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Massachusetts Institute of Technology
Instrumentation Laboratory
Cambridge, Massachusetts

COLOSSUS Memo # 139, Revision 1

TO: Distribution
FROM: M. Hamilton
DATE: 3 February 1969
SUBJECT: Discussion of Anomaly COL 69 (Responses to V99/97 in P40)

Following is a detailed description of Anomaly COL 69.

Attached to this memo is COLOSSUS Memo #144, Revision 1
which gives the recommended work around procedures for
COL 69.

Massachusetts Institute of Technology
Instrumentation Laboratory
Cambridge, Massachusetts

COLOSSUS Memo # 144, Revision 1

TO: Distribution
FROM: M. Hamilton
DATE: 5 February 1969
SUBJECT: Operational Information on P40 for Rev. 249

1. If a new program is selected in P40 between the V50N25 display and TIG via V37EXXE, a restart (V69E) should be executed after the major mode lights have changed to XX in order to reestablish normal optics operation. (If V99 is flashing it is preferable to terminate the program by either a V34E or an ENTER to the post burn display (V16N85) and then PROCEED to exit normally.)
2. If any erroneous display appears after a response to the flashing V99N40 or the flashing V97N40 display, do a terminate (V34E). The possible cases are:
 - A. If V06N16 results from a PROCEED or an ENTER to a flashing V99 or V97, terminate (V34E) and normal program displays will be restored. (V06N16 comes up because the extended verb V90 has been executed inadvertently by the program.)
 - B. If V97N40 comes up after a terminate response to a flashing V99N40 or a flashing V97N40 display, a terminate (V34) will end the program correctly and V37 flashing will result.
3. Use of extended verbs during P40 could overload the computer with too many JOBS. If this happens the ALARM light will come on (1201 or 1202 ALARM). All extended verbs that were going will be wiped out but P40 will be restarted to continue as normally.

NOTE: See anomalies COL 69 and COL 86 for more detailed information on numbers 1 through 3.

If the response to the V99N40 display and/or the V97N40 display takes place between the start of a CLOCKJOB and its ENDOFJOB*, some strange results will occur. These results depend on (1) the type of response made to the display and (2) the order in which the display JOBS are executed.

CLOCKJOB comes every second and sets up a display each time. The new display always replaces the old display.

After a response (which is made during a CLOCKJOB), two JOBS of equal JOB priority (27) are ready to become active. They are

- 1) the old CLOCKJOB display which has just been awakened by the response (i. e. the response to V99N40 display or the V97N40 display)
- 2) the new CLOCKJOB display at MAKEPLAY set up by a GOFLASHR CALL (also a V99N40 display or a V97N40 display).

The executive will treat each of these JOBS with equal priority according to their order in the VAC list. The JOB with the highest VACNUSE location will be treated as the JOB with the highest priority. Therefore each job has a 50% probability of being executed first.

In the matrix below the first two rows for V99 and for V97 show what happens due to the anomaly. Row 1 shows the results if JOB 1 is

* Since CLOCKJOB takes about 9 ms of execution time and CLOCKJOB comes up once a second, the chances of this happening are about 1/100.

executed first. Row 2 shows the results if JOB 2 is executed first. The third row for V97 and for V99 shows what should happen if there were no anomaly. The 3 columns in the matrix show the responses to the display.

	PROCEED	ENTER	TERMINATE
JOB 1 first	V06N16 flashing appears due to erroneous call of V90.	V97N40 for approximately 2 secs followed by V16N85	V97N40 flashing
V99			
JOB 2 first	V99N40 flashing will reappear again until the V06N40 non flash comes up to replace this display within 1 sec.	V99N40 for approximately 2 secs followed by flashing V16N85.	In rev.237 V97N40 is followed by 1502 ABORT with V37 flashing and AVERAGE G is lost. In rev. 249, AVERAGE G still is going and 1502 ABORT is followed by V97N40 flashing.
Normal Conditions	V06N40	V16N85	V37 flashing
JOB 1 first	V06N16 flashing appears due to erroneous call of V90.	V06N16 flashing appears due to erroneous call of V90.	In rev. 237 V97N40 is followed by 1502 ABORT with V37 flashing and AVERAGE G is lost. In rev. 249, AVERAGE G still is going and 1502 ABORT is followed by V97N40 flashing.
V97			
JOB 2 first	V97N40 flashing will reappear again until the V06N40 non flash comes up to replace this display within 1 second.	V97N40 less than 1 sec followed by V06N40 less than 2 secs followed by V99N40 flashing.	In rev. 237 V97N40 is followed by 1502 ABORT with V37 flashing and AVERAGE G is lost. In rev. 249, AVERAGE G still is going and 1502 ABORT is followed by V97N40 flashing.
Normal Conditions	V06N40	V06N40 for 2 secs followed by V99N40 flashing	V37 flashing

