NASA - Manned Spacecraft Center
Langley Field, Virginia

MEMORANDUM for Associate Director

Subject: MR-4 postflight debriefing of Virgil I. Grissom

1. The enclosures to this memorandum constitute Captain Grissom's complete debriefing of MR-4. The first enclosure is a general outline of the three sessions of the MR-4 debriefing. The second enclosure is an index of enclosures four, five and six which are Grissom's comments relative to capsule engineering, operational procedures and pilot performance. In these enclosures each answer by Captain Grissom is preceded by the question proposed except for enclosure four. The debriefing questionnaire used as a guide by the astronaut for this portion of the debriefing is included as enclosure three.

2. The basic concept of the debriefing was to allow the pilot to freely discuss the flight on board the recovery ship before entering into the direct question and answer sessions held at Grand Bahama Island and Cape Canaveral. An index was prepared which, it is hoped, will help direct the various systems' specialists to the information pertaining to their areas of interest.

3. To take full advantage of the information gained from the MR-4 pilot debriefing, it is suggested that a copy of this material be distributed to each branch of the Manned Spacecraft Center. It is requested that all comments on the debriefing be forwarded back to the Training Office.

MSD office file

MR-4 Technical Debriefing Team

Sigurd A. Sjoberg
Flight Operations Coordination

Robert B. Voas
Training Office

WORD ONE/KEYSEARCH

Helmut A. Kuehnel
Spacecraft Operations Branch

Enc: Debriefing

D:07-24-61 MSC N:00 d MER Mercury-Redstone 4 Sjoberg R011016
Grissom Postflight Debriefing MR-4

RGZ:srl

Copies to: All MSC Branches

OUTLINE FOR
ASTRONAUT DEBRIEFING

SECTION A: On board the recovery ship within two hours of completion of the flight.

I. Comments on the highlights of flight by the astronaut without regard to chronological sequence of events.

II. Moderately detailed exposition of flight by astronaut, paying attention to chronological sequence of events. Astronaut described his impressions of complete mission starting from insertion into capsule to boarding of recovery ship.

III. A dozen questions covering appearance of earth and sky and a half-dozen very general questions designed to summarize the flight were used to conclude this portion of the debriefing.

SECTION B: Held on the same day of the flight - Grand Bahama Island.

Chronological exposition of flight using prepared questions covering all areas of interest at the proper times; questions were restricted to those which should logically be asked in a chronological framework. Questions were grouped in the following headings:

A. Prelaunch
B. Launch and Powered Flight
C. Zero-g Phase
D. Reentry
E. Landing
F. Postlanding
G. Recovery

SECTION C: Held on the second day after the flight at Cape Canaveral.

I. All remaining questions regarding the flight were grouped in the following general areas:

A. Aeromedical
B. Evaluation of Capsule Systems Operations
C. Flight Operational Procedures
D. Assessment of the Training Program

II. A few general questions intended to summarize the complete Mercury operation and to allow astronaut to impart advice to astronauts who will man succeeding Mercury missions.

Enclosure 1
NASA - Manned Spacecraft Center

INDEX

Astronaut Grissom's three engineering debriefing sessions are lettered (A) through (C) and the paragraphs within each session are numbered for easy reference.

V ELECTRICAL SYSTEM - A4, B101

VI CREW SPACE LAYOUT - B93, C28-30, C38-39, C60, C104

VII INSERTION - A2-3, B1

VIII OPERATING PROCEDURE

(a) Countdown - A2, A3, A4

(b) Powered Flight - C58-59

(c) Reentry to Landing - A10

(d) Postlanding - A11-12, A27, B87, B94, B96, B105-107, B110, B113, C109

(e) Complete Flight - C105, C108

IX PERISCOPE

(a) Countdown - A4, C21-22

(b) Weightless Flight - A6, A22, B31, B39-41, C32, C43

(c) Reentry to Landing - A9, B78, B88, B94

X PERSONAL EQUIPMENT

(a) Countdown - B3

(b) Postlanding - A11-13, B89, B108, B110

(c) Complete Flight - A31, B3, C6-8, C104

XI PHYSICAL CONDITIONS OF FLIGHT

(a) Acceleration - A5-6, A9-10, A31, B8-9, B20, B26, B29-30, B38, B54, B60, B62, B67, B69, B77, B81, B85, B89, C14, C76

(b) Weightlessness - A14, A19, A29, B37, B45, B48, B52, C107

(c) Noise - A5, A19-20, B8-9, B15, B20, B30-31, B47, C14, C33-34, C40

(d) Vibration - A5, A20, B8-9, B11-12, B46, B54, B59, B64, C33

(e) Orientation - A6, A14, A21, B17, B19, B29, C37, C49

XII PHYSIOLOGICAL SENSORS - A10, B10-12

XIII PRESSURE SUIT

(a) Countdown - B3

(b) Postlanding - All

(c) Complete Flight - C5

XIV PYROTECHNICS

(a) Weightless Flight - A5-6, A8, A22, B19-22, B25, B29-32

(b) Reentry to Landing - A9-10, B65, B73

(c) Postlanding - All-12, B87, B105

(d) Complete Flight - C14

XV REACTION CONTROL SYSTEM - A6-7, A19, B19-20, B33-36, C16-20, C35

XVI SEQUENTIAL EVENTS

(a) Powered Flight - A5-6, B13

(b) Weightless Flight - A8, B17, B19-21, B25-26, B28-32, C34

(c) Reentry to Landing - A9-10, B56, B64, B66, B68, B72, B74-76, B80, B83-85, B87-89, B94

(d) Postlanding - B87-B92

XVII TRAINING

(a) Preflight - A3, C62

(b) Countdown - B5

(c) Powered Flight - A6, C75-76

(d) Weightless Flight - A6, A8, B49-52, C66, C77, C90, C102

(e) Reentry to Landing - B54, B63, C75

(f) Postlanding - B109, C63-65, C74, C106, C109

(g) Complete Flight - B35-36, C63, C67-73, C78-89, C91-101

XVIII VISUAL OBSERVATIONS - A5-9, All, A14-17, A22, A25, A30, B17, B19, B21, B27, B31, B39-40, B42-44, B53, B68, B76, B111, C14, C36, C41-47, C108

XIX WINDOW - A8, A10, B23, B39-41, B56, B76, C36, C48

XX PERFORMANCE - ASTRONAUT

(a) Countdown - A3-4, B4

(b) Powered Flight - B8

(c) Weightless Flight - A7-8, B19, B29, B33, B42

(d) Reentry to Landing - A9-10, B54, B94-95, C35

(e) Postlanding - A11-12, A23, B87

(f) Complete Flight - A26, A32, C36, C-103

ASTRONAUT DEBRIEFING KIT
ABOARD CARRIER

I. What would you like to say first?

II. Starting from your insertion into the capsule and ending with your arrival aboard the recovery ship, tell us about the entire mission.

-122	Insertion	3:00	Retroattitude
- 72	Capsule Pres. Check		Manual Control
- 55	Gantry Removal	4:00	Window Reference
- 50	Panel Check		Observations
- 22	Escape Tower Arming	4:45	Retrosequence
- 20	Panel Check		Retroattitude
- 5	Status Check	5:10	Retrofire
-4.5	Launch Control Switch On	5:35	Retrojettison Arm
-0:35	Umbilical		Rate Command
0	Clock Start		HF Radio
1:13	Press. Hold		Scope View
2:23	Tower Jettison	6:10	Retrojettison
	Retrojettison Off	6:40	Scope Retract
2:33	Cap. Sep.		Stars
	Posigrades	7:46	.05g
	Aux. Damp.	8:18	Peak g
	Scope	9:38	Drogue
		10:16	Main
			Fuel Dump
		10:28	Landing Bag
		14:49	Landing

III. Special Sensory Areas:

1. What were your most outstanding impressions of the flight?

2. Any major surprises?

3. (a) Describe appearance of sky

   (b) Describe appearance of stars

   (c) Using the star charts provided, mark those stars you could identify

IV. Earth and Sky Observations:

1. Describe appearance of land and water through scope.

2. Which check points did you see through the window and periscope? Refer to the map and periscope picture provided.

Observation Points:

Window

Miami City
Keys
Cuba
Isle of Pines
Mexico
Mississippi Delta
Apalachicola Point
Tampa Bay
Orlando

Periscope

Perimeter

North - Charleston, Wilmington, Cape Hatteras

West - Mississippi Delta, Apalachicola Point

South - Cuba, Isle of Pines

Close In

Cape
St. Johns River (North)
Sales Cay
Spanish Cay
Mores Island
Nassau

3. Describe appearance of the clouds? Was weather map accurate?

V. Describe appearance of horizon. How many layers? What colors? Compare to color photograph.

VI. Describe your sensations and reactions to weightlessness?

VII. Describe any new sounds, smells or other sensory impressions associated with the flight that you did not experience in training.

ANNEX TO ASTRONAUT DEBRIEFING KIT

VIII. General Questions

1. Evaluate your general condition at this time. Any discomfort? Describe.

2. What are your most outstanding impressions of the flight? Describe.

3. Were there any major surprises during the flight? Describe.

4. Were any significant physiological problems encountered? Describe.

5. Were any significant operational or capsule systems problems encountered? Describe.

6. Did the period of weightlessness have any unexpected effects on your feelings or performance? Explain.

7. What were the most interesting aspects of the operation for you?

8. When were you most excited?

9. What were the most difficult portions of the operation?

10. What were your major concerns about the operation? When were you most anxious?

11. How would you evaluate your performance during the flight?

12. Did you accomplish all that you had expected to do during the flight?

13. Did you feel in control at all times or were there periods when you felt that you were getting behind?

S E C T I O N A

CARRIER DEBRIEFING

IMMEDIATELY AFTER FLIGHT

JULY 21, 1961

1. The first two portions (I-II) of the carrier debriefing were combined into one section for the Postlaunch Report and are so combined here.

I-II. Description of Mission

2. Countdown - I entered the capsule as previously practiced. Specifically, I slipped my feet in and turned my body away from the leg portion of the couch. Actually, the forward part of my body faces the window. I doubled my knees back, put them into the calf supports and then slid in, rotating my body into the couch. This method works well and is quite easy.

3. I felt fine on insertion. I wasn't nervous any time during the capsule pressure check. Everything was normal, there was nothing abnormal at any time - it was just like the simulated flights and the mission scrubbed two days prior. At gantry removal, I looked out the window after the gantry had started moving, and I felt as if the capsule was falling. This same feeling was observed during a simulated flight, so it was not a new sensation, but the first glance is alarming.

4. Escape tower arming didn't bother me. The panel checks were good. Along about T-15 minutes when the decision was made to go, I started getting a little excited. At T-4 minutes when I placed the launch control switch on, I was ready and anxious to go. I felt certain at this time that the flight would go, and go OK. The countdown information I received from Deke* from minus two minutes to zero was good. Although his communication was a little bit garbled, I knew what was happening. Things happened rapidly from T-35 seconds on when the umbilical dropped. I could hear Deke giving the commands to me and I remember calling out amperage at this time. I believe it was 24 amps after the periscope retracted. I remember calling out that the periscope was retracted. It seemed as though I felt lift-off and heard the rocket's noise before I actually saw the clock start.

*Capsule Communicator in Blockhouse

5. Powered Flight - At lift-off, Al** came in loud and clear. I started my clock and the interim clock started running, as I reported. I made a voice transmission at about plus 15 seconds. My report at 30 seconds was normal; everything was OK. The report at one minute was normal and at this time, I started watching the cabin pressure as it held properly and I really felt good at this time. I reported when I felt the vibration start. The vibration wasn't bad at all; in fact, it was very minor. It never interfered with my vision or voice transmissions. I noticed the rates on the indicators during this time, and there was a pitch rate of about one degree per second with just a very slight oscillation. At about a minute and 30 seconds, after I called cabin pressure sealing, I gave my normal report with the isolated battery and main battery readings. At about this time, I saw a star. I have no idea what star it was, but it was dead in the center of the window. This was the only star I saw during the flight, even though I looked several other times. It was very faint. Possibly, it was a planet. At this time, I was getting up to about 3 g's and the sky started getting black and I reported this. There was no doubt when the tower jettisoned. I didn't see any flame, but I could see it go and I followed it for a long time after it left. I watched it for five or ten seconds and I could see the tail-off. It went slightly off to my right.

6. Weightless Flight - Right at booster cutoff when the tower jettisoned, I felt a little tumbling sensation and I can't recall which way I felt that the capsule tumbled. But I did get a sensation something of the same sort that we felt on the centrifuge. There was a definite second of disorientation there. I knew what it was, so it didn't bother me. This is one place where some of the training really helped me. Capsule separation was good. There was a loud clear pop when the posigrades fired and the capsule separated from the booster. I never saw the booster after separation. The capsule damped okay, stabilized, and made the turnaround right on schedule. I disarmed the retrojettison switch and pulled the manual fuel handle on. I reported these actions, but evidently I wasn't being received very well because Al transmitted a reminder to me to pull on the manual fuel handle. I checked and it was on. Turnaround was good. Everything was black above me and I could see the clouds through the periscope. There were so many clouds around, so much high cirrus, that I couldn't identify any land in the periscope at all. Nothing! The turnaround was just about like we've seen on the Procedures Trainer, with the exception of roll. When I felt the correct time had elapsed to be in proper retroattitude,

** Capsule Communicator in Mercury Control Center

roll rate and attitude were still lagging and it didn't appear that the roll rate was bringing me into attitude.

7. From here on, I tried to go through my flight plan. I went on the Manual Proportional Control System when I positioned the mode selector switch on rate command. I was having difficulty controlling the capsule, not that the control system was bad, but the view out the window was just so fascinating that it distracted my attention and I was taking more time on observing than I had anticipated. In fact, I was concentrating more on looking out the window than controlling. It was just sheer amazement; that's all it was. I was only spending probably a third of my time at the control task. I put in a good four degrees per second pitch rate, but I went past or above the minus 14-degree pitch attitude. I brought the pitch back to minus 34 degrees and then put in the yaw rate and went too far in that axis, also. I went to almost 30 degrees left yaw and then brought it back. By this time, the minute I had allotted for these maneuvers was up. So, I reported I was not going to do the roll maneuver since I had been controlling in roll and I knew the roll axis was working. I decided to make the yaw left maneuver. When I yawed to the left, the pitch attitude got pretty much out of bounds. I could see some of the Coast out the window, but I wasn't able to identify any portion of it until just prior to retrofire. Then, I could see the Cape very clearly. I could see the Cape and I could see what looked like a very large, almost clear area. I thought at first it was a big, broad runway. Obviously, this couldn't be correct. It was almost perpendicular to the Coast and down near Lake Okeechobee. I don't think it was Palm Beach, but it could have been. I'm not real certain. I think if I got a high-altitude flight across the area, I could identify it. In fact, I guess maybe it was just about where Palm Beach is located. As I yawed to the left, I never did see Cuba. Again, there was high cirrus and this blotted out everything except an area from about Daytona Beach back inland to Orlando and Lakeland and Lake Okeechobee and pretty well down to the tip of Florida.

