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MANNED SPACE FLIGHT NETWORK PERFORMANCE ANALYSIS FOR THE GT-2 MISSION

MAY 14, 1965

NASA — GODDARD SPACE FLIGHT CENTER
GREENBELT, MD.

MANNED SPACE FLIGHT NETWORK

PERFORMANCE ANALYSIS

FOR THE GT-2 MISSION

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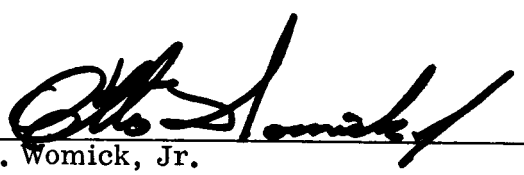
Approved by 

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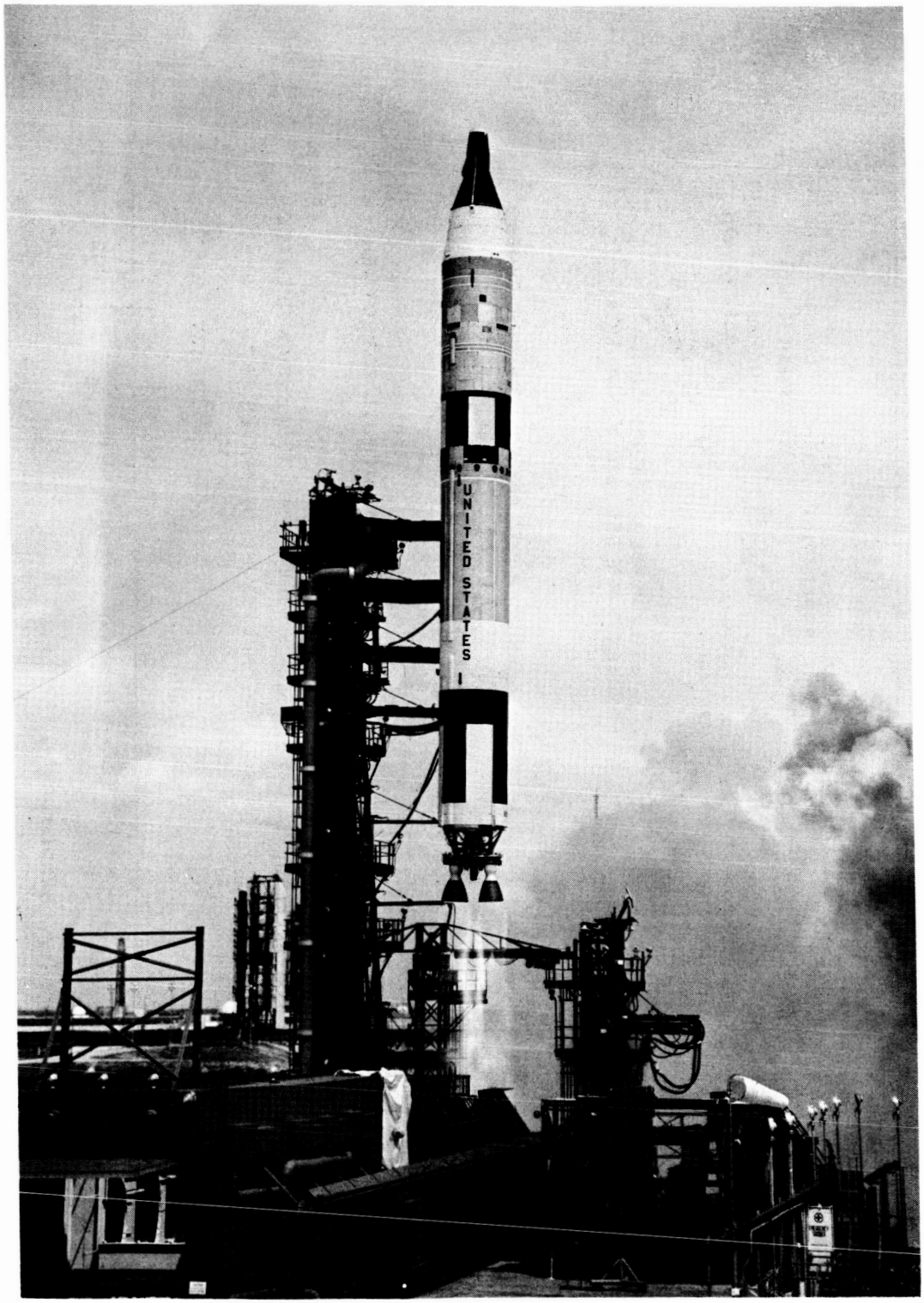

Liftoff of GT-2, January 19, 1965, Cape Kennedy

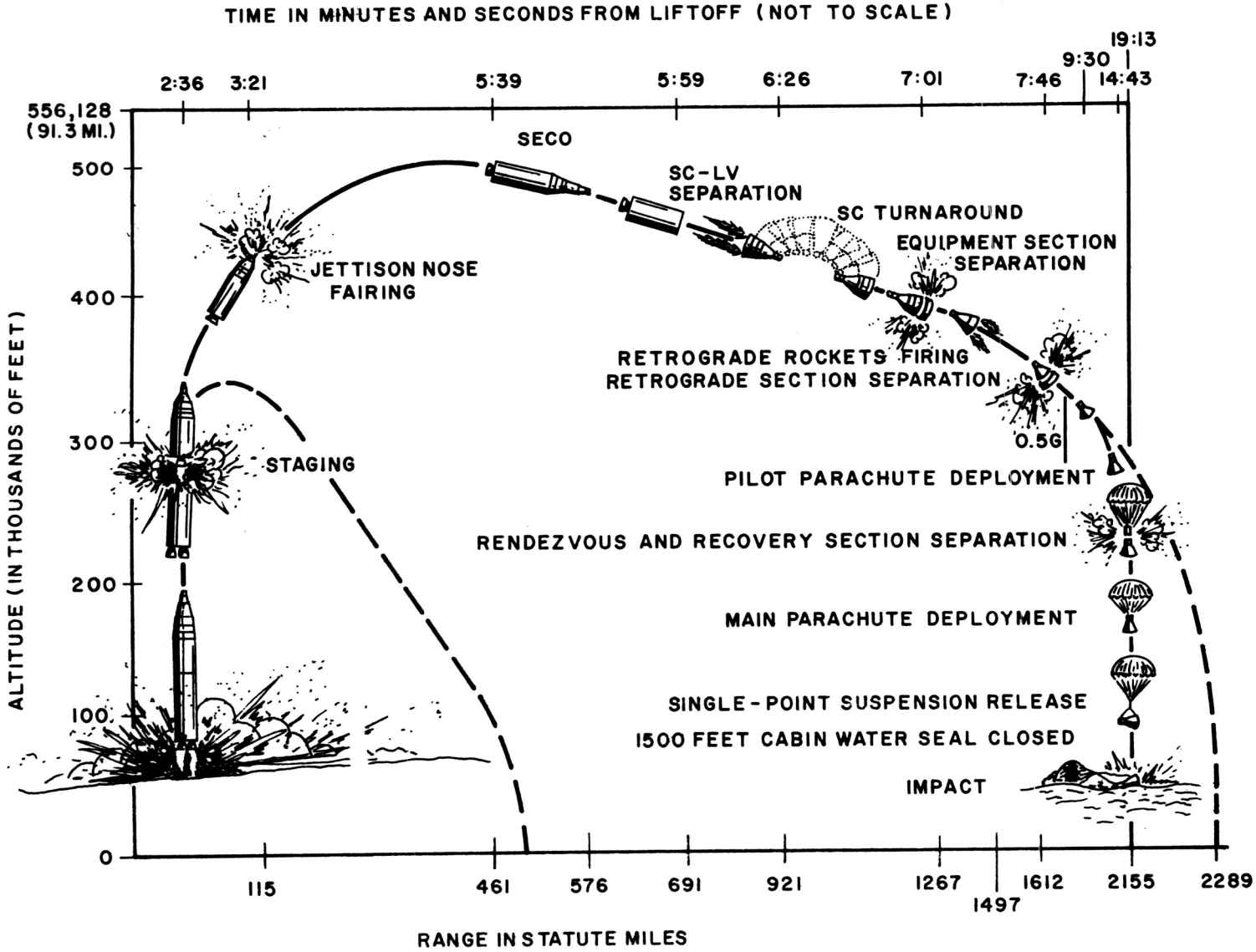

Figure 1. Mission Profile

SUMMARY

The second Gemini mission (GT-2) was an unmanned suborbital flight of the Gemini spacecraft (see figure 1). The objective of this mission was to validate the Gemini launch vehicle and spacecraft systems and to obtain spacecraft performance data concerning reentry heating protection under maximum reentry heating conditions.

The GT-2 flight was first scheduled for December 9, but was postponed when an actuator in the hydraulic system sheered off. This problem was corrected and the mission was rescheduled for January 19, 1965.

Liftoff occurred at 14:03:59Z from Pad 19 at Cape Kennedy, on a launch azimuth of 105 degrees. After a 2127-mile flight down the Eastern Test Range of approximately 19 minutes, the spacecraft landed just 24 miles from the optimum target zone where the primary recovery ship, the carrier Lake Champlain, was stationed.

Tracking support for the mission was provided by CNV, MLA (Merritt Island), MCC, BDA, RKV, CSQ, PAT, GBI, SAL, GTK, and ANT, supplemented by four telemetry recording aircraft. The GSFC computers processed the flight data in real time for display at MCC, and NASCOM provided communications.

Four telemetry links were monitored during the flight: two launch vehicle links and two spacecraft links. CNV, GTK, and BDA recorded real-time launch vehicle and spacecraft data and remoted it to MCC for display to the flight controllers; RKV and CSQ displayed spacecraft data to the on-board flight controllers; and MCC, GBI, ANT, and the four aircraft recorded telemetry for post-test analysis.

The CW acq aid beacon on the spacecraft was tracked by CNV, GBI, GTK, BDA, and MCC; both BDA and MCC autotracked the beacon.

Radar operation was good for the entire mission. Data received during antenna switching and spacecraft turnaround was much better than anticipated and expected corona breakdown did not appear to occur.

The C-band beacon was generally good although the GBI FPS-16 reported a dropout at about T+198 seconds, and several stations reported beacon modulation. The beacon was tracked by CNV, MLA, PAT, GBI, SAL, GTK, and ANT. The FPQ-6 at ANT tracked the C-band beacon continuously through the blackout region and observed skin echo to the horizon.

The S-band beacon, which was jettisoned at T+7 minutes along with the spacecraft adapter, performed satisfactorily during its limited life. It was tracked by CNV, GBI, GTK, and BDA.

DCS operation was normal throughout the mission. The only commands uplinked were IGS commands.

Landline circuits, both voice and TTY, were good during the mission except for a brief interval when partial power was lost at MCC. Approximately ten messages were lost during this time but they were recovered immediately after power returned.

HF communications with RKV and CSQ were intermittently poor because of poor radio propagation during the predawn periods of both the simulations and the mission.

UHF results were good from liftoff to splash with MCC, GBI, GTK, and CSQ reporting contact.

HF results are highly questionable as only two reports were received and both were at variance with results expected.

RSDP's at MCC, BDA, GTK, RKV, and CSQ supported GT-2. This was the first mission supported by the RSDP's and the post-mission evaluation of their performance has confirmed their capability to satisfy Gemini mission requirements.

The GSFC computers (A and B) provided prime computing support for the GT-2 mission. During the critical phase of SECO, MCC had a power failure which lasted for over 30 seconds, cutting off data to the computers. However, data was restored 346 seconds after liftoff and the computers were able to determine cutoff vectors and initial impact point (IP) for the spacecraft.

Although some problems were encountered, most of which resulted from power outages, the network performed quite well during the simulation and mission.

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1. INTRODUCTION

This report summarizes the network performance for the second Gemini mission (GT-2). The purpose of this report is to review critically the network performance to obtain an overall prespective of the capability and reliance that can be placed upon the ground instrumentation. Thus, the report covers the significant problems encountered, without a great deal of emphasis on systems that appeared to function normally.

The second section of this report briefly describes the major premission activities that took place to bring the network up to a state of readiness to support the mission. Following this, performance of the network systems is described and evaluated.

The Manned Space Flight Network's major mission functions were (1) To provide C-band radar track for range safety, for midcourse trajectory information, for data acquisition, and for reentry determination, (2) To provide continuous telemetry reception during the powered flight phase and real-time telemetry during the retrofire sequence from at least one ground station just prior to the communication blackout, (3) To provide A/G voice remoting to MCC via the subcable from CNV, GBI, and GTK, on both UHF and HF, (4) To provide DCS command support from MCC and RKV and tone command support for range safety and ASCO from CNV and, (5) To provide ground communications and real-time computing support.

The station arrangement of the Manned Space Flight Network for GT-2 is shown in figure 2.

Stations	C-Band Radar	S-Band Radar	Acq & TLM	RSDP	HS TLM Data	Cmd	A/G Comm	SCAMA	TTY
GSFC*					X			X	X
MCC			X	X	X	X	X	X	X
MLA		X			X				
CNV	X		X			X	X	X	X
PAT	X				X				
GBI	X	X	X**			X	X		
SAL	X								
GTK	X	X	X	X	X	X	X		
BDA	X	X	X	X	X		X	X	X
ANT	X		X**				X		
RKV			X	X		X	X	X	X
CSQ			X	X		X	X	X	X
ETR A/C									

*Computer support
**Record only

Figure 2. Network Consolidation

2. NETWORK SUPPORT PREPARATIONS

2.1 DOCUMENTATION

2.1.1 Operations Documentation

A revision to the Network Operations Directive for Project Gemini (NOD 63-1) was made on August 1, 1964. In addition, a set of supplements pertaining specifically to the GT-2 mission was issued on October 23, 1964. These supplements comprised the Network Countdown, Radar Handover Plan, Command Function Handover Plan, Supplementary Support Plan, Ground Communications Plan, Computing Support Plan, Computer Countdown, and On-Site Data Reduction Plan. The Data Acquisition Plan Supplement was issued on October 26, and Pointing Data, in the form of plotted curves was distributed as a separate document on October 23. A revised Network Countdown was published on November 23, but this was superseded by ISI No. 2. The originally published Radar Handover and Command Handover Supplements were also superseded by ISI 32 and ISI 21, respectively. ISI 21 was subsequently changed by ISI 51. Revision No. 1 to the Data Acquisition Plan was issued on November 10, and Revision No. 2 was issued on December 31, 1964.

2.1.2 Queries

Thirty-one queries were generated, 17 by BDA, 10 by CSQ, and 24 by RKV. Nine BDA queries, 4 CSQ queries, and 1 RKV query dealt with Supplement 8. The remainder of the queries pertained to miscellaneous subjects which could not be categorized.

2.1.3 Instrumentation Support Instructions (ISI's)

A total of 53 ISI's were issued affecting the following areas:

Flight Controller Documentation and Procedures	14
NOD 63-1, Supplement 8 (Data Acquisition Plan)	17
Equipment Modifications	3
NOD 63-1, Supplement 1 (Network Countdown)	2
NOD 63-1, Supplement 2 (Radar Handover)	1
NOD 63-1, Supplement 3 (Command Handover)	2
Miscellaneous (No documentation affected)	5
Deletions or changes to other ISI's	13

NOTE

Certain ISI's fall into more than one category. Although the number of ISI's affecting Supplements and correcting other ISI's is perhaps high (five ISI's were written to revise or add to ISI 10), improvements have been shown in most other areas. Significantly, only two ISI's pertained to the Network Countdown (although a correction to the wording of ISI 2 was later required).

The number of ISI's again emphasizes the need for a controlled procedure to revise operational documentation before the mission status period is declared.

