National Bureau of Standards
Library, N.W. Bldg
SEP 8 1964

Central Radio Propagation Laboratory

IONOSPHERIC PREDICTIONS

*for
December
1964*

TB 11-499-21/TO 31-3-28

U. S. DEPARTMENT of COMMERCE
National Bureau of Standards
Number 21/Issued September 1964

U.S. DEPARTMENT OF COMMERCE

Luther H. Hodges, Secretary

NATIONAL BUREAU OF STANDARDS

A. V. Astin, Director

Central Radio Propagation Laboratory

Ionospheric Predictions

for December 1964

Number 21

Issued

September 1964

[Formerly "Basic Radio Propagation Predictions," CRPL Series D.]

The CRPL Ionospheric Predictions are issued monthly as an aid in determining the best sky-wave frequencies over any transmission path, at any time of day, for average conditions for the month. Issued three months in advance, each issue provides tables

of numerical coefficients that define the functions describing the predicted worldwide distribution of foF2 and M(3000)F2 and maps for each even hour of universal time of MUF(Zero)F2 and MUF(4000)F2.

NOTE: Department of Defense personnel see back cover.

Use of funds for printing this publication approved by the Director of the Bureau of the Budget (June 19, 1961).

For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C., 20402. Price 15 cents.

Annual subscription (12 issues) \$1.50 (50 cents additional for foreign mailing).

National Bureau of Standards

The functions of the National Bureau of Standards are set forth in an Act of Congress, March 3, 1901, as amended. These include the development and maintenance of the national standards of measurement and the provision of means and methods for making measurements consistent with these standards; the determination of physical constants and properties of materials; the development of methods and instruments for testing materials, devices, and structures; advisory services to government agencies on scientific and tech-

nical problems; invention and development of devices to serve special needs of the Government; and the development of standard practices, codes, and specifications. The work includes basic and applied research, development, engineering, instrumentation, testing, evaluation, calibration services, and various consultation and information services. The Bureau also serves as the Federal technical research center in a number of specialized fields.

Central Radio Propagation Laboratory

The Central Radio Propagation Laboratory at Boulder, Colorado, is the central agency of the Federal Government for the collection, analysis, and dissemination of information on propagation of radio waves at all frequencies along the surface of the earth, in the atmosphere, and in space, and performs scientific studies looking toward new techniques for the efficient use and conservation of the radio spectrum. To carry out this responsibility, the CRPL—

1. Acts as the central agency for the conduct of basic research on the nature of radio waves, the pertinent properties of the media through which radio waves are transmitted, the interaction of radio waves with those media, and on the nature of radio noise and interference effects. This includes compilation of reports by other foreign and domestic agencies conducting research in this field and furnishing advice to government and nongovernment groups conducting propagation research.

2. Performs studies of specific radio propagation mechanisms and performs scientific studies looking

toward the development of techniques for efficient use and conservation of the radiofrequency spectrum as part of its regular program or as requested by other government agencies. In an advisory capacity, coordinates studies in this area undertaken by other government agencies.

3. Furnishes advisory and consultative service on radio wave propagation, on radiofrequency utilization, and on radio systems problems to other organizations within the United States, public and private.

4. Prepares and issues predictions of radio wave propagation and noise conditions and warnings of disturbances in these conditions.

5. Acts as a central repository for data, reports, and information in the field of radio wave propagation.

6. Performs scientific liaison and exchanges data and information with other countries to advance knowledge of radio wave propagation and interference phenomena and spectrum conservation techniques, including that liaison required by international responsibilities and agreements.

Introduction

The "Central Radio Propagation Laboratory Ionospheric Predictions" is the successor to the former "Basic Radio Propagation Predictions," CRPL Series D. To make effective use of these predictions, National Bureau of Standards Handbook 90, "Handbook for CRPL Ionospheric Predictions Based on Numerical Methods of Mapping," should be obtained from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C., 20402, price 40 cents. This Handbook includes required additional data, nomographs and graphical aids, as well as methods for the use of the predictions. The Handbook supersedes the obsolete NBS Circular 465.

The basic prediction appears in tables 1 and 2, presenting predicted coefficients for foF2 and M(3000)F2 defining the numerical map functions describing the predicted worldwide variation of these characteristics. With additional auxiliary information, these coefficients may be used as input data for electronic computer programs solving specific high frequency propagation problems. The basic equations, their interpretation, and methods of using the numerical maps are described in two papers by W. B. Jones and R. M. Gallet, "The Representation of Diurnal and Geographic Variations of Ionospheric Data by Numerical Methods," Volume 66D, Number 4, July-August 1962, pages 419-438, and "Methods for Applying Numerical Maps of Ionospheric Characteristics," Volume 66D, Number 6, November-December 1962, pages 649-662, both in the Journal of Research of the National Bureau of Standards, Section D. Radio Propagation. The predicted numerical map coefficients of tables 1 and 2 may be purchased in the form of a tested set of punched cards. Write to the Prediction Services Section, Central Radio Propagation Laboratory, National Bureau of Standards, Boulder, Colorado, to arrange for the purchase of the set of punched cards and for further information and assistance in the application of computer methods and numerical prediction maps to specific propagation problems.

