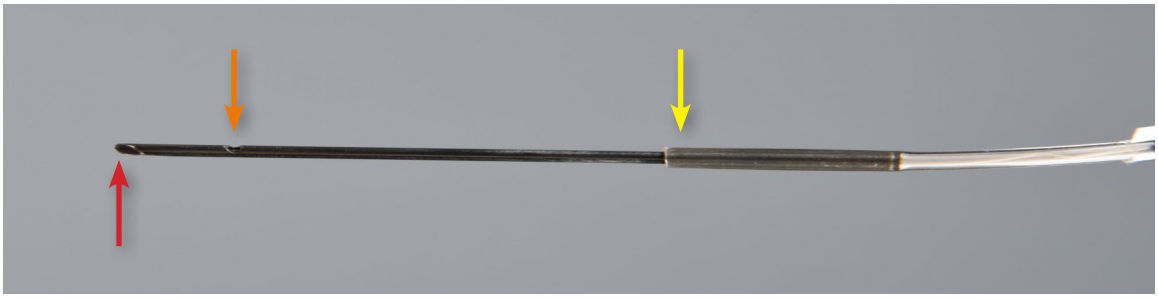

Figure 19. Image of the modified inflation needle with the thermocouple inserted (the tip of the thermocouple is at the red arrow). The air inlet (orange arrow) and the plastic tubing (yellow arrow) are also indicated. The pin was connected to the Master Gauge via plastic tubing to allow for continuous pressure and temperature measurements inside the football.

Figure 20. Photograph of the inflation needle inserted into a football. The needle remained inside the football through the transient data capture process.

Before detailed analyses of the various potential Game Day scenarios can be discussed, a general example of the pressure change vs. temperature phenomenon captured by the above apparatus is presented in order to familiarize the reader with the overall method and to conceptually frame the subsequent results.

The transient pressure and temperature gauge described above was used to generate the data shown in the plot shown in Figure 21. The Master Gauge was used to set the pressure of two footballs at 12.50 psig, representing the reported pre-game pressure for the Patriots footballs, and to set the pressure of two other footballs at 13.00 psig, representing the reported pre-game pressure for the Colts footballs. From each team's set of two footballs, one ball remained dry whereas the other was wet.[36] The footballs were allowed to sit at a temperature of 69°F for 2 hours to approximate the conditions in the shower area of the Officials Locker Room. They were then exposed to temperatures of 50°F for 1.5 hours, followed by 30 minutes at 48°F, all while at approximately 75% relative humidity. These changes were meant to approximate the conditions the footballs were exposed to on the field during the first half. They were then exposed to a temperature of 72–73°F and approximately 20% relative humidity (which represents an approximation of the temperature and relative humidity in the Officials Locker Room at halftime) for 2 hours.

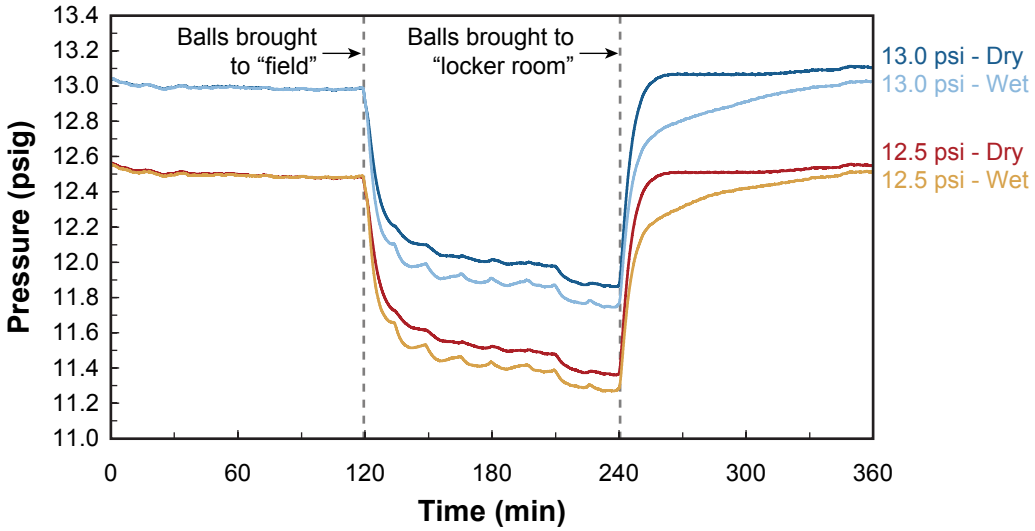

Figure 21. The transient curves of four footballs showing the pressure as a function of time for the Game Day scenario.

36 For these and subsequent experiments a "wet" football was one in which a hand held spray bottle was used to spray a football with water every 15 minutes during the period simulating the first half of game play. The spray bottle with its contents was kept at the same environmental conditions as the footballs undergoing spraying. Each time the footballs were sprayed they were toweled off.

The plot in Figure 21 is qualitatively similar to that in Figure 14. When the footballs are sitting inside the Officials Locker Room prior to the game, the temperature and thus the pressure of the footballs, remains relatively constant. When the footballs are moved to the colder field condition, the pressure drops commensurately. It can be seen that when the field temperature is dropped even further to simulate the conditions during the last 30 minutes of the first half, the pressure decreases further. When the balls are removed from the field and brought back into the warm locker room, the pressure gradually rises towards its initial state.

Several important points must be made about the above plots. The first is that the pressure inside the balls quickly drops as they are initially exposed to the colder temperature and stabilizes as they gradually approach equilibrium at the end of 2 hours. Second, the change in pressure inside the balls when brought back into the locker room from the field is strongly dependent on time. Specifically, the pressure in a football measured immediately after coming into the locker room will be significantly lower as compared to the pressure measured in the same football once it has sat (and warmed up) in the locker room for several minutes. The reason for this is straightforward: the internal temperature of the football, and thus the pressure, does not change instantaneously, but gradually as its temperature equilibrates with the environment. This gradual change is well-understood and predicted by basic thermodynamic principles.[37]

It is also observed that there is a noticeable difference between the pressures in footballs that are wet compared to footballs that are dry. During the experiment, wet footballs are seen to have lower minimum pressures and also appear to have more sluggish response time when brought back into the locker room.

That there is a strong time dependence of the pressure inside the footballs upon return to the simulated locker room is of significant impact in the present investigation. It suggests the possibility that the lower pressures observed in the measurements of the Patriots footballs recorded at halftime could simply be due to the Patriots footballs being measured first, and that the higher pressures seen in the Colts footballs could be a result of being measured at a later time. Therefore, the main focus of the transient experiments was to determine if variation in measurement timing was sufficient to explain the variation in the observed differences in the average pressure drops between the teams, given the ranges of likely environmental factors present on Game Day and the realistic timing of measurements given the sequencing and duration of the various events known to have occurred at halftime. For the reasons described below and based on our experiments, the timing of the measurements taken during halftime of the AFC Championship Game does not on its own completely account for the difference in the observed average pressure drops between the two teams.

It is noted that the pressure-temperature-time relation during the periods when the footballs were kept in the Officials Locker Room prior to the game and on the field during the first half is of lesser importance than that at halftime because these were significantly longer periods than the Locker Room Period and can reasonably be expected to have been long enough for the footballs to come into equilibrium with their environment. Therefore, we primarily focus on the portion of the transient curves associated with the period when the footballs came off of the field and were brought back into the locker room. This section of the curve from the overall plot of Figure 21 is shown in Figure 22.

37 *Fundamentals of Heat and Mass Transfer*, F. Incropera and D. Dewitt, 5th Edition, 2002.

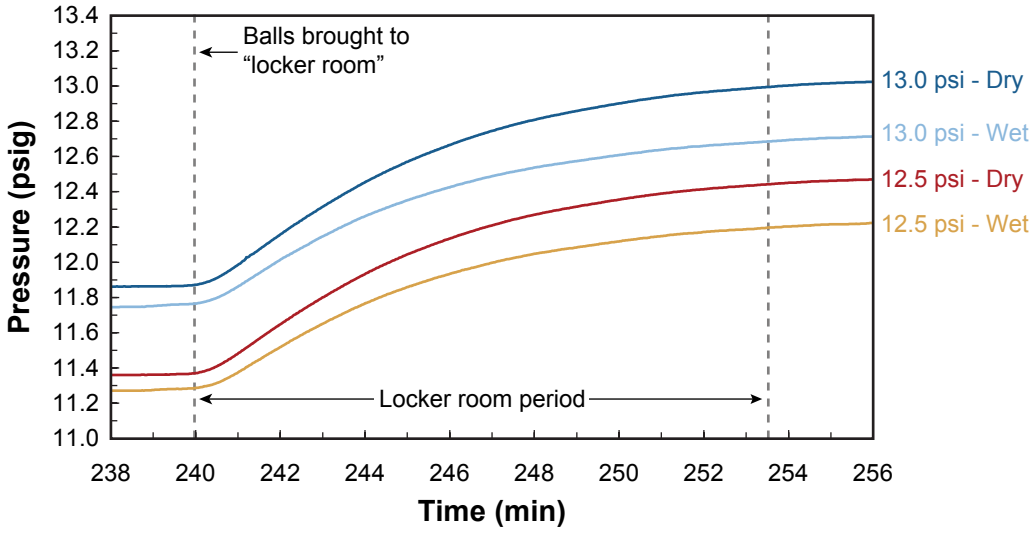

Figure 22. The "Locker Room" portion of the transient curves (first shown in Figure 21).

Pre-Game Gauge: Logo vs. Non-Logo

According to information provided by Paul, Weiss, some uncertainty remains as to which gauge was used by Walt Anderson during his pre-game check of the footballs. As was shown earlier, the Logo Gauge typically read ~0.3–0.4 psig higher than the Non-Logo Gauge on Game Day, according to the data recorded at halftime. It was shown by our experiments that the Non-Logo Gauge was relatively accurate in an absolute sense when compared after the fact against the known calibration of the Master Gauge.

Despite the remaining uncertainty, logical inferences can be made according to the data collected to establish the likelihood of which gauge was used.

According to information provided by Paul, Weiss, personnel from both the Patriots and the Colts recall gauging the footballs for their teams to pressures at or near 12.5 psig and 13.0 psig, respectively, prior to providing the balls to Walt Anderson. Each team used its own gauge to adjust the final pressures before presenting the balls to the referee, who used *a gauge different from either used by the two teams* to measure the pressure in the footballs. Walt Anderson recalled that according to the gauge he used (which is either the Logo or Non-Logo Gauge), all of the Patriots and Colts footballs measured at or near 12.5 psig and 13.0 psig, respectively, when he first tested them (with two Patriots balls slightly below 12.5 psig). This means that the gauges used by the Patriots and the Colts each read similarly to the gauge used by Walt Anderson during his pre-game inspection.

It has been shown that the Logo Gauge consistently reads higher than all other gauges analyzed in this investigation. As a result, it is very unlikely that the Logo Gauge would have read similarly to the gauges used by each team. Therefore, it is most likely that the gauge used by Walt Anderson prior to the game was the Non-Logo Gauge, which read similarly to the Master Gauge and other gauges tested during the investigation.

As discussed below, if the Non-Logo Gauge was used to measure the balls pre-game, we have not identified a set of environmental factors that completely accounts for the Patriots measurements recorded at halftime given the timing and sequencing of the halftime measurements most likely to have occurred on Game Day; the Patriots measurements from halftime are all lower than expected, based on our experimental testing.

Master Gauge vs. Logo and Non-Logo Gauges

Whereas the footballs were gauged at their starting pressures using either the Logo or Non-Logo Gauge, it is important to note that the transient curves in the above discussion were generated using the calibrated Master Gauge. Since the purpose of these experiments is to compare the pressures recorded during Exponent's testing to the pressures recorded on Game Day, it is desirable to use a common frame of reference among all measurements. In other words, to guarantee an "apples-to-apples" analysis, it was necessary to determine what the averages recorded on Game Day (generated by the Logo and Non-Logo Gauges) correspond to on the Master Gauge. Or, put another way, if the Logo/Non-Logo Gauges were used to measure the pressure inside a football, what would the Master Gauge read when measuring the same football?

In order to generate a conversion from Game Day Gauge readings to Master Gauge readings (and vice versa), the data discussed in the Gauge Analysis section of this report was utilized. Using the fit curves discussed in the Long Term Repeatability section of this report, the Logo and Non-Logo Game Day averages of the Patriots and Colts footballs were converted into Master Gauge readings. These converted readings are summarized in Table 11.