2.2 MODIFICATION STATUS

Upon entering premission status of November 23, several GSFC and MCC RED EI's were still outstanding at the sites indicated:

EI	Title	Sites Not Complete
769	Installation of 201A Data Sets (DCS)	GTK
850	Annotation Recorder Loop Interface	RKV
856	Telemetry Receiver Signal Strength Remoting	CSQ
883	DTU/201A Subset Interface	GTK
917	DRUL Switchover, IGS Recording	CNV
950	DRUL Recording Capability	CNV, GBI, GTK
956	Crypto Room Communications	CSQ
960	RTC Red Clear and Super Priority	CNV
961	Crypto Room Teletype Installation	RKV, CSQ
963	HF/UHF Indicator	RKV, CSQ
964	HF/UHF Indicator Closure	RKV, CSQ
966	DCS Teletype Input Mod	CNV
967	Gemini Memory Loaded Indicator Change	CNV
974	Removal of Ringing on Computer P.L.	RKV, CSQ
976	Interim VR-3600 Impedance Mod	GBI, GTK
450	Cape & Downrange Command Carrier Display	
481	Relocation of Model 70 Buffer to the Real-Time Computer Bldg.	
487	Complex 19 Abort Command Implementation	
496	DCS Command Switch Recording (DCS)	
2013	SET/CET Switchover	
2015	Intercom Mods for NST Room	

On November 27, modifications on the DRED at MCC were completed. These modifications were documented by MCC Change Request 18 and followed up by EI 998. On December 2, EI's 966 and 967 were deleted as a mandatory requirement at MCC and EI 950 at GTK. Some problems were experienced with EI 950 and extensive corrections were transmitted to CNV and GBI. EI 950 was reissued as EI 950A.

During the spacecraft simulated flight on December 3, a malfunction in the DCS occurred which necessitated a modification. MCC Change Request 17 documented this modification and was followed up with EI 997.

On December 8, all RED GSFC and MCC EI's were completed and ready to support.

Upon returning to mission status on January 13, EI's 948A and 985 were made mandatory due to additional requirements.

EI 985 reduced the gain of acq aid RF multicoupler buffer which could have possibly created an interference problem during the first GT-2 countdown.

As of January 18, all GSFC and MCC EI's required for support of GT-2 were completed.

2.3 EQUIPMENT STATUS

As of January 11, 1965, the Manned Space Flight Network was in mission status. The following provides a status of the network during the two simulations prior to launch countdown.

January 13 (F—6 days) all subsystems GREEN except:

CNV Subcable break between GTK and ANT.

GBI Radar 3.16 RED for Depot Level Maintenance (DLM) per Equipment Control Certificate (ECC) 3-2058.

ELU Mistram II RED for ECC 4-2004.

GTK Radar 7.18 RED for elevation coder. NASA voice telemetry antenna, quadhelix/HF dipole RED for broken HF dipole clamp assembly. PCM telemetry station 2 RED for capacitor C9 in power supply.

CSQ RF Command RED for lack of deviation meter and elapsed time indicator meter. Command antenna 2 RED for defective support rod. Point-to-point communications RED for defective power transformer in CU-157 SSB converter. VR 3600 tape recorder RED for meter assembly. 150-channel events recorder RED for power cable with plug. RF command spares inadquate.

ANT No. 3 HF Collins SSB transmitter RED for coil L-8.

NOTE

None of the above items precluded support of the simulations.

Brief report of power failures occurring during F—6 simulations:

During the time period T+5 minutes 50 seconds to 6 minutes the RF command transmitters on the RKV were RED due to a loss of AC power. The power loss was due to the fail-safe action of a circuit breaker in the main AC switchboard. It is believed the fail-safe action of the circuit breaker could have been caused by the inverse time delay device oil dash pot containing foreign matter (dirt) and being low on oil. Corrective action taken included cleaning of the dash pot and replacing the dash pot oil with new oil. All other switchboard circuit breakers were inspected for similar conditions.

January 15 (F—4 days) all subsystems GREEN except:

BDA Ground communications RED for outage on circuit 52028. Did not affect test support.

GBI Radar 3.16 RED for DLM per ECC 3-2058.

ELU Mistram II RED for ECC 4-2004.

GTK Status same as January 13 except TDM station GREEN.

CSQ Status the same as January 13.

NOTE

None of the above items precluded support of the simulation.

Brief report on power failures occurring during F—4 simulations:

During the simulations on January 15, 1965, four AC power fluctuations occurred on the CSQ. These fluctuations caused the DCS equipment to lose its load times. The fluctuations were due to a maladjusted circuit breaker located in the main AC switchboard. The overload setting adjustment for this circuit breaker was not properly adjusted and when the generator that had dropped off the line was brought back on the switchboard, the circuit breaker would trip causing power fluctuations.

Simulation Schedule

January 13	NCG 605 FF	- Launch simulations (short count)
January 14	NCG 605 EE	- Maintenance
January 15	NCG 605 DD	- Launch simulations (long count)
January 16	NCG 605 CC	- Detailed Systems Tests
January 17	NCG 605 BB	- Maintenance
January 18	NCG 605 AA	- Trajectory exercise/maintenance
January 19	NCG 605	- (ETR test 4466)

2.4 CADFISS TESTING

BDA (Verlort), CSQ, RKV, MCC, RTC, B/GE, PAT, GTK, MLA, GBI, SAL, ANT, and CNV participated in CADFISS tests in support of this mission. CADFISS DCS test data was transmitted at 0925 GMT as scheduled. (This is not the CADFISS DCS test which will be used effective with GT-3.)

Three scheduled test runs were conducted, as follows:

Run 1 B computer—0710 GMT to 0919 GMT. PAT, GTK, MLA, ANT, CNV, MCC, RTC, and B/GE scheduled.

Run 2 B computer active, A computer standby—0935 GMT to 1030 GMT. BDA, GBI, SAL, CSQ, and RKV scheduled. PAT reruns.

Run 3 B computer active, A computer standby—1210 GMT to 1236 GMT. BDA, CSQ, and RKV scheduled data flow. MLA reruns, RTC and B/GE.

CADFISS support of the GT-2 launch terminated at 1236 GMT with the completion of run 3. The following reflects, by test run, the results of this testing:

Run 1

GTK, ANT, CNV, RTC, B/GE successfully completed their tests. Line GD-1263 northbound was out and line 62 was patched to both receivers for the RTC test 26.

MLA. Prior to the start of testing, MLA reported their transmitter out (part being flown in from New Jersey) which prohibited their response to the range target test in run 1. All other tests were successfully completed in this run and, based on the available ETO, the range target test was scheduled for rerun in the data flow.

PAT. The boresight test failed azimuth (value received in error by 150 octal); the range target test failed azimuth and elevation (boresight azimuth and elevation values were received for this test); and the clockwise slew failed elevation (azimuth and elevation values received were identical in most lines and did not vary by more than 1 octal throughout the test; therefore, elevation data received indicated that elevation slewed through 360 degrees). These results were reported to MCC personnel and reruns were scheduled for run 2.

Run 2

The PAT boresight, range target, and clockwise slew tests were successfully rerun.

CSQ, RKV, GBI, and SAL successfully completed their tests.

BDA Verlort. The clockwise slew failed makeup (site transmitted Gemini skin track ID) via low speed and time (stopped slew slightly early and sent all zeros) via high speed, all other tests were successful.

Run 3

The BDA Verlort boresight test via high and low speed was successful.

MLA. The range target test was successfully completed.

RKV. Test 21 was successful, Test 22 was reported as a failure (1 character in 1 ine in error).

CSQ. Test 21 failed (circuit difficulties had been experienced during the count), Test 22 was successful.

RTC. Line 1263 was restored to service at approximately 1027 GMT. In order to checkout this line, and as RTC had supported the first run simplex, a Test 26 was conducted in this run. RTC utilized their A computer for the first 500 transmissions, switched to B computer and completed the remainder of the expected 1000 transmissions with that computer. The test was successful with scores of 997/3 on both lines.

B/GE. A CADFISS Test 26 was substituted for the scheduled dynamic simplex by the KE's. The test was successfully completed.

Frequent printing errors were experienced with the B system printer.

At approximately 0951 GMT, the A computer, which was being used as standby in a CADFISS run, halted. The computer was released to the CE's for corrective action. The exact cause (machine or program) of this halt has not been determined.

3. SYSTEM PERFORMANCE

3.1 TELEMETRY, ACQUISITION, AND TIMING

3.1.1 General

The following telemetry stations supported GT-2: CNV Tel II, CNV Tel III, MCC, GBI, GTK, BDA, RKV, ANT, and CSQ.

The GLV transmitted telemetry data on FM/FM link 237.0 mc and PCM/FM link 244.3 mc, while the spacecraft transmitted PCM/FM data in the following programmed configuration:

Link	Data Transmitted	Nominal Occurrence
230.4 mc	Gemini Real Time	T-30 min to impact +12 min
259.7 mc	Gemini Real Time	T-30 min to .05 g +200 sec
	Gemini Dump Playback	.05 g +200 sec to tape depletion

An additional RF link, a one-quarter watt CW acq aid beacon, was programmed to radiate on 246.3 mc from approximately T+360 until T+401. BDA and RKV were requested by ISI to attempt autotrack of this beacon on acq aid No. 2 with the prerequisite that acq aid No. 1 had valid track of either link 230.4 or 259.7. BDA successfully tracked the beacon, however, RKV was not able to.

Tel II and Tel III recorded and remoted real-time GLV and spacecraft data to MCC for flight controller display. GTK and BDA remoted spacecraft data via the 2-kb RSDP program to MCC providing a greater range of real-time data to be displayed to the MCC flight controllers. RKV and CSQ recorded and displayed spacecraft data while the remaining stations acquired and recorded data for postmission analysis.

GLV Telemetry Coverage

Site	AOS (GET)	LOS (GET)	Coverage %
Tel II	0:00	7:43	100
Tel III	0:00	7:39	87
GBI	0:23	7:51	93
GTK	2:46	8:31	100
BDA	3:33	8:38	100
ANT	5:42	9:08	100

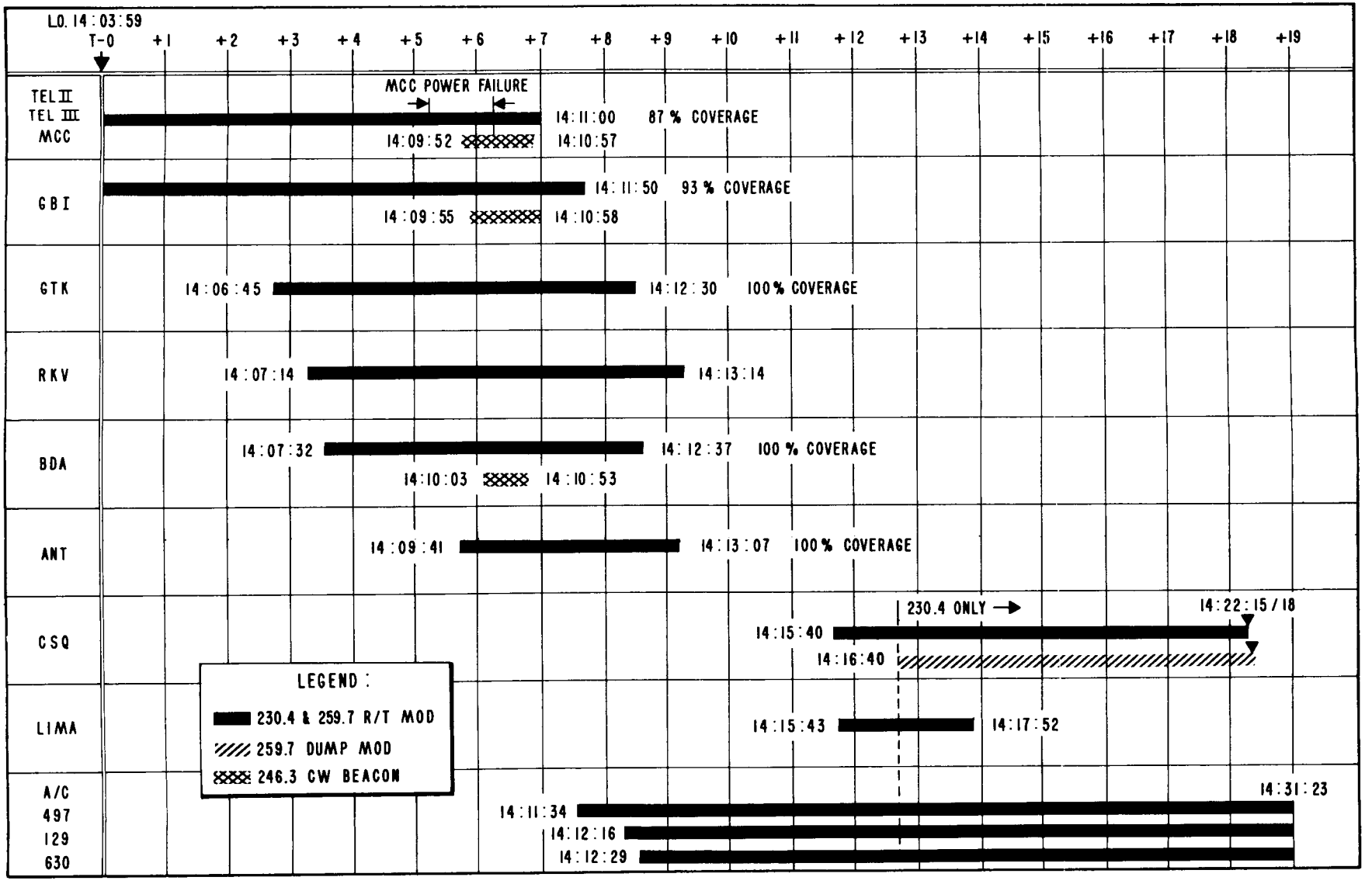


Figure 3. Station Telemetry Acquisition

Acq Aid Beacon Coverage

Site	AOS (GET)	LOS (GET)	Coverage %
Tel II	5:53	6:57	100
Tel III	6:14	6:57	75
GBI	5:56	6:59	100
RKV	None	None	0
BDA	6:02	6:52	100

3.1.2 Acquisition

Figure 3 depicts actual station telemetry acquisition of the PCM/FM data links 230.4 and 259.7 mc. At +12:41, link 259.7 was switched over from real-time data to recorder dump playback.

BDA experienced no difficulty in tracking the acq aid beacon (246.3 mc) in the phase-lock mode with either bandwidth of 500 cps or 250 cps. Maximum elevation was 5 degrees.

RKV reported no discernible signal was received from the beacon, however, confirmation of beacon radiation was made by other stations.

Acq aid No. 2 at BDA, which was tracking link 259.7 prior to and after the acq beacon AOS/LOS times, experienced spurious interference during the latter stage of the pass momentarily knocking the system off track.

3.1.3 Telemetry

MCC

Flight controller displays of both the GLV and spacecraft data was nominal with the exception of a data outage of approximately one minute duration caused by a critical power bus failure at T+313 and was back in operation at T+374.

GBI

Real-time retransmitted data from GBI was displayed to the flight controllers at MCC at T+380 until GBI LOS at T+472. Quality of data was good.

BDA

Although BDA 2-kb data to MCC was not used for display they held excellent track and reported first valid buffer to MCC approximately 5 seconds after AOS with 100 percent lock during the pass.

CSQ

CSQ reported the real-time signal was of very good quality with minor dropouts occurring. AOS of dump playback on 259.7 occurred at T+761.

RKV

The RKV reported approximately 50 dropouts of the PCM systems during the pass. This along with their inability to acquire or receive the acq beacon on 246.3 mc initiated a postmission engineering analysis of the RKV tracking and telemetry systems. A report submitted by MFEB as to their findings of the RKV test results indicated that the RKV systems were compatible (excluding antennas) with other MSFN stations. Evaluation of the antennas was not performed during these tests.

3.1.4 Timing

There were no timing discrepancies reported by the network.

3.2 RADAR

3.2.1 General

Continuous C-band beacon tracking was required for range safety, midcourse trajectory information, and reentry determination. The S-band radars were required to track the beacon until it was jettisoned with the adapter at T+7 minutes.

Beacon characteristics were:

	C-band	S-band
Interrogate frequency	5690 mc	2840 mc
Transpond frequency	5765 mc	2910 mc
Power	1 kw	1.5 kw
Coding	Double pulse	Double pulse
Spacing	9 microseconds	6.5 microseconds
Recovery time	60 microseconds	120 microseconds

3.2.2 C-band

3.2.2.1 Performance

CNV Good signal and track.

MLA Lost first 10 seconds of track due to phasing problem with the GBI FPS-16.

PAT Good signal and track.

GBI FPS-16 experienced a few signal dropouts otherwise signal quality was good.

SAL Track was good but some modulation was apparent throughout the pass.

GTK Good signal and track.

