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21-52-12

B-36 VIBRATION TEST OF A TX-5 E-8 TYPE UNIT

1 st Review Date: 6/16/97	2. Classification (Circle 1-5)
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2 nd Review Date: 7/7/97	4. Classification by (Cite 1-5)
Authority: ADD	5. Classification by (Cite 1-5)
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CENTRAL FILE
 ACCOUNT NO. MK-5
 CARD
 FILE NO. MK-5
 ABSTRACT

Report on results of a test conducted to obtain assurance that the ITD components would withstand maximum service vibrations, and to prove that the MC-23 would operate satisfactorily under those conditions.

~~TOP SECRET~~

Case 430.0

UNCLASSIFIED

October 20, 1952

SANDEIA SYSTEMATIC DECLASSIFICATION REVIEW
 DETERMINING OR DECLASSIFICATION STAMP

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		7-7-97

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B-36 VIBRATION TEST OF A TX-5 E-8 TYPE UNIT

Objects

1. To determine the suitability of the current ITD in the MC-23 mechanism under maximum expected service vibration (No. 4 bomb bay of B-36 aircraft, with gunfire).
2. To prove the electrical operability of the MC-23 mechanism under the combined environmental conditions experienced in normal flight in No. 4 bomb bay of the subject aircraft.
3. To determine vibratory accelerations in the suspension system as well as of major assemblies of the TX-5 unit suspended in No. 4 bomb bay of the B-36 under representative flight conditions.

Conclusions:

1. The ITD, consisting essentially of a plastic-filled core (5Y 105457) and a 150 D-E capsule (TU), successfully withstood more than 23 hours of flight vibration in the MC-23 mechanism (in the "safed" position) under flight conditions, including gunfire, representative of those encountered on a typical mission in No. 4 bomb bay of a B-36 aircraft.
- 2a. The MC-23 mechanism successfully completed 34 arming and 34 safing sequences, with the plastic-filled core and a 150 D-E capsule (TU) in a 2 1/2 hour period of normal flight (cruise) in the No. 4 bomb bay of the subject aircraft.
- b. The MC-23 mechanism would not operate electrically beyond the 34 cycles mentioned above because of accumulative axial expansion of the plastic-filled core, which subsequently resulted in (1) jamming of the guide tube nut; (2) out-of-phase operation of the MC-70 - MC-23 because of a manually triggered No. 7 micro-switch and (3) a burn-out of the stepping solenoid in the MC-70 when power was supplied for an extended period to the "out-of-phase" mechanism.
3. Vibrometer, accelerometer, and strain gage records, obtained on the suspension system and on major components of the TX-5, are in the process of being evaluated and will be summarized in a report to be prepared by WADC personnel at Wright - Patterson Air force Base.

Recommendations

It is recommended that:

1. The current ITD arrangement (Core, 5Y 105457, Issue A with D-E Capsule) be considered satisfactory with respect to resistance to maximum service vibration by W-1 Division, LASL.
2. Division 1242 review the MC 70 drawings and detail specifications in order to be sure that "double-stepping" of the solenoid-actuated selector switch cannot occur, so that resultant "out-of-phase" operation cannot effect a faulty "safed" or "armed" indication, and/or a malfunction of the automatic MC-23 control system. IN PROGRESS.
3. The vibration data obtained be reviewed by Division 1241 for comparison with design criteria, and with Standard Environmental Tests (SCS-5). THIS WILL BE DONE WHEN DATA ARE AVAILABLE.

Discussion of Results:

The subject test was conducted, primarily, to obtain assurance that the ITD components would withstand maximum service vibrations and, secondly, to prove that the MC-23 would operate satisfactorily under those conditions. Recent laboratory testing had indicated that under severe conditions of vibration, the TU cone supporting the 150 weight would fracture^(a).

The subject test was conducted during the period August - September, 1952, under Wright Air Development Center supervision. Detailed test information is contained in the S. R. D. document, "Convair B-36 Aircraft - Proposed Flight Vibration Survey, Project MX-1966" (AMC-WC-2440). Identification of the components of the test specimen are contained in a Confidential memorandum of October 1, 1952, A.C. Schwarz, 1241, to R. L. Brin.

The test was divided into two phases, namely:

(a) Reference memo of October, 1952, R. L. Brin, 1241, to E. H. Draper, Subject: "MK-5 ITD Vibration Test".

- (1) An instrumented phase with the ITD in the MC-23 in the "safed" position, and (2) a non-instrumented phase where the MC-23 was operated electrically. During phase I, representative flight conditions, including preflight, takeoff, climb, cruise, gunfire, and landing, were pursued; suitable instrumentation was provided in order to determine vibratory accelerations at the suspension system and on major assemblies of the TX-5 Unit.

It was originally proposed that phase I consume a relatively short period of time (approximately 6 hours), and that phase II consume an additional period (approximately 12 hours), such that the total time would approximate 18 hours.

However, phase I required 11-12 hours for a single run because of the remote location where gunfire could be conducted; a re-run was required to obtain adequate records, thus approximately 23 hours was consumed for phase I. A six-hour flight was subsequently allotted for phase II.

During the first hour of flight of phase II, 18 complete cycles (arming and safing constituted one cycle) of MC-23 electrical operation were observed. During the next 1 1/2 hours, 16 complete cycles were obtained. At this point, the MC-23 ceased to operate electrically; the guide tube was trying to retract the ITD^(a). The military observer then manually triggered No. 7 micro-switch and the guide returned to vertical without the ITD; the T-35 showed the TX-5 Unit to be "safed" though it was "armed". The in-out switch on the T-35 was then triggered and the guide tube returned to the horizontal position and stopped. The power being on in this out-of-phase condition resulted in a burn-out of the stepping solenoid in the MC-70.

(a) It is believed that the guide tube motor was alternately cut off and on by the thermal protection device on the motor. The guide tube nut was jammed because of the increased ITD length, which resulted in a solid stop almost instantaneously with micro-switch operation.

After the completion of the flight and prior to removal of the unit from the aircraft, it was noted that, with the MC-23 guide tube horizontal, the placement of the manual speed wrench into the guide tube drive was very difficult due to interference with an aircraft component on the panel forward of the No. 4 bomb bay catwalk. Also, the sway braces were 1/2 - 1" forward of the pad areas on the TX-5 Unit. Division 1283 has been notified of this problem and it will be pursued to a satisfactory conclusion.

Post mortem of the test specimen revealed the following:

1. The UTD Core* supplied by LASL had expanded axially by approximately 0.125 inch. (Radial expansion was found to be nil.) As previously noted, this cumulative expansion undoubtedly caused the guide tube nut to lock on the drive screws, thus accounting for the initial inoperability of the MC-23.
2. The stepping solenoid in the MC-70 was burned-out. This resulted from the MC-23 - MC-70 out-of-phase condition, which resulted when the military observer manually triggered No. 7 micro-switch, thus giving a false signal to the electrical system.
3. With a substitute MC-70 and ITD Core, the electrical operation of the MC-23 was satisfactory.

A. C. SCHWARZ - 1241-2

ACS:1241-2:sp

* After remaining in the laboratory for two weeks, the expansion and chemical activity of the filler material (lava compound) resulted in circumferential fracture of the core tube.

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