The graphical prediction maps, derived from the basic prediction, are provided for those unable to make use of an electronic computer. Figures 1 to 12 present world maps of MUF (Zero) F2 and MUF(4000)F2 for each even hour of universal time. Figures 13 to 16 present the same predictions for hours 00 and 12 universal time for the North and South Polar areas. Predicted polar maps for each even hour of universal time may be obtained by special arrangements with the Central Radio Propagation Laboratory. Handbook 90 describes methods for including regular E-F1 propagation. Figure A is a graph of predicted and observed Zürich sunspot numbers which shows the recent trend of solar activity. Table A lists observed and predicted Zürich smoothed relative sunspot numbers and includes the sunspot number used for the current prediction.

Members of the U.S. Army, Navy, or Air Force desiring the Handbook and the Ionospheric Predictions should send requests to the proper service address; for the Navy: The Director, Naval Communications, Department of the Navy, Washington, D.C., 20350; for the Air Force: Directorate of Command Control and Communications, Headquarters, United States Air Force, Washington, D.C., 20330. Attention: AFOCCAA. Army personnel should refer to the Handbook as TM-11-499 and to the monthly predictions as TB 11-499-(), predictions for the month of December 1964 being distributed in September 1964 and designated TB 11-499-(21), and should requisition these through normal publication channels.

Information concerning the theory of radio wave propagation and such important problems as absorption, field intensity, lowest useful high frequencies, etc., is given in National Bureau of Standards Circular 462, "Ionospheric Radio Propagation." A revised work is in preparation which will be announced in the Ionospheric Prediction series when available. Additional information about radio noise may be found in C.C.I.R. Report Number 65, "Revision of Atmospheric Noise Data," International Telecommunication Union, Geneva, 1957.

Reports to this Laboratory of experience with these predictions would be appreciated. Correspondence should be addressed to the Prediction Services Section, Central Radio Propagation Laboratory, National Bureau of Standards, Boulder, Colorado.

NOTE: The MUF(ZERO)F2 values of figures 1A through 12A were derived by adding one-half the gyrofrequency to the foF2 calculated by use of the predicted coefficients in table 1. The error introduced by this approximation is generally not important compared to other uncertainties in the predictions, and is significant only when the foF2 is near or below the gyrofrequency. If more precise values of predicted fxF2 are desired, the theoretical relationships should be applied to the foF2 values calculated by the coefficients in table 1.

Table A

Observed and Predicted Zurich Smoothed Relative
Sunspot Numbers

Month	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1952	43 (53)	42 (51)	39 (52)	36 (52)	34 (52)	32 (52)	31 (51)	29 (49)	28 (46)	28 (43)	27 (38)	26 (33)
1953	24 (30)	22 (29)	20 (27)	19 (24)	17 (22)	15 (21)	13 (20)	12 (18)	11 (18)	10 (17)	9 (16)	7 (15)
1954	6 (14)	6 (12)	4 (11)	3 (10)	4 (10)	4 (9)	5 (8)	7 (8)	8 (8)	8 (10)	10 (10)	12 (11)
1955	14 (12)	16 (14)	20 (14)	23 (13)	29 (16)	35 (18)	40 (22)	46 (27)	55 (30)	64 (31)	73 (35)	81 (42)
1956	89 (48)	98 (53)	109 (60)	119 (68)	127 (77)	137 (89)	146 (95)	150 (105)	151 (119)	156 (135)	160 (147)	164 (150)
1957	170 (150)	172 (150)	174 (150)	181 (150)	186 (150)	188 (150)	191 (150)	194 (150)	197 (150)	200 (150)	201 (150)	200 (150)
1958	199 (150)	201 (150)	201 (150)	197 (150)	191 (150)	187 (150)	185 (150)	185 (150)	184 (150)	182 (150)	181 (150)	180 (150)
1959	179 (150)	177 (150)	174 (150)	169 (150)	165 (146)	161 (143)	156 (141)	151 (142)	146 (141)	141 (139)	137 (137)	132 (137)
1960	129 (136)	125 (135)	122 (133)	120 (130)	117 (125)	114 (120)	109 (118)	102 (115)	98 (110)	93 (108)	88 (105)	84 (100)
1961	80 (100)	75 (90)	69 (90)	64 (90)	60 (85)	56 (85)	53 (80)	52 (75)	52 (70)	51 (70)	50 (65)	49 (60)
1962	45 (60)	42 (50)	40 (48)	39 (45)	39 (42)	38 (37)	37 (34)	35 (31)	33 (29)	31 (28)	30 (27)	30 (34)
1963	29 (31)	30 (28)	30 (26)	29 (25)	29 (25)	28 (25)	28 (23)	27 (21)	27 (20)	26 (18)	23 (18)	21 (17)
1964	(17)	(17)	(17)	(17)	(17)	(17)	(17)	(17)	(17.5)	(17.3)	(17.0)	(17.0)

Note: Final numbers are listed through June 1963, the succeeding values being based on provisional data. The predicted numbers are in parentheses.

* Number used for predictions in this issue.