V99 - Proceed - JOB 1 first (allowable response)

- 1) The PRO response which got in first set up an immediate task which sets NVWORD1 to V06N40.
- 2) MAKEPLAY now sets up the paste for the V99N40 display by subtracting the constant for V06N40 from the constant V97N00 to create a new erroneous display of V90N88. (Normally the display paste is set up by subtracting a +0 or a +400 from V97N00 in order to obtain a paste of V97N00 or V99N00)

$$\text{Constant for V06N40} = 01450_8 \text{ (neg} = 76327_8 \text{)}$$

$$\text{Constant for V97N00} = 30200_8$$

$$76327_8 + 30200_8 = 26530_8 = \text{V90 N88}$$

Displaying a V90 with any legal noun will result in a call to V90. This is true for all extended verbs, i. e. displaying an extended verb will result in its execution.

- 3) V90 will now be executed with the result that a flashing V06N16 will be displayed. P40 will continue but the displays in P40 will not come up since V90 is going with extended verb displays which take precedence. Terminating V90 with a V34E will resume P40 back to its normal state.

V97 - PROCEED - JOB 1 first (allowable response)

Same as V99 - PROCEED - JOB 1 first only substitute V97N40 for V99N40 displays.

V99 - PROCEED - JOB 2 first (allowable response)

- 1) The V99N40 flashing display was redisplayed since the JOB call had been made to set up this display before the response got in to indicate that no more V99N40 displays were desired.

- 2) The PRO response to V99N40 did get in and executed everything normally. This included the setting of NVWORD1 back to V06N40 as well as starting up ignition.
- 3) As soon as CLOCKJOB is called again (1 sec later) the leftover V99N40 display will be replaced by the V06N40 non flash display. **
- 4) If the ASTRONAUT should try to respond to the new V99N40 display before the V06N40 came up there should be no problem for 2 reasons:
 - A. He would have to respond in less than a second to get the response in.
 - B. If the response did get in the Proceed logic would only partially be re-executed since restart logic in this area prevents a double start up of ignition.

V97 - PROCEED - JOB 2 first (allowable response)

- 1) The V97N40 flashing display was redisplayed since the JOB call to set up this display was made before the response got in to indicate that no more V97N40 displays were desired.
- 2) The PRO response to V97N40 was executed even though flashing V97N40 shows up for at least one more second. During this execution NVWORD1 is set to V06N40 to indicate the next CLOCK-JOB display is a V06N40 non flash.
- 3) As soon as CLOCKJOB is called again (~ 1 sec later) the leftover V97N40 display will be replaced by a V06N40 display. **

V99 - ENTER - JOB 1 first (allowable response)

- 1) The ENTER response which got in first set NVWORD1 = +0 and waited 2 secs before setting up a flashing V16N85 display with a REFLASH call. **
- 2) MAKEPLAY now sets up the paste for V99N40 by subtracting the contents of NVWORD1 (=0 in this case) from V97N00. The result is a V97N00 flashing. However the V16N85 display in no. 1 above replaces the new V99N40 display since it is a REFLASH call.

V97 - ENTER - JOB 1 first (allowable response)

- 1) The ENTER response which got in first set NVWORD1 = V06N40.
- 2) MAKEPLAY now sets up the paste for V97N40 by subtracting the constant for V06N40 from the constant for V97N00. The result is a V90N88 (see comment no. 2 & 3 on V99 - PROCEED - JOB 1 first).