ANT Good track with some signal deterioration after 554 seconds. The beacon was tracked during the period of blackout and a skin return was also observed during this time.

3.2.2.2 Coverage

Radar	AOS (GET)	LOS (GET)	% Valid Track	Acquisition Source
CNV (FPS-16)	0 sec	200 sec	100	Autotrack on pad
MLA (TPQ-18)	11 sec	358 sec	97	Acquisition bus
PAT (FPQ-6)	0 sec	363 sec	100	Autotrack on pad
GBI (FPS-16)	63 sec	429 sec	88	DTS from CNV
*GBI (TPQ-18)	110 sec	400 sec		
SAL (FPS-16)	140 sec	492 sec	100	DTS from GBI
GTK (TPQ-18)	235 sec	510 sec	100	ARCAS
ANT (FPQ-6)	410 sec	634 sec	100	ARCAS

*Engineering basis only.

3.2.3 S-Band

3.2.3.1 Performance

CNV Good signal and track.

GBI Good signal and track.

GTK Signal was weak at AOS but good track was obtained.

BDA Difficulty was experienced in acquiring the target because it appeared between the third and fourth range intervals and was obscured by ground clutter. The target was lost shortly after initial lock-on due to beacon countdown. When reacquired, the beacon was tracked for a short time prior to LOS.

3.2.3.2 Coverage

Radar	AOS (GET)	LOS (GET)	% Valid Track	Acquisition Source
CNV (MOD II)	0 sec	315 sec	100	Autotrack on pad
GBI (MOD II)	114 sec	348 sec	100	Pointing data
GTK (MOD II)	360 sec	418 sec	66	TPQ-18
*BDA (Verlort)	382 sec	413 sec	39	Acquisition Aid

*Not committed to mission support.

3.3 COMMAND CONTROL

3.3.1 Launch and Range Safety

The Command Control Systems were GREEN throughout the mission. The IGS updates at T-3 minutes, T+100 seconds, and T+140 seconds were transmitted validly. The spacecraft separation command was not transmitted due to the loss of MCC clocks caused by a power failure. The MCC DCS was not affected by this power failure. However, with the loss of the GMT and GET clocks the correct visual time reference for the initiation of the spacecraft separation command was not available. ASCO (GE Burroughs-Tone) was transmitted at 14:09:33.5Z.

The command carrier on/off times were nominal and conformed to the Command Function Handover Plan. The RKV and CSQ command carriers were not radiated. No Range Safety commands were transmitted.

3.3.2 DCS

The DCS operation was normal throughout the mission. The only orbital commands to the uplink were the IGS updates.

Uplinked Commands

Time	Command	Word Length
12:57:12.670Z	4142577700	36
12:57:12.910Z	2132313700	36
12:57:13.173Z	0134407700	36
12:57:13.423Z	3213337400	36
13:22:53.569Z	4142577700	36
13:22:53.769Z	2132313700	36
13:22:53.970Z	013440770	34

Time	Command	Word Length
13:22:54.260Z	3213337400	36
13:48:25.0895Z	4142577700	36
13:48:26.330Z	2132313700	36
13:48:26.565Z	0134407700	36
13:48:26.83Z	3213337400	36
14:00:57.24Z	21323137	30
14:00:57.49Z	41425777	30
14:00:57.74Z	01344077	30
14:00:57.965Z	32133374	30
	LIFTOFF 14:03:59	
14:05:43.445Z	36715200	30
14:05:43.685Z	76000001	30
(GBI)		
14:06:23.452Z	35454200	30
14:06:23.696Z	76000001	30

The preceding command data was reduced from the GT-2 command recordings.

The listed command bit structure does not include the vehicle address or the system address.

Commands from 12:57:12.670Z through 14:05:43.685Z were radiated from CNV. Commands at 14:06:23.452Z and 14:06:23.696Z were radiated from GBI.

All commands originated at the MCC DCS 12:57:12.670Z through 13:48:26.83Z, the bit word length is 36 with the exception of the command at 13:22:53.970Z which was inhibited after 34 by the test generator in the telemetry area. The inhibit is normal and does not affect spacecraft as it accepts only 30 data bits per word.

The T-3 commands and all subsequent commands, 14:00:57.24Z through 14:06:23.696Z, are computer originated and are 30 bits long.

Recorded data is delayed by 500 milliseconds due to configuration of EI 950.

The following ISI's were issued during the mission:

ISI 3 To supply the DCS patching requirements, granularity settings, MAP delay times, correct IGS update times, and delete conflicting information from Annex G to Supplement 8 of OD 63-1.

ISI 20 To delete GTK command recording requirement.

ISI 21 To revise the Command Function Handover Plan.

ISI 22 To delete BDA command support requirements.

ISI 48 To change the DCS retransmit switch to 3.

ISI 51 To revise the Command Function Handover Plan.

During the simulated flights the following problems occurred:

NCG-605FF-3, January 13, 1965

At T+00:05:40 the RKV RF command system failed due to a main power panel circuit breaker opening. The RKV CapCom was not aware of the failure and his attempt to uplink a command at T+00:07:07 was unsuccessful. The circuit breaker was later repaired.

NCG-605DD, January 15, 1965

The MCC DCS went RED at T-6 minutes due to a power fluctuation which caused a loss of the DCS memory load. The DCS was reloaded and the count resumed. It should be noted that the DCS was not on the noninterrupt power source for the simulations.

The CSQ reported four power fluctuations. The CSQ DCS lost its memory load on each fluctuation. The power fluctuation was caused by failure of diesel engine number one. Diesel engine number two was put on the line in place of number one and no further trouble was reported.

3.3.3 DRUL Recording

On Tuesday, December 1, 1964, the installation of EI 950 was commenced at GBI and GTK. This modification was to permit recording of the update commands. On December 2, these modifications were checked out and problems existed at both sites. Technical assistance was provided at GBI, but none was was available for GTK. NASA made a decision to delete DRUL recordings at GTK for GT-2. ISI No. 20 was issued to delete the requirement. The DRUL system at GTK was restored to an operational condition, without EI 950 being completed, during the night of December 2. The system was validated using the NASA aircraft sitting on the runway at GTK. On December 6, the system was revalidated with the NASA aircraft airborne. No instructions were received to implement EI 950 after GT-2 was scrubbed on December 9. The next indication of a GTK DRUL recording requirement

was a verbal alert on Tuesday afternoon, January 12, 1965. The method by which this was to be accomplished had not been determined, but EI 950 was not to be installed.

On Wednesday, January 13, an official request was received by the ETR directly from MSC to record a composite 1-kc and 2-kc signal from the DRUL at GTK; timing was also requested, but the method was not specified. ETR presented two different equipment configurations for recording the composite signal and NASA decided to implement both. One configuration was to install a NASA 1/4-inch dual-track tape recorder on the output of the Range Safety FRW-3 command receiver in Central Control. It was determined that this would have no adverse effect on the reliable operation of the Range Safety system. The recorder was shipped to GTK on January 14.

The other configuration was the installation of an ETR spare FRW-3 receiver in the telemetry building at GTK. The output of this receiver was to be applied to a track of the 1-inch VR 3600 tape recorder. This receiver was shipped to GTK on January 15, and the installation was achieved on a crash basis.

A test was scheduled on Friday, January 15, at 1600 E to check the recording capabilities of both systems. The data received from this test was not useable and it was determined that a change in the setup procedures was necessary. Another test was scheduled on Saturday, January 16, at 2000 E. The data from this test was picked up by a special aircraft on Sunday, January 16, so that the results could be evaluated by NASA early Monday morning. This allowed time for changes that may have been necessary. The data received from both systems were useable and no further tests were necessary.

No commands were transmitted through the DRUL system at GTK in support of GT-2.

3.4 REMOTE SITE DATA PROCESSOR (RSDP)

3.4.1 General

Postmission evaluation of the performance of the Remote Site Data Processor has certified its capability of satisfying specific mission requirements. The RSDP's supporting GT-2, successfully processed PCM telemetry data, generated summary messages and on-site printouts, and reformatted the raw data for high-speed transmission to MCC. All objectives of the RSDP in its initial support of an actual mission were 100% successful.

At MCC the RSDP using the TOMCAT III operational program processed all the PCM data received. Local printouts and summary messages were generated, the latter going to GSFC for conversion to engineering units and then broadcasted to appropriate stations.

TOMCAT II was used at BDA and GTK where the functions of the RSDP consisted of condensing and sorting the raw PCM data and outputting to the high-speed data lines for retransmission to MCC.

The RSDP's on the RKV and CSQ utilized the TOMCAT I program to process the PCM data and for generation of on-site printouts and summary messages.

A detailed analysis of the data obtained from this mission revealed that the conversions of several on-board computer parameters to engineering units were valid and not a software problem as previously indicated in the preliminary report. The TOMCAT III system program at MCC interpreted the selected parameters during the prelaunch and performed all conversions accordingly.

3.4.2 Simulation

The F—6 days simulations were normal and good data summaries were received from CNV, RKV, and CSQ. On F—4 day, during the long count, all the RSDP operations were good. On the second and fourth simulations of the day, the RKV transmitted static data and an analysis of the summaries indicated the input data buffer in the RSDP was not being updated. This condition was a result of the RSDP not receiving valid data from the PCM ground stations. The F—1 day PCM confidence tests were completed with good results after proper coordination with GSFC.

3.4.3 Prelaunch

During the MCC confidence test, the BDA PCM data was not being identified as such on the ROTR printouts. This was a minor error so no attempt was made to make the necessary changes for this mission.

At approximately T—3 hours, the RKV reported the CAM on the Gemini console RED. This would not affect the summary transmission since the Agena console CAM was operative and could perform identical functions. However, the problem was resolved when it was determined that the Gemini selection bit in the CAM register was not being set.

3.4.4 Launch and Postlaunch

At approximately T+5 minutes a power failure occurred at MCC which caused a failure at the RSDP and consequently no summaries were transmitted from the MCC.

The RKV transmitted six summary messages which were processed at GSFC and broadcasted. Analysis of the data indicated the input data buffer in the RSDP was not updated after T+6 minutes 39 seconds, which meant the PCM data was not being accepted by the computer.

The CSQ computer support was normal and all messages transmitted were of good quality. The five summaries from the CSQ were processed and broadcasted by the Goddard computers in the normal manner.

3.5 MCC POWER SUPPLY

Two near-complete power failures occurred during this mission at MCC. Both power failures were the result of an overloaded secondary critical power buss. The continual addition of instrumentation to the system (oscillographs, recorders, and other equipment) caused the overload which tripped the circuit breaker.

First Power Outage: 11:15:00 to 11:16:00Z

Second Power Outage: 14:09:07 to 14:09:46Z

This situation has been corrected by the installation of an Uninterruptable Power Serive (UPS) system. This task was accomplished through Engineering Instruction 1031, dated February 2, 1965.

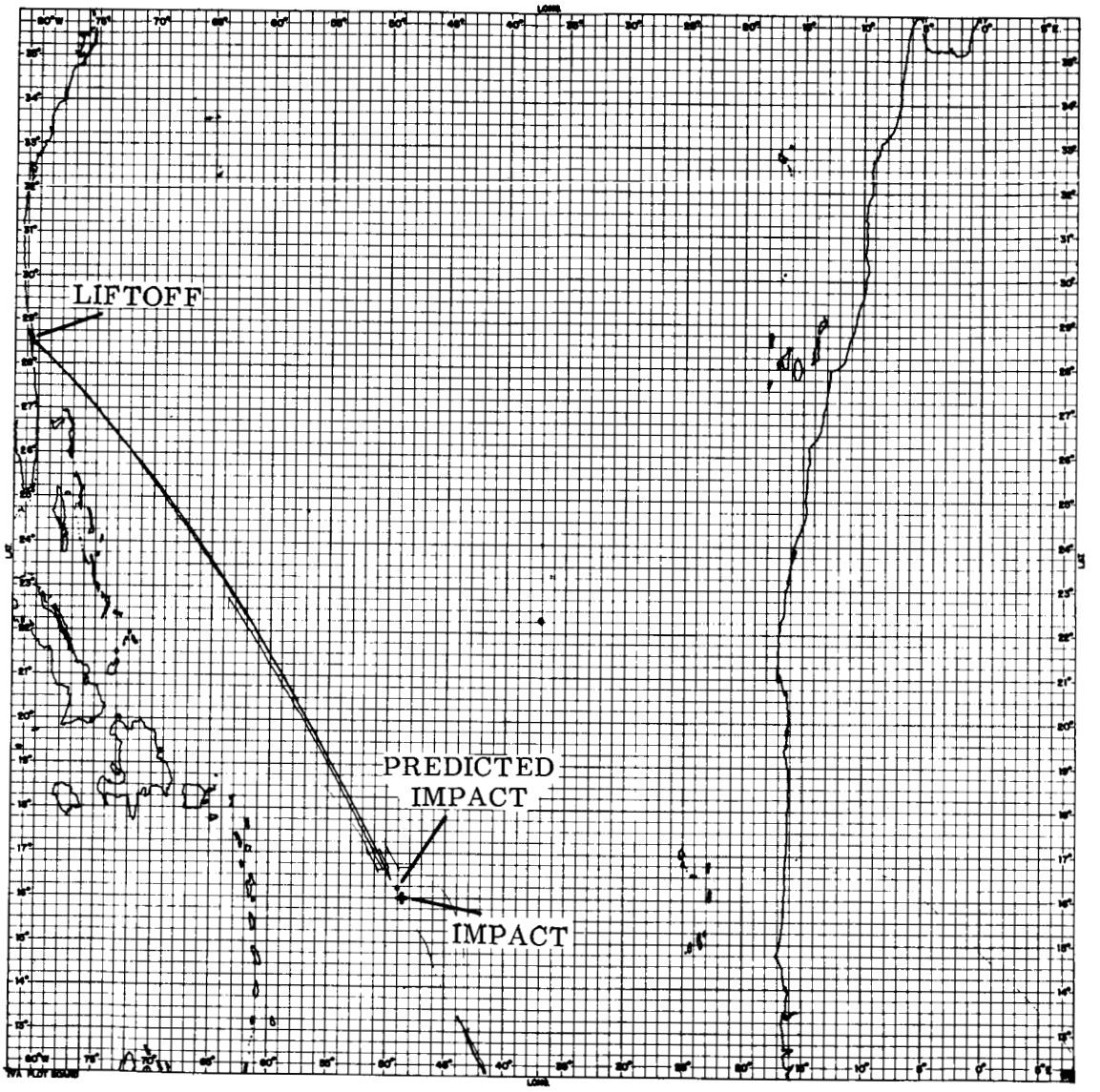


Figure 4. GT-2 Flight Trajectory from Liftoff to Impact

4. COMPUTING SYSTEM PERFORMANCE

4.1 GENERAL

The Data Operations Branch at GSFC was responsible for the mission computing tasks. These included transmitting acquisition data to the participating sites at 25 minutes and 5 minutes prior to horizon times; processing mission tracking data and converting it to parameters necessary for the real-time control of the mission, and transmitting this in real time to the Mission Control Center at Cape Kennedy. Further, it included processing and broadcasting of PCM summaries and DCS messages.

The real-time system performed well. The performance of the launch monitor subsystem, high-speed transmission lines, and the Goddard real-time computing programs was excellent.

Following termination of the launch phase, the operational mode of the computers was manually transferred to high abort and then to reentry.

On the basis of data received during launch, the initial impact point was predicted to be 16 degrees 51 minutes N latitude at 50 degrees 18 minutes W longitude. Antigua (FPQ-6) transmitted 26 frames of valid radar data. The first differential correction of the data indicated an impact point of 16 degrees 36 minutes N latitude at 49 degrees 51 minutes W longitude. However, a final refined impact point computed by the real-time system indicated an impact point of 16 degrees 33.9 minutes N latitude at 49 degrees 46.27 minutes W longitude. The aircraft carrier Lake Champlain, which recovered the spacecraft, reported a pickup point of 16 degrees 31.9 minutes N latitude at 49 degrees 46.8 minutes W longitude. (See figure 4.)

4.2 TRACKING DATA

Table 1 presents a summary of the tracking data received from the participating stations during the GT-2 mission.