FIG. A. PREDICTED AND OBSERVED SUNSPOT NUMBERS

TABLE I

TIME VARIATION

Harmonic	0	1	2	3	4	5	6	7	8
K	S	1	2	3	4	5	6	7	8
I	0	1-8225745E 00	1-9578359E 00	-6-5832752E-01	1-4065070E-01	-1-329910E-01	-4-1582128E-01	1-8923635E-01	-1-6659020E-01
1	0	-1-3668815E 00	5-0464315E-01	-5-6980441E-01	-1-3810913E 00	-1-3810913E 00	-4-1582128E-01	1-8923635E-01	-1-6659020E-01
2	0	-2-5935473E 00	1-4486670E 00	8-2184262E 00	5-5928280E 00	-2-162754E 00	-1-1907195E 00	-2-5301954E-01	-2-7630032E-01
3	0	1-2196110E 01	1-6056838E 01	1-9531052E 01	1-6059960E 01	1-0403469E 01	1-6172216E 01	-9-4820751E-01	3-2028974E-01
4	0	-7-2540872E 01	-6-7314248E 01	-5-6347160E 01	-4-5649951E 01	-1-7750432E 01	1-7730432E 01	1-17222656E 00	2-8043915E 00
5	0	-6-6600443E 01	-6-2555008E 01	-1-3551333E 02	-4-0497709E 02	-3-2517440E 01	-6-4845813E 01	1-1553742E 00	2-3057002E 01
6	0	2-1953212E 02	1-0395572E 02	-1-0011572E 02	7-3384143E 01	-7-3384143E 01	-8-7834455E 01	8-9727856E 00	1-6787284E 01
7	0	2-1953212E 02	1-0395572E 02	-1-0011572E 02	7-3384143E 01	-7-3384143E 01	-8-7834455E 01	8-9727856E 00	1-6787284E 01
8	0	-4-5718226E 02	-2-5810527E 02	-2-5810527E 02	-4-5718226E 02	-4-5718226E 02	-4-5718226E 02	-2-6630825E 00	-5-9603840E 01
9	0	-1-3949590E 02	-2-7651302E 02	-2-7651302E 02	-1-3949590E 02	-1-3949590E 02	-1-3949590E 02	-5-11994704E 01	5-9721523E 01
10	0	2-7651302E 02	2-7651302E 02	2-7651302E 02	2-7651302E 02	2-7651302E 02	2-7651302E 02	5-11994704E 01	5-9721523E 01
11	0	8-2287381E 01	1-3671745E 01	-6-7236356E 02	3-3786431E 01	-1-0942730E 02	-3-3864772E 01	-2-86813500E 01	4-2999876E 01
12	0	-7-0653170E 01	5-9099361E 01	5-2367730E 01	-7-3825861E-01	3-3806921E 01	1-2699980E 01	-1-5757523E 01	-1-5757523E 01
II	0	-2-9677138E-02	-1-9373887E-02	9-3276012E-03	1-7364255E-01	7-2930449E-02	9-2277369E-02	-8-5925542E-02	-1-3048451E-02
13	0	-1-7278131E-01	-2-2960154E-01	9-3276012E-03	-7-770944E-01	1-4278768E-01	2-1977371E-01	-8-0282952E-02	-5-5984034E-02
14	0	-3-9142778E 00	-8-9083160E-01	7-1095512E-01	-4-6678450E-01	3-9675406E-01	3-1875750E-01	5-9408196E-01	1-0146357E-01
15	0	-3-9142778E 00	-8-9083160E-01	7-1095512E-01	-4-6678450E-01	3-9675406E-01	3-1875750E-01	5-9408196E-01	1-0146357E-01
16	0	-3-9142778E 00	-8-9083160E-01	7-1095512E-01	-4-6678450E-01	3-9675406E-01	3-1875750E-01	5-9408196E-01	1-0146357E-01
17	0	-6-5203759E-01	-1-3968870E 00	-3-0434667E 00	-3-0434667E 00	-6-5346071E-01	-1-0795942E 00	1-0456132E 00	4-2448779E 00
18	0	-6-5203759E-01	-1-3968870E 00	-3-0434667E 00	-3-0434667E 00	-6-5346071E-01	-1-0795942E 00	1-0456132E 00	4-2448779E 00
19	0	-6-5203759E-01	-1-3968870E 00	-3-0434667E 00	-3-0434667E 00	-6-5346071E-01	-1-0795942E 00	1-0456132E 00	4-2448779E 00
20	0	-6-5203759E-01	-1-3968870E 00	-3-0434667E 00	-3-0434667E 00	-6-5346071E-01	-1-0795942E 00	1-0456132E 00	4-2448779E 00
21	0	-6-5203759E-01	-1-3968870E 00	-3-0434667E 00	-3-0434667E 00	-6-5346071E-01	-1-0795942E 00	1-0456132E 00	4-2448779E 00
22	0	-6-5203759E-01	-1-3968870E 00	-3-0434667E 00	-3-0434667E 00	-6-5346071E-01	-1-0795942E 00	1-0456132E 00	4-2448779E 00
23	0	-6-5203759E-01	-1-3968870E 00	-3-0434667E 00	-3-0434667E 00	-6-5346071E-01	-1-0795942E 00	1-0456132E 00	4-2448779E 00
24	0	-6-5203759E-01	-1-3968870E 00	-3-0434667E 00	-3-0434667E 00	-6-5346071E-01	-1-0795942E 00	1-0456132E 00	4-2448779E 00
25	0	-6-5203759E-01	-1-3968870E 00	-3-0434667E 00	-3-0434667E 00	-6-5346071E-01	-1-0795942E 00	1-0456132E 00	4-2448779E 00
