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SDN RD8-1102/23

Page 2 of

Copy 2 of 17

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crystal filters are being modified by [redacted] to minimize undesirable ringing following the received pulse. AGC circuits have also been modified slightly as a result of these tests. New protective circuits have been added to the power supplies which have now been operated satisfactorily for several weeks. Recognition circuits have been relocated correcting the previously found lead length problem. A thorough test and evaluation, however, awaits completion of new transistorized amplifiers. Work has been started on final module design of those circuits which have been demonstrated successfully on the system breadboard.

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Thermal tests on the r-f front end and exciter are nearly complete.

TASK 6. RS-16A TEST POWER SUPPLIES

Work on this Task has been completed.

TASK 7. SERVICE AND SUPPORT

Rework of six (6) RS-16A Field Units was started, on a high priority basis, with the schedule calling for two by 25 December and the remaining four to follow at intervals of one every two weeks. Modification plans were agreed upon at a meeting in Washington between Government representatives and Messrs. [redacted]

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[redacted] Refurbishment of an AS-4 Receive Terminal, preparatory to its shipment 25 December, is a part of this same program. Plans have been completed for procuring all parts and performing all necessary work and testing on this crash program.

Repaired Autotune motors were delivered to the Government during this reporting period.

TASK 8. AS-6 DATA TELEMETERING SYSTEM

Field Unit: During this reporting period the digital converter was successfully interoperated in Washington with a breadboard of the data collector. These tests covered only the operation of the converter into the collector memory circuits, and did not check such control functions as the "urgent" indication or the "clear" operation. Some minor problems were discovered which will result in the addition of one flip-flop to the digital converter, and one blocking oscillator to the collector. Final packaging

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SDN RD8-1102/23

Page 3 of Copy 2 of 17

25X1

of the digital converter will begin during the next reporting period.

Design of programming circuits is virtually complete.

The breadboard exciter was made to operate on five channels including the extremes Upon completion of these tests, it was successfully interoperated with the first model of the power amplifier. The combination of these two units will provide a system which can be used for testing of the servo tuning as well as life testing of the components under repeated cycling.

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The second exciter which is packaged in near-final form is being revised to include later thinking of crystal oscillator space requirements. The objective of this effort is a room temperature version of the exciter in final physical size and shape which can be used in electrically testing the complete system.

Extensive tests have been made on the power amplifier to design and test the fail-safe features of the system. Decisions have been made on all components. All critical items have been received except the final variable tuning capacitor and the servo motor, which are expected shortly. Design of the automatic tuning servo unit is complete, and it is about to be connected to the power amplifier for system test.

Tests on various antennas have continued with the emphasis on higher impedance portions of the antennas. Additional antennas will continue to be tested.

A prototype model of the first i-f amplifier has been completed and performs satisfactorily. A breadboard model of the second i-f has been completed and is now being extensively tested. The second i-f employs a new component for interstage coupling which is made by Clevite. If successful, use of this component will greatly simplify circuit complexity.

Work is progressing on the breadboard model of the phase-detector. During the next reporting period, the various breadboard models will be interconnected and preliminary receiver tests will be started.

Transmit Terminal: The simplified breadboard model of this Terminal has been completed and all circuits are now being optimized. This model will be tried with the 231D transmitter during the next reporting period. Mechanical design is progressing smoothly.

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SDN RD8-1102/23

Page 4 of Copy 2 of 17

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Receive Terminal: The breadboard model of this Terminal has been completed, and testing of the various control circuits using actual "on the air" interference from a second receiver will be started soon.

The interrogation and pulse simulator chassis for this Terminal have been completed in final form except for the wiring of the power and signal connectors. All the other chassis for the first RF Cabinet and the Data Cabinet have been started.

TASK 9. LINEAR EXCITER FOR THE AS-4A

This program has been delayed indefinitely pending decisions on the future course of the AS-4B program. This action has been concurred in by the cognizant Government engineers.

