

Aircraft Flight Log for the University of Washington, Cloud and Aerosol Research Group

Date 12-11-00	Flight Number 1843	Main Goals of Flight TEST IMAGING AND HOT WIRE PROBES, TEST RADIO AT WESTPORT WHEN FLYING OVERHEAD. W	
Project name IMPROVE 1:48 TEST		Which of the Main Goals were Essentially Accomplished? FOUND SC LAYER AT 6.5K BAR, 5.0K JUST MAKING LANDFALL ON COAST - GREAT STERILITY - SINCE THIS ALLOWED US TO CK OUR HOT WIRE PROBES - DID PROLONGED PURSUE MANEUVER STARTING AT TOP, TO BASE, THEN TOP AGAIN. CONTINUED OUTBD TO HEAVIER PCPN COMING FROM AS/AC LTR ABV SC LTR. SPINAWED UP IN SIG PCPN TO 10.0K THEN TERMINATED FOR PAE SINCE GOALS ACCOMPL. FOR TEST FLT ROUTE - TOP SC -6°C, BUT LTR DR NO RPN SEEN IN TRACK, VIBRA N THOUGH.	
Engines on time 6:32 LST 6:34 UTC	Engines off time 14:15 LST 14:14 UTC		
Departure airport PAE	Arrival airport		
Flight Scientist signature G. Rangno			
Pilot signature		Other Accomplishments	
Surface met. & visual obs. a) At takeoff E180 @ 56 + 3610		Clouds sampled in flight Ac As Ns Sc St Cu Cb	
b) In flight MULTI-LAYER CLOUDS			
c) On landing			
Research crew WILSON GRAY SPURGEON STUELINGA RANGNO	Equipment failures RANGNO - TRANSMITTER WARRER THAN PREV FLT. F-W - NO READINGS IN CLO DMT NOISY IN + OUT OF CLOUD I-D - NO PULLS ON TXT READOUT BUT OK IN CABLES METR - NOISE SPIKES WINDS AM GPS STILL	Additional Comments on Flight	

Flight 1843
December 11, 2000
Voice Transcriptions*
IMPROVE (Flight testing)

DS: Setting the record level. Testing 1, 2, 3. Checking. Testing 1, 2, 3.

AR: Do you copy, Mark?

12:44 PM

AR: Flight 1843 we have on board Mark Stoeltinga (it's my first time flying with him), Grant Gray, Don Spurgeon and Tom Wilson. Today's flight is to look at the imaging probes and the hot wire probes presuming we find some liquid water around. We do have some altocumulus upwind of the Olympics to the west as we climb out with a solid altostratus overcast kind of banded and thicker and thinner in sections. Mt. Rainer's top is not even being obscured in the least, suggesting bases are well above 15,000 ft anyway. I'm trying to talk a little slowly for Debbie here. I hope this comes across better and I also hope we're using a better tape today. I'll check into that. I didn't think of it until now.

12:45 PM

AR: What the satellite image suggested was that we would have kind of thinning and thickening altostratus until right near the coastline maybe 10 to 20 nautical miles off shore. We'll hit the main frontal band even though it's a dissipating one that should be much heavier in cloud and lower in cloud bases than what we have here.

DS: Put the de-ice on auto.

TK: Down.

DS: I think so.

TK: Down and the red light came on.

DS: Try it up. I think down is but.

TK: It's on again.

DS: Okay.

* AR = Art Rangno, DS = Don Spurgeon, GG = Grant Gray, MS = Mark Stoeltinga, TW = Tom Wilson

TK: It's always down.

DS: It should be down for auto.

TK: Okay.

DS: It's cold enough out there.

AR: We should after we pass over Westport one of the mission goals is to test the radio as we go by. They'll be looking for us at the radar site down there. Grant has contacted them, so we should have no problems. Alto cumulus clouds look like they're in the neighborhood of 20,000 ft as we get a little closer, at least this first group. Coming over the horizon is a lower layer of alto cumulus clouds. They look like they might be just what the doctor ordered here. It looks like they're going to be closer to 10 to 15.

12:47 PM

AR: Don, does the radar have a warm-up time?

DS: Yes.

AR: How much is it?

DS: About 5 min plus or minus.

12:48 PM

LS: (garbled)

AR: You're fuzzy but loud.

LS: (garbled)

AR: I think so.