Table 1. Radar Message Summary

Station	Date	Radar	Rev	Total Obs	Valid Observations			
					First H M S	Last H M S	<3°	>3°
PAT	1/19	FPQ-6	1	52	14 03 54	14 09 00	7	45
BDA		VER	1	3	14 10 30	14 10 54	1	2
GTK		TPQ-18	1	4	14 10 54	14 11 12	0	4
ANT		FPQ-6	1	33	14 11 18	14 14 30	7	26

Table 2 lists the radar data received by the real-time system during the mission. Figures 5 through 16, inclusive, illustrate the observed quantities of range, azimuth, and elevation transmitted from each of the participating stations. Figure 17 illustrates the observed minus the computed quantities of range, azimuth, and elevation of the data received from Antigua. Also included are the computed RMS errors.

Table 2. Radar Messages Received by the Real-time System

STA	DATE	RADAR	REV	VALID	TIME (GMT) H	M	S	RANGE (YARDS)	AZIMUTH (DEG.)	ELEV (DEG.)
ANT	1/19	FPQ-6	1	0	14	10	36	1206015.1	322.802	2.682
				0	14	10	42	1165018.1	323.961	3.051
				0	14	10	48	1123021.0	325.223	3.401
				2	14	11	18	927211.0	333.090	5.209
				2	14	11	24	890480.3	335.080	5.570
				2	14	11	30	854821.6	337.231	5.936
				2	14	11	36	820414.8	339.552	6.303
				2	14	11	42	787425.8	342.096	6.661
				2	14	11	48	756001.3	344.844	7.022
				2	14	11	54	726397.0	347.823	7.369
				2	14	12	0	698831.7	351.058	7.682
				2	14	12	6	673563.2	354.554	7.972
				2	14	12	12	650863.2	358.309	8.224
				2	14	12	18	631016.7	2.324	8.424
				2	14	12	24	614301.1	6.581	8.557
				2	14	12	30	600993.7	11.051	8.615
				2	14	12	36	591313.4	15.703	8.602
				2	14	12	42	585455.4	20.470	8.494
				2	14	12	48	583536.8	25.298	8.290
				2	14	12	54	585600.6	30.122	7.984
				2	14	13	0	591609.7	34.870	7.604
				2	14	13	6	601452.8	39.473	7.169
				2	14	13	12	614944.0	43.906	6.657
				2	14	13	18	631847.2	48.108	6.117
				2	14	13	24	651900.3	52.072	5.526
				2	14	13	30	674820.0	55.764	4.943
				2	14	13	36	700319.0	59.176	4.342
				2	14	13	42	728096.0	62.364	3.756
				2	14	13	48	757864.9	65.288	3.160
				2	14	13	54	789394.9	67.984	2.613
				2	14	14	0	822418.9	70.451	2.058
				2	14	14	6	856709.3	72.699	1.556
				2	14	14	12	891914.8	74.787	1.057
				2	14	14	18	927837.5	76.675	0.645
				2	14	14	24	964406.6	78.350	0.561
				2	14	14	30	1001500.5	79.974	3.618
				0	14	14	36	1068541.7	81.311	360.986
				0	14	14	48	1130007.0	81.867	360.057
				0	14	14	54	1129997.7	81.867	360.055
				0	14	15	0	1130287.1	81.868	360.061
				0	14	15	6	1130397.7	81.869	360.064
				0	14	15	12	1130120.0	81.871	360.058
				0	14	15	18	1130421.7	81.871	360.065
				0	14	15	30	1132652.4	71.799	0.521

Table 2. Radar Messages Received by the Real-time System (Cont)

STA	DATE	RADAR	REV	VALID	TIME (GMT) H	M	S	RANGE (YARDS)	AZIMUTH (DEG.)	ELEV (DEG.)
BDA	1/19	VER	1	0	14	7	6	1462372.3	250.024	40.918
				0	14	7	12	1462372.9	250.027	48.903
				0	14	7	18	1462372.9	250.027	48.903
				0	14	7	24	1462372.9	250.027	48.903
				0	14	7	30	1462372.9	250.027	48.903
				0	14	7	36	1463847.8	250.024	48.903
				0	14	7	42	1463183.6	250.027	48.903
				0	14	7	48	1462851.5	250.027	48.903
				0	14	7	54	1461835.7	250.027	48.903
				0	14	8	0	1462353.4	250.038	48.902
				0	14	8	6	1461935.4	249.442	1.142
				0	14	8	12	1445677.0	248.631	0.486
				0	14	8	18	1415177.8	247.775	0.494
				0	14	8	24	1394623.1	247.060	0.893
				0	14	8	30	1375739.1	246.214	1.037
				0	14	8	36	1347287.0	246.937	2.642
				0	14	8	42	1318977.2	245.410	6.097
				0	14	8	48	1300228.6	243.740	7.644
				0	14	8	54	1288525.9	240.839	0.505
				0	14	9	0	1275717.5	236.785	0.531
				0	14	9	6	1259548.9	237.236	1.088
				0	14	9	12	1239140.5	237.634	1.865
				0	14	9	18	1223418.5	236.686	2.524
				0	14	9	24	1226879.2	235.228	3.795
				0	14	9	30	1209117.1	233.270	2.474
				0	14	9	36	1202095.7	230.402	3.587
				0	14	9	42	1198777.5	228.249	4.884
				0	14	9	48	1198716.7	226.977	4.596
				0	14	9	54	1199306.5	226.590	3.955
				0	14	10	0	1199312.7	220.495	4.618
				0	14	10	6	1199312.4	217.507	3.620
				0	14	10	12	1166838.6	214.804	3.977
				0	14	10	18	1138831.9	212.124	4.811
				0	14	10	24	1141392.5	209.330	5.004
				2	14	10	30	1142126.6	203.093	1.864
				0	14	10	36	1142217.7	200.476	1.448
				0	14	10	42	1076845.1	200.061	4.765
				2	14	10	48	1015425.0	198.226	4.746
				2	14	10	54	1018649.6	195.202	3.136
				0	14	11	0	1018397.8	192.906	3704.039
				0	14	11	6	1034588.4	189.895	4.606
				0	14	11	12	1054143.5	188.313	4.608
				0	14	11	18	1055804.0	184.867	4.593
				0	14	11	24	1055797.0	183.403	3.864
				0	14	11	30	1055809.7	182.864	4.139
				0	14	11	36	1055809.1	178.758	4.079
				0	14	11	42	1055769.5	177.693	2.089

Table 2. Radar Messages Received by the Real-time System (Cont)

STA	DATE	RADAR	REV	VALID	TIME (GMT) H	M	S	RANGE (YARDS)	AZIMUTH (DEG.)	ELEV (DEG.)
BDA	1/19	VER	1	0	14	11	48	1055665.3	174.504	0.914
			(cont)	0	14	11	54	1055624.5	171.244	0.718
				0	14	12	0	1055570.7	171.233	0.585
				0	14	12	6	1055658.3	170.725	0.800
				0	14	12	12	1055710.7	167.388	1.062
				0	14	12	18	1055605.9	165.915	0.641
				0	14	12	24	1055684.7	163.191	0.913
				0	14	12	30	1055563.8	161.872	0.536
				0	14	12	36	1055607.9	160.925	0.623
				0	14	12	42	1055777.3	166.748	1.651
				0	14	12	48	97964384.0	619.956	28.626
				0	14	13	0	1055876.5	165.081	418.349
GTI	1/19	VER	1	2	14	10	54	3024186.2	205.851	49.692
				2	14	11	0	3148745.0	221.398	46.134
				2	14	11	6	3285708.9	235.586	42.503
				2	14	11	12	3433319.6	248.562	38.939
PAT	1/19	FPQ-6	1	2	14	3	54	34342.7	8.067	393.470
				2	14	4	0	34343.1	8.060	396.348
				2	14	4	6	34321.8	8.074	894.117
				2	14	4	12	33868.1	8.069	0.341
				2	14	4	18	34544.6	8.076	0.
				2	14	4	24	34376.1	8.077	0.
				2	14	4	30	34345.8	8.109	3.656
				2	14	4	36	34404.3	8.223	4.662
				2	14	4	42	34501.6	8.508	6.347
				2	14	4	48	34646.8	9.060	8.483
				2	14	4	54	34887.5	9.973	10.944
				2	14	5	0	35267.6	11.341	13.915
				2	14	5	6	35865.6	13.269	17.185
				2	14	5	12	36746.2	15.830	20.674
				2	14	5	18	37987.6	19.102	24.284
				2	14	5	30	41887.8	27.929	31.411
				2	14	5	36	44779.1	33.498	34.594
				2	14	5	42	48480.8	39.704	37.266
				2	14	5	48	53129.7	46.324	39.272
				2	14	5	54	58847.0	53.056	40.537
				2	14	6	0	65740.1	59.594	41.070
				2	14	6	6	73928.1	65.681	40.986
				2	14	6	12	83536.1	71.183	40.439
				2	14	6	18	94691.0	75.962	39.550
				2	14	6	24	107547.2	80.080	38.403

Table 2. Radar Messages Received by the Real-time System (Cont.)

STA	DATE	RADAR	REV	VALID	TIME (GMT) H	M	S	RANGE (YARDS)	AZIMUTH (DEG.)	ELEV (DEG.)
PAT	1/19	FPQ-6	1 (cont)	2	14	6	30	122290.2	83.617	37.174
				2	14	6	36	138638.8	86.554	35.905
				2	14	6	42	155547.9	88.855	34.717
				2	14	6	48	172961.0	90.717	33.596
				2	14	6	54	190352.6	92.251	32.537
				2	14	7	0	209289.2	93.552	31.557
				2	14	7	6	228184.8	94.655	30.576
				2	14	7	18	267339.3	96.438	28.609
				2	14	7	24	287643.1	97.157	27.602
				2	14	7	30	308448.9	97.784	26.616
				2	14	7	42	351795.0	98.862	24.650
				2	14	7	48	374384.1	99.318	23.664
				2	14	7	54	397660.7	99.715	22.686
				2	14	8	0	421652.1	100.096	21.718
				2	14	8	6	446405.3	100.434	20.751
				2	14	8	12	471965.2	100.751	19.802
				2	14	8	18	498388.4	101.038	18.855
				2	14	8	24	525731.4	101.308	17.916
				2	14	8	30	554053.1	101.557	16.981
				2	14	8	36	583429.4	101.782	16.063
				2	14	8	42	613930.8	101.991	15.135
				2	14	8	48	645648.9	102.184	14.214
				2	14	8	54	678679.5	102.367	13.307
				2	14	9	0	713135.9	102.540	12.399