TASK 10. FABRICATION OF RS-16B

Mechanical design of the exciter (formerly the high frequency oscillator and buffer-driver units) is nearing completion and fabrication will be initiated during the next reporting period.

Fabrication of the keying amplifier is now under way. The six initial production models will be diverted to the RS-16A refurbishment program under Task 7, and will be replaced by later production.

Design of the battery box has been completed. Drawings will be released to production early in the next reporting period.

TASK 11. RS-16B BATTERY CHARGER

Electrical design of the battery charger is complete. An investigation of a recently introduced commercial power supply, which could be modified to meet the system requirements, is also being made.

TASK 12. RS-16B ANTENNA TUNERS

Work on this Task is going on at a reduced rate due to the pressure of other programs. A study of the sensing and detection circuits required by the coupler is underway, however.

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SDN RD8-1102/23

Page 5 of
Copy 2 of 17

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TASK 13. CS-15 STUDY

A draft copy of a preliminary evaluation report was submitted to the cognizant Government engineer. This report discussed several approaches that might be used. Effort is being devoted to this Task at a very low rate.

TASK 14. RS-24 STUDY

Modulation studies are continuing and a report is being prepared which will discuss in detail the low power-swept frequency technique. Investigation of storage methods is being carried on and additional emphasis is being placed on transistorization of all r-f circuits.

GENERAL

[redacted] visited Washington from 17 to 21 November to review all contractual matters, with particular emphasis on AS-6 and RS-16A programs.

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We are pleased to advise you that a recent organizational change has been effected.

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[redacted]

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[redacted] Section will remain the focus of all Contract RD-103 equipment development; it will receive increased support in studies, modulation methods and advanced techniques from [redacted] Section, while unusual and critical circuit problems, especially with regard to transistors, will be referred to [redacted]. This support was formerly provided under an informal arrangement; its formalization will achieve more effective and direct control over RD-103 activities. [redacted] has been relieved of his duties as Project Manager - Special Systems (Contract RD-103 matters) to devote full time as Manager of this new Department.

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Progress is satisfactory.

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SDN RD8-1098/23
Page 3 of 6
Copy 5 of 15

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TASK 6. RS-16A TEST POWER SUPPLY

The combined Final Report and Instruction Manual was delivered during this reporting period, thereby completing all work on this Task.

TASK 7. SERVICE AND SUPPORT

One RS-16A Field Unit is undergoing repairs and rework to improve its reliability. This program is temporarily held up due to a shortage of replacement parts for the coder.

A second RS-16A was returned for refurbishing during this reporting period. Work on this unit has not as yet been started, pending further discussions with cognizant Government engineers.

Scheduled completion of repaired receiver autotune motors has been extended to 10 November.

As requested, inexpensive copies of the AS-4 transmit and receive manuals were prepared for use at AS-4A schools. Six copies of each were shipped at the end of the month.

TASK 8. AS-6 DATA TELEMETERING SYSTEM

Field Unit: Tests of the breadboard digital converter circuits have been completed. Preliminary arrangements for testing the digital converter with the data collector are scheduled to take place during the next reporting period.

The breadboard model of the exciter is being prepared for testing with the final amplifier. Fabrication of a second model has been completed and will be used for system test. Crystal oscillators are being constructed to replace the previously used signal generators. The unit will be a five-channel device when completed and will allow checking of time cycling, servo operation and drive requirements.

