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CONFIDENTIAL

Memorandum:

[Redacted]

1 August 1956

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Subject: Sixteenth Status Report
Period 5 July - 5 August 1956

DOC	47	REV DATE	9 MAY 1960	BY	018313
ORIG COMP	033	GPI	56	TYPE	B2
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JUST	22	NEXT REV	2010	AUTH:	NR 10-2

1. Project Study:

As the two mobile units had been delivered, there was but limited activity awaiting the installation of the mobile units at their selected sites.

The [Redacted] slave station was established on a more permanent basis. Some refinement was made in the installation of the horizontal antennas in that a messenger cable has been installed, actually a 1/4" nylon rope to relieve the down lead of any mechanical strain.

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Several sections of the Instruction Manual have been drafted and submitted in this form for consideration by those concerned. Following a hurried preliminary reading of the available material, it was requested that much more emphasis be placed on the equipment time delay factor. This should be emphasized even in the introductory section.

A description of the methods used and a copy of the results of the equipment delay measurements were submitted. Because of the importance of these measurements and the wide variations possible in making such measurements because of control variations, consideration is being given a suggested plan to repeat at least some of these measurements. To do this will require moving the mobile units to an area more readily accessible than they are in their selected locations.

Spare lamp bulbs and extra film cassettes were supplied for use with the Dumont cameras.

2. Trips:

A trip was made to Washington, D. C. on 30-31 July 1956 to discuss the project with personnel concerned.

3. Expenses:

There were no unusual expenses during the period included in this report.

[Redacted Signature]

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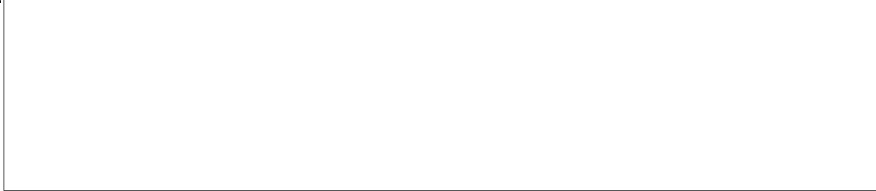
Project Engineer

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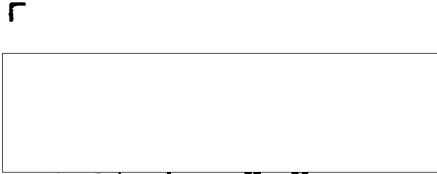
classified
material
STAT
receipt



Nº 2618

For Classified Material Sent to



Date: 1 Aug. 1956



Washington, D. C.

STAT

Shipped by **ds** Date **8/1/56** Originator **NS/ds**

Item No.	Copy No./Nos.	Short Title	Date	Classification
1	III	Ltr. & CC Signed By 	1 Aug. 1956	Secret STAT
2	3 cys.	Org. & 2 CC Memo: SENS -5A1956 Signed By: 	1 Aug. 1956	Secret STAT
				STAT

I have personally received from  the classified material described above. I assume responsibility for safe handling, storage and transmittal elsewhere of this material in accordance with existing laws and regulations.

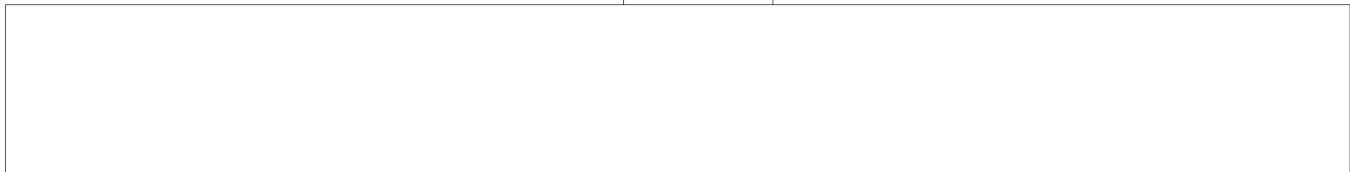
Signed  Date _____

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1 August 1956

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Washington, D. C.

Attention: [redacted]
Reference: Status Report, [redacted]
Task VI, [redacted]

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Dear [redacted]

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Attached is the status report for Task VI for the period 5 July - 5 August 1956.

Except for minor activities as listed in the report, there was little done at the station. However, there is considerable pressure being put on the manual. Several sections in draft form prior to any editing and without the necessary continuity were left with you. We are complying with your request regarding more emphasis on the equipment time delay.

I do hope that an opportunity will be given to follow through on making additional equipment time delay measurements as discussed during our meeting.

With kind regards.

Sincerely yours,

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cc: Orig. & 1

Attachments: 3 cc Monthly Summary

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Memorandum: Contract [redacted] Task VI

4 June 1956

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50X1Subject: Fourteenth Status Report
Period: 5 May-5 June, 1956**1. Project Study:**

A thorough check has been made of the individual equipments, particularly the master control unit and the transponder unit to make certain of their correct performance. This is preliminary to assembling the units into the system preparatory to the initial time delay measurements. A few minor changes were required following these checks. For example, an undesirable feed-back was experienced in one of the transponder units which was eliminated through the use of a shielded wire and some rearrangement of the wiring. Other problems of a similar nature were encountered, none serious, but it did require some time to clear the problems. These have all been finished. Initial time delay measurements have been started. It is expected that these measurements will be completed by 12 June. Allowing a few days in which to clear any last minute problems, it is hoped to ship the trailers for the master station and the slave station about 14 June 1956.

The few remaining details of the antenna system were cleaned up. Housings for the antenna coupling units were completed together with the mounting details.

A thorough review is being made of the original concept of the system which will include a detailed operational analysis of the individual units. In addition, a thorough analysis has been started of the time measuring techniques and interpretation of the photographic records of the system operations.

2. Trips:

There were no trips made during the period covered by this report.

3. Expenses:

There were no unusual expenses during the period covered by this report.

[redacted]
Project Engineer

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1 cc - file

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Memorandum: File Contract [redacted] Task VI

2 May 1956

50X1
50X1Subject: Thirteenth Status Report
Period: 5 April - 5 May 1956**1. Project Study:**

The modifications of the KW amplifiers to enable them to be operated on the recently assigned frequencies have been completed. The transmitters are now complete including not only the changes required to meet the operating requirements frequency-wise, but also such changes found desirable in the keying circuits. The operating characteristics of the transmitter are improved as a result of the keying changes. Before these changes were made, there was an objectionable transient present in the transmitter output, most serious in the follow through of the keyed pulse, manifesting itself as an overshoot having the characteristics of a damped oscillation but also present to a lesser degree in the rise of the pulse. With the changes introduced, these transient effects have been eliminated. A further improvement has resulted from the changes made to fit the transmitters to the proper frequencies. These changes have lowered the "Q" of the tuned circuits somewhat, thereby enabling the transmitter to handle a broader bandwidth than it could before these changes were made. The peak pulse and peak carrier output now coincide. This is a considerable improvement in the operating characteristics.

The transponder units have been modified in order to improve the S/N ratio. These changes involved a slight rearrangement of circuits, addition of an amplifier stage which is used to key a bistable multivibrator. A threshold control has been added to provide means to adjust to the best sensitivity above the noise level. The combination of the amplifier stages effectively limits the noise and enables the threshold to be set for a signal level which is weaker than would be possible without them.

The output of the bistable multivibrator is used to trigger the pulse generating multivibrator for the return pulse. This pulse shape gives an easily distinguishable pulse for film recording.

The transmitter output has been measured with the transmitter properly loaded and indicates an output approximating 700 watts.

Propagation studies were continued. Results of this activity were reported in part in a letter dated 13 April 1956. These results determined from the CRPL predictions for the period of interest indicate that limited useful service may be expected using the assigned frequencies and over the proposed circuits. Further results of these studies are shown on the graphs enclosed with this report. These results indicate the LUHF and expected field strengths using the system as laid out.

