63-3-4

TM-(L)-1080/000/00A

TECHNICAL MEMORANDUM

(TM Series)

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Computer Program Acceptance Specifications for the 1161 Flight Support Tape Milestone 6

by

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10 April 1963

Approved

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Modified Pages	Notes and Filing Instructions
5.0	Replace with pages dated 10 April 1963.
6.0	
14.0	
39.0	
41.0	
61.0	
1.0	Insert pages dated 10 April 1963.
61.1 - 61.8	
84.0 - 86.0	

Preface

This document was produced by System Development Corporation and constitutes validation and acceptance test specifications for the 1161 Flight Support Tape available as of the date of this publication.

2.2.4 Tests

2.2.4.1 Nominal Set Up - Test VAL11D01

2.2.4.1.1 Procedures

1. Mount the following tapes:

   unit 1 - 1100 series Flight Support Tape.
   unit 2 - blank reset tape.
   unit 3 - blank output tape.
   unit 4 - nominal data package.
   unit 9 - blank reset tape.
   unit 10 - blank reset tape.

2. Initialize reset tapes 2, 9 and 10.
3. Write nominal reset tapes from the data package.
4. Input the run number VAL11D01.
5. Enter the time of launch.
6. List the computed times of events on and off line.
7. Generate the Look and Station Requirements Table for the ship stations HORSE and MINT.
8. Generate a nominal injection vector.
9. Generate the Acquisition Table for revs .5 - 2.0.
10. List the Acquisition Table on and off line.
11. Generate a nominal orbital ephemeris from PREDICT for revs .5 - 2.0.
12. Generate a nominal orbital ephemeris from EPHFUN for revs .5 - 2.0.
13. Generate simulated ship data tapes for revs .5 - 2.0.
14. Generate the Look and Station Requirements Table for stations BOSS, ANNE, KODI, HULA, COOK and THULE.
15. Set the Acquisition duration time to 300 seconds.
16. Generate the Acquisition Table for revs .5 - 20.0.

2.3.4.5 Perturbed Orbit - Test VAL11P05

2.3.4.5.1 Procedures

1. Mount the following tapes:

   unit 1 - 1100 series Flight Support Tape.
   unit 2 - reset tape VAL11P03.
   unit 3 - blank for output.
   unit 4 - nominal data package
   unit 9 - blank for reset
   unit 10 - blank for reset
   unit 11 - blank for binary ephemeris

2. Initialize the blanks on 9 and 10.

3. Input the run number VAL11P05.

4. Reconstruct the orbit at the end of rev 79 with Powell cards numbered VAL11D07.

5. Generate the Acquisition Table for revs 80.0 - 100.0.

6. List the Acquisition Table off and on-line.

7. Generate acquisition messages for revs 80.0 to 81.0.

8. Reset in subcycle 80 to the time of crossing the reset latitude and add steps as required by the acquisition messages.

9. Predict for revs 80.0 - 85.0

   a. Acquisition messages
   b. Acquisition programmer tapes
   c. See messages
   d. Local Track listings
   e. Space track messages
   f. Ephemeris

10. Do a follow-on-initial update of the Timer Tables.

11. Predict for revs 80.0 - 100.0

    a. Acquisition messages
    b. Acquisition programmer tapes
    c. See messages
    d. Local Track listings
    e. Space track messages
    f. Ephemeris

after the last update. The number brought in, of course, will depend on the size and quantity of subcycles on the data package.

5. That portion of the prediction which corresponds to the last one must be identical to the last one.

6. The orbital ephemeris for revs 88.0 - 94.0 should be identical to that produced by the prediction for those revs.

2.3.4.5.3 Timing Requirements

Approximately 25 minutes excluding tape setup and off-line printing.

