SECRET SPECIAL HANDLING

9 May 1968

SUBJECT: Transmittal - SS-MOL-1B
Allocations Document

TO: R. Johnson
E. Miller
R. Pepping
J. Sewell

1. Attached are copies of the SS-MOL-1B Allocations Document. This document is an internal SPO technical management control document which is provided for your information as an aid in program coordination.

2. In paragraph 3 of my letter dated 6 May 1968, you were informed that you would receive SCN-2. The technical content of the changes to the SPDR were not felt to be sufficiently important to include as a Specification Change Notice and the attached errata sheet will bring your copy of SS-MOL-1B up to date. The errata sheet is not intended to change the technical content of the SPDR but only to clean up inconsistencies and make clarifying editorial changes.

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SS-MOL-1B

ALLOCATIONS DOCUMENT

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1.0 INTRODUCTION

This document contains contractor allocations against specific numerical requirements of SS-MOL-1B. These contractor allocations are to be incorporated in the applicable CEI/IFS or SOW.

For each numerical requirement, the SS-MOL-1B paragraph and the allocation against this requirement are presented. Entries in the "CEI Reference" column of the allocation pages refer to those items which are or should be incorporated in the applicable CEI/IFS or SOW.

This document is noncontractual and is provided for reference only.

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2.0 ALLOCATIONS

2.1 OV WEIGHT

3.3.6.2.2 Performance Requirements

The Titan IIIM shall be capable of inserting a MOL payload of 30,850 pounds into an orbit having an apogee altitude of 187 na. miles, a perigee altitude of 80 na. miles, with perigee placement at 45 degrees north latitude, and an inclination of 90 degrees. This performance requirement is applicable to both the manned-automatic and automatic configurations.

CEI REFERENCE		SS-MOL-1B REFERENCE
	OV Weight	
	The OV contractual weight allocations (April, 1, 1968) for the manned automatic configuration are as follows:	3.3.6.2.2

	ITEM	SPEC. WEIGHT LBS	
-B3.3.1.3	GBSS AVE	5,600	
EW	GB GFE	59	
	Gemini B		5,659
	LVSS AVE		
M-A3.3.1b	LM-DAC	12,253	
MMPS3.3.1c	MM Primary Structure	2,105	
M0A3.3.1b	LM GFE	90	
	LV-DAC		14,448
M3.3.1.a	MMSS AVE	2,435	
NEW	MM-GFE	122	
	LV-GE		2,557
KC Annex 1, I,5,I,E	PSS AVE		5,714
	PSASS		
PSA3.3.1.1	Basic Pressure Garment - HS (2)	69.78	
EOS3.3.1.1	Emergency O_2 System (2)	13.70	
CWG3.3.1.1	Constant Wear Garment - Spares	22.0	
NEW	Miscellaneous Components	19.3 (Est.)	
NEW	PSA-GFE	1.5	
	PSA		126

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CEI REFERENCE		SS-MOL-1B REFERENCE

OV Weight (Continued)

	ITEM	SPEC WEIGHT LBS	
NEW	Food SS		102
NEW	Flight Crew		360
	OV Total		28,966
	Reserved Weight		
	1 Mark V DRV	475	
	Wideband Scan	485	
	Total Reserved		960

OV weight allocations for the automatic configuration are not available at this time.

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2.2 CPS POWER

3.1.1.6.17 Orbiting Vehicle Electrical Power

The Laboratory Vehicle central power system shall be a nominal 28-vdc power system, shall provide the total power requirements for the Laboratory Vehicle and Mission Payload, and shall provide part or all of the power to the Gemini B from early orbit to the late orbit phase. For the manned-automatic configuration, the average power demand over the nominal mission duration shall not be greater than 1.825 kilowatts (net) with peaks not greater than 4.5 kilowatts (net).

For the automatic configuration, the average power demand over the extended mission duration shall not exceed the capability of the equipment developed for the manned-automatic configuration except for added expendables.

Power utilization for peak and average power for each Orbiting Vehicle segment shall be as specified in SAFSL Exhibit 30001. All OV equipment requiring power outside the characteristics of the LM Central Power System (CPS) shall provide individual power conditioning equipment.

CEI REFERENCE

DAC-NEW
GE-NEW
MAC-NEW
EK-CCN #11

SS-MOL-1B REFERENCE

3.1.1.6.17

CPS Power

Power allocations for the manned-automatic configuration are given in SAFSL Exhibit 30001. The 30-day average power allocation are based upon maintenance of the following reactant allocation and contingency position.

	Average Power Watts	Oxygen lbs	Hydrogen lbs	Total Reactant lbs
Allocated Power Consumption	1825	1036.4	133.6	1170.0
Unallocated Contingency	182	103.6	13.4	117.0
TOTAL	2007	1140	147	1287

The contingency is reserved to cover:

a. uncertainties in fuel cell characteristics
b. load uncertainties
c. timeline effects (reactant consumption is a non-linear function of instantaneous power drain).

Additional average power capacity may be provided to the limit of tankage capacity at the rate of 0.88 lbs of reactant per kilowatt hour.

Power allocations for the automatic configuration and for Flight No. 2 are not available at this time.

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2.3 MISSION EFFECTIVENESS

3.1.3.1 Effectiveness

The MOL Program shall provide a capability for stereo photographic reconnaissance, to include both manned and unmanned operations, with a probability of 30-day mission effectiveness of 0.85 for the manned system and 0.63 for the unmanned system. Mission Effectiveness is defined in SAFSL 30002. The allocation of Mission Effectiveness to each contractor's AVE and to Flight Operations and Recovery Support shall be as specified in SAFSL Exhibit 30002.

CEI REFERENCE		SS-MOL-1B REFERENCE
	Mission Effectiveness	3.1.3.1
DAC-NEW MAC-NEW T-III-NEW GE-NEW EK-NEW	Mission Effectiveness allocations are given in SAFSL Exhibit 30002, in Section 2.1.	

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2.4 PLOT

3.1.3.3.1.3 Probability of Launch On Time (PLOT)

PLOT is the probability that the equipment (AVE, AGE, Facilities) will perform its intended function within countdown operations. The time interval over which the probability applies starts with the initiation of MOL system countdown (inclusive) and terminates at the end of launch phase. It is measured in two ways:

a. PLOT--Success on the First Window--The probability of completing launch within a 1-hour window specified two weeks in advance.

b. PLOT--Success on Any One of Three Consecutive Windows--The probability of completing launch within a 1-hour window on any one of three successive days specified two weeks in advance of the first 1-hour window.

For the manned-automatic configuration, the requirement under a. above is 0.69 and the requirement under b. above is 0.90. For the automatic configuration, the requirement under a. above is 0.69 and the requirement under b. above is 0.89. These numerics do not include delays resulting from adverse meteorological conditions or local rail traffic control. Numerical allocations and the methods and techniques for developing the PLOT shall be as specified in SAFSL Exhibit 30002.