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The LUF^H curves have been determined for two different noise grades. The normal noise grade for the area of interest is 3. However, this is under normal ionospheric conditions free of disturbances. At the present time of unusual solar activities and disturbed ionospheric conditions, this noise grade may vary radically. For this reason, a second curve was plotted at the next higher noise grade. In making these determinations, the service factor used was quite severe. In the absence of any precise information, this had, of course, to be an assumption. Possibly the service factor may actually be less severe than assumed. This will be determined after the system is in operation.

A curve of expected field strengths with the transmitters operating on the assigned frequencies and delivering 650 watts into the antenna is enclosed.

2. Trips:

One trip was made, during the period included in this report, to discuss the project status with the parties concerned.

3. Expenses:


There were no unusual expenses during the period included in this report.



Project Engineer

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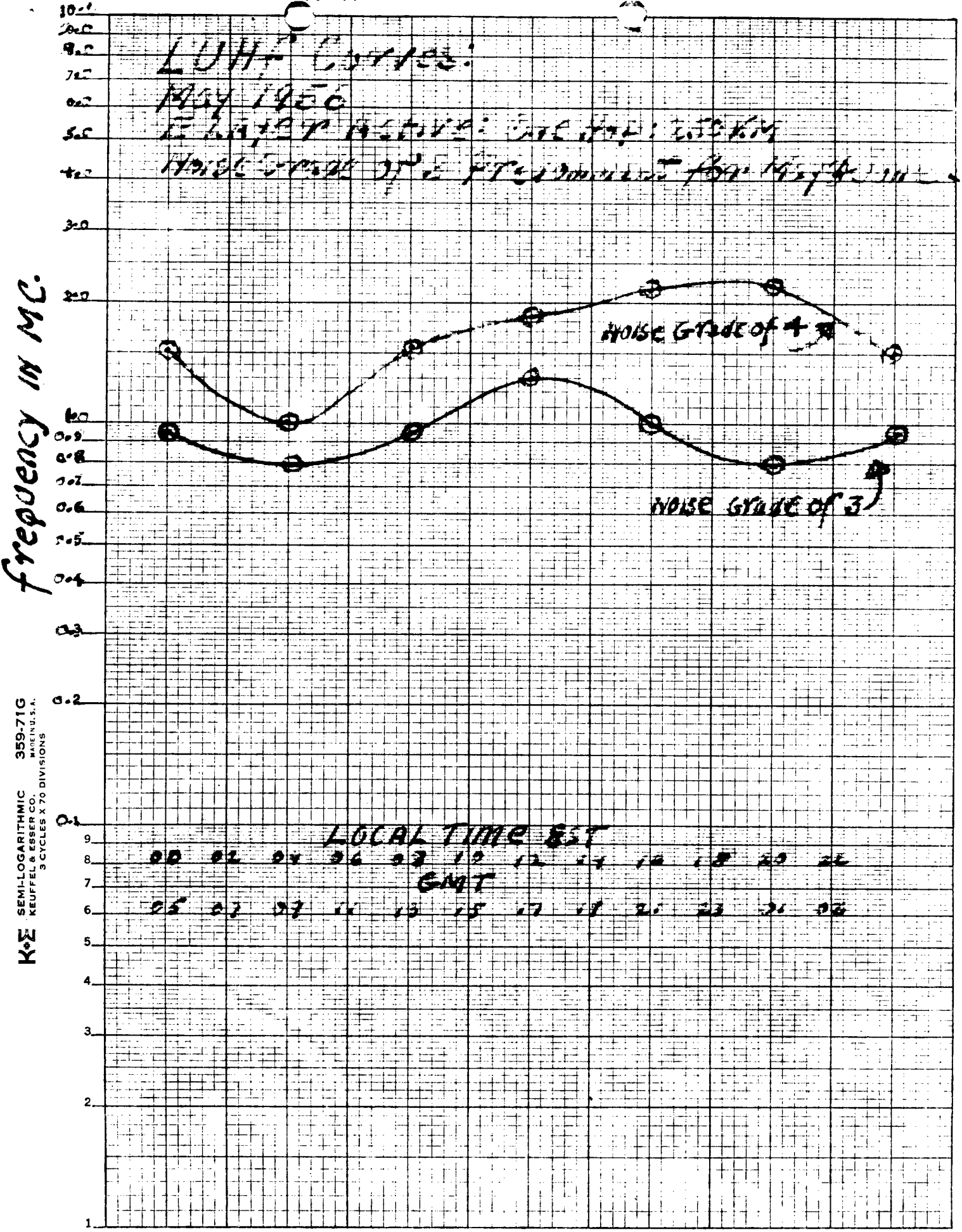
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Attachments: 3 sets propagation curves

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APRIL 29 1956

APPROXIMATE EXPECTED FIELD INTENSITIES
456 SYSTEM CARRIER TRANSMISSION

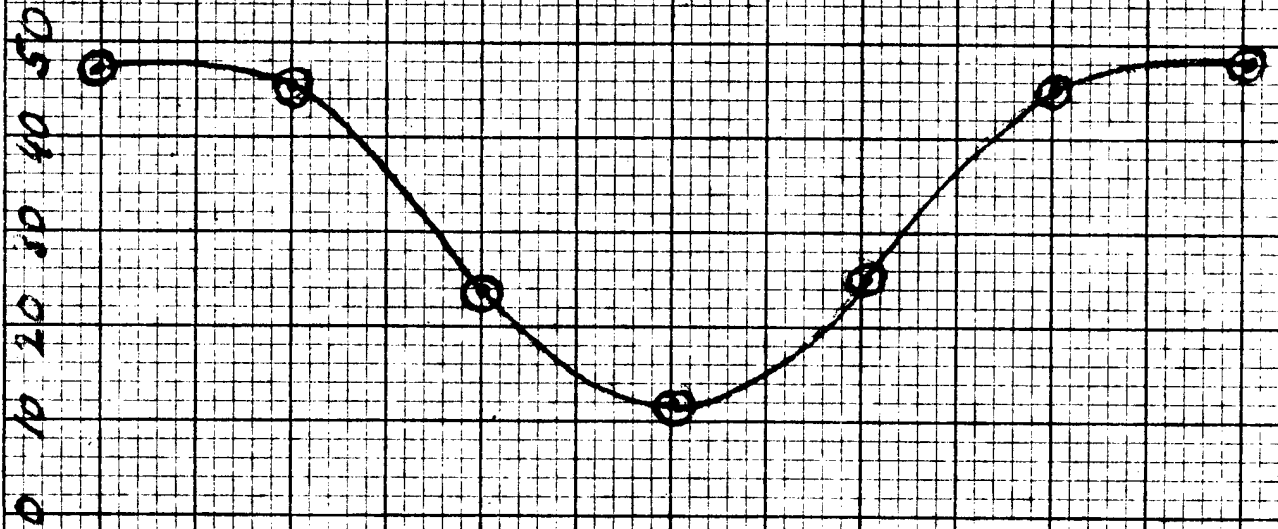
FREQUENCY 2.04 MC
FOR MAY 1956

5 AM Local EST } 100 uV/M
1000 GMT

NOON Local EST } 4 uV/M
1700 GMT

6:30 PM Local EST } 100 uV/M
2330 GMT

DB ABOVE ONE uVOLT PER METER



LOCAL TIME EST

00 02 04 06 08 10 12 14 16 18 20 22

GMT

05 07 09 11 13 15 17 19 21 23 01 03

APRIL 29 1956

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5 April 1956

Memorandum: File, Contract [redacted] Task VI

50X1
50X1Subject: Twelfth Summary Report
Period, 5 March 1956 - 5 April 19561. Project Study

Three frequencies have been assigned to replace those originally assigned and which, because of heavy interference, had to be abandoned. The new frequencies are:

1. 2045 kc MCS
2. 2615 kc Slave
3. 3165 kc Slave

Crystals were obtained for both the transmitters and the receivers. The transmitter exciter units have all been modified to operate at these frequencies. Only the 2615 kc gave any particular problem with the exciter unit, but this has been solved and all exciter units are operating at these frequencies. To modify the exciter unit to operate at 2615 kc, additional capacity was added in the plate circuit of the 6CI6 tube. In addition, the coil in the plate circuit of the final amplifier was removed and a new coil inserted with the proper inductance. This change limits the frequency range of this exciter unit to this particular frequency. The schematic is being prepared incorporating these modifications. The 1 KW amplifier offers more serious problems. The modifications are being made but certain physical changes have to be made in the components before these modifications are completed.