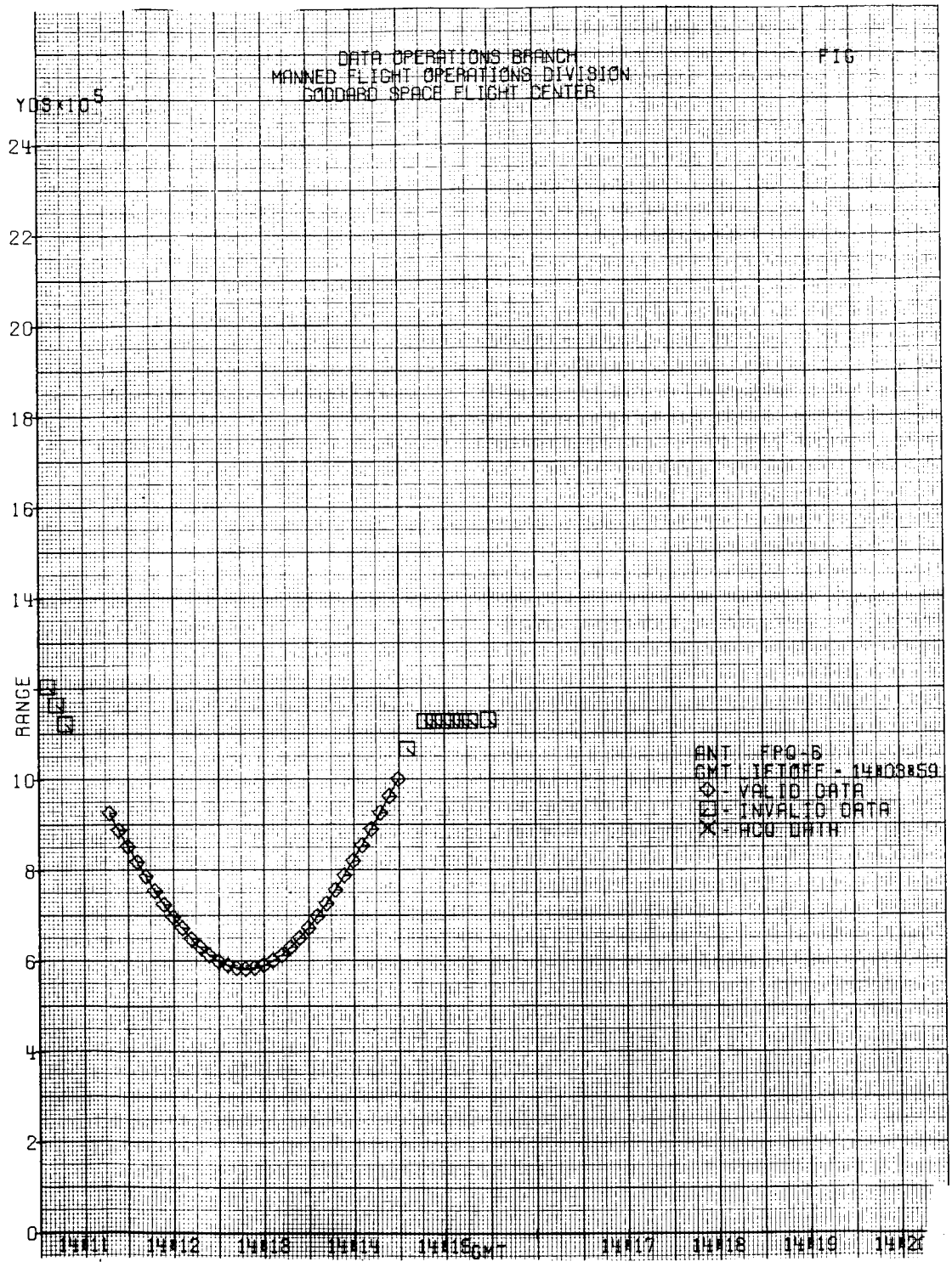


Figure 5. GT-2 ANT Pass 1, Range

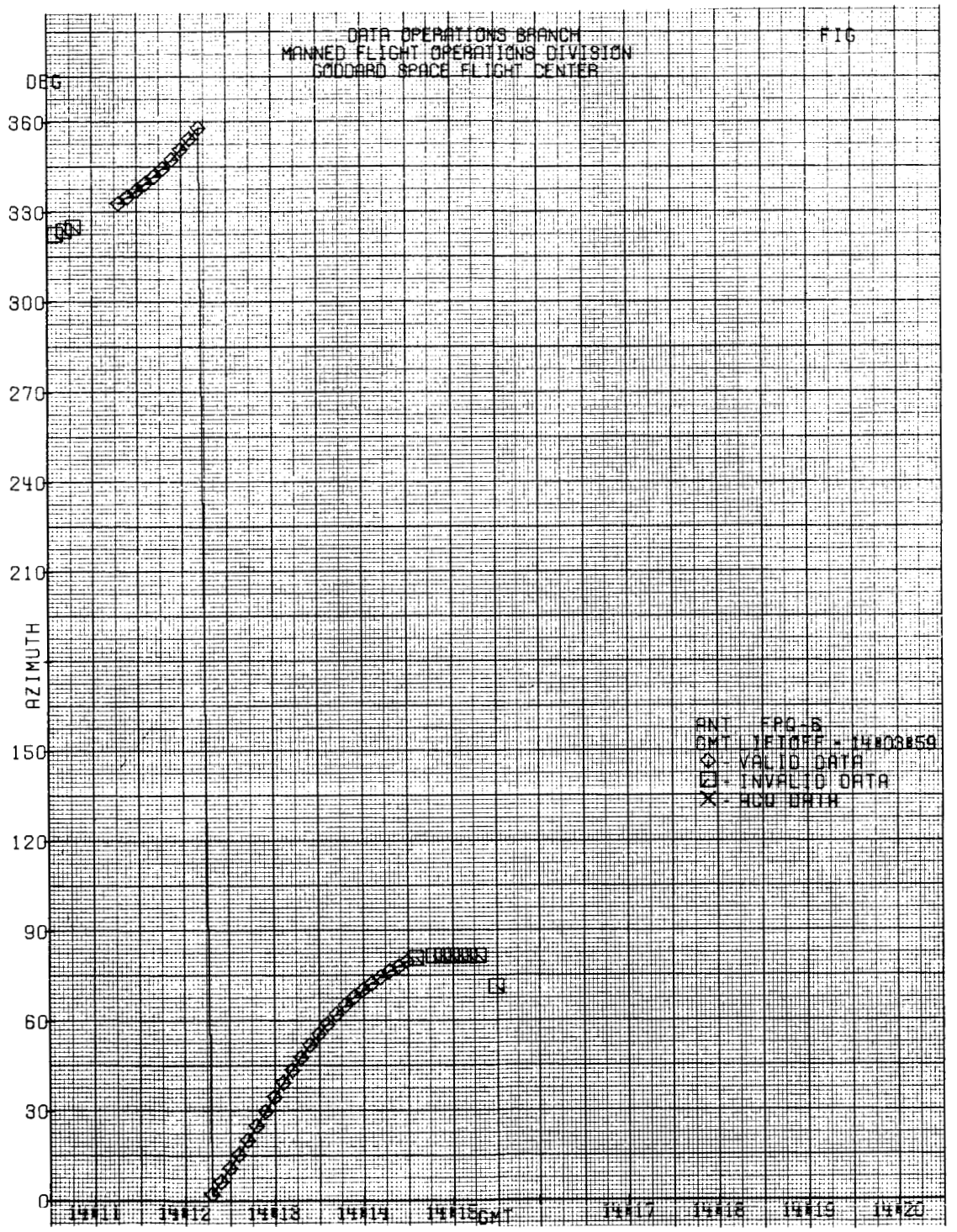


Figure 6. GT-2 ANT Pass 1, Azimuth

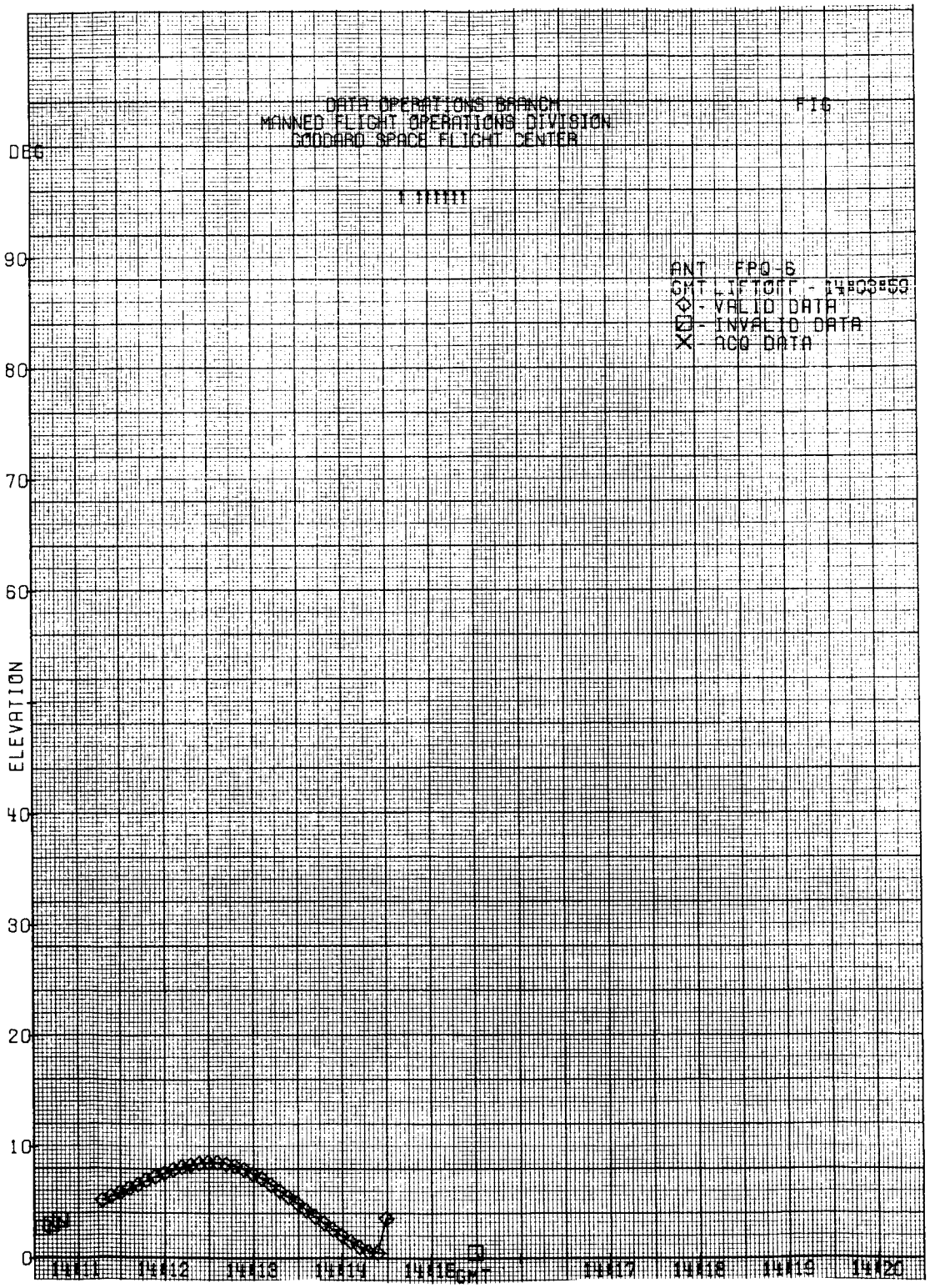


Figure 7. GT-2 ANT Pass 1, Elevation

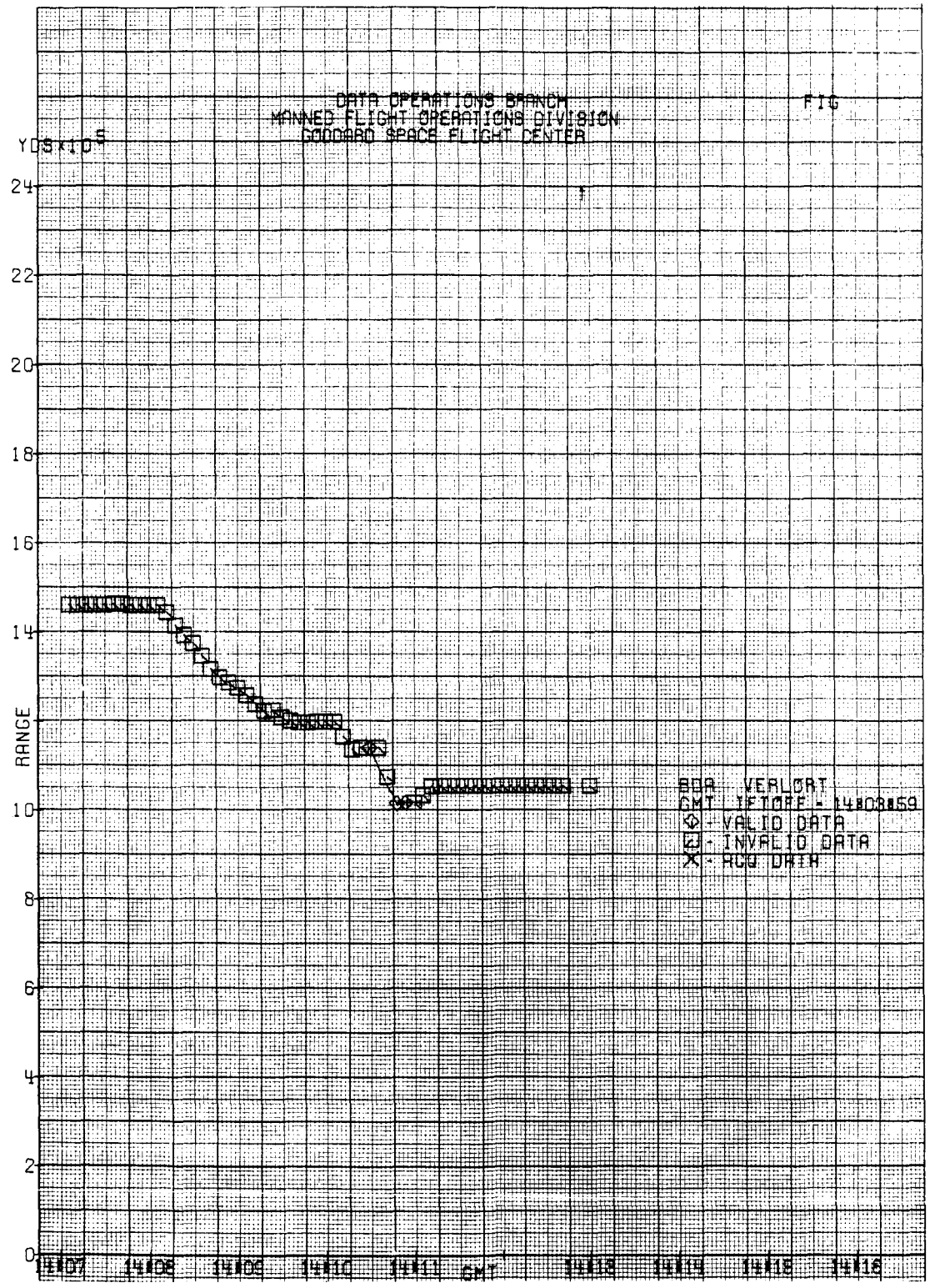


Figure 8. GT-2 BDA Pass 1, Range

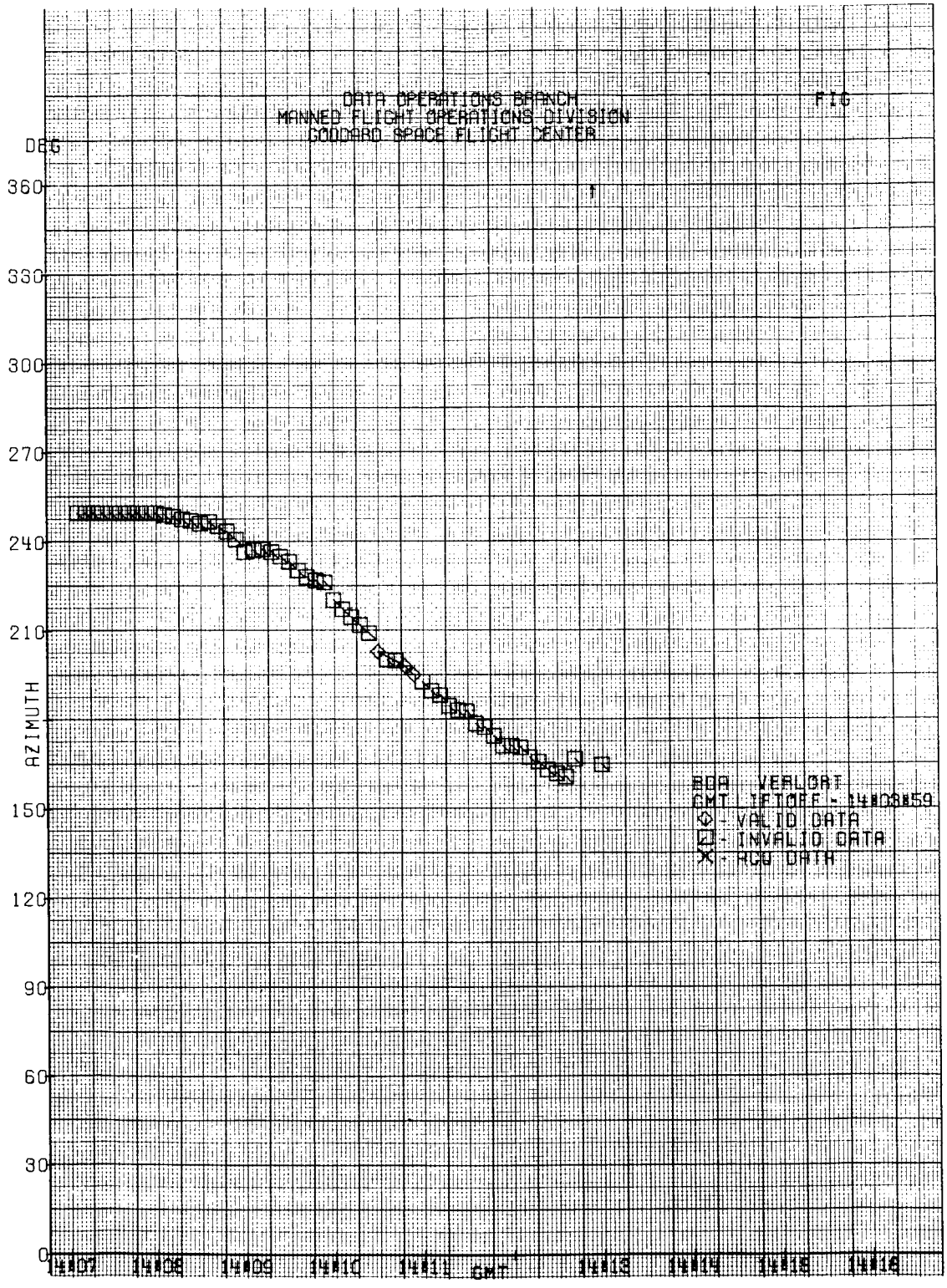


Figure 9. GT-2 BDA Pass 1, Azimuth

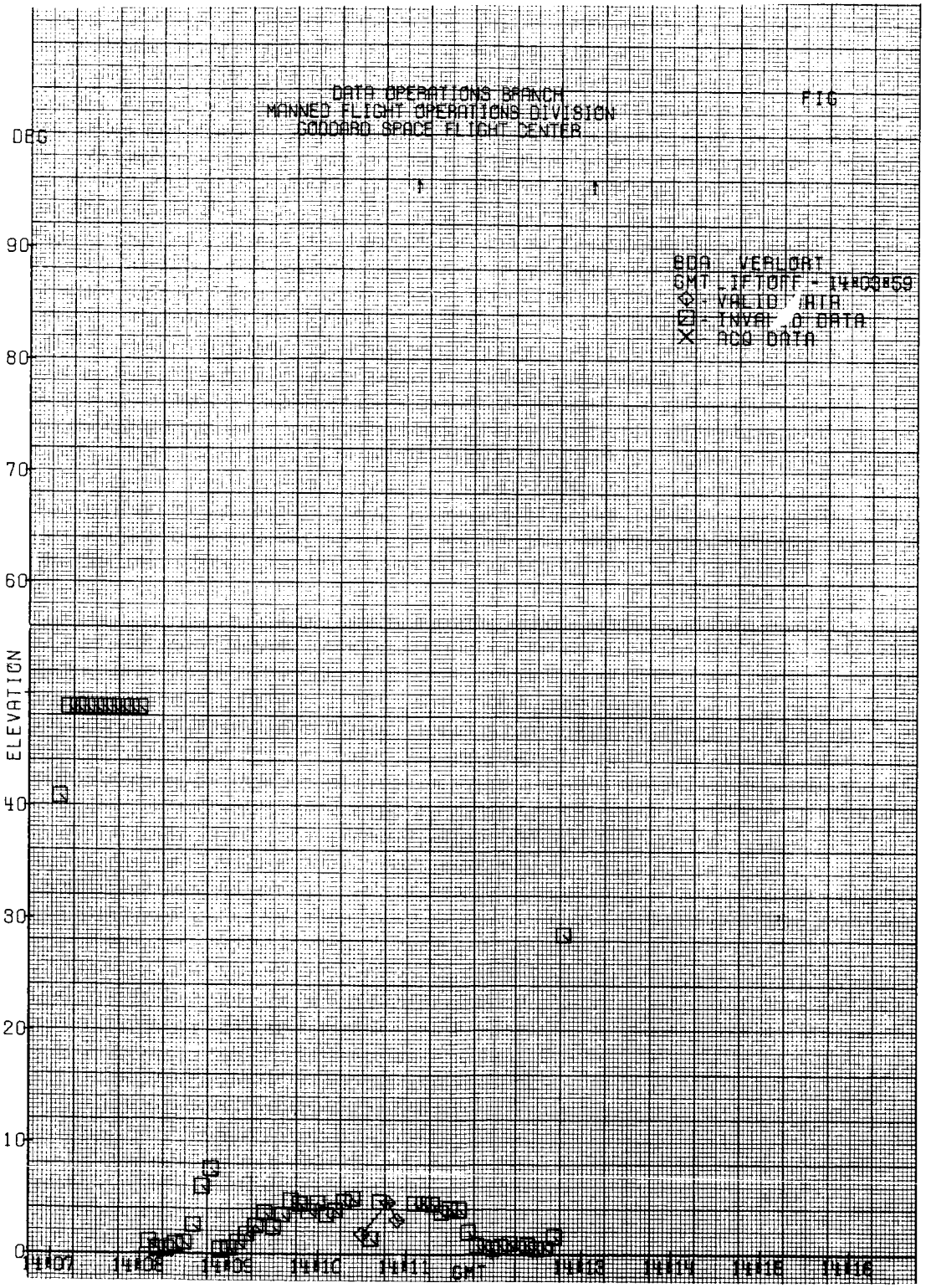


Figure 10. GT-2 BDA Pass 1, Elevation

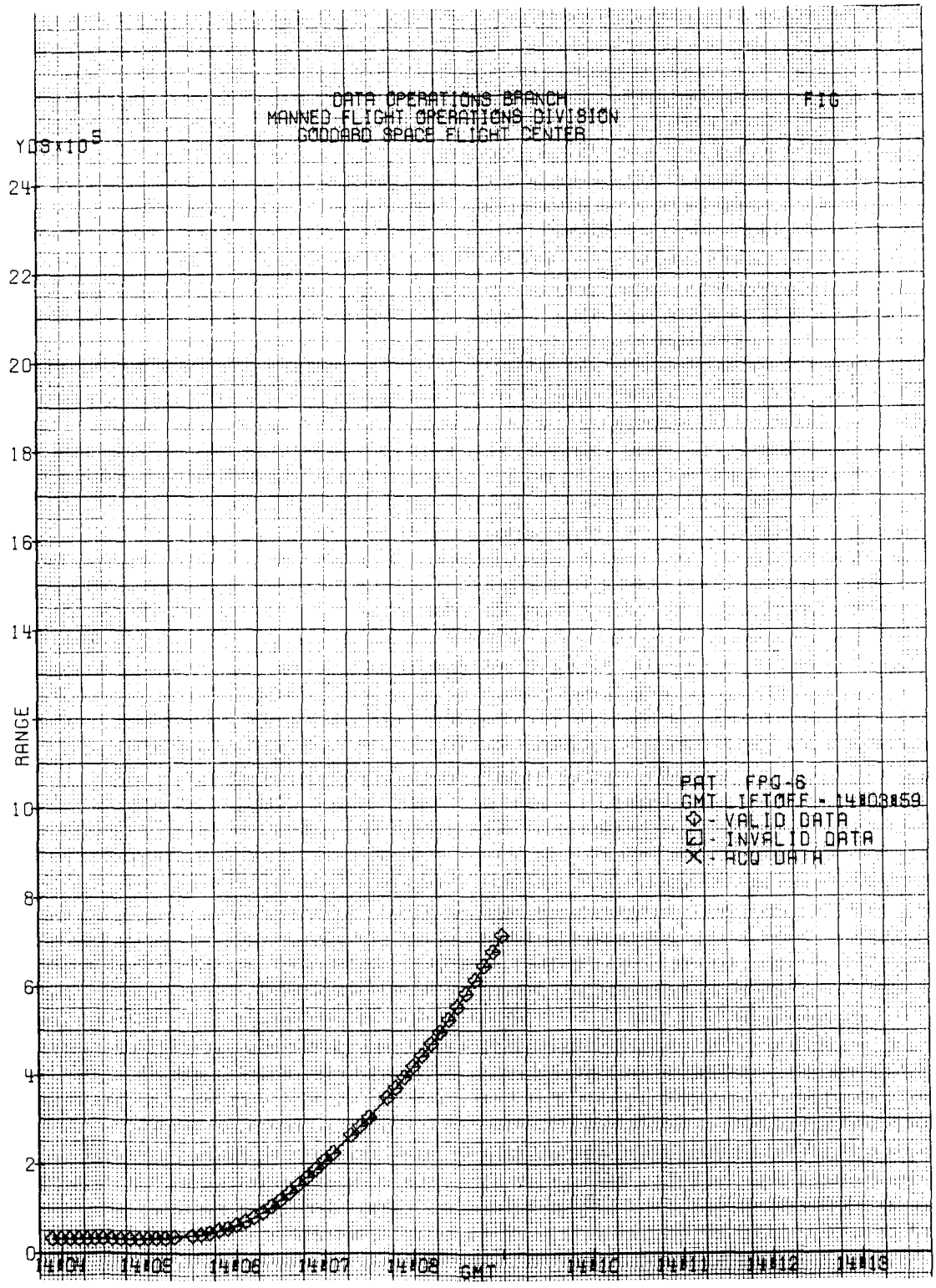


Figure 11. GT-2 PAT Pass 1, Range

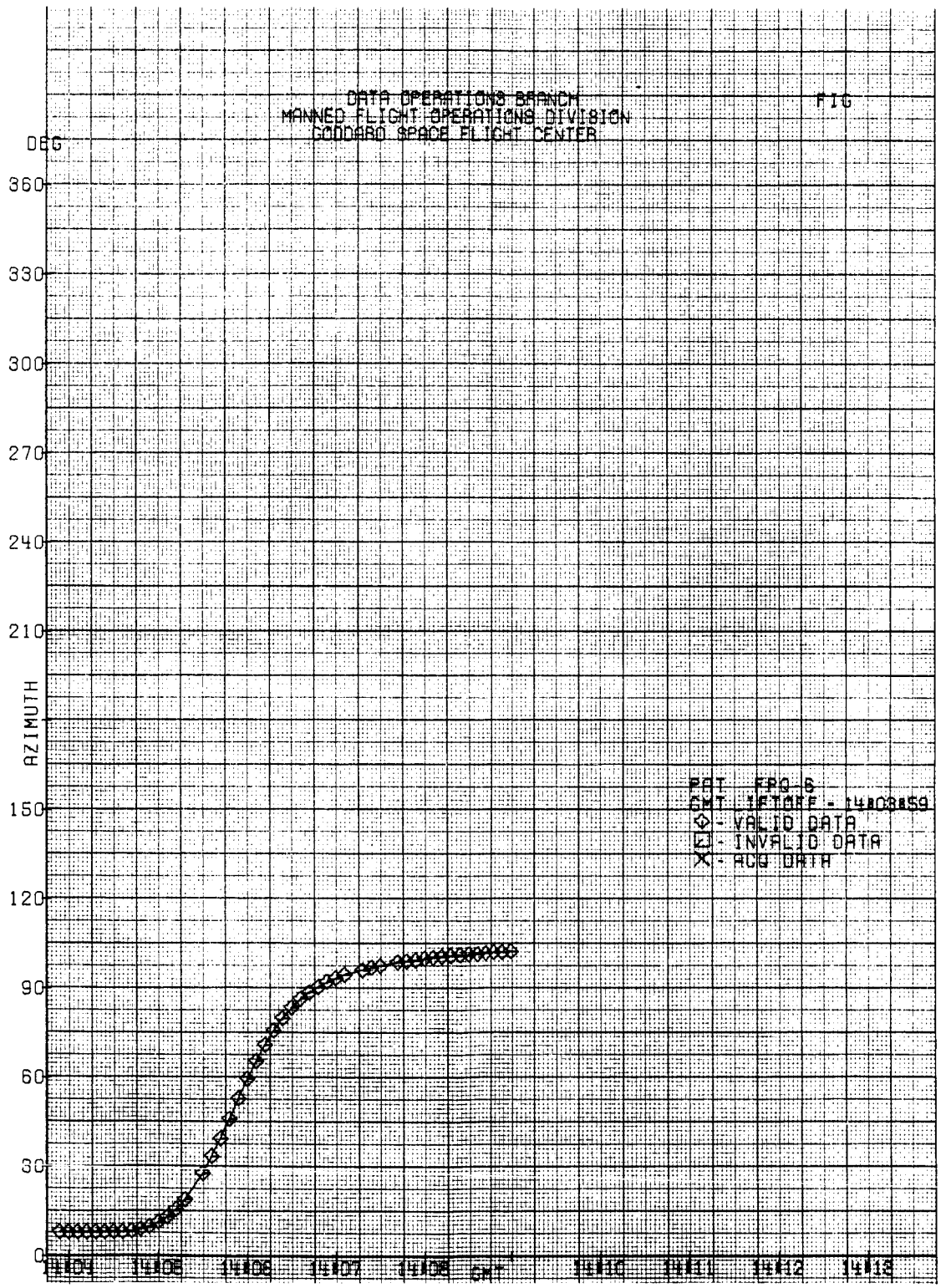


