

MASSACHUSETTS INSTITUTE OF TECHNOLOGY
Instrumentation Laboratory
75 Cambridge Parkway
Cambridge, Massachusetts

TO: Ain Laats ISS MEMO #815
FROM: J. Gilmore and M. Landey
DATE: 2 July 1969
SUBJECT: PIPA Transient Test - Typical Bubble Effects

A. Per your request, enclosed is a copy of typical data resulting at component level for a 6-point transient test on a PIP with a large bubble (2AP40).

Figure 1 shows results (30 Oct. 67) of 11 different tests (conducted over a 2-day period). Each test corresponds to one of the positions used in the 6 position transient test (± 1 g, $\pm 1/2$ g in each quadrant). Age of PIP at this test time was 48 months. Note that test runs #1, 2, 9, 10, 11 show definite bubble transients ranging as high as 4.53 cm/sec^2 .

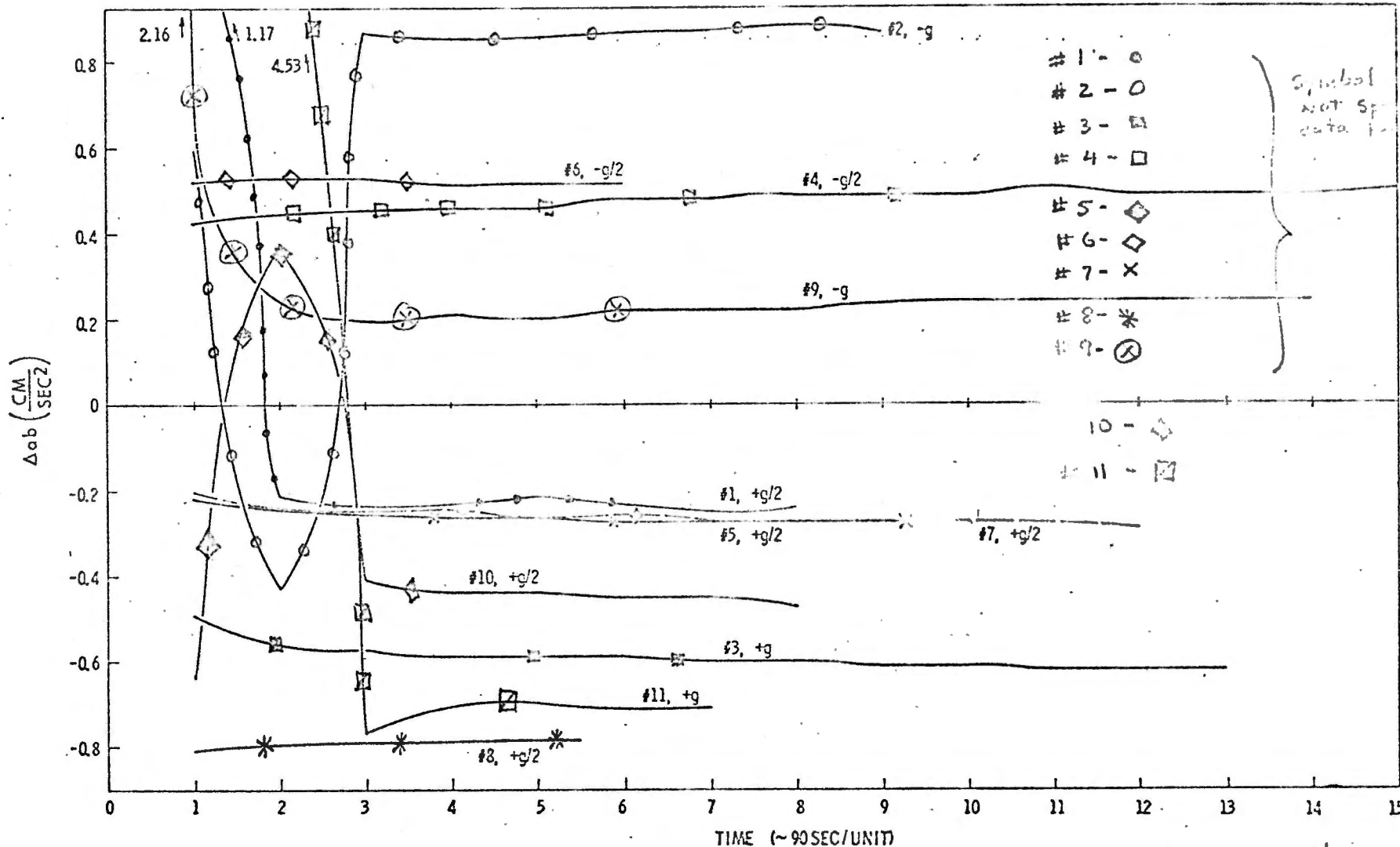
The remaining tests did not show a transient. Thus, repeat runs after a storage with OA up and down is desirable to assure complete screening. In retest on this PIP (2AP40) in Feb. 69, bias excursions in the $+1/2$ g, $+1$ g and $-1/2$ g positions were 3.3 cm/sec^2 , 1.7 cm/sec^2 and 0.4 cm/sec^2 . PIP age at this time was 63 months.