Table 11. Logo and Non-Logo Game Day averages and their corresponding Master Gauge values (all values are listed in psi).

	Patriots	Converted Master Gauge Pressure	Colts	Converted Master Gauge Pressure
Logo Gauge Average	11.49	11.21	12.74	12.40
Non-Logo Gauge Average	11.11	11.09	12.33	12.29

Using these values, it is now possible to compare the experimental transient data with the averages observed on Game Day.

Comparing Transient Data with Converted Game Day Averages

The entire aim of the transient experiments is to identify how the pressure inside the football varies with time and thus expose the underlying governing physics behind the pressure vs. time relationship of warming footballs. The transient curves outlined in the following section reflect the best prediction and simulation of the actual pressure path experienced by the footballs on Game Day. This is accomplished via control over the environmental factors that directly affect this pressure path, namely the pre-game temperature, the field temperature, the halftime locker room temperature/relative humidity, and the condition (wet vs. dry) of the footballs.

With this method we can determine the range of pressures at specific times that are theoretically possible to have been reached on Game Day within the constraints that are known about the various environmental factors.[38] Specifically, with such transient curves we can determine the range of potential pressures that could have been observed based on natural causes during the Locker Room Period.[39] A direct comparison can then be made between the transient curves generated in the laboratory and the recorded halftime data from Game Day. In terms of the scientific method, it allows us to compare "predicted" results with actual "field" results.

Whereas it is unknown exactly when in the Locker Room Period each measurement was made (or, therefore the time impact on the corresponding average of the measurements), it *is* known that the measurements *must* have occurred within the 13.5 minute window of the Locker Room Period. If the experimental transient pressure measurements are equal to the Game Day averages at some time within the Locker Room Period window, then the Game Day results can be explained by the transient physics. If, however, there is no point during the Locker Room Period in which the transient measurements equal the Game Day average(s), i.e., the "predicted" results never match the "field" results during the 13.5 minute Locker Room Period, then the measurements taken during halftime of the AFC Championship Game cannot be explained by environmental and timing factors alone.

Graphically speaking, if the Game Day results can be explained by the governing physics, then the transient curve will intersect the horizontal line representing the relevant Game Day average at some point between 0 and 13.5 minutes. If the Game Day results are not explained by the physics, the transient curve will NOT intersect the Game Day average within the allotted time window. These scenarios are schematically depicted in Figure 23 in which Game Day Average A is a scenario in which the average does intersect the transient curve and is explained by the governing physics, and in which Game Day Average B is a scenario in which the average does not intersect the transient curve and is thus not explained by the governing physics.

38 "Theoretically" in this sense is meant to convey that while these results were experimentally produced in the present investigation, they can be viewed as what theory would predict.

39 The phrase "Locker Room Period" will be used to mean the period of time that the balls were inside the Officials Locker Room during halftime, which we understand was approximately 13.5 minutes.

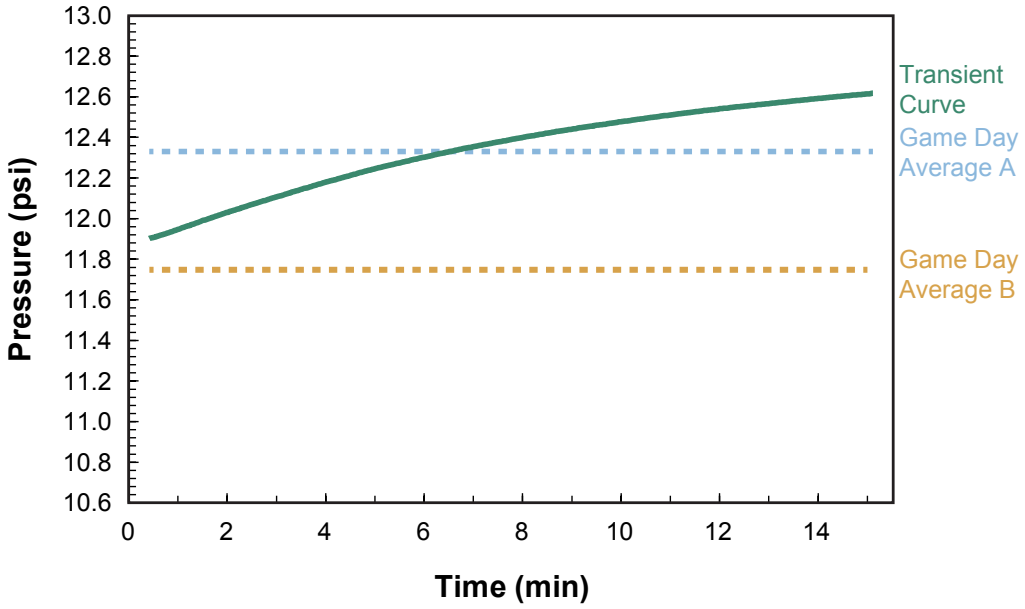

Figure 23. A generic pressure transient curve showing intersection with Game Day Average A, and no intersection with Game Day Average B.

Because it is not possible to reasonably test all permutations of variables, we note that our testing matrix does not cover *every* possible combination of environmental factors. However, reasonable parameters for the relevant variables were set based on information provided by Paul, Weiss. These parameters represent the most reasonable and realistic set of environmental factors that could have been present on Game Day, and parameters outside of this range were deemed unlikely or unrealistic by Paul, Weiss. Accordingly, experiments were conducted within those parameters.

The balls used for these transient analyses were balls actually prepared by the Patriots and Colts organizations and supplied to Exponent by Paul, Weiss. In the case of the Colts, the footballs used in Exponent's analyses were balls used by the Colts during the AFC Championship Game. The Patriots footballs provided to Exponent all had Walt Anderson's mark, which indicates that they were prepared for and or used either during the AFC Championship Game or another NFL game.

Transient Measurements of the Game Day Scenarios

Having mapped generic transient curves for footballs, we then sought to generate similar curves under conditions approximating the environmental conditions present on Game Day. For the purpose of the experiments, Paul, Weiss informed Exponent that there was no plausible basis to believe that there had been tampering by the Colts; therefore, the tests outlined below use the Colts balls as a "control" group when evaluating and setting test parameters. In other words, because we could reasonably assume that the Colts measurements collected at halftime on Game Day were the result only of natural causes, each environmental factor was set for the purpose of our experiments at a level (within the realistic ranges provided by Paul, Weiss) that resulted in measurements for the Colts balls that matched the Game Day measurements. Aligning our experiment in such a way confirmed that the test conditions selected were a good approximation of the environmental factors

on the day of the AFC Championship Game. In effect, by setting the Colts balls as the control group and selecting a range of environmental factors in which the transient measurements for the Colts balls intersect the Colts halftime measurements, we are able to concurrently assess what the Patriots measurements would be under the same conditions. We can then assess the physical plausibility of the Patriots measurements recorded on Game Day.

Assuming that the temperature profile of the game is fixed (according to weather data collected from Gillette Stadium[40]), the other material environmental factors that can be adjusted are: pre-game temperature, halftime locker room temperature/relative humidity, and the condition of the balls (wet vs. dry). These were adjusted within the allowed parameters such that the transient measurements for the Colts intersect the Game Day averages.

The potential parameter space, and the basis for these values, is as follows.

1. Pre-game temperature (67–71°F): when tested prior to the game, the balls were laid out on the floor of the shower area that is adjacent to the dressing area of the Officials Locker Room. Measurements taken by Exponent on February 7th, 2015 in the shower area ranged between 67°F and 71°F. The shower area is neither actively heated nor cooled and is typically colder than the dressing area of the Officials Locker Room (which is constrained between 71°F and 74°F by the building HVAC).

2. Halftime locker room temperature (71–74°F): based on information provided by Paul, Weiss, the thermostat in the dressing area of the Officials Locker Room where the halftime testing occurred can only be set in the range of 71–74°F. If the temperature inside the room falls out of this range, the HVAC system is automatically activated to bring the temperature back within the range.

3. Ball condition (wet and dry): according to information by Paul, Weiss, the ballboys from each team left several balls (up to four) in their respective ball bags during the first half. Ostensibly, these footballs remained dry. Although rain was observed in the first half, information provided by Paul, Weiss indicates that the ballboys kept the balls relatively dry. Clete Blakeman recalled that though some, but not all, of the balls were moist at halftime; none were waterlogged.

A set of experiments was performed in which the Non-Logo Gauge was used pre-game to measure the balls and another set was performed in which the Logo Gauge was used pre-game.

Using the Non-Logo Gauge Pre-Game

The Non-Logo Gauge was used to adjust two balls to 12.50 psig, representing the reported pre-game pressure of the Patriots balls, and two balls to 13.00 psig, representing the reported pre-game pressure of the Colts balls. From each set, one ball remained dry and the other was wet. These conditions are summarized in Table 12. The game temperature and halftime temperature remained the same for both the Non-Logo and Logo Gauge scenarios.

40 These data were recorded by the weather station located on top of the southern scoreboard at Gillette Stadium and were provided to Exponent by Paul, Weiss.

Table 12. Summary of conditions used for transient experiments (all initial pressures were adjusted using the Non-Logo Gauge).

Team	Non-Logo Gauge Reading Pre-Game (psi)	Ball Condition During Game
Patriots	12.5	Dry
	12.5	Wet
Colts	13.0	Dry
	13.0	Wet

For these experiments, the pre-game temperature was set at 71°F, representing the temperature at which the initial gauging was done in the locker room, the game temperature was set to 48°F (halfway between the 49°F measured at 8:00 pm and the 47°F measured at 9:00 pm, and the halftime locker room temperature was set between 72°F and 73°F (i.e., the midpoint of the HVAC setting). These conditions were picked in the following order of importance (each subsequent condition was subject to the preceding condition(s)):

1. They were within the potential parameter space provided by Paul, Weiss at their most likely or known values.
2. Within the constraints of the above item, they were further refined such that they resulted in the Colts balls reaching the values observed on Game Day within the 13.5 minute Locker Room Period.
3. Within the constraints of the above two items, there was to be sufficient time left after measuring the Colts balls to accommodate reinflating the Patriots balls.
4. Within the constraints of the above three items, the parameters were further adjusted such that they were most likely to lead to pressure readings for the Patriots balls that matched the average measurements from Game Day. For example, the pre-game temperature was set at 71°F to maximize the window for the Patriots footballs to reach the average pressured recorded at halftime on Game Day.

The transient curve of each ball tested in this scenario is shown in Figure 24.[41] It can be seen that: (1) the pressures in all of the footballs are lower than their respective initial pre-game pressures (an expected result of exposing the footballs to the cold "field" temperature); (2) both Colts balls show higher pressures than both Patriots balls (because they were initially set at a higher pressure); and (3) the wet ball for each respective team exhibits lower pressures when compared to the dry ball of the same team.

41 In all of the transient plots for the remainder of the report, the pressure on the y-axis is the pressure recorded by the Master Gauge.

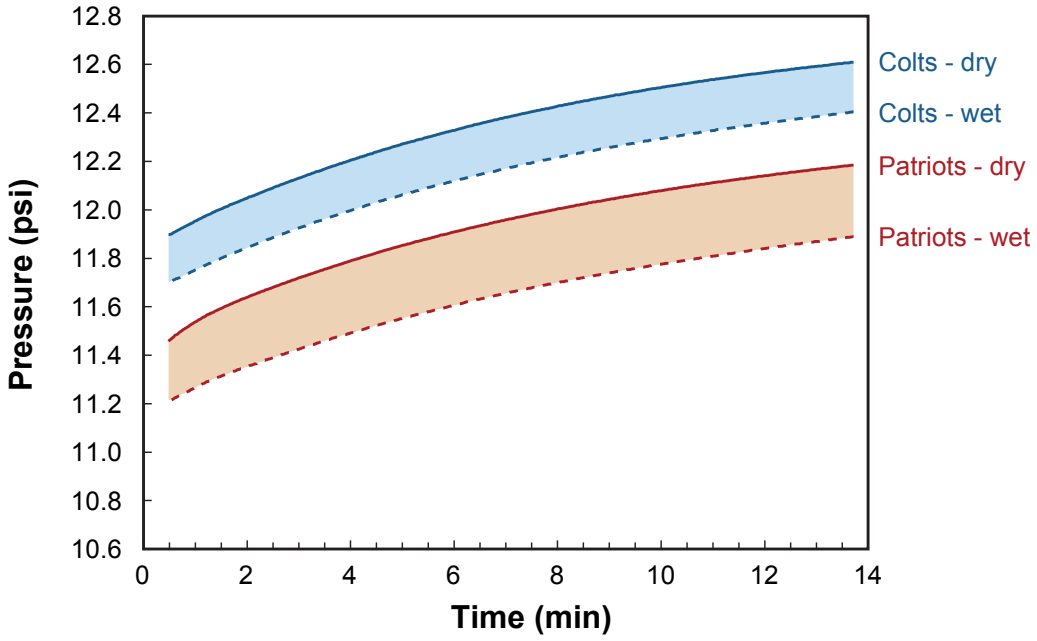

Figure 24. Transient pressure curves for the scenario in which the footballs were set using the Non-Logo Gauge.

