

62-334
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Betsy

FLIGHT PLAN

FOR

MA-7/18

NASA-MSC
LANGLEY STATION
HAMPTON, VIRGINIA

MAY 1, 1962

COPY 20

MA-7/18 FLIGHT PLAN

This publication of the MA-7/18 Flight Plan supercedes the April 10, 1962 edition.

The test objectives for this flight are delineated in the Mission Directive (working paper No. 222).

The pilot's primary responsibility during this mission is flight control and flight safety.

His secondary responsibility is scientific experimentation and observation designed to further evaluate the spacecraft systems and to broaden our understanding of the space environment and man's role in this environment.

The MA-7/18 Flight Plan is organized to guide the pilot in carrying out the mission objectives and the individual experimental objectives. The reference sections of this document describe the flight test activities and their objectives.

All times in this Flight Plan are nominal times. Sunrise and sunset times are for an assumed 0800 EST launch.

This is a final publication of the MA-7/18 Flight Plan. All changes or corrections will be in the form of revision sheets prior to Flight Controller deployment and by ISI thereafter.

This Flight Plan has been compiled by the Flight Activities Section, Flight Crew Operations Division and all comments or corrections should be so addressed.

MA-7 FLIGHT PLAN (LAUNCH)

0:00:00	Lift-off	A-	Report clock operating.	0:03:00	Report	A-	Fuel _____. Cabin pressure holding at _____. O ₂ _____.
0:00:20	Start backup clock	MCC-	Standby for 20 seconds.....2, 1, MARK!	0:03:30	Report	MCC-	Pitch angle.
0:00:30	Report	A-	Fuel _____. Cabin pressure holding at _____. O ₂ _____.	0:03:35	MCC GO-NO-GO	A-	Fuel _____. O ₂ _____. Complete voltage check.
0:01:00	Report	MCC-	Pitch angle _____.	0:04:00	Report	MCC-	Give GO-NO-GO.
0:01:30	Report	A-	Fuel _____. Cabin pressure passing through _____. O ₂ _____.	0:04:30	Report	A-	Give astronaut GO-NO-GO.
0:02:09	BECO	MCC-	Pitch angle _____. Report passing through max q.	0:05:03	SECO and Sep Cap	MCC-	Confirm astronaut GO-NO-GO. Pitch angle.
0:02:30	Jett Tower Manually	A-	Fuel _____. Cabin pressure passing through _____. O ₂ _____.	0:05:08	Turnaround and Orbit GO	A-	Fuel _____. O ₂ _____.
		MCC-	Pitch angle _____.			MCC-	Pitch angle. Report when V/VR is over .8.
		A-	Report BECO. Fuel _____. Cabin pressure sealed and holding at _____. O ₂ _____.			A-	Report SECO and Sep Cap green.
		MCC-	Pitch angle. Confirm staging.			MCC-	Confirm SECO and Sep Cap.
		A-	Report Jett Tower GREEN. Observe tower separation. Auto Retro Jett switch - OFF. Emer Retro Jett fuse switch - OFF. Landing Bag - OFF. UHF/DF - NORM Retro Jett fuse switch - OFF			A-	Aux Damp OK (on ASCS). Go to FEW. Scope out. Report turnaround complete. Orbit attitude. Go to ASCS.
		MCC-	Pitch angle.			MCC-	Confirm events. Give Orbit GO.
		A-				A-	Electrical systems check. Confirm Orbit GO. Complete checklist (For checklists see SEDR 109 supplement).

MA-7 FLIGHT PLAN (FIRST ORBIT)

0:06	Orbit Checklist (MCC/BDA) Sustainer Observation	A- Report orbit checklist complete. MCC- Give GET Mark. Give retrosequence times for 1B, F, and H. Give V/VR. A- Confirm retrosequence times. Unstow camera. Commence sustainer observation and photography. (Reference 15). MCC- Give apogee and perigee altitudes and (CET) times.	0:22	KNO Short Report UHF Lo Check	A- Short Report. KNO- Give retrosequence time for IC. A- Go to UHF Lo and check. KNO- After UHF Lo check instruct astronaut to go UHF HI
0:11	Sustainer Observation	A- Continue sustainer observation and photography.		Gyro Uncaging	A- After several minutes of drifting flight uncase gyros (Reference 2).
0:14	CYI Radar Track Ts + 5 Check	A- Orient spacecraft to -34° pitch, 0° yaw, and -10° roll. Go to ASCS and check for orientation mode.		Attitude Hold	A- Perform a precise attitude hold (Reference 3).
0:17	CYI Short Report	CYI- Report valid radar track. A- Give short report (Reference 1B). Send blood pressure. Confirm Ts + 5, ASCS, and FBW checked. CYI- Give all sunrise and sunset times. Give apogee and perigee altitudes and (CET) times. Inform astronaut when radar tracking is completed.	0:31	IOS Short Report	A- Short Report. Report on drifting flight, gyro uncaging and precise attitude hold. IOS- Give retrosequence times for 1D, 1E, and F.
0:18	Coastline	A- Mark crossing African Northwest Coast.	0:33	Coastline	A- Mark crossing African East Coast.
0:20	Sustainer Tracking Drifting Flight Horizon Photos	A- When released from CYI radar: Cage gyros. Go to manual and track sustainer. Report acquisition or failure to acquire sustainer. Report manual checked. After losing sustainer, allow spacecraft to drift. Go to aux damp. Change to horizon definition film and begin horizon photos (Reference 13).	0:38	VOX Record	A- VOX Power Switch to record.
			0:43	Sunset	A- Go to FBW for sunset. Record sunset observations.
			0:49	MUC Detailed Report Radar Track	A- VOX Power Switch to transmit. Go to ASCS for MUC radar. Give detailed report (Reference 1A). MUC- Report valid radar track. Emergency voice check. R and Z calibrations. Confirm that the astronaut has all sunrise and sunset times. Give missing times on request. Early balloon deploy instructions if applicable (Reference 5).
			0:53	Coastline	A- Mark crossing Australian West Coast.
			0:55	Night Yaw Check	A- Perform night yaw check (Reference 4) and report results.
					MUC/WOM- Monitor roll attitude and warn astronaut if roll goes to 40°.

