X-227

SPECIAL HANDLING

PROGRESS REPORT

Period of February 1 to February 29, 1964

Contract No. AF33(600)40280

SPECIAL HANDLING

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A F-101 FLIGHT TEST

Primary Film data was obtained on each of the three flights made this month. The results of flights 97 and 98 were degraded by erratic Recorder Film transport mechanism and by a 500 cycle noise modulation and video striping. Film drive was improved for flight 99, but the source of the noise modulation and video striping was not determined prior to that flight. Correlated film from these three flights was blurred and streaked because of the extraneous signals present on the primary film.

The erratic film transport was encountered with a Recorder that had been modified to operate with thin-base film. Effective repairs could not be made, so the Recorder was re-modified to operate with thick-base film. No film-drive problems were encountered on flight 99.

Flight 98 concluded flight testing of units for the first system delivered to the Phase II flight program. Units which will comprise the second system were installed in the aircraft and flown on flight 99. The transmitter cover interlock switch failed during flight and was replaced.

Flight altitude of the F-101 was increased from 40,000 to 45,000 feet for all three flights to optimize the antenna pattern position with the recording range segments. Observation of the primary film indicated an improvement in the uniformity of signal strength over the full range recorded.

The CEC recorder has been modified to handle "sine of Heading" and "Roll Table Position" signals. A recording of the Frequency Generator VFO control voltage was added to the magnetic instrumentation

system to determine if the video striping was caused by Frequency Generator transients.

Prior to flight S-99, a Minneapolis-Honeywell representative was at the Test Center to repair the F-101 auto-pilot. Auto-pilot operation was very good during flight 99.

B PHASE II FLIGHT TEST

The first radar system, in place on the frame and mounted on the dolly, was shipped to the Phase II Flight Test location. Also shipped were the Instrumentation and Programmer and the Field Test Equipment, consisting of the System Evaluator, System Test Set and the standard laboratory instruments. The antenna, interconnecting waveguide, and Single Axis Platform preceded the equipment.

With one field engineer already at the test location, the remaining three were underway by the end of the month. Some customer-furnished laboratory equipment has been delivered to the test laboratory area, but the area was not ready for system check-out.

Missing from the equipment installation was the flex section of waveguide between the antenna and transmitter, which allows the antenna to remain aligned with the flight path as the test vehicle yaws or pitches. This section is subjected simultaneously to bending, twisting, tension, compression and internal pressurss. A program to determine the best kind of flexing piece was carried out. Of two mechanically reinforced sections of solid waveguide checked, one was satisfactory in flexing life but imposed severe stresses on the antenna at the extreme antenna positions. Now under consideration are a spiral shaped waveguide and a high temperature flexible waveguide. All sections will be tested on the hydraulic test stand for stresses.

Still unknown is the angle-of-attack of the test vehicle during the initial phase of the flight test. To change this angle between the longitudinal axis of the antenna and vehicle, the pivot end of the antenna will be lowered and an adaptor for the bell crank attachment made to keep actuator operation in the same place, thus maintaining the same degree of linearity between actuator piston and antenna angular motion.

Design of corner reflectors for field use is completed except for determination of smallest size from the results of static correlation. Sketches for building reflectors are about 20% complete.

C ENVIRONMENTAL TEST

The Frequency Generator was vibrated in the fore and aft, lateral and vertical axis, in accordance with the requirements of MIL-T-5422E(ASG), as amended by specification R-1811. The results are summarized as follows (Reference: STM-152):

1. There were no mechanical resonances between 10 and 500 cycles in any axis.

2. There were no jumps in offset frequency greater than 5 cycles from count to count during vibration in the vertical axis.

Exploratory vibration on Nav Tie-In Unit and Single Axis Platform was started and will be completed early in March.

D RECORDER

Two modifications of the film transport were breadboarded to improve drive reliability and exposure station stability. In order to control the maximum supply and take-up free loop of film, a film feeler yoke and special low torque potentiometer were designed to sense any change in shape of the loops and apply a corrective voltage to the loop drive motors. Several trouble-free film runs have been made with both thin and thick film using variable speed film drive.

In addition, a proportional torque control device was installed on the supply cassette to sense the amount of film on the spool and adjust the torque on both torque motors, thus achieving constant film tension before the supply loop and after the takeup loop.

Controlled thickness drive belts were installed and an exposure made for comparison with previously uncontrolled thickness belts. The result is presently being evaluated.

Two power supplies have been returned to Utronics for repair. Power supply #9761 failed after 500 hours operation. An external check revealed that the high resistance precision divider was open. Power supply #9760 had unstable ultor voltage output and poor line regulation.

Component changes and layout modifications of the data flash circuit will be proposed following an analysis for the radiation effects on system operation and for reliable operation at high altitude.

Surge arrestors and avalanche diodes are being investigated for protecting deflection and focus modulation circuitry from damage as a result of flashover from the ultor to focus grid of the CRT.

The focus modulator design overlooked the maximum cathode to filament voltage rating of the 6U8 vacuum tube. Study is continuing to eliminate the tube overrating, which could result in tube destruction and shorting of the 300 volt power supply.

A periodic variation in film density on the fiber optic recorder breadboard was found to be caused by a magnetized pulley driving the capstan. Several manufacturers of precision rotating assemblies have been contacted to obtain nonmagnetic film drive components to replace the present 440C magnetic steel units.

E ANTENNA

One antenna module was assembled to test the bonding of ML fabric to the array stick without masking the slot area. No evidence of delamination was apparent when pressurized. The module was then heated to 550°F and pressurized. The module failed when approximately 20 psi of air had been applied. One seal strip had failed by delamination and two others had large bulges. The module is being reworked to replace the three seals that failed, and will be retested. This failure indicates that little improvement to the fabric reliability can be obtained by this technique of coating the entire fabric surface with the bonding resin rather than masking the area covering the slots.

Samples of ML fabric were subjected to various values of heat and pressure and then pulled apart. An analysis of these results indicates no definite pattern nor any significant improvement of the delamination defect. No additional tests are planned along these lines.

Heat-pressure life tests of the new fabrics have been started. A total time of 262 hours exposure to 550°F temperature and 30 psi internal pressure has been accumulated. In addition to this, the same samples have been exposed for 7 hours unpressurized at -65°F. Of the samples tested, the Westinghouse I7 fabric and the control samples of ML fabric show no signs of leakage. The DuPont 1 ply and 2 ply laminates showed a slow leakage or weepage after 41 hours and the Narmco laminate leaked after 131 hours. This leakage was not considered to be of large enough volume to require changing the sample. Other fabrics were removed from the test because of poor electrical or mechanical properties.

Bonding samples were prepared for all usable fabrics and all

samples indicated that bonding would not be a major problem.

F SYSTEM

Prior to shipment of the first system, all units were operated on the frame, and tested. No significant difficulties were encountered, with operation much as predicted. The Field Test Equipment was used during this composite test phase to generate test signals and to analyze the results.