

Flight 1854
January 23, 2001
Voice Transcriptions*
IMPROVE

GG: ...on January 23, 2001. Starting at about 18:18 Z.

10:20 AM

AR: By golly, freezing level 7,000 ft. For the tape this is flight 1854. Checking here on the ground plumes. Looking around, rippled water over Puget Sound. It looks like it's a southeast wind presently. I guess I was anticipating northeast. There it is northeast. There it is plume okay. Let me change that. It's a northeasterly flow. I see a smoke plume off in the distance about 2 o'clock on the ground. We have a few lenticulars forming over the Olympics. We're underlying a broken shield of cirrus spissatus, which becomes altostratus, a banded type of altostratus. I see a band with a clearing behind it off about 2 o'clock also. A few regular altocumulus off behind the Olympics. So it's a situation with a very dry air flowing offshore trying to desiccate a rainband that's oriented northwest-southeast off the Oregon coast and it's believed to be heading up this way eventually, although its movement is very, very slow. It might provide a nice quasi-steady state situation for our study. On board flight 1854 are Nick Bond as flight scientist, Art Rangno flight meteorologist/flight scientist in some way, Tom Wilson and Grant Gray. Don Spurgeon has the day off. It looks like we're going to be ferrying out at the normal altitude of about 9,600 ft.

10:26 AM

AR: Winds 155 at 40 knots true from our new wind calculations that have been devised and worked out by Grant, which have been, at least from all evidence, extremely accurate. This is the first for our group in probably years, probably more than 10 years and maybe 20 years. I just turned the CPI on here at 18:25 UTC. Don has normally been running that and we had some problems on the last flight. We had some computer crashes, so we may have some problems. It was recommended that we reinstall the software because maybe it got corrupted because of the low inverter voltages that caused a shutdown of the recording on the last flight, but we shall see. I'll make a note here that t-stat is at -4.8° as we level out here at about 9,800 ft tans-alt.

10:28 AM

* AR = Art Rangno, EC = Eric Cooper (pilot), GG = Grant Gray, LS = Larry Sutherland (pilot), NB = Nick Bond, TW = Tom Wilson

AR: Ceiling gradually lowering ahead as we fly to the southwest. There is a rift as I indicated before in the first contiguous band of altostratus showing just a little bit of the mammatus-type virga. It does not get to flight level however. Behind that is some lower liquid altocumulus clouds and then a further lowering of the ice cloud behind that.

10:31 AM

LS: Nick, are you up?

NB: Yes. I'm here.

LS: Where do want to start that first point, do you want to cross at 1,000 ft? Is that right?

NB: Yes. That would be nice. It's not absolutely essential, but at least if we could be pretty low by the time we got there.

LS: I think we can do it.

10:32 AM

AR: CPI a little balky today. I had to restart the software a couple of times and then finally turn the probe on and off and that seemed to allow finally a background to be taken here in our underflight of the altostratus band that I mentioned earlier. The thin slot is just ahead and also are those scattered droplet altocumulus clouds kind of embedded in the ice cloud now I see at least ahead of the aircraft to the right. Then off to the left they're a little bit lower than the ice cloud. Offshore flow at a pretty good clip indicated by the ground plumes/burns or whatever that are going on around in this area today. Estimating 15 or more knots by the degree of bent over plume activity. More importantly the ceiling continues to lower offshore into it looks like now there's precip within view coming maybe another 20 to 30 miles out.

10:41 AM

AR: Noting the position of the sun dimly visible through the thickest part of that altostratus back there and now beginning to brighten up as we approach the thin spot, which should be visible in the video and the coastline in the Westport radar just ahead about 3 miles.

GG: Art, the 35 GHz radar is on and it is pointed upward. Is that your pleasure?

NB: Grant, I think for this low-level run we'd definitely want it pointed up.

AR: The haze layer visible just above the top of the Olympics. It seems to be at the base of the altocumulus clouds, a little patch near the Olympics on the west side.

10:43 AM

NB: Art, Nick here. Did you happen to catch a freezing level on that descent?

AR: It was running around 7,000 ft earlier. I didn't catch it on this descent however. I'm still showing above freezing actually here. Correction, I've gotten confused. It must have been around 6,600 to 6,500 ft.

10:44 AM

NB: I'm going to talk to the radar for a few minutes, so I'll be offline temporarily.

TW: What are we looking at here, Art?

AR: Yes. It looks like precip ahead. With that wind down there it must be another 30-knot day on the surface.

10:45 AM

AR: I'm going to take that back because probably that was some tidal action because now that we're getting out over the free water, there is not nearly so much wind.

10:46 AM

TW: It's looking real calm out there actually.

AR: Yes surprisingly so. I would have thought there would have been 20 to 30 knots flowing out into this thing. It looks like maybe 15 knots.

GG: Tom, are you on?

TW: Yes.

GG: Go to "chat" for a second.

10:47 AM

NB: Larry, Nick here.

LS: Go ahead.

NB: I have a new endpoint for you. We aren't going to go quite as far. It's 46°25'125"22'.

LS: Okay. You got cut out there, Nick. You're going to have to say it again.

NB: Sorry. It's 46°25'/125°22'.

LS: Okay. That's the new endpoint?

NB: That's correct.

LS: Okay.

NB: Talking to the radar they're seeing reflectivities of 40 DBZ out here, so it's a pretty respectable rainband.

AR: Yes. It's great.

NB: So I assume you see precip in sight, right Art?

AR: That's affirmative, about 5 min ahead.

LS: Nick, we're on the track now.

NB: Thank you.