8. At plus four minutes and 30 seconds, Al gave me a reminder of time as planned and I returned to somewhere close to retroattitude. Instead of firing retros looking out the window as I'd planned to do, I fired them on instruments and I don't have any explanation for this. The only reason I can think of is that the last few flight simulations I had were on the Procedures Trainer using the instruments for control. I think it was just a reflex action that I went to the instruments rather than using the window, the way I had planned. I felt that control during retrofire was pretty

sloppy but that it wasn't too difficult. There was no problem knowing when the retros had fired and as soon as they fired, I turned on the retrojettison switch, switched to rate command, and went to HF. I think I gave Al an adequate time to come up on HF, but I didn't hear anything and this was the time when the Cape came into view. I really got fascinated with this view and I tried to report it, but we were either blocking each other out or something. Anyway, I decided to go back to UHF and try to transmit what I was seeing. I don't know whether anyone was receiving me at the Cape because after I had transmitted this information, Al transmitted and said, "Return to UHF Hi Power," and then gave me a call on emergency voice. I read the emergency voice, but I'm not sure that I "rogered" it. Again, I think that I tried to describe what I saw and I didn't go to the periscope. About this time, I think I got a little bit behind the flight. I saw the periscope retracting and knew that it was time to go to reentry attitude, so I pitched to reentry attitude and held it pretty well. I wasn't able to see any stars at this time, although I did look. The sun was shining in and reflecting on the silver next to the window. The sky just looked black.

9. Reentry - The sun was coming in bright at .05g and I think I would have missed the .05g telelight if I hadn't known that it was time for it. I did see the telelight when I looked real close, but the sunlight was shining in, in that area, and made it difficult to see the .05g light. The reentry was good. As the g's built up, some oscillations showed up on the rate indicators that I couldn't feel in the capsule at all. The reentry felt very smooth to me. The g's built up smoothly and came off smoothly and even though there were some oscillations, I had no problem here. I think I was still in contact with Al after I reported the reentry g's. I reported that my condition was good. I also reported the amperage and the fuel quantity. The fuel was 50 percent just prior to peak-g and 40 percent after peak-g. Everything was normal from there on down. I noticed that the rate-of-descent indicator was pegged before the altimeter became active. I wondered if this was an erroneous indication. but evidently it was accurate. On reentry, I could see shock waves off the shield of the capsule. It looked like smoke or a contrail but I'm pretty certain it was shocks. Reentry was smooth all the way. The oscillation, if anything, was rather comforting. The drogue chute came out OK. I could see it deploy and the bag leave. There was a little pulsating of the drogue chute but it was not distracting. Again, I think it was sort of comforting. I'm not sure that I was in voice contact with anyone at this time. I was reporting my condition and calling out altitudes and some switch positions.

Also, I called, "Going on emergency flow rate," and the periscope extension. Through the periscope, all I could see were small cumulus clouds. I couldn't see any recovery ships.

10. The next big event was "main chute." The main chute came out, reefed and stayed reefed a long time, but it was quite evident to me that it was a good chute. When the chute was reefed, I could see the complete chute out the window, so there was no question in my mind about it being a good chute. It unreefed, producing another slight jolt, and it felt real fine. Coming down on the chute, the fuel dumped and I reported this. I was in contact with the Atlantic Ship.* He was very weak but he was reading me and I think passing on my messages. I don't know what happened to the relay airplane;** I don't think we received anything from him. Card File 21** did give me a call at one time, but I was working with the Atlantic Ship at the time, so I didn't change. The landing bag came out right on schedule. The green light came on and I reported it. In the descent on the main chute, the capsule was swinging and turning a little, but it wasn't at all discomforting. On the way down, I read off switch positions, got ready for impact by taking off my visor hose and opening the visor. I left both ventilation hoses hooked up. I disconnected the biomed sensors after I was on the water.

11. Recovery - On landing, the capsule went pretty well under the water. Out the window, I could see nothing but water and it was apparent to me that I was laying pretty well over on my left side and a little bit head down. I reached the rescue aids switch and I heard the reserve chute jettison and I could see the cannister in the water through the periscope. Then, the capsule righted itself rather rapidly and it was apparent to me that I was in real good shape, and I reported this. Then I got ready to egress. I disconnected the helmet from the suit and put the neck dam up. The neck dam maybe had been rolled up too long, because it didn't unroll well. It never did unroll fully. I was a little concerned about this in the water because I was afraid I was shipping a lot of water through it. In fact, the suit was quite wet inside, so I think I was. At this point, I thought I was in good shape. So, I decided to record all the switch positions just like we had planned. I took the survival knife out of the door and put it into the raft. All switches

*Mercury Network Ship near the landing area.

**Telemetry Aircraft near landing area.

were left just the way they were at impact, with the exception of the rescue aids and I recorded these by marking them down on the switch chart in the map case and then put it back in the map case. I told Hunt Club they were clear to come in and pick me up whenever they could. Then, I told them as soon as they had me hooked and were ready, I would disconnect my helmet, take it off, power down the capsule, blow the hatch, and come out. They said, "Roger," and so, in the meantime, I took the pins off both the top and the bottom of the hatch to make sure the wires wouldn't be in the way, and then took the cover off the detonator.

12. I was just waiting for their call when all at once, the hatch went. I had the cap off and the safety pin out, but I don't think that I hit the button. The capsule was rocking around a little but there weren't any loose items in the capsule, so I don't see how I could have hit it, but possibly I did. I had my helmet unbuttoned and it wasn't a loud report. There wasn't any doubt in my mind as to what had happened. I looked out and saw nothing but blue sky and water starting to ship into the capsule. My first thought was to get out, and I did. As I got out, I saw the chopper was having trouble hooking onto the capsule. He was frantically fishing for the recovery loop. The recovery compartment was just out of the water at this time and I swam over to help him get his hook through the loop. I made sure I wasn't tangled anyplace in the capsule before swimming toward the capsule. Just as I reached the capsule, he hooked it and started lifting the capsule clear. He hauled the capsule away from me a little bit and didn't drop the horsecollar down. I was floating, shipping water all the time, swallowing some, and I thought one of the other helicopters would come in and get me. I guess I wasn't in the water very long but it seemed like an eternity to me. Then, when they did bring the other copter in, they had a rough time getting the horsecollar to me. They got in within about 20 feet and couldn't seem to get it any closer. I finally went swimming over to it and we probably met each other. When I got the horsecollar, I had a hard time getting it on, but I finally got into it. By this time, I was getting a little tired. Swimming in the suit is difficult, even though it does help keep you somewhat afloat. A few waves were breaking over my head and I was swallowing some water. They pulled me up inside and then told me they had lost the capsule.

13. Before I end this debriefing, I want to say that I'll ever be grateful to Wally* for the work he did on the neck dam. If I

*Astronaut Walter Schirra

hadn't had the neck dam up, I think I would have drowned before anyone could have gotten to me. I just can't get over the fact that the neck dam is what saved me today.

III. Special Sensory Areas

14. What were your most outstanding impressions of the flight? Well, I think seeing the sky so dark really impressed me. I didn't expect it to be black, and it certainly was. It was quite dark in the capsule when the sun wasn't shining directly through the window. This occurred after we made the turnaround and it was quite dark which made the instruments a little bit hard to see but all went well anyway. I think my biggest impression was that things were happening just too fast. I wanted to see more than I could see. I did have a sense of zero g. I felt the same way Al did - here I am at zero g, everything's floating around (washers and trash) and I have no other feeling of zero g. In fact I felt just about like I did at one g on my back or sitting up. I definitely had a feeling that I was sitting up, and for some reason that I was going backwards. I don't know why, there wasn't anything going by.

15. Any major surprises? I think the only surprises, I had as I said before, were how beautiful the earth is in this area and the transition from the light to the black sky. It's initially blue and a rather rapid transition occurs to black. The horizon is a very smooth transition from the blue band above the earth to the dark band. It's very vivid when you go from the blue to the dark, and very even all the way around, as far as I was able to see. As I described the sky, it got black very rapidly and stayed that way. The only star that I saw was on launch and it was just a little bright one dead overhead and I looked a couple of times later for others but I didn't see any. At the time I looked I was out of pitch attitude to the point where I couldn't see the earth too well so I had a good view of the sky. And so I don't need to use the debriefing star chart to mark any sighted stars.

IV. Earth and Sky Observations

16. I never was able to pick out the Cape through the scope, but I never really took enough time, I think, to hunt for it. I could see clouds and water but I wasn't able to identify the Gulf Stream. This could have been because it was under high cirrus, but I wasn't able to identify any difference in water color. Everytime I looked through the scope the only impression I got was that the view is blue and white; blue water and white clouds, and that was all. About the only checkpoint I saw

through the window was the Cape although there was a big area down south of the Cape which may very well have been West Palm Beach. I think I'm going to have to fly over and look at this area. The Cape impressed me as looking just about like it does from high altitude, not a great deal different. I could still see light greens and browns and white clouds around blue water. I could see the Banana River, the Indian River and I have the impression that I saw roads yet I'm really not sure. I'm a little bit hazy right there. The only thing that I saw was the Cape and maybe West Palm Beach and I'll have to confirm West Palm Beach later. I didn't see any islands anywhere.

17. I looked up towards the Gulf and was trying to pick out the area around Apalachicola and I think that I could see the coast but it all sort of blended together in a haze. It was pretty difficult to identify but it looked like there was a line right where I expected the north part of the Gulf to be. I couldn't really tell anything about this area since it was so hazy.

Through the periscope I didn't see much, I didn't spend much time looking through it. About the only clouds that I recall seeing were the cirrus type. They looked like they covered fairly large areas and were rather wispy and thin. They weren't thin enough for me to see anything through them though.

V. Description of Horizon

18. Describe the appearance of the horizon. The earth's horizon at the surface is a rather light blue and blends into an almost sharp blue to black and then everything else is black. The layers of the horizon are a blending of blue from the earth's surface and a sharp break from blue to black. I'll have to get a color photo to compare these colors. The photos aren't that fresh in my mind right now.

VI. Description of Weightlessness

19. My sensations and reactions during weightlessness? I think I was reacting properly during weightlessness. My reaction was: well here I am and I feel just like I felt in the Procedures Trainer, no different. In fact, I think if the Procedures Trainer was tilted up to the point where you are actually sitting up it would feel just the same.

VII. Description of Sensory Impressions

20. I could hear some sort of clicking or popping as I used the control handle and I think these were the pitch and yaw nozzles

firing. I know that I didn't hear the roll nozzles. I had difficulty controlling roll, it was very sluggish. It just didn't move as fast as I expected it to. As far as sounds are concerned, you have noise and vibration as you launch, evidently coming up through the engine which is a lot less than you really expect. It's sort of a chugging sensation as the booster continues to accelerate.

21. Smells - nothing.

Sensory impressions - As I said previously I felt a tumble and I can't recall whether it was up or down now, but I have the impression that it was in the pitch axis. The other funny sensation that I had was during retrofire. Prior to retrofire I really felt that I was moving backwards. When the retros fired I had the impression I was very definitely going the other way.

22. Right after retrojettison I saw some things floating around. I'm not sure that it was the retropack but it actually looked like a retro motor at one time. These objects floated across my periscope view a couple of times. I spotted them out of the corner of my eye as they went by. Evidently they were hanging pretty close to the capsule. I guess the only sensory impression I didn't get in training was the reversal of direction of my feeling of movement at retrofire. As the scope retracted and I pitched up into reentry attitude, for some reason I regained my impression that I was actually going backwards from the way I should be for reentry.

VIII. General Questions

23. My general condition at this time is good. I feel fine. A little earlier I might not have said this because I was a little shaky. In fact, I was visibly shaking a little bit. But I feel very good now, calm, relaxed with no discomfort.

24. What were your more outstanding impressions of the flight? I've already answered this question. The whole flight was pretty impressive.

25. Any major surprises? I guess the biggest surprise was looking out the window and seeing the view. It just fascinated me. It almost hypnotized me to where I neglected my other duties.

26. Were any significant physiological problems encountered? No. I felt fine. If anything, the flight was probably easier than any of the centrifuge runs we made. I was all ready

for the g's on reentry and the g's on launch were very easy. The six g's on launch I hardly noticed. In fact, I didn't notice what the peak "g" was on the accelerometer. Four g's is the last reading I remember.

27. Any operational problems? I've gone into this question but again on recovery, I think if you get a man in the water and you've got three helicopters standing by you'd better get somebody in the water right now to help him. If I hadn't had a neck dam on I know I would have drowned this morning. So, of course, that's another recommendation. Put the neck dam up right away. Also I would recommend that you get the mylar raft out and keep it in your lap before egress even though the chopper is there. I think I was just a little bit over-confident this morning. I saw the choppers were there and so I thought everything was going to be OK. And I almost didn't put the neck dam up. But I think that I was just over-confident. I think we should plan for a few more emergencies along the recovery line and follow procedures exactly as we planned, not get hurried and not get over-confident, either.

28. No capsule problems. The capsule worked just like I knew it was going to through the whole flight. The only thing that didn't look good was the HF. I might not have given it a good chance to warm up, but I wanted to report what I saw so I went back to UHF rather rapidly.

29. Did the period of weightlessness have any unexpected effects on your feelings or performance? No. I didn't even know I was weightless, so it had no effect. I'm sure I was performing very well.

30. Most interesting aspects of the operation. The whole flight. It's hard to pick out one point. Like I've said and repeated many times, the view, even though I couldn't see land, was just fantastic. Seeing the curvature of the earth, the black sky, the blue band, a mostly clouded sky, and the Cape, when it finally did come into view, was just flabbergasting. It was beautiful.

31. When was I most excited? I sweated out the first few minutes of launch - hoping that I wouldn't get an abort. Which reminds me. Going back to an operational problem, I think we should do away with the chest strap. This strap caused me quite a bit of trouble when I was trying to get out of the capsule. It got hooked on to a strap on the suit someplace, I guess, and I couldn't get free from it. I think we have too many straps. We need to clean this suit up a little bit. I never needed that

chest strap at any time. In fact, I actually think we could have made the flight without any straps on for my part today. The landing was a fair thump which was the hardest thump I got at any time. There wasn't anything bad about it at all. It was very easy. So that was an operational problem. My major concern was the early part of the launch when I was worried about an early abort. The strap problem would have been a problem there trying to unhook everything in case the tower didn't jettison where you might be able to use the personal chute. So I think we should take another look at our restraint system and see if we can't get by without the chest strap. Maybe even the knee straps.