2.5.5 Analysis of Output

1. The rise vector produced by PROPHECY should compare favorably with the information given by a See message for the same station and rev.
2. If the reconstruction of the pre-pass message was completed, the resulting vector, after unit conversion, should be identical to that produced by PROPHECY.
3. There must be a complete pass ephemeris produced by the pass program, that is a point every second from rise to set time. The rise time should agree closely with that input by the prepass message. The pass duration should agree closely with that given in the Acquisition Table for the particular station and rev. Lock-on should occur fairly soon after the bird appears and be lost within a couple of degrees of declination of the bird going out of sight. Assuming a good fix, input declination and azimuth will be approximately equal to output declination and azimuth.
4. The vectors produced in post pass by the plane method and the Schmitt method will be fairly close to each other unless one of the methods rejected an excessive number of points.
5. If the post pass vectors have been accepted for fitting to the current orbit, inspect the resulting tau vector. It will, of course, depend on how well the data fitted the current orbit as well as on the weight of both the orbit and the data.

2.6 General System Test

2.6.1 Purpose

To present a short but comprehensive demonstration of the ability of the 1100 series Flight Support Tape in support of the complete data flow required by a flight.

2.6.2 Method

2.6.2.1 Generate acquisition and ephemeris information for the nominal ascent trajectory.

2.6.2.2 Simulate data collection, orbit prediction and commanding operations under nominal and adjusted orbits.

2.6.2.3 Simulate the production and reception of pre-pass and post-pass data between the STC and a tracking station.

2.6.2.4 Simulate retro performance for a nominal re-entry and the commanding operations involved.

2.6.3 Requirements

2.6.3.1 Input

Function cards - see appendix F

1161 Flight Support Tape

P-(11) Flight Support Tape

GTM-1 Station Master Tape

1159 Data Package

1159 6-D Tape

See procedures for mounting instructions.

2.6.3.3 Equipment

1604 computer

Card reader and punch

Tape units-ten

Paper tape reader and punch

Printer

2.6.4 Test GENSYTST

2.6.4.1 Procedures

1. Mount the following tapes:

   unit 1 - 1161 Flight Support Tape.
   unit 2 - blank reset tape.
   unit 3 - blank output tape.
   unit 4 - 1159 data package.
   unit 5 - blank "scratch" tape for ONAGER.
   unit 6 - 1159 6-D tape.
   unit 7 - blank tape for station programs.
   unit 8 - blank tape for station programs.
   unit 9 - blank reset tape.
   unit 10 - blank reset tape.

2. Initialize tape units 2, 9 and 10.
3. Write nominal reset tapes on units 2, 9 and 10.
4. Input the run number GENSYTST.
5. Correct the reset tape (file 1) - set the minimum acquisition duration time to 200 seconds.
6. Correct the reset tape (file 3) - set "stepsize" flag to zero to indicate a Type VIII Timer.
7. Enter the time of launch.
8. Generate the Look and Station Requirements Table; for COOK, KODI, HULA and THULE, request the following: See Messages, Space Track Messages, Acquisition Messages, Acquisition Programmer tape and Reeves Parameters. Request Baker-Nunn Messages for ORGN and OLIF.
9. List the 6-D tape:
   a) Local pad radar, rectangular, and curvilinear coordinates.
   b) Local pad rectangular velocity components.
   c) Plot of the local pad radar coordinates.
10. Generate ascent acquisition and ephemeris information for COOK:
    a) Acquisition programmer tape.
    b) Space Track message.
    c) Local Track listing
    d) Simulated ascent MODII data tape.
    e) Inertial ephemeris of the ascent trajectory.