26	0	-6-5203759E-01	-1-3968870E 00	-3-0434667E 00	-3-0434667E 00	-6-5346071E-01	-1-0795942E 00	1-0456132E 00	4-2448779E 00
27	0	-6-5203759E-01	-1-3968870E 00	-3-0434667E 00	-3-0434667E 00	-6-5346071E-01	-1-0795942E 00	1-0456132E 00	4-2448779E 00
28	0	-6-5203759E-01	-1-3968870E 00	-3-0434667E 00	-3-0434667E 00	-6-5346071E-01	-1-0795942E 00	1-0456132E 00	4-2448779E 00
29	0	-6-5203759E-01	-1-3968870E 00	-3-0434667E 00	-3-0434667E 00	-6-5346071E-01	-1-0795942E 00	1-0456132E 00	4-2448779E 00
30	0	-6-5203759E-01	-1-3968870E 00	-3-0434667E 00	-3-0434667E 00	-6-5346071E-01	-1-0795942E 00	1-0456132E 00	4-2448779E 00
31	0	-6-5203759E-01	-1-3968870E 00	-3-0434667E 00	-3-0434667E 00	-6-5346071E-01	-1-0795942E 00	1-0456132E 00	4-2448779E 00
32	0	-6-5203759E-01	-1-3968870E 00	-3-0434667E 00	-3-0434667E 00	-6-5346071E-01	-1-0795942E 00	1-0456132E 00	4-2448779E 00
33	0	-6-5203759E-01	-1-3968870E 00	-3-0434667E 00	-3-0434667E 00	-6-5346071E-01	-1-0795942E 00	1-0456132E 00	4-2448779E 00
34	0	-6-5203759E-01	-1-3968870E 00	-3-0434667E 00	-3-0434667E 00	-6-5346071E-01	-1-0795942E 00	1-0456132E 00	4-2448779E 00
35	0	-6-5203759E-01	-1-3968870E 00	-3-0434667E 00	-3-0434667E 00	-6-5346071E-01	-1-0795942E 00	1-0456132E 00	4-2448779E 00
36	0	-6-5203759E-01	-1-3968870E 00	-3-0434667E 00	-3-0434667E 00	-6-5346071E-01	-1-0795942E 00	1-0456132E 00	4-2448779E 00
37	0	-6-5203759E-01	-1-3968870E 00	-3-0434667E 00	-3-0434667E 00	-6-5346071E-01	-1-0795942E 00	1-0456132E 00	4-2448779E 00
38	0	-6-5203759E-01	-1-3968870E 00	-3-0434667E 00	-3-0434667E 00	-6-5346071E-01	-1-0795942E 00	1-0456132E 00	4-2448779E 00
III	0	-1-6661004E-01	-2-7916180E-02	-2-6514159E-01	9-9110409E-03	-5-5022627E-02	1-7714125E-02	-5-3697280E-03	-2-1774078E-02
39	0	-1-6661004E-01	-2-7916180E-02	-2-6514159E-01	9-9110409E-03	-5-5022627E-02	1-7714125E-02	-5-3697280E-03	-2-1774078E-02
40	0	-1-6661004E-01	-2-7916180E-02	-2-6514159E-01	9-9110409E-03	-5-5022627E-02	1-7714125E-02	-5-3697280E-03	-2-1774078E-02
41	0	-1-6661004E-01	-2-7916180E-02	-2-6514159E-01	9-9110409E-03	-5-5022627E-02	1-7714125E-02	-5-3697280E-03	-2-1774078E-02
42	0	-1-6661004E-01	-2-7916180E-02	-2-6514159E-01	9-9110409E-03	-5-5022627E-02	1-7714125E-02	-5-3697280E-03	-2-1774078E-02
43	0	-1-6661004E-01	-2-7916180E-02	-2-6514159E-01	9-9110409E-03	-5-5022627E-02	1-7714125E-02	-5-3697280E-03	-2-1774078E-02
44	0	-1-6661004E-01	-2-7916180E-02	-2-6514159E-01	9-9110409E-03	-5-5022627E-02	1-7714125E-02	-5-3697280E-03	-2-1774078E-02
45	0	-1-6661004E-01	-2-7916180E-02	-2-6514159E-01	9-9110409E-03	-5-5022627E-02	1-7714125E-02	-5-3697280E-03	-2-1774078E-02
46	0	-1-6661004E-01	-2-7916180E-02	-2-6514159E-01	9-9110409E-03	-5-5022627E-02	1-7714125E-02	-5-3697280E-03	-2-1774078E-02
47	0	-1-6661004E-01	-2-7916180E-02	-2-6514159E-01	9-9110409E-03	-5-5022627E-02	1-7714125E-02	-5-3697280E-03	-2-1774078E-02
48	0	-1-6661004E-01	-2-7916180E-02	-2-6514159E-01	9-9110409E-03	-5-5022627E-02	1-7714125E-02	-5-3697280E-03	-2-1774078E-02
49	0	-1-6661004E-01	-2-7916180E-02	-2-6514159E-01	9-9110409E-03	-5-5022627E-02	1-7714125E-02	-5-3697280E-03	-2-1774078E-02
50	0	-1-6661004E-01	-2-7916180E-02	-2-6514159E-01	9-9110409E-03	-5-5022627E-02	1-7714125E-02	-5-3697280E-03	-2-1774078E-02
51	0	-1-6661004E-01	-2-7916180E-02	-2-6514159E-01	9-9110409E-03	-5-5022627E-02	1-7714125E-02	-5-3697280E-03	-2-1774078E-02
52	0	-1-6661004E-01	-2-7916180E-02	-2-6514159E-01	9-9110409E-03	-5-5022627E-02	1-7714125E-02	-5-3697280E-03	-2-1774078E-02