32. How would you evaluate your performance during your flight? Well, I didn't do as good as I thought I should have. I was convinced that I would do much better than I did. I wasn't controlling my attitudes and rates nearly as well as I felt I should have. I think it was probably because I was dividing my time in a way that I hadn't planned. When I did take a few seconds to try to control such as at retrofire, why, I kept the rates down very well and didn't seem to have any problem with attitude control. But I thought I would be a little more precise than what I was. I was looking through the window after retrofire and not through the periscope and it didn't dawn on me that I should have been looking through the periscope until I saw it retracting. I caught back up with myself and got into reentry attitude and was ready for .05g and the g build-up when it occurred. The star charts I can't use since the only star I saw was on launch. I guess this completes my debriefing onboard the carrier Randolph, 21 July. Gus Grissom signing out.

S E C T I O N B

ASTRONAUT DEBRIEFING

AT GRAND BAHAMA ISLAND

JULY 21, 1961

A. Prelaunch

1. Were there any problems with the insertion and countdown procedures? I can't think of any problems. Everything went much faster and smoother than it had in any of the previous practices. So I have no comments in this area.

2. Were your communications and information flow satisfactory at all times during the countdown? The only thing more I really wanted during the countdown was someone giving me the minus time. The count went along sometimes for fifteen-twenty minutes without a reading and you lose track of where you are in the count. But this is no real problem. Down near the last two minutes of launch, Deke gave me plenty of information. I knew exactly what was happening.

3. Did you have any problems with pressure points, stiffness, ventilation, etc., during the countdown? The only problem I had was with the urine collection device made the night before. It bound me a little bit around the penis. As far as the couch was concerned, it was very good. My right thumb is a little bit sore from having a tight glove. For the most part I was very comfortable. I had no problems with ventilation. I noticed that with the suit inlet temperature of 55° today I was much warmer than I was on Wednesday with 65° because the suit was dry inside. It made quite a difference.

4. Comment on the length of the prelaunch period. Let's see...I got in at 4:00 and I launched at 7:20 approximately. That's only three hours and 20 minutes, which wasn't bad at all. I was still feeling very good. I could have lasted for a longer time.

5. Do you feel you had sufficient training in prelaunch operations directly involving you? Yes, I had all I wanted. The simulated flights that we went through, and, of course, the scrub mission on Wednesday was enough prelaunch training for me. I knew exactly what was happening during the launch.

6. Was the ground checkout procedure with the Control Center Capsule Communicator and other MCC operators satisfactory? Every communications check we made was satisfactory. They were very good all the way.

7. Were you satisfied that MCC operators were happy with the capsule TM measurements at lift-off? I don't know that I have any information as to whether they were happy or unhappy. I had no indication that they were unhappy.

B. Launch and Powered Flight

8. What were your predominant sensations during powered flight? Well, at first I was a bit scared, but as the booster continued ok and I felt the g's increasing, I began to have a lot more confidence and when the cabin pressure sealed, I was really elated. I felt then that it was really going to go. Vibrations were very mild. They didn't interfere with my vision or radio transmissions.

9. Relate these sensations to the overall flight environment and to your previous piloting experience, if possible. Well, I don't really know of anything you can relate this to in flying. You feel the g's building up but you really don't have enough of a view outside to relate this experience to flying other than seeing the clouds approach. You go through the clouds rapidly as you do in an airplane. As far as the thrust is concerned, you hear a little more noise than you would hear in an F-106 with the After Burner on and there is more vibration than in an airplane. You can feel a little bit of roughness, probably from the booster guidance system.

10. Did the ECS perform properly during the powered flight phase? It certainly did, all the way. It sealed off at 5.5 psi and stayed there while the suit showed a pressure of 5 psi.

11. Did vibrations interfere with the readability of any of the instruments? No. I called out the start of the vibrations on the launch but they were not bad at all. I was able to see the instrument panel and all the instruments clearly at all times, and was also able to transmit quite clearly. Evidently the fairing and the extra damping in the instrument compartment, etc., must have solved this problem.

12. Did any capsule components vibrate excessively during powered flight? Describe. Not to my knowledge. I didn't see any vibration.

13. Did all telelights operate correctly through separation? If not, what did you do? Yes, they did. The tower separation and cap separation lights came on exactly on schedule, exactly as the event happened.

14. How good were the voice communications during the powered flight phase? Describe. Very good. I was reading Al quite clearly at all times. As far as his communications to me were concerned, they were very good. Excellent!

15. Can you identify the major sources of background noise at various times? (Booster, aerodynamic, RF, inverters, fans, etc.)? Well, booster noise is quite clear. You hear the booster as soon as it ignites until cutoff. Aerodynamic noise, I guess, is what we're picking up when going through Mach 1. This noise builds up and dies out just about this time. The booster noise is the predominant noise that I heard. I didn't notice any RF, inverters, fans or any other noises.

16. Are you satisfied with the procedure for reporting cabin and suit pressure during the critical phase from 73 to 86 seconds (Redstone) from both a "ground" and your point of view? Is it a proper abort procedure? Yes. I don't know how else you'd report these pressures other than calling them as you see them and reporting them when they hold. There is no question but that this is the instrument you're watching at this time, so it's quite natural to call it out. It is a proper abort procedure. If cabin and suit are losing pressure, you absolutely must abort. If just the cabin loses pressure, I don't think you should abort on the Redstone.

17. Could you discern booster cutoff and tailoff characteristics? No. When the booster cutoff and the escape tower jettisoned the only thing I was cognizant of was the view of the tower leaving the capsule. I did get a tumbling sensation when I went from 6 g's, to zero g, but I didn't notice any cutoff or tailoff power.

C. <u>Zero-g Phase</u>

18. Comment on ECS cooling during weightlessness. It was adequate. I felt fine the whole time. I don't recall what suit temperatures were, but I didn't notice any undue heat.

19. What motions did the capsule go through at separation? What were your cues? The first cue was going from 6 to zero g. My sensations were the same as during the centrifuge runs. When you stop on the centrifuge, you feel like you're tilted forward. I couldn't figure out what was going on at first, but it dawned on me quickly that this is what had occurred. At this moment the capsule was stabilized and I was looking out at the black sky. I couldn't see anything but my instruments and the black sky at this time. Then capsule separation occurred and this event is loud and clear. You hear a loud bang as you separate from the booster when the posigrades fire. There's no doubt in your mind when you're separated. You don't need any other cues for this event. Then there was five seconds of damping before the turnaround started. The turnaround was a weird sensation.

I could see the sun's rays moving toward my face and it worried me a little that the light might cross my face and blind me but it never did. As I turned around away from the sun it became dark and I saw the horizon on the earth and I was just lost from there on...the greatest thing I've ever seen. There's no question about concentration on the instruments and ignoring this view, you just can't do it. I glanced around at the instruments in the turnaround and I could see what the capsule was doing, but I couldn't care less right then. The view was really something. At about the time I expected the capsule to be near retroattitude, I started taking a closer look at the instruments. The capsule was almost stabilized in pitch and yaw at this time but I was off somewhat and roll rate was at about a half-scale position to the left. I gave it about 10 seconds longer than I normally did on the trainer before I went to manual control. I'd already pulled out my manual handle when Al gave me a call. I suspect I hadn't reported my action, but I already had the manual handle out when he called me. (Am I getting too far ahead here? I guess I am. I'll just go on with the next question.).

20. Was the sound level annoying or painful? At no time did I have an annoying sound level. You can hear the escape rocket, the posigrades and the retrorockets fire and feel the acceleration. You can hear the pitch and yaw jets fire. Of course, the radio is on all the time, but I heard no annoying sound.

21. Did the escape motor shake the capsule or make the shingles flutter? No, it didn't shake the capsule at all, and I couldn't see the shingles. I could see it take off, peel off to the right. I saw the tailoff of the rocket for what seemed like a long time, probably a very few seconds, until it just disappeared into the black.

22. Did you think the tower either hung up or struck the antenna fairing during separation? No, there's no doubt in my mind that it jettisoned cleanly. You could see the whole tower move away from the capsule. I don't recall seeing any flame but I do recall seeing a white smoke.

23. Was there any deterioration of visibility through the window as a result of escape motor firing? No, none at all.

24. Did you see the tower during separation and did you see the exhaust? Well, I've already discussed this question. I did see it peel off to the right and tail off.

25. Could you sense separation of the capsule clamp ring? I don't recall the separation of the capsule clamp ring. The only thing I recall is the loud bang I heard as, evidently, the ring separated and the posigrades fired, at the same time.

26. Did capsule separation occur immediately? Yes, it did. I could tell by the acceleration I received. The g's were very slight, but I could feel them and, I got a green light immediately.

27. Was the booster pitching, yawing, or rolling at this time? I didn't see the booster at any time. I didn't see anything that I recognized as the booster.

28. Could you detect posigrade rocket firing? Describe. I've already answered this question. Yes! You can hear and feel them.

29. What did you see, hear, and feel during retrorocket firing? Describe. I wasn't right on retroattitude during retrorocket firing, but evidently I was within limits. There was no doubt when they fired. I don't know if this was built into my mind or not but I had the sensation of going backwards before retrofire occurred. As the first retrograde fired my direction changed so I felt I was going forward. You can feel the g's and feel the capsule yaw around. You can control the motion all right, and it's very definite when each one of the retros fire. There's no question in your mind. You don't have to look at the accelerometer or anything else. I could feel the motion; it was mostly yaw with a little bit of roll and pitch. The first retro took me off to the right and rolled me slightly and I don't remember the specific motion from that point on but the first motion was almost a right turn.

30. Could firing of individual retrorockets be detected? Yes, by both the g force and sound.

31. Could you sense separation of the retropackage and did it affect the capsule in any way? I heard a noise when the retropackage jettisoned and I saw something float by the periscope at this time. It looked like two of the retrorockets that had come out of the package. They floated by and a little bit later floated by again and evidently fairly close to the capsule since they looked like they were about an inch across in the periscope.

32. Did retropackage straps spring back and strike the capsule? Not to my knowledge.

33. Did the ASCS sequence properly and did it hold the correct attitude (rate damping, turnaround, etc.)? How? Yes. The turnaround came out very nicely with some oscillations. It's sort of a weird looking maneuver. It seemed like the ASCS was a little bit slow in roll, but roll seemed slow or sluggish to me not only on the autopilot but on manual and rate command control. It didn't have as quick a response as the air bearing and Procedures Trainer have. I think the pitch and yaw response was fairly realistic. The rate damping was good, very steady and the turnaround was a smooth operation. It was sort of an oscillatory movement....hard to describe as I looked out the window. I just couldn't keep from looking out that window so much.

34. Could you hear the operation of the control system (i.e., firing of the control rockets, action of solenoids, control linkages, etc.)? Yes, I could hear the yaw and the pitch nozzles firing, and I'm not certain, but I think that on the rate command system I could hear the solenoids clicking. I wondered about this at the time, but didn't have a chance to really listen to make sure. There were some other noises there besides the rockets firing. Perhaps the rockets were firing very short and very crisp. There was a sharper noise as I was going on the manual control.

Did you see the exhaust from the pitch-down thruster system? To my knowledge I didn't see the exhaust from any of the thrusters. I didn't see anything that I thought was exhaust.

35. Comment on the quality of the hand controller for each manual control mode tried (i.e., effectiveness, backlash, slop, binding, lag). Well, I felt a little overbalance on launch and some on reentry. I think it was a pitch-up motion but it was slight. It didn't seem to effect anything very much. The backlash and slop wasn't bad at all, about the same as the Procedures Trainer.

36. How did performance of the manual control systems compare with what you expected as a result of training on the various Mercury simulators? Well, here again, it seemed to be about the same except for roll, as I thought roll was sluggish. Pitch and yaw responded well. I didn't do a good job of controlling but I think this was because I wasn't concentrating completely on the instruments or the outside. I was switching my reference back and forth so that I didn't do a good job on either one. I don't know exactly why, but I'm sure that's what was happening.

37. Did you have any unusual physical sensations from capsule motions? No, not during the zero-g phase. I felt as if I was sitting here on the ground at 1 g. I could tell I was at zero-g since the time zero cover, some washers, and other bits of materials were floating around through the cockpit. Even though it was quite dark at this time, I could still see this junk occasionally float between the window and my eyes.

38. Could you feel angular accelerations during capsule motions? Yes, during retrofire and turnaround I could feel angular accelerations. I don't think I really could feel when I was controlling and moving the capsule around. It was somewhat like flying an airplane; you just wander over here and there.

39. Did the periscope, window, and instrument attitude references agree during the mission? Well, I only took a few short glances through the periscope. The window and instrument panel agreed. When I had zero roll on the instrument panel I had zero roll out the window.

I didn't have any yaw reference until after retrofire when I saw the Cape. It was very cloudy and I really couldn't recognize anything. I did see an area which I think was southern Florida, but I couldn't adequately identify it.

40. Could you determine yaw attitude:

a. By checkpoints through the window
b. By checkpoints through the periscope
c. By terrain drift through the window
d. By terrain drift through the periscope

a. No. When I made the left yaw maneuver I couldn't tell I had yawed. It looked the same to me as zero yaw. I couldn't pick up any drift. When I had the Cape in sight I had a good ready yaw reference and could control on that basis.

b. Checkpoints through the periscope? I didn't try.

c. By terrain drift through the window? I did try but I couldn't tell a difference. I don't think the capsule was moving fast enough for a yaw reference from terrain drift. Maybe if you were in orbit where you had a long time to look you could tell, but in this short a period of time I couldn't pick up any movement.

d. By terrain drift through the periscope? I didn't try.

41. Could you determine yaw rate:

a. By movement in the periscope
b. By movement in the window

a. By movement of the periscope? Again, I didn't try.

b. By movement in the window? Yes. Very definitely.

42. Did sunlight affect the visibility of any of the instruments or controls? Was it necessary to adjust the capsule light to compensate for this effect? Yes, it did. It's quite blinding when it comes in as a shaft of light with everything else in the cockpit dark. In fact, the cockpit was very dark, and you have difficulty seeing any of the instruments. Maybe this is because the earth is so bright. It was quite hard to see the attitude indicators or the rate indicator because it was so dark. Was it necessary to adjust the capsule light to compensate for this effect? I didn't have time; besides that, the lights were on maximum brightness anyway.

43. Describe the appearance of the earth, sky, and stars relative to colors and light intensities. (Refer to earth-sky camera pictures). The only star I saw was during launch, and I saw it at about a minute and 30 seconds. Then it gradually disappeared and I didn't see it anymore. We went on into a darker and darker sky. The sky on launch turns from blue right into black as you go up. It was quite a sensation, since it goes from blue to black so quickly. The Cape was the only really good reference I had to use on the earth. In southern Florida I could see light green, which must have been the boondocks down there. I could pick out the Banana River at the Cape and the Indian River. I could see the peninsula that runs south. Down the coast of Florida I saw what must have been West Palm Beach. It looked like it was laid out in plan form with rectangular shapes. It was a dark brown color and quite large. This is the only thing I can identify it as at the moment without flying over the area and taking another look. The colors were rather green and they were very similar to what you see flying at 40,000 feet or so. In fact, the Cape looked a lot bigger than I had expected it to look. As far as going from earth to sky, it's pretty much like the photographs we have except that I think the sky is a lot blacker. It's very black, and as you leave the earth there's a blue band that fades right into the black. The curvature of the earth is apparent and the band I mentioned is of even thickness all the way across. It was about a quarter of an inch wide through the window. I don't know what the actual thickness is but this was my impression.