CEI REFERENCE		SS-MOL-1B REFERENCE
Manned-Automatic MAC-NEW MM-NEW PSS-NEW PSA-NEW T-III Annex I-7-11 DAC-NEW Automatic NEW	PLOT Plot Allocations are given in SAFSL Exhibit 30002, Section 2.2.	3.1.3.3.1.3

2.5 SAFETY NUMERICS

3.1.3.7 Safety

The MOL System Safety Program shall preserve mission-essential characteristics of the system while assuring that hazards to personnel, equipment and property are eliminated or reduced to an acceptable level. This shall be accomplished by implementing a safety engineering program as defined in SAFSL Exhibit 30002 and the requirements specified herein.

3.1.3.7.1 Flight Crew Safety

The probability of a flight crew fatality during any portion of the MOL mission as a result of equipment or system segment failures shall be no greater than the values specified below. These values include the abort capability provided by the Gemini B where applicable. The requirements are applicable for the period of time from crew entry into the Gemini B during launch countdown through crew recovery following reentry.

Launch Phase	0.00070
Ascent Phase	0.00250
On-Orbit (includes Early Mission and Late Orbit) Phase	0.00100
Reentry Phase	0.00075
Retrieval Phase	0.00005
Total Mission	0.00500

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CEI REFERENCE		SS-MOL-1B REFERENCE
	Safety Numerics	
DAC-NEW MAC-NEW GE-NEW EK-NEW T-III-NEW	Safety numerics allocations are given in SAFSL Exhibit 30002, Section 2.3	3.1.3.7 3.1.3.7.1

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2.6 VOICE LINK

3.1.1.6.5.1 Voice Communication

Communication between the Mission Control Center (MCC) and crew will be continuous during station contact. Voice quality of the overall TTCV and Gemini B VHF voice links shall meet a word intelligibility score of 80 percent or better as determined by ASA 3.2-1960 (or equivalent) for all voice modes with the PSA helmet removed.

Intercommunications shall be provided during those times when both crew members are in the Gemini B or LV, when one crew member is in the Gemini B and the other crew member is in the crew transfer mode and when one crew member is in the LV while connected to the transfer umbilical.

CEI REFERENCE		SS-MOL-1B REFERENCE

Voice Intelligibility (TTCV)

Voice quality of the overall ground vehicle voice link shall meet a word intelligibility score of 80% or better for all voice words. Voice intelligibility shall be measured in accordance with ASA Standard S.3.2-1960 using the phonetically balanced word lists. Voice intelligibility test requirements for elements of the voice system are listed below. — 3.1.1.6.5.1

CEI REFERENCE		Elements	Input S/N(dB)	Link Bit Error Rate(BER)	% Intelligibility Uplink	% Intelligibility Downlink	SS-MOL-1B REFERENCE
LM-A 3.1.1.1.2t.7	1.	AVE (VCC-KG-XMTR) to MGE(RCVR-KG-VSD-Vocoder)	25	10^{-5}		85	
		MGE(Vocoder-VSD-KG-XMTR) to AVE (RCVR-KG-VCC) (Use master voice test tape as the input.	20	10^{-4}	85		
	2.	Same as Test 1 - with Type 4B data lines and Collins TE216 or equivalent modem.			Design Goal - 80		3.1.1.6.5.1
	3.	Same as Test 1 except use microphone input.			Design Goal - 80		3.1.1.6.5.1
DAC-NEW	4.	GVCS	25		88	85	
ORD	5.	Ground SGLS with GVCS	25	10^{-5}	85	85	L-5611
ORD	6.	Ground SGLS-GVCS-MCC	20		Design Goal - 85		

CEI REFERENCE		SS-MOL-1B REFERENCE
	Voice Intelligibility (Gemini B)	
MAC-NEW	Voice intelligibility test requirements for elements of the Gemini B VHF voice system are not available at this time.	3.1.1.6.5.1

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2.7 COMMUNICATION RF LINK

3.3.2.2.7.2 Communications

LV communications shall be compatible with and shall make primary use of the USAF Space-Ground Link Subsystem (SGLS).

The LV shall contain a transponder consisting of a receiver and transmitter which combines TTCV functions over a single uplink and two-carrier downlink.

The LV communication system shall provide a secure vehicle-to-ground full-duplex voice link with 1/2 duplex backup capability and analog clear voice. It shall provide two independently-operated voice recorders. Processing of the voice shall provide a quality with minimum degradation considering, encryption, decryption, SGLS link, and the requirements of the SCF secure voice link.

CEI REFERENCE		SS-MOL-1B REFERENCE
	Communications RF Link	
LM-A, 3.3.1.2	Communication link requirements are specified in the Air-to-Ground Interface for MOL, Appendix D to the Orbital Requirement Document (ORD).	3.3.2.2.7.2

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2.8 TELEMETRY

3.1.1.6.11 Telemetry

Telemetry shall be provided for the transmission of data to SCF remote stations. Data multiplexing shall be provided by the Mission Module, Laboratory Vehicle, and Gemini B system segments.

The Laboratory Vehicle telemetry subsystem shall combine PCM multiplexed data from the MMSS and PSS with the LVSS data into a serial bit stream for real-time or delayed transmission. Laboratory Vehicle continuous channel FM data and Gemini B PCM data shall be transmitted in real time only.

Fourteen Interrange Instrumentation Group (IRIG) FM telemetry subcarriers shall be provided during ascent for high frequency vibration or acoustic measurements, six to be utilized for LVSS, four for MMSS, and four for PSS. The combined MMSS and PSS video output will be mixed with the LVSS FM telemeter control unit.

LM-A,
CN 39, AI

LM-A CCN 39, AI
GE CCN 39, A2

OV PCM Telemetry

Capability: The PCM telemetry system servicing the LVSS, the MMSS, and the PSS for Flights 3 and up has the following formats and characteristics:

FORMAT TITLE	BIT RATE (kbps)	FRAME RATE (Frames/Sec)	WORDS/ FRAME
1) Real Time, Periodic, & Mission	65.536	64	128
2) Undefined	65.536	64	128
3) Contingency Mode	4.096	4	128
4) EKG	4.096	4	128

Gemini B PCM telemetry is carried on a separate link.

Allocation of Capability: The allocation of words/frame for each format for both the manned automatic and automatic configuration is as follows:

Format 1	WORDS/ FRAME
LVSS	67
MMSS PSS	61
Total	128

Format 2 - Undefined

Format 3

LVSS	128

3.1.1.6.11

OV PCM Telemetry (continued)

	WORDS/ FRAME
Format 4 *	
LVSS	128

GBQ Allocations:

The PCM telemetry channel for Flight No. 2 has a 760 kbps capacity. Allocations for this vehicle are not available at this time.

* Format 4 is not used for the automatic configuration.

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M-A, 3.1.1.2.3.1
E 3.1.1.2.1.6
EW

OV FM/FM Telemetry

3.1.1.6.11

Capability: The FM/FM telemetry system servicing the LVSS, the MMSS, and the PSS has a 14 channel capacity. Twelve of these channels have 500 H_z bandwidth and two have 2,000 H_z bandwidth.

Allocation of Capability: The FM/FM telemetry channels are allocated for the manned automatic configuration as follows:

	500 H_z CHANNELS	2,000 H_z CHANNELS
LVSS	5	1
MMSS	3	1
PSS	4	-
Total	12	2

Assignment of FM channels by measurement numbers is not available at this time.