GEOGRAPHICAL

VARIATION

Harmonic	5	
	K	S
I	0	8.2394387E-02
	1	1.8124202E-01
	2	-3.1908805E-01
	3	-2.0587619E-01
	4	2.3600399E-01

Harmonic	5	6	7	8	
K	S	9	10	11	
I	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
1	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
2	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
3	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
4	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
5	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
6	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
7	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
8	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
9	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
10	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
11	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
12	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
13	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
14	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
15	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
16	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
17	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
18	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
19	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
20	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
21	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
22	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
23	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
24	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
25	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
26	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
27	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
28	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
29	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
30	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
31	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
32	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
33	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
34	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
35	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
36	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
37	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
38	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
39	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
40	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
41	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
42	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
43	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
44	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
45	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
46	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
47	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
48	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
49	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
50	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
51	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
52	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
53	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
54	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
55	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
56	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
57	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
58	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
59	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
60	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
61	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
62	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
63	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
64	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
65	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
66	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
67	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
68	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
69	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
70	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
71	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
72	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
73	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
74	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
75	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
76	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
77	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
78	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
79	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
80	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
81	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
82	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
83	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
84	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
85	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
86	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
87	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
88	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
89	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
90	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
91	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
92	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
93	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
94	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
95	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
96	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
97	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
98	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
99	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
100	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02

Harmonic	5	6	7	8	
K	S	9	10	11	
I	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
1	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
2	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
3	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02
4	0	8-2394387E-01	2-1338480E-01	-5-7763303E-02	-1-5178883E-02

I - Main latitudinal variation. Mixed latitudinal and longitudinal variation: II - First order in longitude, III - Second order in longitude
 Notation: For each entry the number given by the first eight digits and sign is multiplied by the power of ten defined by the last two digits and sign.

PREDICTED COEFFICIENTS D_{SK} DEFINING THE FUNCTION $\Gamma(\lambda, \theta, t)$ FOR MONTHLY MEDIAN $f_0 F_2$ (Mc/s)