10:48 AM

AR: We've cleared the thin spot now and now we're heading into some thicker altostratus with altocumulus at its base and this whole layering lowers ahead. It looks like rain reaching the ground in 3 or 4 min now.

10:50 AM

AR: They looked multilayered. It looks like the altostratus maybe topped by still higher maybe a separate layer of cirrus at least back there a little bit ago. That's maybe what we'll see. Our winds are increasing out here now. It looks like 20 to 25 knots now and numerous white caps.

10:53 AM

AR: Starting to pick up our first drops.

10:54 AM

AR: Indeed we did see rain start in 5 min. It seems like I've been off lately, so I'll point that out. We have virtually no turbulence in spite of the 25 to 30-knot winds

here at our indicated flight level. Everything seems to be working. Tom, do you copy? Is the 2-D cloud probe working?

TW: It should be. I'll take a look at it.

AR: I don't see any images yet. As soon as I say that it's starting to blink.

NB: On the last flight, Don was having to reset it up there a lot, so I don't know if that's something we have to pay attention to.

10:56 AM

NB: I think the CPI might need to have its throat cleared or something.

AR: Yes. I'm starting to get a little concerned, although as long as the concentrations are this low. Actually the rain is going to be increasing here in the next 10 s as we get into more of it. It should start to see a drop or two, but I'm watching it. It's been a bad actor lately.

10:57 AM

NB: I don't know if it is just the display, but the 2-DC is not updating very frequently.

TW: Yes. I can reset it again. Now it should be drawing every strip. I don't know why it's so infrequent.

NB: If it's being recorded okay, it's no big deal that I just see it every once in a while.

TW: What you're seeing is what is being recorded. It's actually reading from the file that is recorded.

NB: Okay. It's doing a little better now for what it's worth.

10:59 AM

GG: Did that other SPEC card show up, Tom?

TW: Excuse me.

GG: Did that other SPEC card show up or did you go into the UW this morning?

TW: You know, I didn't even see if it was there yet. I don't think so. There were a couple of other deliveries on my desk and I didn't see that one.

GG: Kind of a moot point anyway since they moved everything up. Say Nick, do we know if this is going to be one mission or two missions?

NB: I suspect it will just be one, but I don't know for sure.

GG: Roger.

11:00 AM

LS: Nick, we've got about 15 miles to go to our endpoint there. What's your plan to be there?

NB: Yes. That point we'll climb up to say 6,500 ft and reverse course along the same radial. Tentatively, I'd like to go back to about 46°40' and 124°40', but I'll be checking in with the radar after we climb.

LS: Okay.

11:01 AM

GG: Nick, if you would give me a heads up when you feel we're in a non-precip zone, I need to re-zero the J-W I think. It has suddenly taken a turn upward unlike what the PVM-100 did just a little bit ago.

11:03 AM

NB: Grant, this looks like a good time.

GG: Okay.

NB: Say Larry, Nick here.

LS: Okay Nick. Go ahead.

NB: The freezing levels are a little lower than I anticipated out here, so this is plenty high. In fact if we could drop about 500 ft, that would be good for our return.

LS: Okay. We'll go at 6,000 ft on the way back.

11:11 AM

GG: Getting a lot of drift in the J-W.

11:12 AM

NB: I'm going to talk to the radar now, so I'll be offline for a minute or two.

11:14 AM

NB: Hey Larry, Nick here. If we could drop another 500 ft, that would be helpful. Thanks.

LS: Okay.

11:16 AM

NB: Larry, Nick here.

LS: Go ahead Nick.

NB: I have a new northeast point for you. It's 46°45'124°23'.

LS: Okay. Do you want to go that now on this track?

NB: Yes. That's correct. At that point, we'll climb up to 8,500 ft and reverse course to our last point.

LS: Okay.

11:24 AM

TW: Is that noise meaning anything?

GG: Did anybody announce turbulence of something like that? I guess not.

11:25 AM

NB: Say Larry, Nick here.

LS: Go ahead Nick.

NB: We're getting good stuff here. So if we could just keep this course a little longer past that endpoint, I think that would be a good idea. I know we're just a mile or two away.

LS: Okay. We'll extend on this course then until you tell us different.

NB: Yes. Thanks.

11:27 AM

LS: Nick, how much further do you want to go on this track, do you have any idea?

NB: Yes. I think just a mile or two further would be fine. I see the coastline approaching. Not much farther than this and then you can take it up to 8,500 ft.

LS: We'll start our reversal now than.

NB: That's fine.

11:29 AM

NB: I'm going to talk to the radar now.

11:33 AM

NB: Larry, Nick here.

LS: Okay Nick. Go ahead.

NB: I have a new southwest point for you and that is $46^{\circ}34'/124^{\circ}59'$. As you can tell, this rainband is moving onshore pretty quickly. So these are pretty tight little legs.

LS: Okay. Do you want to go to that point now?

NB: Yes. Again, the possibility we'll extend a little bit past it, but you can dial in for that $46^{\circ}34'/124^{\circ}59'$.

LS: Okay.

NB: At that point, tentatively we'll climb to 11,500 ft.

LS: Okay.

11:34 AM

AR: ...the thing that does suggest water. That's what I was looking out the window to see if anything was going by the wing. But if there was, it would be unlikely you would see it on the 2-D probe because the particles would be too small. But the presence of the long columns and needles suggest there is some liquid water or was some liquid water here that produced rimming and splintering caused by the fall of those other particles. But if there's not much up there, then even though it's only -5°C there is still a little deposition going on in the crystals and they're just sucking up anything that might form.