PIP S/N 2AP126 was tested in the STG lab using a systems level computer automated transient test (K-START tape #KST Dwg. 1026530 F09 C101-K 00089-00).

This test was conducted in Sept. 68 (PIP age: 42 months). The PIP exhibited a 0.4 cm/sec^2 magnitude bias transient. The unit was subsequently tested at component level on the same day, using the standard 6-point transient test, and a 0.46 cm/sec^2 bias transient was measured.

B. The standard procedure at ISS level for a PIPA transient test is:
(1/2 Hr storage OA up and rerun after OA down is recommended.)

II AP-40 BUBBLE FAILURE TRANSIENT RUNS 30-31 OCTOBER 1967



CONCLUSION:
 BUBBLE FAILURE
 (GAS IN DRIPPING
 FLUID)

Procedure:

1. Mount IMU on ROTAB, and tilt table so that its rotary axis is horizontal.
 2. Put IMU gimbal angles at 0,0,0 (X PIPA IA Up).
- Note: From this point on, it will be unnecessary to move gimbals.
3. Rotate table -90° , and soak there for 10 minutes.
 4. Rotate table $+90^{\circ}$ (to X IA Up) and start to count immediately. Get 6 counts of about 90 sec duration each.
 5. Rotate table $+60^{\circ}$ and repeat counts.

REPEAT STEP 5 FOR A TOTAL OF 6 TIMES.

End Of Test.

Note that transients due to bubble movement start as the PIP is rotated, and that these transients have died out within 5 minutes. Thus, counts must be started as soon as possible after repositioning the PIP. (See Fig. 1)

C. General Criteria used in screening transient testing at the component level is:

Rejection Spec:

$$\Delta a_b \geq 0.18 \text{ cm/sec}^2$$

Questionable Performance:

$$\Delta a_b \geq 0.10 \text{ cm/sec}^2$$

Expected Value for Good Unit:

$$\Delta a_b \sim 0.05 \text{ cm/sec}^2$$

D. Engineering interpretation of the transient test data follows 3 general rules:

1. If the counts are monotonically increasing, and $\Delta a_b \leq 0.2 \text{ cm/sec}^2$, then the transient is probably due to position memory.
2. If the slope is negative, or if the slope changes

sign, then the transient is probably due to a bubble
In general, a bubble will cause a transient between
0.10 and 5.0 cm/sec².

3. Very large changes in count, i.e., for $\Delta T > 2\%$ of T
indicate a very strong possibility of contamination.

Jerry Gilmore
Jerry Gilmore

Martin Landey
Martin Landey

:ctc

cc: G. Bukow
R. McKern
G. Silver
G. Edmonds
E. Grace
C. Frasier
M. Holley
M. Biggs
P. Headly
R. Masalek, KSC
R. O'Donnell, KSC
T. Lawton, MIT/MSC