Figure 12. GT-2 PAT Pass 1, Azimuth

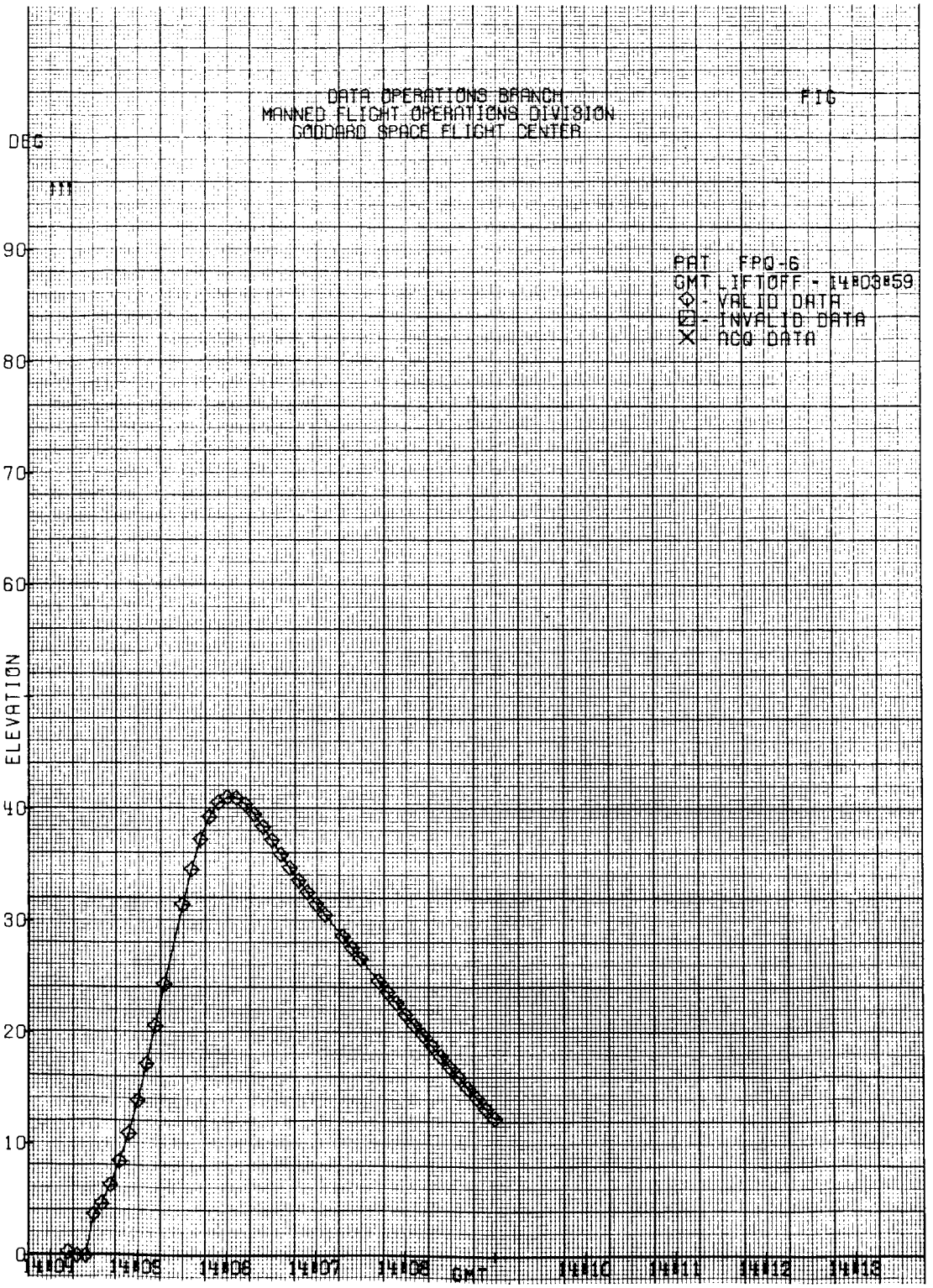


Figure 13. GT-2 PAT Pass 1, Elevation

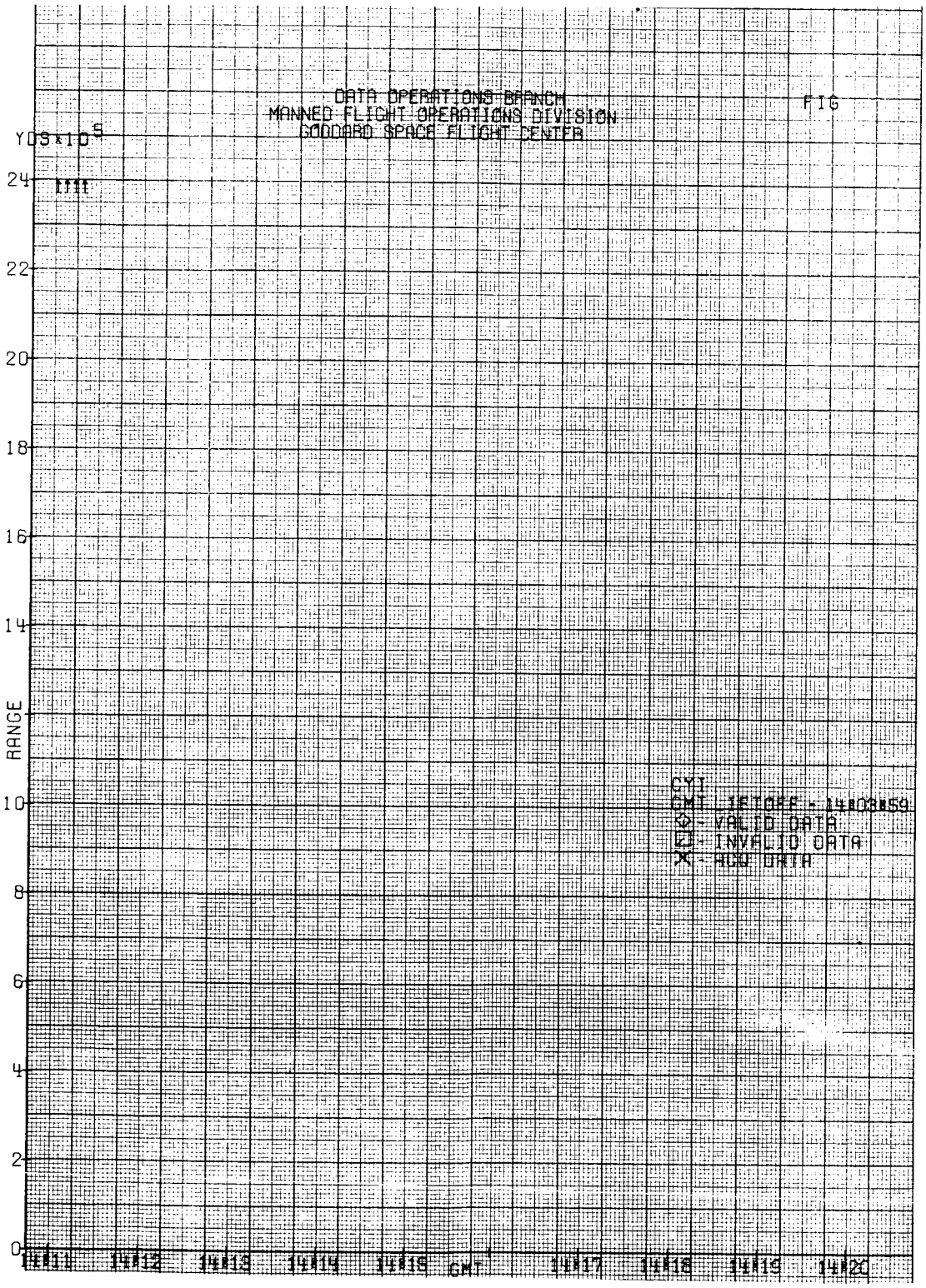


Figure 14. GT-2 GTK Pass 1, Range

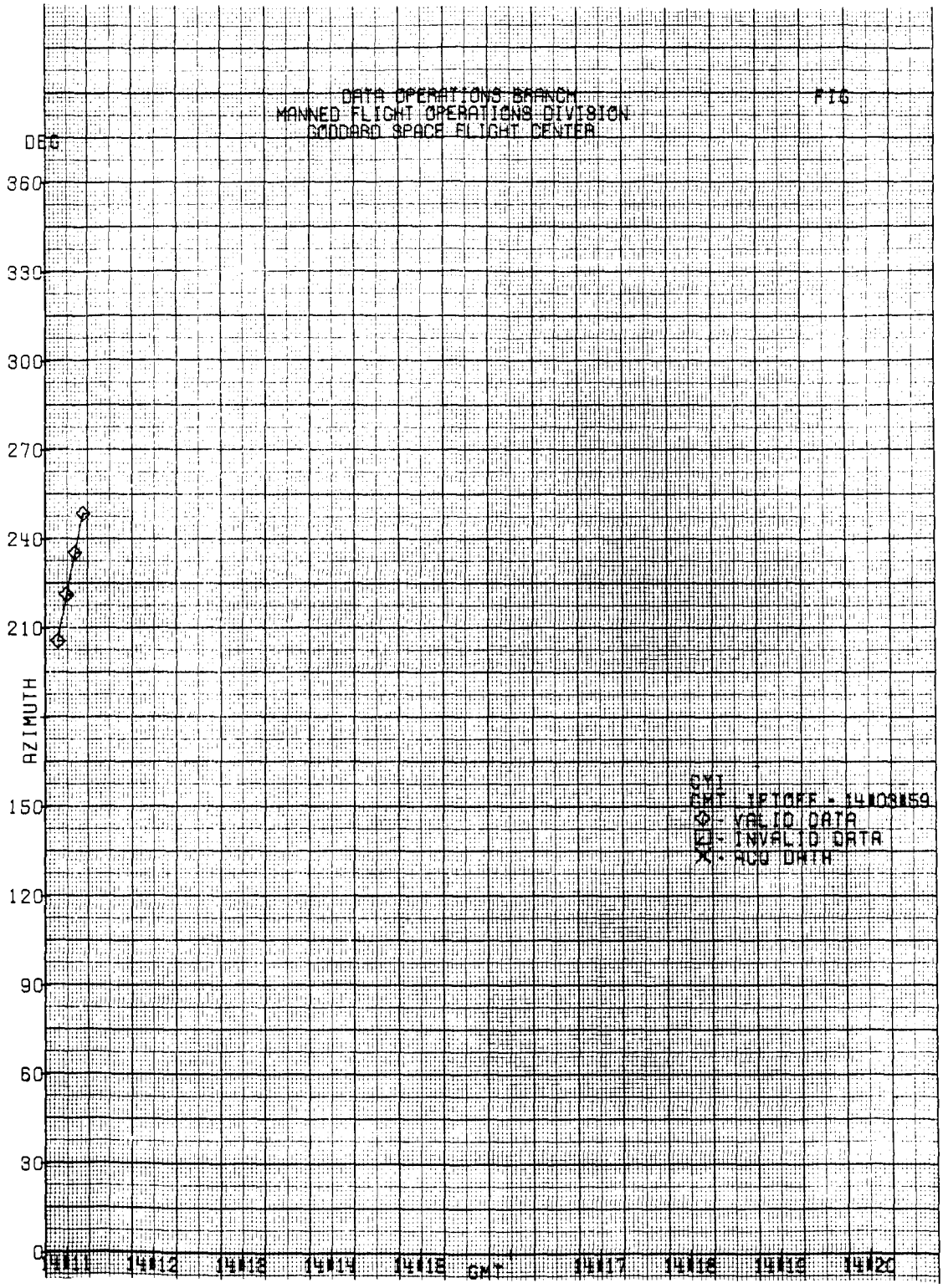


Figure 15. GT-2 GTK Pass 1, Azimuth

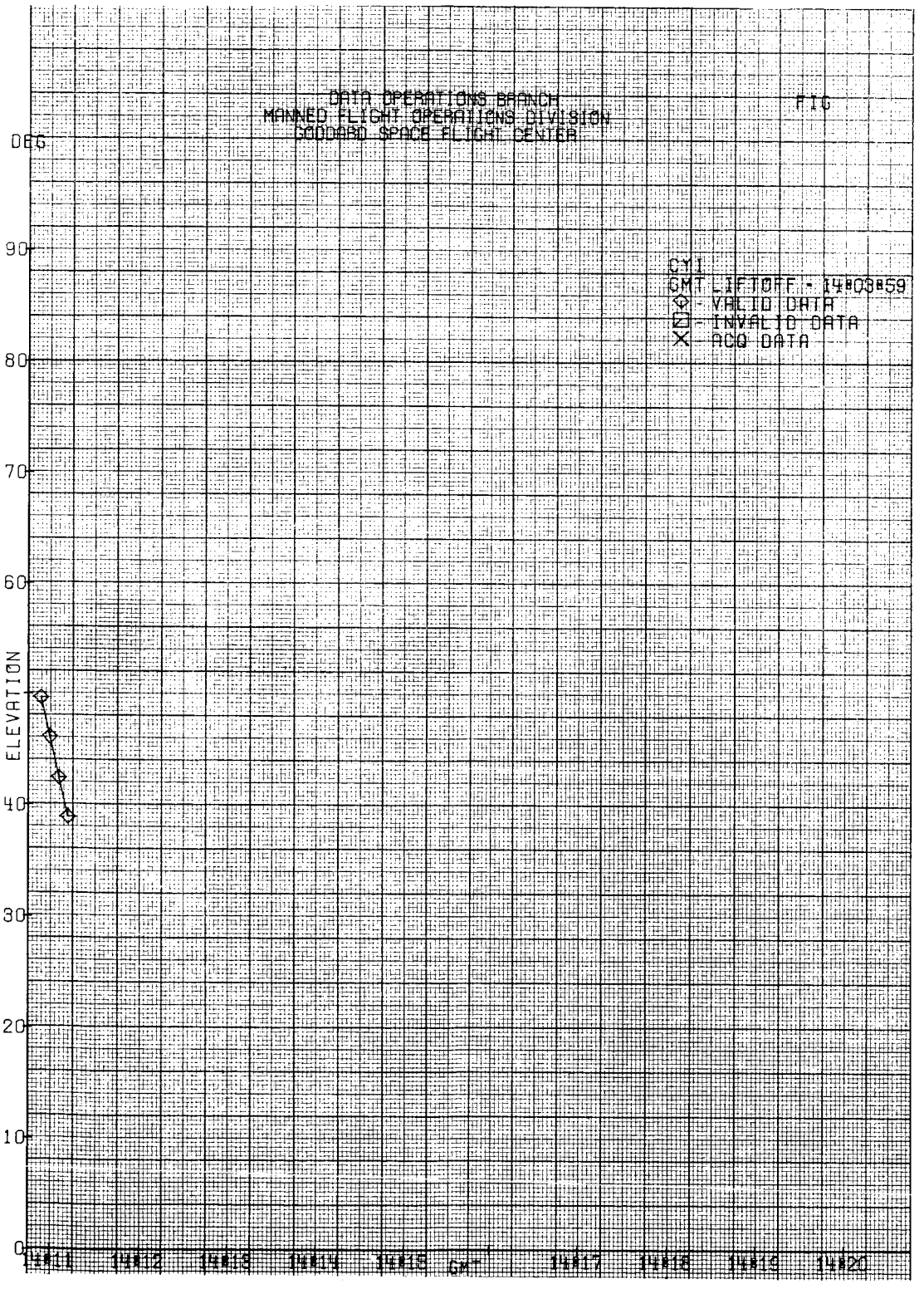


Figure 16. GT-2 GTK Pass 1, Elevation

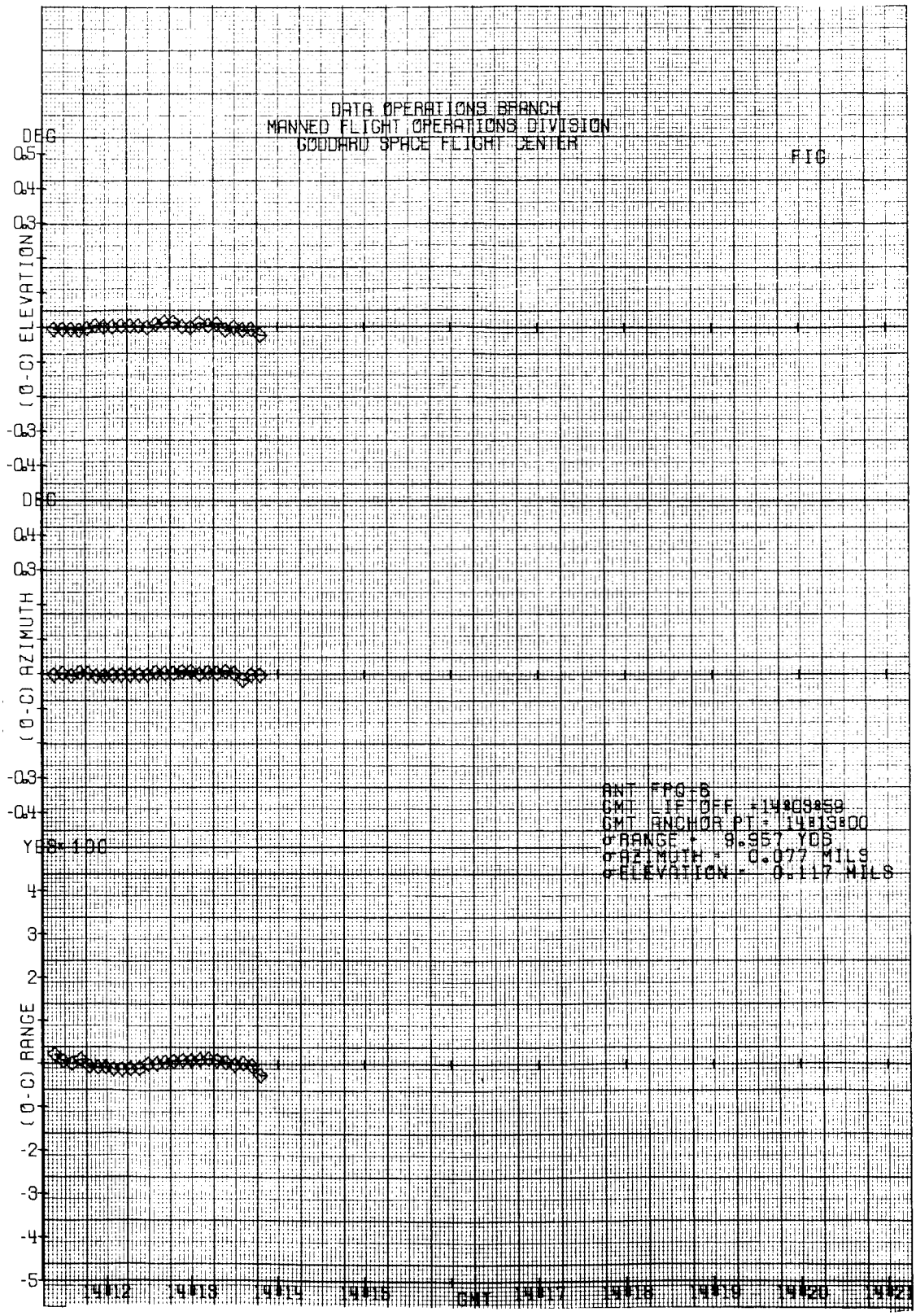


Figure 17. GT-2 ANT Pass 1, Observed Minus Computed

4.3 PCM INPUT SUMMARIES

Prior to liftoff four PCM input summaries, received from Cape Kennedy, were processed and broadcasted by the real-time system. During