Allocation of FM/FM channels for the automatic configuration is not available at this time.

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2.9 MONITOR/ALARM

3.3.2.2.9 Monitor/Alarm

The Laboratory Vehicle monitor and alarm system shall be capable of alerting the crew to critical out-of-tolerance Orbiting Vehicle conditions. Monitored functions shall be classified in two levels of alarm urgency: warning and caution. Each of these levels shall actuate a distinct set of visual and aural alarms for crew alerting. The crew display shall be centralized. Criteria for monitoring and classifying signals shall be:

a. Warning Function--Functions which, if out-of-tolerance, present an immediate threat to crew life.

b. Caution Function--Functions which, if out-of-tolerance, indicate degradation of Orbiting Vehicle performance to a degree which, if no action is taken through crew or ground command procedures, can result in degraded systems performance or reliability.

CEI REFERENCE		SS-MOL-1B REFERENCE
	Monitor/Alarm	
LM-A 3.1.1.1.4b	Capability: The LVSS Monitor and Alarm System has a 206 channel capacity to service the OV.	3.3.2.2.9
	Allocation of Capability: The Monitor and Alarm System channels are allocated for both the manned automatic and automatic configuration as follows:	

WARNING (FULLY REDUNDANT CHANNELS)	CHANNELS
GBSS *	0
LVSS	8
MMSS	12
PSS	
Total Warning	20

CAUTION	
GBSS *	10
LVSS	88
MMSS	88
PSS	
Total Caution	186
Total Allocated	206
Total Unallocated	---
Channels	206

LM-A 3.1.1.1.4b

NEW

NEW

LM-A 3.1.1.1.4b

NEW

* Not used in the Automatic Configuration

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2.10 COMPUTER MEMORY

3.3.2.2.8.4.1 Computer

A centralized capability shall be provided for performing required on-board computations and data handling functions and command functions initiated through the command link or by the crew. Control of the computer shall be provided through the command link via real-time or stored program commands or upon receipt of a signal from the computer subsystem controller.

Capability shall be provided for the crew to enter or request data from the computer, to include but not be limited to operational and failure status displays. Flight crew control of the computer subsystem will be provided as backup.

Two identical computers, together with required peripheral units, each capable of executing all functions essential to Mission Payload and LVSS operations, shall be included. Both computers shall have the capability of interfacing with the MMSS and LVSS.

CEI REFERENCE		SS-MOL-1B REFERENCE
	Computer Memory	3.3.2.2.8.4.1
LM-A 3.1.7	Capability: The computer core memory capability is 16,384 words. This memory capacity must satisfy all MMSS, PSS, LVSS requirements for resident word storage.	
	Allocation of Capability: The core memory allocation is as follows:	

	Manned-Automatic Configuration (Words)	Automatic Configuration (Words)
NEW GE		
Resident	9,300	
Shared *	(1,264)	NOT
NEW DAC		
Resident	5,000	AVAILABLE
Shared *	(1,264)	
Contingency	820	
TOTAL	16,384	

* Free storage and non-resident program block, time shared.

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2.11 EXTERNAL DATA STORAGE

3.3.2.2.8.4.4 External Storage

External storage shall be provided to allow read-only storage of all computer programs required during the mission. The storage unit shall be addressable by either computer for access to stored programs and target data.

CEI REFERENCE		SS-MOL-1B REFERENCE
LM-A, 3.1.1.2.3.4.d	External Storage	3.3.2.2.8.4.4

Capability: The AMU (Auxiliary Memory Unit) has a storage capacity of 204,300 words. (6 million bits.)

Allocation of capability: The AMU storage allocation is as follows:

	Manned Automatic Configuration (Words)	Automatic Configuration (Words)
NEW GE		
Data	68,000	NOT
Copy of resident programs	9,300	AVAILABLE
Non-resident programs	1,250	
Record gaps	50,250	
NEW DAC		
Copy of resident programs	5,000	
Self-test and non-resident programs	830	
Maintenance and diagnostic programs	8,000	
Record gaps	3,696	
TOTAL USED	146,326	
Contingency	57,974	
TOTAL	204,300	

2.12 FV TRANSMISSION FREQUENCIES

3.2.2.1 Electrical and EMC

All electrical components, subsystems, systems, wiring, and segment interfaces of the Orbiting Vehicle AVE and AGE shall meet the requirements of SAFSL Exhibits 20005, 30005, and 30006. All electrical components, subsystems, systems, wiring, and segment interfaces of the T-IIIM shall meet the requirements of SSD-CR-65-334 and SAFSL Exhibit 20005.

All electrical components, subsystems, systems and wiring of the launch facilities shall meet the requirements of IFS-TIII-34000. Interfaces of the launch facility with AVE and AGE shall meet the requirements of SAFSL Exhibit 20005. The launch facility shall be compatible with the EMC, grounding and electrical bonding requirements of SAFSL Exhibit 30005.

Electrical wiring design and manufacturing technique shall be specified and controlled so that potential ignition due to damage wire insulations shall be minimized. This shall include:

a) Utilizing the criteria specified in MIL-W-8160D.

b) Protection of bundles from abrasion from adjacent hardware and ground and flight crew action.

c) Load protection to restrict the current level and duration in shorted wires.

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CEI REFERENCE		SS-MOL-1B REFERENCE
Pad and Launch Frequencies MOL PRD, p. 190	Flight Vehicle Transmission Frequencies The allocated Flight Vehicle transmission frequencies are as follows:	3.2.2.1

Frequency (MH_Z)	USE
$15.016 \pm .001126$	Gemini B Post Reentry Communication
$243.0 \pm .0243$	Gemini B Recovery Beacon
$296.8 \pm .018$	Gemini B Voice Transmission
*259.700	Gemini B Telemetry
5765.0 ± 4.0	Gemini B Radar
2212.5 ± 2.0	LM - Telemetry
2217.5 ± 2.0	LM - Telemetry
***S-Band	LM - Development Telemetry
$2201.5 \pm .5$	T-IIIM Telemetry
$2252.5 \pm .5$	T-IIIM Telemetry
$2287.5 \pm .5$	T-IIIM Telemetry
9310 ± 20	T-IIIM Radar
8425 ± 1	T-IIIM Radar
***9550 $\pm$ 20	T-IIIM Radar
416.0 ± 0.11	T-IIIM Command
8425 ± 1	T-IIIM Radar
$9220 \pm .5$	T-IIIM Radar
$9460 \pm .5$	T-IIIM Radar
5690.0	Gemini B Radar (FPS-16 & TPQ-10)
*400-420	Gemini B Command Transmitter
1775.731 ± 2.0	LM - TTCV
243.0 ± 0.0243	Gemini B Survival Beacon

* Development Flights Only

** Three Channels for Development TM to be Assigned

*** Alternate Channel

On-Orbit Frequencies

Exhibit 67-101, 3.4.2

L-5611

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2.13 OV GROUNDING ISOLATION

3.1.1.2.2 Grounding Resistance

With all OV structure grounding points electrically disconnected, the combined resistance of the negative power returns to the laboratory central power system (CPS) shall have a dc resistance to the vehicle structure of greater than 3,000 Ohms. OV design shall be compatible with this level of isolation.