A breadboard model of a non-servo tuned amplifier is operating into a 50 ohm load. Emphasis at this time is being placed on major components such as the PA tubes, servo tuned plate tuning capacitor, PA coil form, plate choke and servo motor. At a lower

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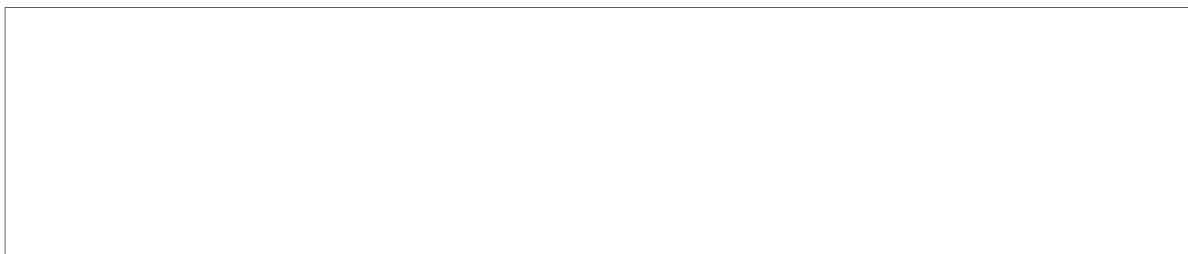


SDN RD8-1098/23

Page 4 of 6
Copy 2 of 15

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priority, studies are being conducted on the fail-safe features of the system.



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Transmit Terminal: All units of the Transmit Terminal have been separately breadboarded. Maximum effort will now be devoted toward integrating these units electrically and mechanically in the form of a complete terminal breadboard. Plans call for this breadboard to be tested with the 231-D Power Amplifier.

Receive Terminal: A second breadboard model of the Receive Terminal IF amplifier has been completed and is now undergoing tests. All components for the receiver drawer which require a long procurement time have been delivered.

The recognition and pulse simulator chassis of the Receive Terminal are being fabricated in final form. Other chassis are undergoing mechanical design preceding the fabrication which will be started in the very near future.

The recognition and pulse simulator chassis of the Receive Terminal are being fabricated in final form.

TASK 9. LINEAR EXCITER FOR THE AS-4A

Work under this Task is being deferred, with Government approval, pending more definite specification of the AS-4B program.

TASK 10. FABRICATION OF RS-16B

A second model of the combined oscillator-buffer driver unit has been constructed, tested and found to perform satisfactorily. The purpose of this model was to reduce the mechanical complexity of the sheet metal structure experienced in the earlier model. Electrical design of this unit is complete and mechanical design under way.

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SDN RD8-1095/23

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Page 3 of 5
Copy 2 of 15**TASK 7. (continued)**

At the request of the Government, one RS-16A is undergoing some minor changes which will add materially to its reliability. This work has just been started.

TASK 8. AS-6 DATA TELEMETERING SYSTEM

A complete model of the digital converter has been assembled and is now undergoing test. Fabrication of the deliverable models will begin shortly.

A second model of the Field Unit exciter is being fabricated incorporating a mechanical layout compatible with space allocations.

Impedance measurements have been conducted on a 36 foot horizontal wire antenna as well as on a series of continuously-loaded whip antennas. This data is part of the evaluation program aimed at the solution of the low frequency antenna for the Field Unit.

Final values have been assigned to the power amplifier matching network components based on the use of a 36-foot horizontal wire located 2 feet above the ground. This decision was necessary in order to allow the power amplifier development program to advance during this period when a multiplicity of choices exist for the low frequency antenna. The changes necessary to accommodate other antennas are minor and will not affect the basic design of the power amplifier.

Electrical design of the several converters and narrow band audio filters for the Field Unit receiver is complete.

A breadboard model of the Receive Terminal is complete using only one receiver. Emphasis on this terminal is now being placed on circuit refinements and preparing for construction of deliverable chassis.

Several breadboards of the transmit terminal have been completed and are now being tested.

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SDN RD8-1094/23

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Page 1 of 5

Copy 2 of 15

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30 September 1958

TO:

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SUBJECT: Informal Progress Report, Contract RD-103

This letter constitutes the Twenty-ninth Monthly Progress Report submitted in compliance with Contract RD-103, covering the period 1 August to 1 September 1958.

TASK 1. REDESIGN OF RS-16A

Work under this Task has been completed.

TASK 2. REDESIGN AND FABRICATION OF AS-4

Work under this Task has been completed.