0:58 WOM Flares
 Limited Drifting
 Flight
 Eat and Drink
 ASCS Flight

WOM- Report flare ignitions.
 A- Go to FBW.
 Report flare sightings (Reference 16).
 Begin limited drifting flight:
 Gyros - FREE
 Maneuver - ON
 Maintain low thruster operation
 schedule of 1 pulse every 3 min.
 in each axis.
 Eat and drink first meal.
 Report spacecraft drifting tendencies.
 Conclude limited drifting flight:
 Go to ASCS
 Gyros - NORMAL
 Maneuver - OFF

1:02 Coastline

A- Mark crossing Australian east coast
 (Brisbane).

1:10 CTN Short Report
 Haze Layer

A- Short Report
 CTN- Confirm faceplate closed.
 A- Track a star to check haze layer
 (Reference 6).

1:17 180° Yaw
 (Optional)

A- Go to FBW.
 Yaw 180° to observe sunrise
 (Reference 9).
 HAW may be contacted on HF.
 VOX Power Switch to record.

1:20 Sunrise

A- Record sunrise observations.
 VOX Power Switch to transmit.
 Go to ASCS.
 Prepare for second orbit GO-NO-GO.

1:27 GYM GO-NO-GO

A- Check UHF H1.
 Short report.
 Give astronaut GO-NO-GO.
 GYM- Give ground GO-NO-GO.
 Give retrosequence times for 2A, G,
 and H.
 R and Z calibrations.
 A- Prepare for WBS radar test No. 1
 (Reference 7).

WBS Radar Test
 No. 1

A- Go to FBW and conduct WBS radar test
 No. 1 on ground command.

1:34 MCC Detailed Report
 ASCS Zero Pitch

A- Detailed report.
 MCC- Give retrosequence times for 2B and
 2C.
 R and Z calibrations.
 Give sunset and sunrise times on
 request.
 Give time for optional balloon
 release.
 Emergency voice check.
 A- ASCS Zero Pitch uncaging procedure
 (Reference 17).

MA-7 FLIGHT PLAN (SECOND ORBIT)

			2:12	Sunset	A-	Record sunset, stellar, lunar, and atmospheric observations.
1:37	Balloon Deploy	A-				
			2:23	MUC Detailed Report Celestial Observations City Observations	A-	VOX Power to transmit. Detailed report. Celestial Observations. Night Observations of cities. Balloon Test.
1:40	BDA Radar Test No. 2 (MCC/BDA)	MCC-				
		A-				MUC- R and Z calibrations.
					A-	If balloon was released, track stars or perform drifting flight.
1:48	CYI Short Report	A-	2:27	Coastline	A-	Mark crossing Australian west coast.
1:51	Coastline	A-	2:32	WOM Flares	WOM-	Report flare ignitions.
					A-	Report flare sightings. If required, cage gyros and roll 180° (Reference 12).
1:55	KNO Short Report	A-	2:35	Coastline	A-	Mark crossing Australian northeast coast (Townsville).
		KNO-				
			2:43	CTN Short Report Eat and Drink	A-	Short Report. Eat and drink second meal. Report faceplate closed.
1:57	Coastline	A-			CTN-	Confirm faceplate closed.
			2:49	HAW Short Report Sunrise	A-	Short report.
1:59	Coastline	A-			HAW-	Confirm faceplate closed.
					A-	VOX Power Switch to record. Record sunrise observations. If balloon was released, at astronaut's option go to FBW and yaw 180° to observe sunrise (Reference 9). VOX Power Switch to transmit. Prepare for third orbit GO-NO-GO.
2:04	IOS Short Report Xylos Pill	A-				
			2:58	CAL GO-NO-GO	A-	Short Report. Blood pressure. Give astronaut GO-NO-GO.
	Go to FBW	A-			CAL-	Give ground GO-NO-GO. Give retrosequence times for 3A and H. R and Z calibrations.
	Optional Balloon Release Area	A-				
			3:02	Coastline	A-	Mark crossing U. S. west coast.
2:08	Coastline	A-				
			3:07	MCC Detailed Report	A-	Detailed report.
2:10	Coastline	A-			MCC-	Give retrosequence times for 3B and 3C.
2:11	Coastline	A-				

MA-7 FLIGHT PLAN (THIRD ORBIT)

3:09	Coastline	A-	Mark crossing U. S. east coast.	4:15	CTN Short Report	A-	VOX Power Switch to transmit. Short report on HF.
3:11	Balloon Release (MCC/BDA)	A-	Go to FEW. Release balloon. Photograph balloon separation (Reference 5).	4:17	Sunrise	A-	Observe sunrise.
		MCC-	Confirm balloon release. R and Z calibrations.	4:21	HAW Short Report	A-	Check UHF Hi. Reorient spacecraft to orbit attitude. Send blood pressure.
	Forward Inverted Flight	A-	After losing visual contact with balloon perform forward inverted flight (Reference 11). VOX Power Switch to record. Horizon definition photographs. CYI and KNO may be contacted on HF!			HAW-	Count down to GET "Mark." R and Z calibrations.
3:35	Coastline	A-	Mark crossing African west coast.	4:24	Checklists	A-	Begin equipment stowage and retro- sequence checklists.
3:38	IOS Short Report	A-	VOX Power Switch to transmit. Check UHF Hi. Short report.	4:26	Preparation for Retrosequence	A-	Complete equipment stowage and retro- sequence checklists. Report checklists complete.
		IOS-	Give retrosequence times for 3D, 3E, and H.			HAW-	Confirm checklists complete.
3:40	Sunset	A-	VOX Power Switch to record. Record sunset observations. Perform maneuvering flight, drifting flight, star navigation, or star tracking.	4:30	CAL Short Report	A-	Electrical systems check and check- lists complete.
3:41	Coastline	A-	Mark crossing African southeast coast.			CAL-	Confirm astronaut ready for retro- sequence.
3:57	MUC Detailed Report	A-	VOX Power Switch to transmit. Detailed Report. Night observation of cities.	4:32	Retrosequence	A-	Ready to backup and control retro- events. Report sequence light illuminations.
4:00	Coastline	A-	Mark crossing Australian west coast.		Retrofire	CAL-	Confirm retrosequence. Countdown to retrofire "Mark". Confire retrofire.
4:04	WOM Flares	WOM-	Report flare ignitions on HF.			A-	Mark each retrorocket firing. Report reentry checklist completed. Report retro pack jett. Assume reentry attitude. Observe 0-g sphere.
		A-	Report flare sightings on HF. Observe cities. Continue maneuvering flight, drifting flight, star navigation, or star track- ing. VOX Power Switch to record.	4:41	MCC Short Report Landing and Recovery Infor- mation	A-	Short report.
						MCC-	Give landing and recovery information: Predicted landing time. Location of nearest recovery vessel. Estimated time from landing to recovery. Wind velocity. Wave height. Air temperature.