44. I don't recall seeing any stars but the sky was black all over. I wasn't particularly looking for stars, but I think if they had been there, I would have seen them. Later I did look for them on reentry and I didn't see any. The one during powered flight is the only one I saw. The color of the sky was absolutely black.

45. Were controls easier or harder to reach under zero g? No difference -- no problem under zero g.

46. What items, if any, vibrated excessively during zero g? None vibrated at all.

47. Could you identify major sources of background noises at various times during zero g? Well, I wasn't aware of any annoying background noise. There was almost continuous contact on the radio. I was either transmitting or receiving most of the time. I could hear the nozzles firing, but I don't recall hearing any other noise in the capsule.

48. Were any objects floating in the capsule during weightless flight? Yes, I saw one washer, a lot of dirt and some other things that I didn't really try to identify. I just saw objects floating around my periphery vision. Occasionally the debris came between the window and me, but it didn't interfere.

49. Compare the sensations (sight, sound and feel) during retrofire versus the ALFA trainer and the Procedures Trainer and the Centrifuge. I can't really say that there is a direct comparison because I was looking out the window, and your motion during retrofire is quite obvious when looking at the horizon. I could see I was yawing to the left and rolling.. This isn't as obvious to me on the ALFA Trainer. I don't know why I switched right back to instruments to finish retrofire instead of staying on the window. I actually didn't realize I had switched references until the retros had finished firing. The control of retrofire was about the same as on the Procedures Trainer. I think the air-bearing trainer is a pretty good simulation of the way the maneuver feels with the exception of the visual presentation, of course. The centrifuge retrofire acceleration wasn't anything like the flight. The flight is a very smooth acceleration without a jolt or jar. I felt the pulse of g of each retro but it wasn't a jar at all.

50. What was the difference in the degree of difficulty in controlling retrofire as compared to controlling retrofire simulation presented to you during your training on the ALFA Trainer? I think the ALFA trainer is a pretty good simulator for retrofire. The control of the flight retrofire didn't appear to be particularly difficult, probably I should have done a lot better on it than I did. Retro-fire runs on the centrifuge were much more difficult with the jolting and jarring which make them much more difficult to control. Control of the flight retrofire was easier because the acceleration is smooth and you can tell when the next retro fires. As far as the Procedures Trainer is concerned, the instrument displays reacted quite similar to those in the flight. The rate indicators looked about the same. As I previously said, I think I had some trouble with the roll axis being a little sluggish. It was no real problem though.

51. Did the whole body motion training received on the ALFA Trainer help you in flying the capsule at zero g? Yes, I think it did. I think we probably need to make the horizon simulation more realistic than the one on the ALFA Trainer now. For a Redstone mission, we need a bright round earth and a black sky so that you can get a little better reference. But as far as controlling yaw, roll and pitch, the ALFA is a very adequate trainer.

52. Were you aware of any resemblance between the angular accelerations you experienced during weightlessness with those experienced during the ALFA Trainer? Well, there is little bit of difference on the ALFA Trainer since you are laying on your back. During actual zero-g, I had a definite feeling that I was sitting upright. Perhaps this was because I was looking out at the horizon. I seemed to be getting more of a floating sensation than I did on the ALFA Trainer. As I yaw across the horizon on the ALFA Trainer, I feel a definite yaw movement. During zero-g, it was more like floating. The capsule was just floating around. I was upright and floating around very gently. There is a difference but I'm not sure just what it is. I don't know if it was the rates or that I was busy looking out at the sky, but there is a difference.

53. Did you see the booster after turnaround? No.

D. Reentry

54. Compare your reactions to the reentry acceleration profile to correspond with your experience on the centrifuge. Well, I thought the reentry was a lot smoother than the ones we ran on the centrifuge at Johnsville. The accelerometer only went up to 10.2 g's during the flight. I got some indications of pitch and yaw rates which I tried to damp out, but I didn't do a very good job of it. I couldn't feel these oscillations at any time in the capsule. I could tell the capsule had rates only from the rate instrument. During peak-g, rates were pretty much the same as on the simulator. I came down to low frequency and large amplitude oscillations, almost full scale and then came down to small amplitude oscillations of about, Oh, I judge about 2° per second as I recall, plus or minus 2° per second. This was in pitch, yaw and, of course, the roll rate was already in. G-buildup was very smooth and tailed off very smooth, with no vibrations. I thought it was a lot easier than the centrifuge. Of course, I was probably pumping a little bit more adrenelin too.

55. Comment on ECS cooling during reentry. It was fine. I had no problem.

56. Did the telelights all work properly between .05g and main? Yes, I almost missed the .05g light coming on at the time because the sun was shining on the window. I don't think it was shining directly into the cockpit, but it was very difficult to see the .05g telelight. When I saw it was time for it to come on I looked over and sure enough, it was on, but I didn't see it come on. It was very dim. All the telelights worked properly during the whole flight.

57. Were cabin or suit pressure changes excessive during reentry? There were none that I could notice.

58. Did you lose communications during reentry? Yes, I did. It was after peak-g. I forgot the last acknowledgement I had from Al, but I think it was after peak-g. I kept transmitting to him or anyone but I guess I was out of range for Al. During this period I probably didn't transmit too many times because the altimeter was unwinding pretty rapidly. The Procedures Trainer seems to take a longer time to get down. I was worrying about the drogue chute coming out at this time, so I started watching for the drogue chute and had my hand on the button.

59. Did any capsule components vibrate excessively during reentry? No, I wasn't really looking around too much but everything looked fine to me.

60. What was your first cue of g reccurring upon reentry? Well, I felt it first and then called "g's building". I looked at the accelerometer and it wasn't quite up to 1 g. I felt it pretty early. I looked out the window at something else and the next time I called it, it was about 6 g. I called 6, 9, peak and a couple more readings on the way back down.

61. Were there any oscillations of the capsule during reentry? According to the rate indicators, there were, but I couldn't feel any. I was quite amazed at this because it felt very smooth to me. The amplitudes prior to peak g were increasing in pitch. I think I had yaw down to pretty low values for a while at least. Pitch went full scale at least once or twice and then went down to about 2°/sec. After peak g, the rates stayed quite low.

62. Were you aware of lateral accelerations during reentry? No, and I don't feel it is important to simulate these on the centrifuge.

63. Was there any noticeable difference between the linear acceleration sensations experienced in the capsule and on the centrifuge? Yes, the flight was a lot smoother. That's about all I can say. There obviously isn't any stepping or roughness in the flight. It seems to be a lot easier. I think the centrifuge training is adequate. I don't see why we should change anything to make it easier.

E. Landing

64. Was the capsule stable during drogue deployment? Yes, it was. The drogue came right out. I could see it the whole time. I saw the cannister leave and the drogue deploy. You can feel it pulsing a little bit, but it is not as bad as the vibration of lift-off. In fact, it is a pretty good feeling. There was a little bit of swinging and some angular motion between the capsule and the drogue chute but I could only tell this by looking at the drogue chute.

65. Did you hear the drogue mortar? Yes, I heard the drogue mortar fire.

66. Did the drogue deploy automatically? Yes, right on schedule.

67. Describe the drogue opening shock. It was on the order of a couple of g's. As I said, it felt good, and I don't know how else to describe it.

68. What was the indicated altitude at drogue opening? As near as I could tell, the altitude of drogue opening was just about 21,000 feet. I was watching the altimeter quite closely when I heard the drogue mortar fire. I looked out the window and saw the whole sequence of drogue deployment.

69. Did the drogue canopy "pulse"? Yes, it did. It was hardly enough for me to feel.

Did the capsule stabilize after drogue opening? The capsule was stabilized after drogue, though there was a slight angular motion between drogue and capsule. I would estimate this motion to be not more than $\pm 15^{\circ}$; maybe not that much. The capsule was swinging relative to the drogue chute a small amount.

70. Did the snorkel door eject properly? As far as I know, the snorkel operated properly. The snorkel opened at the same time the drogue deployed. I am fairly certain of that. I know the emergency flow rate occurred at this time.

71. At landing did the relief valve function properly and did the snorkel valve prevent seepage? Evidently it did. There wasn't any seepage that I could detect anywhere in the capsule.

72. Was the capsule stable when the antenna section jettisoned? Yes, I could see it eject outward, directly behind me.

73. Did you hear the antenna mortar? I don't recall hearing the antenna mortar.

74. What was the indicated altitude at antenna jettison? It was just about 10,000 feet.

75. Did the antenna jettison automatically? I guess it did, I didn't do anything to make it jettison.

76. Could you hear the opening of the main chute? No, I couldn't hear anything but I could sure see it. I could see the whole deployment. I could see the complete chute when it was in the reefed condition. After it opened I could see 75 percent of the chute out the window. I could see well beyond the center of the chute and since there was some swinging and rotating, it was no problem at all in seeing the complete chute in a matter of probably 15 or 20 seconds.

77. Did any noticeable angular accelerations accompany the main chute opening? As the main chute deploys it stabilizes you in a rather smooth operation. You get a little jolt as it first opens, but it's not bad. As it unreefs, you get another slight jolt which is a little bit larger than the first one. Maybe I was a little more relaxed and noticed it more the second time. When I saw it unreef, it looked good, and I relaxed some.

78. Describe your view of main chute deployment. I have already answered this question. I had good view through the periscope too and could see it quite well there also.

Could you see any chute riser damage? I couldn't see any riser damage, but there was a triangular rip in the chute that was about 6 inches on the side. There was one other hole I would guess about the size of a half dollar or quarter. The rest of the chute seemed to be in perfect shape.

Was the capsule turning relative to the chute? Yes, it was turning and swinging a little bit. I would estimate the amount to be only ten or fifteen degrees; not very much. The period of rotation was on the order of a minute or a little less. It was hard to judge, but the capsule was turning around slowly, and reversing its direction. It was not enough to bother me at all. The chute canopy was very stable.

79. Describe the capsule motion after main chute deployment? I've just completed this question. It was swinging and rotating a small amount.

80. Did the main chute sequential light work normally? Yes, it did. I got a green light at the correct time.

Not applicable.

81. Were angular accelerations noticeable at deployment? No, I don't think so. The capsule was in a pretty stable condition at this time. The chute streamed straight out behind me.

82. Was it a clean deployment? Yes it reefed and came right out.

83. Did the impact skirt deploy normally and did the sequence light work properly? Yes. I didn't time it, but it must have occurred at approximately 12 seconds. After the chute had unreefed and I had taken a look at it, I felt the impact bag drop. This was my clue to glance down at the indicator light which was already on.

84. What time did the skirt deploy relative to main chute deployment? I think it was right on time - about 12 seconds.

85. Did the heat shield drop have any shock? I could feel it but it was just a slight jar as it dropped down.

86. Describe the voice communications with ships and aircraft during parachute descent? I was in contact with the Atlantic ship Cap Com, but communications were very weak. Evidently, he was reading me. I called off some altitudes to him, but he had a hard time determining whether I had my fuel dumped or not. I had to call this to him several times. He was very weak to me. Later Card File 21 called me but then Hunt Club gave me a call, so I started working with Hunt Club.

87. What was the approximate capsule attitude at impact? Well, I think that I hit a little bit on the left side. After impact the capsule went immediately over on its side, the windshield was completely under water and I felt that I was lying on my left side slightly head down. With the window under water the tower was probably pretty well under water, so I decided not to switch the Rescue Aids switch to manual immediately since the reserve chute might be under water. I waited a few seconds until I saw some light out the window and then switched to manual rescue aids. The reserve chute ejected immediately and I could see it in the water through the periscope. The capsule then righted itself in less than a minute. It came to a very near vertical position and was stable. At this time, I felt like I was in very good shape. That's why I went ahead and told the Chopper not to come in right away and I started to mark up the Switch Chart. I had a lot of trouble trying to use a grease pencil on this chart with pressure suit gloved hands.

88. On what part of the chute swing did landing impact occur? I don't know. I was watching the water advance towards me through the periscope.

89. Describe briefly the landing impact? I've just answered this question. Compare it with a common experience? I don't know of anything comparable. It's not a very hard jolt. There was no tendency for me to slouch around or move out of the couch. I didn't have my straps very tight. My seat belt was reasonably loose. My chest strap was sloppy. The shoulder harness was fairly snug. The knee straps were quite loose. So, there was no tendency to come out of the couch at impact. Most of the shock was taken up by my back and slouching occurred later and this was on a low order.

90. How long did it take the capsule to right itself? Probably on the order of one minute. Maybe less, but it didn't take long after it came up enough to eject the reserve chute.

91. What was the final trimmed angle of the capsule in the water? It was very nearly vertical, as near as I could tell. It felt like it was vertical, and looking out through the periscope, it looked like it was.

92. Did the main chute disconnect normally? I think it did. I didn't see it go, but it must have. The reserve chute ejected normally and it was quite evident when it ejected because I heard it and could see it through the periscope floating in the water.

93. Did any equipment break loose at impact? No. Everything in the capsule was intact.

94. Could you anticipate the landing time and prepare for landing shock? Yes, by looking out the periscope, you can see the water coming up. I watched the altimeter until it got to about 1,000 feet and then I started concentrating on the periscope. You can see the water rushing up and you know you are going to hit pretty quick. You can't tell the exact time. You can see so much better out the periscope than the window since it has a much greater viewing angle. I was watching the water and looking for helicopters, boats, etc. You know you are going to impact in a few seconds, so all you have to do is hang on.

95. Could you estimate your horizontal speed at impact? My guess would be it was zero. Probably wasn't zero, but I couldn't tell if it was anything different. Probably I was drifting in the direction that caused me to roll on my left side. I couldn't pick up any landing speed through the periscope.

F. Post Landing

96. Comment on the period of time when you were waiting for recovery vessels or aircraft. Well, during this time, I prepared myself to get out of the capsule. This was the first thing I did. I disconnected my helmet, rolled up the neck dam and got everything unhooked except the suit inlet hose. With the suit inlet hose still connected the neck dam tended to balloon up but I just let it flutter or I pulled it to one side to let the air escape. Then I got the switch chart out and marked the positions of all the switches. I read off all the valve, battery and switch positions into the tape recorder. I took the knife off the door and stuck it in the suit survival kit, and all this probably took a matter of 5 minutes. I wasn't rushing at any time because the capsule was floating well and the Chopper's were outside. I thought I was in pretty good shape so, I was just taking my time trying to get all this done.

97. Comment on ECS cooling during the post impact period? I was comfortable enough and I didn't notice any increase in temperature. I think I would have been comfortable in the capsule for quite some period of time. I don't know for how long, but I am sure for a half hour, or an hour more I would have been all right.

98. Was there any leakage in the capsule from any source? Not until the hatch blew.

99. Describe the voice communications with the ships and aircraft during the post impact period? I was in contact with Hunt Club and communications were very good.