TASK 3. AS-4A HIGH-SPEED PROCESSING SYSTEM

The drafting program for manufacturing drawings of the AS-4A system is well under way. Early emphasis was put on the DT-4A Transmit Data Terminal and the AT-4A Transmit RF Terminal while they are available prior to shipment.

Work on the Final Report of the AS-4A development program is 90% complete. The Transmit RF Terminal description is approaching completion.

TASK 4. STUDY OF AS-6 SYSTEM

The Final Engineering and Evaluation Report has been edited and is being typed in final form.

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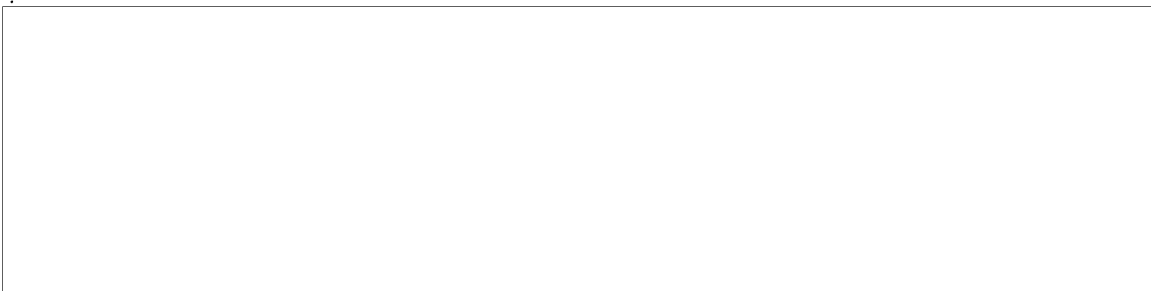
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TASK 5. DEVELOPMENT OF AS-5 SYSTEM

The digital sections of the AS-5 have been modified to incorporate redundant slow-speed operation into the breadboard model of the input section. All delay lines have been received and inspected. The recognition circuit breadboard is nearing completion. Sections of the parity circuit breadboard have been modified to incorporate the low-speed redundant mode. Initial circuit design for the gated AGC has been completed. The AGC amplifier has been designed and will be tested in the near future.

Preliminary system redesign for the redundant mode of operation has been completed. Several wave-shaper circuits have been breadboarded for comparison. The more promising ones are now being tested with the exciter.

The output circuits which drive the Soroban GP-2 punch have been modified to accommodate differences from the GP-1 model. Control circuits have been designed and are being breadboarded.

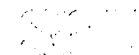


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Crystal filters have been received and are being tested in conjunction with the I.F. amplifiers.

In the exciter, stability tests were run on the local oscillator from 0 to 55° C. Drift of 5 parts per million was initially observed but improved insulation reduced this figure to less than 2 parts per million. It was determined that temperature compensation was not required for the selective tuned circuits through the exciter. All bands were checked for range and bandpass. It was determined that no higher than second harmonic operation would ever be required of the crystal oscillator. An order has been placed for fabrication of one AN/ARC-68 kilowatt linear amplifier.

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TASK 6. RS-16A TEST POWER SUPPLY

The combined Final Report and Instruction Manual has been released to publication.

TASK 7. SERVICE AND SUPPORT

Two AS-4 receiver autotune motors were received for repair.

Return of the AS-4A high-speed punches to the Soroban company for repair and adjustment was authorized.

TASK 8. AS-6 DATA TELEMETERING SYSTEM

Design and fabrication of the test model of the Field Unit digital converter is well under way. With the exception of the frequency standard and clock pulse generator, all of the converter circuits have been packaged in a form suitable for installation in the operational equipment.

A model of the Field Unit exciter has been completed and tested. A second model is now under construction which will incorporate necessary component changes and a new mechanical layout compatible with the space allocation in the final package. A preliminary breadboard of the power amplifier has been constructed. Tests of its components are under way.