REFERENCE NO. 1

Communications - General

4:43 .05 G A- Mark .05 G
4:48 Maximum G A- After peak G (approximately 4 to 6 G's) Remove roll rate. Perform the damping coefficient test (Reference 14).

For air to ground communication purposes the following policy is established.

In all transmissions the control modes will be designated by the following terminology:

<u>Control Mode Terminology</u>	<u>System Referred To</u>
Auto	ASCS
Aux Damp	Auxiliary Damping
Fly-By-Wire	Fly-By-Wire
Manual	Manual Proportional
Rate Command	RSCS

It is important to note that astronaut control of the spacecraft is inferred by the control mode in use. The expression "manual control" is used exclusively for manual proportional and not to indicate the astronaut has control of the spacecraft on FEW or Rate Command.

Contact Procedure

Analysis of the MA-6 Mission, together with information obtained from MA-4 and MA-5 reveals that HF communication is not necessary or desirable for a normal mission pass.

Since HF is desirable only when line-of-sight communication is impossible, HF communications are to be restricted to fringe area passes, when it is desirable to establish contact or pass important information.

UHF is to be used for all normal pass communications.

Initial contact with the capsule is to be made on UHF by the Cap Com at TM ACQ time based on nominal time from the computer. (Pad MSC)

After initial contact, call signs may be omitted, used only as needed.

If initial contact should be made by the Com Tech, make sure the Cap Com is on the air/ground loop before data is transmitted - otherwise, it may have to be repeated.

Contact procedures are to be followed as closely as possible.

Example:

* Friendship 7, Friendship 7, This is Hawaii, over.

Roger, Hawaii, This is Friendship 7.

Astronaut status is GO.

(Continue detailed or short report as specified in Reference 1A or 1B.)

*NOTE: If contact has not been established within a reasonable period of time, ask the astronaut to check his VOX Switch position.

Detailed Report Format (MCC and MUC)

Contact Procedure will be as specified in Reference No. 1.

Astronaut:

- * 1. Astronaut status _____.
- * 2. Capsule status _____.
- 3. Control Mode _____.
- 4. Gyros _____.
- 5. Maneuver _____.
- 6. Fuel _____.
- 7. O₂ _____.

Cap Com:

- 1. Confirm report.
- 2. Give retrosequence times if applicable.
- * 3. Coolant quantity _____% remaining.
- * 4. Inverter temperatures _____.
- * 5. Thruster temperatures _____.

Astronaut:

- 1. CET time check _____. (Mark onboard tape.)

Cap Com:

- 1. Reply with CET error.
- 2. Give GMT time check.

Astronaut:

- 1. Send blood pressure, exercise, 2nd blood pressure.
- 2. Give deviations from Flight Plan.
- 3. Give an observation summary.

*Negative reporting scheme

Only abnormal readings and systems will be reported unless requested. Refer to the mission rules for normal ranges and limits.

Short Report Format

Contact Procedure will be as specified in Reference 1.

Astronaut

- * 1. Astronaut Status _____.
- * 2. Capsule Status _____.
- 3. Control Mode _____.
- 4. Gyros _____.
- 5. Maneuver _____.
- 6. Fuel _____.
- 7. O₂ _____.

Cap Com

- 1. Confirm report.
- 2. Give retrosequence times if applicable.
- * 3. Coolant quantity _____% remaining.
- * 4. Inverter temperatures _____.
- * 5. Thruster temperatures _____.

Astronaut

Give an observation summary.

*Negative Reporting Scheme.

Only abnormal readings and systems will be reported unless requested. Refer to the mission rules for normal ranges and limits.

REFERENCE NO. 1C

C W Code

1. This code will be used by the astronaut in either of two situations:
 - a. Complete loss of voice communications.
 - b. Loss of astronaut ability to transmit voice.
2. Three BT's (----) will be transmitted by the astronaut before the initial message to a station to allow the TM Monitor time to switch the C W tone on for the Cap Com.
3. All C W words will be transmitted at approximately five words per minute.
4. Detailed messages will be transmitted in Morse code using spelled out words and universally understood abbreviations.

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C W Code

AAA	.-.-.-	Affirmative, I concur, Yes.
AL	.- .-.-	Abort light.
AR	.-.-.	End of message.
BT	----	Message follows.
CP	--- .----	Cabin pressure.
EEEE..E	.....	Error.
EF	. .-.-	Emergency O ₂ rate flow.
F	---	Off.
FA	--- .-	Automatic Fuel.
FM	--- --	Manual Fuel.
GMT	-- -- -	Clock GMT.
IMI	.....	Repeat your last transmission.
K	--	Over.
L	---	Leaking.
MAN	-- .- .-	Operated manually.
NO	-. ---	No, Negative.
O	---	On.
O ₂	(Followed by four numbers)	Oxygen primary and secondary quantities.
OK	1,2,3 --- -- 1,2,3	Status green for 1,2,3 orbits.
Q	---	Request, question.
R	1,2,3 .-. 1,2,3	End of 1,2,3 orbit retrosequence time.
RRR	-. -. -.	Roger, Wilco.
RE	(Followed by contingency area)	Reentering at indicated contingency area.
REO	-. . ---	Reentering at end of this orbit.
RS	-. ...	Retrosequence.
SP	... ---	Suit pressure.
T	-	Temperature.
UUUU	... .. - - -	Aborting or reentering immediately.
X	---	Out of operation.
Mark		Long dash with Mark at end of dash.