11. Define an orbit based on a fit to ascent data using the simulated MODII data tape.
12. Generate a nominal injection vector.
13. Generate the Acquisition Table for revs 1.0 - 3.0.
14. List the Acquisition Table on and off-line.
15. Initially update the Timer Summary Table.
16. Generate acquisitions and camera parameters for the Baker-Nunn stations for revs 1-3.
17. Delete stations ORGN and OLIF from the Look and Station Requirements Table.
18. Generate Local Track Listings, See Messages, Reeves Parameters and an orbital ephemeris for the stations in the LOOK for revs 1.0 - 3.0.
19. Generate an orbital ephemeris directly for revs 1.0 - 3.0.
20. Update the Timer Summary Table by resetting to the RMN time in subcycle 2.
21. Generate Acquisition Messages for revs 2.0 - 3.0.
22. Update the Timer Summary Table by resetting the RMN in subcycle 2 to a time 21 days later and by entering a new period.
23. Do a follow-on initial update of the Timer Summary Table.
24. Update the Timer Summary Table by negating the previous reset.
25. Generate Acquisition Messages for revs 2.0 - 3.0.
26. Generate the Acquisition Table for revs. 16.0 - 18.0.
27. List the Acquisition Table on and off-line.
28. Generate simulated MODII data tapes for one active rev between revs 16.0 - 18.0.
29. Reduce the data tapes generated above doing a combined fit. Save the combined Powell cards for use in #44.
30. Generate the Acquisition Table for revs 24.0 - 26.0.
31. List the Acquisition Table on and off-line.
32. Punch a paper tape pre-pass plan for COOK during rev 25. Read the tape back in for verification.

33. Replace the tape on unit 1 with the GTM-1 station master and those on units 4 and 6 with blanks.

34. Input the pre-pass plan to the pre-pass program.

35. Input the pre-pass "transfer for tracking" magnetic tape for the pass program. Use the "simulate track", no interrupt, no PICE options. Put jump switch 1 up for the lock-on bit.

36. Input the "track transfer" magnetic tape from the pass program to the post-pass program. Use the plane and Schmitt methods to reduce the data. Produce a post-pass data paper tape; read the tape back in for verification.

37. Replace the tape on unit 1 with the P-(11) Flight Support Tape.

38. Use the post-pass data to update the orbit if acceptable.

39. Perform an orbit adjust on rev 16.

40. Generate the Acquisition Table for revs 25.0 - 27.0.

41. List the Acquisition Table on and off-line.

42. Generate simulated MODII data tapes for one active rev between revs 25.0 - 27.0.

43. Reduce the data tapes generated above doing a combined fit. Label and save the Powell cards.

44. Reconstruct the orbit prior to the adjust by using the combined Powell cards punched in #29.

45. Update the Timer Summary Table to the first RMN in subcycle 33 and set the retro-mode printout flag.

46. Compute the retro fire time based on the nominal impact latitude. Output the impact message and the current and desired settings of the DMT command.

47. Special command for the Timer Summary Table, retro mode; enter the current and desired DMT settings obtained from above--use the current period.

48. Re-entry from TAU12 - determine impact conditions based on the fire time computed above. Generate the binary re-entry ephemeris.

49. Generate a listable re-entry ephemeris, and for COOK, KODI, and HULA local track listings.
50. Input the commands to be reflected in the Acquisition Message.
51. Generate the Acquisition Table for revs 33.0 - 36.0.
52. List the Acquisition Table on and off-line.
53. Generate Acquisition Messages for revs 33.0 - 34.0.
54. Special command for the Timer Summary Table, retro mode; enter the desired setting of the DMT command with the new period.
55. Generate Acquisition Messages for rev 33.0 - 34.0.
56. Take the Timer Summary Table out of the retro mode - do not reset the Timer.
57. Generate Acquistion Messages for revs. 33.0 - 36.0.

2.6.4.2 Analysis of Results

1. Investigate the list of times of events -- the time interval between the calculated events must be equal to the nominal delta times on the 1159 data package.
2. The plot from CCOORD should be identical to the local track listing for station COOK by NASCENT.
3. The Striebel fit made by ASCENT on the MODII data tape must converge and the resulting tau vector should compare favorably to the nominal injection vector.
4. Investigate the Look Table and the Acquisition Table to see that they are free from obvious errors.
5. Compare the Timer Summary Table with a listing of the data package. All commands should be present, the timer period should equal the nominal tape period and the reset time should equal the launch time plus the timer delay.
6. Inspect the Baker-Nunn predictions for:
   a) Event on and off-times as in the Timer Summary.
   b) That the Timer period and the requested number of steps agree with the Timer Table.
7. Investigate the Local Track listings, See Messages and Reeves Parameters and compare with earlier runs on the same data package.
8. Compare the orbital ephemeris obtained indirectly through PREDICT with that from EPHFUN - these should agree.
9. From the listing of the Timer Summary Table, verify that the Timer has been reset to subcycle 2.
10. Check the Acquisition Messages for rev 2 also as a further check of the current timer setting.
11. Verify from the listing of the Timer Summary Table that the Timer has been reset as requested.
12. Verify from the listing of the Timer Summary table that the Timer is back to its earlier setting.