A noteworthy feature of Figure 24 is that the two curves for each team represent the outer boundaries of what is physically plausible (as a function of time) given the specific set of environmental factors listed above. The respective shaded area between the two curves represents the region of potential measurements that can be explained by the environmental conditions tested in our experiments. (For instance, if a ball is damp rather than wet or dry, it would be expected to fall within the shaded region and away from the boundaries defined by the "dry" and "wet" curves.) We can further refine this construct by overlaying a representation of the average pressures observed on Game Day for each team, as measured by the Non-Logo Gauge. The result of this is shown in Figure 25.

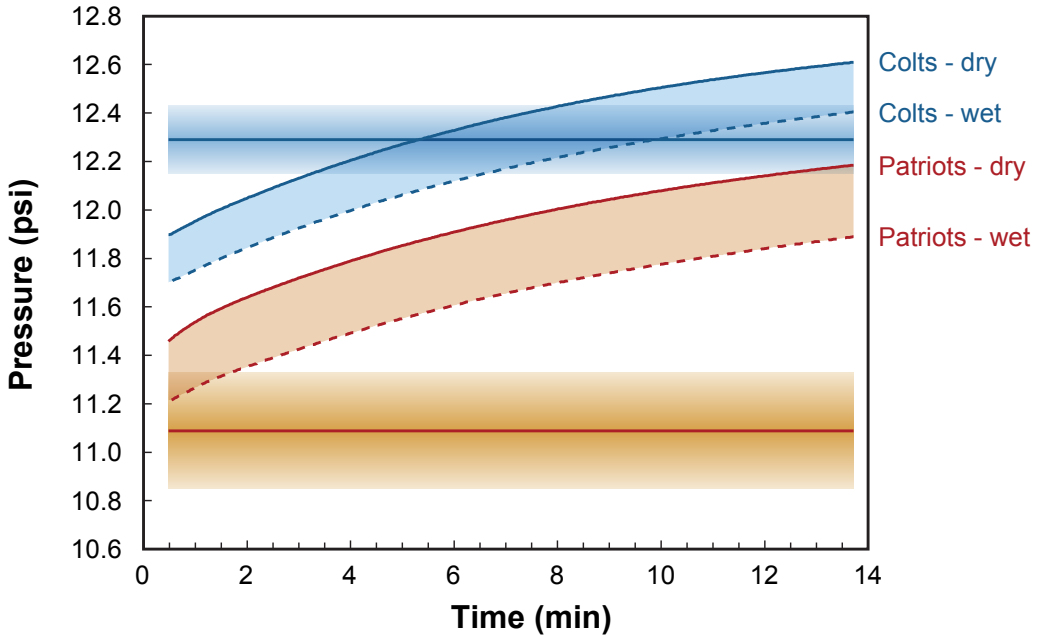

Figure 25. Transient pressure curves for the scenario in which the footballs were set using the Non-Logo Gauge and the average measured Game Day pressure (with error band) is overlaid.

For a given team, the overlap between the shaded area of that team's Game Day average[42] and the shaded area of that team's transient curves represents the window in which the Game Day measurements can be theoretically explained by a physically plausible combination of environmental variables as well as a possible range of average measuring times.[43] For example, using Figure 25 to illustrate, it appears that so long as the average time at which the Colts balls were measured is no sooner than approximately 5.5 minutes and no later than approximately 9.5 minutes after the balls were brought back into the Officials Locker Room, the Game Day results are explainable based on natural causes. For the Patriots, there is no such window in which the Game Day average crosses the region defined by the transient curves. Although there is a small overlap between the outer edge of the error band and the transient curve for approximately the first 100 seconds of the simulated Locker Room Period, it is unlikely that the window is representative of the measurements actually recorded on Game Day because the testing of the Patriots balls is likely to have begun no sooner than two minutes into the Locker Room Period.

Therefore, had the balls been set pre-game to 12.5 and 13.0 psig, respectively, via the Non-Logo Gauge, there is a relatively large window in which the Colts measurements on Game Day fall within the range predicted by the transient curves. There is a relatively small window in which the Patriots measurements overlap with the range predicted by the transient curves, but the window

42 In this figure, the average is identified as the average produced by the Non-Logo Gauge on Game Day for each team and is represented by the solid line. Using our statistical model, we calculated the standard errors for the Non-Logo Gauge for each team. The overall error band is ±2 standard errors for each team. This error band is graphically represented by the shaded areas extending above and below the solid line representing the average.

43 The average measurement time (the average of the time when the first and last measurements were taken in the Locker Room Period), as opposed to the start time, is chosen to ensure that all measurements would fit within the described time window.

coincides only with the outer region of the error band of the Game Day average. The values at the upper edge of the error band are relatively less plausible than values in the middle of the error band. Therefore, this overlap region corresponds to a relatively implausible scenario.

In addition, the Patriots halftime measurements will only fall within this small window if they were taken immediately after the footballs arrived in the Officials Locker Room at halftime and were completed no more than 4 minutes later. Based on information provided by Paul, Weiss, however, we understand that testing is likely to have begun no sooner than 2 minutes after the balls were brought into the locker room and was estimated to have taken approximately 4 to 5 minutes (leading to an ending time of between 6 and 7 minutes, and thus, an average measurement time of between 4 and 4.5 minutes, assuming a start time of 2 minutes). The timing conditions required for the transient curves to overlap with, and thus explain, the average pressure measured for the Patriots balls at halftime (even at the outer edge of the error band) are, therefore, unlikely to have been met. Given the likely timing of the testing, one would expect the average halftime pressure measured for the Patriots footballs on Game Day to be higher than what was actually recorded.

It is important to note that the values for the pre-game measurement temperatures shown in Figure 25 put the Patriots transient curves at their *lowest* possible positions (and thus maximize the area of overlap with the Game Day averages in its error bands). Any change in these temperatures within the allowed range that still permits the Colts transient curves to match the Colts halftime measurements will only push the Patriots transient curves up and make it more difficult to explain the observed Patriots halftime readings by environmental and measurement process factors alone.

Using the Logo Gauge Pre-Game

In recognition of the remaining uncertainty as to which gauge was used to measure the footballs pre-game and in the interest of completeness, similar tests were run using the Logo Gauge. The Logo Gauge was used to set the pressure of two balls to 12.50 psig (representative of the Patriots) and two balls to 13.00 psig (representative of the Colts). From each set (corresponding to each team), one ball remained dry while exposed to the game temperature and the other was wet.

In this scenario, the game temperature and the halftime measurement temperatures were set to the same values (for the same reasons) as the experiments done with the Non-Logo Gauge (48°F for the game and between 72 and 73°F for the halftime measurement temperatures). However, the pre-game temperature was set at 67°F because this was the only temperature that allowed the Colts balls to subsequently reach their average pressure during the simulated Locker Room Period. Any pre-game temperature that was higher than 67°F resulted in the Colts balls reaching the Game Day halftime average pressure later than 13.5 minutes into the Locker Room Period.

The transient curve of each ball tested in this scenario is shown in Figure 26. Qualitatively, the results are the same as those observed in Figure 24, which were obtained using the Logo Gauge. The same construct regarding the shaded areas between each team's respective curves can be applied.

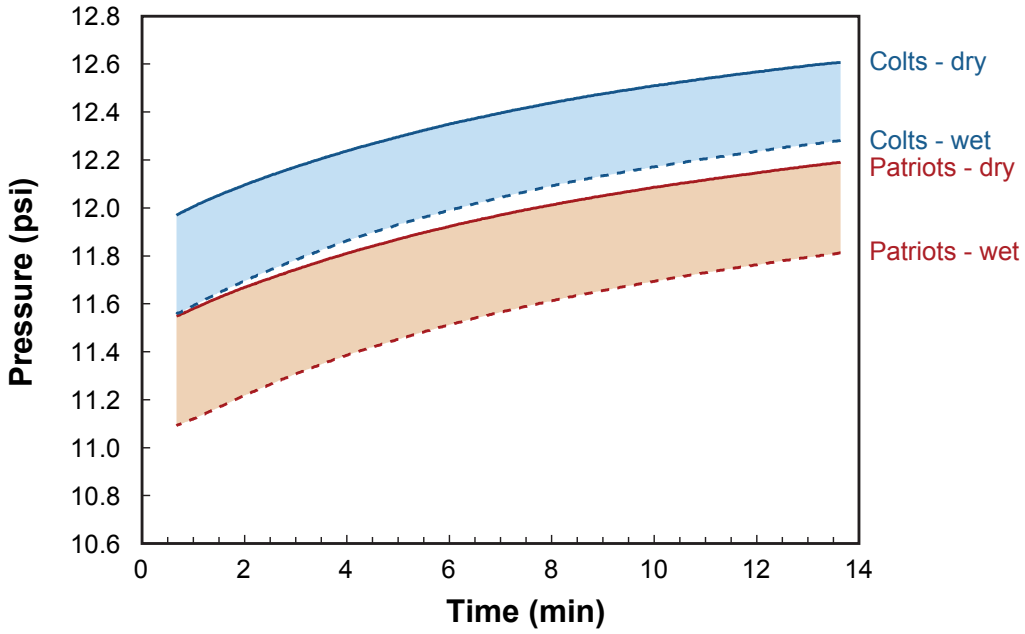

Figure 26. Transient pressure curves for the scenario in which the footballs were set with the Logo Gauge.

A representation of the average pressures observed on Game Day are then overlaid on these curves, as discussed in the previous section, and the results are shown in Figure 27.

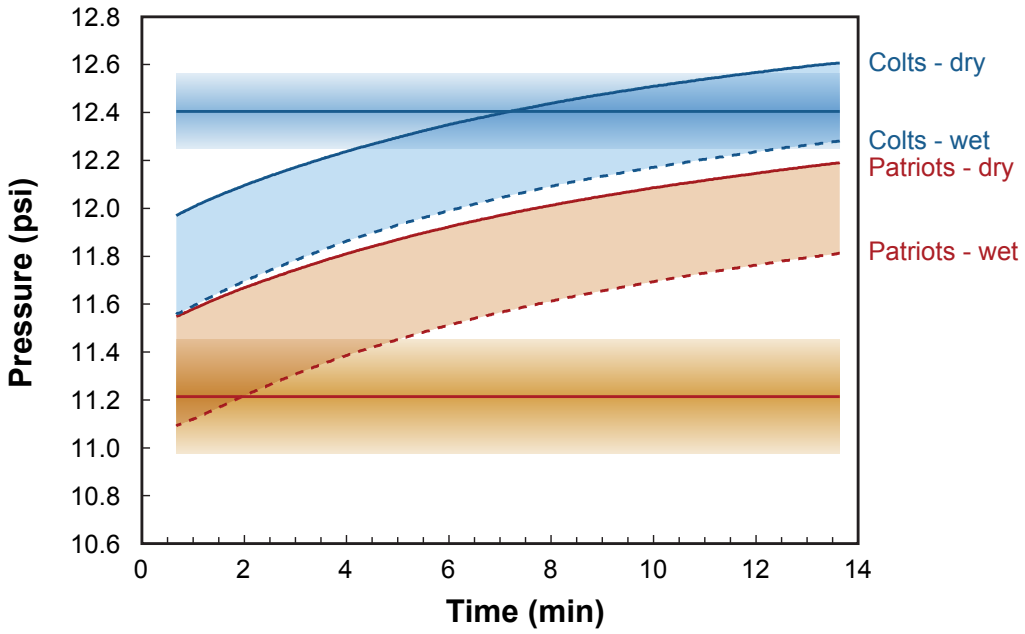

Figure 27. Transient pressure curves for the scenario in which the footballs were set with the Logo Gauge with the average measured Game Day pressure (with error band) is overlaid.