the high abort and reentry phase, six input summaries were received from the RKV, and five input summaries from the CSQ which were processed and broadcasted by the real-time system.

4.4 LAUNCH PHASE

GT-2 was launched from AFETR launch-complex 19 at Cape Kennedy (see figure 18). Liftoff occurred at 14:03:59 GMT on an azimuth of 105 degrees. The time of liftoff was corrected by manual insertion into the real-time system at T+308.5 seconds just before

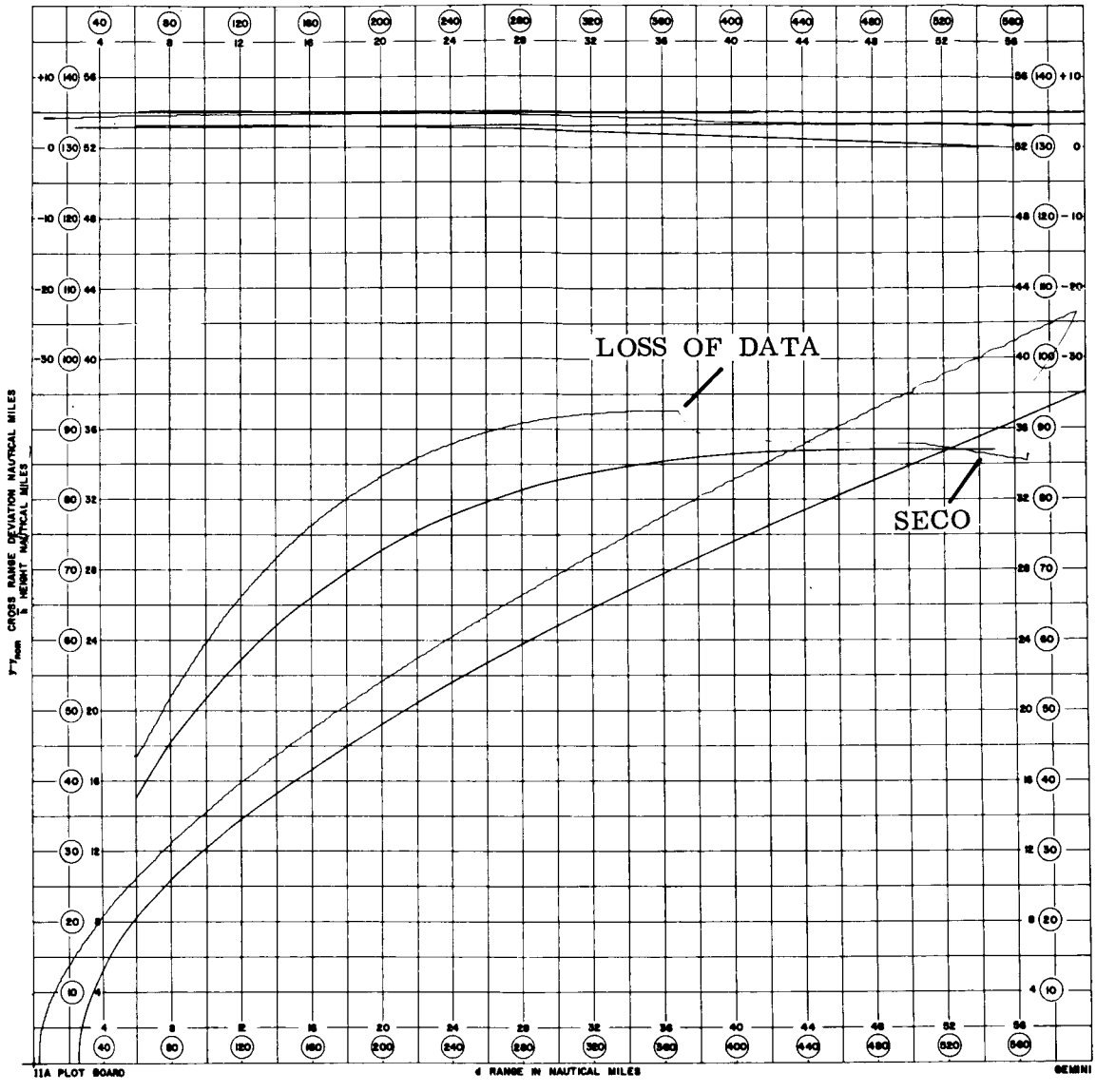
$$\frac{V}{VR} > .8$$ (factor used to determine the abort mode to be entered; i.e., mode 2 or mode 3).