NB: Yes. Certainly it looks like liquid water contents are very low on the Johnson-Williams, right.

AR: Do you have that somewhere?

LS: Nick, confirm you wanted 11,000 on the reverse track?

NB: Yes. That's 11,500 ft to be precise.

LS: Okay. Do you want to go back to those easterly points that we departed?

NB: Yes. That's right, at least that far. Because this rainband is moving onshore, unless it's a problem we'd probably like to take it another 5 miles past that point or so.

LS: Yes. We can get clearance for that.

AR: Actually just then when I looked out, when I was looking at this 0.03 I wasn't sure if it was an offset or not. Sometimes the J-W tends to drift and so I tend to look at the PVM or the FSSP integrated liquid water, although frankly in ice there would be a little bit showing up in the FSSP integrated liquid water. But certainly the 0.1 and 0.13 from the FSSP is real and those drops were going by. Now the question is with the low liquid water content not looking it suggest we maybe near cloud base of some embedded layer that maybe producing those splinters because probably with 0.1 or 0.05 g/m³ of liquid water the spectrum is still going to be very narrow and that suggests cloud base. It's uplifting but more toward the bottom. Then the question arises, if this is a layer that's say 500 ft thick or 1,000 ft thick, and the spectrum broadens because there's enough lift, then do you want to measure the full properties of some embedded liquid cloud layer rather than skip over it and then find you had splinters, but you were only nipping a little bit of the bottom of the cloud? Now see if I was back in the bubble, I might have been able to see that because sometimes the sun's disc or the position of the sun is visible and you can see the liquid water going by and you kind of estimate whether there is anything to it or not.

LS: Nick?

NB: Yes. Go ahead.

LS: We've probably lost our cabin compressor here, so I think you guys are going to have to go on oxygen here when we go to this next level.

NB: Okay. I assume everybody heard that. We don't have cabin pressure, so it's get out the oxygen masks.

11:42 AM

AR: Is that tans-alt or p-alt that altitude?

GG: What's our target for altitude, Nick?

NB: Well, we'd like try to get max altitude in this stuff maybe 21,000 to 22,000 ft.

GG: Roger that. I heard that they lost cabin pressure.

NB: That's correct. So you should get your oxygen mask. I'm going to talk to the front and see if we have chance to kind of get that back.

GG: Roger.

TW: There was some gear on my seat back here. I put it in the pouch behind me. It was like an oxygen mask.

GG: That was mine, Tom. Don put it back there.

TW: Okay. I'm also not getting any oxygen flow. So I don't know if some tank needs to be switched on or not.

NB: Well it could be they haven't done it yet. We're climbing right now for our 11,500-ft leg.

11:44 AM

AR: It's not looking real good, but something seems to be working for the moment.

11:45 AM

AR: I guess I don't have to read sign language. Yes, when that's pushed out like that.

GG: I think I just found a major noise source of the J-W. When the de-ice is on auto, it tends to flicker a lot as the switch opens and closes and that definitely affects the J-W as far as noise is concerned.

AR: Is that producing those big spikes then? Well I'll be darned.

GG: It's going off the end of the chart. I turned it off over here. On the way back I'll turn it back onto auto and see if it flickers.

11:46 AM

NB: Larry, Nick here.

LS: Go ahead.

NB: Are we liable to be able to get pressurization on this flight or from here on are we on oxygen when going up?

LS: I think you're going to have to be on oxygen. We have a malfunction in the system.

NB: Okay. Does that put a ceiling on us at some place?

LS: No not as long as you're willing to go on oxygen.

NB: Okay. I'd like everybody to pay attention here and make sure that you're feeling okay and that your mask is working.

AR: Check those fingernails. Look for blue fingernails and blue lips.

11:47 AM

TW: When we get to these higher altitudes, is there a chance that it might start heating up inside?

NB: Is it cold back there?

AR: Roger, very cold.

NB: Larry, in the back of the plane, it's getting pretty chilly. I don't know if the same problem with the pressurization will kind of prevent any heating, but there has been a request made.

LS: Okay.

NB: I'm going to talk to the radar now and I'll temporarily offline.

11:48 AM

AR: Back in the bubble here looking around after fiddling with the CPI for the last few legs, it's been not working quite right. We couldn't get it going and then it would crash, software would crash, and got the blue screen, frozen screen, but for the time being it's working.

NB: Larry, Nick here.

LS: Go ahead Nick.

NB: I've got a new northeast point. That's 46°54'124"6'.

LS: Okay. We got it.

NB: That's about right over the radar. So if you can bomb them or something, it might be a good time.

LS: Good idea.

11:51 AM

AR: Tans-alt flight level 11,151. CPI is working. The 2-D is working and HVPS appears to be working without incident. There's occasional noise, however, in the HVPS. Nick, could you refresh me as to what the leg height was before this one? Say Nick, could you tell me what the flight level was on the leg before this one? I'll try to catch up a little bit.

NB: Yes. That was 8,500 ft.

11:53 AM

NB: Art, Nick here. You were talking about the lack of lift before. For what it's worth, there seems to be some convergence in the cross band component of the wind all the way up to this level. So we're at least getting some gradual kind of upward motion I would think from just the mesoscale wind conversions.

AR: Yes, Nick, and along with that we are picking up embedded droplet clouds again here. Those little bumps, little droplet tufts, embedded altocumulus essentially in altostratus/nimbostratus.

11:55 AM

LS: Nick, I think we might have our pressurization back.

11:58 AM

LS: Nick? Anybody back there read me?

GG: Yes. I read you Larry. Nick is off the phone right now.

