NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

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Interview with

WAYNE OTTINGER

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July *27* and 28, 1971

(TRANSCRIPT OF TAPE RECORDINGS)

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C O N T E N T S

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P R O C E E D I N G S

(START OF TAPE ONE, SIDE ONE.)

MR. ERTEL: This is conversation with Wayne Ottinger in Los Angeles, July 27, 1971, while we are looking at some pictures.

MR. OTTINGER: Okay, that's tho RV in on -- these pictures will all be Edwards pictures. I don't have any film on Houston operations. These would all be LRV, Number 1. I don't think I have any films at all on the second RV.

There was just a very short check-out program for that second ship, before it went down to Houston.

It's real difficult to pin down also what these ?articular films --

: (Inaudible.)

MR. OTTINGER: Oh, yes. Right. 'vie only did very limited testing right at the tail end of the Edwards program of an enclosed cockpit.

I would ssy there were approximately 200 flights, I think, made at Edwards in the RV program, and I think most all of then on the first unit. I've forgotten how many flights were made on the second.

See, I'd left an3 gone to Bell before they ever finished the program at Edwards.

This is a ~~Paul~~ full Lunar sim ~~SIM T.~~

MR. ERTEL: I understand that's when the wheels

were corning off. (Laughter.)

MR. OTTINGER: Yes. I've forgotten now whether we nade the first flight with wheels on or not. I think we did, yes.

MR. ERTEL: The first four or five.

MR. OTTINGER: The first four or five, yes. Okay. We got so much rolling due to the lateral forces that any little bit of wind would really scoot him around.

It's one of those things that works in reverse. We figured initially that would be the greatest way to go for the first flight. We would have been far better off --

That was taken fro%a helicopter. That was a pretty good trajectory there. Picked him up from (I-EV). Probably a good five-six hundred feet, maybe. I don't know. It's hard --

Okay, this is X-15 staff here. This is a (plas-mark spray rig that we put together. And actually right down here in I,. A. at a shop. 3ut we actually built the panagraph and tooling to hold the engine at Edwards at our shops there at FRC.

And we did the initial plas-mark spring down here on Sepulveda Boulevard.

We are re-coating the engine in the X-15, the 60,000 pound chamber there, with ceramic coat! ng.

This is a shot of the test stand. We checked the engines out. This particular one, I think, is the one where

it blows, We had a combination of warm locks and a stack-up of tall X's and switches and so on.

Let the ignition sequencing get oat of band and there she blew.

And this is somewhere where the airplane, tied ~~triad~~ down, engine runs in the aircraft. And this is another blower. Scott Crossfield is ~~It's got a cross field. It's~~ in the cockpit at the time.

This was before the large engine ever Slew, the 60,000 pound engine ever had its first flight.

Ground runs just prior to trying to get it into the air. Regulator and relief valve failures in the ammonia tank caused the ammonia tank to over-pressurize and not relieve properly, and GSE was not designed properly to relieve things When that ammonia tank blew, it blew the peroxide tank and kept the airplane idle too right at the aft edge of the wing.

It blew the tail section out in front: Crossfield in the forward section shot forward about 20 feet. The rille: ride he ever had.

It was a real fortunate thing too, the ground crew was just being notified to go ahead and come out of the pill-boxes, and make an inspection as a result of an engine mal-function shut-down that had no relation to the propulsion system problem, and the tanking.

And they were just ready to unlock the pillboxes,

and had they done that, out of the three pillboxes, they would probably have lost about 15 guys.

They were Just within seconds of doing that when that thing blew.

This is a mating shot, bringing the thing up under.

Finally, these films -- I've put the ~~press~~ heat of the RV stuff that I had on the front of this, and now I've got the X-15 on it, and it's probably a combination set-up.

MR. ERTEL: -- the X-15 (inaudible).

MR. OTTINGCR: Yes. Well, that's a good trainer for -- in a way for re-entry in a broad sense.

MR. ERTEL: You're never going to see one of those ~~(inaudible).~~ Saturn V's blow up.

MR. OTTINGER: Yes. Here's the take-off sequence. The ~~locks~~ LOX tank cross ~~fin.~~ there. Chase shots going out to the launch site.

We did a lot of pre-launch check-out with the chase watching the various strain ports, checking prime coming sut the back end on both the ~~locks~~ LOX and the ~~(feel)~~ fuel.

There's a control room shot. I'm on the left. (Perry Rowe) there is on the right. We ran about 35 or so propulsion parameters on tankage systems and engine systems snd sequencing and so on, in the TM room.

Pretty involved check list, prior to launch. We'd get the engine pump going and light the ignitors, which was

a thousand pounds of thrust or so riding all the way down to about a 60 second pump battle, as I remember, before launch and about a ten second igniter, with the igniters.running two-stage igniters,

And then after he drops off .the hooks, he just pushes the throttle up and lights the main chamber, but his igniters are all ready, so he can usually get rolling pretty · oh, within 500 foot or so of altitude launch.

After he drops off the hook, he will be off and running. You'll see some shots in a minute, of the chase and everybody right in formation in launch.

These are the plotting boards. The large narks on the maps are the energy levels for various emergency recovery lakes that he can use in case of propulsion failure or any problem requiring emergency --

The thing was altitude and velocity combination and where he *I s* on that flight oath,

The camera is in the [B-] 52, and this was with a small engine. Now, this is with a large engine. And he doesn't drop nearly so far. But that first shot was with the eight small chambers, and we only got about., oh I think it was about 5000 pounds per chamber. No, it wasn't that milch. 1500 pounds per chamber times 8 chambers.

MR. ERTEL: 12,000.

MR. OTTINGER: 12,000 pounds for the airplane,

whereas we had 50,000 with the -- but we had cameras on this thing. You know you saw the 52 cameras, the chase cameras, the bug-eyes behind the cockpit on the bird itself, and a cockpit camera looking at him and the instrument panel.

MR. ERTEL: (Inaudible.) Who was that flyin 6?

MR. OTTINGER: No. Do you want to stop and go back -

MR. ERTZL: No, no; that's all right.

MR. OTTINGER: Okay, These are the bug-eyes. The speed brakes are out. He's on the power climb-out with speed brakes out to keep his velocity down to flight plan.

You can *see* the curvature real well on the horizon. And this shot here is -- this ~~white~~ flight was taken very shortly after Gemini got going. I think -- wasn't it Gemini where they were seeing these foreign particles coming by --

MR. ERTEL: That was the Mercury.

MR. OTTINGER: That was the Mercury? Okay.

MR. ERTEL: Glenn saw it first and then (Carpenter saw it) 2

MR. OTTINGER: Well, okay. It was about that time when Mercury then -- that they were having their problems, and we picked up something on this flight, and you'll see it in a minute, I think.

We didn't know what it was, but the bug-eye cameras picked it up, but I think eventually we wrote it off as frost or something breaking off. I'm not sure if this is the sequence or not. But it's up in the dark part of the horizon

there.

You almost have to slow the thing down to pick it out and *see* it, but there's a flash of white stuff going by.

The film speed on this *is* pretty slow -- the camera speed, rather, so it looks like it is going like that.

I can remember a lot of North American footage on this thing with Crossfield flying.

Here's a landing sequence. He flew the(ventril) just; then, and it -- they had a recovery chute on it that worked about half the time. Those tnings run about ten or twelve thousand bucks, for the ventril, so they are trying to get them back.

Here cones the gear. Landing flares. About a mile roll-out on the average on those *skids*.

A few flights where it was nip and tuck on getting the nose gear down. Or a skid would hang up or something.

Here's some more chase shots -- pre-launch. I think this is the one with Pete Peterson, Navy pilot, his first big engine flight. No, it wouldn't be big engine; it would be small engines, and he couldn't get alight. And he jettisons here pretty quick.

He tries a couple of times to get alight on the main engine. Doesn't do it. He's headed to that lake bed over on the right of the screen.

And, some real nice chase coverage on this thing.

There his Jettison strap -- no, that was the second try at th start ignite -- going to start his jettison.

That's Mud Lake in Nevada. There's his jettison.

Plan form on the T-38 chase there when they go into this next turn -- look at it compared *to* the X-15. It sure is similar.

MR. ERTEL: Yeah, really is ~~(Inaudible.)~~

MR. OTTINGER: That's a real nice shot there. He's trying to dump about 15,000 pounds of propellant, and he's got three minutes to do it, something like this. I've forgotten exactly what the thing is.

We got away witn it on that one. There's some more sequence on another one with Jack McKay ~~(McCabe)~~ flying that -- he wasn't so lucky.

But he's coming in fairly hot, We've got emergency recovery crews at these various lake beds, and the launch lak site is always the heaviest manned with the most equipment, in case of a problem.

There's a little light plane that got the hell out of there because of the ammonia fumes. When you are venting off that thing, it gets pretty bad, depending *on* the wind.

I barely got oat of a pillbox with a crew chief one time on the ammonia. We didn't have the full mask equipment. All we had was some filter masks. They weren't good enough. They can move you out when your wind *is* cut *off* with it. It'

30 things physiologically to you that you won't do normally. In terms of speed and getting, you know --

MR. ERTEL: ~~(Inaudible) utilize the liquid in~~ Chrome realized the length of the X-15.

MR. OTTIMGER: I've forgotten how long it is. This is bug-eyes with the lens turned 90 degrees. The vapor trail will dissppear in a minute -- in a few seconds.

This is a big engine flight with -- we only had about 70 seconds of burn time. There's the vapor trail disappearing. And that thing will get pretty small.

And I think this is the one where those foreign particles I was telling you about. Keep an eye out for them.

You're seeing the whole Southwest there. He's probably gone to 250, 300 thousand feet. I think the record was 400-and-some-odd-thousand feet.

Look on the left side of the screen now, and watch for a flashby about the nid-point. There it goes. Did you see it?

We spent a iot of time poring over that thing.

This is a landing. Okay. This is McKay's landing after he couldn't get the engine lit and he didn't get rid of as much of the propellant on jettison as we would nave liked to nave bad.

He came In high. He had apparently a hair line crack In the left, I think it was the left rear skid. It

snapped off on impact, and about a second later -- a fraction of a second later, the nose gear snapped off. And he's headi about 300-and-some-odd knots, 390 knots; no, 390 miles an hour, I think it was. His touch-down velocity.

He's skidding broadside down the length there. And from touchdown to full stop was 12 seconds, at 390 miles an hour. And the thing keels over on one wing and it flips over

Fortunately, he jettisoned the canopy as it was rolling over upsidedown. And the crew was able to cut his straps and get him out of the thing in a real narrow spot between the ground and the rail where the canopy met, you know. The rail of the cockpit. They just got him out.

He came out half an inch shorter, I think, in his height, His spine was compressed on that thing. But other than that, he really wasn't seriously injured at all. It's just a real miracle in that that airplane got rebuilt, length ed out, and those ~~pile-on~~ pylon tanks put on. External tanks, to pick up another 40 seconds, 30 seconds of burn tine.

I've forgotten how much those things -- but that airplane was a mess.

MR. ERTEL: I don't *see* how you could rebuild that'.

MR. OTTINGER: It took a while.

MR. ERTEL: It looks ready for the salvage yard.

MR. OTTINGER: We didn't -- *the* closest crane to ha lifted the nose in case he hadn't blown that canopy was 100

miles away though, So we got a portable hoist built up for the emergency gear after that.

MR. ERTEL: When did you go to ~~Wrigley~~ work at FRC? How long were you there?

was helping put the documentation together as well as verify some of this stuff.

MR. ERTEL: Were you still at {Ellington} when you creamed that RV-1?

MR. OTTINGER: I was there running the TV flight test program then -- ground test at that time: we weren't into flight test yet, but I was there at the time, In fact, I sat in on the -- I was in my office when it happened and rushed out as soon as we got the word and arrived at the trailer just as Neil [Armstrong] was getting nut of the station wagon.

We went in and sat down and had a post-flight on it and -- it was real funny; he started lisping about five minutes into the post-flight, You could sit next to him; you could tell he wasn't -- he was unaware of why should this happen, you know, and a little bit puzzled.

It turned out he had bit his tongue when he got the ejection boot, and his tongue was swelling up on him and he was having a little speech difficulty. That was about the only thing, I think, that affected him, besides probably being a little bit sore.

Okay, I didn't do this, so let's take it back out. Now then. There's a good reason for most levers and instructions; right?

You know, I left before, however, the first flight of the TV.

MR. ERTEL: Yes, that was too bad. Have you been back to see any of them?

MR. OTTINGER: Yes, I've maintained pretty good contact.

Am I glad to see these on a pad. That's down here In ~~(L-Central)~~ El Centro. That was our flying ~~time~~ pipe rack. That simulated the weight and the CG of the LORV and we put our ~~droge~~ drogue system on it, as you can see there, the ~~drake~~ drogue chute and the recovery chute.

In case the jet engine went out, we wanted to get that thing home on this chute system plus some emergency rockets. And we were concerned with the stability of the thing.

As you can see In those shots, it -- actually, we had more chute deployment problems with the test set-up than

we did with the --

MR. ERTEL: (Inaudible.)

MR. OTTINGER: Oh, no. That's being taken on a rise. It's on the down-slope, That's what --

KR. ERTEL: (Inaudible.)

MR.OTTINGER: It didn't go in, no. I'm sure it dent in a few inches, but not what it looks like in this picture. But we had to run a number of tests before we got a proper deployment system out of the helicopter.