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CEI REFERENCE		SS-MOL-1B REFERENCE
	OV Grounding Isolation With structural grounding points electrically disconnected, each segment shall have a DC resistance to the vehicle structure exceeding the following values:	3.1.1.2.2

		Manned-Automatic Configuration 10^3 ohms	Automatic Configuration 10^3 ohms
NEW	Gemini B	40	--
NEW	LVSS	4	4
NEW	MMSS	40	40
NEW	PSS	40	40
	OV System Equivalent Impedance	3	3

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2.14 THERMAL LOADS

3.1.1.1.5.2 On Orbit

All equipments located in the LM shall be integrated with the LM thermal control system. All power dissipating equipments in the LM requiring active cooling shall utilize the LM liquid cooling loop for heat dissipation. Passively controlled equipments shall be mutually compatible with the convective and radiative environments that surround the equipment.

Interface thermal effects shall be minimized by using a common design criteria for the LV segments as specified in SAFSL Exhibit 10003.

CEI REFERENCE		SS-MOL-1B REFERENCE
	Thermal Loads Allocations for thermal loads are not available at this time.	3.1.1.1.5.2
DAC-NEW GE-NEW EK-NEW		

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2.15 ATMOSPHERE LEAK RATES

3.1.1.6.4.1 Leak Rate

The overall atmospheric leak rate for the OV in the manned-automatic configuration shall be no greater than 1.55 lbs/day equivalent oxygen with the Gemini B at 0.1 psi and the LV at 5.0 psi.

The automatic configuration system leak rates shall include the leakage contribution from the LM, film handling system, and DRV's, including the effects of the cutter-sealer units. These leak rates shall be compatible with the extended life duration.

CEI REFERENCE

SS-MOL-1B REFERENCE 3.1.1.6.4.1

Atmosphere Leak Rates

For the manned automatic configuration, atmospheric leak rates shall be less than the following values:

	MAC			DAC				EK
	O_2		H_e	O_2		H_e		H_e@ 5 psia
	Gemini B #/day	Tunnel #/day	Tunnel #/day	Lab #/day	Tunnel #/day	Lab #/day	Tunnel #/day	Ross Barrel #/day
A-Dual Gas								
1. On-Orbit	----- NA ----			1.19[3]	NA	.05[3]	—	
2. Early Orbit	1.5[2] (A)	.9[7] (A)	(A)	----------NA----------				
B-Single Gas								
1. On-Orbit	.030[7]	.018[7]		1.5[5]	.002[7]	—	—	.0001[8]
2. Early Orbit	1.5[2]	.9[7]		----NA----				.0001[8]

[2] GB, 3.1.1.2, 2.1.1.1

[3] LM-A, 3.1.1.1.1d

[5] OV Spec

[7] S106002, 3.1.4.1.1.4

Atmospheric leak rates for the automatic configuration are not presently available.

[8] NEW

NOTE

(A) Leakage rate in dual gas mode shall be equivalent to oxygen leakage rates shown.

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2.16 CONTAMINATION

3.1.1.1.7 Contamination

The FV shall be designed such that contamination shall not cause electro-optical sensing devices to operate out of specification during the entire 30-day mission nor the degradation in optical systems performance be greater than the following:

Camera optical system (resolution)	1 percent.
Acquisition and tracking system (resolution)	5 percent,
View port windows(transmissibility)	10 percent.

The effects of effluents upon sensitive elements, such as optics and thermal coatings, shall be minimized by design including selection and control of material, outlet location, direction of flow, sequencing, and equipment filtering or sealing where appropriate. Effluent sources to be considered include: OV wastes; DRV rockets; LV ACTS and propulsion jets; ascent fairings and MM door separation devices; and SRM ignition, staging, or separation rockets of the T-IIIM.

Contamination of MM optics resulting from internal sources shall be minimized by material selection design and controlled manufacturing and test procedures. Potential sources include bearing lubricants, blanket or coating deterioration and trapped foreign material released or redistributed during ascent.

Contamination of the LM internal optical elements, windows, precision mechanisms and film shall be minimized by material selection, equipment sealing or filtering, compartment and flow distribution, design and controlled manufacturing, and test procedures. Potential sources include lubricants, trapped foreign material, food particles, liquid spillages, lint, skin flakes, and the like.

CEI REFERENCE		SS-MOL-1B REFERENCE
	Contamination Quantitative contamination allocations are not available at this time.	3.1.1.1.7
MAC-NEW		
DAC-NEW		
GE-NEW		
T-III-NEW		

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2.17 GUIDANCE INSERTION

3.1.1.4.3 Insertion Accuracy

The uncertainty in achieving the nominal insertion conditions, within the limits of 3.1.1.4.1 shall not exceed the values (0.997p) specified below:

Inertial velocity (tangential in-plane)	± 25 fps
Inertial flight path angle	± 0.10 degree
Altitude	± 2.0 n.mi.
Out-of-plane velocity	± 250 fps
Out-of-plane position	± 10 n.mi.

3.3.6.2.3 Guidance Requirements

The guidance system shall be capable of meeting the requirements of 3.1.1.4.1 and 3.1.1.4.2. The guidance system shall have the capability of switchover to a backup guidance system located in the Gemini B vehicle for Stage I and Stage II flight. Automatic and manual switchover to the secondary guidance system and manual switchback to the primary guidance system shall be provided.

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CEI REFERENCE		SS-MOL-1B REFERENCE
	Guidance Insertion Accuracy	3.1.1.4.3
	Allocations for guidance insertion accuracy (0.997p) are as follows:	3.3.6.2.3

	BIGS(1)	GIGS(2)
Inertial Velocity (In-Plane) (fps)	12	22*
Inertial Flight Path Angle (deg)	0.05	0.08
Altitude (n. mi.)	1.0	1.5
Out-of-Plane Velocity (fps)	12	123
Out-of-Plane Position (n. mi.)	0.5	4.7

TIIIM SP/DR + SCN 29

(2) GB CEI + ECP 010R

* Contingent on Stage II tailoff not exceeding 6.2 fps.

** Does not include switchover decision requirements

NEW

Guidance Malfunction Monitoring

Allocations for the third data source for guidance switchover decisions are given below. These allocations assume initialization of the autonomous phase of flight to occur at 280 sec. after liftoff. The values specified for the TIIIM auxiliary reference system (ARS) are equipment errors only. All values are specified as (0.997p).

TIIIM Auxiliary Reference System (Insertion)		GERTS (At 280 Sec)	
ΔV_x	= 20 fps	Radial Velocity	28 fps
ΔV_z	= 45 fps	Tangential Velocity	7.1 fps
Pitch Attitude	= 0.54 deg.	Normal Velocity	6.0 fps

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2.18 UNOBSTRUCTED LOS

3.0.1.1.2 Target Access

The MOL System shall provide the capability for photographic access, at obliquity angles up to ± 37 degrees relative to the orbit plane, to arbitrarily located targets anywhere on the sunlit surface of the earth between 80° S and 80° N latitude at least three times during a 30-day mission. Stereo capability relative to the orbit plane shall be a minimum of 14° forward to 25° rearward.