A preliminary breadboard model of the second converter for the Field Unit interrogation receiver has been completed.

Testing of the prototype model of the 455KC I.F. amplifier for the Base Station has been completed and mechanical design has been started. This I.F. amplifier has essentially the same electrical characteristics as the I.F. amplifier which is used in the AS-4, but it is superior mechanically and much cheaper to produce.

Most of the units of the Receive Terminal breadboard have been completed and testing of this Terminal has started.

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Construction of a breadboard model of the Transmit Terminal has started.

TASK 9. LINEAR EXCITER FOR AS-4A

Very preliminary work on the Linear Exciter indicates the 310F1 can be channelized in contrast to the other models which select frequency manually. This program is being carried at very low priority in deference to work on other Tasks.

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TASK 10. FABRICATION OF RS-16B

A considerable improvement in RF output signal amplitude and stability has been achieved by the addition of several minor circuit changes in addition to the redesign of the high frequency oscillator and buffer driver. Several design changes have been made in the coder to improve its manufacturability and reliability. A prototype coder incorporating all design changes is now being fabricated. To date, three units have been released to the Production Engineering Department. These are the receiver, power amplifier and stepping oscillators.

TASK 11. RS-16A BATTERY CHARGER UNITS

A breadboard of the battery charger has been tested and found to perform satisfactorily. By mutual agreement, the battery charger will be designed to charge only the RS-16B battery pack instead of the battery packs for both the RS-16A and RS-16B. This change will simplify both the circuit design and the operation of the charger in the field.

TASK 12. RS-16A ANTENNA TUNERS

A study of the range of circuit values required to match the latest antenna characteristics is being initiated. Concentrated effort is being deferred in favor of higher priority Tasks.

TASK 13. CS-15 STUDY

Additional information concerning the data to be studied was brought to light at a conference held in Washington during the

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SDN RD8-1094/23
Page 5 of 5
Copy 2 of 15

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reporting period. The data reduction problem now appears more hopeful. The determination of an information storage system is the point requiring the greatest study. Plans are being formulated for conferences with various specialists in the generation and analysis of this class of data.

TASK 14. FEASIBILITY STUDY OF RS-24 SYSTEM

Study of a phase modulation system locally developed has been completed. Its purpose was an investigation of the optimum bandwidth and channel spacing of a multiple channel phase modulation system. Although this study was conducted under a company sponsored program, the results are directly applicable to the RS-24 system. Consideration of alternate modulation systems is now under way.

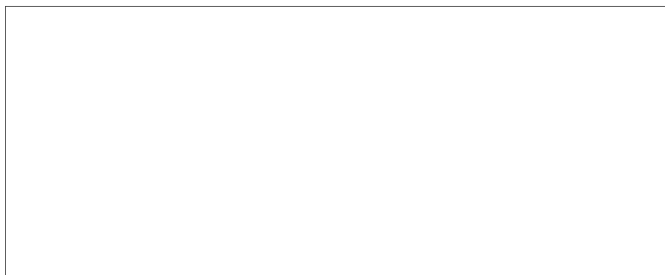
The search for an inexpensive, light-weight, static storage system continues. It appears that a mechanical storage device utilizing magnetic tape or some other recording media still represents a promising approach to the problem of storing the quantity of data required.

GENERAL


visited on 4 August to observe work on all Contract Tasks. 
remained through 5, 6 and 7 August for more detailed discussions.

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Progress is generally satisfactory.



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Page 3 of 5Copy 2 of 14

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➤ TASK 8. AS-6 DATA TELEMETERING SYSTEM

The active audio filters designed for the interrogation receiver has been found to be satisfactory. Environmental testing will continue upon receipt of components with low temperature coefficients.

The majority of the digital converter circuits have been assembled in a preliminary package design. The ring counter, Barker code generator and advance programmer circuits have been tested. Tests of the ring counter circuits indicate no degradation in performance over a temperature range from -55° to $+55^{\circ}$ C and with simultaneous voltage variations of $\pm 20\%$.