Those pads were interesting. Lockheed put those on as a free ride. You'll *see* soae shots -- I've got some slides at home, if it doesn't show the detail here, of --

Those things -- they are tubes that nave been pre-cut. Here's an ejection shot and the dummy.

We apparently didn't get the seats firing. Jnfortunately, these were clips that whatever, as I said, I could get off the floor or scrounge or something, and some of the3 have the key parts taken out.

Those landing pads -- they were energy absorbers by letting the metal peel up in sections, and I'll show you ~~the (inaudible) areas,~~ later today *in the* slides at home.

We had probably four or five ejections tests, most of which were successful: a few problems. Seat: WE put *a* lo of effort in on that seat, and it has paid off, obviously. We have had three out of three, and the middle one with Al

Greuning) was a fantastic recovery.

MR. ERTEL: (Inaudible) check those segments.

MR. OTTINGER: That gets to you, doesn't it?

MR. ERTEL: -- standing out there watching that.

MR. OTTINGER: Joe's a lucky man.

Some of this film isn't the greatest. This is the onfiguration when It first came from Buffalo, of the first V. Electronics on the back. There's Joe Walker.

The electronics on the back were standing up ertically and -- this was all done. The equipment was rranged to the CG requirements; as the vehicle design changec hough, we had to really readjust --

MR. ERTEL: Who is that in the back?

MR. OTTINGER: That's Joe.

MR. ERTEL: (Inaudible) at an angle.

MR. OTTINGER: Yes. That's fixed base simulator hat we built up there at Edwards an3 did a lot of work with.

MR. ERTEL: (Inaudible.)

MR. OTTINGER: Yes, oh, yes. Our first -- actually e put in the hand controller probably -- I've forgotten hether it was halfway through the program or a quarter of the ay. It was --

?EX. ERTEL: It was the Gemini 3.

MR. OTTINGER: YES, it was the Gemini 8. In fact, I'll show you some of the guys that did that work, that modif:

that thing for our system, when we are up there tomorrow.

MR. ERTEL: ~~(Inaudible.)~~ Joe Walker said it was a tough simulator.

MR. OTTINGER: It was a tough simulator. It was much harder to fly than the real thing.

MR. ERTEL: (Inaudible) the way they told me was ~~inaudible). (Laughter.)~~ Walker said he tried to keep away from that darn simulator.

MR. OTTINGER: The displays were interesting. They had quite a changeover in the TV, of course, trying to get up-to-date with the LEM.

That's the rack on the back of the simulator.

MR. ERTEL: 10-28 --

MR. OTTINGER: 10-28-64. This is the first flight. No control van down there: we Just had one radio vehicle, JHF vehicle, and this is --

Okay, here's the -- when I came back from Buffalo -- here's a NASA ~~(inaudible)~~ rep back there during the RVN in desig and fabrication and assembly.. Our guys at Edwards were putti together the GSE and things, you know, and I'd try to coordin e it from back there as much as I could, but the plan was to trailer everything in a train down fro? home base -- home hangar up at the north end of Edwards down to the south base, where our flight area was.

And this was five miles across a lake be?, Eight miles across the paved roads. And you had to cross the runway and use radio vehicle equipment and everything, and it was jus

a big drag. We had 28 vehicles going down the first morning. There's part of them; so we just stayed down there after the first day. We ~~couldn't~~ didn't go back for, I think, quite a long time.

We did all of our ground running and so forth until we thought we were reedy for flight, before we went down there So once we got down there and setting up ~~the dual~~ to do our checkouts, we tried to to stick around on that ramp down there -- not haul back eight miles, you know, on that trailer.

We used canvas covers, left the thing outside with a guard standing by all night. In fact, we had in the early phases there checking out the canvas cover we put over -- the waterproof cover -- we went home one night saying, "Well, we'l get a --" It looked like real threatening weather.

"Maybe it will snow real hard and then we will proof load that cover." Come by the next morning, we had eight inches of snow. (Laughter.)

MR. ERTEL: (Inaudible.)

MR. OTTINGER: Yes. You can just see the problem of trying to tuck a rocket test cart we'd built up -- refreshe and electrical checkout on the rocket system. And things sure evolved in that.

We learned a lot as time went on an3 condensed thing down, changed them around.

There's a blast shield. We are sitting pretty close

to the pavement with a vertical mounted engine and that gave us problems. We had to -- we worried a great deal about the -- The original casters on those things were about a foot in diameter. You can see that those are about six inches, We ha to get rid of the big ones due to weight and CG.

We wound up -- our first flight now you can see was made with this rack, electronics rack, on the back laying down, which was done primarily for CG control.

But with casters on the back versus the foot pads -- things like this -- we were playing adequate ballast all the time, having to worry about our weight and balance. It was quite critical with the limited control ability we had, and winds of any kind.

We had to know within a 10th of an inch where our CG was, and even the ~~fluctuare~~ fixture of the structure -- weighing it on the scales would, in a conventional weight and balance procedure, would throw us off so much that we had to build special fixtures to put -- to mount the thing up in the air to take our reading.

It was really quite an involved process to get an accurate weight and balance on that thing. Doing the engine separately: doing the vehicle with the engine in it, and things of this nature.

We hit a bad spot in the film here. I'm not sure how I get this thing off.

There it goes. I was trying to (inaudible). Here is my problem down In here.

If I pull on this --there's something -- I think it's better to go ahead and pull it out by hand and hand wind it. I hope it doesn't have any more like that, but we are going to be ready on the switch if it does.

This is still this first flight caravan coming through. Weather played a great part in our ability to get things done out there, particularly when we got into the flight program, because of the winds. And the temperature. During the warn months, we -- during the warm weather, we had a temperature problem on the jet engine, on the thrust.

We always had a weight problem on this thing. Our coolest temperatures and our lowest winds, surface winds, would be in the early nornings, so we would start these operations at anywhere from one or two o'clock in the early stages -- for the important flights, in order to be ready to go as soon after dawn as we could -- to maybe standard reporting time of 3:30 in the morning for any flight day.

In fact, as I recall, we had shifts set up so that we, even if it wasn't a regular flight day, we would be used to coming in at the saxe time every morning.

MR. ERTEL: Where did you live?

MR. OTTINGER: Lancaster. Most of the people lived in Lancaster. Some of the crew lived in Palmdale.

We got rid of the big blast shield and went to a small one. If that concrete would spall with the heat, we would wind up having to replace our bolts and --

So when we serviced out about six, seven hundred pounds of peroxide -- I think the tanks held 300-and-some-odd pounds apiece. By the time you pry them out and get everything checked out and topped off, you know, you go throug , well, what would that be? Eight hundred pounds -- about 80 gallons of peroxide. Ninety percent concentration.

And you would have to have the rubber suits on to service that stuff with. In the summertime it would be hot.

This is the first flight. And I may -- finally, I just have to check out stuff: they've plucked out the actual flight. [telemetry]

We had TM manned up at the station five miles away, and then I was on the radio down there at the base.

MR. ERTEL: (Inaudible) radio wasn't working?

MR. OTTINGER: No, we didn't even have that until about Flight Number 15 or 20 or something like that.

MR. ERTEL: (Inaudible.)

MR. OTTINGER: All the -- yes.

MR. ERTEL: (Inaudible.)

MR. OTTINGER: I'll come back to this later because right now, not being able to say half whet I want to -- we'll talk about those early TM days and some of the things we

learned. On the first flight, for example, we flew the whole thing with malfunctioning relay. And we were flying with both sets of rockets and didn't know it.

Well, they knew it up in TM, but we didn't know it down there, and the pilot didn't really fully recognize it, We were looking for so many other things that it got away from us.

well enough to go ahead and correct the things. We took plenty of time in-between operations to look at data and decide what we should do, if anything, before we flew again.

MR. ERTEL: (Inaudible.)

MR. OTTINGER: Oh, this is priming before flight.

It

m

out.

MR. ERTEL: (Inaudible.)

MR. OTTINGER: Did you?

MR. ERTEL: (Inaudible.)

MR. OTTINGER: That's right. Yes. Have you been told about the story about the seat cushions and the ejection

seat requirements?

MR. ERTEL: (Inaudible.)

MR. OTTIRGER: Yes.

MR. ERTEL: I could just get a little bit of it.

MR. OTTINGER: Well, we'll go through some of it.

MR. ERTEL: (Inaudible.) -- screwed up with that control that you had on the engine (inaudible) on the hand control (inaudible) and he was doing something. After that they de-activated it because (inaudible).

MR. OTTINGER: Yes. It'll come back to me. Yes.

MR. ERTEL: (Inaudible.)

MR. OTTINGER: We had quite an environment right behind that cockpit there. We had JP-4, hydrogen peroxide, the ejection rocket solid propellant, hydraulic oil: we had a lot of stuff that was crammed in right behind this seat.

We were always worried in the program about the weight -- the problems of -- we were forced in by basic desig: -- the whole thing in trying to do this job as a simulation was the general equipment and technology available.

We were forced into doing things that we normally wouldn't do in a conventional program.. And accept some of these penalties and then set up the extra precautionary measures that you would have to in order to -- you know, that were justified because of it.

I don't know whether the rest of that stuff is worth

playing or not, at this point. I think it is just more of the same kind of stuff and I think maybe at the risk of the projector, we ought to put another reel on, in consideration of the projector.

That's an old film.

MR. ERTEL: That's one thing that tends to --

MR. OTTINGER: I'm sure it's another splice problem.

I didn't think about it until now, but these guys may be wanting to get back into this room now. Tne gal's probably gone to lunch and these guys don't want to come in -- barge in. I suppose I ought to go out and offer it to them if they want it.

Fortunately, I think we have seen the LARV stuff I had. I'll look at the other reels and make sure that -- to just see what else.

I want to re-verify this. There's somethin; that he said. He's an AVTOL. And he made 2 statement that we were the first ones to fly any vehicle for that matter aircraft type vehicle now, not spacecraft, with purely electronic controls with no mechanical backups of any kind, for attitude control.

I just want to verify that with him. I always remember that as scaring the hell out of me when we --

It says "X-15 footage" there. Now this is a lot of LARV stuff. They didn't need the room, so I will show this

reel. It looks like a good reel. It doesn't look like I've got any splices on that.

Now, I've got a groove that's -- oh, here. That houldn't be too hard.

Here we are flying a ~~V-stall~~ VSTOL Which -- or ~~V-tall~~ VTOL -- t's not a ~~stall~~ STOL A ~~V-tall~~ VTOL which has got a first in terms f control systems, variable stability, all electronic -- o mechanical backup.

A ~~V-stall~~ VSTOL, plus adding the lunar simulation on top of it -- it's to fit the LEM mission. It became quite a unique aeronautical project -- R&D type of thing not decided on a for that

MR. ERTEL: ~~(Inaudible.)~~ -- flying bedstead. They used, I understand, ~~about 59 over~~ that was used in England before.

MR. OTTINGER: Yes, that's -- that's why it wouldn't o.

MR. ERTEL: -- a flying pipe~~line~~ rack or --

MR. OTTINGER: Yes. All those names have been agged on it. I think there's been one or two names that have een very peculiar -- or significant.

I'm sure we will flush some of them out tomorrow. These are shots taken when it first was delivered from Bell. We got it up on the lakes there. Let's see, no, there we're n the fixture, on that center of gravity fixture. Have you seen any shots like this?

Or have you seen (Lanny Pullman)? You haven't seen

any runs? Go through all this.

We had a -- this was a heck of a challenge to go through the ground test program with the systems working as much as possible. Jet engines systems, rocket systems, doing

Here we are out on the ramp on that CG fixture, and we've got cable restraints on it. Rocket systems.

Yes, there's Joe flying the thing. He's got friction rolls free; no yaw. Yaw is a non-critical axis as far as control is concerned.

It's easy to control. But he's flying with pitch roll free. Close loop. And he has a heck of a lot of confidence In the control system to be able to do this in a simulated flight situation with *a* hot rocket system.

MR. ERTEL: (Inaudible.)

MR. OTTINGER: Yes. Very good. Just for training, but it was used a great deal in setting up and tweaking out all the electronics and getting the feedback sensors in the loop.

This is an ejection sequence and I'll go through that. with you in more detail later as to just how the system works.

MR. ERTEL: is this like the Gemini machine'?

MR. OTTINGER: In principal. No, it's a modified ~~Airport C-6~~ Century F-106 system. It's the lightest weight, highest powered seat in the world.

We originally came in about 95 -- 96 pounds, including the parachute, seat, and rocket motor -- the entire system was about 96 pounds.

We added on a rocket to improve the thrust capabilit by impulse -- total impulse -- by about 50 percent. We added about 10 pounds, 15 pounds, onto the systea, before we got through with all the things the pilot wanted on it and so on.

Now this is a firing through the canopy, styrofoam canopy, that we put on. The pilot's boot, the dummy's boot, in this picture hit the corner of the simulated instrument panel and it imparted a vitrol and yaw moment, which made that thing twist.

Neal and Bud (Rheam) and Neil Armstrong were watchin that particuiar shot and they just turned their tacks and walked away.

The dummy's boot was broken in half and the thing went wild in gyrations, but the chute care out and the recover was fine. And the shot -- since we could identify what was wrong and what happened and follow up with the right clearance and so on, we called it. a successful shot, because we could explain away any of the anomalies on it.

MR. ERTEL: (Inaudible.)

MR. OTTINGER: Well, this was the final qualificatior for the LAIVC. Before we ever flew the TV.