V97 - ENTER - JOB 2 first (allowable response)

- 1) The V97N40 flashing display was redisplayed since the JOB call to set up this display was made before the response got in to indicate that no more V97N40 displays were desired.
- 2) The ENTER response was executed even though V97N40 reappears for a second. NVWORD1 is set to V06N40 for 2.5 secs to indicate a V06N40 non flash display to the next CLOCKJOB. After 2.5 secs, NVWORD1 is set to +400₈ to indicate the flashing V99N40 to CLOCKJOB.
- 3) As soon as the next CLOCKJOB is called (in less than 1 sec), the V06N40 will replace** the extra V97N40. In less than 2 secs V99N40 flashing will appear on the DSKY.

V99 - ENTER - JOB 2 first (allowable response)

- 1) The V99N40 flashing display was redisplayed since the JOB call had been made to set up this display before the response got in to indicate that no more V99N40 displays were desired.
- 2) The ENTER response to V99N40 did get in even though V99N40 is redisplayed for approximately 2 seconds. The ENTER logic set NVWORD1 = 0. This will turn off CLOCKJOB. After a DELAYJOB of 2 seconds in the ENTER logic, a REFLASH flashing display ** V16N85 will replace the V99N40 flashing display.

V99 - Terminate - JOB 1 first (response conditionally allowable)

- 1) The Terminate response which got in first set NVWORD1 = 0 and went to GOTOPOOH with the result of V37 flashing. The Terminate also set IMPULSW, turned off the TVC DAP, turned off CLOCKTASK, etc.
- 2) The MAKEPLAY JOB now sets up the paste for V99N40 by subtracting the contents of NVWORD1 (=0 in this case) from the constant for V97N00. The result is a new erroneous display of V97N40 flashing which replaced the V37 flashing since the LINUS call on V97N40 display call behaves like a REFLASH display. **
- 3) Responses to the unwanted V97N40 display are as follows:
 - A. An ENTER to the flashing V97N40 will return to the ENTER address of V99N40. This logic clears NVWORD1 to zero to kill CLOCKTASK (already killed by terminate on V99) and after a delay of 2 secs calls V16N85 flashing display which replaces the V37 flashing since V16N85 is a REFLASH. (allowable response)
 - B. The PRO on the flashing V97N40 will return to the PRO return address of V99N40. The PRO will turn on the engine and assume that an impulse burn has been set up

(See no. 1 above). The DAPs and CLOCTASK will not be going with this burn since the terminate turns them off. If the burn had been a non impulsive case to start with, TGO will not have been calculated by S40.13. However since the IMPULSW is on an impulse burn will be attempted. The WAITLIST call to turn off the engine in this case is called with a garbage time. This could make possible a negative WAITLIST call. A negative WAITLIST call will lock out SERVICER for 163.84 secs. If any attempt is made to select a new program, it won't get in until the 163.84 secs is over. The reason for this is that SERVICER must be going in order to sense that the V37FLAG has gone on. A flashing V16N40 REFLASH** display in POSTBURN will finally come up at the end of this sequence and replace the V97N40. (Use PROHIBITED)

- C. The terminate on the flashing V97N40 waits 2 secs and then goes to GOTOPOOH with a V37 flashing as a result. (allowable response)

V99 - Terminate - JOB 2 first (allowable response)

1. The V99N40 flashing display was redisplayed since the JOB call had been made to set up this display before the response got in to indicate that no more V99N40 displays were desired.
- 2) The terminate response to the V99N40 display did get in even though the V99N40 was redisplayed. The terminate goes to GOTOPOOH which attempts to set up a flashing V37 display but results in a 1502 ABORT since the V37 display conflicts with the leftover V99N40 display. The Terminate logic also sets up a 4.1 restart phase change and sets NVWORD1 to zero.
- 3) The 1502 POODOO ABORT wipes out SERVICER in Rev. 237. However in Rev. 249, a POODOO will turn into a BAILOUT and SERVICER is restarted.
- 4) In Rev. 237 the 1502 ABORT will result in V37 flashing since the 1502 ABORT is a POODOO. In Rev. 249, the POODOO ABORT will turn into a BAILOUT ABORT. The BAILOUT will restart the last display via a .1 restart phase change (See No.2). This means that V99N40

(the last legal display will be restarted. However, since NVWORD1 was set to zero, (see No.2 above) the V99N40 display will turn into a flashing V97N40 display. This will happen due to the fact that the display JOB, MAKEPLAY will subtract the contents of NVWORD1 from the constant for V97N00 with the result that V97 is pasted instead of V99.