MORSE CODE

REFERENCE NO. 2

Gyro Uncaging Procedure

<u>Encode</u>	<u>Decode</u>	<u>Numbers</u>
A ..	. E	1 .----
B -...	.. I	2 ..----
C -...-	... S	3-
D -..	.... H	4
E .	.. A	5
F -...-	.. R	6 -....
G ---	... L	7 -...-
H ....	... W	8 -....
I ..	... P	9 -....
J .----	... J	0 -....
K -..	.. U	
L -...-	... F	
M --	... V	
N ..	- T	
O ---	.. N	
P -...-	.. D	
Q -...-	... B	
R ..-	... K	
S ...	... C	
T -	... Y	
U ...	... X	
V -...-	-- M	
W ---	... G	
X -...-	... Z	
Y -...-	... Q	
Z -...-	... O	

A. Objective

To establish that the astronaut can position the capsule in orbit attitude from an arbitrary attitude using the window as his sole reference. Further, that he can resume normal gyro operation from a gyro caged condition.

B. Pre-Maneuver Conditions

1. The capsule is in drifting flight.
2. The gyros are caged.
3. The maneuver switch is off.

C. Control Mode

Fly-by-wire, low thrusters only.

D. Procedure #1

1. Orient the capsule to 0° roll, 0° yaw, and -50° pitch using the window as the reference. Establish these attitudes as rapidly as possible.

2. Pitch up to -34° and hold 0° roll and 0° yaw.

3. Gyro switch to the free position.

4. Pitch up at 2°/sec to a +34° indicated, maintain 0° in roll and yaw. (The capsule is now in 0° roll, 0° pitch, 0° yaw actual attitude.)

5. Cage the gyros then go immediately to gyros normal. The capsule's actual attitude and the indicated attitude are now in agreement. Small uncaging errors will be corrected immediately by the horizon scanners.

6. Pitch down at 2°/sec to an indicated -34°, and cross check the attitudes with the scope and window.

7. Check maneuver switch-off.

Precision Attitude HoldE. Procedure #2

1. Cage gyros.
2. Maneuver - ON.
3. Pitch to -50° .
4. Align yaw.
5. Gyros to FREE.
6. Pitch up to -34° (visually) holding yaw rate and attitude zero.
7. Cycle gyros to CAGE then FREE (0° , 0° , 0° indicated).
8. Pitch to $+36^{\circ}$ (0° pitch true) indicated in 30 sec.
9. Cycle gyros to CAGE then FREE (0° , 0° , 0° indicated and true).
10. Maneuver - OFF.
11. Pitch down to -34° indicated.
12. Gyros to NORMAL.

A. Objective

To determine the limits for holding a specified (orbit) attitude using the window as the only reference.

B. Pretask Conditions

1. The capsule is in orbit attitude.
2. The gyros are normal.
3. The maneuver switch is off.
4. The capsule has been in drifting flight. The astronaut has just finished uncaging the gyros (Reference 2).

C. Control Mode

Fly-by-wire

D. Procedure

1. Maneuver - ON
2. When starting the maneuver mark the onboard tape.
3. Hold 0° yaw, 0° roll, and -34° pitch on the window. Hold these attitudes as tight as possible for at least two minutes.
4. Mark tape and announce completion of hold.
5. Evaluate the drifting tendencies of the spacecraft.
6. Maneuver - OFF

REFERENCE NO. 4

Night Yaw Check

A. Objective

To establish that the astronaut can position the capsule to 0° yaw at night, from an arbitrary yaw attitude using the window and rate indicators as his sole references.

B. Pre-Maneuver Conditions

1. The capsule is in orbit attitude.
2. The gyros are normal.
3. The maneuver switch is off.
4. MJC and WOM are monitoring roll attitude.

C. Control Mode

Fly-by-wire, low thrusters.

D. Celestial Procedure

1. Maneuver - ON
2. Initiate a right yaw rate on instruments of 2°/sec.
From this point on the window will be the sole attitude reference.
3. After approximately 30 seconds, stop the yaw rate and reorient to 0° yaw using stars as references.
4. Before cross checking the instruments inform WOM that 0° yaw is established, and mark the onboard tape by keying.
5. Maneuver - OFF.

E. Terrestrial Procedure

1. Maneuver - ON.
2. Initiate a right yaw rate on instruments of 2°/sec.
From this point on the window will be the sole attitude reference.
3. After approximately 30 seconds, stop the yaw rate, pitch down to -50°, and reorient to 0° yaw using the Earth as a reference.
4. Before cross checking the instruments inform WOM that 0° yaw is established, and mark the onboard tape by keying.
5. Maneuver - OFF.

REFERENCE NO. 5

Balloon Experiment

A. Objective

1. The objective of the visual portion of the experiment is to evaluate the relative merit of various colors for optimum visibility in space at short and long ranges.
2. The objectives of the aerodynamic portion of the experiment are to:
 - (a) Measure the drag of an object of known aerodynamic qualities throughout an orbit of the spacecraft.
 - (b) Observe the behavior (gyrations, period, etc.) of a tethered object of known aerodynamic qualities.
 - (c) Observe the separation from the spacecraft of an object of known aerodynamic qualities.
3. An additional objective is to observe the behavior of small particles of known size, shape, and mass when dispersed from an orbiting spacecraft.
4. This experiment will also show the feasibility of conducting future experiments of this nature, possibly with untethered objects, for further aerodynamic and visual studies.