This is the J.P. Forest servicing. We had about

400 pounds of jet fuel on board split in two tanks, one front and one in the rear. And then the peroxide tanks on the side

It usually took us three to four hours to come in in the morning and get the power on and start checkout with our various systems, The longest time was getting the flight control system pre-flighted.

Those checks were quite complex in the beginning. In fact, I think our first ones were ten or twelve hours, something like that. And then we got it down. And then, eventually, into the TV, got into some automated checkout equipment.

But --

MR. ERTEL: (Inaudible.)

MR. OTTINGER: Yes. This was an X-15 recovery van that we used until we got our own van, any time it was available. We had no TM in that until we got our own van.

As I say, I've forgotten how many flights it was. It was something on the order of 15 or 20 flights, I think, before we got our own van.

You see the can in front of the electronics rack in the back? That contains the drogue chute that you saw the drogue tests with that pipe rack.

And in the event of a jet engine failure, the pilot would come on with a lift stick down here by his leg with his left hand. He would move his hand from the jet throttle down

to this lift stick, pull it up, and then he would turn on six emergency rockets, three on either side of the thrust, plu the two normal lift rockets.

They would have eight rockets burning at 500 pounds apiece, plus a stabilization chute, and he would be able to make the emergency landing without the jet engines, without arrangement.

It became such a tricky thing to -- after we got some flight experience under our belts -- to manage this thing from an energy management standpoint. In other words, as we were flying, we would use fuel for attitude.

If we ran lunar SEM, we would use fuel for the normal lift rockets to provide the lunar thrust equivalent. So your tanks would be dwindling down, you know, and what was remaining throughout the flight -- as a result, the fuel available for emergency recovery would go down.

The capability of recovery from, let's say, a given altitude would change. I didn't word that right, but I mean your altitude recovery capability goes down as the fuel that you have available for emergencies goes down.

And it is also not just a function of altitude, there is vertical velocity. If you had a high vertical velocity, you know there is maybe a low altitude, you still wouldn't have enough left to kill off that velocity -- the vertical thrust.

So It became a -- after accumulating jet engine

reliability, a good feel for that, and it was good. In recognizing some of these energy management problems and playing with the simulator more and more, the ground base -- fixed base simulator, and It was an extremely marginal thing for an experienced pilot even to feel confident that he could make a successful emergency landing.

So (Cloover) had a great deal of influence on this along with (Maleck) and the others, but he took a lead in it in terms of getting rid of that crutch that might get an astronaut into trouble,

Let's put our eggs in the good ejection seat and a good set of standard procedures instead of maybe giving hi% a marginal crutch to use. Because, you see, if you give him that crutch and he -- and it is poor and he does try to use it you're just putting hia in a more unfavorable ejection situation.

But why take a chance? Blow him out in the ejection seat and --

In retrospect, it was a damned good decision because we have yet to have a -- we've gotten through all the problems we had without a jet engine problem.

We know we've got a reliable seat. We saved a great deal of weight. And we also had some other things in this -- down at Houston in this energy management situation, which pointed back to that being a very wise decision. Get rid of

those emergency rockets.

So we took the drog chute can off and the whole works. These are sequences when we got the cockpit on. You can see we were flying it without the roof there.

The radar on thst thing was an antiquated radar. Landing radar for getting some vertical height readings. We had a doppler for velocities. But it was quite an antiquated radar, so when we went to the TV, O'Ryan designed and built a complete new radar system, both --

Let's see, I've forgotten now if they did the altimeter. I know they did most all the instruments for the radar system. I think they did both.

Let's sen, we used out of the Gemini -- not Gemini, but the LEM. We used the LEM hand controller. We had some -- Minneapolis-Honeywell made some nods to it, but it was basical y a standard LEM hand control.

MR. ERTEL: (Inaudible.)

MR. OTTINGER: I'm sure it was. (laughter.)

(Coover) got into that thing an3 flew it like it was strapped onto his but. He just really -- he went down to Houston to put on a show for the astronauts and I guess they were quite impressed.

Like the time he came on board to replace Walker. Walker was put on the B-70, and he'd been off, I guess, our program for three or four months at the time he was killed.

Coover Klemin?

? Coover got in and we got him on a diet. He and I went on a crash diet together so we could get his weight down, so he could fly the thing. He was Army. He had more helicopter time in the Army, I think, than anyone they had at the time.

And he pretty well proved it out in this machine as far as adapting to it. He just -- from his very first flight, he just flew the thing like --

MR. ERTEL: (Inaudible.)

MR. OTTINGER: Well, he was at Edwards at the Army test station at Edwards for a few yecrs, I don't know how long. Then he got assigned to NASA and had been -- I think was going to do some flight -- ended up in a flight test engineering group at NASA at the time they picked him out for this.

He was just serving out a two year stint with NASA or something like that.

You ought to -- he probably ought to he back about - I know last June he went to Viet Nam and -- I don't know; if the normal tour of duty is a year, he ought to be back by now. You ought to be able to track him down. He went to the War College Just before he -- some of the early sunrises.

MR. ERTEL: Well, that was a good film. It didn't mess up.

MR. OTTINGER: Yes.

How come that happened? Did I lose a splice? I guess I must have.

MR. ERTEL: (Inaudible) capitalize the end, but --

MR. OTTINGER: Let me use this tape. Have you seen many of these movies like this?

MR. ERTEL: No, I haven't. I checked a couple here. I saw some ~~(vacant)~~ in Houston ~~might have some.~~ when they first got back there (Inaudible.) Just so many years ago, it was just a curiosity item.

MR. OTTINGER: I've been meaning to get over to Weber and see their movies -- they always get a copy of the ejection -- the live ejections, for evaluation of the seat system. I've been meaning to get over there and look at them.

I've seen -- yes, I did see Joe's, and Neal's, of course. I haven't seen the one that happened --

MR. ERTEL: (Inaudible.)

MR. OTTINGER: Yes. Joe said that was sure a text-book ejection. He had a perfect attitude and altitude and low descent rate, just like Neal. Neal's was beautiful. He had all kinds of --

Let's see if there is any more that we should look at. I guess that's it.

We'll take off now for a quick sandwich and then --

(Short blank spot on tape.)

MR. OTTINGER: If we have the time, we'll drop by that south base tomorrow while we're up here, and you can see

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the sights. Those are a couple of hangars down at the ramp.

Generally the base puts their ~~V-stall~~ VSTOL, all their ~~V-stall~~ VSTOL stuff down there. We had company down there from tim to tine. I think we out-lasted most of them: but we had everything from the Army's caribou on ~~(Stole)~~ STOL to Lockheed's flying bedstead,they called It. They never really got to fly that.

~~(Inaudible.)~~ I can't recall that. Orion XP5A -- there were just quite a Few. And the U-2's were down there. (Inaudible.)

The ~~X-0-2~~ F-102 landing recovery tests.

MR, ERTEL: Why is the (inaudible) the best?

ME. OTTINGER: Yes, that's what it is. It's gravity pull. I'll fix that.

Ertel . ~~You can switch this.~~ A glitch in the system

MR. OTTINGER: Yes. It needs more prop.

Did you ever see those U-2's flying?

Hello, (Uma). That's my pooch.

That's the rocket base. They fired the Saturn engi n on there on that ridge. That's Loch Lomand ridge they called it. Edward's test station.

There's our ground servicing area before we put our hangar in, and generally what we had to work with over there. It's five miles away from our (tanks). It turned out to be a remote site operation and gradually built up the little

hangar and trailers and stuff, and we had our own operation. We used to report to work and leave from there.

We had our own transportation.

MR. ERTEL: ~~(Inaudible)~~ for about three years ~~was (inaudible).~~ I loved that.

MR. OTTINGER: Yes.

MR. ERTEL: We stayed away from that crew altogether. (Laughter.)

MR. OTTINGER: Oh, yes. We all enjoyed it down there. I had a little hibachi and we had a freezer and we had a range down there and a refrigerator. We took the little hibachi out --

MR. ERTEL: (Inaudible) steaks out of there,

MR. OTTINGER: They busted in on a Saturday night and they stole all the tools. We had three or four guys with any tools. I was taking it pretty cool until we found out that I had about $20.00 worth of steaks out of the freezer missing. Then I lost my cool.

MR. ERTEL: ~~(Inaudible.)~~

MR. OTTINGER: Yes, that was south ~~(bay).~~

Now, this is --

MR. ERTEL: What's the ~~steak (inaudible)?~~

MR. OTTINGER: In the same part.

MR. ERTEL: (Inaudible.)

MR. OTTINGER: Well, we -- I know when Neal had to

eject, the thing come in inverted, and about 3:00 that afternoon we had it picked up out of the ~~(verd)~~ dirt with a crane, out of the grass there between the runways.

There was a half-burned, still alive snake that the vehicle had crashed on top of, and this thing was trying to crawl out froa under him when the crane picked this thing up, you know. It was burned real bad, but it was still alive,

But we used to find a lot of snakes and I know some of my crew would get garfish and put the garbage can down there and bring a guy up and get him right next to the thing and pull the lid off, and that garfish would come flying up at him.

And one of our troops found a big -- real record length coral snake down there. Got him all boxed up in a Houston zoo. They come out and got him.

Wife-type : (Inaudible.)

MR. OTTINGER: These are sir-show pictures here, and they are mixed in with *these* slides. The next slide tray is all a lot of these things. These are just a few thrown in. 141.

Wife-type : (Inaudible).

MR. OTTINGER: I got my new camera, and that's -- you can *see* that's the runway, or the ground next to the runway. it (inaudible) and that's the touchdown at about 150

knots. 120 knots, probably. I've forgotten the kind of airplane ~~port~~ we were in, ~~but~~ I was Just seeing how fast (inaudible).

Here's (Refken), and that's taken out here at Clark's field at Lancaster. It's a mini-Mustang. Remember I told you some of the structural mods and the nand controllir mods that we did to that Gemini 8 hand controller.

A lot of the machine work we did was done by a guy by the name of Charlie (Wen). You'll meet him tomorrow at the machine shop. He built that mini-Mustang by hand. That's a fifth scale Mustang P-51 ~~351~~.

Flew it at 200 miles an hour, and he's gone all over the country in it. He's written up in a lot of magazines and books. He's got national recognition over it.

One of our engineers out here took it within six months after that picture was aade, and he's working on with para ~~(inaudible)~~ glider guy, and he told us -- real sensitive stick, and he made two fast (inaudible) pullaways. Wiped out the whole thing. There was no way insurance -- killed him.

And Charlie went right to work and built another one It took him about three years to build that one.

We were laughing in the tent the other day about the B-58 we used to run the capsule ejection tests out of. Rears, Live bears. One time the hypos didn't work right and the bear got loose *and* really mauled up one of the handlers when they were loading him into the capsule.

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MR. ERTEL: When did that happen?

MR. OTTINGER: Oh, back in the early '60's.

MR. ERTEL: (Inaudible.) What happens to bears ormally? Do they get along all right?

MR. OTTINGER: Yes. I don't know if they lost any r not. I wasn't that close to the program. They were hooting them off. They were flying around making their uper-sonic ejections with the capsule.

I think it was super-sonic ejection. I think that as the eventual goal.

We had pig drops in the Mercury program

MR. ERTEL: ~~(Inaudible.)~~

MR. OTTINGER: Up to 15. It's got the old -- everyhing I taped at the air show. (Inaudible.)

They didn't have an air show this year. First time n 20 years.

Here's some shots on -- here's a guy with an engine roblem coning in the wrong way against the traffic in one f the air races out here at the flight test. (Laughter.)

He peeled out of the group when he got fouled up. limbed up and then came back, and came right back down through. ost of these were P-51's that fly in the air races there.

Did you ever hear of that old Pontiac? They had a special engine and transmission in that thing.

The next thing when the ~~(prayer)~~ para glider program started out, and the ~~(prayer)~~ para glider is ~~then running this shot~~ in one of these shots

It must be in the other room.

Here's one of those pipe racks that didn't work. Now

Anyway, that Pontiac would used to ground ~~(toper)~~ gliders and (lifting bodies) with it. The thing would do about 170 on a lake bed, and 150 towing.

MR. ERTEL: (Inaudible.)

MR. OTTINGER: Yes. This got hung up due to the deployment system. We really didn't go back and change the design of the drogue chute as a result of any of the testing. As I told you earlier today in the movies, all the problems that we had -- and we had to re-run this test six or eight times to finally get a couple of good repeats, to make sure the stability of that drogue chute was okay.

And the problem was in the deployment out of the chopper when you dropped it and getting that system deployed and actuated and so on.

MR. ERTEL: (Inaudible.)

MR. OTTINGER: Okay. Now this thing that Lockheed put on that thing is just a test for a new impact absorber - energy absorber. You can see the way they peeled those back and started to split.

MR. ERTEL: Yes.

MR. OTTINGER: Well, that thing is supposed to get his landing pad and keep on.

MR. ERTEL: (Inaudible) roller plate.

MR. OTTINGZR: Yes, peel it on up. It's quite a peel. And that will absorb that energy and be a real cheap -- here's a close-up of the chute. It's tangled.

MR. ERTEL: Do you want these on here? Several things like this.

MR. OTTINGZR: This will add a little flavor in it.

MR. ERTEL: Yes, that's right. The shell -- the early problems and what was the (inaudible) automatic ejector (inaudible).

MR. OTTINGER: Well, there's -- there is a shot taken from where we eventually put our hangar on the south base; now that hangar has been moved away since then. It was a little old 40 by 40 building.

And that was taken since we got our -- you can see our control van out there.