A preliminary breadboard of the Field Unit exciter has been completed. This exciter provides approximately 15 watts of driving power to the power amplifier over the frequency range of 3 - 30 mc. A service test model of the exciter is now being constructed. Fabrication of the chassis for the power amplifier is under way. Impedance measurements are being made on a 50 ft. horizontal antenna located 2 to 4 feet above the ground. These data are required for the design of the antenna matching networks for both the power amplifier and receiver front end.

Development of the Receive Base Station is progressing with the breadboard now about 60% complete.

Construction of a prototype model of the new i.f. amplifier has been completed and it is now ready for testing.

TASK 10. FABRICATION OF RS-16B

The production schedule has been submitted to the Product Engineering Department. Plans call for the release of the Field Unit receiver drawings and specifications to the production control group

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on August 6. Redesign of the coder and high frequency oscillator / buffer driver circuits is now under way.

TASK 11. RS-16A BATTERY CHARGER UNITS

A breadboard of the battery charger has been constructed, and tentative mechanical layout has been made. Construction of the prototype is dependent upon receiving the necessary components, which are on order.

TASK 12. RS-16A ANTENNA TUNERS

No work has been performed under this Task to date. Information on critical components has been requested from manufacturers. Action on this Task must be deferred until personnel become available from other r.f. development programs.

TASK 13. CS-15 STUDY

Work on this Task has been postponed until August, when a detailed course of action will be planned at a meeting between Government and Hughes engineers. A tape recording of the data under study has been received and a visual recording of it will be made as soon as this can be arranged.

→ TASK 14. FEASIBILITY STUDY OF RS-24 SYSTEM

A study of existing modulation techniques is being undertaken. System performance data on a phase modulation system developed by [] is now being collected.

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Various static storage systems are being considered. Although the study has hardly been started, it appears that an all-electronic active storage system will be quite bulky and prohibitively expensive.

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1. [] visited on 9 July 1958 to discuss technical details relative to Tasks 8 and 13.

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2. [] visited on 16 and 17 July 1958

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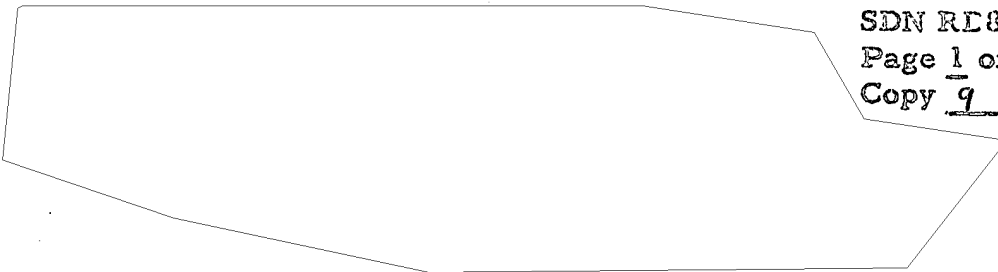
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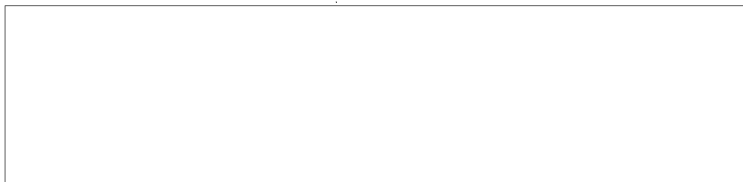
Page 1 of 4

Copy 9 of 14



16 July 1958

TO:



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SUBJECT: Informal Progress Report, Contract RD-103

This letter constitutes the Twenty-seventh Monthly Progress Report submitted in compliance with Contract RD-103, covering the period 21 May to 30 June 1958.

TASK 1. REDESIGN OF RS-16A

Cataloging of drawings prepared under this Task has been completed; reproducible copies of all drawings and parts lists have been delivered, thereby satisfying all requirements for Task 1.