100. After landing, could you tell the status of the following rescue aids: SOFAR Bombs, No. Chaff, No. Beacons, No. Dye Marker, No. Light, No.

101. How rapidly did the battery voltage deplete after landing? The last time I took a check on the batteries, they were still in good shape in the order of about 25 volts all around as I recall. My last current reading was after jettison of the reserve chute and as I remember it was on the order of 19 amps.

102. Could you detect the erection of the HF antennas? No.

103. Was steam noticeable at any time? No.

104. Did you think the heat shield was still hanging below the capsule while floating? I hadn't given it a thought. The capsule was stable and as far as I could tell it was still on the capsule.

105. Did the explosive hatch eject properly? No! I will relate the hatch experience once more. I called the helicopters and told them I was ready to get out as soon as they had hooked on and when they gave me the call that they were hooked on I would get ready to come out. I would take off my helmet, power down the capsule and blow the door. As I recall, he rogered this transmission. So then he called me on the base leg and on final. While the chopper was making his approach, I took the detenator cap off and put it down toward my feet. Then I pulled the safety pin out and I dropped it, as I recall. I was just lying there, waiting for the Chopper to come in. I had the helmet broken loose and the neck dam was up. I heard this "pow" or dull thud which really wasn't a loud explosion. I looked up and could see blue sky, and water running into the capsule. This gave me a little start but I immediately flipped off the helmet and scooted out the hatch without a single thought of taking the survival kit with me. I think this was probably just as well, in this case, since the Chopper was overhead and I had the neck dam up. From my experience I think one of the first things

you would do on the water is to remove the survival kit and place it on your stomach all ready to egress in case of trouble. Go ahead and prepare for an emergency. I commented on the noise of the hatch blowing. It was like a dull thud. I didn't see it go nor did I notice any debris in the cockpit.

106. Describe your egress from the capsule? I went out so fast, I don't know how I got out. I remember reaching up and grabbing the edge of the instrument panel on the right side and that's the only thing I remember. I popped out. I took the helmet off and I think I dropped it on the left side. I'm not even sure where I dropped it. I remember grabbing the panel and coming out on my back.

Any problems or changes recommended? As far as egress is concerned, no, I can get right out without any trouble.

107. During egress did you encounter any hot spots on the capsule? No.

108. How much of the survival equipment was used? Only the neck dam. Was everything adequate? The neck dam, while it saved me and was comfortable enough, it just wasn't big enough. I think we can say it was adequate, but it wasn't as good as it could be. I'd have felt a little more secure if it had fit tighter when I was out there in the water.

109. Did you notice any deficiency in the status of training relative to capsule egress? Well, I 've been thinking a little bit about recovery since this happened. It seems to me that this is probably our weakest area in the whole training program. When we get into orbital flights it's going to be pretty difficult to predict landing conditions and where we will come down. I think, certainly before we have a manned orbital flight, we ought to make a renewed effort on survival training. Before the flight I felt that this was my weakest area. Maybe because it's been a long time since I've had any survival training. I knew that I could get out of the capsule all right and I knew that the choppers could pick it up all right, but it seems to me there's a lot of unknowns in this area. Maybe more than there is in the other areas. This is the portion that seemed to concern me most.

Was the capsule more or less stable hydrodynamically than the Egress Trainer? With the very small swells we had out there, I'd say the capsule is about like the Egress Trainer in the tank.

G. Recovery

110. Were there any difficulties during the ship or helicopter pickup? Describe. Yes. The chopper hadn't hooked onto the capsule when the hatch blew off and still hadn't hooked on when I was outside the capsule in the water. When I got out into the water there was a strap hanging over me. I guess it was attached to the capsule. I'm not sure where it was attached but I was concerned that it might entangle me like a chute. So the first thing I did when I got into the water was to make sure I wasn't hooked to the capsule because I knew it was going right down. Then I saw the chopper crew trying to hook onto the capsule and they were having difficulty. So I swam over and was going to help him hook onto the capsule but he hooked it just at that moment. You know how the hook fits on the pole and when you snag onto the capsule it drops off the pole. Well when that hook dropped off the pole I almost had a heart attack because I thought we'd lost the capsule. Then he picked it up, of course, and I really felt good. I thought, he'll just pull it right straight up like he would normally and drop a horse collar down to me. But instead, he moved off to one side and left me out between the choppers. At this time I felt like I was in good shape. It wasn't until a little bit later that I noticed that I was riding a little bit lower in the water than I had been. I suddenly happened to think that the suit inlet connection down on the side of my pressure suit was not locked so I reached down and locked it and that stopped anymore water from coming in the suit. Swimming around in the suit was pretty difficult, always trying to keep my head up out of the water. The last time I saw the capsule and the helicopter they were about 20 or 30 yards away from me with the capsule impact bag part way out of the water. At this time I was either being blown away or I was drifting away or they were drifting from me, I'm not sure which. I saw the other helicopter coming in then and when I looked up I recognized Cox before they got very close and thought, well, I've got it made now. Then they had trouble getting the horse collar to me. OK. I think helicopter pickup has been described fully.

111. Were any recovery ships or search aircraft sighted while the capsule was still descending on the parachute? No. I was looking through the periscope but I couldn't find any.

112. Was adequate information obtained from the recovery helicopter or ship to allow you to decide whether to egress or not before capsule pickup? Yes, I knew I was in good condition and the helicopter was right there, so I had all the information I needed.

113. If you did egress prior to capsule retrieval, did you receive assistance from recovery forces and was it adequate? At the time I didn't really feel that it was adequate. I was having a little

bit of difficulty staying afloat the last few minutes. I felt they should have put someone over the side of one of the helicopters or the boat to give me a hand. I was worried that the neck dam might not stop me from getting flooded and I would go right on down. I certainly would have appreciated some help along about this time.

114. If you remained in the capsule until it had been retrieved by recovery forces, did you receive proper and adequate assistance from shipboard personnel during capsule egress? Not Applicable.

S E C T I O N C

ASTRONAUT DEBRIEFING

AT CAPE CANAVERAL

JULY 23, 1961

I. Questions in Specific Areas

A. Aeromedical

1. Did you experience dryness of the nose and throat? When? No. Not at any time.

2. Were you thirsty at any time? When? No. I wasn't aware of being thirsty at any time.

3. Was your mouth dry? When? No. I don't recall my mouth being dry at any time.

4. Did you experience an urge to defecate? When? No. No problem there.

B. Evaluation of Capsule Systems Operations

5. Comment on your suit. Do you suggest any changes? The suit functioned well. It was comfortable. The new wrist rings helped a great deal in making arm movements and hand movements easier. I have no suggestions for improving this suit. Maybe a neck ring might help as much as the wrist rings helped, other than that...I can't think of anything.

6. Comment on your parachute harness? Changes? The parachute harness was very comfortable. I wasn't even aware that I had it on, so I really can't recommend any changes there. I'm not real sure we need the parachute, so in that case we could do without the harness, of course.

7. Comment on your couch. Changes? The couch was a perfect fit. I had no rough spots and there were no pressure points at any time.

8. Comment on your restraint harness. Changes? Well, I feel that the restraint harness is too complicated. There are too many straps. It certainly holds us in very well but it's too

complicated and too difficult to get off in a hurry. My feelings are that we probably could do without the chest strap and the knee straps. I'd like to see the harness cleaned up so that we would have less chance of getting snagged on something in the capsule in a rapid egress.

9. With regard to the ECS, could you hear the fans? Was there any apparent change in fan operation? If so, when? I could hear the fans prior to launch but after we launched I don't recall hearing them again. Was there any apparent change in fan operation? Not to my knowledge.

Was there any noticeable overpressure in your suit at any time? No.

Was there any noticeable negative pressure in your suit at any time? No. Did you take any measures to correct this? Doesn't apply.

Could you hear the demand regulator? No.

Could you hear oxygen flow through the helmet exhaust hose? Yes, I could but it wasn't annoying. This noise is with you from the time you go onto the oxygen system so you get used to it and it just blends in with the rest of the background noise. It's one of those things you just ignore.

Did it interfere with communication or your ability to concentrate? No.

Did you use emergency oxygen? I went on emergency flow rate automatically at 21,000 feet which is the normal time. I couldn't tell if this made any difference in my cooling or not. I was very comfortable before and after actuation.

Was adequate temperature control maintained in suit and cabin throughout the mission? I was very comfortable the whole time. Prior to launch the suit inner temperature got down to 55° and this didn't feel cool at all. In fact, I felt that I probably could have stood it a little bit cooler. Cabin temperature at this time was 95° and the suit inlet temperature was 55°, at least this is what the instruments indicated. It didn't really seem to me to be actually that cool. On Wednesday, when the mission was scrubbed I had a damp pair of underwear on and a temperature of 61° almost froze me out. I was real chilly and I was getting to the point where I was actually starting to shake a little bit from chill before I got out of the capsule. On launch day, with the urine device I had on, the suit was dry and this made a tremendous difference in the body cooling. This 55° was keeping me comfortable

but it certainly wasn't making me cold.

Was the temperature control variation adequate? Well I didn't try any temperature control, I just turned it full cold and let it go. I don't think there was any coolant quantity used during the whole flight, as I recall. Seemed to me this is one of the things that surprised me when I was on the water. I read off coolant quantity and saw that it was still 30 percent.

Did you notice any leakage in coolant tank or circuit? No.

Did the ECS signal lights operate properly? No. The O_2 quantity light kept coming off and on like it had done before launch through the whole flight. But this is a known malfunction so it didn't concern me at all. We probably should have taken the bulbs out and I don't know why we didn't. When we have a warning light obviously malfunctioning I think we should take the light bulbs out so we won't have the confusion of a known malfunctioning panel light during the flight.

Did the ECS supply quantity indicators operate satisfactorily? Yes, they did. The primary O_2 went down very gradually. I think after landing the primary system was down to 85 percent and the secondary system was still at 100 percent. I've forgotten the O_2 quantity on launch but it seems to me it was up about 90 percent.

10. Comment on the biosensors. I have no particular comment. They were comfortable, in fact I wasn't even aware that I had them on.

11. Were you aware of the cannon-plug on your right thigh? No. It wasn't a problem.

12. Do you have any suggestions for biosensor modification or change? I recommend we don't use the rectal probe any more. It isn't uncomfortable but I just don't like it. I think we ought to find some other method of obtaining body temperature.

13. Did you notice whether the clock stopped at any time during the flight? No, I did not. That's one thing I intended to check on the water and I forgot all about it. As a matter of fact I never did read the time any time during the flight.

14. Do you have any comments on the overall operation of the rocket and pyrotechnic systems? All of the systems worked perfectly. I got every indication that I should have gotten that they were working properly. When the escape tower fired I heard it and saw it go. I didn't actually see any flame from the nozzles but I saw what appeared to me to be smoke. Then I saw the rocket for quite some time and it looked to me like it peeled off to the right.

I could see a little flame and a little tailoff, as it went out into the black sky. The next pyrotechnic to fire was the capsule adapter clamp ring and the posigrades, and it was quite obvious when the posigrades fired. It was a loud bang and a nice acceleration. I felt no tumbling motions at all. It seemed like a very linear acceleration from the booster. The next pyrotechnic to fire was the retrorockets and these I could hear and, of course, feel. The misalinements appeared to be rather moderate. I would say about like the average case on the Procedures Trainer. Then the next one to fire was the explosive bolt on the retropackage. I could hear it and I think that I probably heard some of the straps twang. I heard some other noise besides a mild explosion. I saw at least two retrorockets float by the periscope on two occasions. Then I heard the drogue mortar very clearly. I saw the drogue pop out and blossom. I think that's the last one I heard. Well, when the whip antenna fired there was a noise as the reserve chute went out and possibly I heard the squib on the whip antenna, but I'm not really certain of this. The whip antenna could have been under water at this time, it was down pretty low. But most of the pyrotechnics I could hear.

15. Did the roll, pitch, and yaw rate and position indicators function properly (no gyro tumbling, attitude hands on stops, etc.)? Yes, all the way through the flight. I started receiving rate indications as soon as we got lift-off. As I went through the area around max q I was receiving a pitch and yaw vibration on the order of about $\pm$ 1° per second. The attitude indicators functioned properly. When Al gave me a call giving me pitch attitude I checked and it was right on the money. There was no gyro tumbling and hands never hit the stops, of course.

16. Describe the capsule response to the manual control system operation, automatic control system operation, and rate command control system operation during the mission (manual control system operation). Well, I felt that response was rather sluggish. I had difficulty getting the rates that I wanted. As I tried to get a pitch-up rate of 4 °/sec it seemed that it took longer than it should have and when I did get to 4 °/sec I overshot. I tried to bring it back and get it pinned down to 4 °/sec exactly and I went beyond it again down to less that 4 °/sec. Then I decided that the pitch axis was working so I'd better get back to retroattitude and try yaw. At the same time I was having trouble getting roll to zero. My roll rate from the turnaround wanted to hang in. Yaw appeared a little bit sluggish to me also and I'm not sure what rates I got in yaw. I don't think I got up to 4 °/sec in yaw. After I came back to something that approximated zero yaw attitude, I skipped the roll check and started my 45° left yaw maneuver. Here again it seemed like it took a very long time to get over to about 45°. I checked the yaw indicator to make sure that I was over near 45°.

Then Al gave me my mark at 4 min. and 30 sec. and it seemed to take an extremely long time to get back to my retroattitude.

17. On the air bearing when I've been given a mark at 4 min. and 30 sec. I'd been able to get back into retroattitude from a 45° left yaw attitude and get stabilized about the time retrosequence starts. On the flight, retrosequence had already started when I suspect I was still out of the retroattitude limits and I had difficulty getting the capsule into limits before the retros fired. (Automatic control system). The automatic control system seemed to operate very well. As we came off the booster the rate damping after the posigrades fired held the capsule very stable. The capsule then started its rather weird turnaround motion and this is the only way to describe it. Looking out the window it was difficult to tell exactly what was happening. I didn't know whether I should stop the capsule or let it go, until the horizon actually came into view. This is something that confuses me a little bit. I was able to tell that I was turning while looking at a pitch black sky. I've been wondering if I didn't see several specks of stars at this time and I was too busy for them to actually register in my mind or it was too bright to look and see if that's what it was. I know that I saw the one star during launch and I didn't see any more until the turnaround started, and then I had the sensation that the capsule was turning or oscillating around. Of course, the horizon came into view rapidly and the sun was shining in the window and they gave me a sensation of motion too, so they may have been my cue to the motion. I'm not sure. I don't think I saw any stars but I just wonder what let me know that the turnaround was occurring. I remember that the motion produced a rather weird feeling. The autopilot was working very good although it seemed like it took a lot longer than we had thought it would to put the capsule into retroattitude. It really wasn't completely stabilized when I switched to manual and I waited until 3 min. and 10 sec., I believe, before I went to manual control. Roll hadn't zeroed out by then and as I recall pitch and yaw were in pretty good shape. Actually, the attitudes were fairly close, it was just the rates that hadn't settled down. (Rate command control system operation). The rate command control system seemed to work better to me than the manual system. This sort of surprised me because I usually do much better in the trainers with manual control than I do with rate command. But the rates did damp out pretty well to within the limits that the system was designed to work, around 2 to 3 °/sec. I had no trouble holding the reentry attitude pitch and zero yaw. I thought the rate command system functioned better than the manual proportional system.