The transmitters were also modified to permit a more effective keying technique to be used which will permit a more efficient operation to be realized. This modification also resulted in a cleaner pulse modulation in that it has removed a slight follow through transient which was present with the original keying system.

Refinements have been made in the master control unit which has resulted in a cleaner more positive type of operation. A schematic of the Master Control Unit as used at present is attached.

Further studies have been made of propagation irregularities which might be encountered. Several photographic records have been made indicating the presence of such, but until further studies have been completed these cannot be positively indicated as such. A continued study of expected propagation conditions based upon the CRPL periodic predictions is in progress. An increasing concern is felt regarding possible "E" layer propagation problems in the coming months ahead. It is also realized that the uncertainties of the "F" layer for the particular operation with which this project is concerned rules out its use.

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2. Trips:

Two trips were made during the period of this report to discuss the project with the personnel concerned.

3. Expenses:


There were no unusual expenses during the period of this report. It is noted that the antenna supporting towers for the MCS and one slave were shipped during the period of this report.



Project Engineer

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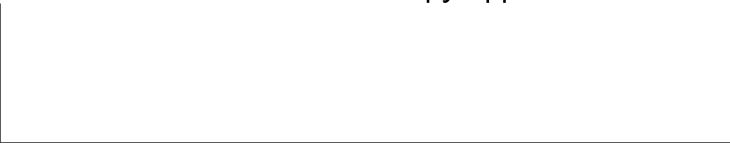
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Attachments: 3 cc Master Control Unit Schematic
dated 26 March 1956

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4 April 1956
7402



Washington, D. C.

Attention: [Redacted]
References: Periodic Status Report, [Redacted]
Task VI, [Redacted]

Dear [Redacted]

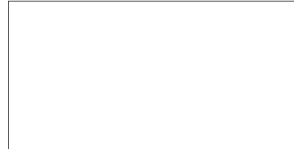
Attached is the status report, our [Redacted] for the period
5 March 1956 - 5 April 1956.

You will note that while there was no difficulty experienced modify-
ing the exciter units to operate at the recently assigned frequencies,
there are some problems to accomplish this with the 1 KW amplifiers.
This is not serious, however, but will delay 1 to 2 weeks the initial
local systems tests. This is because the output coils must be changed
as well as certain other components. Electrically this is simple, but
physically the space limitations make this operation somewhat awkward.
However, a solution has been found which it is believed will make it
possible to complete the modification within 2 weeks.

It is hoped you have received the antenna towers and have been able
to go ahead with the installation without any problems. However, if you
do have any questions, we are, of course, available at all times to assist
you in any way possible.

With kind regards.

Sincerely yours,



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Attach: 3 cc Monthly Summary

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5 March 1956

Memorandum: File. [redacted] Task VI

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Subject: Eleventh Summary Report
Period 17 February 1956 - 5 March 1956

1. Project Study:

Four frequency bands were suggested as areas in which frequencies may be found to replace those previously assigned and found to be occupied with other services.

A general search was conducted during a four day period with daily operation between 0830 hours and 1645 hours. The results of this search are listed.

A. 2000 - 2065 kcs.

For all practical purposes this band is clear as there was no particular activity noted except at 2000 kcs. Some slight activity has been noted at infrequent intervals at 2038 and one or two other areas, but none of these are considered serious.

B. 2105 kcs - 2335 kcs.

In this band there were several frequencies in quite active service, namely 2107 kcs, 2190 kcs, 2300 kcs and at 2327 kcs. The other areas within this band were found to be quite clear.

C. 2505 kcs - 2855 kcs.

This band appeared to be quite active throughout.

D. 3155 kcs - 3240 kcs.

At 3160 kcs, 3180 kcs, 3200 kcs, 3215 kcs and 3240 kcs, there was considerable activity, aotherwise the band was clear.

A suggested frequency, 2065 kcs, was reported as the one to be used at the master station, to be received at the [redacted] slave. Also the [redacted] slave might use 2615 kcs to transmit to the master. Upon receipt of this suggestion, a careful surveillance was instituted of the 2035 kcs - 2095 kcs band. Activity of an intermittent nature was noted at 2038 kcs, which later shifted to 2037 kcs, and a similar activity appeared on 2 March 1956 at 2050 kcs, while one at 2090 kcs previously reported disappeared. At the same time, a fairly steady activity of moderate intensity appeared on 2 March 1956 at 2040 kcs; otherwise there was no activity observed. Some doubt had been expressed as to the practicability of using these lower frequencies because of:

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1. Transmitter operating frequency range.
2. Propagation using the "E" layer and with the limited transmitter power.

The transmitter frequency range can be extended.

A study was made of the predicted propagation and it is not believed that there will be any serious difficulties. A calculation was made of the LUHF for the particular circuit using the Viking transmitter, and this was determined to be 1.7 mc.

Improvements were made in the keying of the transmitter found desirable following the recent [redacted] tests. These improvements are undergoing test. The preliminary results are promising.

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No further tests are contemplated using the vertical antennas to study ground wave propagation and all effort will be concentrated on the horizontal antennas and depending on "E" layer propagation. These antenna systems are being installed at the [redacted] slave station.

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Time delay measurements cannot be completed until the operating frequencies have been established.

2. Trips:

A trip was made on 23 February 1956 to discuss with those directly concerned the status of the project. This discussion was held in Washington, D. C.

3. Expenses:

There were no unusual expenses during the period covered by this report.

[redacted signature box]

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/Project Engineer

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5 March 1956
7060

[Redacted]

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Washington, D. C.

Attention: [Redacted]

Reference: [Redacted] Task VI, [Redacted]

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Dear [Redacted]

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Attached are three copies of the eleventh status report covering the period 17 February 1956 to 5 March 1956.

You will note that we are erecting the antenna support towers and getting everything in shape to move as rapidly as possible as soon as we are advised regarding the frequencies to use. It is hoped this information will be made available promptly.

With kind regards.

Sincerely yours,

[Redacted Signature]

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cc: Orig. & 1

Attach: 3 cc Monthly Summary

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21 February 1956

Memorandum File, []

Task VI, []

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Subject: Tenth Summary Report
 Period, 5 January 1956 - 17 February 1956

1. Project Study:

The vertical antenna material was received and installed at the field station. The impedance matching units to couple the output of the transmitter to the antenna were installed and tested. With the particular antenna systems used, a match at 4031.5 kc was obtained, which gave a 1:1 SWR, at 3177.5 kc a 1.3:1 SWR was obtained. These two frequencies had been selected from the three assigned frequencies for use during these particular tests. Tests were conducted locally preparatory to the actual field tests to determine the comparative equipment time delays and also to insure the proper functioning of the equipment proper. There was no difference noted in the time delay through the equipment operating at the one frequency compared to the time delay through the equipment operating at the other frequency. It was therefore assumed that any difference in between the time of arrival of the signals would probably be due to propagation. However, certain irregularities did appear in the operation of the transponder unit used at the remote stations. Modifications were made to correct this situation. The schematic of the transponder circuit as used is shown on the drawing dated 17 February 1956. It should be noted that this circuit supersedes the schematic dated 28 December 1955, which was included with the Ninth Summary Report.