Prior to SECO, MCC had a power failure which terminated the transmission of launch data to the Goddard Real-time System for approximately 38 seconds. At T+346 seconds power was restored and the real-time system immediately began to receive data. The first frame of data contained the SECO signal from the Burroughs discrete. It was necessary to manually enter AMC (Abort Mode Changeover) and AAA (Astronaut Actuated Abort) signals into the real-time system through the use of the PCC (Program Control Console). This prevented the computer program from going back into the launch phase.

As a result of the late SECO time (post flight indicated that SECO actually occurred at T+335.5 seconds), the collection period for the GO-NO GO was delayed 10.5 seconds. Table 3 tabulates the parameters, based on the average vector calculated, during the GO-NO GO computation cycle.

Table 3. Parameters Calculated During GO-NO GO

GE/B Computer	IP 3600 Computer
20 points	25 points
Recommendation NO-GO	NO-GO
Velocity 25759.48 ft/sec	25753.85 ft/sec
Gamma -2.485 deg	-2.461 deg
Vel at 400K ft 24332.89 ft/sec	24350.30 ft/sec
Gamma at 400K ft -2.951 deg	-2.930 deg
GMTRC $14^h11^m07^s$	$14^h11^m07^s$



Nominal

Actual

Figure 18. GT-2 Launch Trajectory

On the basis of data received during launch, the real-time system predicted an impact point of 16 degrees 51 minutes N latitude and 50 degrees 18 minutes W longitude. Table 4 lists the events occurring during launch. Also included are the nominal and actual time at which each event occurred.

Table 4. Launch Events

Event	Nominal	Actual
Stage I engine ignition signal (87FS1)	-3.34	-3.36
Liftoff	0.00	0.00
Roll program begin	4.40	4.34
Roll program end	20.48	20.40
Pitch rate number 1 starts	23.04	22.99
Pitch rate number 2 starts	88.32	88.07
IGS update received	103.00	103.75
Control system gain change number 1	104.96	104.67
Pitch rate number 3 starts	119.04	118.71
IGS update received	143.00	144.55
Stage I engine shutdown circuitry armed	144.64	144.28
BECO, (87FS2) Stage I engine shutdown signal and Stage II engine ignition (91FS2)	153.52	151.71
Stage separation begins	154.22	152.40
Stage II MDFJPS makes	154.42	152.37
Pitch rate number 3 ends	162.56	162.09
RGS enable	162.56	162.12
First radio guidance command received	169.00	168.29
Jettison spacecraft radar cover, scanner cover, and heat shield fairing	198.52	196.74
Stage II engine shutdown circuitry armed	317.44	316.58
SECO (91FS2) Stage II engine shutdown	336.48	335.50
Stage II MDFJPS unmakes	336.78	332.47
SECO +20 seconds, spacecraft separation	356.48	352.74

4.5 HIGH ABORT PHASE

The real-time system entered the high-abort mode with the B/GE vector as the selected source for differential correction and impact prediction purposes. Table 5 lists the nominal GT-2 orbital parameters.

Table 5. GT-2 Orbital Parameters

Definition	SECO +20 Seconds	Ohms Burnout	Retro Burnout
Time	$T+6^m$	$T+6^m17^s$	$T+7^m23^s$
Velocity	25734.2 ft/sec	25770.2 ft/sec	25548.6 ft/sec
Mass	-	6731.8 lbs	5195.6 lbs
Flight Path Angle	-2.2825°	-2.2710°	-2.472°
Height (above oblate earth)	85.96 nmi	83.04 nmi	71.58 nmi
Longitude	+25.72° N	+25.34° N	+23.73° N
Latitude	-70.94° W	-69.79° W	-65.38° W
Heading Angle	109.07°	109.60°	111.53°

Table 6 lists the parameters, based on the GMTRC (Greenwich Mean Time to Retro Fire Computed), recommended by the launch program of the real-time system.

Table 6. High Abort Parameters

Definition	Value	Definition	Value
Gamma at 400K ft	-2.969 deg	GMT at 10K ft	$14^h18^m21^s$
Velocity at 400K ft	24332.77 ft/sec	IP minimum lift latitude	17.03 N
GMT at 400K ft	$14^h11^m39^s$	IP minimum lift longitude	50.65 W
Blackout begins	$14^h12^m51^s$	IP maximum lift latitude	14.31 N
Blackout ends	$14^h15^m21^s$	IP maximum lift longitude	45.69 W

Table 7 lists the events occurring during the high abort and reentry phase. Also included are the nominal and actual time at which each event occurred.

Table 7. High Abort and Reentry Events

Event	Time	
	Nominal	Actual
Separate equipment adapter section, initiate automatic retrograde firing sequence	418.48 (T_S+62) ($T_R$to)	414.22
Jettison-retrograde adapter section	463.50 (T_R+45)	459.12
0.05 g's, initiate roll	567.1	560.23
Initiate full lift	717.1	710.01
Pilot chute deploy	879.2	871.76
Touchdown	1149	1096

4.6 RETROFIRE

Retrofire was received, via telemetry, at the following times: Retro 1, T+415.42 seconds; Retro 3, T+421.41 seconds; Retro 2, T+426.20 seconds; and Retro 4, T+328.18 seconds. Table 8 lists the reentry parameters, based on telemetry data, computed by the real-time system.

Table 8. Reentry Parameters

Definition	Value	Definition	Value
GMT at 400K ft	$14^h11^m39^s$	GMT 10K ft	$14^h18^m02^s$
Velocity at 400K ft	24332.78 ft/sec	IP minimum lift latitude	17.03 N
Gamma at 400K ft	-2.969 deg	IP minimum lift longitude	50.65 W
Blackout begins	$14^h12^m51^s$	IP maximum lift latitude	14.31 N
Blackout ends	$14^h15^m21^s$	IP maximum lift longitude	45.69 W

4.7 REENTRY

The real-time system was placed in the reentry mode of operation by manual insertion of a retrofire time of 14:11:00 GMT and nominal altitudes. The parameters computed by the real-time system are as follows:

Velocity at 400K ft, 24341.99 ft/sec

Gamma at 400K ft, -2.963 deg

Blackout begins, $14^h12^m52^s$

Blackout ends, $14^h15^m22^s$

The differential correction applied to the 26 frames of valid radar data transmitted from ANT indicated a residual in the data of 10^{-12}. The quantities reflected by the correction are as follows:

Velocity at 400K ft,	24377.89 ft/sec
Gamma at 400K ft,	-2.83 deg
Blackout begins,	$14^h 13^m 00^s$
Blackout ends,	$14^h 15^m 35^s$

4.8 PREFLIGHT LOG

The following is a summary of events occurring during the GT-2 mission countdown.

GMT	EVENT
0510	B Computer on diesel power, time standard manned. CE checks on A&B.
0520	GD-1263 running open (north and south).
0535	FP-3 hot to computer room.
0540	GD-1263 released to Telco.
0547	CE checks complete, KE checks on B.
0553	CE checks complete, KE checks on A.
0610	MCC hi-speed/KE's on A&B.
0650	MLA Red/transmitter out.
0650	KE checks complete, CADFISS Prep on B.
0710	CADFISS/PAT, MLA, GTK, ANT, CNV, RTC, B/GE, MCC - B Computer.
0720	MLA ETO reported as 1100 GMT.
0802	KE/MCC hi-speed checks complete on A, computer released for production.
0850	KE/BDA hi-speed checks on A.
0920	KE checks complete, CADFISS Prep on A.
0920	CADFISS complete on B, processing HISTAN.
0925	CADFISS Prep on B.
0935	CADFISS/BDA, CSQ, RKV, GBI, SAL/PAT reruns - B Active, A Standby.
0952	A Computer malfunction, CE's notified.
1002	A Computer released to CE's.
1020	A retruned by CE's/no problem found.
1020	Load operational program/A Computer.

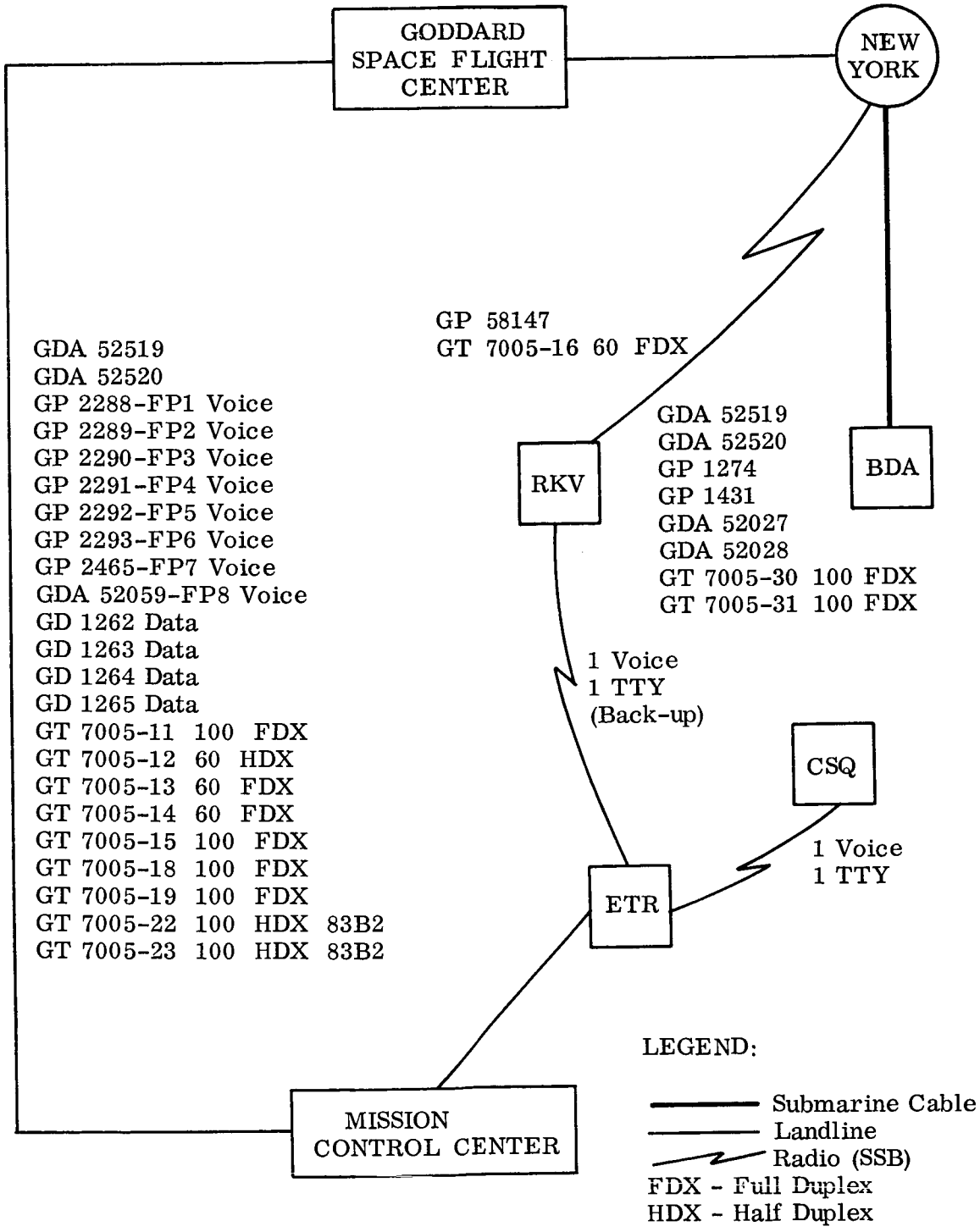


Figure 19. NASA Ground Communications Network for GT-2

GMT	EVENT
1026	MLA reported Green as of 1013 GMT.
1028	GD-1263 released by Telco.
1030	CADFISS complete on B.
1030	Load operational program/B computer.
1040	Live trajectory run/A&B.
1059	A released from trajectory run/CADFISS processing HISTAN.
1118	MCC reports momentary power loss.
1120	HISTAN complete, A turned over to CE's.
1131	Operational Program loaded/A&B.
1135	Live trajectory run/A&B.
1152	Trajectory complete, CADFISS Prep on A&B.
1210	CADFISS/BDA, CSQ, RKV data flow/MLA reruns, RTC and B/GE.
1230	CADFISS terminated on A.
1242	CADFISS complete on B.
1250	Loaded operational program/A&B.
1251	Trajectory run/A&B.
1305	Trajectory complete on A&B.
1310	Loading operational program/A&B.
1342	A&B loaded and cycling.
1345	MLA RED due to power loss/no ETO.
1352	MLA Green.
1356	Count recycled to T-6 and holding.
1358	Count resumed at T-6 and counting.
14:03:59	LIFTOFF
1405	Log Secured.

6. CONCLUSIONS AND RECOMMENDATIONS

For maximum coverage during the dynamic pressure phase of the flight, the F4C photo aircraft pilots should participate in other launches prior to the actual Gemini missions.

There are three people using the SRO MOPS circuit (Network Controller, DOD Communicator, and Aircraft Controller). It is recommended that a separate green phone be installed for direct and lengthy conversations between the SRO and Aircraft Controller and that the SRO loop be reserved for brief conversations.

To prevent future problems in scheduling the Flight Controller Confidence Tests (in particular, the DCS and telemetry tests), the documentation should be updated to reflect the Flight Controller requirements. Procedures have to be established to insure that the GSFC computers are set up and ready to support any and all tests—and that all support has been scheduled in conjunction with the tests.

In performing command (DCS) tests, it is critical that the Network Controller be notified at least five minutes in advance of the command carrier being turned on. This requirement should be made available in the proper test documentation.

Coordination between MLA and the Cape in the near future is recommended concerning power switching. The uncoordinated power outage on the MLA TPQ-18 radar late in the countdown indicates this need.

Prior to the mission day, arrangements were made to have a Network Controller (NC) present at the MCC by T-560 minutes to coordinate Houston-MCC activities. The NC was present for duty at T-600 minutes but communications were not established in time to coordinate any activities. These late requirements should be established prior to F—4 days.

A possibility exists that additional ship sailing times will have to be added to normal sailing times. The CSQ was to be on OSP by approximately F—1 day. However, rough seas and foreign matter (barnacles and seaweed) slowed down the ship sufficiently that at one time the estimated-time-of-arrival was as close as T—4 hours.

Further tests should be conducted with the RKV prior to subsequent Gemini missions to insure an equipment operational readiness condition. These tests should include the antenna systems.

5. NASCOM PERFORMANCE

The portions of NASCOM (NASA Global Communications Network) that were used in support of the mission are shown in figure 19.

Landline circuits, both voice and teletype, were good during the mission period except for the brief interval when partial power was lost in the MCC. Approximately ten messages were lost during this time but were recovered shortly after power returned.

HF communication with the RKV and CSQ was intermittently poor due to poor radio propagation during the predawn periods of both the simulations and actual mission but most particularly during the actual mission. Teletype, particularly from the CSQ, was affected more than voice. On January 19, CSQ teletype was declared RED on three separate occasions for a total outage of 1 hour, 6 minutes. However, conditions became good approximately 1 hour before actual liftoff. During the disturbed propagation periods results were similar using both the ETR and RCA communications facilities.

On January 15, during a critical portion of the simulations, the CSQ experienced a blown fuse which affected their 112A intercom power. Investigation disclosed that a 15-ampere fuse value was being used in the 105D G1 power supply instead of 30 amperes. This resulted because the rating had been doubled after a modification added additional power drain.

During the first GT-2 exercise in early December, CSQ experienced interference to telemetry when in the vicinity of the spacecraft landing area which was believed to come from radars aboard either the carrier or a destroyer. In order to verify and identify the problem, on F—1 day the CSQ rendezvoused with the carrier. It was determined that when the two ships were within a few miles of each other the high power radar, located in the upper VHF band, from the carrier interfered with the CSQ's telemetry reception. A positioning plan for the two ships to allow the CSQ's antenna to point away from the carrier was put into effect and a time schedule to avoid radar transmissions during critical periods was arranged.