CEI REFERENCE		SS-MOL-1B REFERENCE
	Unobstructed LOS	3.0.1.1.2
GE-NEW	GE has analysis responsibility for this requirement. The contributors to loss of LOS angular range are as follows:	
	Orbital to LV/RVV coordinate system	
	Yaw ± 3.5 deg	
	DAC-AVE	
	OV reference coordinate system attitude excursions from LV/RVV (maximum error):	3.1.1.6.10.1
	Roll ± 5.8 deg Pitch ± 2.64 deg Yaw ± 3.0 deg	
	Mission module thermal hotdogging (0.95p):	
TBD-NEW	± 0.5 deg effective COA deflection per axis	
	EK-AVE	
EK-NEW	Optical axis alignment - 0.1 deg per axis (0.95p)	
	GE-AVE	
GE-NEW	Optical axis alignment - 0.1 deg (0.95p) per axis	
NEW-Replaces GE, 3.1.1.2. 5.2.6.1	Unobstructed LOS angular range relative to the Orbiting Vehicle reference coordinate system (minimum excluding hotdogging):	

	Manned-Automatic Configuration, Manual Mode	Manned-Automatic and Automatic Configuration, Automatic Mode
Stereo, deg	+ 19.4 to -29.5	+ 22.0 to - 29.5
Obliquity, deg	± 41.7	± 42.0

Unobstructed LOS (Continued)

The above contributors result in the following minimum capability.

	Manned-Automatic Configuration, Manual Mode	Manned-Automatic and Automatic Configuration, Automatic Mode
Stereo, deg	+14 to -25	+17 to -25
Obliquity, deg	± 37	± 37.5

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2.19 MAIN OPTICS LIGHT

3.3.13.2.2 Optical Assembly and Tracking Mirror Assembly

The OA of the payload shall consist of a 70-inch aperture, [redacted] length, Ross telephoto lens having a 0.54-degree semifield angle. The optical axis shall be approximately parallel to the roll axis of the tracking mirror gimbal. A 70-inch diameter, circular, flat tracking mirror shall be located in front of the main optics for target tracking.

The static nadir resolution 0.4 degree off-axis shall be at least 90% of the static on-axis values.

Approximately 5% of the image forming light shall be diverted from the OA for use in the visual optics and the image velocity sensing system. All, approximately one half, or none of the light diverted from the OA shall be provided to the visual optics with the residual energy to the IVS. In the automatic configuration, the visual optics shall be replaced by a second IVS system.

Appropriate mechanical mounts shall be provided to connect the OA to the MM.

CEI REFERENCE		SS-MOL-1B REFERENCE
EK SOW Appendix I IIIG GE - NEW	Secondary Light The total energy diverted from the main optics system for use in the visual optics and/or the IVS system is 5 percent of the light incident on the main pellicle. The split between the visual optics and the IVS for the various options is as follows:	3.3.13.2.2

	IVS	VO
Mirror	≈100%	0
Pellicle	≈ 40%	40%
Open	0	100%

CEI REFERENCE		SS-MOL-1B REFERENCE

GE-EK IFS-101.2.6
NEW

Stray Light

The total non-image forming light incident on the film plane is controlled to be less than 1% of the incident image forming light. This percentage is allocated as follows:

EK-AVE	0.7%
GE-AVE	0.3% *
TOTAL	1.0%

* The area-average diffuse reflectance of the surface visible, looking forward at the MMFS along the optical axis excluding the tracking mirror assembly shall be 0.3% integrated spectrally from 0.3 to 1.0 microns.

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2.20 MAIN OPTICS POINTING ACCURACY

3.3.3.2.1.4 Target Pointing Accuracy

The system, exclusive of the crewmen, shall be capable of automatically acquiring the target to within 0.1 degrees (0.95p) including all OV errors, assuming perfect ground-furnished ephemeris data and perfect target-location data. Further, the system shall be capable of correcting the actual main optics pointing error within 0.1 degrees under control of a crewman.

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CEI REFERENCE		SS-MOL-1B REFERENCE
	Main Optics Pointing (Manned-Automatic or Automatic Configurations, Automatic Mode)	3.3.3.2.1.4
GE, 3.1.1.1.6.3	GE has responsibility for the 0.1 deg (0.95p) pointing requirement. The budget against this requirement is as follows:	

		LOS Error (0.95p) Arc Min	
	EK-AVE		
EK Annex I	TM to mounting ring alignment (30 sec (0.95p))	1.0	
EK Annex I	Optics alignment assembly (20 sec (0.95p))	0.67	
NEW	FAMS light source placement (10 sec (0.95p))	0.33	
	RSS EK-AVE		1.3
	GE-AVE		
	TM alignment	3.0	
	Gimbal angle measurements	1.1	
	Software	1.0	
	TM control system	1.0	
	Attitude measurement		
	Star tracker and alignment (1 min (0.95p)) to hub	1.8	
	Roll axis alignment (6 min (0.95p)) * to LM/MM mating plane	0.1	
	RSS GE-AVE		3.9

* Roll axis alignment contribution is based upon use of 40 sec between star tracker updates and (0.95p) vehicle rates as given in Appendix I.

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CEI REFERENCE		SS-MOL-1B REFERENCE

Main Optics Pointing, (Continued)

NEW

(See Appendix I)

	LOS Error (0.95p) Arc Min	
DAC-AVE		
Structure (3 min (0.95p) star tracker to LM/MM mating plane)	3.0	
Equivalent rate gyro error *	1.4	
RSS DAC-AVE		3.3
TARGET LOCATION RSS TOTAL		5.3
In-track (500 ft)	3.5	
Cross-track (500 ft)	3.5	
Altitude (100 ft)	0.4	
RSS TARGET LOCATION		5.1
EPHEMERIS		
In-track (1200 ft)	8.5	
Cross-track (210 ft)	1.5	
Altitude (145 ft)	0.5	
RSS EPHEMERIS		8.7
RSS TOTAL TO TARGET		11.4

* Rate gyro error is based upon 40 sec between star tracker updates, (0.95p) low frequency rate errors, and (0.95p) rate dependent errors as given in Appendix I.

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CEI REFERENCE		SS-MOL-1B REFERENCE
	Main Optics Pointing (Manned-Automatic Configuration, Manual Mode)	3.3.3.2.1.4
GE-NEW EK-NEW CREW-NEW	GE has analysis responsibility for this requirement. Allocations for this mode are not available at this time.	

2.21 MAIN OPTICS SMEAR (ON-AXIS)

3.1.1.6.22 Smear Limits and Tracking Mirror Target Acquisition Time

The total OV smear contribution to dynamic resolution loss in terms of angular rate shall not be greater than the values given in the table below at the center of the format.

The slew and settle time for the tracking mirror shall not be greater than $\frac{\Delta\theta}{6}$ +N seconds, where $\Delta\theta$ = slew maneuver, in degrees of the gimbal motion required at the instant the slew command is issued.