The tests as planned and carried out required the simultaneous operation of two transmitters keyed with the common pulse source. Some difficulties were encountered paralleling the keying operations through the master control circuit. However, temporary modifications were made to permit the desired operation without affecting the basic characteristics. Installation of the antenna systems and equipment was made at [] on 3 February 1956, and actual tests started on 6 February 1956. The distance between the Field Station and the [] installation is approximately 60 miles. A schedule which had been prepared in advance included precautions to reduce to a minimum actual radiation time to avoid possible complaints of interference. A series of initial pulse transmissions were made over a short period of time to enable the equipment to be accurately checked as to tuning and proper operation. Following the initial test transmissions, which were on the air less than 3 minutes total, a series of pulsed transmissions were carried on the two frequencies simultaneously. Various pulse widths, repetition rates and various other combinations were used during the tests which were conducted over a period of several days. Unfortunately, the presence of other operations in the immediate vicinity of the test frequencies introduced such interference it was not possible to obtain any meaningful data. Some records were taken of the interference. There is a MARS circuit on 4025 kc which gave a signal of some 60 db reference 1 microvolt signal which blotted out any possibility

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of our signals on 4031.5 kc. With the pulse used, a bandwidth of 48 kc is required and accordingly, it was necessary to operate the receivers at maximum bandwidth of 13 kc. With a broader pulse narrowing the bandwidth requirements, there was no improvement. At 3178 there was a teletype circuit in practically continuous operation making our circuit on 3177.5 useless. Because of the heavy interferences noted, a general search was instituted to locate possible clear channels. The results of this search are shown on the attached charts indicating conditions as they are at the Field Station at present. Similar searches should be made at the two other proposed sites and from the combined results, it is hoped that some useable frequencies may be found.

The tests established that the transponder circuit is satisfactory within the limits of the test. It must not be overlooked that there were no return transmissions, but the results of the laboratory tests indicate that this control feature is satisfactory in the transponder unit.

The tests also indicated that the keying of the transmitters should be further investigated as there appears to be a delay in buildup of full output. This matter is now being studied and it is expected that the desired improvements will be incorporated and tested by 27 February 1956. It is expected that the two trailers and accessories such as the towers for the antenna system will be ready to be moved to their respective final sites within three weeks. This depends on having the necessary new operating frequencies assigned on or before 28 February 1956.

A schematic of the Master Control Circuit is attached for information.

In considering possible new frequencies for use in this system, it was considered desirable not only to conduct the general search but to review briefly LORAN experience.

The experience of LORAN has indicated that for other than ground wave operation, only the "E" layer is sufficiently stable and reliable the year around for dependable results. Average error due to variability in delay increased slightly in comparison with ground wave. It was found in LORAN operations that this error is in most part compensated for by the increased geometrical accuracy resulting from the longer leg lengths between the sites permitted by "E" layer operations.

Ground wave transmission by LORAN feeding 100 KW into a vertical antenna was limited to 100 miles over land, 500 miles over sea water. The average errors are low. Considering the limited overland range of 100 miles with 100 KW antenna power, it is easy to understand the difficulty, even at 60 miles, to obtain satisfactory operation with less than 1 KW antenna power!

It is believed advisable in the system under consideration that the tests be confined to "E" layer transmissions and that no further efforts be spent

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using ground waves. Using the "E" layer should make possible greater separation between the master and slave stations resulting in greater geometrical accuracy. The antenna systems to be used are designed to use sky wave transmission, and it is expected that the assigned frequencies will be in the "E" layer range, between 2. and 3.5 mc.

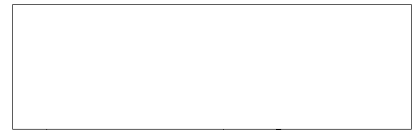
Considerable thought is being given to possible accuracies to be expected using the existing equipments, time delay measurements, etc. This analysis is not yet complete but is expected to be completed by 28 February 1956.

2. Trips:

Field trips were made while the field tests were in progress during the period covered by this report.

3. Expenses:


Except for the materials required for the field tests, there were no unusual expenses during the period covered by this report.



Project Engineer

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Attachments: 3 cc Freq. Search Chart 8 February 1956
3 cc Freq. Search Chart 9 February 1956
3 cc Transponder Schematic 17 February 1956
3 cc Master Control Schematic 2 February 1956

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SECRETMemorandum: File, Task VI,

4 January 1956

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Subject: Ninth Summary Report
Period - 5 December 1955-5 January 1956**1. Project Study:**

There have been delays in the delivery of the vertical antenna material to be used in the investigation of the possibility of using ground wave propagation. The material was originally promised for delivery in time to permit the tests to be started about 19 December 1955. It is now expected that these tests may be started about 16 January 1956. A tentative site for the outstation to be used in the tests has been selected at about 60 miles east of the field station. All towers, wire and insulators, and other antenna accessories have been received for the horizontal antenna systems to be used in the final tests. A folded dipole antenna system will be used initially, having an input impedance of approximately 300 ohms. The antenna system layout has been completed.

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The three impedance matching units to couple the output of the transmitter to the antenna have all been modified to permit operation at the three assigned frequencies. SWR measuring units have been received, one for each station together with low pass filter units to reduce possible radiation, particularly such as might occur at the higher frequencies. This precaution will, it is expected, eliminate possible interference with television receivers.

Results of tests made at the assembled control station indicate the need for shielding and proper distribution of the interconnecting cables. There appears to be heavy interference from the unit pulser which is serious. However, in observing the precautions noted, this problem is apparently solved.

The control units incorporating the transponder circuit for use at the slave stations have been assembled. Each control unit is complete on a single chassis and includes not only the transponder circuit but the carrier controlled relay circuit together with the required power supply. A schematic of this unit is attached hereto. One unit is ready for use while the other is short the front panel. The functions of the slave station control unit are:

1. In response to a start signal originating at the master station, the camera drive is turned on at the slave station.
2. Automatically distinguishes between a true start signal as received from the master station and other undesired signals.
3. Following the reception of the true start signal the transponder proper is activated. A new pulse is generated for each pulse fed into the transponder. Using a 2D21 thyatron in the circuit together with a control switch on the front panel, the transponder may be set for either a single pulse or ten pulse operation.

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Some signals which may be received at the outstation are:

1. **Static bursts:**

If a static burst is less than 1/3 second in duration, no response is noted in the transponder.

2. **True start signal:**

This signal is a pulse of approximately 0.6 second duration and such a signal will start operations at the slave station.

3. **Other carriers:**

A carrier on approximately the same frequency as the true signal, if on longer than 2.5 seconds, will not start operations at the slave station.

The only signals which will give false indications at the slave station are pulses with durations between 1/3 second and 2.5 seconds.

2. **Trips:**

No trips were made during the period covered by this report.

3. **Expenses:**

There were no unusual expenses during the period covered by this report.

[Redacted Signature Box]

Project Engineer

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Distribution: 3 cc - [Redacted]
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4 January 1956
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Washington, D. C.

Attention:



Reference:



Task VI



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Dear



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Attached are three copies of our ninth status report covering the period 5 December 1955 - 5 January 1956.

It is regretted that there has been an unavoidable delay in conducting the preliminary tests mentioned in our letter # 6077 dated 30 November 1955. Delivery of some essential parts has been held up causing the delay. However, these parts should be here within a few days and as soon as received, we are prepared to start immediately with these tests.

The work on the trailers and these special tests has cut down appreciably on the test period which will be available for the final tests if we adhere strictly to the specified date of contract termination, namely 17 April 1956. It is doubtful whether we will be able to collect sufficient data within such a short time to be of much value in the over-all evaluation expected. Under these circumstances it is suggested that the contract be extended to run at least until 1 June 1956, preferably until 15 June 1956. In requesting such an extension of time it is not expected that any additional funds will be required.

With kind regards.

Sincerely yours,



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Project Engineer

MS:ar

CC: Orig. & 1

Attach: 3 cc Monthly Summary

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30 November 1955

Memorandum: File, Task VI -

50X11

Subject: Eighth Summary Report
Period 5 November 1955 - 5 December 19551. Project Study:

(a) Expected propagation conditions for the period remaining to completion of the project have been investigated. The MUF and OMF were calculated for January 1956 based on the CRPL predictions. The results of these calculations are shown on the attached chart and plotted on the attached graphs. It will be noted that the expected propagation is not too favorable for the frequencies assigned except possibly under some favorable conditions such as the E_s layer. However, experience has shown that for only about 50% of the time, perhaps even for less time, do the precise conditions as assumed in making the calculations exist. Unfortunately the variations found under actual operating conditions generally favor the higher frequencies and as the assigned frequencies are already on the low side, it is quite possible that this condition may be worsened. This means that the signal will be some weaker than has been estimated. It has been determined using the antenna system considered, namely a folded dipole, and a transmitter with an output of about 1 kilowatt that the field strength at the proposed receiving station site will approximate 1000 microvolts per meter. This figure is based on the propagation conditions as predicted. It is not known what the local noise level is at the receiving site, but it is doubtful that the noise level will be serious. Assuming that this be so, the calculated field is extremely favorable. It is believed possible to establish a reliable circuit with a signal level of the order of 100 or so microvolts per meter, that is, at 1/10th the calculated field. It is believed that fading swings of 20 db can be tolerated.