As described earlier, where there is overlap between the shaded area bounded by the transient curves and the shaded area of the Game Day averages,[44] the Game Day results are physically plausible. Analysis of Figure 27 yields such an area for both the Colts and Patriots. Specifically, it appears that so long as the average time at which the Colts balls were measured is no sooner than approximately 7 minutes after the balls were brought back into the Officials Locker room (a relatively large window of pressure/time combinations), the Game Day results can be explained by natural causes alone.

For the Patriots, it appears that so long as the average time at which the Patriots balls were measured is no later than approximately 2 minutes after the balls were brought back into the Officials Locker room, the Game Day results can be explained by natural causes. However, as noted above, the average measurement time for the Patriots footballs is unlikely to have been 2 minutes or earlier because testing of the Patriots balls is unlikely to have begun prior to 2 minutes into the Locker Room Period and was estimated to have taken approximately 4 to 5 minutes, according to information provided by Paul, Weiss (leading to an ending time of between 6 and 7 minutes and an average measurement time of between 4 and 4.5 minutes, assuming a start time of 2 minutes). Given the most likely timing of the measurements on Game Day, one would expect the average halftime pressure measured for the Patriots footballs on Game Day to be higher than what was actually recorded.

In addition, for the Patriots halftime measurements to overlap the results predicted by the transient curves generated with the Logo Gauge, the majority of the Patriots footballs would have had to be wet. According to information collected during witness interviews conducted by Paul, Weiss, the Patriots ballboys attempted to keep the balls as dry as possible during the first half, and the game officials did not consider the balls to be overly wet when tested at halftime.

As with the Non-Logo Gauge results, it is important again to note that values for the pre-game and halftime locker room temperatures shown in Figure 27 put the Patriots transient curves at their *lowest* possible positions. Any change in these temperatures within the allowed range that still permits the Colts transient curves to match the Colts halftime measurements will only push the Patriots transient curves up and make it more difficult to explain the observed readings by environmental and measurement process factors alone.

44 The Game Day averages and the error bands associated with each team's Game Day averages were obtained in a manner analogous to the previous scenario.

Comparing Non-Logo Gauge and Logo Gauge Transient Results

We can now compare the potential outcomes of either pre-game scenario (Non-Logo Gauge vs. Logo Gauge). The results from Figure 25 and Figure 27 are presented side-by-side in Figure 28.

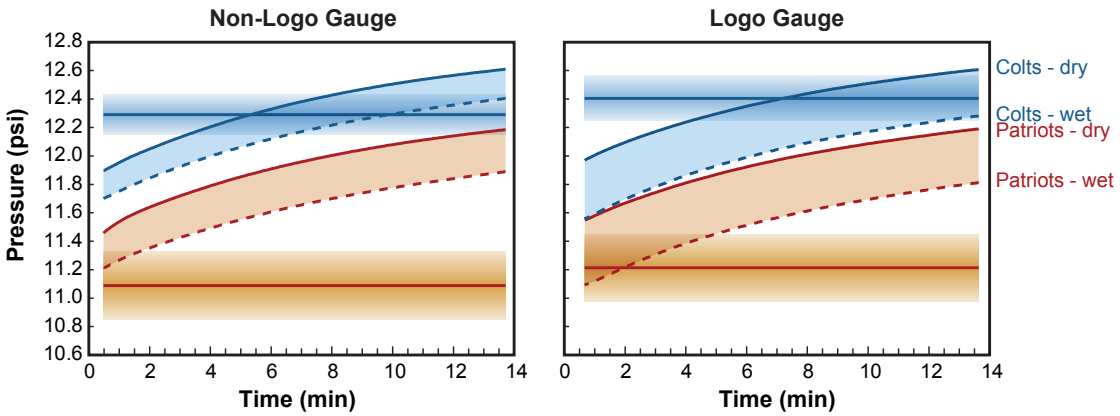

Figure 28. A comparison of the transient pressure results from the Non-Logo (left) and Logo Gauge (right) pre-game scenarios.

Using the Colts balls as a "control" group while concurrently using conditions that would maximize the possibility for the transient curves to match the Game Day average pressure measurements, the following conclusions can be drawn from Figure 28:

1. Had the Non-Logo Gauge been used pre-game and using the information provided by Paul, Weiss that the first Patriots measurement most likely occurred no sooner than 2 minutes into the Locker Room Period, there appears to be no realistic window in which the Game Day results from both teams can be explained; the Colts measurements are explainable, but the Patriots measurements are not. The only overlap between the Patriots transient curve and the Patriots Game Day average is too early in the Locker Room Period to be realistic, and the overlap is only with the outer edge of the Patriots error band.

2. Had the Logo Gauge been used pre-game, there is a small window in which the Game Day results from *both* teams are theoretically explainable. However, this would require the testing of the Patriots footballs to have begun immediately upon entering the Officials Locker Room, before the balls had time to warm up. Moreover, a majority of the Patriots balls would have had to have been in a condition equivalent to what Exponent tested as "wet." According to Paul, Weiss, both of those conditions were most likely not present on Game Day. Therefore, there appears to be no realistic window in which the Game Day results from both teams can be explained.

Based on the above conclusions, although the relative "explainability" of the results from Game Day are dependent on which gauge was used by Walt Anderson prior to the game, given the most likely timing of events during halftime, the Patriots halftime measurements do not appear to be explained by the environmental factors tested, regardless of the gauge used.

Experimental Simulations of Game Day

The transient measurements described above can be thought of as the boundary for the possible range of "predicted" results. Given that the football gradually warms up in the locker room, the pressure is shown to vary as a function of time. Depending on when a measurement is taken, different pressures can be recorded. These transient curves answer the fundamental question: "What is the pressure as a function of measurement time?"

In order to further model the events that transpired on Game Day, a comprehensive effort was undertaken by Exponent to fully simulate, as closely as possible based on available information, what happened on Game Day. Data from such simulations can then be compared to the "predictions" made by the transient curves to help assess their validity. These simulations are described below.

The physics and experimental results discussed above concern themselves with the range of theoretical possibilities. But the measurements recorded on Game Day involve multiple footballs that have been exposed to potentially varying conditions (e.g., some wet vs. some dry, ball-to-ball variations in fill, etc.). Thus, we endeavored to simulate the actual process of the Game Day events in an attempt to account for these variations and possibilities.

Procedure

The pertinent events from Game Day were systematically reproduced under controlled conditions. Again, balls prepared by each team were provided to and used by Exponent for this analysis.

In general, the simulation procedure was as follows:

1. Eleven Patriots balls and four Colts balls were measured pre-game using either the Non-Logo or Logo Gauge, in a simulated Officials Locker Room that was temperature controlled.

2. All footballs were allowed to sit in an environment representative of the Officials Locker Room for approximately 2 hours before being taken to a simulated field (in actuality, a large temperature-controlled chamber). The field conditions were identical to those on Game Day, namely 50°F at the start of the half and dropping to 48°F near the end of the half.

3. Inside the chamber, the condition of the balls was varied. Some remained dry and in ball bags (these bags, provided by Paul, Weiss, are believed to be similar, if not identical, to those used by the Patriots and Colts on Game Day), and some were occasionally wetted from a standard household spray bottle to simulate exposure to the damp environment present on Game Day. The balls remained in the chamber for 2 hours, the length of time that the balls were outside before coming back inside at halftime.

4. At the end of 2 hours, the balls were removed from the field and brought back into the simulated Officials Locker Room in the ball bags.

5. The procedure used to generate the halftime measurements during Game Day was replicated. Namely, the Logo and Non-Logo Gauges were used. The Patriots balls were measured first and then the Colts balls were measured. The timing of these measurements varied for each simulation.

Paul, Weiss provided information from the ballboys of the respective teams stating that up to four footballs remained in the bags on the sideline during the first half, which is replicated in the simulations. The pre-game and halftime temperatures were in the same range as discussed earlier.

The time at which the Patriots balls and Colts balls were measured during the Locker Room Period was also varied. As discussed in the Introduction and Background section of this report, the Patriots balls were measured first. Sometime after the Patriots balls were measured (but prior to the conclusion of the approximately 13.5-minute Locker Room Period), the Colts balls were measured.

Similar to the transient experiments, two sets of simulations were performed; one using the Non-Logo Gauge to set the pressure in the footballs pre-game and the other using the Logo Gauge to set the pressure in the footballs pre-game. As before, when identifying environmental parameters to test, the Colts balls were used as a "control," i.e., the various temperatures were adjusted such that the measurements obtained via these simulations correspond to the Colts measurements recorded on Game Day. Once parameters that allowed the Colts balls to match were identified, they were further refined to maximize the possibility that the Patriots measurements would also match those recorded (for the Patriots) on Game Day. Unsurprisingly, the parameters in these simulations are the same as those used in the transient experiments (pre-game temperature and halftime temperature). The results of the simulations are now presented.

As an aside, Paul, Weiss provided Exponent with detailed information about the procedures that were used by each team's ballboys during the actual game. Generally, these involved how the balls were maintained on the sideline and how often they were switched in and out of game play. Using this information, Exponent performed a simulation in which individuals acted as "ballboys" and the ballboy procedures outlined by Paul, Weiss were followed. Concurrently, the game telecast was used to guide how much playing time each team's footballs experienced, and the balls were rotated in and out of "play" accordingly. The entire "ballboy simulation" took place inside the cold chamber that was set to the field conditions, i.e., cold and wet, and was meant to test the impact of differences in the thermal histories of each individual ball. It was concluded that there was no observable difference in the results between this type of simulation and the one described above. Because there was no difference between this type of simulation when compared with letting the balls remain idle in the cold chamber, all subsequent simulations did not use ballboy actors.[45]

Game Day Simulations Using Non-Logo Gauge Pre-game

Using the Non-Logo Gauge to adjust the balls prior to the game and following the protocol enumerated above, several simulations were performed with varying start times for the measurements for each team. The results of these simulations are shown in Table 13. (Note that the values listed in this table are Master Gauge readings.) The pre-game temperature was set to 71°F and the halftime locker room temperature was set to between 72 and 73°F. According to information provided to Exponent by Paul, Weiss, the earliest reasonable start time for the Patriots measurements was likely to have been 2 minutes into the Locker Room Period. In order to bound the range of reasonable start times, Exponent performed a simulation during which the first football was

45 We understand that the Patriots have suggested that the proximity of the Colts ballboys to the sideline heaters used during the AFC Championship Game may have impacted the temperature, and thus pressure, of the Colts game balls when tested at halftime. According to information provided to Exponent by Paul, Weiss, the Colts ballboys were not standing near the sideline heaters during the first half, and therefore the footballs in their possession were unlikely to have been affected by the heaters.

measured at 1.5 minutes into the Locker Room Period (a starting point earlier than that considered likely by Paul, Weiss), a simulation during which the first football was measured at 4 minutes into the Locker Room Period (the latest starting point considered likely by Paul, Weiss), and a simulation during which the first football was measured at 3 minutes into the Locker Room Period (a starting point within the range considered likely by Paul, Weiss).

Table 13. Results of simulations using Non-Logo Gauge (pressures listed are Master Gauge readings).

Patriots Measurement Start Time (min:sec)	Patriots Average Measurement Time (min:sec)	Patriots Average Pressure (psig) Master Gauge	Colts Measurement Start Time (min:sec)	Colts Average Measurement Time (min:sec)	Colts Average Pressure (psig) Master Gauge
1:40	2:44	11.44	6:56	7:10	12.30
3:38	4:17	11.54	8:02	8:15	12.35
4:11	5:04	11.62	9:02	9:14	12.38

As can be seen, where the average measurement time for the Colts footballs falls later in the simulated Locker Room Period, at 8:15 and 9:14 minutes into the period, the Colts measurements correlate well to the Game Day measurements (recall that the Colts averages from the Game Day gauges when converted to Master Gauge readings are 12.29 and 12.40, respectively). For the Patriots measurements, all averages are higher than what was observed on Game Day (the Patriots averages from the Game Day gauges when converted to Master Gauge readings are 11.09 and 11.21, respectively), even when the Patriots balls are measured earlier during the Locker Room Period than is believed likely. Unsurprisingly, all averages, regardless of team, rise the later the measurements begin, which tracks the natural warming of the footballs.

Game Day Simulations Using Logo Gauge Pre-game

In the interest of completeness, we also performed simulations using the Logo Gauge to set the pressure within the footballs pre-game. The measurement times for each team were varied in the manner described previously. The pre-game temperature was set to 67°F and the halftime locker room temperature was set to between 72 and 73°F. The results of these simulations are shown in Table 14.

Table 14. Results of simulations using Logo Gauge (pressures listed are Master Gauge readings).