LS: Okay. We found our cabin compressor problem there. So we're going to get cabin pressure back. It's coming down.

GG: Roger that. The fuzziness is going away.

LS: You'd probably already figured that out in the ears.

12:00 NOON

LS: Nick, are you on yet?

NB: Yes. I'm here.

LS: We're about a minute from our endpoint here.

NB: Yes. So at that point, let's climb up to 14,500 ft and reverse course back to that same last southwest point, which was 46°34'/124°59'.

LS: Okay.

12:02 PM

NB: I'm going to talk to the radar now. I'll temporarily be offline.

12:03 PM

AR: The pressurization is working again.

GG: Yes. That's what Larry just said. They got it back on.

AR: Sun's disc visible off the right wing now as we turn and some droplet clouds above us. It's mostly ice though, but there are droplet elements up there. The flight level is 11,000 ft. No precip reaching the ground here according to...

LS: Say Nick.

NB: Yes Larry, Nick here.

LS: Are you going to want to be going on that Olympic transition on the way home?

NB: I'll talk to the radar right now and ask him about that. Is there any problem with that or do you just want an early heads up?

LS: I just wanted to get the navigator setup for it.

NB: Okay. I'll ask.

12:05 PM

GG: The J-W is experiencing extreme zero today.

AR: Yes. I don't know why that would be. We're not doing anything different, are we?

GG: No we're not. I don't know what's going on here.

12:06 PM

AR: That sun is almost full out here. Quite a thin spot in this band indicating in the path of the sun a little droplet cloud, but mainly glaciated to cloud top. There are isolated droplet clouds in this area, but they did go by.

12:07 PM

AR: Nick, do you copy?

GG: He's on the radio to the radar.

NB: Yes. I'm back.

AR: Nick, it might be worthwhile asking of any precip is getting to the ground. The radar is indicating it's only getting to within 5,000 or maybe 2 kilometers both below the aircraft and above the ground. It turns out to be about the same distance.

NB: Yes. I guess I'd be astonished if there were not. Certainly the last time I talked to John he was talking about the two rainbands here when we first went out at low levels there was the first one and then there was kind of a clear spot and then we just started getting into the second one and he gave me the impression that there was still that kind of separation there.

AR: Yes. So you're indicating that there the precip is getting to the ground. It would be a good way to test the radar because we're practically flying over the Westport radar.

NB: Well, I'll go ahead and call him up and see what they see there and certainly we're close enough to the radar that even the lowest beams is essentially skimming the tops of the waves.

AR: Right. So anyway because I've been using it in my little notes here as to whether the precip is getting to the ground or not and here it's clearly a long, long ways from reaching the ground and I would like to see if there's any truth to that.

NB: Okay. So I'll call him up, but first I'd like to give some way points here to the front of the plane. Larry, Nick here.

LS: Go ahead Nick.

NB: Our new southwest point is 46°38'124"48' and chances are we would like to kind of slip the northeast point a little bit inland this time kind of this moving stack pattern.

LS: It shouldn't be a problem. Give me that northern coordinate again on that.

NB: Okay. This is the southwest point that we're headed to right now and that's 46°38'/124°48' and for our northern point you could have tentatively something like 46°57'/124° even or something like that.

LS: Got it. If you have them Nick, let me have those Olympic points there on the Olympic transition sometime here in the next hour or so.

NB: Right. I just talked. I'm glad you brought that up. I just talked to the radar people about that. They see the precip or anticipate the precip breaking up over the Olympics as this band moves in. So right now I'm not anticipating that nor are they anticipating a landing at Hoquiam and waiting for another rainband to come in. So right now, at least, the idea is to do this rainband as high as we can go.

LS: Okay.

AR: Sun position still visible through ice and droplet cloud.

12:11 PM

AR: Now just in the last minute, Nick, the radar is painting precip to the ground, so it's kind of interesting. It kind of goes with our offshore flying experience down low anyway to some extent.

NB: Yes. I think that just an extra little bit of drying over the land or something, the easterly components at low levels are probably, that makes sense.

AR: So far the sun has been visible along this whole leg.

NB: So you think there's a chance we might be able to get to the tops here?

AR: Standby. I lost track of our flight level.

NB: We're at 14,500 ft right now.

AR: It's going to be close. Usually what I'm looking at is kind of that sun through ground glass and it's usually 2 to 3 kilometers even when you do see the sun's disc.

12:12 PM

AR: Heck. I guess we just turn the radar in the up position, Nick. Hang on just a second.

12:13 PM

AR: Well at the present time the radar is indicating between 2 and 3 kilometers higher for the tops of this stuff.

12:14 PM

LS: Nick, 4 miles to go there, 4 1/2. Do you want to go up to 17,500 ft?

NB: Roger that and reverse course and head along the same track basically about 5 miles or so maybe 10 miles a little further inland than we went before. I'll take to the radar while we're out here though.

LS: Okay.

12:17 PM

AR: There were some altocumulus clouds here again. Liquid water 0.3 on the integrated FSSP liquid water content, which is probably pretty good in the absence of ice here.

12:18 PM

AR: The sun's disc has not been visible for a couple of minutes now.

12:19 PM

AR: Here comes the ice and along with that cloud tops dropped down during that altocumulus period. Not much, they're with a kilometer of flight level. Now they're back between 1 and 2 kilometers as these crystals began appearing. The liquid water contents are pretty high suggesting we are near cloud top with that guy. Although now the droplets we're getting into suggest either we are near cloud base or the clouds dissipating in this region of the band.