LS: (garbled)

AR: Fuzzy logic I think.

12:49 PM

AR: Don, I don't know if you noticed the Ophir isn't giving us any measurements right now for some reason.

12:51 PM

LS: (garbled)

12:52 PM

TW: Art?

AR: Roger Tom.

TW: What particular dewpoint do you think it would be outside right now, about -40° or so?

AR: I think that's pretty accurate. The chilled mirror is indicating about -37° .

TW: Is there any chance that it's too low right now for the Ophir?

AR: I said that one goes on its ear, yes, when it does get very dry, but it usually indicates -50° . I mean it doesn't just die.

TW: Well, I mean we are getting like a canned temperature from it and things like that, so it might be that.

LS: Hey Art?

AR: Roger.

LS: (garbled)

AR: Yes, I saw that a little bit ago that underlying sort of altocumulus layer. I think it's going to be a little higher than that. Also if I didn't mention it, Grant wants to fly directly over the radar on the way offshore. Will that be a problem?

LS: No, we can do that.

AR: He's going to test some radio communications at that point. He's made them aware of our timing, so they're looking for us.

LS: Okay.

12:54 PM

AR: Mark, do you copy?

12:55 PM

AR: Once again looking off the left wing we're coming up off the Satsop Nuclear Power Plants here about 2 to 3 miles ahead and out about 20 to 30 miles there are numerous probably 10 slash burns out there off in a distance. There are a couple we're flying over right now and several ahead, so again lots of slash burn activity today (December 11, 2000). It must be because of the exceptionally dry weather they're just getting by with extending the burn season I'd say.

12:59 PM

AR: Larry, what do you estimate the height of that lower layer up there ahead? I think you're going to right on this one. I see Larry's back here actually.

1:00 PM

AR: Jerry, do you copy?

?: (garbled)

JR: Go ahead Art?

AR: I was just saying I think Larry's going to be right on that layer coming up yet ahead the lowest one. We want to be in that say near the top and we'd like to pass over that Westport radar. Maybe Larry could tell you where it is. I guess you weren't on the flight when we buzzed it a few days ago.

?: (garbled)

JR: Get the radar site set up here and you want to be in that layer of clouds then.

AR: That's affirmative. That's the most important thing and when we come up on it give me a few minutes and I'll tell Grant because he just wants to do a radio test mimicking conditions that we would be in as much as possible. So you can stay at whatever level it takes to get into those clouds ahead and then just give us a little warning. I'm going on break.

LS: So am I.

1:02 PM

DS: Go ahead. I'll hold the button up. Quick question, what's the ____ command?

TW: Use.

DS: Use.

1:03 PM

TW: Shouldn't we be getting any 1-D data out here?

DS: I don't think so. It doesn't look like we're in enough of anything out there.

AR: Roger on that.

DS: Are we getting some stuff on the 1-D?

TW: We're getting an occasional PCASP I think.

DS: That looks like it would be normal.

TW: Yes.

DS: With PCASP up we'll get some stuff on lower channels, but that's normal.

TW: Art, are we due for clouds pretty soon. I need to restart the 2-D board.

AR: Roger.

TW: We are?

AR: Yes.

TW: Okay.

1:04 PM

LS: Okay, Art,....

AR: Roger. Go ahead Jerry.

LS: (garbled)...try to get you down in those clouds offshore.

AR: Yes, this is looking great. Larry, you were right on the button. I was a little pessimistic thinking we wouldn't see anything this low with our offshore flow, but this is looking great because it will give some of our probes a test that we weren't really expecting to give them today.

1:05 PM

AR: Will we be pretty free to do what we want once we cross the radar?

LS: I think so, Art. (garbled)...what you want to do.

AR: Roger, I think if we can get into cloud over the site that's going to be great and then maybe give us 5 min and a heading of about 210. Make that 180 magnetic.

LS: (garbled)

AR: After passing the site 180 magnetic and in cloud.

LS: Okay.

JR: Say that again, Art.

AR: After we pass over the radar, I want a head of about 180 magnetic in cloud.

JR: Okay.

1:08 PM

AR: We're picking up some icing in here, so we'll probably only stay about 5 min and then climb on top and by that time we'll be in the snow precip and won't have any icing in it, but you see out there below the sun.

LS: How long do you want to stay in clouds?