18. Was there any indication of thrustors leaking on automatic control system? Well, I had no indication other than there was a roll rate that seemed to be in all the time. This could have been either the

manual or the automatic system. The automatic system should have been shut off, so I don't know what system was leaking, but there might have been one. Did tailoff seem excessive? I don't know how you can tell whether you've got excessive tailoff or whether you have poor operation of your nozzles or one sticking open. I don't really know how you'd tell. Maybe with more time you might be able to tell.

19. Was there evidence of thrustors failing to start? I don't think so. As soon as I moved the control handle I got some thrust. I was never aware of any delay.

20. In general, do you have any comments pertaining to the reaction control system? Well, I was a little surprised at the amount of fuel we'd used. I think that after retrofire we were down to 50 percent on the manual system and then used another 10 percent going to peak g. The last reading that I remember seeing was 40 percent on the indicator and this was sometime after peak g.

21. If used, was the manual periscope extension-retraction level adequate? It wasn't used. I used it in the pre-launch phases and simulated flights and it worked very nicely.

22. Was the periscope reticle light adequate? I've never seen that reticle light. Never.

23. Was the periscope filter usable? I didn't have to use the filters at any time during the pre-count or during the flight. On the pre-count, on the scrubbed mission, I did put in the dark grey filter and I've used all the other filters and they worked easily. They are usable. With the levers that we have on this periscope it would be very easy to operate in flight or at any time.

24. Comment on radio reception as to continuity, clarity, (indicate excellent, good, fair, unintelligible) for those radios used (UHF main, HF orbital, command voice receiver). The UHF reception was excellent. Al was coming in clear as a bell to me all the way until the time that he dropped out completely, which was about 65,000 feet descending. He didn't fade. Reception from Card File and Hunt Club was good. They seemed to be a little bit weaker than the Control Center. The reception from the Atlantic Ship was very weak but clear. I could read him but he was very weak. I didn't receive anything on HF and I received Al very loud and clear on the command voice receiver.

25. What was the relative noise level in audio? The noise level was low. The communications system was very good.

26. Is a 400-cycle or an 800-cycle tone prevalent? No, it is not.

27. Is HF fading present or prevalent? I never received any HF, so that doesn't apply.

28. Comment on any difference in quality between HF, UHF, and command system outputs. Well, I could tell no difference between UHF and command and of course we received nothing on HF.

29. What volume control settings did you use during various phases of the mission? Did the controls work properly? Any dead spots? I had set my volume knobs during the RF compatibility checks when the gantry was out and I had no occasion to change them. I marked these positions on the volume control knobs and occasionally on the launch when something was interfering, I would decrease the volume but I always put them back to the same spot and this was adequate for the whole flight. The background noise was very low and all reception was quite clear. So I didn't use the volume controls at any time during the flight and as near as I've been able to tell from checking the volume controls there are no dead spots.

30. When the volume is turned down completely I could still receive a very faint signal. When the volume is up to its maximum the background noise is too loud but I could still tell there is someone transmitting.

31. Was RF interference noticeable? Cross-talks? No! There were no cross-talks.

32. Were there any differences in instrument readibility from the static situations during powered flight, weightless flight, and during reentry? No. The instruments were very clear and easy to read all during the powered flight. Even during the max q phase when we picked up a slight vibration the instruments were quite clear and quite easy to read. During weightless flight the flight indicators were difficult to read due to the extreme contrast between the bright outside and the relatively dark cockpit. The eye just couldn't adjust fast enough. The roll needle was especially difficult to read. It is being changed, and that's an important change for us. Make sure that this gets done. Probably all the needles should have been white instead of colors as we decided at one time. They would have been a little easier to read since the other instruments are easier to read being white needles on a black background. The telelight panel or the instruments on the right were readable. I guess my eyes had a little longer to adapt or there was more light from the cabin lights on these panels too, but they were readable. I know that I could read the lettering by the switch that says "Auto Retro Jettison". The left panel was lit quite well and faded gradually as you move toward the telelights. I don't recall reading the g meter during weightlessness but I did read the fuel indicators. The first time I read it the fuel was down to 50 %

and this was just before the reentry got started. I don't recall reading it at any other time, but it was quite clear at that time. I happened to notice the rate-of-descent at about this time and it was pegged at 150 fps and this surprised me. I didn't think that there would be enough atmosphere at that altitude to cause the rate of descent indicator to be active. So that portion of the panel was readable. The clock was readable all the time. It was sort of a hazy area, again about like the attitude and rate indicators. I think the hardest instrument to see was the roll needle and the roll rate indicator and this was probably due to the color as much as anything. I actually didn't pay too much attention to the panel in the right during weightless flight because there wasn't a great deal I could do about anything over there anyway. I didn't notice any of the warning lights other than the O_2 quantity light which was on most of the time. I do recall checking the cabin pressure and suit pressure at one time during weightless flight, so those instruments were readable. My impression now is that the right panel wasn't as well lighted as the left panel. I can't really describe why or how I know this. But at any rate the instruments were readable and only one I'm really concerned about is the attitude indicator. During reentry, everything in the cockpit was readable because I was looking out at the black sky and even though the sun was reflecting on the silver piece above the windshield I could see my attitude indicators very well. I could see the roll rate much easier. I could see the clock and the altimeter. Everything in the cockpit was quite visible at this time. It made quite a difference not to be looking at the bright earth so probably the eye just wasn't able to adapt fast enough.

33. Could you read the indicators easily at all times? Any glare? I think I've pretty well discussed the answer to this question. There was no glare off any of the instruments. The only glare was the sun shining on the aluminized portion of metal between the inner and the outer window.

34. Did you encounter any unexpected problem relative to reaching any of the controls? No, I reached everything that I wanted with ease. I didn't have too many things to reach, but I wasn't aware of any restriction by the suit at all. As near as I can tell I had no overshoot or undershoot when reaching for the switches. When I reached for the retrojettison switch I got it the first time I tried. When I wanted the manual fuel handle out, I also got it the first time I tried and it was the same when I returned it to the "in" position. I reached for the voltmeter knob to check the isolated battery on launch. At this time we were up to about 2 1/2 to 3 g's and I had no problem reaching it or reading it. I reached for the HF-UHF switch and I got this very rapidly, flicked it over to HF and when I couldn't get hold of anyone I immediately put it back to UHF without any problem. I didn't have to fiddle around trying

to get hold of it, I went immediately to it. No underreach or overreach or undershoot or overshoot.

35. Did you encounter any instrument malfunctions? If so, describe. No. Everything in the capsule worked perfectly.

36. Did any of the ejected items collide with the capsule? (or come close to the capsule?) The only things that I know of that came close were the two retrorockets. I'm reasonably certain they were retrorockets and they were fairly large in the periscope. The way they looked to me they were about an inch across. I don't know how close this would be to the capsule, but they appeared to be fairly close. They went by twice, or I swung by them twice, probably. But they were sort of tumbling. I never saw anything out the window that came close to the capsule.

37. Did noise and vibration interfere or aid in the execution of your control tasks or communication tasks? Explain. I don't know if the noise helped with my control tasks or communication tasks but the noise of the rockets firing certainly was a help to confirm what was going on. The vibration didn't interfere nor did it aid at any time. The only real vibration was during the launch phase and this was very mild.

38. Did sound cues offer any confirmation of sequence operations? If so, comment. Very definitely. It was obvious when each function happened. You didn't have to check the telelights. I heard the function happen, I knew it had happened and I checked the telelight to see if the telelight was working. The way things went you really don't need the telelights. I'm not saying to take them out. But it is quite obvious when functions occur.

39. Were there any pecularities in hand-controller characteristics? If so, describe. Well, I don't know. I was working awfully hard with the hand-controller and not getting very much out of it. I did feel that right yaw was hanging a bit on the fly-by-wire switch. I'm sure this is what it was. Other than that I couldn't feel any hanging up or binding at any time. On launch I felt the handle come back in pitch very slightly and on reentry I'm sure that it moved in pitch. It might have moved in roll but I'm not certain. It is not enough to be a problem. I don't even recommend balancing it. You have no control authority at this time, so when you're squirting you're not helping yourself and you're not hurting yourself. As the oscillations started on reentry I tried to dampen them out and just couldn't do it. They weren't bad but I couldn't see that I was helping myself at any time during the peak g phase where the oscillations were on the order of + or - a degree per second. I could not feel any of the oscillations during reentry.

40. Were you ever certain of the capsule attitude relative to the earth? Yes, when I had the horizon in view I knew exactly what my roll and pitch attitude was. Roll was very obvious to me and so was pitch. Yaw was the only axis which gave me any trouble. Let's correct that last question to: Were you ever uncertain of the capsule attitude relative to the earth? No. Not when I had the horizon in view. On the turnaround when I was looking up at the black sky I had no idea what my attitudes were, other than what my attitude indicators read, of course. Going to reentry I had no idea what my attitudes were other than by the indicators. When I had the horizon in view I wasn't certain of my yaw attitude until the Cape came in view. Then I had a definite checkpoint. If the whole area that you are looking at is obscured by high cirrus clouds like it was on this flight, I'm fairly certain that there would be enough breaks in the clouds for you to be able to pick out a hole in the cirrus clouds or a slight change in shape of the cirrus clouds to use as a checkpoint. There isn't anything on the horizon that you can use as a checkpoint for manual control of yaw unless there is a cloud or something that you can see. The horizon is very smooth and very well even all the way around and so you need something down from the horizon to use as a checkpoint. If you were on the dark side of the earth, I'm sure a star would be a perfect checkpoint. I think one or two checkpoints would be about all you would need, if you had a horizon with them.

41. Did you at any time think the capsule was tumbling when in fact it was not? I had this sensation at BECO. When the thrust dropped from 6 g to zero I had a sensation that the capsule had tumbled. I knew instantly that it had not and I was familiar with the sensation so it didn't worry me. This is one of the places where some of our training really paid off. There was no question in my mind what had happened because the sensation was the same as I had experienced on the centrifuge previously.

42. Was the cabin display adequate throughout the flight? Yes, I think it was. I don't recall anything that I wish that I'd had. I can't think of anything at this time. I'd practiced with this capsule so much that it seemed quite comfortable to me. I'm sure it was not the best display in the world but I was satisfied with it since I knew it so well.

43. Were any fuse switches changed to the alternate switch position during the flight? No. Did you note the ammeter reading at this time? Doesn't apply.

44. Did you observe any structural deformations or hear any noises that could have been caused by structural deformation of: Small pressure bulkhead and egress hatch? No. Oil-canning of

cabin skin? No. Painting of entrance hatch? No. Working of window panes? No. Instrument panel and cabin equipment? No. The capsule was very sturdy.

45. Is there much difference in the apparent color of the land areas, water areas, or clouds as compared with their appearance from a high-flying conventional aircraft? The first time that I really got a good look at the land, which was the Cape, it seemed to me that it was very much like flying at high altitude. I hope tomorrow or the next day to get the F-106 and fly at about 40,000 feet and take a look at this area again to see how much difference there is. My first reaction when I first saw the earth below was "gee, it's just like flying." It's very obvious that the clouds are way, way below you, very far away. You still know that they're cirrus clouds and they're obscuring things, that's very evident. I don't recall seeing any thunderstorms or cumculus clouds, but the cirrus was very evident.

46. Is there much difference in the color attenuations from as oblique view as compared to a vertical view of the earth? Yes, as I looked out near the northern Gulf Coast, there was a lot of haze and the whole picture blended into a sort of light bluish-grey, or light blue. I was fairly certain that there was a line through this area that was the coast but couldn't really tell the difference between the Gulf and the land. This was the only view I actually had of the land mass. As far as looking at the clouds are concerned, I could see them all the way to the horizon. Above the cirrus everything is clear. There is no haze and the clouds out on the horizon are still very white and very clear.

47. Is it possible to distinguish the Gulf Stream and other ocean currents by its color? I did not see a difference in color of the water. This doesn't mean that there is no difference, it just means I didn't see any. The only way I could have viewed the Gulf Stream would have been through the periscope. I looked through the periscope just a few brief seconds and the view takes in so much area that I think it might be a little bit difficult to pick out the Gulf Stream. But I think you could do it through the window. There's a tremendous difference between the view through the window and through the periscope, all the differences in the world.

48. Does one get an impression of the relative heights of different clouds? Well, the only clouds I could see were the high cirrus. They blanked everything else out. So I can't really answer that question.

49. Are the different types of clouds distinct enough so that one might get an idea of cloud height from the cloud type? Most of the clouds, when you've got a cirrus layer are blotted out. Even in

flying an aircraft when you get up on top of this wispy stuff (cirrus) you have no idea what's down below you and this was the same way here. This light wispy cloud pretty well blanked out everything down below. Maybe with more time to look and concentrate you might be able to see below, but the quick looks I had I couldn't tell any difference between the cloud heights.

50. Is it possible to discern haze layers which might be associated with the tropopause or other stable layers of the atmosphere? This is probably the area where the horizon turns from blue to slightly darker blue and also the fuzzy area that goes from a dark blue to black, because this looked like it was rather low. I don't know how I can say 50 miles above the earth but it seemed like it was quite a bit below me. I think we can almost pin down this area where it changes from blue to black because I remember this change occurred about a minute and 30 to a minute and 45 seconds on the launch. It starts changing rather rapidly at about this time.

51. On the horizon, was the transition from light to dark smooth? Well, it was pretty much as I have described it. It's a light blue close to the earth turning to a darker blue and then there is a transition area between the dark blue and the black which makes another little border. It is actually sort of three borders or rims. There's a blue area, then there's this transition (dark blue) area, and then the black. It was very smooth and very evenly distributed all across the horizon. There were no irregularities.

52. Did you use any one display almost exclusively? If so, which one (window, periscope, rate-and-attitude indicators)? I used the window most of the time in conjunction with the attitude indicators. I didn't use the periscope at all for attitude control. I looked through it some but really didn't see a great deal. The rate indicators are very valuable instruments to me on their own. Even if we had a gyro display I think we'd still want rate indicators. I think they are a very valuable asset.

53. Did you notice any reaction response of the capsule to your movements? No, I did not. I'm not sure that I would have known it if I'd had any. I wasn't able to detect any.

C. <u>Flight Operational Procedures</u>

54. Were voice procedures adequate? I think so. I noticed that I was trying to talk too rapidly at times. I noticed in reading through the transcript that it's a little difficult sometimes to identify exactly what I was trying or wanted to say. There was just so much to say I couldn't get it all in and do it properly. Ground-to-air voice procedures were fine. Al and the

recovery people gave me all the information I needed. Their discipline was excellent.