12:20 PM

AR: The sun still not visible in this turn, which is interesting, because we're getting some light snow and also some droplet clouds still. Also I can make out a liquid layer below us. There is something down there at this turnaround point in the way of a liquid layer to help the precip out.

NB: Say Larry, Nick here.

LS: Go ahead Nick.

NB: I'd kind of like to get an idea of how high you think we can go today. I see that we are getting a little bit of ice and so I assume you have the anti-icing on.

LS: You bet we have. If we get out on top of this thing in the clear, I can get you up high. But as long as we've got this heavy icing on, we're not going to get much past about 19,000 ft.

NB: Okay. So again we're doing good getting up to 17,500 ft here and then I'll talk to the radar and I'll get back to you.

LS: Okay.

AR: Just then it looked like we got some supercooled drops, drizzle drops.

12:22 PM

AR: We're just heading back and I can see the sun's disc now or the sun's position through ice cloud. We're also near the tops it appears of droplet clouds because I can see those go by and now they've obscured the sun. Along with that the radar is depicting the situation quite well. Just a second ago we had a separation between some clouds just above the flight level, a separation zone, and then some ice cloud. Now it looks like it's contiguous probably about 1 1/2 to 1 kilometer above the aircraft. Obviously the ice cloud is going to be higher than that, but I can't really pick it out here.

12:24 PM

AR: Nice droplet cloud top off the right wing. Ice cloud above and off the left wing for that matter, altocumulus mounding turrets, and some altocumulus clouds floating by. Well I can see now it's part of the layer...

NB: Larry, Nick here.

LS: Go ahead Nick.

NB: Yes. What we'd like to do is continue along this course and go a little bit past the radar to somewhere near that point that I gave you. What we think is going to happen there is that we'll be in the clear air and then maybe we can turn off the de-icing and kind of spiral up another 3,000 ft.

LS: Okay. We'll give it a try.

AR: Yes. So far there's certainly nothing but ice cloud along this leg above us, so any icing has sort of been left behind just at the beginning of this leg and below us.

NB: Yes. That sounds reasonable. One thing also for Grant and Art, that our cloud radar seems to be pretty consistent with what they're seeing, the S-Pol, and that it's not raining on them now and they're seeing the echoes going down to about 2 kilometers just offshore.

AR: That's great. As you can see out the right window, we're getting rapid brightening of the sun as pass into a thinner area of this band or perhaps the end of it.

GG: May I take this unparalleled opportunity to zero the I-W again?

AR: It sounds good. We're not going to hit any liquid cloud now for a while.

12:28 PM

AR: It's beginning to look like, Nick, we might see what seems to be a common scenario we saw in the Arctic all the time too. There would be two layers of ice cloud, a very high layer (more true cirriform levels) and then something that's sort of associated with a storm and precip. The higher layer perhaps not putting any crystals down into the storm itself, but being completely separate. Also, probably too high for us to get to.

12:31 PM

AR: By golly, down at this end there's a few droplet clouds still embedded up there probably 3,000 to 4,000 ft above our flight level judging by the rate of movement by the sun there.

NB: So that mean that it's unlikely we're going to be able to turn off the anti-icing stuff?

AR: Well, it's very thin whatever it is. It would have negligible liquid water content and probably is only less than 100 meters thick. It's more like shred clouds almost.

12:33 PM

AR: Which again, Nick, as you were pointing out about the confluence we had three or four different droplet layers embedded in this whole glaciated mass and that all points to a pretty good lift today as you had mentioned. Our very excellent radar is indicating cloud tops are 1.5 to about 2 kilometers above the aircraft at least the detectable clouds.

NB: Yes. Well certainly we're not going to be able to get that high.

AR: We've been to 25,000 ft if we can find an opening and turn off that anti-icing or whatever it is. Somebody tell me the correct name for that. Anti-ice heat or what, I know I've got that mixed up now.

12:35 PM

NB: Art, if you could take a look around and see if you see any kind of thin spots that are promising that would be helpful. I'm inclined to just climb up as high as we can at this point.

AR: I couldn't agree more. I don't think we're going to find anything even though it probably looks pretty good from the radar out in this direction it's just solid falling, slowly falling ice crystals, no holes.

NB: Larry, Nick here.

LS: Go ahead Nick.

NB: Even though we're not in much liquid water here, obviously we're still in cloud and ice crystals and so I guess what I'd like you to do is at your convenience climb up to what you can and reverse course. Hopefully we can get at least to something like 20,000 ft, but I understand if we can't.

LS: Okay. What I'm doing is continuing east until I get out of this overhang here and then I can get the anti-icing off and I can climb.

NB: Yes. The trouble is I'm not sure how long this overhang is going to go.

AR: Exactly right.

LS: Well I'll start a reversal now then, but I'm not sure how high we'll go.

NB: Thanks.

AR: Yes. Because we were underflying that all the way out here and altostratus, particularly the tops, are in the cirrus entourage.

12:38 PM

AR: Nick, are we going for all we can get on this, is that it?

NB: Yes. That's correct.

12:40 PM

NB: Larry, Nick here.

LS: Go ahead Nick.

NB: I see you've got me 20,500 ft or so. That was great. I guess everybody got out and pushed.

LS: Yes. Well I turned some of the anti-icing off when we got up into that thin scattered stuff there.

NB: Okay. So do you think this is about the ceiling?

LS: Well if we get down to the other end, I think we'll be in the clear at this altitude and then we can go ahead and climb again.

NB: Yes. So at that point, what do you think we could get?

LS: Hang on just a minute. Okay. Go ahead Nick.

NB: Yes. If we do kind of get into the clear at the southwest end, how high do you think you can get there?