AR: I'd like to be in clouds about 5 min. That should give us a nice test of our liquid water instruments. In fact instead of flying just in cloud top if you can start just in cloud top maybe 30 to 50 ft below cloud top, then we'll porpoise if we can do it. Just porpoise down to the bottom and we'll go almost VFR then and then back to the top. We'll do that say over a 5-min period and see what we come up with.

LS: Okay.

1:09 PM

JR: Seattle, Husky 1.

AR: Jerry, when we're porpoising beginning at the top can we go down about 300 ft/min rate of descent in these porpoise maneuvers to base and then back up again? Thank you.

1:10 PM

AR: Debbie's not picking anything up.

GG: Yes, I just noticed that.

AR: The DMT looks pretty good.

GG: The PVM is kind of noisy.

AR: The FSSP is looking good, only about 100 to 200. That's about right for this kind of stuff.

1:11 PM

AR: The PVM is pretty darn good here too. The JW is still.

DS: Yes, I'm going to take a look at the JW right now.

AR: I guess we've got two good measurements, PVM and FSSP are probably cranking out liquid water pretty darn well.

1:13 PM

AR: We have some nice clear icing here indicative of low droplet concentrations and larger droplets.

1:14 PM

AR: Tom, do you see anything on the imaging probes?

TW: I see an occasional particle go by, but not like a ton of particles. Should there be a ton?

AR: No. As we head in this direction, we'll be flying into the snow and I'm not sure when it's going to begin, but I would just guess from where those clouds that we'll start going into the snow storm maybe within the next 2 to 3 min.

TW: Would that mean a lot of particles for me then?

AR: That's affirmative especially on the HVPS.

TW: We don't have a display on that. I can look at that data raw, but I don't have any display yet created for that.

AR: Is that the way the project's going to be? Here comes some flakes now on this black rod I'm looking at.

TW: No, it won't be that way. I'm hopefully going to have it done this week.

AR: For the 2-DP?

TW: No. We have the 2-DP, but not the HVPS.

AR: Right. Do we have a display on the 2-DP because we're getting into some snow now?

TW: Yes. I'm looking at it now.

AR: And you are getting images?

TW: Not a whole bunch. How big should they be, pretty big?

AR: Yes. Snowflake sizes, a couple millimeters. We're popping out of cloud base and we can see what's ahead. Yes, there wasn't much precip back there. You can see it was hardly anything coming out of these clouds. It's still ahead maybe a couple of minutes.

TW: So there wasn't much in that cloud?

AR: No, not much in the way of precip. But that's good, your report is good then.

TW: All right.

AR: We've got about 30 knots down there on the water.

1:16 PM

AR: Larry, do you copy or Jerry?

JR: Go ahead Art.

AR: Let's turn 30° to the right and then continue doing what we're doing with the slow ascent.

??: (garbled)

JR: I'm trying to get 300 ft/min.

LS: (garbled)

AR: I'd like to turn 30° to the right and continue this maneuver.

LS: Okay.

JR: Okay, 30° right.

AR: Thanks.

DS: Are we still on precip, Art?

AR: There's an occasional flake or two, but that's about it.

DS: Okay. I'll try to set the zero on the JW is why I'm asking.

AR: Well now we're going back into cloud base, so it should be very low liquid water. You know, like 0.01, 0.02. As we climb it will gradually increase.

1:18 PM

AR: Larry, you can keep climbing. Let's go up there a little faster say 500 ft/min and up into the higher layer and then we'll orbit in that a little bit and I think that's going to make our day.

LS: Okay. We'll do that then.

1:19 PM

AR: Tom, we'll be coming into some snow here in the next 1 to 2 min. I'll let you know when I start seeing something. This will be quite a bit more than what we saw before.

1:20 PM

LS: Art, did you get the start time by any chance?

AR: Yes, I did Larry, it's 12:32.

LS: Okay.

AR: We're starting to come into some snow here. Tom, you should see some images.

TW: I'm seeing a couple.

AR: And so the HVPS liquid or lab, get back to the lab to see whether that worked or not?

TW: We'll probably have to wait like a day or two. I'm just finishing up the display.

AR: I see. Okay. Great.

TW: Definitely getting particles. There are not too many but a couple here and there.

AR: It's steadily increasing in this direction.

TW: The strips are going by so fast. I'm probably missing half of them.