TASK 2. REDESIGN AND FABRICATION OF AS-4

Work under this Task was completed during a previous report period. During this month, however, the Transmit Terminal was used in conjunction with the tests of the receive portion of the AS-4A. The AS-4 Receive Terminal was used to monitor and receive local and transcontinental RS-16 tests with equally good results.

TASK 3. AS-4A HIGH-SPEED PROCESSING SYSTEM

The Final Report is approaching completion. The only major description still to be prepared is of the AT-4A Transmit RF Terminal.

TASK 4. STUDY OF AS-6 SYSTEM

The Final Engineering and Evaluation Report has been completed in draft form.

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TASK 5. DEVELOPMENT OF AS-5 SYSTEM

1. Two new turrets and chassis for the receiver are being used for r-f development, temperature control and filtering investigation. A separate chassis is devoted to I.F. amplifier development. A chassis for the exciter is being used in conjunction with one tuning strip for preliminary evaluation of the design parameters of the local oscillator and balanced modulator.

2. One sample of the final modularized I.F. amplifier has been modified and tested with satisfactory preliminary results. A second sample is being fabricated for further evaluation.

3. Work has begun on the power amplifier consisting chiefly of initial steps for procurement of power supply components to establish weight and size. A preliminary specification is based primarily on the AN/ARC-68 power amplifier.

4. Waveshaping circuits have been designed and partially tested for feasibility.

5. The Flexowriter was received and is operating properly.

6. Breadboards of the low voltage power supplies have performed satisfactorily. Engineering models of the supplies are under construction.

TASK 6. RS-16A TEST POWER SUPPLY

Work on the three Test Power Supplies constructed under this Task has been completed. One power supply was delivered several months ago, while a second unit awaits shipping instructions. The third Test Power Supply is to be GFP during construction of additional RS-16A Field Units under a proposed Task, to aid in the testing of the finished products. The combined Final Report and Instruction Manual is being edited.

TASK 7. SERVICE AND SUPPORT

The long hours of testing the AS-4A Transmit Terminals revealed some minor weaknesses. Examples which were later corrected

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include a malfunctioning flip-flop in the DT-4A Transmit Data Terminal, and occasional instability at the start of transmissions in the high power keyer.

TASK 8. AS-6 DATA TELEMETERING SYSTEM

1. A basic Flip-Flop design has been evolved for use in the digital converter. A number of these circuits have been constructed in breadboard form and tested in the ring counter and preamble generation circuits of the converter. A miniature package 3/8" x 1.6" x 3" containing two flip-flops has been designed and will be fabricated in test quantities early in the next reporting period.

2. Work on the Field Unit transmitter and exciter is under way. A breadboard model of the exciter is now under test. Since mechanical layout so seriously affects the electrical performance of high power RF circuits, a strictly electrical breadboard of the power amplifier will not be constructed. Instead, effort will be applied to the development of a test model having the same mechanical configuration as the final equipment.

3. During this reporting period a sub-contract was let to [redacted] for design, development and production of the transistorized receiver front-end modules. [redacted] on 17 June to monitor and plan the development progress. At that time work had just started at [redacted] Breadboard models of active audio filters for the interrogation link receiver have been constructed and are now being extensively tested.

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4. Development of the Receive Base Station is progressing. A breadboard model of the terminal is about 50 percent completed. A new IF amplifier is being designed which will be electrically equivalent to the AS-4A IF's, but much easier to produce and maintain.

GENERAL

1. Effective with this report, the monthly reporting period is changed from the 21st to the 20th of the next month, to the 1st to the 31st of a given month.

2. [redacted] visited on 4 June to

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discuss a proposed data collection study.

3. [Redacted] visited on 11 and 13 June to observe all phases of Contract RD-103. 25X1

4. [Redacted] discussed the AS-6 program in Washington 18-20 June. 25X1

5. Progress is satisfactory. 25X1



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