Slew and settle time is defined as the time to accomplish the slew maneuver and attain the specified pointing accuracy and to allow all elements of the OV to settle to the LOS rate accuracy given in the table below.

	LOS Rate Accuracy (0.95p) (Microradian/Sec)	N Seconds
Automatic or Manned-Automatic Configuration without LOS IMC	[redacted]	3
Automatic or Manned-Automatic Configuration, Automatic Mode		4
Manned-Automatic Configuration, Manual Mode		5

*These are the RSS values of the vibration, IVS or crew, and NCS, with cross format IMC and visual optics magnification inhibited.

With the main optics slaved to the ATS and with crew rate-nulling of the ATS, the main optics LOS rate shall be within 100 μrad/sec (0.95p) of the desired target tracking rate after on-orbit boresighting.

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2.21 MAIN OPTICS SMEAR (Continued)

3.3.3.1.2 Total NCS Contribution to Smear

The MMSS shall provide the capability to limit image smear rate due to the IVS to a vector sum of [redacted] micro-radians per second (0.95p). In addition, the NCS contribution to image smear rate (except the IVS contribution above) during photography shall be limited to a vector sum of [redacted] micro-radians per second, (0.95p).

CEI REFERENCE		SS-MOL-1B REFERENCE
	Main Optics Smear (Manned-Automatic and Automatic Configurations, Automatic Mode Without IMC)	
GE, 3.1.1.1.6.3 GE, 3.1.1.2.6.3.5	GE has responsibility for [redacted]/sec (0.95p) requirement. The budget against this requirement is as follows:	3.1.1.6.22

		LOS Rate Error (0.95p) μ Rad/Sec	
	GE-AVE		
	TM gimbal angle measurements (30 sec each axis)		
	Software		
	Servo performance		
Drive noise only, GE, 3.1.1.2.6.3.4	Tracking mirror drive noise		3.3.3.1.2
	Attitude measurement (See page 50)		
GE, 3.1.1.1.6.3 (See page 51) (See Appendix I and below)	DAC-AVE Structure (See page 51) Vehicle rate measurements (0.95p vehicle rates as given in Appendix I, 0.0005 deg/sec measurement error each axis, and 6.0 min misalignment about each axis)*	RSS GE-AVE [redacted]	
(See page 61)	VIBRATION (See page 61)	RSS DAC-AVE [redacted]	3.1.1.6.22.1
	EPHEMERIS (145 ft altitude error)		
		RSS TOTAL [redacted]	

*Misalignment (0.95p) about each axis

DAC-NEW	[redacted] gyro input axis to LM/MM mating plane mating accuracy	
DAC-NEW	RSS TOTAL	

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CEI REFERENCE		SS-MOL-1B REFERENCE
, 3.1.1.2.6.3.5	Main Optics Smear (Manned-Automatic and Automatic Configuration, Automatic Mode with IVS) GE has analysis responsibility for the [redacted] µrad/sec (0.95p) requirement. The allocations against the requirement are as follows:	3.1.1.6.22
ive noise only, , 3.1.1.2.6.3.4 , 3.1.1.1.6.3 ee page 61) E-NEW	GE-AVE Tracking mirror drive noise VIBRATION (See page 61) IVS PERFORMANCE RSS TOTAL	3.3.3.1.2 3.1.1.6.22.1 3.3.3.1.2

LOS Rate Error (0.95p) µRad/Sec

[redacted]

CEI REFERENCE		SS-MOL-1B REFERENCE
	Main Optics Smear (Manned-Automatic Configuration, Manual Mode)	
GE, 3.1.1.2.6.3.5	GE has analysis responsibility for the [redacted] (0.95p) requirement. The allocations against this requirement are as follows:	3.1.1.6.22
	LOS Rate Error (0.95p) μRad/Sec	
Drive noise only, E, 3.1.1.2.6.3.4 E, 3.1.1.1.6.3 See page 61)	GE-AVE	
	Tracking mirror drive noise [redacted]	3.3.3.1.2
GE-NEW	VIBRATION (See page 61)	3.1.1.6.22.1
	CREW	
	RSS TOTAL	

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CEI REFERENCE		SS-MOL-1B REFERENCE
GE - ECP 17R5 3.1.1.2.6.3.5	Main Optics Smear (Manned-Automatic Configuration, Slaved Mode) GE has responsibility for the [redacted] (0.95p) rate tracking requirement. The budget against this requirement is as follows:	3.1.1.6.22
	LOS Rate Error (0.95p) μRad/Sec	
	GE-AVE	
	TM servo noise ATS servo noise* (1/4 sec jitter) Slaving error [redacted] RSS GE-AVE	3.3.3.1.2
(See page 61)	VIBRATION (See page 61)	3.1.1.6.22.1
	SLAVING ACCURACY EQUIVALENT RATE ERRORS (6 min (0.95p))	3.3.3.2.5.1.4
	RSS TOTAL (Main Optics to ATS) ATS RATE NULLING (Crew) RSS TOTAL (Main Optics to Target) [redacted]	
GE-NEW		

* Computed for 6 cps servo bandwidth

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2.22 FILM PLANE VIBRATION (MAIN OPTICS)

3.1.1.6.22.1 Vibration Smear

During photography, the uncompensated image smear resulting from random vibrations and impulse distrubances shall not be greater than a vector sum of [redacted] microradians/second (0.95p) on axis when across-the-format IMC and visual optics magnification changes are inhibited.

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2.22 FILM PLANE VIBRATION (Continued)

3.3.3.1.1 Vibration Smear Limits

The vibration contribution of the MMSS AVE to image smear rate during photography shall be limited to a vector sum of [redacted] (0.95p) on axis.

3.3.13.1.1 Vibration Smear Limits

The vibration contribution of the photographic payload system segment equipment to image smear rate during photography shall be limited to a vector sum of [redacted] (0.95p) on axis when across the format IMC and visual optics magnification changes are inhibited.

3.3.2.1.1 Vibration Smear Limits

The vibration contribution of the LVSS/equipment to image smear rate during photography shall be limited to a vector sum of [redacted] (0.95p) on axis.

3.3.1.1.1 Vibration Smear Limits

The vibration contribution of the Gemini B system segment equipment to image smear rate during photography shall be limited to a vector sum of [redacted] (0.95p) on axis.

CEI REFERENCE		SS-MOL-1B REFERENCE
	Film Plane Vibration (Main Optics) GE has analysis responsibility for this requirement. Image smear due to vibration is allocated as follows:	3.1.1.6.22.1
	LOS Rate Error (0.95p) μ Rad/Sec	
NEW	GE-AVE [redacted]	3.3.3.1.1
EK Annex I, P.I-65M	EK-AVE	3.3.13.1.1
NEW	DAC-AVE	3.3.2.1.1
NEW	MAC-AVE	3.3.1.1.1
	CONTINGENCY	
	RSS TOTAL	

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2.23 ATS POINTING ACCURACY

3.1.1.6.27.2 ATS Pointing Accuracy

The system, exclusive of the crewmen, shall be capable of automatically pointing the ATS to within 8 arc-minutes (0.95p) of the target including all OV errors, but assuming perfect ground-furnished ephemeris data and perfect target-location data. Further, the system shall be capable of correcting the actual ATS pointing error within 2 arc-minutes (0.95p) under control of a crewman.