B. Description of Test Device

1. The test device consists of a 30-inch diameter balloon constructed of 30 gores of 1/2 mil Mylar - 1/2 mil aluminum foil material. It will be divided into five equal size lunes composed of uncolored aluminum foil, yellow and orange Day-Glo, flat white paint, and phosphorescent paint (figure 1). The balloon will be inflated to 2000 psi tensile stress from a small, attached, 900 psi nitrogen bottle.
2. The balloon and attached inflating bottle will be tethered by a five-pound-test nylon line 100 feet long. A shock absorber, consisting of a roll of .005 annealed aluminum eight feet long, which tapers from one inch to one-half inch as it unrolls, is between the balloon inflating bottle and the nylon line to damp Z-axis deployment motion.
3. The balloon, bottle and shock absorber will be packaged between two balsa half cylinder shells in a metal cylinder which is three inches in diameter and seven and one-half inches long. It will be mounted in the Mercury spacecraft antenna fairing

in the compartment under the folded destabilization flap. Firing of an electric squib will allow a spring-loaded door to open. A spring will eject the balloon and bottle. The bottle will inflate the balloon in approximately two seconds upon loss of restraint on a spring-loaded valve actuating arm. The nylon line will deploy from a spinning reel. Upon full deployment of the line it will be stripped entirely from the reel and will load a small strain gage instrumented metal beam. The strain gage measurements will be recorded on the spacecraft onboard tape to measure drag. Release of the line will be accomplished by firing a second squib to cut the line.

4. The balloon and inflating bottle will weigh 0.5 pound. The entire device, with instrumentation, will weigh approximately three pounds.
5. A small quantity of 0.250-inch diameter Mylar disks will be placed in the folds of the balloon. The Mylar is backed by aluminum foil on one side and is coated with Claray (diffuse-reflecting) compound on the other. These will disperse as the balloon inflates.

C. Deployment

1. Time

- (a) Nominal - Over East Coast of U. S. at end of first orbit.
- (b) Special - On ground instructions from MUC.

2. Procedure

- (a) Orient spacecraft to 0° , 0° , 0° .
- (b) Fire deployment switch and give voice mark.
- (c) Hold spacecraft attitude until balloon Z-axis motion damps.
- (d) Pitch down slightly for observations and photography.
- (e) If balloon fails to inflate, fire release switch.

3. Ejected Objects

- (a) Balloon.
- (b) Two half-cylindrical balsa shells, $5" \times 3" \times 1/4"$, painted on the inside yellow and orange Day-Glo, respectively. The outside of each is coated with a black lubricant.

- (c) Confetti, $1/4"$ diameter Mylar, coated with Claray on one side and backed with aluminum foil on the other.

4. Observations

- (a) Balloon deployment and stabilization.
- (b) Relative visibility of yellow and orange balsa blocks.
- (c) General observation of brightness and motion of confetti particles.

Towed Phase

1. Observations

- (a) General stability characteristics of balloon.
- (b) Period of pendulum oscillations.
- (c) Period of oscillations about balloon's axis.
- (d) Relative brightness of various colors.
- (e) Visibility of phosphorescent paint in shadow on daylight side of earth.
- (f) Visibility of phosphorescent paint on night side of earth.
- (g) General visibility characteristics at night.
- (h) Give voice marks as applicable.

2. Drag Measurements

- (a) Approximately every five minutes throughout orbit align spacecraft Z-axis with balloon and give voice mark. Dark side drag measurements are optional. The balloon is properly aligned when the top of the balloon is held at the bottom of the spacecraft window. Coordinated visual observations of period and amplitude of balloon pendulum oscillations should be included on tape along with voice mark.
- (b) Desirable to measure at 0° , 0° , 0° whenever balloon moves through spacecraft Z-axis (give voice mark).

3. Photographs

- (a) Photo coverage should include, (1) a series just after balloon deployment, (2) a series at high sun angle, and (3) a series just prior to release.

- (b) If gyrating or oscillating, as various colors are presented, a series should cover one rotation of the balloon.
- (c) Rapid sequence with camera fixed to show balloon relative motion.
- (d) Give voice marks for each series of photographs.

E. Release

1. Time

- (a) Nominal - Over East Coast of U. S. at end of second orbit.
- (b) Special - Astronaut's discretion if balloon does not stabilize or on ground instruction from MCC.

2. Procedure

- (a) Fire release switch and give voice mark.
- (b) Pitch down for optimum visibility.
- (c) Track balloon to limit of visibility and make timed observations and reports.

3. Observations

- (a) Best color contrast against earth background.
- (b) Time from release to disappearance.

4. Photographs

- (a) Against earth background.

F. Artificial Damping of Balloon Disturbances

1. Even with the best possible deployment of the balloon it is expected that initially oscillations of balloon will be present and that changes of capsule attitude could add additional disturbances. These oscillations may occur as the following:

- (a) A few cycles of limited rebound when the attachment line becomes fully unspooled.
- (b) Oscillations of the balloon about its c.g.
- (c) Balloon rotation about its attachment point.

- (d) Pendulum motions of the balloon-string combination about the capsule attachment point.

2. The shortest period for the pendulum type of oscillation is estimated to be about 80 seconds at perigee. With no added disturbances, the amplitude of these oscillations will increase and the frequency of oscillations decrease with increase of altitude, and, conversely, the amplitude should decrease and frequency increase when altitude is decreasing. Corrections or adjustments of capsule attitude could be properly phased to help decrease the pendulum motion of the balloon. The most natural and effective corrective motion to damp a swinging pendulum is a step displacement at the pivot applied at the end of each swing that opposes the direction the pendulum is about to start moving. For example (figure 2a) if the capsule attitude required a correction in yaw to the right, this correction should be made when the balloon oscillation had its maximum displacement to the right. If a deliberate effort is made to damp the pendulum oscillations, the most efficient fuel usage would be to use very small single control pulses to generate a triangular type of capsule attitude time history (figure 2b). The maximum capsule angle and the control pulse should then occur at the times the balloon is passing through the center of its oscillation. The capsule attitude at this time should be opposite to the direction the balloon is moving and the control pulse should be applied to move the capsule attachment in the direction the balloon is going.