NECFMREF 1964

TIME VARIATION

TABLE 2
TIME VARIATION

Harmonic	0		1		2		3		4		5		6			
	K	S	1		2		3		4		5		6			
I	0	2.9907983E 00	-9.9433633E-02	-2.6064568E-01	3.3580967E-02	-9.1976889E-02	3.9967059E-02	-2.4825942E-02	-9.1976889E-02	3.9967059E-02	-2.4825942E-02	-9.1976889E-02	3.9967059E-02	-2.4825942E-02		
	1	4.9437196E-01	1.4059814E-01	2.0444930E-02	1.3294449E-02	5.9235837E-03	-2.8245941E-01	-3.5772433E-02	5.9235837E-03	-2.8245941E-01	-3.5772433E-02	5.9235837E-03	-2.8245941E-01	-3.5772433E-02		
	2	1.9235049E-01	9.8427118E-01	2.2866386E 00	1.5683553E-01	-6.0266898E-02	7.3670822E-01	-3.3504204E-01	-6.0266898E-02	7.3670822E-01	-3.3504204E-01	-6.0266898E-02	7.3670822E-01	-3.3504204E-01		
	3	-7.1000417E-01	-7.6766841E-01	1.2059450E 00	-3.6347121E-01	-2.7224339E-02	1.3294449E-02	2.0258305E-02	-2.7224339E-02	1.3294449E-02	2.0258305E-02	-2.7224339E-02	1.3294449E-02	2.0258305E-02		
	4	-5.6848781E-01	-2.5684853E 00	-4.3865354E 00	-1.499381E 00	6.3073468E-01	2.5137738E 00	1.4680460E 00	6.3073468E-01	2.5137738E 00	1.4680460E 00	6.3073468E-01	2.5137738E 00	1.4680460E 00		
	5	1.5406171E-01	1.4290032E 00	-2.1787997E 00	7.3449917E-01	3.194275E-01	-1.8321422E 00	6.2432126E-02	3.194275E-01	-1.8321422E 00	6.2432126E-02	3.194275E-01	-1.8321422E 00	6.2432126E-02		
	6	6.1955078E 00	2.8635139E 00	3.2975185E 00	1.7710252E 00	-6.2287078E-01	8.2033893E-01	-1.8500097E 00	-6.2287078E-01	8.2033893E-01	-1.8500097E 00	-6.2287078E-01	8.2033893E-01	-1.8500097E 00		
	7	1.2699893E-01	-7.7871723E-01	1.0479692E 00	-3.7646503E-01	3.1970307E-01	1.4295591E 00	-4.1771966E-02	3.1970307E-01	1.4295591E 00	-4.1771966E-02	3.1970307E-01	1.4295591E 00	-4.1771966E-02		
8	-2.3463257E 00	-1.1653255E 00	-8.9917352E-01	-8.0149919E-01	1.6293211E-01	1.4295591E 00	7.6265216E-01	1.6293211E-01	1.4295591E 00	7.6265216E-01	1.6293211E-01	1.4295591E 00	7.6265216E-01			
II	9	-5.4306836E-03	-1.3339810E-02	2.7233768E-02	2.7233768E-02	-1.5201424E-02	1.7919448E-02	-7.5624312E-04	-1.5201424E-02	1.7919448E-02	-7.5624312E-04	-1.5201424E-02	1.7919448E-02	-7.5624312E-04		
	10	-1.2500402E-01	-4.6379781E-02	-4.5309170E-02	-4.5309170E-02	-1.7636383E-02	1.1801973E-02	8.9765214E-03	-1.7636383E-02	1.1801973E-02	8.9765214E-03	-1.7636383E-02	1.1801973E-02	8.9765214E-03		
	11	1.0899830E-01	1.0198856E-01	1.0198856E-01	1.0198856E-01	3.6324521E-02	1.5804032E-01	4.3266073E-02	3.6324521E-02	1.5804032E-01	4.3266073E-02	3.6324521E-02	1.5804032E-01	4.3266073E-02		
	12	-2.4879318E-01	-2.5876032E-01	-9.4941660E-01	-9.4941660E-01	4.3763064E-02	-8.9469522E-02	8.6124773E-02	4.3763064E-02	-8.9469522E-02	8.6124773E-02	4.3763064E-02	-8.9469522E-02	8.6124773E-02		
	13	-1.2053116E-01	1.130027E-01	3.0797845E-01	3.0797845E-01	1.7240971E-01	1.1786614E-01	3.7464312E-01	1.7240971E-01	1.1786614E-01	3.7464312E-01	1.7240971E-01	1.1786614E-01	3.7464312E-01		
	14	1.3244826E 00	7.662913E-01	2.1997126E-01	2.1997126E-01	2.6884388E-01	-2.8130924E-01	-1.0637405E-01	2.6884388E-01	-2.8130924E-01	-1.0637405E-01	2.6884388E-01	-2.8130924E-01	-1.0637405E-01		
	15	-3.1634918E-01	8.1761240E-01	-2.9637765E-01	-2.9637765E-01	-1.680421E-01	-8.2136256E-01	4.5775428E-02	-1.680421E-01	-8.2136256E-01	4.5775428E-02	-1.680421E-01	-8.2136256E-01	4.5775428E-02		
	16	1.2338351E 00	1.7948560E 00	6.0490451E 00	6.0490451E 00	5.7982444E-02	2.5777716E-01	-6.3187820E-01	5.7982444E-02	2.5777716E-01	-6.3187820E-01	5.7982444E-02	2.5777716E-01	-6.3187820E-01		
17	9.5968455E-01	1.3638264E 00	5.373740E-01	5.373740E-01	-2.9047105E-01	-1.9118655E-01	-1.7449834E 00	-2.9047105E-01	-1.9118655E-01	-1.7449834E 00	-2.9047105E-01	-1.9118655E-01	-1.7449834E 00			
18	-4.1279312E-02	-3.0911134E 00	4.6626702E-01	4.6626702E-01	-2.1699523E 00	1.3745223E 00	6.8906762E 00	-2.1699523E 00	1.3745223E 00	6.8906762E 00	-2.1699523E 00	1.3745223E 00	6.8906762E 00			