The foregoing is based on the assumption that the propagation will be exclusively by sky wave, that is, ionospheric. However, it is believed desirable to investigate the possibility of using ground wave propagation and accordingly, tests will be made to determine the practical working range depending on ground wave propagation. For this purpose use will be made of a vertical 1/4 wave grounded antenna. This type of antenna has a very low angle of fire with an almost total absence of high angle radiation. Of course, every effort must and will be made to eliminate any high angle radiation as the presence of such high angle radiation together with a low angle radiation can lead to serious interference patterns which must be avoided.

The results of the proposed tests may indicate a limited range which will give a very short base line. This will probably so restrict the possible hyperbolic pattern resolution that the system may be quite impractical using ground wave propagation with such limited power as is available. An analysis will be undertaken of the resolution of the hyperbolic patterns using various base lines.

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(b) A master control unit was completed which combines the several individual units used for control purposes on a single chassis. This unit is at the control station. The unit has been tested and found to be satisfactory.

The impedance matching unit to couple the output of the transmitter to the antenna has been received. The results of preliminary tests indicate that the unit is satisfactory. Control circuits for the accessory equipment such as the camera at the slave stations have been developed. In addition, a control circuit for remote operation of the slave station transmitter has been developed. The components for these circuits are being assembled on a suitable chassis and it is expected will be tested and installed on or before 12 December 1955.

(c) The two remaining Dumont cameras have finally arrived, although there was a 5 months delay in delivery from the original delivery date promised. These have been tested and found to be satisfactory. Two heaters are still short although they are 8 weeks overdue according to the last delivery promise. Assurance has been given that they should arrive not later than 8 December 1955. Water tanks and developing sinks are being installed in the trailers.

Antenna material has been ordered for the preliminary tests. This material comprises a number of vertical telescopic masts. Wire for the horizontal antennas is available, and towers to support these antennas should be available by 10 December 1955.

(d) It was mentioned at a meeting in Washington on 14 November 1955 and again at the meeting held at the [] field station on 22 November 1955 that security regulations will not permit access by [] personnel to the two sites selected for two of the stations. As this project is largely developmental, this situation made it impossible for [] to properly complete the project. In discussion of this situation, it was decided that other sites accessible to [] personnel may be used with the understanding, of course, that comparable base lines will be established in selecting the new sites.

50X1
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2. Trips:

One trip was made to Washington on 14 November 1955.

3. Expenses:

There were no unusual expenses during the period covered by this report.

[]

50X1

Project Engineer

Distribution: 3 cc - []
1 cc - File

50X1

SECRET

Date 20 November 1955

MUF-OWF WORK SHEET FOR PATHS 4000 KM OR LESS

From: To: Washington, D. C. Distance, Zone Predicted for January 1955

STAT

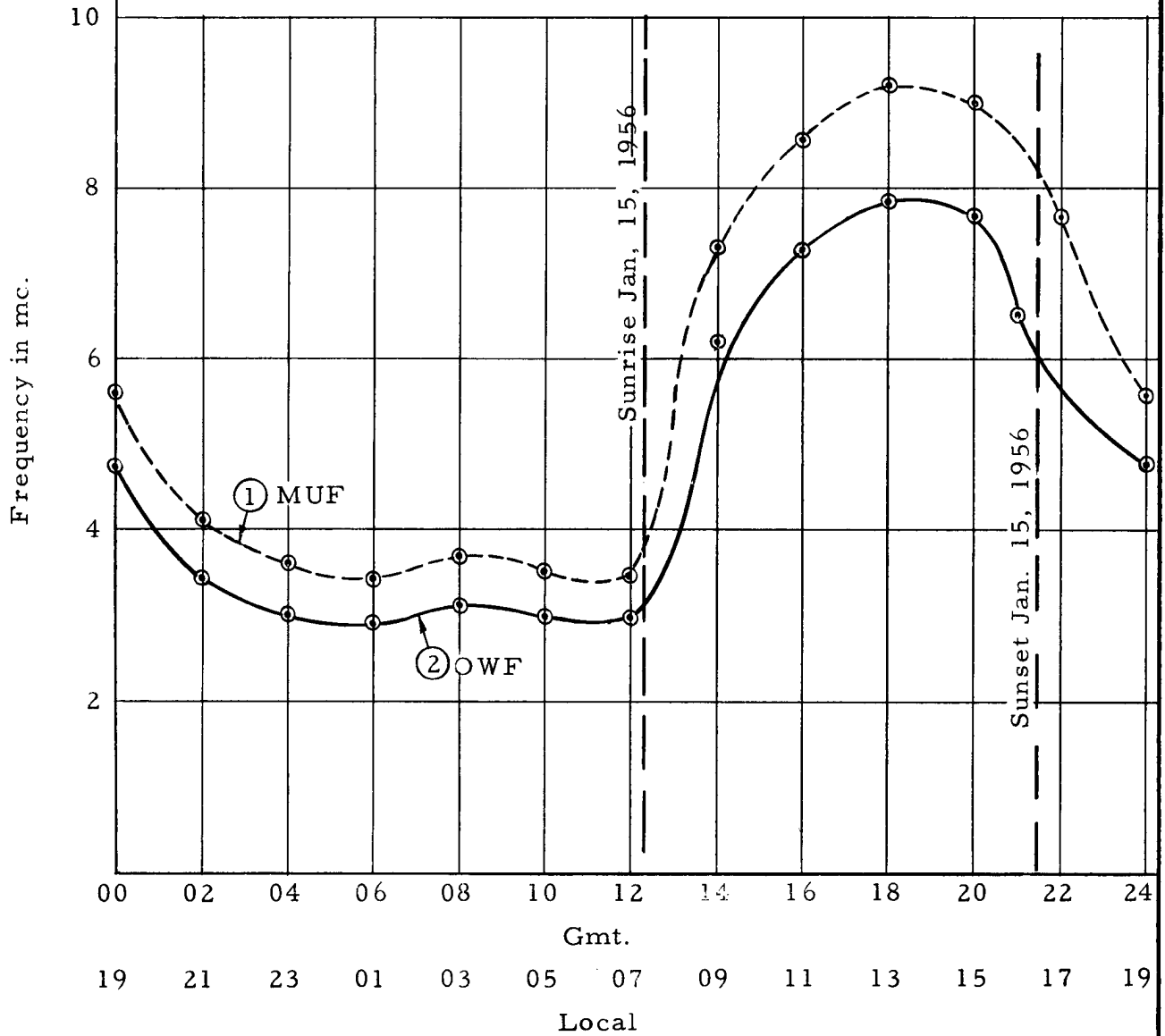
Note: All frequencies are in megacycles.