AR: Roger. I understand. I think in our old system it was displayed for a couple of seconds because it wasn't displaying every strip, but like every tenth strip or something like that.

1:22 PM

AR: Jerry, do you copy?

JR: What do you need, Art.

AR: You can go further offshore if you want to orbit here and continue climbing that would be great.

JR: Okay.

LS: Art, after we complete this, what's your plan?

AR: Go back to Paine Field.

LS: Okay. We've got a clearance to 10,000 ft, which is about another few thousand feet. Is that going to be enough for you?

AR: I think we need to go higher than that, but heck we're only out here to get images. So I think that will be fine.

LS: We can get the clearance if you need it.

AR: Can we go to 15,000 ft? Well, how much longer will it take us to go to 15,000 ft if we go that high?

LS: Roughly another 15 min if you want to climb 500 ft/min?

AR: Roger. I think really, even though I want to do it for science purposes, I think probably getting enough to know what we need to know, so let's just go to 10,000 ft and then once we get there we can head back.

LS: Okay.

TW: Art, should be getting any FSSP-300?

AR: Negative. Don't worry about that probe. It doesn't work in clouds. Thanks for asking though.

TW: But we're getting all the other three I-D probes. They're all getting stuff.

AR: Now the 1-D I don't have that much. When you call that up, are you saying the CP rate is showing particles?

TW: Well I have the histogram I'm actually showing. It's showing what's going in what bins. Do you want me to bring that up for me?

AR: No. That's okay. I'll bring it up back here myself, but thanks a lot. That sounds great because I don't think it worked in SAFARI, so that's another plus. We're dancing like mad.

1:24 PM

JR: We've got 2,000 ft to go to 10,000 ft. Art. Will that do you good?

AR: That's great, Jerry. In fact if you want to start heading back to Paine Field and climbing that last 2,000 ft, that would be great too.

JR: I'll just continuing the circle until we get to 10,000 ft and when we get to 10,000 ft we'll just bore straight on back.

1:25 PM

AR: I'm not getting any 1-D concentrations back here, particles/liter from the 1-D cloud probe.

TW: I'll come back and take a look.

1:28 PM

TW: Are you talking about these first two, Art?

1:29 PM

AR: Jerry, you can go ahead and speed your climb up to 10,000 ft and head back if you want.

JR: Just arriving at 10,000 ft and we're headed back.

AR: Okay. Tans-ait back here says 9,400 ft, but this is good anyway. It doesn't matter whether we're at 10,000 or 9,400 ft. Thank you very much. We're heading back now.

TW: What would be a 1-D cloud probe value?

AR: 30, 50.

TW: That comes from the OAP-200, right?

AR: Yes. We're departing most of the precip area, so it's going to drop off. There should still be something here, but it's not going to be very much.

TW: This is the histogram of what's going in the OAP right here, not very much.

AR: We left the main precip area, so that's probably okay because I don't see anything on the back rod.

TW: We'll need to check maybe the definition for the CPRT. Because we're definitely getting stuff from the band, we're just not computing CPRT correctly from it.

1:31 PM

AR: I can see the sun's disc now so it's definitely light, light precipitation. So it's hard to tell from right now, but back there a way it should have had 30-50 type concentration I would guess. We just missed it. You were seeing more concentrations than this a minute ago when you were talking about it.

TW: Yes, it wasn't a huge amount. I don't think it was going off the chart or anything. I don't think it was over 100 like right here.

AR: That's plenty. Yes, that sounds real good.

1:32 PM

TW: I notice occasionally you'll get a pretty nasty looking strip and what happens is it will get offset. It's like a word off and so you'll see all the sink bites right along here and everything has shifted. It's really strange. I can definitely check for that and shift it out. But all of a sudden that started happening for a while and then it went away. I don't know why that happens. You'll know when you see it, because there will just be all these lines.

DS: I'm watching it too right now. This looks pretty good.

TW: Yes, you'll see an occasional particle goes by and you'll know when it happens. It's not this line. It's a line all the way across.

DS: Yes. This is a far better screen than the other one I'm using over here. Go on over to "chat."

1:35 PM

LS: (garbled)

AR: I can understand that transmission, Jerry. Yes, I could understand that last transmission, Jerry, a lot better than the first one, which was breaking up a lot.

JR: You've got to work on that PA thing now. See if we can get that worked up.