Diameter 30 inches

Weight	
Bottle	0.192 lb
Balloon	0.344 lb
Shock Absorber	0.056 lb
Nylon Line	0.004 lb
Total	0.596 lb

Balloon Material	
Mylar	1/2 mil
Aluminum	1/2 mil
Total	1 mil

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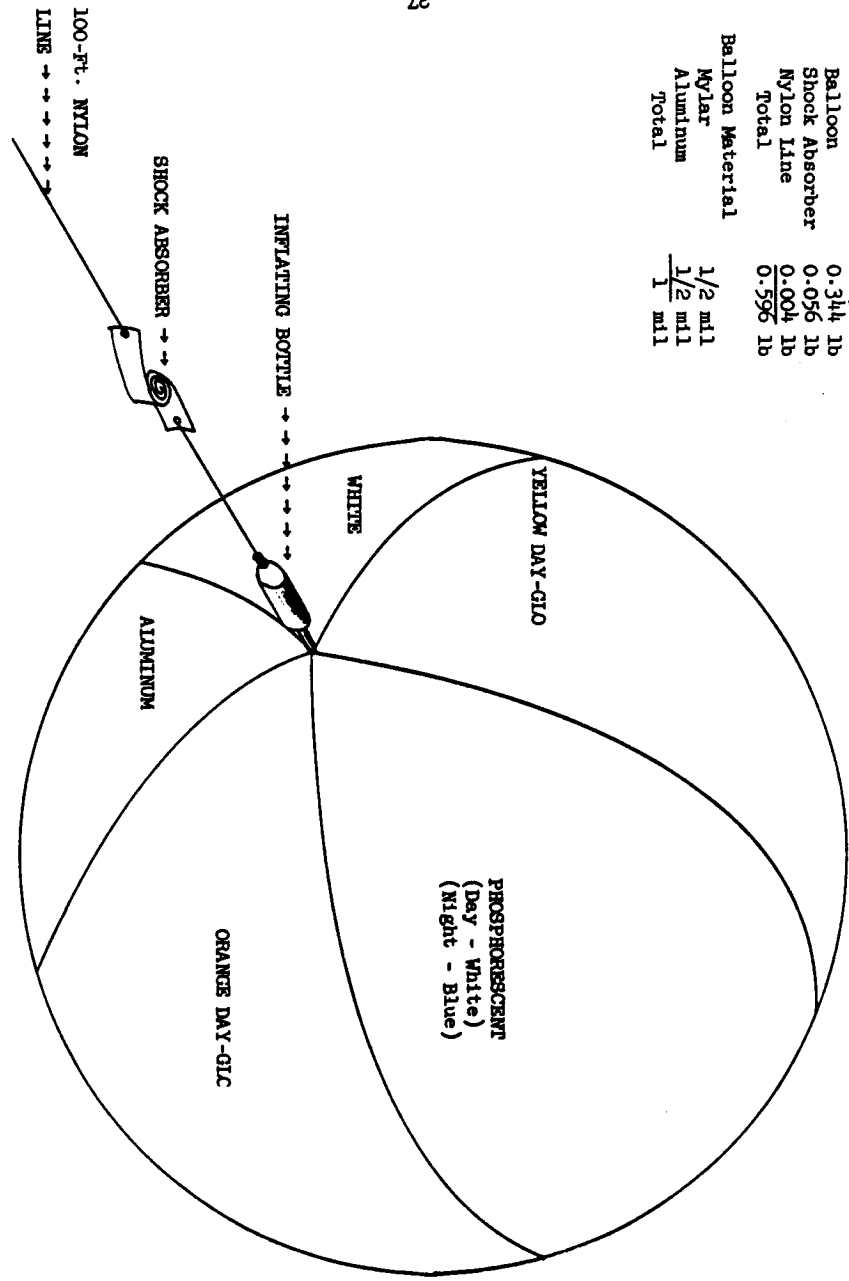
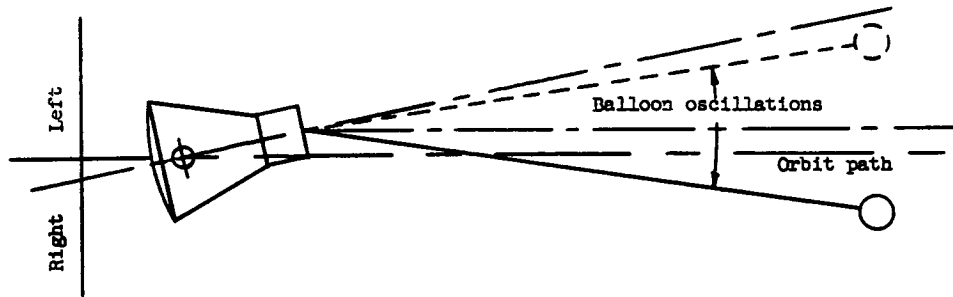
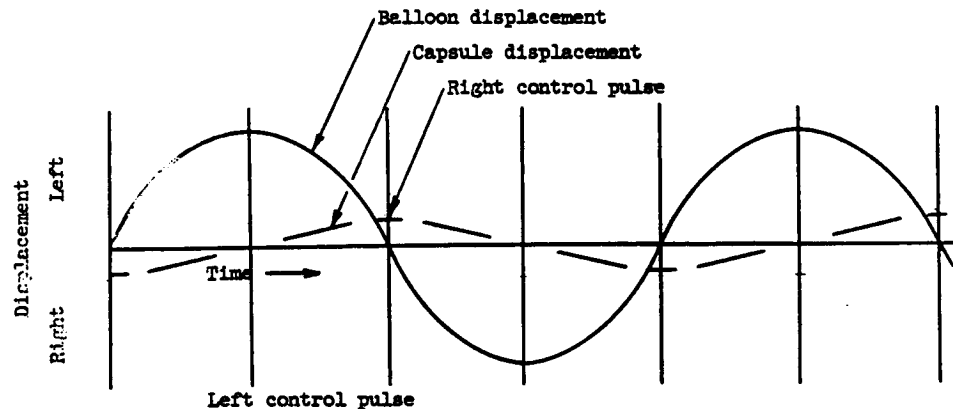


Figure 1. - MA-7 Balloon Experiment



a. Yaw correction to the right should be made when the balloon is to the right.

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b. Control mode to damp pendulum swing of balloon.

Figure 2. - MA-7 Balloon Experiment

Star Observation and Haze Layer CheckA. Objective

To establish the tracking limits of the pilot-spacecraft combination of a distant object. Also to obtain the altitude and thickness of the haze layer observed on MA-6.