We had a (Yell[illegible] helicopter on lease throughout the program to keep the pilots trained up in proficiency so the pilots could --

MR. ERTEL: Do you spend much time (inaudible) those

MR. OTTINGER: A little bit. Not a lot.

MR. ERTEL: I never liked --

MR. OTTINGER: I sever did have to pick 'em that ~~write about~~ much.

MR. ERTEL: Yes. (Inaudible.)

MR. OTTINGER: This is the water tower service, emergency shower (inaudible). There's the slab for a little

40 by 40 hangar we put in. Eventually we had to put in trail because we outgrew that. Just barely enough room to get two ships in there, with some of the check out equipment.

There's the U-2's. So that's that tray. I'll get the other one in.

That's Johnson's visit set up there. And that was before we lowered the rack, before our cockpit was changed around, and we did a lot of messing around deciding how we wanted to display the things.

We were still too early in the program to put on any kind of live demonstrations.

MR. ERTEL: (Inaudible.)

MR. OTTINGER: So we just sort of simulated a cockeyed landing like that. We had light bulbs screwed in where all the rockets were -- taped on and temporarily wired up so that the guy back here at the console could run through I can't remember if Walker was in the cockpit faking the contr movements and then the guy at the console would flash the Lights, you know, where the rockets were, as Joe talked.

So you can *see* where these *things* were located, and we had talked about using some helium gas with a -- and just letting them, with a low pressure, you know, with a colored smoke come out. But that --

MR. ERTEL: (Inaudible.)

MR. OTTINGER: *Yes*. And all that was for Johnson.

Oh, one thing. On the cockpit of that -- this was in October -- now the '64 election was in November, and Goldwater was running and they had bumper stickers out -- AUH2O for Goldwater.

We had a big warning light panel in the cockpit and I had an amber lens, made up with AUH2O on it, wired it in with a switch down here, and gave the lens to Joe Walker, because Joe was going to be in the cockpit with Johnson.

In fact, they were going to sit in the seats, *see*. So we had it all figured out. Here it is, three weeks before election. We thought *we* would get a big charge out of flashing Goldwater's bumper sticker sign. You know, AUH2O, the chemical symbol for Goldwater.

So, we showed the thing to Bickel, and Bickel -- he didn't know what it meant. And so -- he hadn't seen the bumper signs and he didn't know that's what it meant, so one of the guys got him off and told him and he got a big kick out of it.

He didn't care. So Dee Beeler got wind of it, and the morning that -- he was worried about it. And the morning *that* Johnson was to visit, he called me up per se. And he called me up and he says, "Wayne, I want that lens up in my office. I don't want you to use it,"

I said, "I'm sorry. I gave it to Joe Walker. Joe Walker has got it in his pocket." And Joe had already gone down to -- Joe has gotten the word that Dee didn't want it,

and he used his better judgment and didn't put it in, But we thought of it.

MR. ENTCL: I doubt seriously that with so much wrong that L.B.J. would have caught it.

MR. OTTINGER: He probably wouldn't have. It was sort of a gamble. I could be either --

MR. ERTEL: And later he probably would' have laughed like hell.

MR. OTTINGER: He probably would have. You know the kind of people -- a lot of them would -- there's a hunch of 51's lined up to the start on that air race,

There's a pack of them in there. They are all about 100 foot. Look at them there. They are more than 100 feet, aren't they?

MR. ERTEL: It looks like it.

MR. OTTINGER: Okay, there's an interesting shot. That's before dawn with the lights on and "the guys working cn the check out. They are out of the scene of these pictures.

MR. ERTEL: There are lots of things I'd like, like that one.

MR. OTTINGER: I can remember. I'll remember. And there's a shot of the early control panel that was manual. It took this -- quite a few hours to check out the system with that. Nothing really automated in that. Guys heving to patch in most all the checks along the way.

MR. ERTEL: What kind of a shot is this? (Inaudible in color,

MR. OTTINGER: Yes.

MR. ERTEL: But that other --

MR. OTTINGER: There's an early morning prime before light.

MR. ERTEL: That's an awfully good shot there ~~(Inaudible.)~~

MR. OTTINGER: There's -- you'll see I've got some shots somewhere of this atitude system. Oh, that's the lift system, trying it out. And that is true there. But we will get more of the attitude system. It's disappearing --

That's a good cold morning, see. The colder it gets, the more steam you get when you prime then out.

There's one. There *you* got the attitude system and the lift system. It looks like a calliope. One of those, I've got blown up.

This is the control van and I was fighting ~~frightened~~ -- I was allowed one vehicle for control 2nd rescue, and I -- so there's what I ended up with, And then we wound up getting it so loaded down, you'd never use It for rescue!, so we eventually took the rack off the top and -- but we ha3 to have that ~~height~~ weight of rack to get Into the cockpit -- unless the ~~lights~~ legs were ~~(Inaudible)~~ crumpled and then we could use the pick-up.

Eut as it turns out, I believe they arc using today a pick-up truck that's got a high enough platform on it that

they can get into the cockpit if he needs help.

(Trout) was the problem -- you know, this is the replica, duplicate light panel in the van as to what the cockpit has. And then, in addition, in the van I had -- well we looked at about 60 channel of data? 60 or 70 channels of data, real time, on the rocket system, control system, the jet engine system, all the pressures, the sequencing, the whole works.

And it took about five of us inside that van to run a (ply). But I had the UHF controls all in front of ae, and I did the communicsting, with the pilot. And had the check list there. And then I'd use these other three or four guys to back me up and feed me information. Relay to the pilot when he ran into problems.

MR. ERTEL: (Inaudible.)

MR. OTTINGER: Right. (Laughter.) Now that first light, -- I had Mike Mahan, that's all I had, and we ha:', the TM station up there on the line. They never said anything.

I kept -- an: Joe ~~picked~~ it up -- about, *oh*, he was supposed to ~~pick~~ it up about two or three feet and come on back down and just get a minute or two of feel for it In two or three feet.

So he goes up and he gets about three or four minute in about ten or twelve feet. And he scared the hell out of me I didn't want to see him get that far away from the ground

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And I was sitting there yelling at him that I haven't got the guts to key the ~~mike rolls~~ microphone. I mean, he's quieter- and he -- I was just biting my tongue and I'm yelling just to relieve my own tensions. I was about as nervous as a --

MR. ERTEL: I forget who it was. Somebody in Buffalo told me (that you were sitting on) ~~, he was not~~ there -- ~~the voice kept these guys down, you know, and~~ everybody was yelling, especially you, (inaudible) you couldn't separate the voices and make any sense of what ~~you~~ anybody was saying.

MR. OTTINGER: Yes. Well, it started out as a riot and it worked itself out gradually flight by flight until finally we got our own van in, and we would keep having one incident after another. We'd get smarter, and before long, we had a pretty reliable --

MR. ERTEL: (Inaudible.)

MR. OTTINGER: Yes.

MR. ERTEL: That's what I need. Because what I want to do is --

MR. OTTINGER: Go from that to --

MR. ERTEL: I want to show the van --

MR. OTTINGER: To what they have got at Ellington today.

MR. ERTEL: -- control center (inaudible).

MR. OTTINGER: Yes. That's a real seat of the pants

comparison.

MR. ERTEL: (Inaudible.)

Wife type : What you should do is show him the one that's of -- *not* Joe, but the one that wasn't (inaudible). The first part.

MR. OTTINGER: Well, no, we haven't got any pictures of that. But you'll get to meet the first guy that it really did fly it right the first tine, and that's the crew chief. (Laughter.) It didn t have a jet engine then.

During tie-down tests, we were running a *rocket* test, and it was the first time that the rocket was ever fired, and we didn't want to take a chance with a complete new rocket systea and vehicle. Of testing live with a half-million dollar Jet engine in it. Quarter-million dollar jet engine.

We didn't have that many around in the first place.

MR. ERTEL: How was that jet engine --

MI. OTTINGER: All right. it was very, very excell ... I would say we had -- I think they did an outstanding job. And it's not just because I worked for GE before I -- (Laughter.)

But I'm an old engine man out of Evandale. And I hadn't worked at Lynn before.

MR. ERTEL: Whoops. (Inaudible.) Then goes our picture.

MR. OTTINGER: This is a shot -- I'll tell you more

bout it when you meet Ray White. You'll meet the first rew chief tomorrow.

I'll tell you more about that little incident of im flying the thing without an engine in it. It's an nteresting and --

MR. ERTEL: Yes, I need ~~anything~~ to get things like that (inaudibl).

MR. OTTINGER: Oh, yes. Right. Put a little humor n.

We'd start the thing with the conventional jet tart cart that's caught on the back of that trailer. And e've kept the APU's off of the big trailer running until we ould transfer power, got the jet engine running to transfer he power, go on internal vower.

Then that truck could be -- the electrical could be [auxillary power in its] isconnected and take off. And we used old B-29's -- APU's n that truck to furnish external power with.

It was quite a little operation to get that thing ll cocrdinated.

Those are a couple of (turnical) bottle banks of helium and nitrogen from the back of the trailer.

Joe Algranti ~~Al~~ Algranti ~~Ed~~, we hauled that thing down to Houstc . Gave it to ~~Al (Greuning)~~ for his troops.

~~MR. OTTINGER:~~ Now, there's a B-70 taking off In the background, and we had a pretty good flight. Every other light or every flight -- that B-70 would have its gear

problem, and become an aeronautic emergency. Well, we were setting there right in the center of the lake bed cross-wise, so to speak, so that we had a perfect view by getting up high on some of our equipment.

We could see that. And we'd lose our firetrucks and everything else in these emergencies that we had. Our operations would be shut down.

MR. ERTEL: I was ~~with (inaudible)~~ at Downey the day the accident happened.

MR. OTTINGER: That was *my* first day of work at Bell. That was my first day in the plant in Buffalo as a new employee.

MR. ERTZL: Was that June the 4th or 5th?

MR. OTTINGER: Yes.

MR. ERTEL: June the 4th ~~(inaudible)~~ was my birthday. I guess it was June the 5th. (Inaudible) on June the 4th. My wife and I were married at the time and we both came out here together. She was working in public affairs and I was working ~~at the~~ for the History Institute.

And we ~~(inaudible)~~ arranged to be out here together and everybody ~~(inaudible).~~ Of course, everybody was sick everywhere about it.

MR. OTTINGER: Yes.

MR. ERTEL: Because it was so useless. A waste of talent. ~~(inaudible.)~~

MR. OTTINGER: Yes.

MR. ERTEL: That's a beautiful shot there.

MR. OTTINGER: Yes. There's some back to the B-79's It's landing on the lake bed.

We tried to operate as much as we could before we got that facility in down there. It really paid off. We even shared space with the Aero Club on the base in one of the old hangars for a while in order to avoid, you know, getting them in --

There's a good shot.

MR. ERTEL: There's a good shot. (Inaudible.)

MR. OTTINGER: We got to where when we got to going higher in altitude and expanding our envelope and worrying about higher velocities and higher altitudes, we started with a balloon -- Just didn't have any instrumentation on it, but we could figure from the angle of the balloon, from its tie point, whether we really had anything that would bather it.

Combined with that plus the air speed readings out of the helicopter, which we had always sent down, we could make sure we stayed out of trouble and stayed within our control limits throughout our flight envelope in altitude.

And we would get tricky wind conditions even in the, you know, under 500 feet there where you get these transitions. And it turned out Ellington's got them too and they --

MR. ERTEL: Those wind ~~(jeers)~~ sheers they call them?

MR. OTTINGER: Yes. And it's murder with a vehicle with limited controls like this. So you've got to pay attention

:o it and it's --

MR. ERTEL: I think now when the chopper stays on .he ground you've got --

MR. OTTINGER: ~~You've got it~~ so that right?

The lifting body -- they had a problem with chopper n the landing pattern. It really wasn't in a position but t did bother the pilot, and he had a couple of other --

(END OF TAPE ONE, SIDE ONE.)

(START OF TAPE ONE, SIDE TWO.)

MR. OTTINGER: -- Corky Meyers, from way back in .he 1-F days (inaudible) 1-F days.

MR. ERTEL: ~~(Inaudible.)~~ OK we're back in business now

MR. OTTINGER: Well, these T-birds, they were there .t the air races and I was sitting out there near the inter- ;ection of these runways that they were using as their focal)oint on their four-cross, you know.

MR. ERTEL: Yes.

MR. OTTINGER: This is not the four-cross deal. It's ;imilar to that.

MR. ERTEL: (Inaudible.) (Laughter.)

MR. OTTINGER: This bomb burst is something. Isn't .hat a nice sequence? Look at that (Plimpton) going up :hrough the center.

Isn't that something? Now, there's three airplanes ut of the four making the cross, and to get those in one

frame --

I tried to convince myself I had the fourth one in there somewhere, but it's got to be coming from the --

MR. ERTCL: Prom the outside of this.

MR. OTTINGER: Either that or it's got to be already by and on the left. And I don't know which.

MR. ERTEL: (Inaudible) two are coming in from the left and one from the right. The other must be just on the outside of the frame.

MR. OTTINGER: Yes.

MR. ERTEL: (Inaudible) photography.

MR. OTTINGER: As close as those three are -- and I st l don't see the fourth. Do you? I'm still proud as hell to get the three.

MR. ERTEL: That's right.

MR. OTTINGER: I was pumping away on that shutter.

Depending on the angle that you're shooting at -- isn't that pretty?