LS: If we get in the clear we can go to 26,000 ft today.

12:44 PM

NB: I'm going to talk to the radar now. I'll be temporarily offline.

AR: Sun dimming as we come under a thicker part of these cloud tops here after having a nice partial 22° halo.

GG: For the time being, the radar antenna transfer switch is frozen in the downward looking position. It won't move.

AR: Gee, how did it get switched?

GG: Well I switched it just to take a look downward and it's staying there.

12:45 PM

AR: Got some striations in the altostratus going by, altostratus top of this nimbostratus I guess it would be. Although the radar is not indicating precip to the ground, so I guess it would be altostratus. That would be the better description. We're starting to get a few indications of some barely existing droplet cloud up there. It's not real clear. It could be some icy kind of cirrocumulus in the post-freezing stage, but my guess is there's a little water right now. This is the same area we underflew and I commented on it earlier.

12:46 PM

NB: Larry, Nick³ here.

LS: Go ahead Nick.

NB: It's great that we got up this high here. What we might like to do here is, if we go a little further southwest than we did the last time maybe something 46°34'/124°59', we might be able to break out and kind of continue to climb another 3,000 ft.

LS: Yes. We're already breaking out, Nick, I can climb here if I needed to.

NB: Okay. So just tentatively then let's head not quite as far southwest, but to that previous point that we used, 46°38'/124°48', and we'll see if we can climb 3,000 ft there.

LS: Okay.

AR: Yes. This might be kind of a thin spot in here.

12:48 PM

NB: Certainly I'm seeing less ice on the leading surfaces here on the engines, so presumably we're not picking up anything more and kind of slowly losing what's there.

AR: Yes. That's right.

LS: Okay.

NB: Say Art, are you seeing precip to the ground here with the radar?

AR: It's a negative. It's a little hard to tell. It may be just minimally present. There are no bright bands at least that I can find indicating it's going through the melting level quite yet. Although just as I say that something begins to pop up about 2 kilometers above the ground. So I think, yes, in fact it's strengthening right here, Nick. Definitely reaching the ground here. So I think that was a real gradient of non-precip to precip just as you were asking that question.

12:50 PM

NB: I'm going to talk to the radar now to see if they have any sort of updates on our southwest point, temporarily offline.

12:51 PM

AR: We now seem to be overflying the deeper droplet cloud that produced that 0.3 liquid water content and it looks like some of tops may actually get up to this level. Looking back it looks like one of the mounding semi-shredded tops reached this level off the right wing. Now it looks like we're even coming into a little bit of it, although the FSSP hasn't shown anything. I'll be watching though.

12:54 PM

AR: The main point is we've come into a deeper more active part of this band here at 12:52 and about 124°50' down our line, which was near a previous endpoint.

NB: Larry, Nick here.

LS: Standby Nick.

AR: We're passing into a more enhanced version...

LS: Okay Nick, what do you got?

NB: Well I'm not sure if you can spiral up at this point. But I do have some guidance from the radar, a place where they think that we can do such. That is at 46°25'/125°19' and maybe even before that, but certainly by that point they think we'll be mostly out of it and able to climb.

LS: You're going to have to say the whole thing over, Nick, because I was blocked there.

NB: Sorry. I'm not sure if you can climb up an additional 3,000 ft at this point. But if not, if we could head farther southwest and in particular at the point 46°25'/125°19'. Then we're pretty sure we can spiral up at that point.

LS: Okay. I'm doing okay right now, Nick, so I'm reversing. I already started that, but it's clear enough air here for us to have the anti-ice off.

NB: Okay. Then that's great. All the goodies are from this point in toward the radar. So if we can climb up 3,000 ft here.

AR: Nick, I don't know. It seems a little strange to me here at least from the radar vantage point because it looks like we've still got precip all the way to the ground. We're turning and at least visually above us and below us from the radar there's a more enhanced version of this band. But I guess if they want to turnaround in mid-band, I guess that's fine.

NB: Yes. I'm pretty sure they want to get this...

LS: Nick, I guess we didn't that clearance to 24A, so we're going back down to 210.

NB: Okay. That's fine. Is there a chance that if we were to loiter out here a bit that we could get it or is this something that we should give up on?

LS: I'll have to check with ATC.

NB: Because right now if we could continue going south, if we're at this level, if we could continue going southwest, we'd be doing better than just going back to just about the level we were at.

LS: It's not a matter of the air. We can't get the clearance right now because of traffic.

NB: I see.

AR: Does he have to _____ from this area then, is that it?

NB: I'll check.

12:58 PM

NB: So Larry, just to check. We're heading back at the 21,000-ft level?

LS: Hang on Nick.

TAPE 1, SIDE 1 END

AR: Oh, well.

12:59 PM

GG: One apparent problem with the J-W is that the zeroing potentiometer is pretty well shot. It's pretty old.

AR: It's probably 30 years old.

GG: It's been fiddled with around this point probably for all 30 years, so it's probably well worn out. I'll get a replacement.

1:01 PM

AR: We've broken out here a little bit. No ice crystals reaching this level here for a couple of seconds anyway or just above us.

LS: Nick, we're going up to 240 now.

NB: That's great. I appreciate that.

AR: The boys at the S-Pol don't care that we haven't cleared it?

NB: I guess not. They said a few times they really want us to work this part that's kind of been closer to them.

1:02 PM

NB: I'm going to talk to the radar now, temporarily offline.

AR: Looking to the southwest we have enhanced cloud. It looks like emerging lower-layer clouds that we have below the right wing, merging, almost building up. They look a little more tufted in this region, altocumulus castellanus. The ice cloud thickens.