B. Pre-task Conditions

1. The capsule is in orbit attitude.
2. The gyros are normal.
3. The maneuver switch is off.

C. Control Mode

Optional

D. Procedure

1. Maneuver - ON
2. Acquire a star slightly above the haze layer and observe it until lost over the horizon.
3. Announce what star you are using, if known.
4. If possible mark the tape as the star passes into the haze layer and comment on apparent drift of the star.
5. Note by voice on tape when star appears to be at its dimmest position.
6. Make a voice note on tape when the star exits the haze layer.
7. Mark the tape when the star disappears below the horizon.
8. Roll the capsule (monitor gyro limits) and check to insure window reflections are not creating haze effect.
9. Yaw 90° and evaluate polar haze layer.
10. Return to orbit attitude.
11. Maneuver - OFF.

WHS Radar Test No. 1A. Objective

This test is designed to check the affect of the phase shifter on the beacon antenna pattern.

B. Pretest Conditions

1. The capsule is near orbit attitude.
2. The gyros are normal.
3. The maneuver switch is off.

C. Control Mode

Optional

D. Procedure

1. Cage the gyros.
2. Upon command from the ground initiate a left roll at 6°/sec.
3. After 360° of roll place the phase shifter fuse switch off. (Allow roll to continue)
4. After 720° of roll (2 revolutions) stop the roll rate and any pitch and yaw rates which may exist.
5. Place the phase shifter fuse switch on.
6. Perform the gyro uncaging procedure.

REFERENCE NO. 8

Star Navigation

A. Objective

To establish that an astronaut can recognize star patterns on both the day and night sides of an orbit.

B. Pre-task Conditions

1. The capsule's attitude is approximately 0° , 0° , 0° .
2. The gyros are normal.
3. The maneuver switch is off.
4. The capsule is towing the balloon.

C. Control Mode

Aux Damp or Manual

D. Procedure

The astronaut will have a set of star charts very similar to those used in MA-6. His task is to simply identify a star pattern and if possible count the number of stars in a constellation.

REFERENCE NO. 9

180° Yaw Maneuver

A. Objective

To obtain an evaluation of orbiting small end forward. This corresponds to a capsule attitude of 0° roll, 180° yaw, and -34° pitch.

B. Pre-Maneuver Conditions

1. The capsule is in orbit attitude.
2. The gyros are normal.
3. The maneuver switch is off.

C. Control Mode

Optional

D. Procedure

1. Pitch to 0° at $2^\circ/\text{sec}$.
2. Cage the gyros.
3. Maneuver switch - on.
4. Yaw right at $3^\circ/\text{sec}$ to 180° . Pitch down at $2^\circ/\text{sec}$ to -34° . Align the capsule at -34° pitch and 180° yaw. (At the astronaut's discretion he can make the 180° yaw a timed turn. Then pitch down to -34° on a timed basis.) When 180° yaw, 0° roll, and -34° pitch are established proceed with Step 5.
5. Place the gyros in the normal position. A new 0° , 0° , 0° reference has now been established with respect to the small end forward. The horizon scanners will remove pitch and roll gyro errors and provide pitch plane precession.
6. To return to normal orbit attitude it is necessary to cage the gyros. Reorient to 0° yaw, 0° roll, and -34° pitch and follow the standard gyro uncaging procedure, using the periscope for reference.

HDA Radar Test No. 2

A. Objective

This test is designed to acquire additional information on the phase shifter and antenna patterns.

B. Pre-Test Conditions

1. The capsule is near orbit attitude.
2. The gyros are free.
3. The maneuver switch is off.
4. The balloon is being towed.

C. Control Mode

Not applicable

D. Procedure

Power for the phase shifter is fused through the top row, left hand, fuse. (Formerly a spare position.) After passing the zenith of Bermuda radar, the Cap Com will instruct the astronaut to place the phase shifter fuse switch - off. Approximately 20 seconds later he will instruct the astronaut to place the fuse switch - on. This pattern is then repeated after 20 seconds to complete the test. The fuse switch is on at completion.

Forward Inverted Flight

A. Objective

To obtain an evaluation of orbiting inverted, small end forward. This corresponds to a capsule attitude of 180° roll, 180° yaw, and 0° pitch.

B. Pre-Maneuver Conditions

1. The capsule is at an arbitrary attitude. The astronaut has just lost sight of the balloon.
2. The gyros are caged.
3. The maneuver switch is off.

C. Control Mode

Pilot's option

D. Procedure

1. Keep the gyros caged and maneuver to the forward, inverted position.
2. Place the gyros on the free position. Leave the maneuver switch off. The gyros will now be indicating variations about a 0° , 0° , 0° with respect to the forward, inverted position. With the maneuver switch off the programmed pitch precession will be in the proper direction.
3. Prior to reorienting to orbit attitude cage the gyros.
4. Reorient the capsule to orbit attitude and perform the gyro uncaging procedure.

REFERENCE NO. 12

180° Roll Maneuver

A. Objective

To obtain an evaluation of orbiting inverted and heat shield forward. This corresponds to a capsule attitude of 0° yaw, 180° roll, and 0° pitch. (Pitch attitude may vary for evaluation purposes.)

B. Pre-Maneuver Conditions

1. The capsule is in orbit attitude (Pitch may be 0°).
2. The gyros are normal.
3. The maneuver switch is off.

C. Control Mode

Pilot's option

D. Procedure

1. Pitch to 0° maintaining 0° yaw, 0° roll.
2. Cage gyros.
3. Initiate a 3°/sec. roll rate. Hold yaw and pitch rates to 0.
4. Stop capsule at 180° roll (on window) without an overshoot.
5. Evaluate attitude hold on the mirror.
6. Evaluate inverted flight on Aux Damp.
7. Return to orbit attitude on Manual, at pilot's discretion.
8. Evaluate manual control.

REFERENCE NO. 13

Photographs

1. Color Photographs

Color photographs will be made of:

(a) The sustainer, periodically from as soon after orbit insertion as possible until it is lost from sight.

(b) The balloon during deployment (of Mylar confetti if balloon is not visible), periodically during orbit if visible, and from release until it is lost from sight.

(c) Sunrise

(d) Sunset

2. Horizon Definition Photographs

These photographs are taken through a special filter on special panchromatic film from just after sunrise to just before sunset. It is desirable to obtain about 36 exposures of the earth horizon equally spaced over the daylight side. These exposures may be taken in part on each orbit depending on time available so as not to conflict with the color photographic requirements stated above.