13. Check the Acquisition Message as a second check on the Timer setting.

14. Check the on-line print out during the first ONAGER runs - no difficulty should be encountered in doing a combined fit to the nominal orbit using tapes from rev 16.

15. The rise vector produced by PROPHECY should compare favorably with the information given by a See Message for the same station and rev.

16. If the reconstruction of the pre-pass message was completed, the resulting vector, after unit conversion, should be identical to that produced by PROPHECY.

17. There must be a complete pass ephemeris produced by the pass program, that is, a point every second from rise to set time. The rise time should agree closely with that input by the pre-pass message. The pass duration should agree closely with that given in the Acquisition Table for the particular station and rev. Lock-on will occur soon after rise-time and will be lost at some small time increment prior to set-time. Assuming a good fix, input declination and azimuth will be approximately equal to output declination and azimuth.

18. The vectors produced in post-pass by the plane method and the Schmitt method will be fairly close to each other unless one of the methods rejected an excessive number of points.

19. If the post-pass vectors have been accepted for fitting to the current orbit, inspect the resulting tau vector. Since no real tracking data has been input to the system, the difference between this vector and the pre-PROPHECY vector should be negligible.

20. Verify the fact that an orbit adjust has been performed and that the new orbit compares with earlier tests on this data package.

21. The combined fit of data simulated on the basis of the adjusted orbit should be possible using the P-(11) master. This reduction of data should not make any extreme changes to the orbit since the data was simulated from the current orbit.

22. Verify that the orbit produced only on the basis of the last set of combined Powell cards prior to the adjust is indeed identical to the orbit prior to the adjust.

23. Verify from the Timer Summary Table that a reset to subcycle 33 has been performed and that the Timer is in retro-mode.

24. Investigate the impact messages as output in #46 and #48 in (2.6.4.1). These should be nearly identical. Verify that a DMT command is found in subcycle 33 and that REENTRY COMPT listed the actual and desired settings.

25. Investigate the re-entry ephemeris as output in #49 in (2.6.4.1). This should be the same as in earlier runs on the same data package.

26. Verify from the Acquisition Messages output in #53 of (2.6.4.1) that the commands input are reflected and that an RSL time based on the current period has been calculated by PREDICT. Check its accuracy by comparing with the RSL time on the listing of the Timer Summary Table.

27. Verify from the Acquisition Messages generated in #55 that an RSL time based on the new period input in #54 has been calculated by PREDICT.

28. Verify from the Acquisition Messages generated in #57 that the Timer has not been reset and is not in the retro mode.

2.6.4.3 Timing Requirements

Approximately 90 minutes, excluding off-line printing.