LS: Nick, do you want to go to 235, is that right?

AR: I think he's still confabing with the radar. How's the cabin pressure, Larry?

LS: The cabin is at 12,000 ft.

AR: Does everybody copy, the cabin is 12,000 ft. So it's not a bad idea to grab a little oxygen now and then.

1:04 PM

AR: Nice, weak 24° halo off the left wing suggesting ice crystals at cirrus levels, -40° or so.

LS: Nick, we're at 23,500 ft. Is that where we want to be?

AR: I think he's still confabulating.

NB: Sorry. Nick here. Larry, Nick here.

LS: Go ahead.

NB: I just spoke with the radar and so they'd like us to do this 24,000-ft run over this same track we've been laying down. Once we get over the radar at 46°54'/124°06', then we're done and you can take it in.

LS: Okay. Do you want to be up at 24,000 ft for this run?

NB: That's correct, if we can get it.

LS: Yes. We can get it.

1:06 PM

NB: Say Art, talking to John, he thought we cleared both bands by the time we got out here and just saw some other kind of low-level precip out there not connected with the bands we had been flying.

AR: Well certainly the radar indicated they were connected. It would have been fascinating to go down and check out who is right and what the heck is going on I'll tell you that.

NB: Yes. It would have been a lot of time of course to get down there and mess around with that. I agree that it is best to clip this top one of the one we've been working though.

AR: Yes. I find myself getting "upset", you know, concerned. Dog gone it, let's finish that last band. We're not at the end of this stuff you know. I start to think thoughts like that that those guys are not quite right. I think we were supposed to fine-tune these endpoints if they had some problems with it. But as I say, those kind of thoughts are meant for, you know, individuals and wild doggers.

NB: Well to me, I guess, I obviously wasn't looking at the same thing you were. But it wasn't clear to me that they were necessarily connected up and maybe it was something that had just kind of evolved in the last half hour or hour and is not necessarily that meaningful to the stack that we were doing.

AR: It certainly went down to the ground if our radar is trustworthy, which I really have come to believe, and it certainly went down to the ground and we were turning at about the mid-point of where the lower layer clouds had thickened up. Where it was actually over that area where we started seeing at one point liquid water of 0.3, 0.4 and even at that point we went just a little beyond that to make the turn. Visually ahead that thickening seemed to continue at almost to flight level and then there was as we've seen these alternating, dimming brightening phase of the altostratus certainly indicative of banding and there was this other band back there with the enhanced liquid water cloud below it just ahead. You know, I would have loved to have punched through to see what was on the other side. But as you know, we can't spend all day out here.

1:09 PM

NB: Say it looks like the HVPS might be kind of a little bit flaky. Can anybody shed any light on that?

AR: Standby. It's not going to see any of this stuff. That's part of the problem, Nick. These particles are so small they may actually be there and they're just little dots. The crystal size in the 2-D is down around 100 to 200 to 300 microns and the pixel sizes on the HVPS are 200. So I doubt anything would even show up there even if it were working at 100%. I do see some noise in it. You're certainly right about that.

1:10 PM

AR: I don't know that the radar would have picked anything up, but we cannot turn it to the upward position. It's still pointed downward.

NB: That's a little bit regrettable in that we can't see necessarily how high this stuff extends above us. Why can't we turn it to point up also?

AR: It seems to be a mechanical problem. The switch is frozen in one position. It's a toggle-type switch.

NB: Okay. Got it.

1:11 PM

AR: Here we seem to be going through one of those elevated top regions with kind of dimming and brightening of the sun that we saw earlier. Looking at the sun now, you'd have to estimate a good 2 kilometers at least to go to get to the top of this ice-crystal cloud here. When we did break out in a thin spot, we did have a separate layer and it did look like in some places it was merging with this lower ice cloud. I'm guessing that's what has happened here. As I said earlier, that one appeared to be at true cirrus levels probably up around 30 or more.

NB: So the bottom line is, are we flying in crystals that are seeding the rainband of interest?

AR: Absolutely. It was a fabulous display of that going on because we're all glaciated here and at that turnaround point we had I know we had at least 4 liquid droplet layers. Let me get that out before I get too confused. The one on the southwest end was enhanced and that was the one near the southwest endpoint had that 0.3 liquid water into which some crystals were falling. These would be more like altocumulus seeder-feeder. Most of the time when people think that, they're talking about the underlying stratocumulus, you know, and creating raindrops or aggregates falling into the seeder-feeder like over mountains and that kind of thing when you have that underlying and orographically enhanced stratocumulus.

1:14 PM

AR: I'm going to go on a soapbox. That's what makes it a little complicated to document the precip process here because some of those layers we didn't even sample those droplet layers. But of course if you did, you could imagine the flight time it would take to sample the liquid water spectra in the embedded droplet clouds here in the mid-levels.

NB: Well does that say that a competing strategy would be to kind of slow spirals up and down?

AR: Well that would certainly be one of them that you would think because then you'd nail all the liquid water clouds if there were some (they're not always there) that are contributing to precip mass. It's a toughy.

1:15 PM

AR: Here's another interesting thing from the radar, Nick, indicating crystals dropping down below us about a kilometer or so. Then it looks like if you pick it up at this level no precip, and then a separate layer spawning precip maybe 2 to 2 1/2 kilometers below the aircraft where we get quite a large increase in echo and that echo goes all the way to the ground. So if you took the radar at face value, you'd be flying in something that does not connect to the lower layer at this immediate point.

LS: Nick, confirm that you want to depart for Paine Field at the endpoint?

NB: Yes. That's correct.