1:42 PM

GG: This is a recording level test. Recording level test. Recording level test. Testing, testing, testing. We don't seem to have any effect here.

1:45 PM

GG: What was that Art?

AR: Did the radar look okay today?

GG: It was getting solid returns, but for some odd reason suddenly we're not getting much power out of it. Not to mention that I haven't had a chance to address the receiver sensitivity issues.

AR: Roger. I was just laughing because it's right here and I forget.

GG: (garbled)

1:46 PM

AR: You folks have an ETA for Paine field?

LS: (garbled)

AR: 20 min to Paine Field.

1:47 PM

TW: Art, the 2-DC will bring a lot more particles because we're running the 2-DP.

AR: Right.

TW: The 2-DC you can see a lot more in probably?

AR: Yes.

TW: We're probably not even going to be running this probe probably.

AR: I think that's correct.

TW: Okay. (garbled)

AR: The main thing is that your software is working.... We can interface with the probe because it should be interchangeable.

TW: Right. (garbled).. it should work pretty much. The HVPS is a whole other bag of worms. It's a different data format. I'm saving the data, so we still have HVPS data from this flight and the last one too.

AR: I doubt we will have another test flight this week is my impression.

TW: Is it clearing up a lot.

AR: No, it's going to get rainier actually near the end of the week.

TW: Friday. Yes, I heard it was supposed to.

AR: Yes, exactly. I think Peter wants Nick to go on, who is away this week, and it will give everybody more time to fix stuff. I mean I would be in favor of that. I mean we did what had to do today. If we hadn't got the liquid water cloud, which was a big surprise, that first cloud we went into.

TW: Right.

AR: Completely unexpected. I was just hoping we'd get something, but instead there was that nice shelf, a shelf cloud. It was fabulous, so we really, I think, took care of the whole week. Because had we not found a liquid water cloud or didn't get enough to test, we probably would have had to go back out on Friday or Thursday whenever something came up again.

TW: Yes, there's an amazing amount of wasted strips coming through on the 2-D probes. I mean like we've got 23,000 strips right now.

AR: Yes. The way we dealt with that was.

TW: The 2-D convert program or whatever.

AR: Right. We didn't save the zero image particles.

TW: When I'm talking with Alexi he likes the raw files, so I think it's good that we save them out like that.

AR: I think we're exactly right.

TW: Because he's been getting back to me, he's like I hope you didn't save milliseconds on all our files. We just saved a whole second.

AR: Exactly.

TW: That's really cramping his style. It's really hurting his code because he can't compute particle offsets or something like that.

AR: It's kind of amazing, milliseconds.

TW: I don't know how accurate everything is anyway because everything is traveling through and then saved.

AR: Yes. And exactly in our previous cloud studies, you know, we were looking at concentrations of a kilometer or 5 kilometers. We had typically hundreds or thousands of particles to look at.

TW: Right.

AR: But there are people out there that are interesting in the finer structures and there are certainly some things we will be able to do but we haven't done before. Like if you don't have the zero images, which people think are actual droplets or small particles, you can't get all the spectra information from the 2-D probe.

TW: Right. There must be some noise too I think on this thing because a lot of the particles are right at the top or right at the bottom of the strip.

GG: Yes. That's kind of an odd situation.

TW: Right.

AR: Now that doesn't make any meteorological sense. That's right, that's the reason we didn't bother with those is we felt we shouldn't count them because there might be artifacts of who knows what they are.

TW: I don't know how prevalent it is in the 2-DC really. That wasn't far enough along before we sent it back, but when it gets back we can take a look at it and see. I mean, I don't know if it's a cleaning thing or an alignment thing. It's like right on the edge. It's always like the top row and the bottom row of the strip. It's full of little 1-pixel particles.

AR: This is the probe that went back after I guess it was KWAJEX. It's been in the shop and so it should be pretty good. I don't think we even took it to SAFARI.

TW: No, we didn't. No, we didn't have all four on there, right?

GG: No.

1:52 PM

AR: The DMT seems to be doing seems to be doing its thing still.

GG: It's responding, but it's being noisy.

AR: It looked like for a while, when I was looking at it when we first went into the cloud that, oh boy, this looks like something! But I hadn't looked at it before then, so I didn't realize it was so noisy until later.