3.6 APPENDIX F - GENERAL SYSTEM TEST

```
* REM          TEST GENSYTST
* 3 IRT           2 9 10
* 3 WNRT             1100 4 -3
* 3 RUNNUM           1100  GENSYTST
* 3 WNRT             1100 0 3
TIM3001  DEC         0
         END
* 3 WNRT             1100 0 0
ACQ1     DEC         200
         END
* 3 TIME             1100 1 1 2 1 0 0 0.0
* 3 TABLE            1100  1 1 59 4 59 5 59 9 59 71 4 72 4
* 3 CCOORD           1100 4 0.2  , -1 6 0
* 3 NASCENT          1100 2 1 0 0 0.0 0 4 0 1 13
* 3 ASCENT           10 1100
* 3 INJFUN           1100 0
* 3 ACQTABLE         1100 1.0 0 0 0 0 3.0 0 0 0 0
* 3 ACQTABLE         1100 -3
* 3 TIME             1100 3 3 0
* 3 BAK/NUNN         1100 69 1 3 , 0 0 0 0 1
* 3 TABLE            1100 3 71 0 72 0
* 3 PREDICT          1100 0 30 0 0 0 0 0 3 0 0 0 0 1 0 0 0 0 1 1.0 3.0 0
* 3 EPHFUN           1100 0 5 60.0 1.0 0 0 0 0 3.0 0 0 0 0
* 3 TIME             1100 3 2 0 2 0 0 0 0 -1 0 0
* 3 PREDICT          1100 3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 2.0 3.0 0
* 3 TIME             1100 3 2 2 22 4000 0 5 0 1 0 0.0 5500.0 2 1
* 3 TIME             1100 3 4 0
```

```
* 3 TIME            1100 3 2 2 1 11268 0 0 0 -1 0 0.0 5439.03 2 1
* 3 PREDICT  1100   3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 2.0 3.0 0
* 3 ACQTABLE        1100  16.0 0 0 0 0 18.0 0 0 0 0
* 3 ACQTABLE  1100  -3
* 3 PREDICT         1100  0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 16.0 18.0 1
* 3 ONAGER          1100 1 0 0 0 0
* 3 ONAGER          1100 0 0 0 0 0
* 3 ACQTABLE        1100  24.0 0 0 0 0 26.0 0 0 0 0
* 3 ACQTABLE        1100  -3
* 3 PROHHECY        1100  0 2 1 25 22
*REM      MOUNT THE STATION MASTER TAPE ON UNIT 1 - BLANKS ON 4 AND 6
* 10000B PREPASS    1100 VAFB PT
* 10000B SVPAS      SIM NINT NPICE
* 10000B POSTPASS TDSCH TDPLA
*REM      MOUNT A P-(11) FST ON UNIT 1
* 3 HISTORY         1100 1 1 1 0 2              1.0 1.0
* 3 LBROAD          1100  1 0 2 2 1 3 14.6
* 3 ACQTABLE        1100  24.0 0 0 0 0 26.0 0 0 0 0
* 3 ACQTABLE        1100  -3
* 3 PREDICT         1100  0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 25.0 27.0 1
* 3 ONAGER          1100 1 0 0 0 0
* 3 ONAGER          1100 0 0 0 0 0
* 3 LBWRED          1100 3
*(89945Z*G*(*(X=P((/*(X(*)X(X*XXO+  *XG((((('(9(X((',P)((X'Z)(*X'*,*$*D((*W*
*(89(((XS(*P*)P,PXVX*P)*(X(*$)XPN(((*X7)(',**X(XP)ZPN(',(*G(X(*(*(*(N,),N*,
END
* 3 TIME            1100 3 2 0 33 0 0 0 2 -1 0 0
* 3 REENTRY COMPT   1100 1 0 +33 0 0 0 0
```

```
* 3 TIME  1100  0 0 TM1 BCN TPI DMT RMN INT TM2 TRE
* 3 TIME    1100  3 1 2 3 6607  6620  0 0
* 3 REENTRY TAU12  1100 0 0 0 0 0 0 0 0 1
* 3 REEPH          0 1 1 4 1 5 1
* 3 ACQTABLE       1100 33.0 0 0 0 0 36.0 0 0 0 0
* 3 ACQTABLE       1100 -3
* 3 PREDICT        1100 3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 33.0 34.0 1
* 3 TIME           1100 3 1 2 3 6607  6620  5433.0  0
* 3 PREDICT        1100 3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 33.0 34.0 1
* 3 TIME           1100 3 2 0 -1 0 0 0 0 -1 0 0
* 3 PREDICT        1100 3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 33.0 36.0 0
```

10 April 1963

TM-(L)-1080/000/00A

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COMPUTER PROGRAM ACCEPTANCE
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