After initial boresight alignment, when the main optics is commanded to track the ATS, the ATS LOS and main optics LOS shall remain aligned to within 0.1 degree (0.95p).

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CEI REFERENCE		SS-MOL-1B REFERENCE
	ATS Pointing Accuracy (Manned-Automatic Configuration, Automatic Mode)	3.1.1.6.27.2
GE-ECP 17R5 3.1.1.1.6.3b (Assumes 1/2 min for DAC structural changes)	GE has responsibility for the [redacted] (0.95p) pointing requirement. The budget against this requirement is as follows:	

	LOS Error (0.95p) Arc Min
GE-AVE	
Alignment (ATS optical axis to ATS-TM ref)	[redacted]
Gimbal angle measurements	
Software	
TM control system	
Attitude measurement (See page 50)	
DAC-AVE RSS GE-AVE	
(See page 51) Structure (See page 51)	
(See page 51) Equivalent rate gyro error (See page 51)	
Structural changes	
NEW ATS optics to mating plane (1.0 min (0.95p) total)	
NEW ATS-TM to ATS optics (1.4 min ΔP, 0.4 min hotdogging, and 1.1 min radiator expansion)	
RSS DAC-AVE	
(See page 64) SLAVING ACCURACY	[redacted]
RSS TOTAL	
TARGET LOCATION (See page 51)	
EPHEMERIS (See page 51)	
RSS TOTAL TO TARGET	

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CEI REFERENCE		SS-MOL-1B REFERENCE
	ATS Pointing (Manned-Automatic Configuration, Slaved Mode)	
3.1.1.1.6.3 (Excludes crew contribution)	GE has responsibility for the [redacted] (0.95p) slaving requirement. The budget against this requirement is as follows:	3.1.1.6.27.2

	LOS Error (0.95p) Arc Min
BORESIGHTING ERROR (Crew)	[redacted]
GE-AVE	
Alignment change	[redacted]
Software	
ATS	
TM control system	
Gimbal angle measurements	
Main optics	
TM control system	
Gimbal angle measurements	
RSS GE-AVE	[redacted]
DAC-AVE	
Structural changes (See page 63)	
ATS optics to TM ref.	[redacted]
ATS-TM to ATS optics	
RSS DAC-AVE	[redacted]
RSS TOTAL (Main Optics to ATS)	
ATS TRACKING ERROR (Crew)	
RSS TOTAL (Main Optics to Target)	

GE-NEW

(See page 63)

(See page 63)

(See page 65)

CEI REFERENCE		SS-MOL-1B REFERENCE
GE-NEW DAC - NEW CREW - NEW	ATS Pointing Accuracy (Manned-Automatic Configuration, Manual Mode) GE has analysis responsibility for this requirement. Allocations for this mode are not available at this time.	3.1.1.6.27.2

2.24 ATS RATE ACCURACY AND JITTER

3.1.1.6.27.3 ATS Rate Accuracy and Jitter

At the end of ATS slew and during ATS track, the LOS rate error without crew participation due to all CV sources shall not exceed [redacted] (0.95p). Capability shall be provided to reduce the LOS rate error below [redacted] with manual control.

During ATS tracking cycles, the image jitter at the ATS eyepiece shall not exceed 0.25 arc sec (1/2 amplitude) above 6 cps (0.95p).

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CEI REFERENCE		SS-MOL-1B REFERENCE

ATS Rate Accuracy (Manned-Automatic Configuration, Automatic Mode)

GE-ECP 17R5
3.1.1.1.6.3b

GE has responsibility for the [redacted] (0.95p) LOS rate accuracy requirement. The budget against this requirement is as follows:

3.1.1.6.27.3

	LOS Rate Error (0.95p) μ Rad/Sec
GE-AVE	[redacted]
Rate offset	
Servo performance	
ATS servo noise	
Gimbal angle measurements (30 sec each axis)	
Software	
Attitude measurement (See page 55)	
RSS GE-AVE	
DAC-AVE	[redacted]
(See page 55) Vehicle rate measurements (See page 55)	
(See page 55) Structure (See page 55)	
NEW Rate gyro noise (ACTS firing, slewing, etc)	TBD
RSS DAC-AVE	TBD
(See page 71) VIBRATION (See page 71)	TBD
EPHEMERIS (145 ft altitude error)	[redacted]
RSS TOTAL	TBD

CEI REFERENCE		SS-MOL-1B REFERENCE
CREW - NEW VIBRATION - (See page 71) GE-NEW	ATS Rate Error (Manned-Automatic Configuration, Manual Mode) GE has analysis responsibility for this requirement. Allocations for the manual rate accuracy are not available at this time.	3.1.1.6.27.3

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CEI REFERENCE		SS-MOL-1B REFERENCE
	ATS Jitter	
GE-ECP 17R5 3.1.1.1.6.3.b	GE has responsibility for the ATS jitter requirement. The budget against this requirement is as follows:	3.1.1.6.27.5

	Error Contribution (0.95p) Arc Sec
GE-AVE	
Bearing noise	0.174
Electronic noise	0.070
Gyro noise	0.102
Input noise	0.098
RSS GE-AVE	0.236
DAC-AVE	
Rate gyro noise (ACTS firing, slewing, etc.)	TBD
VIBRATION (See page 71)	TBD
RSS TOTAL	TBD

NEW

See page 71)

2.25 VIBRATION (ATS OPERATION)

No specific SS-MOL-1B requirement, but included in the jitter requirement of paragraph 3.1.1.6.27.3.

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CEI REFERENCE		SS-MOL-1B REFERENCE
DAC-NEW EK-NEW GE-NEW MAC-NEW	Vibration (ATS Cperation) GE has analysis responsibility for this requirement. Allocations for vibration at the ATS eyepiece are not available at this time.	

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2.26 STAR TRACKER COMMAND ACCURACY

3.3.3.2.1.6 Vehicle Attitude Determination

The MMSS shall provide two star trackers which shall supply data to be utilized by airborne computer software in conjunction with the ACTS reference data to accurately determine vehicle attitude. The specific stars to be tracked shall be determined by ground data processing prior to target acquisitions on photographic passes.