GCT	f _{E_s}	E _s 2000- muf	E-layer 2000- muf	F ₂ zero- muf	F ₂ 4000- muf	E _s -muf for Path	E-F ₁ - muf for Path	F ₂ -muf for Path	E _s 2000- owf	E _s -owf for Path	E-owf for Path	F ₂ -owf for Path	MUF for Path	OWF for Path	MUF for Path
	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
Procedure	Scale	5Xa	Scale	Scale	Scale				b-4.0		Same as g	.85 h	Highest of fgh	Highest of jkl	Inc. Effect
00	2.0	10.0		5.5	18.00	2.75		5.6				4.5	5.6	4.96	5.6
01															
02	2.0	10.0		4.0	11.8	2.75		4.0				3.3	4.0	3.49	4.0
03															
04	2.0	10.0		3.4	8.8	2.75		3.6				3.0	3.6	3.06	3.6
05															
06	2.2	11.0		3.5	9.2	3.0		3.4				2.9	3.4	2.9	3.4
07															
08	2.2	11.0		3.7	9.8	3.0		3.65				3.2	3.65	3.1	3.65
09															
10	2.5	12.5		3.5	9.5	3.4		3.45				2.9	3.45	2.94	3.45
11															
12	2.8	14.0	5.5	3.5	10.0	3.8	1.5	3.45		1.5	1.5	3.2	3.45	2.94	3.8
13			9.0				2.5			2.5					
14	3.0	15.0	11.6	7.0	24.0	4.0	3.2	7.3		3.2	3.2	6.0	7.3	6.2	7
15															
16	3.4	17.0	14	8.4	28.0	4.8	3.8	8.6		3.8	3.8	7.3	8.6	7.3	8.6
17															
18	3.4	17.0	14.2	8.9	29.8	4.8	3.85	9.2		3.85	3.85	7.8	9.2	7.81	9.2
19															
20	3.2	16.0	12.8	8.6	28.7	4.4	3.5	9.0		3.5	3.5	7.4	9.0	7.65	9.0
21			11.0				2.6			2.6					
22	2.6	13.0	8.0	7.5	25.0	3.6	1.85	7.7		1.85	1.85	6.5	7.7	6.55	7.7
23	2.2	11.0				3.5									

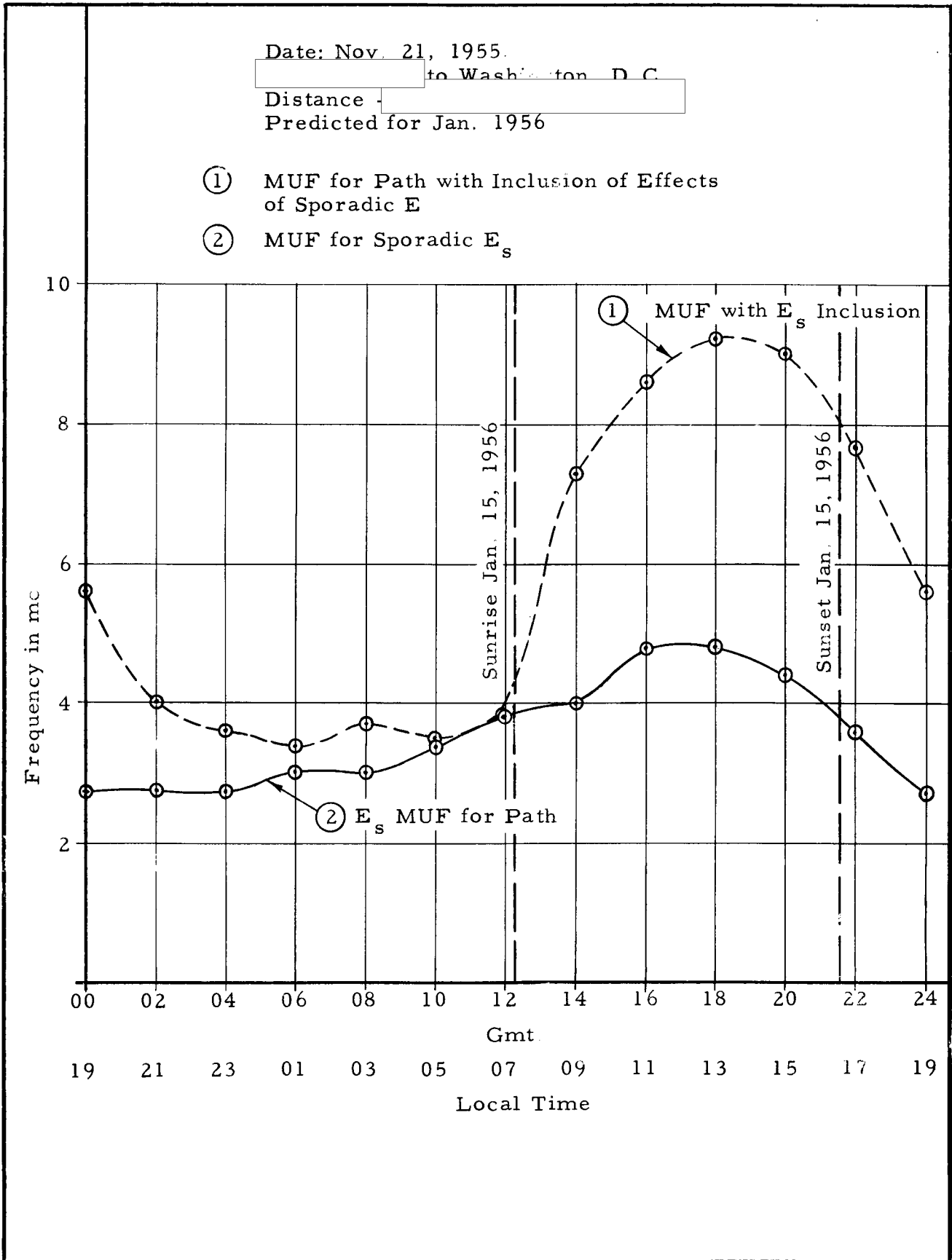
STAT
STAT
STAT

Date: Nov. 21, 1955
 [] to Washington, D. C.
 Distance []
 Predicted for Jan. 1956: []

- ① MUF for the Path by Regular Layers.
 (Highest Frequency of E, F₁, F₂)
- ② OWF for Path: Regular Layers.



STAT
SIAI



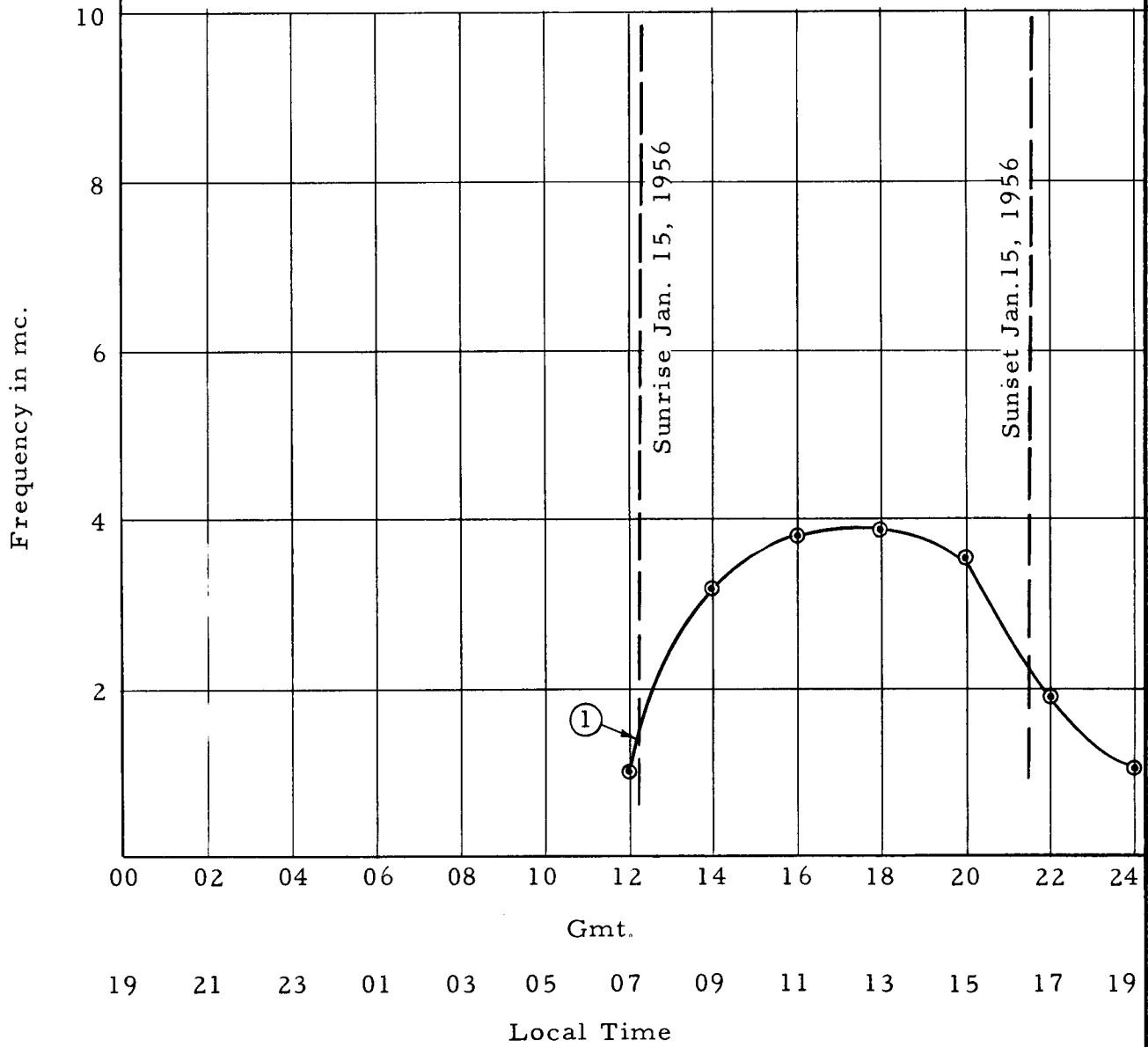
STAT
SIAI

Date: Nov. 21, 1955

Distance - [redacted] to Washington, D. C.

