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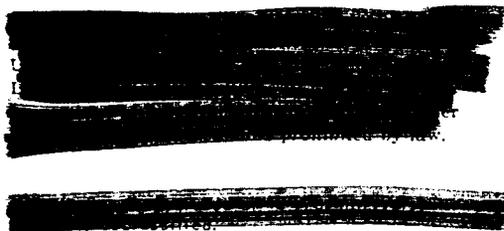
Development Report

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May 1971

TEST REPORT OF THE SPRINT AEC-DOD JOINT  
FLIGHT TEST QUALIFICATION, UNIT 1A  
(FTQU-1A), TEST NUMBER 60 (U)

O. R. Berg  
Test and Evaluation Division, 1553  
Sandia Laboratories, Albuquerque, N. M.



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TEST REPORT OF THE SPRINT AEC-DOD JOINT FLIGHT TEST  
QUALIFICATION, UNIT 1A (FTQU-1A), TEST NUMBER 60 (U)

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ABSTRACT (U)

This report describes and presents the results of the electrical and environmental testing performed on the Sprint AEC-DOD Joint Flight Test Qualification Unit 1A (FTQU-1A), Test Number 60.

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QUALIFICATION, UNIT 1A (FTQU-1A), TEST NUMBER 60

Introduction

The FTQU-1A test was conducted to assure that the Block I flight test warhead section configuration was structurally and electrically capable of fulfilling the intended purpose of the flight test program. Hardware supporting this test was provided by Martin-Marietta at Orlando (MM-O), Picatinny Arsenal (PA), Bell Telephone Laboratories (BTL), and Sandia Laboratories, Albuquerque (SLA). The test, accomplished in accordance with the FTQU-1A Test Plan,<sup>(1)</sup> was divided into five phases.

- Phase 1 - Electrical Bench Test
- Phase 2 - Mechanical Compatibility Test
- Phase 3 - Mass Properties Test
- Phase 4 - Centrifuge Test
- Phase 5 - Vibration Test

The test conducted at SLA began on May 6, 1969 and was completed on August 1, 1969. This report describes and presents the results of the FTQU-1A test.

Test Objectives

The objectives of the FTQU-1A test were to:

1. Provide confidence that the structural integrity of the flight test unit is adequate for flight
2. Obtain additional structural data on the new flange location in the ballistic case
3. Obtain data that can be used to define the difference between tactical and flight test warhead sections

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4. Determine the ability of the instrumentation system to function properly when subjected to flight loads
5. Verify the mechanical and electrical compatibility of the flight test hardware
6. Determine the suitability of the tactical and flight test handling equipment used for assembly of the warhead section.

#### Conclusions

All of the test objectives were met. Assurance was obtained that the Block I flight test warhead section configuration is structurally and electrically capable of fulfilling its intended purpose.

#### Test Configuration

The FTQU-1A test warhead section configuration is defined on PA Interface Drawing No. 9239231 (FTQU-1). Its major components are

1. The MM-O ballistic case, including tactical cables and the flight safety system and associated cabling
2. The PA adaption kit and associated tactical and instrumentation cabling
3. The SLA warhead including telemetry, signal conditioning, and instrumentation cabling.

#### Testing

##### Phase 1 - Electrical Bench Test

Test Description -- In this test, which was conducted to check the telemetry (TM) instrumentation interfaces, signal simulators provided by the agencies concerned were employed.

Results -- The PA simulator was employed for the initial testing. The cross talk which occurred was traced to open circuits in the PA simulator. Modification of the

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simulator operation corrected this problem. Simulator runs with the SLA simulator were satisfactorily completed and no problem areas were discerned.

All signals simulated were transmitted and received correctly.

Phase 2 - Mechanical Compatibility Test

Test Description -- In this test the adaption kit (AK), warhead, and externally mounted instrumentation were assembled into the ballistic case and interconnected; PA supplied the assembly procedures and handling equipment. Calibration signals were applied through the instrumentation cables to the TM. These signals were then transmitted via the ballistic case antennas to a ground station.