Patriots Measurement Start Time (min: sec)	Patriots Average Measurement Time (min:sec)	Patriots Average Pressure (psig) Master Gauge	Colts measurement Start Time (min: sec)	Colts Average Measurement Time (min:sec)	Colts Average Pressure (psig) Master Gauge
1:30	2:21	11.35	6:40	6:55	12.18
3:20	4:03	11.46	8:00	8:12	12.25
5:00	5:33	11.54	9:30	9:43	12.31

These results are qualitatively similar to those observed in the Non-Logo Gauge simulations: the Colts measurements are all relatively close to the Game Day measurements, whereas the Patriots averages are all higher than those calculated from the Game Day data. The average for each team rises as a function of time; the later the measurement start time, the higher the average.

Comparison of Game Day Simulations with Transient Data

It appears that the average pressures of the Colts footballs that were measured on Game Day are explainable by the simulation, whereas the average pressures of the Patriots footballs that were measured on Game Day are not.

The simulation results can also be compared to the transient data presented earlier. This is accomplished graphically by plotting the simulation results directly onto the transient data plots presented in the previous section.

The comparison of the game day simulations with the transient data using the Non-Logo Gauge is shown in Figure 29. The data sets generated by the two methods (game day simulations and the transient curves) correlate well to one another. The average pressure generated by all of the game day simulations fall within the shaded region bounded by the transient curves for each respective team. Furthermore, as was discussed earlier, the pressure rises as a function of time, as seen in the overall shape of the transient curve. A similar effect is seen in the game day simulation data; the average pressure rises as the average measurement time is increased.

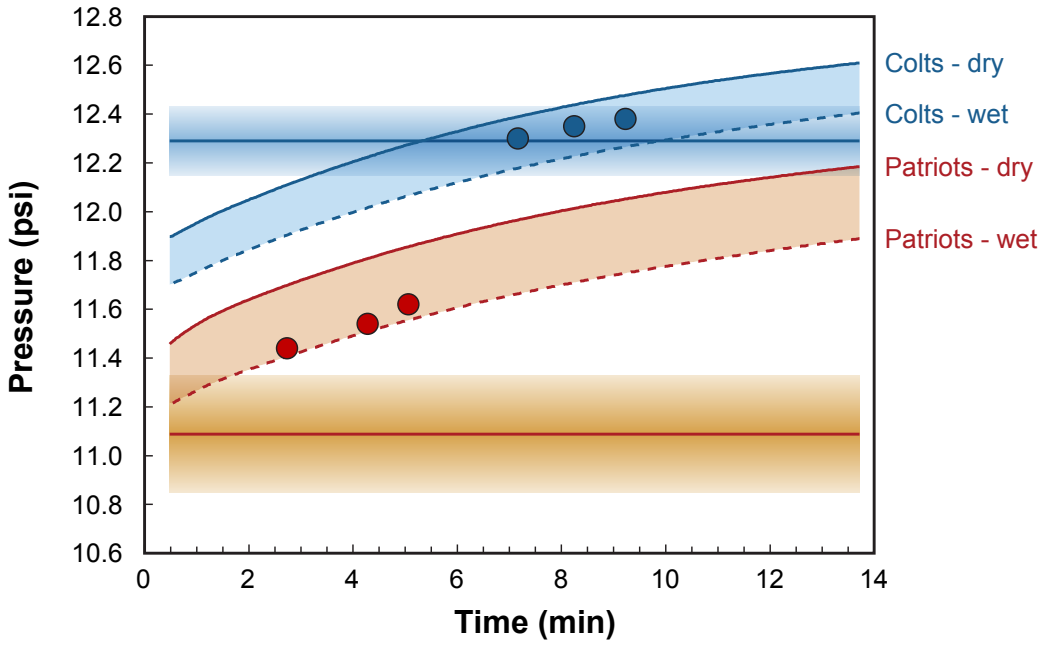

Figure 29. A comparison of the simulation results using the Non-Logo Gauge pre-game with the transient data previously discussed. The dots represent the averages of the measurements taken during a particular simulation.

The comparison between the game day simulations and transient data using the Logo Gauge is shown in Figure 30. Qualitatively, the results are similar to the Non-Logo Gauge scenario. For the measurements that started relatively early, lower averages for the Patriots were obtained when compared to the early measurements using the Non-Logo Gauge. Again, this is not unexpected because the Logo Gauge reads high when compared to a calibrated gauge; thus, the actual pressure inside the ball is relatively low.

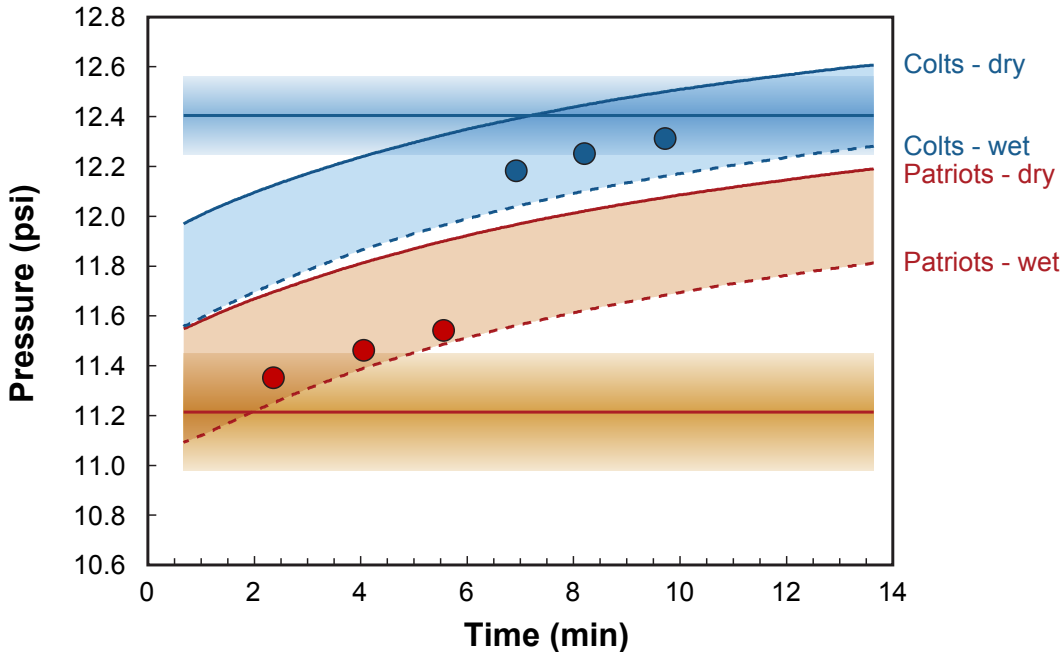

Figure 30. A comparison of the simulation results using the Logo Gauge pre-game with the transient data previously discussed. The dots represent the averages of the measurements taken during a particular simulation.

Experimental Simulations Conclusion

In both the Non-Logo Gauge and Logo Gauge simulations, we see that the average measurements for the Colts footballs are generally at or near the line representing the average measurements from Game Day. In contrast, all of the average measurements for the Patriots footballs generated by the simulations are noticeably higher than the line representing the average measurements from Game Day. Therefore, subject to the discovery of an as yet unidentified and unexamined factor, the measurements recorded for the Patriots footballs on Game Day do not appear to be completely explainable based on natural causes alone.

Game Day Data – Revisited: Variability

As was mentioned in the section of this report analyzing the Game Day data, the variability in the Patriots measurements recorded at halftime on Game Day was greater than the variability in the Colts halftime measurements, although the difference between the variability for each team is not statistically significant (see the Results and Discussion in the Data Analysis section of this report). However, when these data are reconsidered in view of the findings from the above experiments, several individual fluctuations in the halftime pressures of Patriots footballs measured in close time proximity to each other (e.g., Balls 1 and 2, Balls 2 and 3, etc.) exceed in magnitude the fluctuations that can be attributed to the combined effects of the various physical, usage, and environmental factors we examined.

Based on the transient curves explained above, one would expect that if the Patriots footballs were set to a consistent or relatively consistent starting pressure, the pressure would rise relatively consistently as they were tested later in the Locker Room Period. An exception to this general trend would be the testing of a dry ball followed by the testing of a wet ball, which would be expected to have a lower pressure at the start of halftime that would rise more slowly. However, according to both the transient curves set out in Figure 25, the maximum differential observed between the dry and wet footballs tested under the same conditions was only approximately 0.3 psig.

Table 15 tracks the pressure fluctuations observed between Patriots footballs measured at halftime with the Non-Logo Gauge. Starting with the first football tested (which measured 11.50 psig), we have calculated the pressure increase or drop for each football measured at a later time.

Table 15. Pressure differential of a given ball compared to a later reading.

Non-Logo Reading	11.50	10.85	11.15	10.70	11.10	11.60	11.85	11.10	10.95	10.50	10.90
11.50	0.00	-0.65	-0.35	-0.80	-0.40	0.10	0.35	-0.40	-0.55	-1.00	-0.60
10.85		0.00	0.30	-0.15	0.25	0.75	1.00	0.25	0.10	-0.35	0.05
11.15			0.00	-0.45	-0.05	0.45	0.70	-0.05	-0.20	-0.65	-0.25
10.70				0.00	0.40	0.90	1.15	0.40	0.25	-0.20	0.20
11.10					0.00	0.50	0.75	0.00	-0.15	-0.60	-0.20
11.60						0.00	0.25	-0.50	-0.65	-1.10	-0.70
11.85							0.00	-0.75	-0.90	-1.35	-0.95
11.10								0.00	-0.15	-0.60	-0.20
10.95									0.00	-0.45	-0.05
10.50										0.00	0.40
10.90											0.00

According to this table, there are 16 pairs of measurements (highlighted in yellow, orange, and red) in which the drop in pressure between the earlier ball tested and the later ball tested is greater than or equal to 0.5 psig. There are seven pairs of measurements (highlighted in orange and red) in which the drop in pressure between the earlier ball tested and the later ball tested is greater than or equal to 0.75 psig, and there are three pairs of measurements (highlighted in red) in which the drop in pressure between the earlier ball tested and later ball tested is greater than or equal to 1.0 psig.

The fluctuations in pressures between the pairs of Patriots football measurements highlighted in Table 15 exceed those expected based on the transient curves. Based on information from Paul, Weiss, it also exceeds the variation in starting pressures observed by the game officials during pre-game inspection. Therefore, subject to discovery of an as yet unidentified and unexamined factor, the most plausible explanation for the variability in the Patriots halftime measurements is that the 11 Patriots footballs measured by the officials at halftime did not all start the game at or near the same pressure.[46]

46 Note that a corresponding analysis of the variability in measurements of the Colts footballs results in a range of variation that does not exceed that predicted by the transient curves.

Conclusions

In this section, we analyzed various physical, usage, and environmental factors that may have been present on Game Day to determine the impact of each on the pressure measurements taken during halftime.

It was shown that the variations in game use have no discernible effect on the pressure measurements. Furthermore, the short-term leak rate through the bladder and bladder materials was found to be negligible. Our analyses also showed that the football can, with good approximation, be assumed to be a fixed-volume container, and thus pressure changes due to volume variations can be ignored.

According to basic thermodynamics, it is completely expected that the temperature and pressure inside a football drop when it is brought into a colder environment and rise when brought back into a warmer environment. It is important to note, however, that these variations in temperature and pressure are time-dependent (in the time ranges at issue in the present investigation). The transient analyses detailed in this section describe this pressure vs. time relationship and for the purposes of this investigation can be viewed as defining the "theoretical" range of possible pressures that *could* have been measured on Game Day, allowing for variations in measurement time and environmental conditions.

Using the Colts measurements as a control group and further refining the test parameters to maximize the chances that the Patriots ball measurements would match those from Game Day, our transient experiments show that had the Non-Logo Gauge been used to measure or set the game balls pre-game, there appears to be only a very small window in which the error band of the Patriots average measurement from Game Day overlaps the transient data. However, it is noted that this window corresponds to an average measurement time that, according to information from Paul, Weiss, is earlier than what likely occurred on Game Day. Thus, when accounting for the most likely timing of events at halftime, there appears to be no such window in which the average Patriots halftime measurement from Game Day overlaps the transient data.

Had the Logo Gauge been used, there is a slightly larger, but finite, window in which the Patriots average pressure from Game Day is "predicted" by the transient results. But, similar to above, the theoretical window does not correspond with likely Game Day events or conditions. Specifically, the only way for the Patriots average halftime measurement to fall within this window is to apply timing and ball surface conditions unlikely to have been met on Game Day.