3. Weather Bureau Cloud Photographs

These photographs will be made of specific cloud formations to be designated by the Weather Bureau, using a special film and filter. They will be made on a basis of noninterference with the foregoing photographs.

REFERENCE NO. 14

Damping Coefficient Test

A. Objective

To determine the damping coefficient of the spacecraft.

B. Pre-Test Conditions

The capsule is reentering.

C. Control Mode

As required.

D. Procedure

1. The capsule is being damped by either the astronaut or automatic control.
2. After peak g, continue in damping mode until the g field has dropped to where the astronaut can reach the control mode selector switches.
3. At this time, damping is terminated and the oscillations are allowed to build. When the rates build to 4°/sec the astronaut will again select a damping mode.

This test will be done only if Aux Damp and rate damping are functioning and Auto and Manual Fuel are above the minimums required for the reentry.

REFERENCE NO. 15

Sustainer Tracking

A. Objective

To determine the limits of the pilot-spacecraft combination on tracking a moving object at varying distances. Also to investigate the visual limitations associated with a receding object in space.

B. Procedure

1. Remain on ASCS after the orbit go is received.
2. The sustainer will appear in the top of the window at approximately 0:06:15 CET.
3. When the sustainer is about 3° above the horizon, switch to FBW, place gyros to free, and align the window reticle on the sustainer.
4. Track and photograph the sustainer.
5. Continue tracking until 0:14:00 (or until pitch is -60°) then go to orbit attitude for CYI radar.
6. Record and transmit remarks on the motions of the sustainer.
7. After radar track, cage gyros, go to manual, and attempt to reacquire the sustainer.

REFERENCE NO. 16

Ground Flare Visibility

A. Objective

This experiment is intended to evaluate visibility from the capsule at various ranges and look angles through the atmosphere and to determine the light attenuation through the atmosphere.

B. Pretest Condition

May be in drifting or limited drifting flight depending on outcome of night yaw check.

C. Procedure

1. Yaw left about 90° and pitch down at $2^\circ/\text{sec.}$ as required to observe the flare (gyros free or caged, maneuver switch on).
2. Go to aux. damp and evaluate damping mode.
3. WOM Cap. Com. will report ignition of the flare and the astronaut will take a reading through the variable filter. Note and report filter setting at which the flare is just visible. At the same time an observer on the ground will make the identical measurement and note the filter setting and his distance from the flare.
4. After the flare observation, the astronaut and the ground observer will take simultaneous readings of a discreet star through the variable filter and will note and report the filter setting. The star to be used for observation is chosen by the astronaut with the restriction that it is on the star chart. Both astronaut and ground observer will mark the star used on the star chart.

REFERENCE NO. 17

ASCS Zero Pitch Procedure

A. Objective

To fly the spacecraft on ASCS at an attitude of 0° , 0° , 0° during the balloon experiment.

B. Pre-Maneuver Conditions

The astronaut has just completed the WBS Radar Test No. 1 (Reference 7).

Maneuver is OFF.

C. Control Mode

Optional

D. Procedure

1. Maintain 0° yaw and roll.
2. Pitch up to $+34^\circ$ (indicated and true).
3. Cage gyros, and immediately uncage to the FREE position.
4. Pitch down to -34° pitch indicated (0° true) attitude.
5. Go to ASCS.

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MA-7/18 FLIGHT PLAN

Revision A write-ins

MA - 7/18

FLIGHT PLAN

Revision B write-ins

Page 1 - change 0:02:30 to 0:02:22

Page 3 - 0:20 delete "Drifting Flight" in left hand column
A - line 3 change "track" to "acquire."
line 8 add "within limits of about ± 50 ° from orbit attitude in all axes" after "to drift."

Page 5 - 0:58 A - line 3 add "(within gyro limits)."

Page 7 - 2:04 delete VOX Power Switch to record.

Page 8 - 2:23 delete second A - "If balloon was released -----drifting flight."

Page 9 - 3:40 A - after "drifting flight," insert "for about 10 min."

4:04 A - line 3 delete "drifting flight"

Page 10 - 4:21 In left column add "Go to ASCS"
A - after line 2 add "Go to ASCS, check Maneuver OFF."

4:32 CAL - line 3 "Confire" should be "Confirm."

4:41 A - After "Short report" add "Go to RSCS."

Page 11 - 4:48 A - Delete "Perform the damping coefficient test (Reference 14)."

On page 11 add Notes:

Note 1 - VOX record is intended only for recording sensitive information.

Note 2 - Primary retrofire control mode is ASCS.
Primary reentry control mode is RSCS

Page 37 - Reference No. 14 - delete entire Reference.

Page 3 - 0:20 A - Change to read "When released from CYI radar: Go to Manual. Cage gyros. Acquire sustainer. etc."

Page 7 - 2:04 second A - Change to read "Go to FBW. Cage gyros. Gyros normal. Pitch down to orbit attitude."

Page 8 - 2:12 A - Add "Go to ASCS."

Page 8 - 2:32 A - Add "Go to ASCS."

Page 9 - 3:11 A - Insert "Cage gyros" between "Go to FBW" and "Release balloon."

Page 32 - Ref. 9 - Paragraph D. 4. Delete all after "Yaw right at 3°/sec to 180°."

Page 35 - Ref. 12 - Paragraph D. Add "9. Perform the gyro uncaging procedure."

Page 38 - Ref. 15 - Paragraph B. 7. Change to read "After radar track, go to Manual, cage gyros, and attempt to reacquire the sustainer."

Page 40 - Ref. 16 - Paragraph C. 2. Add "Return to FBW."

Page 3 - Add "0:10 Retro Delay Normal MCC- Advise Astronaut to place retro delay switch to normal.
A- Confirm retro delay switch to normal."

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INDEXING DATA
DATE BY SUBJECT SERIALIZED
CLASSIFIED DECLASSIFIED

Flight Activities Section
Flight Crew Operations Division
May 10, 1962

Flight Activities Section
Flight Crew Operations Division

May 8, 1962

Copy 120

MA - 7/18
FLIGHT PLAN
Revision B write-ins

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Cage gyros.
Acquire sustainer.
etc."
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Flight Activities Section
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