GG: It's that the constant is off by a factor of 10.... We'll just have to look at the data when we're in cloud. We still have an A to D converter problem. When the inputs get right around 0 volts within 10 millivolts we start spiking and it just doesn't make any sense at all. We've got an inquiry in and Tom's code factor. This guy at Omega who sold us the board, hopefully he'll come up with some idea.

AR: Okay. I did see when the pilots were keying I did see some temperatures going off into orbit in the T-stair.

GG: Yes, I was going to try that with the other radio. As a matter of fact, I'll just go do that right now.

1:54 PM

GG: Art, which parameter is that that goes berserk? It's "t" what "r"?

AR: It's T-stair.

GG: T-stair.

Summary of Flight 1843 (Test Flight)

AR: Now I'll do a flight summary here. A stationary low center offshore is sending bands of clouds mainly high and middle clouds toward Seattle, altostratus and cirrus, mainly over Seattle and on our little test flight here mainly directed at the imaging probes and the hot-wire probes for liquid water content. We were extremely fortunate to find a stratocumulus layer based at 5,000 ft and topped around 6,000 ft right just making landfall or at least stuck there I should say because it's not moving; it appears. We had a chance to give our hot-wire probes a little workout in that by porpoising (starting in cloud top and then descending at 300 ft/min down to cloud base and then back up to top) and that layer mainly had no precip. We continued outbound to a heavier region of precip coming out of a higher layer of altostratus/altocumulus combination. We spiraled up in that to

about 10,000 ft and collected quite a few images and then we called it quits having accomplished our two goals of looking for precip and finding some liquid water cloud right off the bat. Grant was also getting this radio checked and that worked out fine. We're able to communicate better with the radar site on the coast at Westport. Generally things went pretty well considering the stratoscumulus was not expected, so that was a great plus. We had several of our usual outages and some improvements. Like the 1-D cloud probe did work even through the display indicated zeros, but we did see the 15 channels light up the particles when we were in precip or most of them anyway. The JW didn't see any liquid water at all indicated by the JW for some reason. The DMT was noisy in and out of cloud. We still have our noise spikes in T-stair, which impacts a couple of parameters. The radar had some problems. I'll let Grant mention that if he would. Grant, do you copy? Could you say something about the radar and anything else you might have noticed?

GG: On the radar aside from the receiver sensitivity problem, which we have to address, the transmitter doesn't seem to be putting out as much as it did on the last flight. So we're going to have to disconnect the antenna, put on the dummy load and run some serious checks on that. We did see some cloud targets. We don't have digital processing on it yet. We're still waiting for the card. We did see some cars. We were able to see the ground and things like that, but we're still lacking sensitivity.

AR: Thanks. Tom, did you notice anything that you want to mention for the record?

TW: I don't think so. We definitely have got some 2-D images coming through not a lot, but we've got some on the 2-DP probes. That looked good.

AR: Roger. Thanks. I forgot that. Is Don there?

TW: He's off the headset. Do you want me to put him on? Just ask him if he say anything that he wants to put on the tape, any malfunctions or anything.

TW: He has nothing to report.

AR: Now that is the best word of all.

TW: He's just into saving tape.

GG: I wanted to point out too, Art, regarding this communications interference problem, that when I keyed up the mike on the VHF-FM, which we're talking to ESPOL, I saw about a -1° depression in the T-stair temperature reading. So we're going to have to deal with that too.

AR: Roger. Thanks Grant. I'm going to be putting things away here. It won't be long until we're landing, so I'm going to be off the headset.

TW: Hey, Art?

AR: Yes.

TW: Did you see any differences in the Taz today?

AR: You know, I didn't look.

TW: Because we had an altitude correction. Right now it's about 117, which is about 8 meters/sec faster than the Shadin.

AR: That's interesting. That has quite an effect. We'll have to see what happens to our winds. Although I have been looking at the winds a little bit, they're still pretty high, but not outrageously. I haven't seen the Shadin winds, but maybe we'll see some effect there.

2:04 PM

GG: We still have the sign of the pitch angle wrong.

AR: ...how long did that take? It's been sitting here a couple of minutes since I indicated...

2:05 PM

AR: It's shutting down. Jerry, do you copy?

JR: Go ahead Art.

AR: At one time we had planned a flyby of the tower, but we don't have.... No post flight....

GG: You're cutting out, Art.

AR: Yes, I probably waited too long to pass that along because he was talking to the tower.

2:07 PM END OF TAPE