Results -- During the preparation of the ballistic case, it was discovered that tiedown clips for the 5A1W26 and 5A1W27 cables and the functional antennas had not been installed. SLA installed the clips and modified the case to accept the antennas in accordance with MM-(O) instructions.

Mechanical compatibility between the warhead, ballistic case, AK, and associated hardware was demonstrated. In addition, all calibration signals were transmitted successfully.

Phase 3 - Mass Properties Test

Test Description -- The warhead section, as assembled in Phase 2, was to be tested to determine its mass properties.

Results -- Because of time constraints, mass properties of the FTQU-1A were not taken; however, mass properties of an identical configuration were taken at a later date.

Phase 4 - Centrifuge Test<sup>(2)</sup>

Test Description -- The FTQU-1A was subjected to a centrifuge test to gain confidence in its structural integrity and functional capability when subjected to acceleration levels in excess of those to which a flight test unit will be exposed during a flight. The TM was operating during all phases of this test.

Results -- The unit was accelerated at the SLA 35-foot centrifuge to the following levels:

<u>Axis</u>	<u>g-level</u>
-Y	100
+Y	100
-Z	100
+Z	100
-X	50
+X	180

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After five of the axes tests were successfully completed but prior to +X axis test, the unit was inadvertently dropped from a height of 3 feet. Initial inspection revealed that one displacement gage was bent and some cable ties were broken. No structural damage was observed. The cable ties were replaced and the 180-g phase was run.

NOTE: The test plan called for 188 g's; but, because of a malfunction of a centrifuge hydraulic pump, the 188-g level could not be achieved; the test was run at 180 g's.

At the conclusion of the centrifuge testing, disassembly of the unit revealed that eleven of the eighteen No. 10-32 warhead forward cap flange bolts were broken, the flange was bent in several locations, and the O-ring was out of its groove. An investigation revealed the following:

1. TM records indicated a loss of internal pressure between the -X and +X test phases.
2. Structural analysis of the joint which failed showed that more than 600 g's would be required to cause the joint bolts to fail in the -X direction. (Loads in the +X direction close the joint.)
3. An analysis of the accidental impact conditions showed that joint failure could be expected. The impact induced loads in the -X and lateral directions.

In that the 3-foot drop occurred between the -X and +X tests, it was concluded that the joint failure was caused by the drop. Subsequent centrifuge tests on six flight units, three FTQU's, and a tactical unit have verified this conclusion. The TM responded properly to all of the environmental stimuli.

#### Phase 5 - Gibration Test<sup>(3)</sup>

Test Description -- The vibration testing of the FTQU-1A was accomplished for reasons identical to those established for the centrifuge testing.

Results -- The unit was tested at the requested specifications, according to the test plan, except to those levels of the Y- and Z-axis tests which could not be achieved because of equipment limitations. The Y- and Z-axis tests were run on the Teem table, while the X-axis portion was done on the vertical thruster.

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Hardwire data were gathered from the case mounted hardware which did not have telemetered transducers. Additional hardwire comparison data were gathered from strategic points on the warhead. All other vibration data were gathered through the telemetry. The TM functioned as designed in all phases of this test.

#### Summary

The FTQU-1A warhead section tests are considered successful, (in accordance with the Test Plan) except for those areas where minor equipment limitations precluded complete testing. Test results indicate that this system is capable of fulfilling its intended purpose.

More detail on the Phase 4 and 5 portions of this test are available in References 2 and 3.

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1. Sprint AEC-DOD Joint Test Plan, AEC-DOD Test Number 60, Flight Test Qualification, Unit 1A (FTQU-1A), Sandia Laboratories, March 1969.
2. Centrifuge Acceleration Test of the Sprint, FTQU-1A, Sandia Laboratories, R-100650, December 15, 1969.
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