MR. ERTEL: That's right. That's another thing (inaudible,)

MR. OTTINGER: Yes, that's true. It's just that -- that's (Fonder's) sister. She's downstairs now with the boys.

That's some air pilot.

And that used to -- well, we used to battle over fire trucks between our program and that program, and --

FIR. ERTEL: I hated to see that one go down the drain like it did. I never really --

MR. OTTINGER: There's a take-off.

MR. ERTEL: I had a chance one time to go up to Ediiards and see that baby fly.

MR. OTTINGER: Never did do it.

MR. ERTEL: Never did it. And I was so sorry.

MR, OTTINGER: Look at that P-38, would you? That's flying. That P-38 is flying on the right of the 5-70. He's probably doing, oh,150 knots, whatever his minimum air speed is.

Oh, now look at him there. He's still there in the picture. Can you find him? See the P-38, with his gear down?

MR. ERTEL: Yes, I know --

MR. OTTINGER: Sane type (inaudible), Have you had some?

MR. ERTEL: Yes.

MR. OTTINGER: He's still what -- 20 feet off the deck and he's about the same altitude. He's about even with the top Of that thing.

MR. ERTEL: (Inaudible.)

MR. OTTINGER: Would you like a *shot* -- would you like to use that? I mean, there's that and the plan form on that f-38 and the 15 *and* things like that that are just odd things that you just run into --

There he is again.

MR. ERTEL: That's just amazing.

MR. OTTINGER: There's the 13. I've got a take-off sequence on him. You can see the distance of the runway. Now that's a 70 over there in the middle of the picture to the left just a little on take-off, with its nose up.

So we had a pretty good view with our ramp out there where we were flying from. It was a whole operation. And, of course, we'd have to cross the runway to get back home so to get over to the shops to do work with, so we had a lot of waits down there at the end of the runway, and a lot of --

Look at that cartoon on the side of the 52.

There's the three 104's. One of those is what Joe was flying when he had the mid-air, one of those three.

There's a take-off roll on the 15.

Right here where we're standing is the -- right near the end of the runway. And one summer early in the 15 program we had a -- right after take-off, we had a power problem with the breaker assembly. We thought it was just a breaker, on the climb-out. It was the launch site.

So we told them to come back in and land and we would -- we figured we knew what the problem was -- we'd reject this breaker and it would go, It wouldn't jettison, you see. We'd still make that flight. All you had to do was come back in and land.

Well, it was a hot day and time was wearing on and e comes in heavy and -- the 52 is heavy as hell - and he blows ll his tires. And they are all -- every last one of them s gone by the time he's at the end of the runway.

See, at the end of his row. And he couldn't even et it off the runway very well. He just barely got it off he edge, and we rushed down there because we knew we got a oaded 15, and it's not in our service area and we haven't ot any facilities to handle loaded propellant, you see,

It's got 15,000 pounds of propellant on board. We ot down there, and I was in the first truck to get to it. e had a precaution system.

The doggone smoke was billowing out behind the ockpit and we had a fire in the equipment bay - electrical ire. And we couldn't have power -- we had to get power off nd everything out of the way in case of electrical fire. moke was blowing all over.

And here we were stuck with that thing. You know it took us about twelve, fourteen hours -- swept it out incn by inch to get that dam thing unloaded because we couldn't ave any of the access to normal electrical controls.

Everything had to be done pneumatic. We had to get. n on the actual valves and points in the back end. We had to ull these panels, which were heavy.

Fully loaded, and a lot of then you couldn't get

to and pull out without a problea. Talk about a fast bit of engineering, in terms of what you can do and can't do in emergencies.

You know, to keep out of trouble. It was really an experience. Believe me, we never landed full of propellani Never. In the whole program the rest of it. That happened early in the program. But we learned our lesson well.

We never brought it in. We had to jettison. Mandatory.

MR. ERTEL: I always said that getting the fuel (inaudible) was something in itself.

MR. OTTINGER: Here's a display we set up out there in the hangar. It was some shots. I've forgotten what this was for. We put on a bunch of shows.

We'll talk about that a little bit later. I'll never forget our first TV press conference -- TV show. About Flight Number 6, i thi rk. Pretty early in the program. We had 150 guys out there. Cameramen -- all the networks out. That's another story.

There's a guy -- an artist who used to edit the Bonanza script that was 70 years old -- come in to work for us He left -- retired from the TV industry and came out to work as an air brush artist. And he did this picture, of course. And we superimposed the pictures of the RB and put the various trajectory information on it. Made a real nice display.

There's the 15 Mother ship fly-by over at the chase. After the landing. North American did right well with that. They put a -- they got about a 20 foot blowup of that picture and put it on the wall in the hangar, for the guys.

There's Bob White. He's CO on the base out there now.

There's a Gemini shot. There's a program that's interesting.

There's a movie being shown during that display of a (inaudible) flying the canyons up in the high Sierras. With a nose camera and a guy's doing that thing, and it was something else.

There's the energy management display of one of the X-15 panels.

Indirect gearing systems, lifting body.

Here's a -- you can't see the details very well, but that's a contour three-dimensional thing -- model set up in the trajectory of X-15, and there's about 400 miles of range on that table. And the 400,000 foot trajectory was put on there.

There's those external tanks I told you about. That that Number 2 ship you saw in the movie today, that was rolled over. There it is after it's lengthened *out* and re-built.

MR. ERTEL: It's really amazing.

MR. OTTINGER: This is the M-2 lifting body.

Here's a Gemini shot.

MR. ERTEL: Keep going.

MR. OTTINGER: Those are some I bought out of the NASA cafeteria down there.

And there's the Pontiac again. As I said, they'd towed that lifting body out and paraglidered it at 150 miles an hour on the lake bed with that thing.

You can see they got that rearward facing front seat, and they got a winch in the trunk and special engine rollover bars. And bringing that thing down to L. A. to get worked on was something else. The Highway Patrol wouldn't believe that was a Government car.

Well, that's it. I thought I --

MR. ERTEL: Well, that's great.

MR. OTTINGER: There's a few goodies in there.

MR. ERTEL: Yes, sir. I tell you --

I tell you -- your slides -- the one I'd really like to get ahold of -- if you knew where to get ahold of it --is the kind of a thing up there.

MR. OTTINGER: That?

MR. ERTEL: Yes. I always like to put a little -- in the Mercury history, I illustrated it. And I put in ~~(this)~~ Enos and (Ham) walking away. As I say, we were a little behind the Russians and a little ahead of the Americans, a few things like that, you know.

Ertel: (Ottinger)

~~MR. OPPINGER~~: It went over real well. Well, you know, this thing is -- you could build this up very nicely, I think, because -- to show the fact that the Army -- the most experienced helicopter pilot the Army had at the time was assigned to NASA and got assigned to the program and this kind of stuff fits in real well, sort of as a come on, when you're laying out his participation in it.

MR. ERTEL: We had trouble in the Gemini Program (Inaudible) you know, on those ejection seats, because, I think it was ~~(Foreman)~~ Borman and somebodg else, I think, were out watching the tests one week and the next week they went back and said, well, send out -- i don't know whether it was ~~(Foreman)~~ Borman or Stafford or somebody -- send out so many number of 27 on this end (Inaudible)

It was rigged for the confidence factor. All these other dummies and this guy has been {creamed} in. Oh, boy.

(Laughter.)

Ottinger : ... crack the whip and he cut our preflights down from several hours to where we could shave it in half, just by whipping the boys into shape and moving them along, that it sure worked out real, real well in phasing it out.

He had dropped a lot more stuff through the crack, you know, then Monterey would, so we worked them together

in their respective spots and it worked out real well.

They didn't like each other but 'dilly was a practical Joker, along with a lot of the rest of the boys. You get out on a remote base operation and you get a lot of horseplay and, fortunately, none of it any really got into any trouble and it was a good tensisn reliever.

But Willy I hired in at Bell and he was our foreman down at Ellington, and Is he still there?

MR. ~~ERTEL~~ Ottinger: No, he was the last Bell man to leave, besides the engineering people that stayed on and so he left about a year and a half ago.

But he did all right. He's back in Rosemond now working in Lockheed on the (10-11) down at (Palmdale).

~~MR. OTTINGER~~: In Bell I can attribute whatever norseplay we had at Ellington probably to --

MR. ERTEL: ~~I'm not~~ saying anything, because I ~~don't want to~~ won't use ~~I don't want~~ it to get anybody into any trouble.

MR. OTTINGER: But, there were enough practical jokes and so an throughout the program, you know, both of then: here and down there, to keep it alive.

You never knew wnat might come up, you know, at any time the: you're coming in to work and I can remember occasions coming back from *the* main base up here at Edwards and going back to down to the south base, my car's gone.

And I figured, well, you know, it's a wide open ramp. We had a thrust stand pit below the ramp level down there off to one side of the hangar and I went over there and looked in and there, sure enough, is my little Volvo down at the bottom of the pit.

They had put it down there with a forklift or something or a boom or crane off the back of a truck, you know, and taken the keys and everything and gone home.

Well, I had seen them and they were on their way out, and I run on back and got the keys from them. I chased them and caught up with them and got the keys and went on back and got it out.

Another time in the same period, I came back and the Volvo was loaded up onto the flatbea trailer with all the rest of the equipment.

The fellow that I got in as an Office Engineer to replace me at Edwards before I went to Bell and he also pinchhitted while I had to go back on the (TV) with (Gremlin) during the last six months or so and his name was Baron and he was a young guy and really gungho, you know.

A loudmouth. And he had a few -- he used to wear these knee length socks and this used to really get to the techn! cians.

Here this young buck engineer, fresh out of school, loudmouth, you know, coming in in garters and all that crap,

so they got him indoctrinated pretty fast.

We had one head in the corner of the hangar and when they put the door in for it, they left a pretty good sized gap under the door.

Well, he locked himself in there one morning early, taking a crap, and the guys brought in a hell of a big firecracker and they light that son of a bitch and put it under the door.

And here he is in this little cramped spot with this lit firecracker, you know, and this thing goes off with a four inch short fuse and that poor guy, he comes flying out of there, shit flying and everything and it was the funniest thing, I'll tell you.

(Laughter.)

I was back in Buffalo and missed all the good stuff.

MR. ERTEL: Well, with the hours you worked there had to be a lot of horseplay to keep the morale up.

MR. OTTINGER: Oh, yes. We were running -- a lot of those guys we were running 70 - 80 hours a week and we were just working then Into the ground.

MR. ERTEL: (Business) a lot of time.

MR. OTTINGER: Most of the tine, about 80 percent of the time, our electronics, modifications, checkouts, data analysis was ~~facing~~ pacing items.

We generally kept up about 80 percent of the time

with all the rest of the systems with the pace they set, so the electronics engineers and technicians, the key guys, they were the guys that we had the most pressure on as far as overtime, because we could substitute other people in some of the other areas to fill in, but because we had only had a very small handful of guys that could really do that electronics control business, the brunt of the scheduling was on their backs.

The same thing held true in Ellington. On the (TV) and the ground test phases we were going to go down there and, hopefully, get maybe 90 days of ground testing off and then be able to start flying.

It turned out it was just about a year and there were setbacks and I would say maybe 80 percent of that delay was due to electronics debugging and problems that had to be solved, technically.

There was a certain portion of it was due to facilities, equipment, not being there at the right time, improper scheduling support, a few incidents in which accidents would occur that would damage equipment and you've got to reorder, you know, and things of this nature, short of parts.

...incident on the south base out here and then I'll sort of start from scratch as far as --

MR. ERTEL: When you come on the program and --

MR. OTTINGER: Yes. Go through with some problems

that we solved, pick up the important events, but there's one thing on the south base that occurred,

We had -- there had been a period, I think, after Walker got off of the RV, while he was still getting trained for the B-70, and we had Malek and Walker and (Hoover) and a couple of Air Force pilots, as I recall, standing by one morning watching our servicing.

We had been delayed. He had been scheduled to fly fairly early and we lost our fire trucks to the B-70 on emergency landing and we had to hold peroxide servicing until we got it, standby, so we had to kill off a couple of hours and we had a young, colored electronics engineer that worked for us and was just out of school and really beginning to learn the practical side of things.

He didn't know now to drive, even. So one of the electronics technicians decided to teach him that morning. We had a Government station wagon that we used for transportation and so we had him out on that big ramp, a big expanse, the technician did, and got him pretty well checked out that morning with driving.

I took him for a run or two that morning, as well and so this station wagon was parked in front of the LLRV and the fire truck pulled in -- we had just gotten the fire truck back -- pulled in about 20 feet behind the station wagon.

This group of pilots were standing to the rear of the station wagon, just behind me, and the technician that had been teaching Al, the colored boy, how to drive, needed something over at the hangar and it was far enough that he was in a hurry and he wanted to use the car so he said, "Come on, Al. Drive me over to the hangar to pick up the part."

So they both hop in and the pilots just sort of subconsciously stepped to one side when they got in, although it was his intention to pull on out ahead.

He had a clear field ahead. But Al, being just freshly checked out and not familiar with it, flipped it into reverse.

He's nervous, and he's a very timid fellow, anyway, and he floorboarded it. Well, he was doing probably about 20 miles an hour when he hit the fire truck, going in reverse, broadside.

And here these pilots are standing there, you know, and half of them have got their feet almost under tne tread of the tires as they're whizzing by; just about wiped five top pilots in one whack.

Well, the back end of the wagon had taken out the whole tank full of water in the fire truck and it's spilling out all over the place.