19	1.8327392E-01	-1.9289053E 00	5.6739507E-01	5.6739507E-01	8.1466303E-01	1.4318811E 00	2.5193036E-01	8.1466303E-01	1.4318811E 00	2.5193036E-01	8.1466303E-01	1.4318811E 00	2.5193036E-01			
20	-1.9895628E 00	3.4656352E 00	1.1204107E 01	1.1204107E 01	-2.5162179E-01	-3.8332721E-01	1.0423870E 00	-2.5162179E-01	-3.8332721E-01	1.0423870E 00	-2.5162179E-01	-3.8332721E-01	1.0423870E 00			
21	-1.9789157E 00	-3.0661088E 00	1.3350926E-01	1.3350926E-01	7.3446670E-02	1.2431639E 00	2.3877973E 00	7.3446670E-02	1.2431639E 00	2.3877973E 00	7.3446670E-02	1.2431639E 00	2.3877973E 00			
22	4.9850870E 00	4.3937372E 00	-2.6062634E 00	-2.6062634E 00	4.3761554E 00	-2.4117808E 00	-2.2185594E 00	4.3761554E 00	-2.4117808E 00	-2.2185594E 00	4.3761554E 00	-2.4117808E 00	-2.2185594E 00			
23	1.7823818E-02	1.1771035E 00	-4.7519730E-01	-4.7519730E-01	-4.0835921E-01	7.6637651E-01	-2.7187347E-01	-4.0835921E-01	7.6637651E-01	-2.7187347E-01	-4.0835921E-01	7.6637651E-01	-2.7187347E-01			
24	1.0339895E 00	2.0999289E 00	6.6101913E 00	6.6101913E 00	1.6757894E-01	2.6461702E-01	-5.0442336E-01	1.6757894E-01	2.6461702E-01	-5.0442336E-01	1.6757894E-01	2.6461702E-01	-5.0442336E-01			
25	1.2196901E 00	1.9367501E 00	-2.3477801E-01	-2.3477801E-01	7.2538750E-02	-1.0356908E 00	-9.9664662E-01	7.2538750E-02	-1.0356908E 00	-9.9664662E-01	7.2538750E-02	-1.0356908E 00	-9.9664662E-01			
26	-2.1683851E 00	-2.0493952E 00	2.0593062E 00	2.0593062E 00	-2.4687634E 00	1.4223016E 00	1.2963474E 00	-2.4687634E 00	1.4223016E 00	1.2963474E 00	-2.4687634E 00	1.4223016E 00	1.2963474E 00			
III	27	-5.0627127E-02	-1.2293288E-02	-1.6814474E-02	-1.6814474E-02	1.2722240E-02	2.9995051E-03	5.7692587E-03	1.2722240E-02	2.9995051E-03	5.7692587E-03	1.2722240E-02	2.9995051E-03	5.7692587E-03		
	28	-3.0764014E-02	-1.9730802E-02	-1.9034817E-03	-1.9034817E-03	-5.9782153E-03	6.9619126E-03	4.8379377E-03	-5.9782153E-03	6.9619126E-03	4.8379377E-03	-5.9782153E-03	6.9619126E-03	4.8379377E-03		
	29	-1.0414192E-01	-4.6151045E-02	-9.4849755E-02	-9.4849755E-02	2.0999584E-02	-8.7125341E-02	1.3259326E-02	2.0999584E-02	-8.7125341E-02	1.3259326E-02	2.0999584E-02	-8.7125341E-02	1.3259326E-02		
	30	1.1341843E-01	-6.3420434E-02	-1.7943815E-02	-1.7943815E-02	2.7694315E-02	-8.7954609E-02	-2.5171486E-02	-6.3420434E-02	-1.7943815E-02	-8.7954609E-02	-2.5171486E-02	-6.3420434E-02	-1.7943815E-02		
	31	1.9509924E-01	1.2080710E-02	1.6716050E-01	1.6716050E-01	-6.2541554E-03	-2.7603588E-02	-1.4103678E-02	1.2080710E-02	1.6716050E-01	-6.2541554E-03	-2.7603588E-02	-1.4103678E-02	-1.4103678E-02		
	32	4.8400509E-02	1.2768343E-01	-3.5588334E-02	-3.5588334E-02	-2.0278560E-03	3.3867185E-04	-5.8167825E-03	-2.0278560E-03	3.3867185E-04	-5.8167825E-03	-2.0278560E-03	3.3867185E-04	-5.8167825E-03		
	33	2.5325946E-01	1.6103575E-01	2.6017449E-01	2.6017449E-01	-3.0649798E-03	1.0357207E-01	-3.5510549E-02	1.6103575E-01	2.6017449E-01	-3.0649798E-03	1.0357207E-01	-3.5510549E-02	-3.5510549E-02		
	34	-2.6536983E-01	1.9694053E-01	-2.0958042E-03	-2.0958042E-03	-1.6186185E-03	1.9911752E-01	-6.3840622E-02	-1.6186185E-03	1.9911752E-01	-6.3840622E-02	-1.6186185E-03	1.9911752E-01	-6.3840622E-02		
35			1.4412780E-02	1.4412780E-02	7.3175458E-03	-4.0792634E-03	2.0573429E-01	1.4412780E-02	1.4412780E-02	7.3175458E-03	-4.0792634E-03	2.0573429E-01	2.0573429E-01			
36			1.0010777E-02	1.0010777E-02												
VARIATION																
Harmonic	K		S		7		8		9		10		11		12	
I	0		-1.4550808E-03	-2.3550169E-03					1.7565526E-02	2.2735727E-02					-1.1018069E-02	-2.8038983E-03
	1		-2.6673493E-04	-1.0869473E-01					3.6696738E-02	2.7378740E-02					2.8008511E-03	3.2094335E-02
	2		-4.5458784E-03	2.0013205E-03					-2.7511974E-02	-6.2487069E-02					1.7241884E-02	1.2895037E-03
	3		-1.8748963E-03	1.1695788E-01					-4.35871174E-02	-3.9549705E-02					-3.5722442E-02	-3.5722442E-02