The results from the game day simulations agree with the "predicted" results from the transient curves. They also agree with the average measurements recorded for the Colts on Game Day. They do not, however, agree with the average Patriots measurements recorded on Game Day, regardless of the gauge used. Specifically, the average Patriots halftime measurements from Game Day are lower than the lowest averages attained by the Exponent simulations.

CONCLUSIONS

1. According to basic thermodynamics, it is completely expected that the temperature and pressure inside a football drop when it is brought from a warmer environment into a colder environment and rise when brought back into a warmer environment. It is important to note, however, that these variations in temperature and pressure are time-dependent (in the time ranges at issue in the present investigation).

2. As a result of being exposed to relatively colder temperatures when brought outside to the field for the first half, the pressure inside the footballs for both teams was lower at halftime when compared with the reported pre-game levels. This is consistent with the Ideal Gas Law, which predicts, among other things, the change in pressure that is caused by a change in temperature. Based on information regarding actual conditions on the day of the AFC Championship Game, however, the application of the Ideal Gas Law (assuming equilibrium conditions) cannot account entirely for the pressure drops observed in the Patriots halftime measurements. Most of the individual Patriots measurements recorded at halftime were lower than the range predicted by the Ideal Gas Law. Indeed, all but three of the footballs, as measured by both gauges, registered pressure levels lower than the range predicted by the Ideal Gas Law, assuming an initial pressure of 12.5 psig and temperature conditions that we understand were present on Game Day. In addition, applying the Ideal Gas Law while assuming equilibrium conditions fails to account for the transient nature of the halftime testing, as described in detail herein.

   It also appears that the Patriots game balls exhibited a greater average pressure drop than did the Colts game balls. This difference in the magnitude of the decrease in average pressure between the Patriots and the Colts footballs, as measured at halftime, was determined to be statistically significant, regardless of which gauges were used pre-game and at halftime. Therefore, the reasons for this difference were an appropriate subject for further investigation.

3. The Logo and Non-Logo Gauges appear to have worked reliably and consistently on Game Day, and the difference in the pressure drops between the teams was not caused by a malfunction of either gauge. Based on our experimental results, both gauges would have read consistently and with good repeatability when used in the range of temperatures to which they were exposed in the Officials Locker Room (approximately 67 to 74°F) and when used to measure a range of pressures that includes those measured on Game Day (approximately 10 psig to 14 psig). Further, it is unlikely that the battery on either gauge was below the voltage level required to induce battery-related reading and measurement errors, or that the measurements recorded on Game Day were affected by issues relating to the human factors of how the measurements were made.

4. When the Logo and Non-Logo Gauges measure an identical pressure, different readings are produced: the Logo Gauge reads higher than the Non-Logo Gauge. However, for a given set of measurements, the error for either gauge remains consistent compared to a calibrated gauge. In other words, in the short term, both gauges (as well as the other model gauges used by Exponent during our experiments) will read consistently, but differently from each

other. Thus, the short-term *repeatability or precision* of the two gauges used at halftime is not a factor that contributed to the difference in the magnitude of the pressure drops between the game balls of the two teams, although their apparent difference in *accuracy* must be taken into account.

5 Information provided by Paul, Weiss to Exponent indicates that the Patriots and the Colts inflated the game balls for the AFC Championship Game at or near 12.5 psig and 13.0 psig, respectively. Information from Walt Anderson (which was also provided by Paul, Weiss), the referee who checked the pressure of the game balls prior to the game, indicates that the game balls measured at or near 12.5 psig and 13.0 psig, respectively, when measured. Although there remains some uncertainty about which gauge was used to measure or set the game balls prior to the game, because we found the Logo Gauge to read at least 0.35 psig high in our experiments, while the Non-Logo Gauge reads closer to a calibrated gauge and most of the other gauges tested during the investigation, and because we found during our testing that the Non-Logo Gauge never produced a reading higher than the Logo Gauge, we conclude that it is more likely that the Non-Logo Gauge was used to measure the balls prior to the game. This conclusion is based on data provided to us by Paul, Weiss and data generated by our experiments. It also is consistent with the pressure readings reported by the Patriots, the Colts, and Walt Anderson.

6. A series of physical factors were evaluated for their potential contribution(s) to the difference in the observed pressure drops at halftime. These included:

   a. The impact of game use.

   b. The impact of repeated insertions of an inflation needle into the football.

   c. The natural leak rate and permeability of properly functioning footballs.

   d. The relative humidity of the air in the room(s) in which the footballs were inflated.

   e. The variation of volume of the footballs.

   f. The different treatments used by the Patriots and the Colts to condition the surface of the balls prior to the game (including the vigorous rubbing described by the Patriots as a step in the process used to break in their footballs).

   Notably, the potential differences in the amount and type of use by each team during the game as well as the ball preparation methods used prior to the game, including vigorous rubbing taking place more than 30 minutes prior to pre-game inspection, were found to have little to no impact on the recorded pressures. None of the above physical factors, at the levels we understand were applicable on Game Day, were found to contribute in any material way to changes in the internal pressure of the footballs, and do not, therefore, explain the relative difference in the pressure drops measured at halftime.

7. A series of environmental factors were evaluated for their potential contribution(s) to the difference in the observed pressure drops at halftime. These included:

   a. The effect of external temperature on the pressure inside the football:

      i. The likely temperature of the room when the pressures of the footballs were measured prior to the game (67–71°F).

      ii. The likely temperatures on the field during the first half (48–50°F).

iii. The likely temperature of the room when the pressures of the footballs were measured at halftime (71–74°F).

b. The impact of timing on the halftime measurements (i.e., when and in which sequence the measurements were made during the period of time in which the balls were inside the Officials Locker Room at halftime (the "Locker Room Period"), which we have been told by Paul, Weiss was approximately 13.5 minutes).

c. The effect of ball surface conditions on the pressure of the footballs (i.e., wet vs. dry ball).

d. The impact of which gauge was used prior to the game (Non-Logo or Logo).

The ranges listed above were based either on weather reports, measurements made by Exponent, or information provided by Paul, Weiss, and represent the lower and upper bounds for the realistic ranges of these factors.

All of these factors were found to contribute in varying degrees to changes in the internal pressure of footballs. However, given the magnitude of the temperature change that would have affected the footballs at halftime when they were brought from the field to the locker room, a key factor in explaining the difference in measurements between the Patriots and Colts footballs is timing; that is, the change in pressure with time as the footballs were brought from a colder environment (the field) to a warmer environment (the Officials Locker Room) at halftime.

8. For the purpose of the experiments, Paul, Weiss informed Exponent that there was no plausible basis to believe that there had been tampering with the Colts footballs; therefore, the Colts footballs were used as a "control" group when evaluating and determining test parameters for the pertinent experiments. In other words, because we could reasonably assume that the Colts measurements collected at halftime on Game Day were the result only of natural causes, a combination of environmental and timing factors was identified (within the realistic ranges provided by Paul, Weiss) for the purpose of our experiments that resulted in measurements for the Colts balls that matched the Game Day measurements. Aligning our experiment in such a way confirmed that the test conditions were a good approximation of the environmental factors present on Game Day, and allowed us to concurrently assess what the Patriots measurements would be under the same conditions. We could then assess the physical plausibility of the Patriots measurements recorded on Game Day.

9. A series of transient experiments were run to quantify the time-dependent pressure behavior of footballs and to understand how such behavior might help explain the difference in the magnitude of the pressure drops measured at halftime. The objective of these transient experiments was to identify how the pressure inside a football varies with time after that football is moved from a cold environment to a warmer one. These transient experiments were used to determine the range of pressures at specific times within a simulated locker room period that were theoretically possible to have been achieved on Game Day. We then sought to determine whether any combination of the factors listed in 7a through 7d above (within ranges defined as realistic by Paul, Weiss) suggested pressure levels that matched those recorded on Game Day. If those factors could be set in such a way that the pressures suggested by the transient experiments matched the Game Day measurements, then we could conclude that the Game Day measurements could be explained by physical or environmental factors.

10. Overall, we determined that there was a small window in which it was theoretically possible to combine the factors listed in 7a through 7d above to achieve pressure levels that matched those recorded for both the Colts and the Patriots on Game Day, regardless of which gauge was used to measure the footballs pre-game, test them at halftime, or set them prior to our experiments. However, as described below, the precise combination of factors required for the Patriots halftime measurements to fall within the range predicted by the transient experiments while also matching the Colts halftime measurements to the predicted range required setting certain parameters—particularly the timing of the halftime testing and the surface condition of the footballs—at levels believed to be unrealistic and unlikely to have been present on Game Day. In particular:

    a. If the Non-Logo Gauge was used pre-game, the Patriots average halftime measurement from Game Day is always lower than the pressures predicted by the transient curves. If one allows for the standard error associated with the Game Day measurements, the Patriots halftime measurements will overlap with the pressures predicted by the transient curves (with the Colts halftime measurements also matching the predicted range), but only in the outer range of the error band, and only if testing of the Patriots balls began immediately once the footballs arrived in the Officials Locker Room at halftime and took no more than 4 minutes. Based on information provided by Paul, Weiss, however, we understand that testing is likely to have begun no sooner than 2 minutes after the balls were returned to the locker room and is likely to have taken approximately 4 to 5 minutes.

    b. If the Logo Gauge was used pre-game, the Patriots average halftime measurement will match the pressures predicted by the transient curves (with the Colts halftime measurements also matching the predicted range), but only if the testing of the Patriots balls began immediately once the footballs arrived in the Officials Locker Room at halftime and took no more than 4 minutes, and only if the majority of the Patriots game balls were wet. As noted, testing of the Patriots balls is likely to have begun no sooner than 2 minutes and is likely to have taken approximately 4 to 5 minutes. Further, based on statements made to Paul, Weiss (and subsequently conveyed to Exponent) by Patriots ballboys and game officials, we understand that some of the Patriots game balls may have been damp when tested at halftime, but none were water-logged.

    Accordingly, within the range of game conditions and circumstances most likely to have occurred on Game Day (based on information provided by Paul, Weiss), including the timing of various events that are understood to have occurred in the Officials Locker Room during halftime, we have identified no combination of the environmental factors listed above that could reconcile the Patriots halftime measurements with both the results predicted by our transient experiments and the measurements of the Colts balls taken at halftime on Game Day.

11. A series of experimental game day simulations were also run under conditions intended to be as realistic as possible based on videotape of the game and information collected by Paul, Weiss during interviews. The experimental simulations produced results that agree with the results predicted by the transient curves. They also produced average pressure measurements for the Colts footballs similar to those recorded for the Colts at halftime on Game Day. However, the experimental simulations failed to explain the measurements recorded for the Patriots on Game Day. Specifically, the averages of the Patriots measurements recorded during each of the experimental simulations using the Non-Logo Gauge to set the footballs

were higher than the average of the Patriots Game Day halftime measurements. The averages of the Patriots measurements recorded during each of the experimental simulations using the Logo Gauge to set the footballs were also generally higher than the average of the Patriots Game Day halftime measurements, and the only way to achieve measurements for the Patriots balls similar to those recorded on Game Day in experimental simulations using the Logo Gauge was to start the simulated halftime testing immediately once the footballs arrived in the simulated Locker Room, which is earlier than we are told is realistic. In fact, the average Patriots measurements from Game Day are lower than the lowest average attained by the Exponent simulations.

12. In addition to noting the difference in average pressure drops between the Colts and Patriots footballs when measured at halftime, we observed that there appears to be a difference in the variability of the measurements recorded for each team. Although we found the difference between the variability in halftime pressure measurements of the Patriots and the Colts footballs not to be statistically significant, we can draw certain conclusions on variability when these data are reconsidered in the context of our experimental results. Specifically, the fluctuations in the halftime pressures of Patriots footballs exceed in magnitude the fluctuations that can be attributed to the combined effects of the various physical, usage, and environmental factors we examined. Therefore, subject to discovery of an as yet unidentified and unexamined factor, it is our view that the most plausible explanation for the variability in the Patriots measurements recorded at halftime is that the 11 Patriots footballs measured by the officials at halftime did not all start the game at or near the same pressure.

13. In sum, the data did not provide a basis for us to determine with absolute certainty whether there was or was not tampering as the analysis of such data ultimately is dependent upon assumptions and information that is not certain. However, based on all of the information provided to us, particularly regarding the timing and sequencing of the measurements conducted by the game officials at halftime, and on our testing and analyses, we conclude that within the range of game characteristics most likely to have occurred on Game Day, we have identified no set of credible environmental or physical factors that completely accounts for the additional loss in air pressure exhibited by the Patriots game balls as compared to the loss in air pressure exhibited by the Colts game balls measured during halftime of the AFC Championship Game.