AR: I kind of doubt that myself. I would think these crystals are going down in a lower layer and maybe the sensitivity is just not quite high enough. So you have to watch the radar a little bit. When people look back at it, they infer that it wasn't getting there.

NB: Well that's something that is certainly worth putting in your report.

AR: Yes and here again a spiral down would be good, if nothing else, just to check the radar out if we get a few minutes some day.

NB: Yes. I want to keep going at this level over the radar. I got the indication that's what they want out of us. I'm not sure how far down they'll go for the ferry back to Paine Field.

AR: Right. I'm kind of in old pining and rhetorical mode here.

NB: Right. I can tell.

1:19 PM

LS: Nick, it looks like they want us out of vector now. Is this close enough to your endpoint?

NB: Affirmative. Yes affirmative.

1:21 PM

AR: Nick, what's the next move? I've kind of forgotten here.

NB: Nick here. Sorry, I was talking to the radar.

AR: I'm sorry. I didn't mean to interrupt. I was just wondering what's the move now, the next move?

NB: We're heading home.

LS: Nick, what did you say?

NB: Sorry, I was on the wrong channel. I was talking to Art. I'll go back to the side channel. Art, we're going to head in now.

AR: Thanks Nick.

1:28 PM

AR: Clearing virga base in here and the radar did a great job of finding the bottom of this stuff.

NB: Say Art, maybe this might be a good time for us to do our summaries.

AR: Roger Nick.

TO SUMMARY

1:36 PM

AR: I think these overlying clouds are in almost exactly the same spot they were when we flew out here. Talk about steady state.

TO SUMMARY

1:37 PM

GG: Well we had 6,132 s of radar data.

1:44 PM

GG: Tom, are you on?

1:46 PM END OF TAPE

Summary of UW Flight 1854

AR: I'll just say I thought this case turned out to be pretty decent considering I was a little bit of a skeptic on whether it would hold together. But by golly, there was precip just offshore and it was a multi-layered quasi-steady state system, although it was very complicated. I say that because there were undulations in the tops of the altostratus cirroform top of the storm as evidenced by the sun dimming and brightening as we flew at constant levels. Then in the levels below 20,000 ft why we had at least four droplet cloud layers, these are the mid-level embedded altocumulus-like layers toward the southwest end, which provided possibly rimming targets. That's something that will have to be looked at in the data before to see if the ice crystals dropping down from the glaciated upper part of the storm actually did rim. But at least they were down there and if nothing else those droplet clouds were signposts for water supersaturation in this otherwise glaciated cloud mass. Which we can't always tell, as I should point out, what the degree of ice supersaturation is because our dew point measurements just do not work that well in precip and at low temperatures. But the intercept of droplet clouds is an absolute sign that you're at water saturation, of course, and an appropriate level of ice supersaturation depending on the temperature. So they are very important to know about in these precipitating systems from both the rimming standpoint and the other you're experiencing water saturation in all this stuff. So I thought it was a pretty neat day all in all with the quasi-steady state conditions and those droplet clouds out there embedded in this stuff.

NB: Just to summarize what we did. We flew an eight-level stack through a pre-frontal rainband. I believe it was probably a cold rather than an occluded front, but that remains to be seen. This eight-level stack was at the levels of 1,000, 5,500-6,000 and then 8,500, 11,500, 14,500, 17,500, 20,500 and finally 24,000 ft. The instrumentation largely worked pretty well except for the CPI, which on the legs below 11,500 ft was basically non-functional. One thing highly encouraging was that the cloud radar for the plane at least was grossly consistent with the reports from the S-Pol radar. Finally, regarding some of the meteorology, I saw a low-level convergence or the convergence seen not just at low levels, but up to as high as 11,500 ft. That was probably providing some of the lift for the liquid water clouds that Art just mentioned. Finally in comparing with the MM5 prog, the low-level winds were a bit stronger than prog, but otherwise the model seemed to have a pretty good handle on the overall flow. By way of comparing with previous flights at least the ones I've been on, we I believe were at the

coldest temperatures where we were collecting ice crystal data of the program so far. At the 24,000 ft, we were at -37°C approximately. Over.

AR: Grant, do you want to add anything about the radar or anything like that? He's not on the headset. Tom, do you want to say anything? He's on "chat." I think Tom was busy programming the whole flight.

NB: Yes. Grant's going to say something about his bailiwick here.

GG: We had a lot of trouble with the J-W. It seemed to be drifting badly in zero. One problem is that the zeroing potentiometer is shot. It's been zeroed right around that point for a long time. We need to replace it. Also, I noticed that when the device was in auto position, where the light flickers a little bit, it seemed to put a lot of noise on the line. That propagates over into the J-W, so that maybe one of the noise sources on some of the instruments. The radar performed well except we ran out of disk space someplace along the way after 5,000 s of operation. Otherwise we do have data recorded.

AR: Are we going to have to get a new hard drive for that or is this something we can...

GG: No. The problem with that is the software. We can just repartition this disk. We're having to run it under DOS right now, which is a painful old piece of software, but we've got the source code and it should be in today. So hopefully we can import it over to QNX and we won't have any more problems and we'll have real-time displays too.

AR: Great.

BACK TO MAIN TEXT

1:36 PM

GG: I need to put in one more little remark here. We need the heat source for the radar antenna transfer switch because the thing freezes up when it gets down below about -10°C .

AR: That's something that's easily done?

GG: Nothing is ever easy, Art. Hopefully, Bob Eatwell can get us a little bit of hot air off the front of the wing. If not, we'll rig up some sort of electric heater for it.

1:37 PM