DECEMBER 1964 UT = 00

FIG. 1A. PREDICTED MEDIAN MUF(0)F2 (Mc/s)

FIG. 1B. PREDICTED MEDIAN MUF(4000)F2 (Mc/s)

DECEMBER 1964 UT= 02

LONGITUDE

FIG. 2A. PREDICTED MEDIAN MUF(0)F2 (Mc/s)

LONGITUDE

FIG. 2B. PREDICTED MEDIAN MUF(4000)F2 (Mc/s)

DECEMBER 1964 UT=04

FIG. 3A. PREDICTED MEDIAN MUF(ZERO)F2 (Mc/s)

FIG. 3B. PREDICTED MEDIAN MUF(4000)F2 (Mc/s)

DECEMBER 1964 UT=06

FIG. 4A. PREDICTED MEDIAN MUF(0)F2 (Mc/s)

FIG. 4B. PREDICTED MEDIAN MUF(4000)F2 (Mc/s)

DECEMBER 1964 UT=08

FIG. 5A. PREDICTED MEDIAN MUF(0)F2 (Mc/s)

FIG. 5B. PREDICTED MEDIAN MUF(4000)F2 (Mc/s)

DECEMBER 1964 UT = 10

FIG. 6A. PREDICTED MEDIAN MUF (Z0)F2 (Mc/s)

FIG. 6B. PREDICTED MEDIAN MUF (4000)F2 (Mc/s)

DECEMBER 1964 UT=12

DECEMBER 1964 UT=14

FIG. 8A. PREDICTED MEDIAN MUF(0)F2 (Mc/s)

FIG 8B. PREDICTED MEDIAN MUF(4000)F2 (Mc/s)

DECEMBER 1964 UT = 16

DECEMBER 1964 UT = 18

DECEMBER 1964 UT = 20

FIG. IIA. PREDICTED MEDIAN MUF(ZERO)F2 (Mc/s)

FIG. IIB. PREDICTED MEDIAN MUF(4000)F2 (Mc/s)

DECEMBER 1964 UT = 22

LONGITUDE

FIG. 12A. PREDICTED MEDIAN MUF(0)F2 (Mc/s)

LONGITUDE

FIG. 12B. PREDICTED MEDIAN MUF(4000)F2 (Mc/s)

NORTH POLAR AREA
DECEMBER 1964 UT = 00

FIG. 13A. PREDICTED MEDIAN MUF (ZERO)F2 (Mc/s)

FIG. 13B. PREDICTED MEDIAN MUF (4000)F2 (Mc/s)

SOUTH POLAR AREA
DECEMBER 1964 UT = 00

FIG. 14A. PREDICTED MEDIAN MUF(ZERO)F2 (Mc/s)

FIG. 14B. PREDICTED MEDIAN MUF(4000)F2 (Mc/s)

NORTH POLAR AREA
DECEMBER 1964 UT = 12

FIG. I5A. PREDICTED MEDIAN MUF (ZERO)F2 (Mc/s)

FIG. I5B. PREDICTED MEDIAN MUF (4000)F2 (Mc/s)

SOUTH POLAR AREA
DECEMBER 1964 UT = 12

FIG. 16A. PREDICTED MEDIAN MUF(0)F2 (Mc/s)

FIG. 16B. PREDICTED MEDIAN MUF(4000)F2 (Mc/s)

UNITED STATES
GOVERNMENT PRINTING OFFICE
DIVISION OF PUBLIC DOCUMENTS
WASHINGTON, D. C., 20402

OFFICIAL BUSINESS

PENALTY FOR PRIVATE USE TO AVOID
PAYMENT OF POSTAGE. \$300
(GPO)

DEPARTMENTS OF THE ARMY
AND THE AIR FORCE

WASHINGTON, D. C., 20301, 1 September 1964

TB 11-499-21/TO 31-3-28, Central Radio Propagation Laboratory Ionospheric Predictions for December, 1964, is published for the use of all concerned.

BY ORDER OF THE SECRETARIES OF THE ARMY AND THE AIR FORCE:

HAROLD K. JOHNSON,
General, United States Army,
Chief of Staff.

OFFICIAL:

J. C. LAMBERT,
Major General, United States Army,
The Adjutant General.

CURTIS E. LEMAY,
Chief of Staff, United States Air Force.

OFFICIAL:

R. J. PUGH,
Colonel, United States Air Force,
Director of Administrative Services.

DISTRIBUTION:

Active Army:

USAECD (1); USACBRCD (1); USACECD (1); USAMSCD (1); USAOCD (1); USAQMCDA (1); USATCDA (1); USA Msl Spt Comd (1); USASA Bd, Arlington Hall Sta (1); USA Sig Msl Spt Agcy (1); USA Sig Comm Agcy, Japan (4); USASA, Arlington Hall Sta (4); USA Elet Comd (1); Fld Comd, DASA (2); USA Test & Eval Comd (1); USACECD Agcy (Ft Huachuca) (1); USCONARC (3); ARADCOM (2); OS Maj Comd (5); OS Base Comd (2); Log Comd (2); MDW (1); Armies (5); Corps (2); Div (2); USA Elet Rsch & Dev Agcy (Ft Monmouth) (4); USA Elet Rsch & Dev Actvy (Ft Huachuca) (4); USA Elet Rsch & Dev Actvy (White Sands) (4); Svc Colleges (4); Br Svc Sch (4) except USASCS (20); ARADCOM Rgn (2); WSMR (2); JBUSMC (12); USA Corps (1); USA Mbl Equip Cen (1); USAEPG (3); USAMC (1); Atlanta Army Dep (1); USSTRICOM (1); USASA, Europe (1); USASA, Pacific (1); USASA, Alaska (1); USASA, USARSOUTHCOM (1); MAAG Pakistan (6); Units org under fol TOE: 11-18 (1); 11-95 (1); 11-500 (1).

U. S. GOVERNMENT PRINTING OFFICE: 1964—O.

NG: None.

USAR: None.

For explanation of abbreviations used, see AR 320-50.