We had started loading propellants and at first

the people thought it was gasoline, you know, and it took them a minute or two to realize it wasn't.

So fire trucks were at a premium, anyway; but with this one knocked out of commission we had to get another one, and AP's show up,, and, well, here's a guy, here's a cat with no Government driver's license, no state driver's license, no learner's permit, fresh out of school with no means about him at all, and the AP's couldn't believe it.

They had their radio going about four hours between them and headquarters trying to get -- finally wound up with a Major down there, the OD on the base, you know.

So they finally settled the incident so in the aftermath, the ~~airport~~ Air Force is going to prosecute him, fine him $500, make him serve some tine, all this jazz, damaging Government property and all, and all this, so finally, (Bickle) Paul Bickle writes a Letter to the CO of the base to get him to withdraw all of the charges against this young NASA engineer which they do and it all gets tucked away but (Bickle) calls me in and Dollman in and wants to hear the story so he looks at me end says, "Wayne, you've done a pretty good job so far but this little thing, I'm winding you back to zero. You've got to start from scratch."

(Laughter.)

MR. ERTEL: How white did you turn?

Dettinger: He was a scared boy, I'm telling you.

MR. OTTINGER: Our key electronics engineer on mostly LLRV and TV, the guy that worked the most on it, spent the most time, had the most heartaches on it, was a fellow by the name of Bill Bascom, and he was a colored boy, as well, and a champion chess player out of New York.

He worked full time on the RV and TV throughout the entire life of the program. He headed all the electronics work on the TV but he turned a little bit white now and then at Ellington with peroxide on him and also he was pretty scared about being around that thing when it was serviced up with propellant, you know, and not firing it.

When we made our first TV CG stand runs (pitch and roll) -- I had flown the thing on that stand out here myself and had a feel for it from the RV program.

We didn't have anybody that had done this in Bell when it came time to do it at Ellington and ~~(Inaudible)~~ both ~~and~~ checked out in the RV and flown it.

But we were putting the TV up on the stand and running three shifts, around the clock, seven days, and we had to get our own people checked out to run these tests on the CG fixture down at Ellington, on the TV.

So I climbed in and got it started and then checked our people out as we went along and Bascom and his troops needed to be checked out as far as the -- it was a fun thing to get these guys confidence and get accustomed to being

around it and, with the proper precautions and everything, there's no problem with it.

But it's a new experience for a lot of them but it's sort of funny sideplay when you get a colored guy around let's say, peroxide, and it's going to turn your skin white, and you sort of get the big eyeball treatment, anyway, in some of these things, when you're flying around and you've got a lot of noise.

We had NASA build a big shed to go over the vehicle while it was mounted up there because it took a fair amount of time to get this thing mounted up with a crane, you know, and tied down and all equipped out with (Inaudible) on it and everything and sometimes it would be up there for a week or two at a time.

Well, you've got to protect it when it rains and so we had this big rollover shed built, quite high, and we built it with canvas sides and so on so we could hopefully even go ahead and test while -- maybe.

With the light rain, you know. The weather down there in Houston, you know, if you get several days of rain, if we had it would just be shot down, if that's what we were involved with.

So we got -- we put this shed over it and some of the very first testing we did was in rainy weather and we did it with the shed over it.

But while we didn't realize at the time we were planning to do this that the steam from the rocket would condense off the bottom of the ceiling, of the shed, and drip small concentrations but, nevertheless, corrosive stuff, down on the vehicle.

And particularly in starting up the rocket system you get a lot of wet peroxide depending on the condition of the motors and it can get to be a hazard.

We ran into that very early in using that shed in hot firing. We had an engineer by the name of Tom Stafford, a rocket engineer.

One night he was sitting up there doing the quiet bit in the cockpit, you know, operating it on the fixture, and we had a -- it wasn't a fire as much as it was concentration of peroxide getting on something and it wasn't an open flame fire but peroxide was dissolving and burning whatever it was.

It had been a small, restricted area of the vehicle but it was handled, you know, right away and no real damage and it was that operation that we decided that well, we just can't operate with a shed over it.

We've got to wait for good enough weather to be able to pull it back but it's still good for check out and clean up and things of this nature.

So it still served a very good purpose, as I said.

But the next morning there were furors flying around and they got all the way up to Gilbert's office was that the night bef re Tom Stafford, meaning the astronaut now, according to the rumor circles going, was flying the LLTV, preflight now, mind you, it wasn't on the fixture, it was free flight, through the shed and started -- I don't know what the rest of the story was but, the way it started It out, you know, it got pretty wild and fortunately it got Stopped by about 9:30 that morning.

(Laughter.)

. Well, back to the -- maybe a chronological thing from the start of the program at Buffalo on the RV and just quickly take it on through.

I guess the first two or three months back there of our design phase on the RV Program was pretty well involved in getting that cockpit moved from up on top of the engine down in front and working out the long lead items like the jet engine and getting GE up at Lynn, Massachusetts to get that engine program going because we were taking basically an engine that had been qualified for commercial use, now, a fan jet -- it was a fan jet version of the J-85 which is used in the F-38, but it's got an (Inaudible) put on it in addition to the basic gas generator.

This thing had already gone through it's full qualification testing, acceptance testing -- or not acceptanc

but I mean qual testing for that particular ~~(Inaudible~~ engine for horizontal mounting for commercial operations. So our job, basically, in the RV program, was to get that engine qualified for vertical operation, which meant changing stuff in the (sump) and in the oil system, basically, is ail it was.

So we had to run and requalify the engine with these mods and changes and write some new specs for it and do a little bit of testing for reingestion and things of this nature that we were worried about.

As it turned out we pretty well waited on the reingestion problem to -- no, ~~it~~ we didn't either. We got it, mounted in a stand, well, it was about 10 feet off the ground, I'd say, to do our testing.

We had pretty well accumulated, as far as peroxide rocket systems was concerned, a lot of experience and effort, and it was probably the thing that both myself and our efforts team, collectively, were the most confident in was the whole rocket system.

We probably influenced Bell more strongly, let's say, in the rocket system area, in design and dictating to them what we had to have, than in any of the other systems.

And it was only because of the experiences through all of the excellent aircraft and ~~(excellent beams)~~ X-15 and so on and the fact that we had been set up out there

jrd

already.

So, in electronics-wise, this was really the new thing and I think both Bell and FRC were plowing new ground as far as systems approaches on putting this electronic Contro system together and staying within the weight constraints.

We wound up overweight in, I think, pretty much everything except the structure. The structure in this thing, I think, came in meeting its original weight allocation pretty well.

Why don't you turn it off and we'll --

MR. ERTEL: Okay.

MR. OTTINGER: As I said last night, FRC furnished the telemetering and data system an? the cockpit displays, 90 percent of them, the ejection seat, the *engines,* let's see.

I'm trying to recall. No, the engines were under the Bell contract but so there's a fair amount of interplay between work going on out here at FRC with our engineers feeding back through me then into Bell, tieing in all these Government furnished items that had to be part of the flight vehicle and ~~part~~ support equipment.

And simulator work, fixed base simulator work going on at FRC here, which would interface with the control system people back there, wind tunnel testing, which was done at Langley, under FRC's cognizance, would then be fed back

into Buffalo in terms of control systems work involved.

So we had the normal gamut of technical meetings and design reviews used with MSFC participation in probably 60 to 80 percent of these and, of course, then eventually, as time went on, it was pretty much 100 percent, ~~(Grim)~~ Dean Grimm and myself trying to keep up with everything that was going on out at Buffalo and all the major subcontracts.

The TV engines, I was getting confused -- the TV engines were Government-Furnished. MSFC bought them out directly from Lynn; purchased them as Government equipment.

MR. ERTEL: You say there were a few bugs?

MR. OTTINGER: Yes, I'm not really sure that they did. This is always a questionable item because if you can saddle the prime contractor with the full responsibility, maybe the extra overhead he will put on that subcontract is well worth it to keep any (glitches) in coordination out of the thing because with the amount of Government-Furnished equipment ~~it has~~ we had, particularly in the TV, hand controllers, displays, engines, radar, a fair amount of ground support equipment, what else?-- I think those are the major things.

Oh, we had leftover rockets from the Army which were Government-Furnished to the TV, okay? We had a heck of a -- and particularly in the new stuff that the Government furnished you've always got that problem of interface and the fact that

Minneapolis Honeywell

the prime can come on back and charge for changes which are not properly communicated and phased in, let's say, and I think you wind up, in the end, probably paying about as much as if you would pay that overhead in the beginning and let it be channeled through one outfit.

I'm sure Dean Grumm would probably argue the point in looking at maybe his administrative problems with a lot of his subs like Mini Honey in furnishing the hand controllers, would -- it couldn't have gone any other way because here they are, making the LEM hand controllers, and now they're going to slip off and peel off the same production line to use for the TV.

In my mind, to a certain extent, it wouldn't have made sense for Bell to handle that under the prime. They've already got their contract established with (Mini ~~Hunting~~ Honey) and they just tack it on.

But in the case of engines and things of this nature I think you have got to look at everyone different. But, anyway, we had, I think, about a year's program on the RV scheduled at Bell and two things happened.

One is that we slipped, I think, about a couple of months or so and it turned out to be a 14 month program but that's still not the whole story because of the technical development problems we ran into, well, we just -- and probably bad estimates as well, in the beginning -- then

we weren't able, and I think more from a cost standpoint now than it was actual calendar schedule, we didn't do the complete job on the RV in Buffalo.

We got it out without any testing and, in fact, finished the assembly on the Number One Unit and Number Two was delivered in baskets, completely, on this thing.

That period in April of '64, when we got the Number One RV -- I think Number Two followed a week or two Later -- and in the basket and so on, then we had that period from April to October to do our final assembling, which included a lot of these design changes, structural mods, electronic changes; we had to get it wired up, replumbed; we had to rearrange the mounting in installation (of nuts) or the hardware are the biggest things in the electronics rack in the back.

The method of weight and balance for even a 10 pound difference in pilot weight up in that cockpit would change the balance of the ship, or CG of the ship enough that we would have to compensate for it,

if you were to -- the way the control system worked, you had a given amount of authority, control authority, and if you -- that was available to be used against aerodynamic drag forces, which would include wind effect -- and depending on the relative wind, you know, it would determine your -- if you wanted a certain ground speed and then, depending on

your relative wind, you would -- sometimes these things would, the wind would work against you arid sometimes it would work with you.

But, in terms of flying a given trajectory out to the maximum envelope it was one of these things where if you had a center of gravity that was offset from the geometric center where the control forces were operating, then you're just detracting that much from your velocity capability, velocity envelope capability.

So the idea wasn't as much, well, if you take off, you know, and fly In this thing and you put in that heavier pilot you're going to crash or anything but at the same time you may be limited to an envelope that blends with what you had applied to that (Inaudible.)

We really tried to keep that center of gravity right down to the -- as close as we could and the goalwas to be able to measure it and know where it was within a tenth of an inch.

And with that flexible a structure we went through all of this special fixture work to get that center of gravity and fairly complex bookkeeping and calculations to get it, considering even the selection of the gimbal ring because of the engine thrust.

During flight, changing the weight in that gimbal system by so much, and now, what effect does that have on

the center of gravity?

And just a lot of refinements that had to be looked at to pin it down and so that meant everytime we had a design change and moved this or that we had to keep in mind, where are we headed here, as far as the weight balance on this thing.

Lots of equipment was relocated with the weight balance criteria being the governing factor and we didn't have, in the early phases, enough engine thrust to consider using, much, if any, ballast to balance it because the ballast would be just dead weight you were carrying around.

MR. ERTEL: Now long did it take you to switch tram one pilot to another?

MR. OTTINGER: Well, --

MR. ERTEL: How much rearrangement had to be done on it?

MR. OTTINGER: I would say it was several hours to readjust the platform because of the -- well, maybe not that but depending on the harness (routing) and so on, and how you are able to do that.

Moving that platform -- we did it on occasion but it was fairly infrequent and our first two pilots, Walker end Malek, were within -- I don't know -- five, six, seven pounds of each other, as I recall.

So, for that kind of thing we did go ahead and

compensate with a little weight on the legs, as it turned out in this one.

Again, our missions weren't as -- in the early flight phases we weren't going out with a full envelope, and all it meant, maybe, if you had to use ballasts in some of these early cases, since you had a little leas jet fuel you had a little less flight duration, and, again, you can get by, maybe, with less in an early R and D stage that what maybe eventually you want to have in the TV when the astronauts are using it and have a 30 pound pilot differential. That's a different story.

By the time we got to that we had more engine thrust and we went to ballast. We designed leg ballasts, pieces that could be quickly put on in between pilots to account for --

MR. ERTEL: Well, I was thinking particularly, you get somebody like Pete Conrad. In there, who weighs nothing and --

MR. OTTINGER: I think the biggest trouble we were planning on was the fellow that was killed in the T-38 I've forgotten his name but he was --

MR. ERTEL: C. C. Williams? Yes, he was a big one.

MR. OTTINGER: But, anyway, and I hope we at Edwards will see the day from the pictures of that -- you

saw *the* PG stand with it but we built another stand.

In the period of April to October *part* of the ramp testing and closed loop testing *of* the rocket system and jet engine (gimbaling) system, hydraulic system, *both* being, you might say, hotfiring the Jet engine and the rocket sytem simultaneously with the feedback sensors and the loop, *we* wanted to go as far as we could towards actual flight in a tied down situation and we voted this in lieu of tether *tests*, hanging from a pendulum, you know, because of the dangers involved with *that* and previous experiences with Bell and *other* people in tether testing, it didn't seem *to* be the best way to go.