- 5) An additional terminate to V97N40 will end up with V37 flashing (allowable response). See the V99-Terminate-JOB1 first description for example of results that could occur from any other response than a terminate at this erroneous V97N40 display.

V97 - Terminate - JOB 2 first (allowable response)

- 1) The V97N40 flashing display was redisplayed since the JOB call to set up this display was made before the response got in to indicate that no more V97N40 displays were desired.
- 2) The terminate response to the V97N40 display did get in even though the V97N40 was redisplayed. After a 2.5 sec wait the logic goes to GOTOPOOH, NVWORD1 is zeroed and a 4.1 restart phase change is made which attempts to set up a flashing V37 display but result is a 1502 ABORT since the V37 display conflicts with the leftover V97N40 display.
- 3) The 1502 POODOO ABORT wipes out SERVICER in Rev. 237. However in Rev. 249, a POODOO will turn into a BAILOUT and SERVICER is restarted.
- 4) In Rev. 237 the 1502 ABORT will result in V37 flashing since the 1502 ABORT is a POODOO. In Rev. 249, the POODOO ABORT will turn into a BAILOUT ABORT. The BAILOUT will restart the last display via a .1 restart phase change (see No.2 above). This means that V97N40 (the last legal display) will be restarted. Even though the contents of NVWORD1 were altered in the terminate logic, they happened to be correct for the V97 paste logic at MAKEPLAY.
- 5) An additional terminate to V97N40 will end up with V37 flashing (allowable response). See the V99-Terminate-JOB 1 first description for example of results that could occur from any other response than a terminate at this erroneous V97N40 display.

V97 - Terminate - JOB 1 first (allowable response)

- 1) The terminate response which got in first set NVWORD1 = 0 . After 2.5 second delay a V37 flashing display request at GOTOPOOH is made. A 4.1 restart phase change is made at this time.
- 2) MAKEPLAY will set up a legitimate verb-noun in the paste for V97N40 this time since NVWORD1 happens to have the correct values for a V97 paste (see 1 above). However V97N40 will still be redisplayed.
- 3) Approximately 2.5 seconds after V97N40 reappears the V37 request will cause a 1502 ABORT. In Rev. 237 this means that SERVICER is lost and a V37 flashing will result. In Rev. 249, SERVICER is restarted since a POODOO turns into a BAILOUT during SERVICER. The BAILOUT will restart the last legal display since a 4.1 restart phase change was made (see No. 1 above). The last legal display was V97N40 flashing. Even though the contents of NVWORD1 were altered in the terminate logic, they happened to be correct for the V99 paste logic at MAKEPLAY.
- 4) An additional terminate to V97N40 will end up with V37 flashing (allowable response). See the V99-Terminate - JOB 1 first description for example of results that could occur from any other response than a terminate at this erroneous V97N40 display.

CONCLUSION

All responses are allowable to the flashing V99N40 or to the flashing V97N40 provided the correct procedure is followed in the event of unusual behavior.

If any erroneous display appears after a response to the flashing V99N40 or the flashing V97N40 display, do a terminate (V34E). The possible cases are:

- A. If V06N16 results from a PROCEED or an ENTER to a flashing V99 or V97, terminate (V34E) and normal program displays will be restored. (V06N16 comes up because the extended verb V90 has been executed inadvertently by the program.)
- B. If V97N40 comes up after a terminate response to a flashing V99N40 or a flashing V97N40 display, a terminate (V34) will end the program correctly and V37 flashing will result.

CAUTION: Do not PROCEED to erroneous flashing V97N40 which results from an attempt to terminate (V34E) on a flashing V99N40 or a flashing V97N40.

** V06N40 non-flashing display in CLOCKJOB is a REGODSPR display. This allows it to replace a normal flashing display.

The V16N85 flashing display is a REFLASH display. This allows it to replace a normal flashing display.