55. Was there too much talk from the ground? No. I got just enough and just what I wanted. I thought that it worked out very well.

56. Did you have enough information from the ground on trajectory and impact prediction? I don't know why, but trajectory really didn't concern me. It was nice to know that it was going all right, but if they hadn't mentioned it, I wouldn't have missed it. The only information I want on impact prediction is how far away are the recovery forces. It's comforting to know that the impact point is going to be nominal since this means to me that recovery forces are going to be close by. The time to give this information is sometime when things are quiet. Anytime it can be worked in is fine. I think Al had the right idea by giving me the impact prediction in place of rogering one of my calls. On capsule telemetry measurements? I could not care less.

57. On advice on astronaut procedures from the Capsule Communicator(s)? Al was very helpful by giving me the marks at 4 min. and 30 sec. and at retrofire. If Al hadn't gotten the 4 min. and 30 seconds mark through to me, I probably never would have gotten back into the retrofire attitude. I also appreciated the time hack prior to .05g although the periscope retracting is a good warning, but it still is nice to have.

58. On recovery information and problems? I had a little trouble getting recovery information. Maybe I didn't ask for it in a proper manner. The people were listening to me and if I had called them and asked them for information I would have gotten it.

59. On the weather? I had all the information I needed on the weather.

60. Was there too much standardized talk procedure to perform? Would you have preferred a more impromptu procedure for reporting your flight impressions during the flight? As near as I can tell there wasn't any standardized talk procedure other than the readouts on launch and I think this is a good procedure. During launch you need a procedure that is pretty well outlined so you will cross-check the panel and you won't get fixed on say, cabin pressure, or oxygen. I think this procedure is very good.

61. Did the abort light ever come on? No.

62. Would you have liked to be informed about how the booster and the ASIS was performing in real time? If the ASIS commands an abort and I don't receive it, I want to know this. I don't care to know anything else about the ASIS. As far as booster performance

is concerned I could tell how it was going in the capsule. The g's were building and the rates were stable and you know everything is going OK. I think this is all you really need.

63. Would you prefer to abort the mission yourself if required or are you satisfied with the system of "abort by ground command?" Our ground rule states that the pilot will abort if at all possible with ground abort command as backup. This is the way I would prefer it.

64. Were you able to assess properly the operations of all the capsule systems by reference to the onboard instrumentation? Yes, the ECS was the one system I was most interested in monitoring and I knew from the oxygen quantity and the pressure gages that things were working properly. It would be nice if we had our flow indicators working. I think they are a valuable asset to us, but I really didn't miss them on this short flight. On an orbital mission I think it's a mandatory item.

65. Would you like to know from the ground what the capsule attitude is? How many retrorockets had fired? (i.e., All major capsule events.)

On the launch phase, I think it was good that Al had decided to give me pitch attitude instead of just rogering my transmissions each time I gave the standard report. I felt that this was good information, but I wouldn't want it after launch. No, we don't want to know how many retrorockets have fired because it's quite evident from the capsule when each event occurs. If there's any doubt about an event, we can ask for confirmation, but I don't think we want it fed to us automatically.

66. Were you adequately briefed on all phases of the mission? Yes.

D. Assessment of the Training Program

67. Were you sufficiently trained for the mission? Explain. I think that I would like to have had more time on the ALFA trainer to practice using the window for attitude control. In the last two weeks prior to launch, all my training was in the procedures trainer using the instrument reference for attitude control of retrofire. I feel this is the reason that I went automatically to the instruments instead of using the window. I don't know how you can be here and do the things you want to do and get this time on the air bearing also. We talked about getting an airplane to run back and forth between the Cape and Langley but this didn't work out. If it had we could have gotten one or two more sessions on the air bearing before the flight. You must be at the pad

when things are going for two reasons: (1) to build up your confidence in the capsule and (2) to let all the people working out there see you and your interest. There are a lot of benefits in being on the pad with the capsule. The only suggestion I might make is to move the air bearing to the Cape. I don't know what else you can do. I think it is very important to have it there. I would have liked to have had some more recovery training. In fact, I think the whole recovery area is something we ought look into further. This was the area that I was in doubt about before the mission. It seems to me that I knew all the capsule systems. I knew what was going to happen in the mission, but the recovery business was a little bit haphazard.

68. I don't know what we can do about it. When you're lying out on the water, the problem is to find you, get you in, and pick up the capsule. I think this is an area to study and before we go into orbital flights, we need some extensive recovery training. I don't necessarily mean the recovery people, but I mean us. It would be a heck-of-a-thing to take this flight and then drown after it was all over. I think we need to sit down and decide what areas we might expand on in the recovery situation. We need the help of some experts to give us information on recovery and survival. We should learn this information, then place ourselves in some unusual recovery situations so that we will have the confidence in ourselves to handle most any situation. I wasn't particularly concerned down in the water because we'd had water recovery training and I'd used the suit previously in the water. The problem was I had too much confidence in the helicopter and pickup method and therefore, I didn't approach the problem correctly. What I'm trying to say is, these procedures ought to be outlined clearly so everyone will know exactly what we're going to do when the capsule comes down in the water. We should not rely on the helicopter or on anything else. We've got to have procedures down firm and we've got to have all the confidence in ourselves. In the flight, we're not depending on all the automatic systems, we're depending on ourselves. It's only right that we're depending on ourselves in the recovery situation also. We've got to be prepared to take care of ourselves. Right now, I'm not sure that I'm adequately prepared to take care of myself in the desert, mountains, or on the water for days, even though I've had this training. I sort of wonder if I'm prepared in this area. I'm not saying the recovery training we've had isn't good. I'm just saying it hasn't been recent enough and that we haven't had enough. I want some more survival training in general. I want some more desert, and water survival. I want to know more about Africa and Australia. I'm serious about this. I think we have to take the time for this training.

69. Okay, has your flight experience pointed up any areas where you felt you had no training and needed it? I just covered this question.

I think as far as flying the capsule, and knowing all the systems, everyone of us is prepared. The recovery is what bothers me.

70. How do you rate the relative worth of the ALFA Trainer, the Mercury procedures trainer, and the centrifuge with regard to preparation for doing the actual manual control tasks in the capsule? Orbital task? Retrofire task? The simulations didn't feel exactly like what I saw in the capsule on manual control. Flying, using rate command, was probably a little bit easier than it was in the procedures trainer. The ALFA Trainer, as I've already pointed out, is one of the fine trainers for actually controlling the capsule. The procedures trainer is, I think, probably better for testing out procedures and for controlling retrofire on the instruments. It's ideal for this purpose. I like the ALFA Trainer very much, I think it's a very valuable trainer for this program or for any program which is coming along. The centrifuge is definitely a good trainer. Although the rides in the centrifuge are more difficult than the actual flight, I certainly wouldn't want to take the flight without the centrifuge training. I can't really evaluate the value of the trainers for the orbital task. For retrofire, I think the procedures trainer is adequate.

71. Which trainers could have been omitted without loss in your state of readiness in this flight? I feel that you don't need a great deal of concentrated time on the trainers, but you need to get time over a long period. I've never felt that it was necessary for me to go to the procedures trainer everyday for the past two years. You soon get to a point or a level where you can do all your control tasks well and you have all your procedures down and from that time on all you need is time to refresh yourself. It may be difficult for some people to justify having all that money tied up in trainers, but there are enough valuable things for us to do that we should have to spend time at the procedures trainer to justify its' cost. I think it's justified its cost already, and the time when you really need the procedures trainer is just before missions when you start practicing for a specific mission. Even at this time, you can reach a point of saturation when you have gone through the mission so many times that you actually became bored and get sloppy.

72. So, I think there's a point that you reach where only short refreshers are needed, something like two or three missions a day. You shouldn't try to run it time after time; at least, this is my experience. The simulations with the controllers gave me a lot of confidence. It gave me a lot of confidence to see how each one of the controllers reacted to different failures and how they handled the situation. The simulations were very good and were real confidence builders. I certainly wouldn't want to see us do

without them. I'm sure we never will. I think they're a very valuable part of the flight preparation. I would have liked to have had another session at the planetarium. I don't feel that I know the constellations and stars as well as I should. This is my own fault due to a lack of study. I would have liked to have had another session of a couple of days at the planetarium. I knew nothing about the constellations and stars before the two-day trip to the planetarium, but they really pumped me full of information. I think this is important and I don't know why I didn't get around to it. It probably should have been done prior to rapid buildup down at the Cape before the flight. The trainer I could have done without is the revolving room down at Pensacola. The MASTIF at Cleveland is a very good confidence builder, and I'm glad we had the experience and I think all the rest of the guys feel the same.

73. I've already discussed the ALFA trainer and the procedures trainer, and I see no difference between the one at Langley and the one at the Cape. The MASTIF, I've discussed. I could have done without the periscope view trainer at Langley. I think the air bearing is adequate and its view is probably better than the periscope trainer. I've only spent probably a total of 15 minutes in the periscope trainer. The instrument demonstration device I think is good. It gives me a refresher on how the instruments behave in some maneuvers. I think this is one trainer we should keep around. I count the centrifuge as being one of the most valuable training aids. The centrifuge, the ALFA Trainer and the procedures trainer are the three most valuable training aids. Whether the centrifuge is run closed-loop, or open-loop, depends on which method is the simplest, easiest and smoothest since we don't have all the gyrations in flight that we do on the centrifuge. Any way we can cut the roughness down is to our advantage without complicating the systems. I could have done without the MAC mockup. The egress trainer was a necessary trainer and one that I think we need a refresher in occasionally. It ought to be brought up to date for use before each flight, with the helicopters in open water. I never used the insertion trainer, so I didn't miss it. The aeromed trainer we used. The EEAC trainer I think was of very little value to us. The MB-3 trainer was of great value since we utilized it to learn to control the reentries and the retrofires. I have to admit that I've never read the Familiarization Manual all the way through. I use it as a reference. Having grown up with the capsule, I'm familiar with the material in the Familiarization Manual, so when I try to read it, I just get bored. As a reference, it's ideal and I certainly wouldn't want to do without it. The pilot's manual is a very handy reference to carry around. I use it quite frequently. The star charts would be of value to me if I would use them. I just never seem to get around to it. I used them at various times when I went down to the planetarium, and I got a lot of good out of them.

74. I think it would be valuable to have a good, useable star chart and do a little more along this line. I think the terrain maps aren't adequate. From the view I had of the Cape, I think we need maps covering the whole orbital flight in a great deal more detail, and I think that we should spend a good deal more time on these maps. I applied for maps for this flight and got standard jet charts and I think we need something that has a bit more detail than the jet charts. The jet charts probably give enough detail for general study, but I think we need a big chart with a lot of detail covering the whole route to use as a reference to cross back and forth with the jet charts. The charts we have now aren't much good. I've been trying to find the earth-sky pictures for the last two weeks, but it is my fault I don't have them. I would like to study them and I would like to take a look at those again. I never got around to using the environmental controls trainer. The trainer was broke down at ACEL, and we were busy at the time so I never had the chance.

75. Obviously, I cannot remark on the value of this trainer. The zero g training in the C-131, and the C-135 was valuable and it was adequate and I wouldn't want to have been without it, but I don't think we need any more training. I think the F-100 flights most nearly simulated what I felt during this flight and this is probably true for anyone strapped into their seats. In vehicles where a person can float around and move about, probably the KC-135 training would be better. The weightless flights in a darkened room were not of any great value to me. I think the flights in the F-100's were the best simulation. F-106's and 102's are a necessary part of our flight training. A lot of trainers are confidence builders and I think flying is one of the more valuable confidence builders. Most of the other trainers do not give us the chance to make critical decisions and this is our most important function——decision making. We need time to fly. The ideal setup is to be attached to some place where you have your own airplane and doing some sort of test, working in conjunction with the project so that you're not just boring holes in the sky. I think the aircrafts are very valuable and they may be expensive and hard to justify, but I don't see how we can get by without them. The pressure chamber runs are valuable only one time to see if the suit works. I don't think we need to do this very often, maybe everytime you get a new suit. You need to get into the chamber to develop confidence in your suit. The pressure chamber runs at the Cape with the capsule in the chamber are very valuable. This is one of the more valuable tests we do at the hangar. You get into the capsule and pump the chamber up to 200,000 feet and see that everything works and works as it should. This is another real confidence builder. I don't think you need to do this more than once. All the heat tests and familiarization we've done has been adequate. We know that the systems will take care of us and that is all that is necessary.

76. The training I got at the Cape going through the SEDR's was extremely valuable. This is where you really learn the capsule systems, and how they function. This is one portion of training we can't do without. There are certain SEDR's that I think you have to be there and others that someone else can follow for us. When the capsule goes to the pad, you want to be with it all the time. Some of the SEDR's at the hangar, like SEDR-77, you want to participate in along with the communications check. The RCS checks are valuable although maybe not as much as the sequential SEDR and the simulated flights. Anyone can run the RCS SEDR and whether the jets are firing with clean bursts and cutoffs and this is all I need to know. This is all I found out was that the jets were cutting off clean. You don't learn anything from the feel of the hand controller as long as it is within reasonable limits. What is important is to try to set up the same control forces in the procedures trainer. I think the altitude chamber runs, the abort checks, the overall checks, the simulated flights, and the RF compatibility tests are very valuable. It's good to get into the capsule as many times as possible and get buttoned up inside by yourself. So, on launch day, I had no feeling of sitting on top of a booster ready for launch. I felt just like I felt at the hangar or anyplace else. Here is home. Here are surroundings that are familiar to me. I felt comfortable and at ease in the capsule. I wasn't in a strange environment, and you can't acquire this feeling from sitting in the procedures trainer. It is very important to get into the capsule. This is a valuable part of the training.

77. Do you have any suggestions relative to retiming of the training program? For example, were you rusty in any particular control task? I think I have pretty well discussed this already. The Procedures Trainer Mission Familiarization has got to be done early and then just keep current. No, I didn't feel that I was rusty in any control task. I felt on flight day that I was at about peak performance. I would like to have had the airbearing down at the Cape for refresher. Most of the training that must be done prior to the flight should be done before the capsule gets down to the Cape, because after the SEDR's begin, especially the last two or three weeks, your time is very limited. You don't really have time to do such training as star study at the planetarium or recovery work at Langley. So it has to be done before the capsule gets to the Cape and starts through its last processes. At that time, you should feel that you've received all the training you need and the only thing you need to do is stay current in the control task in the procedures trainer and the airbearing, if possible.