So what we did was to design a test stand, a vertical test stand support to grab the vehicle at the (gimbal) bearings where the jet engine was gimballed in the center *and* this had to be done with extremely -- say, it was *something* like three eighths thick plate, which was rectangular shaped and went up alongside of *the* Jet. engine and had bearings in the plate and it fitted over the gimbel trunion ~~(inaudible)~~ and supported the weight of the vehicle on *this.*

It came down and fanned nut *with* large Cubes going into the ramp, making a tripod affair and with that particular test stand, which we welded up and fabricated there, we *were* able to run the gimbal system of the engine in two axis of freedom; pitch and roll on the jet engine gimble and one

.xis of freedom, pitch *or* roll, *at* a time on the vehicle .ttitude control system.

So we ran that, let's say we *set* In on the fifth imb(a/b)l and *we* were able *to* run the pitched rocket;, the ttitude rocket *system* hot in the pitch axis and *let* the et engine gimb(a/b)l system -- with the jet engine being run ot, now in running the hydraulic system on *its* own internal ydraulic pump -- then we were able to run all that stuff ogether *and* take our data and then we would pick it up ith *a* crane and turn the vehicle 90 *degrees,* set it on he roll trunion and do the roll rocket attitude testing, again, with the gimb(a/b)l going in pitch and roll, hot and get our data, and that, together with the pitch-roll combine(xis testing on *the* CG picture with no jet engine running, ave us *a* good handle, technically, on all these systems efore we flew.

So we had a -- and then our flight test, our actual flight testing was done in a very gradual step by step process so that we only started with the bare assistanc(we had to have, the least amount of complexity, I'll say, and it actually turns out, the ship is easier to fly when you have all this stabilization stuff working on the gimb(a/b)l system and the engine is hanging straight towards the ground.

And the gyros are going to drive it and keep it going straight towards the ground and then it's sort of like

a guy can sit up there and he can fly around on any attitude he wants and he's not going to go scooting off anywhere unless the wind's going to blow him because the engine thrust vector is not following his attitude system.

But in terms of hardware complexity, that was more complex than -- and more risk involved, in the early phases.

So what we did was we ha im lock the gim e hydraulically and we had a redundant system in the vehicle to do this so that the engine stayed aligned with the vehicle at ail. times and if he tipped the vehicle, the engine would tip with it and so that thrust vector would be shooting him off so it was a little touchier to fly as far as the attitude system in checking it out with that gimble locked up.

But we still were afraid of going too fast with this fancy stabilization system on the engine gimble and they'd rather build up gradually than have hardware complexity.

And little things like those casters that got -- that we had on for the first few flights. A little bit of engine misalignment or wind, surface wind, would get you rolling and some of those flights looked pretty funny; we'll probably see them on the movies today.

MR. ERTEL: I was wondering about whether the

lateral translation was on as they broke ground because of the wind and so forth. if' it surprised you any?

MR. OTTINGER: Well, I don't think we just were really conscious or realized that tne casters would make that much difference.

MR. ERTEL: Well, I mean, *even* after the casters came Off?

MR. OTTINGER: Yes.

MR. ERTEL: It seems like, here at Ellington, it's almost always agreed that everytime tnis thing gets two feet off the ground it goes a good 15 or 20 feet sideways before they could get that thing powered up enough to gain altitude again.

MR. OTTINGER: Well, it may be strictly a function of pilot experience and proficiency, too, because, as I recall, that would be a rare happening out here in our testing and I -- primarily because with (Inaudible) from research pilots that are testing new hardware they're going to be more sensitive to being cautious, let's say, because they're not sure what to expect, maybe, if you're expanding -- if you're going with a new set of control settings, let's say -- he's going to sit there in a helicopter and he's going to practice and he's going to plan -- not everytime but a lot of the time these guys would be out there flying around and getting the feel of things before they get

in and they get in there and then maybe if there was a surface wind they would be anticipating it and correct for it as they lifted off.

With a little bit of practice at this kind of thing you can cat that kind of stuff out. Now, if you are looking at it in an operational trainer and you've got a lot of other things on your mind and this thing is supposed to be already checked out then it's a lot different.

MR. ERTEL: Well, I remember the jar I got when I first -- when I saw the TV flights and I watched it get up to speed and it would skid sideways 20 feet and it was all happening now and, of course, a lot of people remarked about the same thing and I wondered from that time on whether it had been expected from the start out here; of course, you've got different wind conditions out here.

MR. OTTINGER: That's true. And had we had as much wind, maybe, as you have down there a lot of the time, you were trying to fly more often than we were up here and it's one of these things that if you were using the same pilot down there all the time you would eventually work out techniques to where you would minimize that but you're bringing in people, training them all the time, too, you're probably going to run into more things like that.

MR. ERTEL: Yes, I think, it was Malek that told me, you 'd probably remember when I mentioned it, about the --

jrd 1

We were talking about the wheels, the casters, and he said that he didn't remember which flight it was -- it was one of the earlier flights -- but you could feel the wind and there was a pretty good breeze getting on down the runway manhole gap (Inaudible) the engine and everything else. That was the end of the casters.

MR. OTTINGER: Well, those manhole covers, that was really something. That thing weighed about 100 pounds and it didn't, as I recall, hit the vehicle at all.

It was real fortunate that it was -- we went around and we welded them all down after that. But getting the gap resolved helped two things.

One was, as I recall, our rack was adjustable on the back, the electronic control rack was adjustable, both vertically and laterally and longitudinally, so that we could a lot of our CG adjusting on that.

But it was quite a bit of trouble to change it, like you say. It was easier to change it sideways or longitudinally than it was vertically because of the place you had to make the changes at with the harness involved and everything.

So the changes weren't made that often but we were in extreme ends of the limits in some of these areas and as I recall the casters were -- and we originally went on with real heavy casters that Bell furnished and we never did

jrd 2

operate with them.

We put on much smaller ones and even with the smeller ones we were -- because they were so far down on the vehicle at the bottom, away from the CG, we picked up enough small CG conditions that we tended to have a rather stable vehicle.

It was, you know, like the CG was five-six inches, I think, below where it Should have been. Maybe not that much but -- that seems like maybe an awful lot for it to gap but it was quite low.

We wanted to get it back up where it belonged to be neutrally stable to do a good simulation job, of course, and even to achieve certain maneuvers with certain range it is going to eat up a lot of your control power if you've got that ~~whole~~ low CG ~~(checked out)~~ set down there below the engine.

MR. ERTEL: Well, somebody said the first time that you put on a show for a bunch of people in Washington and so forth somewhere something wasn't quite right after you had powered up.

It was sitting on the runway ready to take off and people were saying look, we're going to have to get some of these people out of here or we are going to run into people before we ever get off the ground.

Do you remember that? ~~(Inaudible)~~ A bunch of generals and high NASA officials -- The first real test that you had shown anybody of that stature.

jrd

MR. OTTINGER: I guess I had forgotten about the nip and tuck operations as far as the -- after we got the engine started, burning off the jet fuel and we had a rather complex check list to go through and if you had a glitch here and there you had to work out the damn thing before you could take off and sometimes it got pretty close to whether you board or not.

In general, though, as far as any of our demo flights, we're going to hit that as a subject all by itself. I think it was about Flight Number Six that we scheduled for the first press flight and we had major networks there and I think there were 150 people from the press corps that came in and we had started about one or two o'clock in the morning, started the preflight, and were going to try and fly about 8:00 or 8:30 fo it.

The wind was blowing like hell, and I mean like 25 knots and we're saddled with about a five knot limit, five miles an hour.

Later on we expanded it to ten miles an hour after we got strong division about it. The guys would be coming about three or four o'clock in the morning in time to get it out and move it out of the hangar, you know, put the peroxide in it and start the long cycle.

Of course you are biting off a lot of extra work to purge it out and clean it up, once you put that stuff in.

jrd 4

So here we are, blowing like hell, three o'clock in the morning, you know, and I told Glenn to move it out and the crew just bitched like hell.

They knew damn well, you know, no chance of flying. Just making them work but it's my job, put it out. Get it ready.

Well, it was all ready to go. It was sitting out there, serviced out and all checked out, and about 7:30-8:00 (Bellman) has 650 people up in the cafeteria, everybody having coffee and doughnuts.

He got a mike up there and he just told them, he said, "Well, we are sorry. We've got a 20-25 knot wind. We're going to have to reschedule and we'll be back in touch with you, you know. It may be the next day and it may be two or three days."

So he just told everybody this and I called in on the radio and they telephoned down and got him on the phone and I said, "Don"- I guess they got him upset with the tower there at NASA to talk to me on the radio and I said, "Don, we got a break.

We're in the center and it's dead down here and we're ready to start the engines." This is the first demo, okay?

So he runs back down and here these guys are wrapping up the coffee and stuff ready to take off. And he

runs and yells out, "Come on. Let's go. They got a break down there." And it's blowing like hell up this -- you know, five miles away it's still blowing.

It's hard to believe. Don asked on the other end, he says, "What you been drinking?" I said, "Nothing, man, now get down here. We're ready to go. We've got a pilot here and everything."

So, I'll tell you, I made a believer out of that whole damn crew with that one incident, I think, because I never had any more problem with any of the crew arguing with me about whether to service that thing.

It paid off to go ahead and be ready and if we wouldn't have fired up that engine and went through our checks and -- we gave them five minutes or so.

It was going to take ten or fifteen minutes to get down there, get loaded up on buses and get there and we waited for five or ten minutes to start the engines.

But I knew we didn't have very long before it would pick up again so they came around the curve of the road that comes into that mountain range on those buses and -- oh, we got the helicopter down there and I think we had Malek go up and tell us when they were within two or three miles from there and we went in and fired the engine up and went through our preflight check with the engines running, and as they pulled into the parking spot we lifted off.

And these poor bastards trying to get their cameras nut here, the first one weirdest thing had ever flown and the thing is lifting off and here they haven't got their cameras on.

You should have seen the ankles and elbows fly with the film and oh, hell, it was funny. But they got their shots and they got the last half of the flight and everybody was just tickled pink because they were going to sweat out the old two or three day wait routine.

So they got their stuff; we all got on the networks that night. Big deal. The next big show was a show for the Time and Life magazine executive tour.

Every year they put on a big tour. There's an assembly hangar for the Ten-Eleven. They can get, oh, I don't know, probably five or six in there at a time.

That's the most modern automated assembly plant in the industry. It's really quite something the way they -- there should be a Ten-Eleven sitting out here.

This is a flight deck thing they did.

MR. ERTEL: Isn't that one over there?

MR. OTTINGER: Yes. That's one right there. They called Bickle in August or September and said they wanted to come cut and watch the flight,

Bickle says, "Well, you are welcome to do it if we are flying but we haven't flown yet. We haven't made the

jrd 7

first one and we don't know when we will. And if it works out, great and if it doesn't, sorry. However it falls out."

And they said, "Well, hell, you've flown. We've got pictures of it flying in our magazine."

And they had a full page spread they had done on simulators. They had put that out in September, I think, and then they were asking us about this thing in October or something.

Anyway, it was all within a couple of months time that it happened. It turned out -- you know that picture on my wall in the living room with Joe in the cockpit -- the way he had those shadows and the filter effect, it looked like it was flying.

They thought that was a picture in flight, just at touchdown. So they were a little pushed out of shape. They thought Paul was pulling their leg when they said he hadn't flown yet.

But, anyway, I think that was the next big show and I have forgotten what flight number it was but that one came off just beautiful.

We got a lot of satisfaction out of putting on that show. We had another show where the AIAA had 600 or 700 guys out here for the National Annual Conference.

It was held in the Base Auditorium, the technical sessions were and then the display areas were set up in the

rd 8

NASA hangars and we put on a flight demonstration.

For that one, for that many people, we decided we couldn't do it down at south base with the problems of transmitting and transporting that many people down there.

So it was worth shutting down FRC ramp and the whole flight operation for a whole damn week to put on this damn AIAA thing.

Well, to give you an idea, we come in there, all the aircraft had to be moved off. They couldn't bring in -- we had to pull all the light standards down.

We had to put in a flash shield. We had to get a bunch of GFE's relocated. We went through a big effort. We got the control van back up next to the buildings for the flight.

We'd start him off out here down the ramp by the fire station. Joe made that flight. He made about four or five practice flights before the big show on that ramp to get used to the trajectory coming in.

He did a beautiful job. The day of the show came around and what did we have? We had a -- I told you that the XV5A was down there on the south base ramp there flying?

Well, the week before that or two weeks before that, there had been a problem with -- a guy had been putting on a press flight and he crashed and was killed and the reason was he had a critical transition switch that he couldn't see.

jrd 9

It was behind him and he reached back and got the wrong switch and didn't have time to get to the right one in a critical transition.

It was all because of the damn switch location. And we had enough moxy to -- without that incident in our minds to sort of be cognizant of -- it's just plain old common sense.

But we had a situation where we had a similar problem and I'm trying to remember the details of it now but anyway it's enough to say that we had a bad switch location, too.

Depending on what the problem was and the emergency requirement was it needed some improvement. I was having a tough time with Joe Walker convincing him we ought to change it because you get used to something and it's a little bit hard.

Joe came in -- he did this flight this day -- when you go under the lunar sim mode in this trainer you're activating it by coming up on the liftstick and in the TV it's a T-handle to simulate the LEM control, but anyway what you are doing is you are turning on these lift rockets and these lift rockets become your lunar propulsion, so to speak.