CEI REFERENCE		SS-MOL-1B REFERENCE
	Star Tracker Command Accuracy	3.3.3.2.1.6
GE, 3.1.1.1.6.2 (2 σ rather than 0.997p)	Requirement: The star tracker must be initially aligned to within ± 2 degrees of the selected star for acquisition. GE has responsibility for this requirement.	
	Allocation of Requirement:	

	Error Contribution (0.997p), Deg	
DAC-AVE		
(See Appendix I) Attitude control (RSS of all axes, See Appendix I)	0.80	
(See page 51) Structure (See page 51)	0.08	
(See Page 55) Mating accuracy (See Page 55)	0.05	
RSS DAC-AVE		0.81
GE-AVE		
Software	Negligible	
Mechanical alignments and pointing accuracy (6 min (0.95p))	0.15	
RSS GE-AVE		0.15
RSS TOTAL		0.82

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2.27 TRANSLATIONAL MOMENTUM DISTURBANCES

3.1.1.6.15 Translational Momentum Disturbances

The effects of overboard venting, overboard leakage, and attitude control shall not be greater than:

IMPULSE (LB-SEC/REV)

Mission Phase	Posigrade	Retrograde	Normal to the Velocity Vector	
			Out-of-Plane	In-Plane
Early Orbit	125			
Orbit				
First Orbit	100	15	400	400
After First Orbit	15			

CEI REFERENCE

SS-MOL-1B REFERENCE

3.1.1.6.15

Translational Momentum Disturbances

The posigrade (forward) translational impulse is allocated as follows:

		Contribution, lb-sec/rev		
		Early Orbit Operations	Orbit Operations	
			First Orbit	After First Orbit
	DAC-AVE			
NEW	Overboard venting and leakage	3.4	3.4	3.4
NEW	Attitude control misalignments/ impingement	10.0	10.0	10.0
	RSS DAC-AVE	11	11	11
	MAC-AVE			
NEW	Overboard venting and leakage *	122	60	2
	RSS TOTAL	123	61	11

* Assuming that the Gemini B guidance system is shut down.

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CEI REFERENCE			SS-MOL-1B REFERENCE
	Translational Momentum Disturbances (Continued)		
	The retrograde (aft) translational impulse during the Early Orbit and Orbit operational phases is allocated as follows;		3.1.1.6.15
		Contribution Lb-Sec/Rev	
	MAC-AVE		
NEW	Overboard venting and leakage	2	
	DAC-AVE		
NEW	Overboard venting and leakage	3.4	
NEW	Attitude control misalignments/ impingement	10.0	
	RSS DAC-AVE	11	
	RSS TOTAL	11	

Translational Momentum Disturbances (Continued)

3.1.1.6.15

The out-of-plane lateral impulse is allocated as follows:

		Contribution, lb-sec/rev		
		Early Orbit Operations	Orbit Operations First Orbit	Orbit Operations After First Orbit
	DAC-AVE			
NEW	Overboard venting and leakage	3	3	10.4
NEW	Attitude control, misalignments, and impingement	150	150	150.0
	RSS DAC-AVE	150	150	150.5
	MAC-AVE			
NEW	Overboard venting and leakage *	22	10	1
	RSS TOTAL	152	150	15 1

* Assuming that the Gemini B guidance system is shut down.

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CEI REFERENCE

SS-MOL-1B REFERENCE

Translational Momentum Disturbances (Continued)

The in-plane lateral impulse is allocated as follows:

3.1.1.6.15

		Contribution, lb-sec/rev		
		Early Orbit Operations	Orbit Operations	
			First Orbit	After First Orbit
	DAC-AVE			
NEW	Overboard venting and leakage (down)	3	3	32
NEW	Attitude control, misalignments, and impingement	150	150	150
	RSS DAC-AVE	150	150	153
	MAC-AVE			
NEW	Overboard venting and leakage (up) *	155	70	2
	RSS TOTAL	216	166	153

* Assuming that the Gemini B guidance system is shut down.

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2.28 TORQUE DISTURBANCES

3.1.1.6.16 Torque Disturbances

The disturbance torque induced due to magnetic field interactions, purging, overboard venting, and overboard leakage shall not be greater than 4.5, 1.0, and 0.1 ft-lb about the pitch, yaw, and roll axis, respectively. The maximum allowable angular momentum of the OV induced by overboard purging, venting, and leakage for a 30-day mission excluding failure conditions shall be limited by the following formula:

$$\left| H_P \right| + \left| H_Y \right| + 12 \left| H_R \right| \leq 9.2 \times 10^4 \text{ ft-lb-sec}$$

Where

H_P = pitch angular momentum

H_Y = yaw angular momentum

H_R = roll angular momentum

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CEI REFERENCE		SS-MOL-1B REFERENCE
		3.1.1.6.16

Disturbance Torque

Magnetic Disturbance:

The maximum magnetic moment about any axis is allocated as follows:

		Moment Amp Turn Ft^2	Equivalent Torque Ft-Lb
NEW	DAC-AVE	14×10^3	0.057
NEW	MAC-AVE	7×10^3	0.029
NEW	EK-AVE	17×10^3	0.072
NEW	GE-AVE	6×10^3	0.027
	RSS TOTAL	24×10^3	0.10

Overboard Venting and Leakage:

The maximum moment due to overboard venting and leakage is allocated as follows:

		Contribution, Ft-Lb		
		Roll	Pitch	Yaw
NEW	MAC-AVE	0.036	4.20	0.616
NEW	DAC-AVE	0.020	0.18	0.176
	TOTAL	0.056	4.38	0.792

Total Disturbance Torque (Ft-Lb)	Roll	Pitch	Yaw
Magnetic	0.010	0.10	0.050
Overboard venting and leakage	0.056	4.38	0.792
TOTAL	0.066	4.48	0.842

SECRET SPECIAL HANDLING

CEI REFERENCE		SS-MOL-1B REFERENCE

Disturbance Angular Momentum

DAC has analysis responsibility for this requirement. The 30-day mission disturbance momenta during the Early Orbit and Orbit operational phases due to overbaord venting and leakage is allocated as follows: 3.1.1.6.16

		Contribution Ft-Lb-Sec		
		Roll	Pitch	Yaw
NEW	MAC-AVE	400	47000	6900
NEW	DAC-AVE	1475	8100	6110

TOTAL

NEW MAC-AVE $47000 + 6900 + 12(400) = 5.9 \times 10^4$ Ft-Lb-Sec

NEW DAC-AVE $8100 + 6110 + 12(1475) = 3.2 \times 10^4$ Ft-Lb-Sec

TOTAL $= 9.1 \times 10^4$ Ft-Lb-Sec

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Appendix F - ACTS Attitude and Rate Accuracy

Attitude Accuracy

In the LV/RVV mode, the ACTS shall provide the following OV reference coordinate system attitude information to the GE-AVE computer, providing the changes in angular momentum due to operation of MPSS-AVE are as specified in IFS-707003, ICN 030. The attitude reference accuracy (0.997p) relative to the orbital coordinate system, in deg, is:

Pitch	0.37
Yaw	0.60
Roll	0.37

Rate Accuracy

In the LV/RVV mode, the ACTS shall provide the following OV reference coordinate system rate information to theGE-AVE computer. The total body rate accuracy (0.997p) relative to an inertial reference, in deg/sec, is:

	High Freq. ($> 1 \frac{rad}{sec}$)	Low Freq. ($\leq 1 \frac{rad}{sec}$)	Rate Dependent
Pitch	0.0003	0.0003	0.00096
Yaw	0.0003	0.0003	0.00096
Roll	0.00168	0.00052	0.00077

The quantization shall be less than 0.0005 deg/sec.

CEI REFERENCE		SS-MOL-1B REFERENCE
IFS-707003, ICN 030	OV Rate Excursions The maximum vehicle rates at the end of a 60 sec inhibit period, exclusive of MPSS-AVE disturbances are: Pitch ± 0.0244 deg/sec Yaw ± 0.0244 deg/sec Roll ± 0.0231 deg/sec	