Appendix A

Statistical Analysis of Halftime Data

MAY 6, 2015

Exponent®

APPENDIX A—STATISTICAL ANALYSIS OF HALFTIME DATA STUDY

Background

On January 18, 2015, the New England Patriots defeated the Indianapolis Colts 45–7 in the AFC Championship Game. Following the game, media reports surfaced claiming that footballs used by the Patriots during the game had been found to be underinflated. During halftime of the game, the air pressure inside footballs from both teams was measured. In this section, we present our detailed statistical analysis of the data recorded at halftime.

We understand that prior to the start of a National Football League (NFL) game, each team presents the game balls that will be used on offense to the game officials for inspection. Some are designated by the respective teams to be the "primary" footballs, with others as potential "backup" footballs. (For the remainder of this Appendix, any reference to "footballs" shall be assumed to be referring to primary game balls.) These footballs are measured by the referee prior to the game and are required to have a pressure between 12.5 and 13.5 pounds per square inch gauge (psig). If necessary, the referee adjusts the pressure to be within these bounds. The referee approves the balls for game use, marks them as such, and is to maintain possession of the approved balls until the start of the game.

The Data

Eleven footballs from the Patriots and four footballs from the Colts were measured at halftime by two different officials, each using a different pressure gauge.[47] Although the pre-game measurements were not recorded in writing, based on witness interviews conducted by Paul, Weiss, the starting pressure for the Patriots footballs was reported to be at or near 12.5 psig and the starting pressure for the Colts footballs was reported to be at or near 13.0 psig. Our analysis was conducted on the basis of these starting pressures. According to Paul, Weiss, some of the Colts footballs measured 13.1 psig when tested prior to the game. In the interest of completeness, we conducted the same statistical analysis using a starting pressure of 13.1 psig for the Colts, and our conclusion with respect to statistical significance remains the same. Specifically, assuming a starting pressure of 13.1 psig, all the p-values for Scenarios 1–4 are less than 0.05; 0.010 for Scenarios 1–3 and 0.037 for Scenario 4. These results indicate that even with the increased starting pressure for the Colts, the difference between the average pressure drops of the two teams is statistically significant. Our analysis herein uses 13.0 psig as the starting pressure for the Colts balls because we understand from Paul, Weiss that 13.0 psig was the pressure targeted by the Colts when inflating their footballs prior to the game. Our analysis focuses on the measured differences between the starting and halftime pressures of individual footballs. The data are provided in Table A-1.

47 According to information provided by Paul, Weiss, we understand that the Patriots may have delivered 13 primary balls prior to the game, but it is clear that only 11 were measured at halftime.

Table A-1. Measured pressure (in psig) of footballs, recorded at halftime of AFC Championship Game, January 18, 2015.

Team	Ball	Gauge/ Official	Measured Pressure at Halftime (psi)	Assumed Pressure at Start of Game (psi)	Difference in Pressure (psi)
Patriots	P1	A	11.50	12.5	–1.00
Patriots	P2	A	10.85	12.5	–1.65
Patriots	P3	A	11.15	12.5	–1.35
Patriots	P4	A	10.70	12.5	–1.80
Patriots	P5	A	11.10	12.5	–1.40
Patriots	P6	A	11.60	12.5	–0.90
Patriots	P7	A	11.85	12.5	–0.65
Patriots	P8	A	11.10	12.5	–1.40
Patriots	P9	A	10.95	12.5	–1.55
Patriots	P10	A	10.50	12.5	–2.00
Patriots	P11	A	10.90	12.5	–1.60
Patriots	P1	B	11.80	12.5	–0.70
Patriots	P2	B	11.20	12.5	–1.30
Patriots	P3	B	11.50	12.5	–1.00
Patriots	P4	B	11.00	12.5	–1.50
Patriots	P5	B	11.45	12.5	–1.05
Patriots	P6	B	11.95	12.5	–0.55
Patriots	P7	B	12.30	12.5	–0.20
Patriots	P8	B	11.55	12.5	–0.95
Patriots	P9	B	11.35	12.5	–1.15
Patriots	P10	B	10.90	12.5	–1.60
Patriots	P11	B	11.35	12.5	–1.15
Colts	C1	A	12.70	13.0	–0.30
Colts	C2	A	12.75	13.0	–0.25
Colts	C3	A	12.50	13.0	–0.50
Colts	C4	A	12.55	13.0	–0.45
Colts	C1	B	12.35	13.0	–0.65
Colts	C2	B	12.30	13.0	–0.70
Colts	C3	B	12.95	13.0	–0.05
Colts	C4	B	12.15	13.0	–0.85

The Statistical Model

As shown in Table A-1, all of the recorded halftime measurements were below the reported pressures at the start of the game, but the magnitude of the pressure drop varies from –0.05 psig (Colts Ball 3, measured by Gauge/Official B) to –2.00 psig (Patriots Ball 10, measured by Gauge/Official A). This variation is potentially attributable to, among other things, differences between the individual footballs provided by a team, the teams providing the footballs, the measurement gauges used, and the officials involved in taking the halftime measurements.[48]

We used a statistical model to assess the observed variation in football pressure measurements and to determine whether the drop in average pressure measured for Patriots footballs after the first half of play was statistically significantly greater than the corresponding drop in pressure measured for Colts footballs. In other words, the model expresses the pressure drop associated with a single halftime measurement as being composed of a series of additive terms:[49]

Pressure Drop = Average Drop + Team Effect + Gauge Effect + Gauge/Team Interaction Effect + Football Effect + Random Error

The interaction term is included to capture an anomaly observed in the halftime data: for Patriots footballs the readings taken by Gauge A are systematically lower than the corresponding readings taken by Gauge B, but for Colts footballs the difference between gauges is reversed for three of the four measured footballs.

In this study, the outcome of interest is the measured pressure drop—i.e., the difference between the measured halftime pressure and the reported starting pressure (12.5 psig for Patriots, 13.0 psig for Colts) at the beginning of the game. Letting $D_{\{ijk\}}$ denote the pressure drop measured for the k-th football provided by team i and measured by gauge/official j, the statistical model can be written mathematically as:

$$D_{\{ijk\}} = \mu + \alpha_i + \beta_j + (\alpha\beta)_{\{ij\}} + \tau_{k(i)} + \epsilon_{\{ijk\}}$$

where, μ is the overall mean (average) pressure drop in psi; α_i is the main effect on pressure drop of team i (i = 1, 2); β_j is the main effect on pressure drop of gauge/official j (j = 1, 2); $(\alpha\beta)_{\{ij\}}$ is the interaction effect on pressure drop of team i and gauge/official j; $\tau_{k(i)}$ is the random effect on pressure drop of football k from team i, assumed to be distributed normally and independently with mean 0 and variance σ_τ^2; and $\epsilon_{\{ijk\}}$ is the random error, assumed to be distributed normally and independently with mean 0 and variance σ^2.

48 Because each official used a different gauge and only that gauge, any effects due to gauges and officials cannot be distinguished from the halftime data. For simplicity in further discussion we refer to the combined effect from these sources as the gauge effect.

49 As discussed above, our experiments have confirmed the time dependence of the pressure inside the footballs upon return to the locker room, even though a visual examination of the data recorded at halftime suggests the absence of a time effect. To account for any time effect in our statistical analysis, we incorporated an order effect into our statistical model to determine whether any portion of the observed ball-to-ball variation in pressure was explained by the order of measurements (1 to 15). Ultimately, we determined that the order effect was not statistically significant (p-value = 0.299), and its inclusion in the model did not alter our overall conclusion regarding the statistical significance of the difference between the average pressure drops for the Patriots and the Colts footballs as measured at halftime on Game Day. The difference in the average pressure drops cannot, therefore, be explained solely by the timing of the measurements.

We used this model to evaluate four different potential scenarios:

1. The data exactly as listed on the handwritten notes from Game Day.
2. Assuming the "switch" of the gauges in between the Patriots and Colts measurements.
3. Assuming Scenario 2 while concurrently assuming that the third Colts measurement was switched when recorded.
4. Fully discarding the third Colts measurement.

The results from each of these different scenarios are presented below.

Results

Using the air pressures measured at halftime of the AFC Championship Game and the reported pressure values for those footballs at the start of the game, we estimated the terms of the statistical model and reached several conclusions regarding the effects of study factors on pressure drop:

- The magnitudes of the pressure drop for Patriots footballs differs significantly from the magnitude of the pressure drop for Colts footballs.
- The magnitude of the pressure drop measured by the Logo and Non-Logo Gauges also differ significantly.
- For a given team, the pressure drop varies significantly among the footballs, based on the assumption of starting pressures of 12.5 psig and 13.0 psig, respectively.

Data Exactly as Listed on Game Day

For each effect in the statistical model, Table A-2 presents the estimated mean pressure drop, adjusted for other effects, and its associated standard error.

Table A-2. Estimated mean changes in pressure (psig) from the statistical model.

Effect	Team	Gauge	Estimate	Standard Error
Team	Colts	—	–0.4688	0.1815
Team	Patriots	—	–1.2023	0.1094
Gauge	—	A	–0.8830	0.1103
Gauge	—	B	–0.7881	0.1103
Team*Gauge	Colts	A	–0.3750	0.1890
Team*Gauge	Colts	B	–0.5625	0.1890
Team*Gauge	Patriots	A	–1.3909	0.1140
Team*Gauge	Patriots	B	–1.0136	0.1140

The main effect of team is estimated by the average change in pressure between the start of the game and halftime: –1.202 psig for the Patriots footballs as compared to only –0.469 psig for the Colts footballs. Therefore, the average drop in pressure measured for Patriots footballs was more than 0.7 psig greater than the average drop in pressure measured for Colts footballs. Note the difference in sample size between the two teams is accounted for in the estimated standard errors: the standard error of the Colts estimate (0.182 psig) is larger than that of the Patriots estimate (0.109 psig), because fewer Colts footballs were measured (4 vs. 11).

The interaction effect of team and gauge/official can be understood by noting that the average pressure drop for the Patriots footballs based on halftime measurements by Gauge/Official A was –1.391 psig versus an average drop of –1.014 psig based on halftime measurements by Gauge/Official B. In contrast, for the Colts footballs, the average pressure drop based on halftime measurements by Gauge/Official A was –0.375 psig versus an average drop of –0.563 psig based on halftime measurements by Gauge/Official B. This is a significant but anomalous result, which will be discussed later.

Table A-3 presents the supporting numerical results of the statistical analysis. The statistical significance of the team effect—i.e., the difference between the average pressure drops for Patriots and Colts footballs—is confirmed by its p-value, the last column in Table A-3. The p-value for the team effect is 0.004, meaning that a between-team difference in average pressure drop as large or larger than the 0.73 psig difference observed between the Patriots and Colts would occur by chance only 0.4% of the time. The convention in statistical applications is to declare a finding significant if the p-value is less than 0.05—i.e., there is less than a 5% probability of observing a finding of that magnitude by chance. Thus, the p-values reported in Table A-3 also confirm the statistical significance of the team/gauge interaction effect and the variation in pressure drops among footballs provided by an individual team.

Table A-3. Analysis of variance table for the statistical model (the team and football effects are statistically significant, as is the team/gauge interaction effect).

Source of Variation	Degrees of Freedom	Sequential Sum of Squares	Adjusted Sum of Squares	Adjusted Mean Square	F Statistic	P Value
Team	1	3.15659	3.15659	3.15659	11.98	0.004
Gauge	1	0.38533	0.05282	0.05282	2.37	0.147
Team*Gauge	1	0.46782	0.46782	0.46782	21.02	0.001
Football (Team)	13	3.42457	3.42457	0.26343	11.84	< 0.001
Error	13	0.28935	0.28935	0.02226		
Total	29	7.72367				

The standard deviation of a measured pressure is about 0.15 psig. The R-squared value is 0.96, indicating that 96% percent of the variation in pressure measurements in explained by the factors in the statistical model.

Applying the "Switch" of Gauges by Officials in between Patriots and Colts Measurements

According to information provided by Paul, Weiss, it appears that the officials switched gauges in between taking the Patriots and Colts measurements. When taking this switch into account, the data presented in Table A-4 shows the estimated mean pressure drop, adjusted for other effects, and its associated error. The team/gauge interaction effect is no longer statistically significant and is therefore dropped from the model for this and subsequent scenarios.