Predicted for Jan. 1956

① E Layer OWF for Path



SECRET

28 October 1955

Memorandum: File, Task VI -

50X11

Subject: Seventh Summary Report
Period 5 October 1955 - 5 November 19551. Project Study:

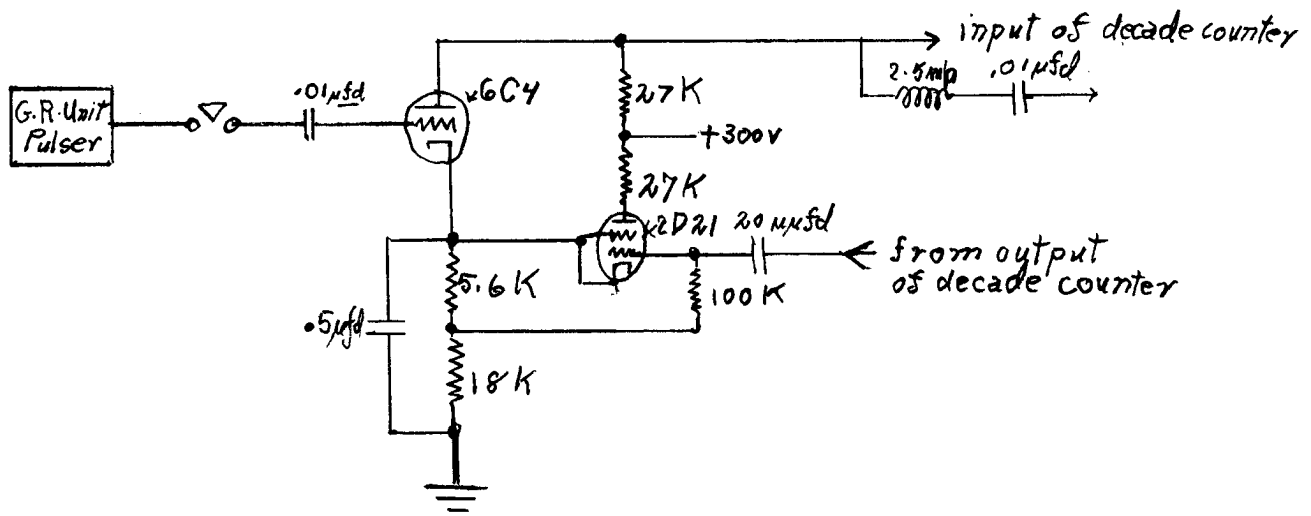
Crystals for both the transmitters and the receivers for operation of the frequencies specified in the letter dated 7 October 1955 have been received. The frequency range of the transmitters has been extended and all necessary modifications completed.

An automatic ten pulse gate circuit was developed and completed to permit the transmission of ten and only ten pulses. A brief description of the circuit developed is included herewith.

Ten Pulse Gate Circuit

The output from a General Radio Unit Pulser (positive pulses) is amplified through a single stage 6C4 amplifier. The inversion in this stage is necessary for the proper operation of the transmitter. The output of this stage is coupled to the input of a Hewlett-Packard AC-4A decade counter and also to the transmitter through a low pass filter. The decade counter counts the pulses and upon the receipt of the tenth pulse, it has generated an output voltage of about 80 volts. This tenth pulse is used to fire a 2D21 thyatron which has a common cathode resistor with the 6C4 amplifier stage. When the 2D21 fires the cathode of the 6C4 is raised to about 150 volts which is quite sufficient to cut off this tube. This effectively gates the transmitter so that only ten pulses are transmitted.

The cathode of the 2D21 thyatron must be opened momentarily before a second train of ten pulses can be transmitted. It is not necessary to recycle the decade counter as the tenth pulse automatically returns the counter to zero. The circuit used is:

**SECRET**

SECRET

A circuit is being developed to control the automatic operation of the slave stations from the control station. Preliminary tests give promising results and it is believed that only minor modifications may possibly be necessary to complete this unit. The system devised requires that the operator at the control station press a button which activates the local transmitter. The control station transmits a blank signal for approximately $\frac{1}{2}$ second. This transmission automatically sets the cameras in operation at the slave stations. Approximately $\frac{1}{3}$ of a second later, a second circuit closes which initiates the transmission of the series of ten pulses. Provision is made to include facilities which will permit the return by the slave station of either the entire pulse train or single pulse to the control station. This feature is desirable because it does permit an accurate check to be made of the system operation and there may be periods during which there is heavy atmospheric which might obliterate a single pulse but allow enough of the series through for useful observation.

It is planned to have local systems measurements completed in time to permit initial field testing to be underway at the selected sites by about 19 December 1955. However, this schedule is somewhat dependent upon the early receipt of the necessary priority for the delivery of the Dumont cameras. This priority was expected in September 1955 but for reasons not understood has not yet been received.

2. Trips:

No trips were made during the period covered by this report.


3. Expenses:

There were no unusual expenses during the period covered by this report.



Project Engineer

50X1

Distribution: 3 cc - 
1 cc - File

50X1

SECRET

SECRET

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50X1

28 October 1955
5750

[Redacted]

50X1

Washington, D. C.

Attention: [Redacted]

50X1

Reference: Task VI, [Redacted]

50X1

Dear [Redacted]

50X1

Attached are three copies of our seventh status report covering the period 5 October 1955 - 5 November 1955.

The various control circuits such as the ten pulse gating circuit, signalling circuit to be used at the control station to operate the slaves automatically have all been designed and the preliminary testing practically complete. We plan to have everything completed and available to start the field installations early in December. This information is mentioned particularly as we expect you to provide the drivers for the two trailers in accordance with the arrangements made with you and as agreed upon by you.

We have not yet received the priority you are to send us without which we will continue having difficulty to obtain the two remaining Dumont cameras. Of course we continue to press Dumont and perhaps we will succeed in obtaining delivery, but it is uncertain. It would be appreciated if you would expedite the priority for us.

[Redacted] delayed again in completing shipment of the heaters for the trailers but this is not a serious matter and we ill not delay because of this.

50X1

With kind regards -

Sincerely,

[Redacted Signature]

50X1

Project Engineer

MS:ar

cc: Orig & 1

Attach: 3 cc - Monthly Summary

SECRET

SECRET

29 September 1955

Memorandum: File, [redacted] Task VI - [redacted]

50X1

Subject: Sixth Summary Report
Period 5 September 1955 - 5 October 1955

1. Project Study:

All transmitters are in operating condition as are the receivers, timers and associated equipment.

One of three Dumont cameras has been received. An inspection and tests made of the camera indicate that the camera is entirely satisfactory.

The supplier has not yet completed shipment of the materials required to finish the modifications of the trailers. Assurances have been given of complete shipment within 10 days.

A study has been made of the factors affecting the signal time delay through the equipment. Variations in the time delay are due largely to improper tuning. The system is apparently sensitive to changes in the tuning, even slight off tuning in the receiver changes the time delay 25 to 30 microseconds, an error of 5 miles. This appears to be unavoidable with the particular equipment because of the bandwidth limitation of the receiver. However, this problem is not considered serious for this particular project. Operating frequencies have been agreed upon verbally, but operations cannot be made until a written authorization is received.