The jet engine is your propulsion, okay? Now, that triggers -- when you do this and you turn on these rockets you have got an extra force there and the

jrd 10

accelerometer sensors sense this increase and in those days we had a weighing mechanism in the electronics which -- a circuit, rather -- which you got so much -- let's see, how does it work? -- you got so much acceleration that you-- that's the same as knowing how much force you have got.

Okay. We had a pressure transducer on the rocket and we knew what the force input was and we knew what the resulting acceleration was and if you had calculated properly you'll get the weight.

So we called this thing an intial weighing circuit for this sim mode so that we would know how far to throttle the jet engine back with the automatic throttle to simulate five sixths of the weight, you see, of the lunar sim mode.

The weighing circuit was tricky, though, because you had to come on just at the right speed with this throttle or the weighing circuit would get out of phase and it would weigh you wrong, okay?

And when it weighed you wrong it would put the throttle to the wrong position and when it put the jet throttle to the wrong position you had to make up for it with the rocket throttle.

So Joe's got 700 guys down here watching him, lined up against the building on the big day of the show. He's probably a little nervous and it happens every once in a while, anyway, and he comes on too damn fast with the

throttle.

So the jet engine ~~problem~~ throttle gets sucked back too far. So he doesn't have enough jet thrust and he's sinking like hell but he's bound and determined and he brings that son of a bitch in hotter than hell, sinking like a bat out of hell and he's got he's lift rockets full bore and he's barreling in towards this crowd and the buildings -- he's going to land out here, you know, one side and we're watching him coming right out on his head.

He knows he's got to changeover and I'm telling him to ~~(inaudible)~~ turn the TM var and at about 20 feet off the ground he aborts the lunar sim mode and the whole effect of the maneuver was that coming into, say, 20 feet and then an obvious control change, and he bumps up a little bit and comes on in, you know, and to the novice that thing was so beautiful.

Everyone was thoroughly impressed and he was so damn close and for him to pay attention at that point, with the time that he had, in going back and looking at the data, he made four specific control maneuvers and switch changes in less than two seconds. With his left hand now, mind you, okay?

Now, that's pretty goddam fast and four or five, I've forgotten exactly the number but it was in that area, there was a couple of those which were mistakes.

In other words, he could have done the job with less

jrd 12

but in the process in that emergency he added these extra two steps in which became an extra burden on him and they didn't add anything.

What he did, I think, he went and put a switch one way, did something else, came back and undid what he had done and then had to come back later and redo it.

So, anyway, this whole thing got changed around right quick. We made our switch change and we got the thing put where it should have been for a lot less screwing around so that in case the thing ever came up again he could just make one maneuver and do it and never worry about where that thing was.

He could always find it, not look for it. So that was quite an experience on that show.

MR. ERTEL: Did you fly for LBJ?

MR. OTTINGER: No, never did. That particular day we had -- I don't remember if it was Phillips that was scheduled to come in -- I think it may have been in a Jet Star that afternoon after the AIAA show.

He couldn't make it. He started for a flight that morning and Bickle asked me to make a turnaround flight for Phillips if he showed up.

So when Joe landed we had our NASA guard sitting out there and we told him to move out and keep people from getting up around the ship because it was still hot.

jrd 13

That ~~high~~ hot rocket business and peroxide and everything, that stuff could get on people and the control fires inadvertently and you've got a hell of a problem on your hands. It's a hazard.

So this damn crowd moves in and of all the guys that should know better, it was the newsmen that were the biggest offenders, and those guys, they swarmed over and they got past the guards and we had guys milling around all over that thing for a while.

We finally got them chased out but they wanted,one of the major networks, wanted to interview Joe in the cockpit. So I said okay but I had an inverter running to keep the power on so we could make a turnaround for Phillips and he wanted it turned off.

I said, "No, I can't do it." He was getting all unhappy and I said, "Well, the way that inverter system works, I talked to my control assistant there and we could give him 10 second bursts (Inaudible) and I said, "If you want your energy at 10 seconds at a time, you can have it. We'll give you bursts."

Joe sat there, beaming all over. We gave him, I don't know, it probably wasn't more than four or five bursts of questions and answers about why couldn't we turn that thing on and run it and let's turn it on.

All we wanted to do is keep the gyros up and it

jrd 14

took them -- we probably could have given him 30 seconds but we weren't going to take a chance. So he said, "Okay, 10 seconds."

But we had one show for some local civic people that came out, there was 100 or so of them from Lancaster, Palmdale and the Valley and this was a group of businessmen.

Out of about six or seven, maybe eight press shows and demos for big wheels we missed only that one, and that was for the local people and that was because of wind.

We didn't miss a single one because of -- well, I shouldn't say that. Gilruth came out by himself and we put on a show for him and he had to stay over. He didn't have to stay over.

He was making a speech at a test pilots school graduation ceremony on a Friday night and we were going to fly Friday for him and we had a hardware problem and we found it, fixed it overnight, worked around the clock and some of the guys hadn't even gone home and flew for him early Saturday morning before he took off and went back to Houston.

He was just as tickled as could be.

(END OF TAPE ONE, SIDE TWO.)

(START OF TAPE TWO, SIDE ONE.)

MR. OTTINGER: Well, let's see, we wound up -- I think we pretty well went through the test stands, the --

MR. ERTEL: Special shows.

MR. OTTINGER: Shows. We wound up getting G.E. to put about 20, 25 guys, both in their fab shops and also ~~during~~ done installation work, in ~~(warming~~ wiring) up and ~~forming~~ plumbing up the Number 2 RV, getting it ready to go down to Houston.

If you remember right, we couldn't get the TV's in time so they wanted to start training with the RV's.

MR. ERTEL: Yes.

MR. OTTINGER: And they wanted both RV's, so we -- and we decided to make some changes. On RV Number 2, like getting rid of that emergency rocket system, because of the recovery problems, you know the marginal decision-making problem as far as a trainee pilot would have to face on using that system.

So that eliminated quite a bit of weight, six 500-pound rockets. You know, a lot of plumbing and eliminated the parachute, the drogue parachute on the bag.

We wanted to streamline the electrical wiring quite bit. There have been a lot of changes just made piecemeal o the RV Number one -- we streamlined a lot of that.

We wanted to do the new cockpit work through the LEM simulation visibility-wise on Number 2. So we sort of had a -- that was really the first time we had to go to work and bring our documentation up to date.

Out here at Edwards, because of the proto shop type of operation, with maybe making a major configuration change

just based on the work orders, says ' build the suit'" type of thing, you. know,

MR. ERTEL: Yes,

MR. OTTINGER: Make it work. And you've got a good bunch of technicians and inspectors and know what they are doing, you can get by with It,

3ut it's a little hard to make carbon copies when you get ail done, so --

We had a hell of a problem in trying to go back and update all of our documentation. We didn't have -- well, I shouldn't say we didn't have enough manpower because, well, we didn't, so we hired G.E. to do It, and we had a crew of -- maybe seven or eight ~ r draftsmen, with the lend man out at G.E. flight test, but in trailers down here at the south base living with us for six months to learn what we did to RV 1 to make It like it was, so they could build two Like it.

And part of the GFE on the TV contract that I got saddled with at Bell was a damned set of drawings which I had done by the G.E. crew because -- yes, we had -- in other words, here you've got a basic R+D vehicle that forms the maybe 50 percent of what an LLTV is going to be like.

And, well, you've got to start from somewhere. You're not going to start from scratch, so we had to take the set of reproducable drawings that I had G.E. make down here at Edwar and then generate TV drawings which complemented these.

And, to give you an idea now, we had a -- the Model Number on the RV was 71-61 -- the Bell Model Number. And the Model Number on the TV was 72-60.

So, we wound up with a whole lot of 72-60 drawings that had 71-61 detailed parts on them. And we wound up, in some cases, with RV 71-61 drawings with 72-60 parts on them because we had upgraded the RV. And we had one hell of a mes

And our configurations control was, let's say, very skimpy, very poorly done, in the early days. We attempted to recover with it through G.E. -- their efforts on a sub-contract basis.

Once you lose something like that, it's hard as hel to go back and pick it up, and we were just constantly living with problems, and you wind up, nine chances out of ten, having to depend on people who have lived with it long enough to just know what the hell they're doing and solve the proble as they come up, because just to do it by pure paper work -- impossible.

Bert Adams retired from Bell in -- oh, just in the last six months, but I dare say -- I guess if there's one other guy that did stay on the program as much as I have, it' been Bert.

Because Bert was a lead designer in Bell on the RV - started out with Ken (Lavens) when we first got -- he didn't get in on the early studies, I don't think, but he did get in

on the initial preliminary design on the RV.

(This is the golf course on the old)--

Bert came out as the lead man from Bell, designer-wise, to support us when Reiken came out, He was the top man from Cell, but we always had Bert as design detail supporting in this drawing documentation area.

And so he spent time in residence at Edwards to support the RV program, We want back to Bell and. stayed an working on the studies that were done out at Houston then to try and upgrade the RV, and he came -- and he was my assistant technical director on the TV program and went with me to Houston and stayed at Ellington until just six months ago.

So you see, he's had a hell of a long history and background in the program, and his whale job was to menage configuration control,

And Dean ~~(Grom)~~ Hinson relied heavily on him and paid dearly for his services. And Bert's a hell of a guy. He started with Bell the year after Larry Bell started the compan in 1934.

When he retired six months ago, he was among the -- I don't know how many are left there today, but you can count them on one hand, I bet, that have the seniority he has.

MR. ERTEL: Yes, I imagine so. It's a long time.

MR. OTTINGER: Don Wright is the guy's name that

I was trying to think of yesterday that; was the other assistant technical director that I had, who started two or three years after Bert Adams did, for Bell. Bern with them *for* years and years.

I think he retired probably a year *ago,* But, Don's a salty old guy that -- oh, he was salty. He was good, practical -- could get a job done.

But In his Last Pew years there, he was *so* damned salty that he just -- you really had to motivate him.

Look at the guppy.

There's some pretty good-sized hangars down there.

MR. ERTEL: How did you move RV 2 to Houston, ~~and then -- on a~~ another basket case. It never did get ~~put~~ put together

MR. OTTINGER: No, RV 2 -- RV 2 was ~~pawned~~ flown here and checked out. I'm trying to think --

MR. ERTEL: Taken to Houston and put in the hangar and never put back together, I think. I think they cannibalized some of the parts, didn't they?

MR. OTTINGER: Yes, I think it just wound up as a cannibalization victim in Ellington there. The RV electronics had been through an awful lot, and it really wasn't up to snuff as far as LEM controls were concerned.

It didn't have all the features and modes and so on built into it. It had a lot of variability for the research program we did out here.

Don't forget the RV flight test program was not something that was 100 percent just lunar landing things because there were some programs run for V-stall research,

They were interweaved on a non-interference basis pretty much, with the lunar landing program. It served as a pretty good V-stall tool and because of this, we had a lot of variable stuff built into the system -- into the control system that didn't wind up being put into the TV because the TV was strictly an operational trainer,

But at the same time the TV had a lot of updated LEM stuff in it, so in the TV, in one sense, was even maybe even more complicated with additional modes and things of this nature, but less complicated from the standpoint of variability.

I think in the end because of the -- actually because of the possibility of LEM changes, we still did make some variability in the TV to keep up with LEM, but not to do research with.

So we wouldn't get locked into maybe a LEM configuration that got obsoleted. So that --

MR. ERTEL: Dean told me --

MR. OTTINGER: -- control system, I think, probably had as much to do with, you know, soft-peddling the RV and the operational differences between an RV and a TV and getting a pilot accustomed to certain ways of flying, and having to

change -- hopping back and forth.

That was a consideration. The ground crews getting trained, and check that cut and maintain It, and check it out, That was another factor in GSE.

And that whole Ellington scene was a fairly good example of the -- having A great big complex picture in mind over here as to what needs to he done *an:!* starting out with a very meager shoestring over here, and trying to make that thing grow from one end *to* the other) and you wind up somewher In between.

And the distance between these two extremes is really far because we started out real meager and you wind up today with a fairly complex operation.

Stuart M. Present

MR. ERTEL: Dean told me that night after ~~(inaudible) or~~ present clobbered that last one in. He asked a few questions *again* about how much it would cost to bring RV *2* **up** *to* snuff. He'd say $2 million. (Inaudible.) a few years ago. (Laughter,)

It's dead but id's not dead, gnu know, Dead but not forgotten.

MR. OTTINGER: We started Joe's flight for AIAA right across from this fire station. In the middle of the ramp, and he landed down here next to the building, and all that crap was cleared out to those light standards over there

The airplanes were all pulled off.

There's the old X-1-E mounted. That's the actual

airplane. Okay, Could never eject out of that aircraft because his knees would have been cut off. He was toil stocky That cockpit was so tiny.

MR. ERTEL: What have we got here? (Inaudible.) Those old NASA badges. They come in handy *once* in a while,

MR. OTTINGER: These are lifters?

MR. ERTEL: Okay, well --

MR. OTTINCER: It's been quite **an** experience, **I** must *say*, going back **through** --

(END OF INTERVIEW ON TAPE TWO, SIDE ONE)

jrd 15

C E R T I F I C A T E

I hereby certify that the tape recordings represented by the foregoing pages were transcribed by me, or under my direction; that this transcript is a true and accurate record to the best of my ability

METROPOLITAN REPORTING SERVICE, INC.

Judith R. Dovel

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