Table A-4. The estimated mean changes in pressure (psig) from the statistical model when applying the "Gauge Switch" theory only.

Effect	Team	Gauge	Estimate	Standard Error
Team	Colts	—	–0.469	0.1815
Team	Patriots	—	–1.202	0.1094
Gauge	—	Logo	–0.672	0.1097
Gauge	—	Non-Logo	–0.999	0.1097

The main effect of team is estimated by the average change in pressure between the start of the game and halftime: –1.202 psig for the Patriots footballs as compared to only –0.469 psig for the Colts footballs. Therefore, the average drop in pressure measured for Patriots footballs was more than 0.7 psig greater than the average drop in pressure measured for Colts footballs.

The gauge effect can be understood by noting that the average pressure drop based on halftime measurements using the Logo Gauge was –0.672 psig versus an average drop of –0.999 psig based on halftime measurements using the Non-Logo Gauge.

The supporting numerical results of the statistical analysis are presented in Table A-5. The statistical significance of the team effect—i.e., the difference between the average pressure drops for Patriots and Colts footballs—is confirmed by its p-value, the last column in Table A-5. The p-value for the team effect is 0.004, meaning that a between-team difference in average pressure drop as large or larger than the 0.73 psig difference observed between the Patriots and Colts would occur by chance only 0.4% of the time. The convention in statistical applications is to declare a finding significant if the p-value is less than 0.05—i.e., there is less than a 5% probability of observing a finding of that magnitude by chance. Thus, the p-values reported in Table A-5 also confirm the statistical significance of the gauge effect and the variation in pressure drops among footballs provided by an individual team.

Table A-5. Analysis of variance table for the statistical model, using the assumption of the gauges being switched by the officials.

Source of Variation	Degrees of Freedom	Sequential Sum of Squares	Adjusted Sum of Squares	Adjusted Mean Square	F Statistic	P Value
Team	1	3.15659	3.15659	3.15659	11.98	0.004
Football (Team)	13	3.42457	3.42457	0.26343	10.78	< 0.001
Gauge	1	0.80033	0.80033	0.80033	32.75	< 0.001
Error	14	0.34217	0.34217	0.02444		
Total	29	7.72367				

The standard deviation of a measured pressure is about 0.16 psig. The R-squared value is 0.96, indicating that 96% percent of the variation in pressure measurements in explained by the factors in the statistical model.

Applying "Switch" of Gauges and "Switch" of Colts Third Measurements

When taking into account the potential for (1) the gauges to have been switched by the game officials in between taking the Patriots and Colts measurements, and (2) the switching of the Colts third measurements, the data presented in Table A-6 shows the estimated mean pressure drop, adjusted for other effects, and its associated standard error.

Table A-6. The estimated mean changes in pressure (psig) from the statistical model when applying the "Switch" theories.

Effect	Team	Gauge	Estimate	Standard Error
Team	Colts	—	–0.469	0.1815
Team	Patriots	—	–1.202	0.1094
Gauge	—	Logo	–0.642	0.1062
Gauge	—	Non-Logo	–1.029	0.1062

The main effect of team is estimated by the average change in pressure between the start of the game and halftime: –1.202 psig for the Patriots footballs as compared to only –0.469 psig for the Colts footballs. Therefore, the average drop in pressure measured for Patriots footballs was more than 0.7 psig greater than the average drop in pressure measured for Colts footballs.

The gauge effect can be understood by noting that the average pressure drop based on halftime measurements using the Logo Gauge was –0.642 psig versus an average drop of –1.029 psig based on halftime measurements using the Non-Logo Gauge.

The supporting numerical results of the statistical analysis are presented in Table A-7. The statistical significance of the team effect—i.e., the difference between the average pressure drops for Patriots and Colts footballs—is confirmed by its p-value, the last column in Table A-7. The p-value for the team effect is 0.004, meaning that a between-team difference in average pressure drop as large or larger than the 0.73 psig difference observed between the Patriots and Colts would occur by chance only 0.4% of the time. The convention in statistical applications is to declare a finding significant if the p-value is less than 0.05—i.e., there is less than a 5% probability of observing a finding of that magnitude by chance. Thus, the p-values reported in Table A-7 also confirm the statistical significance of the gauge effect and the variation in pressure drops among footballs provided by an individual team.

Table A-7. Analysis of variance table for the statistical model (the team, gauge, and football effects are statistically significant).

Source of Variation	Degrees of Freedom	Sequential Sum of Squares	Adjusted Sum of Squares	Adjusted Mean Square	F Statistic	P Value
Team	1	3.15659	3.15659	3.15659	11.98	0.004
Football (Team)	13	3.42457	3.42457	0.26343	174.24	< 0.001
Gauge	1	1.12133	1.12133	1.12133	741.67	< 0.001
Error	14	0.02117	0.02117	0.00151		
Total	29	7.72367				

The standard deviation of a measured pressure is about 0.04 psig. The R-squared value is 0.997, indicating that 99.7% percent of the variation in pressure measurements in explained by the factors in the statistical model.

Discarding the Colts Third Measurement

Rather than assuming that the measurements recorded for Colts Ball 3 were switched, we have also conducted this analysis excluding those measurements altogether, once again assuming that the officials switched gauges in between the Patriots and Colts Measurements. Thus, we have applied our statistical model to the data with the Colts third measurement removed. The effects on the mean changes in pressure are shown in Table A-8.

Table A-8. The estimated mean changes in pressure (psig) from the statistical model when applying the Gauge Switch assumption and discarding the Colts third measurement.

Effect	Team	Gauge	Estimate	Standard Error
Team	Colts	—	–0.533	0.2149
Team	Patriots	—	–1.202	0.1122
Gauge	—	Logo	–0.677	0.1214
Gauge	—	Non-Logo	–1.059	0.1214

The main effect of team is estimated by the average change in pressure between the start of the game and halftime: –1.202 psig for the Patriots footballs as compared to only –0.533 psig for the Colts footballs. Therefore, the average drop in pressure measured for Patriots footballs was nearly 0.7 psig greater than the average drop in pressure measured for Colts footballs. Note the standard error of the Patriots estimate (0.112 psig) is little changed from the value in Table A-6 (0.109 psig), but the standard error of the Colts estimate increases (from 0.182 to 0.215 psig), because of the reduction (from 4 to 3) in the number of Colts footballs for which measurements were used in the data analysis.

The gauge effect can be understood by noting that the average pressure drop based on halftime measurements using the Logo Gauge was –0.677 psig versus an average drop of –1.059 psig based on halftime measurements using the Non-Logo Gauge.

The supporting numerical results of the statistical analysis are presented in Table A-9.

Table A-9. Analysis of variance table for the statistical model when applying the Gauge Switch assumption and discarding the Colts third measurement.

Source of Variation	Degrees of Freedom	Sequential Sum of Squares	Adjusted Sum of Squares	Adjusted Mean Square	F Statistic	P Value
Team	1	2.10955	2.10955	2.10955	7.61	0.017
Football (Team)	12	3.32447	3.32447	0.27704	189.38	< 0.001
Gauge	1	1.02223	1.02223	1.02223	698.77	< 0.001
Error	13	0.01902	0.01902	0.00146		
Total	27	6.47527				

It is found that the difference in pressure drops between the Patriots and Colts footballs remains statistically significant, albeit slightly less so (p-value of 0.017 compared to 0.004). The standard deviation of a measured pressure is about 0.04 psig. The R-squared value is 0.997, indicating that 99.7% percent of the variation in pressure measurements in explained by the factors in the statistical model.

Appendix 2

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May 6, 2015

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Subject: Ball Deflation Timing Investigation
Exponent Project No. 1500736.000

As requested by Paul, Weiss, Rifkind, Wharton & Garrison, LLP (Paul, Weiss), Exponent conducted an investigation of how quickly an individual can partially deflate 13 footballs, and what the magnitude of deflation would be, if the individual were to use only a standard air needle (inflation needle). The report below summarizes our activities and findings.

Experimental Procedure

Thirteen exemplar footballs of known initial pressure were placed into an equipment bag, which was provided by Paul, Weiss. The bag is believed to be similar, if not identical, to the bag used by the Patriots on day of the AFC Championship Game, which occurred on January 18, 2015. For Exponent's testing, an individual carried the bag into an enclosed room that measured 76 inches by 98 inches. The bag was initially completely zippered shut prior to entering the room. The door that was used to ingress/egress the room opened inwardly into the room, with a latching door lever. Once inside the room, the subject, who had possession of a standard inflation needle, closed the door and attempted to insert the needle into all 13 balls (such that a small amount of air was released) in as short a time period as possible. After partially deflating all 13 balls, the subject re-zippered the bag and exited the room, while holding the bag, from the same door in which he/she entered.

An electronic timer was used to measure the amount of time that elapsed during the entire procedure. The timer was started as the subject turned the door handle, and stopped after the subject had exited the room and closed the door. The pressure inside each football was measured at the conclusion of the test and compared to the initial pressure. The pressure measurements were performed with a calibrated pressure gauge.

Three subjects independently performed the above procedure. Each subject was allowed to practice the experimental procedure once. After this practice round, the experimental procedure was then performed by each individual again, with the entire process being timed.

Results

The table below summarizes the total time to deflate 13 footballs, and the pertinent statistics relating to the pressure drops for each subject. The average pressure drop for a given subject is calculated by adding up the pressure drop from each individual ball and dividing by the total number of balls. The minimum/maximum pressure drops equate to the smallest/largest pressure drop observed in the entire set of 13 footballs for a given subject.

Table 1. Summary of total deflation time and relevant statistical metrics for each of the three subjects

Subject No.	Time (sec)	Average Pressure Drop (psig)	Minimum Pressure Drop (psig)	Maximum Pressure Drop (psig)	Standard Deviation
1	71	0.762	0.623	0.923	0.089
2	61	0.772	0.601	0.974	0.104
3	70	0.747	0.652	0.932	0.081

The complete data for each of the three subjects is shown in Table 2 through Table 4.

Table 2. Initial and final pressures for Subject 1

Ball ID	Initial Pressure	Final Pressure	Pressure Change
1	12.500	11.806	0.694
2	12.500	11.741	0.759
3	12.500	11.795	0.705
4	12.500	11.714	0.786
5	12.500	11.877	0.623
6	12.500	11.797	0.703
7	12.500	11.688	0.812
8	12.500	11.864	0.636
9	12.500	11.730	0.770
10	12.500	11.577	0.923
11	12.500	11.682	0.818
12	12.500	11.744	0.756
13	12.500	11.585	0.915

Table 3. Initial and final pressures for Subject 2

Ball ID	Initial Pressure	Final Pressure	Pressure Change
1	12.500	11.816	0.684
2	12.500	11.740	0.760
3	12.500	11.651	0.849
4	12.500	11.801	0.699
5	12.500	11.730	0.770
6	12.500	11.708	0.792
7	12.500	11.532	0.968
8	12.500	11.833	0.667
9	12.500	11.526	0.974
10	12.500	11.734	0.766
11	12.500	11.779	0.721
12	12.500	11.721	0.779
13	12.500	11.899	0.601

Table 4. Initial and final pressures for Subject 3

Ball ID	Initial Pressure	Final Pressure	Pressure Change
1	12.500	11.779	0.721
2	12.500	11.636	0.864
3	12.500	11.773	0.727
4	12.500	11.698	0.802
5	12.500	11.836	0.664
6	12.500	11.568	0.932
7	12.500	11.827	0.673
8	12.500	11.792	0.708
9	12.500	11.848	0.652
10	12.500	11.760	0.740
11	12.500	11.844	0.656
12	12.500	11.717	0.783
13	12.500	11.717	0.783

Conclusions

With minimal training (a single practice run), it is possible for an individual using a standard sports ball inflation needle to perform the following in approximately 60-70 seconds: open a door and enter a room, close the door, open a zippered bag containing 13 footballs, insert the needle into all

footballs releasing a small amount of air from each, close and zipper the bag containing the footballs, and leave the room through the door, closing the door behind.

Limitations

At the request of Paul, Weiss, Rifkind, Wharton & Garrison, LLP (Paul, Weiss), Exponent investigated the amount of time required to partially deflate 13 footballs. The scope of services performed during this investigation may not adequately address the needs of other users of this report, and any reuse of this report or its findings, conclusions, or recommendations is at the sole risk of the user. The opinions and comments formulated during this investigation are based on observations and information available at the time of the investigation.

The findings presented herein are made to a reasonable degree of engineering and scientific certainty.