2. Trips:

No trips were made during the period covered by this report.

3. Expenses:

There were no unusual expenses during the period covered by this report.

[redacted signature box]

50X1

Project Engineer

Distribution: 3 cc - [redacted]
1 cc - File

50X1

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SECRET

[Redacted]

50X1

September 29, 1955
5511

[Redacted]

50X1

Washington, D. C.

Attn: [Redacted]
Reference: Task VI, [Redacted]

50X1

50X1

50X1

Dear [Redacted]

Attached are three copies of our sixth status report covering the period 5 September 1955 - 5 October 1955 of the work done on Task VI.

We are ready to make field tests but should have from you written authorization to use the frequencies agreed upon before we actually go on the air. The reason is given in our letter 5490 dated 28 September 1955 to [Redacted] with a copy for you.

50X1

[Redacted] supplying some of the material required for the trailer modifications, have been inexcusably slow in completing deliveries but even with a shortage here we can go ahead.

50X1

The operation, as you know, appears to be over sensitive particularly to tuning. Further study of this problem indicates that the limited bandwidth of the receiver is probably the most important factor. We do not believe, however, that this problem is too serious for this particular study.

With kind regards -

Sincerely,

[Redacted Signature]

50X1

Project Engineer

NS/er

cc: Orig & 1

Attach: 3 cc - Monthly Summary

SECRET

SECRET

31 August 1955

Memorandum: File, [] Task VI - []

50X1

Subject : Fifth Summary Report
Period 5 August 1955 - 5 September 1955

1. Project Study:

Failure of a switch in one of the kilowatt amplifiers has temporarily put this unit out of service. A replacement has been ordered and is expected to be delivered before 10 September 1955.

Racks on which to mount the receivers, timers and associated equipments were received. These have been assembled and the equipment mounted. The various necessary cables were assembled and installed.

Measurements were made of the overall time delay through the initiating transmitter, through the remote receiver, through the remote transmitter back through the receiver at the source. It was found that this overall delay is 235 microseconds. This does not include the actual space propagation time. There is a distortion present in the final received pulse which is due to the bandwidth limitation of the receiver. However, it is not believed that this distortion will affect the overall operation of the system nor its usefulness. The material required to complete the modifications being made in the trailers was received. The actual work modifying the trailers is expected to be completed before 12 September 1955.

The Dumont cameras originally scheduled for delivery on or about 10 August 1955 were delayed and shipment is now expected before 9 September 1955.

Local systems tests over a 15-25 mile circuit are being held in abeyance awaiting receipt of the necessary authorization to be on the air.

2. Trips:

No trips were made during the period covered by this report.

3. Expenses:

There were no unusual expenses during the period covered by this report.

[]
Project Engineer

50X1

Distributions: 3 cc - []
1 cc - Contracting officer
1 cc - File

50X1

SECRET

SECRET

August 31, 1955
5254

[Redacted]

50X1

Washington, D. C.

Attn: [Redacted]

50X1

Reference: Task VI, [Redacted]

50X1

Dear [Redacted]

50X1

Attached are three copies of our fifth summary report covering the period 5 August 1955 - 5 September 1955.

The damage found in the kilowatt amplifier noted in our letter #4981, dated 2 August 1955, was repaired. Unfortunately there was a recent failure in a switch temporarily putting the unit out of service. This is mentioned in the report.

System tests over a local circuit are being held up until you send the authorization from the FCC to be on the air.

This will remind you that we are expecting you together with [Redacted] on Friday, 9 September 1955. Please advise us of your expected time of arrival and whether or not you wish hotel reservations to be made.

50X1

With kind regards -

Sincerely yours,

[Redacted]

50X1

Project Engineer

cc: Orig & 1

Attach: 3 cc - Monthly Summary

NS/mss

SECRET

SECRET

1 August 1955

Memorandum: File, Task VI -

50X1

Subject : Fourth Summary Report
Period 5 July 1955 - 5 August 1955**1. Project Study:**

Two one kilowatt Amplifiers were received thus completing the total of three required on the project. Both units were received in slightly damaged condition but the broken parts have all been replaced and the units tested. They were found to be satisfactory.

The pulse distortion found in the receiving equipment and as previously reported upon appears to be the result of interference from the nearby pulse generating equipment. Reversing the pulse character and improving the shielding has improved the general situation.

A local test circuit has been established over a triangular system. The distances are 10 to 15 miles. This circuit will be used for a preliminary system operation.

Measurements of the bandwidth of the transmitter output indicate it to be somewhat in excess of 100 kcs.

Two trailers together with tractors were received on 26 July 1955. It is expected that the required work on these trailers will commence about 8 August 1955 and it should be completed within one week.

Time measurements as well as stability measurements were held up to permit the necessary repair work to be made on the transmitters.

2. Trips:

No trips were made during the period covered by this report.

3. Expenses:

There were no unusual expenses during the period covered by this report.

Project Engineer

50X1

SECRET

SECRET

August 2, 1955
4981

[Redacted]

50X1

Washington, D. C.

Attn: [Redacted]

50X1

Reference: Task VI, [Redacted]

50X1

Dear [Redacted]

50X1

Attached are three copies of our fourth summary report covering the period 5 July 1955 - 5 August 1955.

You will note that two pieces of equipment, namely the recently ordered one Kilowatt Viking amplifiers were received in a damaged condition. Although it was a simple matter to repair these units, it did take up some time preventing us from completing the time delay and stability measurements mentioned in our third summary report.

Sincerely yours,

[Redacted]

50X1

Project Engineer

cc: Orig & 1

Attache 3 cc - Monthly Summary

NS/mss

SECRET

SECRET

30 June 1955

Memorandum: File Task VI -

50X1

Subject : Third Summary Report
Period 5 June 1955 - 5 July 1955**1. Project Study:**

The one kilowatt power amplifier to be used with the Viking transmitter was received. Preliminary tests indicate that the amplifier will be satisfactory and accordingly an order was placed for the complete set of equipments required.

Slight modifications in the output circuit will be made in the power amplifier to make it more readily adaptable to the particular antenna system.

Measurements will be made as to bandwidth occupancy of the transmissions as soon as the modifications have been made. Delay measurements were made on the receiving system indicating a time delay of approximately 125 microseconds. In addition there is a slight distortion introduced to the pulse in the receiving system which although not serious will be more thoroughly investigated. It may be possible to eliminate or at least reduce this distortion by recording the output ahead of the audio output.

More detailed and accurate delay measurements are in progress to determine the stability of the system.

The multivibrator unit is successful. A gating system is now being assembled. It is expected it will be completed and tested by 20 July 1955.

A layout for the trailers was prepared and approved. It is expected that the trailers will be available at by 15 July 1955. Preliminary systems tests made locally are scheduled to take place during the 2nd week of August 1955.

50X1

2. Trips:

A trip was made 9 June 1955 and again on 29 June 1955 to discuss the project with the project manager in Washington.

3. Expenses:

Two Viking one kilowatt power amplifiers and accessories were ordered on 21 June 1955 at a total cost of \$3437. Spare tubes and other necessary items were obtained at an approximate total cost of \$100.

50X1

Project Engineer**SECRET**

SECRET

**June 30, 1955
4699**

[Redacted]

50X1

Washington, D. C.

Attn: [Redacted]

50X1

Reference: Task VI, Project 45

Dear [Redacted]

50X1

Attached are three copies of our third summary report for the period 5 June 1955 - 5 July 1955.

The method used in delay measurements will be written up separately and sent to you as requested. Measurements of the bandwidth of the transmission will be completed within the next ten days and the results forwarded to you at that time.

Consideration is being given to the question of modifying the pulse transmissions for the reasons discussed during our meeting on 29 June 1955. As soon as our ideas have crystallized they will be presented for discussion.

Sincerely yours,

[Redacted Signature]

50X1

Project Engineer

cc: Orig & 1

Attach: 3 cc - Monthly Summary

NS/mss

SECRET