78. When were you the most anxious? Would extra training have helped? I think the time that I was the most anxious was during the early

period of launch, the first 40 to 60 seconds when an abort might have occurred and the tower wouldn't have jettisoned. I wasn't really convinced that I could get everything unhooked, get the parachute out and get out the hatch in time. I felt that this was one of my weaker areas. The next most anxious time was waiting for the main chute deployment, and I don't know anyway that training could help here. These are the two times that concerned me most. I suppose looking back on the flight, I should have been concerned about the escape rocket firing, but this phase is similar to the chute opening in that it is just a matter of waiting for the event to occur. Also, you're so busy up through this portion of the flight that you don't have time to worry about it. Extra training might have helped on the rapid egress, although it would be difficult to simulate. You must have a suit on for this training, and when you've got to get out in a hurry you're not going to be worried about ripping the suit. You're not going to be worried about cuts, scratched, or being hungry. You're going to be about three times stronger than you are normally. Therefore, I really don't know how you can train but some way ought to do it, even if we have to do it slower and easier without ripping our suits. It probably ought to be done so we have a procedure firm and tight. This was an area where I felt I was weak. If I should abort, which straps do I disconnect and in what order? I had my mind made up before the flight, but I never had any practice.

79. How did the noise and vibration experienced in the capsule compare with that experienced in the centrifuge training program? The vibration was a lot lower during the launch than in the centrifuge. The noise was different on reentry. It was a roaring noise. On launch, you can hear the booster, and it almost sounds like the sound we had cranked into the centrifuge. It had sort of a roaring noise like coming in through a sewer pipe. It's sort of a hollow sound like you are getting it up through the tanks.

80. Were any physiological effects experienced during the mission accelerations that were not experienced on the centrifuge accelerations or vice versa? (Angular acceleration, etc.?) Well, the effects on the centrifuge were far worse than those on the actual launch, so again I think the centrifuge is a good trainer. The centrifuge makes us familiar with all the g effects and this is what we need.

81. Compare the acceleration produced during the retrofire task in the October centrifuge program with that experienced during the actual retrofire. The accelerations on the centrifuge were far worse. They were not even a close simulation. The retrofire is a very smooth maneuver. It's a nice, easy, positive acceleration. There is no vibration or jerking. It feels more on the order of an afterburner being kicked in——you know it's there and pushing.

82. What sound effects do you wish we had had on the procedures trainer? I think we ought to go ahead and crank in the sounds we had on the centrifuge.

83. Was the periscope display in the Langley procedures trainer valuable or not? I can't really answer that question since I didn't use the periscope.

84. In retrospect, was there proper balance between failure training and normal procedure training? I never felt that the failures that we've been given have been good failures. Too many of them are fuse failures, and I don't feel that these are realistic ones. Of course, a lot of these have been cut out, but I got pretty disgusted with the whole program because I got to the point where the first thing I wanted to do was flip a fuse because I knew this was the answer. I don't think this is realistic. I'm not sure what realistic failures are, but I think the main training should be normal procedures.

85. Was an area of training overlooked on the procedures trainer? No!

86. Did you notice any difference in the operation of the rate-and-attitude indicator in the capsule as compared to that in the procedures trainer? Of course, we're getting vibrations through the rate indicators, and I'm not sure that this is an important thing to simulate. Basically, the rate indicators worked the same in the procedures trainer as in the flight. They looked like old friends to me.

87. Compare the response of the H_2O_2 jets with the response of the controls of the ALFA trainer. I guess I've covered this question a number of times. I think the jets on the capsule were more sluggish, at least this is my impression. I wasn't getting the response I expected.

88. Should we have had an ALFA trainer powered by the actual H_2O_2 control systems? Absolutely not!

89. How did the overall angular response of the capsule compare with that of the ALFA trainer? I didn't get the response I had expected to. The ALFA trainer responds much more readily.

90. Of what value was the periscope display training on the ALFA trainer in preparing you to fly the capsule using the actual periscope display? Did you notice the difference in sensitivities between ALFA trainer and capsule scope displays? Since I didn't use the periscope, I can't really comment on this question. I will say that the view out the periscope didn't look to me like the view on the big ALFA screen. I don't know why, unless it's distortion.

91. How realistic was the horizon display on the ALFA trainer? Well, I sure would like to see us simulate the bright earth, blue band and black sky and how you go about doing this, I don't know. The bright earth makes quite a difference in controlling the capsule. It is actually easier to control. Also, with the horizon and earth more closely simulated, we could get used to looking at the bright outside, and dark inside of the capsule. This would mean, of course, providing a lighter cover over the air bearing, so no light could get inside the cabin area. It would be a good idea to take some of the earth-sky pictures we have and try to simulate these in the airbearing V room.

92. Should we have had an ALFA trainer at Cape Canaveral in order to keep you peaked-up just prior to the flight? Yes!

93. Do you think you could have controlled the capsule satisfactorily if you only had had training on fixed-base trainers such as the EAAC and the procedures trainer? (Orbital stabilization? Retrofire? Reentry?) I think I could have, but I'm certainly glad we had the air bearing because it's a valuable trainer. In fact, maybe the air bearing is a better trainer for controlling the capsule than the procedures trainer. You've got many references such as, vestibular reaction to angular motion, horizon position looking out the window, periscope display, and the gyros, so probably the air bearing is a better control trainer than the procedures trainer. Of course, the procedures trainer is needed for procedures training.

94. Did your previous zero g training in Project Mercury have any value in preparing you for this flight? It had value in that I was confident that there was no problem during zero g. Other than that, I don't think it's of much importance. I don't think it's anything we have to do periodically as long as we know there's no problem.

95. How important was your training in the MASTIF trainer relative to this flight? Do you feel you had sufficient training? Again, this was a confidence builder. I don't think that it is anything that we have to repeat at intervals of time. Once is sufficient. We now know we can control high-tumble rates. This is all we need, but it was quite a confidence builder, and I'm certainly glad that we had it.

Do you feel you had sufficient training on the MASTIF? Yes, I do.

96. Should more or less emphasis have been placed on environmental training? If so, in what way? (Procedures trainers' training or surgeon's capsule training) I don't think so. I think that the training that you receive in the altitude chamber with the suit with the capsule you're going to fly is the training you

really need. You can train in an environmental control trainer and this really isn't of much value to you since that system isn't like the system you're going to have in the capsule. The system you are interested in is the one you're going to fly. The environmental training we've done had to be done, but I don't think it's something we have to continue to do.

Should more or less emphasis have been placed on environmental training? I've answered that, I guess.

97. Was the training you received on the transparent gimbal capsule of any value? If yes, why? Yes, as a refresher on what happens to the gyros at odd angles. It's something I wouldn't want to see destroyed or put away. Before a flight, you ought to take a look at it for ten or fifteen minutes. It has value. I think this is true of a lot of trainers that you don't need them for hours and hours on end, but their value for ten or fifteen minutes is worth their price. I don't think you have to justify all the time you log, or all the time you don't log.

98. If any maneuvers were made in two or three axes simultaneously, how did the attitude display compare to the display on Procedures Trainer I? Almost all of my maneuvers were three-axis maneuvers, and the indications that I received from the instruments were very much like those that I received on the trainer with the exception that I wasn't getting the response that I wanted. I think that the indicators were giving me true indications. It's just that I couldn't get the response. The reentries on the centrifuge looked almost identical to the ones on the flight. The reentries at Langley seemed to me were a lot easier. The needles were going full scale rather rapidly and I never did get in phase with the motion, and this is one of the problems that I had on the centrifuge at Johnsville during high g's. The problem was getting in phase with the oscillation, and it took several trys before I could control the reentry adequately on the centrifuge and so this is the way it was in the flight. I hadn't done a reentry for some time, and I didn't control it very well. I never got the rates damped out. The g effect makes quite a difference over the Procedures Trainer. Even in the early stage of reentry, when the g's were just starting to build up, they had an effect. This is probably due, somewhat, to control balancing but certainly for Redstone flights, I don't feel we have to have a mass balanced control system. For orbital flights, I'm not sure. This period is not a very long one, so I think we can do without it.

99. Were any Mercury trainers detrimental to your state-of-readiness? No. I can't think of any.

100. If in retrospect, you could pick just one Mercury trainer to

help you train, which one would you pick? I'd pick the air bearing. If two, which two? I'd pick the air bearing and the centrifuge. If three, which three? The air bearing, centrifuge, and procedures trainer.

101. Should the procedures trainers have been mounted on a centrifuge? No, I don't think so. I think that the simulations that we've had on the centrifuge were adequate.

102. Was the star field simulation on Procedures Trainer Number 1 useful in any way? I guess not. I never used it.

What cabin lighting did you use and could you see the stars at any time during the flight? The cabin lights were up full bright with no red filters on them. I only saw one star, and that was during launch.

103. Should we have included a cloud cover on the ALFA trainer? I guess so, that's all I saw.

104. Was the star display on the ALFA trainer realistic? Well, no, not for my flight. But I don't think I can really give a "no" answer here, since the ALFA is purely for orbital training.

105. Was there any comparison between the noise of the H_2O_2 jets and the noise of the air jets on the ALFA trainer? The noise on the ALFA trainer is far greater. The noise you hear in the capsule is very slight. You have to listen to hear it. You can miss the noise of the jets firing on the flight with no trouble at all. Retrorocket jets? The retrorocket jets on the ALFA trainer are also very much louder. I don't know if it is important to cut the sound down, but there is quite a difference. You can hear the others, but they sound different. It's a smoother, softer sound. That's the only way I can describe it, compared to the rather harsh sound of the air jets.

106. Do you feel there is any future for submersion simulations for weightlessness training? No, other than scuba diving. Well, Let's see, maybe I'd better think about this a little more. I would compare weightless training under water as being similiar to weightless training in the KC-135 and C-131. This isn't a true simulation of weightless flight. I think the scuba diving had a lot of value. In fact, I really think that with a water recovery and the chance of being in the water for long periods of time, we need to gain familiarity with this environment. Being a landlubber like myself, I'm a little ill-at-ease out in the water with the sharks, fish and rubber rafts. I don't feel we need any more weightless training.

II. Summary Questions

107. From a pilot's point of view, what did you get out of this flight? Well, I got a lot of confidence in the capsule. I got more confidence in myself. I have a good idea of what I can see from orbit and how well we can fly in orbit. I now feel certain that zero g reentry, and landing is no problem. As a training device, I don't know how you could do without it, and still I don't know how you could say that you need it before you make an orbital flight. So I can't honestly say that you need it. I'd like to. But this has been my opinion all along, and I haven't changed my mind. I don't know really that I can sit down and answer number 1 adequately. I think that all of these things that are going to come out of the debriefing will answer that question.

108. What capsule systems need improvement the most? I would say the explosive hatch, at least the detonator. Well, I don't know that I really can say that. This was an obvious answer that came to mind. The detonator does need to be modified, though. I think maybe the control system needs to be improved. The lighting needs improvement. I'm not satisfied with the restraint system. If we're going to use this explosive hatch, maybe we need to develop a neck dam for the hatch or something of this sort. We need to look a little bit more at what could happen to the capsule on the water and what we can do about it. Those are the only ones that come to mind at this time. We have a whole list of things which I'm not going into all the details of at this time, but need to be looked into.

Is the capsule ready for orbital missions? Well, the control systems worry me because of the fuel usage by the end of retrofire. I think that I must say that the capsule is ready. Even though the fuel usage is high, it doesn't necessarily have to be a problem. We can shut it off. You don't have to control and the autopilot should do a much better job than I was doing. If you were controlling manually in orbit where you knew you had lots of time, you probably wouldn't use fuel at the rate that I did. On a short flight like this, you aren't concerned about fuel, but it's one of the things we have to consider.

109. What flight control procedures should be improved and in what way? I can't see any way we can improve on what we did. Maybe the communications with the Card File aircraft and the relay airplane need a little work. But I thought it went very well. I got all the information I needed from the blockhouse (Deke) just prior to lift-off, and I got all the details I needed from the lift-off on from Al.

110. In retrospect, would you have liked to train any more than you did on any particular systems study area? If so, which ones? As I said before, I wasn't satisfied with my recovery training. We've covered this question previously, so I'll continue.

111. How do you feel about your ability to perform during longer periods of weightlessness? Are you ready for 4 1/2 hours of zero g? I don't think there's any problem. I think I perform in weightlessness as well as I do in a 1g-field in the procedures trainer or any place else, probably a whole lot better. It seemed to be very comfortable, and I was getting a little bit tired lying on my back during launch, but I noticed no discomfort at all during the launch or during weightlessness. I suspect it's going to be very comfortable sitting there for long periods of time. Are we ready for 4 1/2 hours of zero g? Yes.

112. What is your advice to the astronaut who will fly the next Mercury Capsule? Well, I think his workload should be cut down from what I had and I strongly recommend that he fly the whole flight on autopilot. I think he ought to look out more and make observations. I think that Al and I have both demonstrated the capsule can be controlled manually, even though neither of our control systems was working real good. And I don't think there is any doubt in anybody's mind that everyone else can control the procedures trainer as well as we can, and this is where we got our training. I think he should control in the yaw axis only, and yaw around the horizon to give himself an idea of how the control system works and how it reacts. This will also give him a tremendous opportunity to observe the ground, because he won't have to concentrate on what's going on in the cockpit. I would like to see him leave the autopilot on in pitch and roll and maneuver in yaw only to give himself a lot of time to do what I was doing——looking out. I think it would be a big mistake to do it any other way. I think we've proven that man can function in space and I now think we need more information on what you really can see. My time was divided between looking, moving, and doing things; therefore, I didn't get enough of anything. I'm convinced from what we've done that we can control the capsule. I'm convinced that all the systems in the capsule work and you don't have to manually overrride. One thing we can't do any place else except in space, is look down at the earth, and I think we ought to take advantage of it during this time. Again, this will have to be sold to the guy who is taking the flight. He has to be convinced. If he's not convinced, then you have to go ahead and do whatever he wants to do. But whomever is chosen, I'm going to strongly recommend that this is what he should do.

113. In your opinion, is the present debriefing adequate? In my opinion, it is. It is up to someone else to decide if they have gotten all the information available.

Would you suggest any changes? Yes. We should have our recovery procedures more clearly defined than they were for me. I had the feeling even before the flight that I'd trained for everything up to the time when I hit the water, but again it was my own fault for not going ahead and doing what should have been done. In fact, I had trained for everything up to the time the main chute deployed. From there on, I hadn't really had any training. I didn't have it clear in my mind what I would do. It wasn't clear in my mind exactly what I should have been doing on the water although I went ahead and did the proper things, like taking out that safety pin. The procedure should be a little more clear at the time, and have been practiced once or twice. I don't think it's something you have to be doing continually, but it should be done a few times to get the procedure firmly in your mind. Getting unhooked from the suit in the capsule should be routine so you don't have to think about it. I had to think about it. You ought to know exactly the way you're going to get unhooked. You know that you should get your life raft out, get it ready, get your neck dam up, and there should be no question in mind. You ought to practice this procedure and go through each step every time, whether everything goes perfectly or not. Then you're ready for any emergency. On the recovery itself, I think anytime you've got a man in the water, you should get a horse collar to him right now, or put another man in the water. Again, I don't know how you could do this. You've only got two men on board a chopper, but you're sending three, four, and five choppers out. One of those choppers ought to leave a photographer off and carry a guy to be put in the water with a wet suit and flippers to help you.