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**TRANSCRIPT OF PROCEEDINGS  
TRANSCRIPT-IN-CONFIDENCE**

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**INSPECTOR-GENERAL AUSTRALIAN DEFENCE FORCE  
INQUIRY INTO THE CRASH OF A MRH-90 TAIWAN  
HELICOPTER IN WATERS NEAR LINDEMAN ISLAND  
ON 28 JULY 2023**

**PUBLIC INQUIRY (PRIVATE HEARING SESSION)**

**THE HONOURABLE M McMURDO AC  
AVM G HARLAND AM CSC DSM**

**COL J STREIT, with MAJ L CHAPMAN and FLTLT A ROSE,  
Counsel Assisting**

**LCDR M GRACIE, representing CAPT D Lyon  
SQNLDR I CASHA, representing LT M Nugent  
LCDR M TYSON, representing CPL A Naggs  
SQNLDR C THOMPSON, representing WO2 J P Laycock  
COL N GABBEDY, representing MAJGEN Jobson  
COL S THOMPSON, representing BRIG D Thompson  
LTCOL D HEALEY, representing BRIG J Fenwick  
SQNLDR T SCHMITT, representing COL D Lynch  
SQNLDR M NICOLSON, representing D10  
CMDR B JONES SC, with LCDR M HAY, representing D19  
MAJ M BARNES, representing D146 and LTCOL A Norton  
LEUT R CLUTTERBUCK, representing D147  
MR G O'MAHONEY, representing Airbus  
MS K MUSGROVE, representing the Commonwealth**

**THURSDAY, 27 MARCH 2025**

**DAY 42**

**TRANSCRIPT VERIFICATION**

**I hereby certify that the following transcript was made from the sound recording of the above stated case and is true and accurate**

<b>Signed</b>	.....	<b>Date</b>	.....	(Chair)
<b>Signed</b>	.....	<b>Date</b>	.....	(Recorder)
<b>Signed</b>	Epiq Australia Pty Ltd	<b>Date</b>	14/04/25	(Transcription)

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.MRH-90 Inquiry 27/03/25

**EXHIBIT LIST**

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MS McMURDO: Now, the following people are permitted to be in the hearing room for this Private Inquiry. I understand the video link has been stopped. So, of course, AVM Harland and me. LCDR Malcolm Gracie.

5 LCDR GRACIE: Ma'am.

MS McMURDO: SQNLDR Ian Casha.

10 SQNLDR CASHA: Yes, ma'am.

MS McMURDO: SQNLDR Chris Thompson.

SQNLDR THOMPSON: Yes, ma'am.

15 MS McMURDO: LCDR Matthew Tyson.

LCDR TYSON: Ma'am.

MS McMURDO: Mr Greg O'Mahoney.

20 MR O'MAHONEY: Yes.

MS McMURDO: Mr Nick Humphrey.

25 MR HUMPHREY: Yes.

MS McMURDO: Mr Alexander Griffith.

30 MR GRIFFITH: Ma'am.

MS McMURDO: COL Nigel Gabbedy.

COL GABBEDY: Ma'am.

35 MS McMURDO: MAJGEN Stephen Jobson.

INQUIRY ASSISTANT: Not present, ma'am.

MS McMURDO: Thank you. SQNLDR Michael Nicolson.

40 SQNLDR NICOLSON: Ma'am.

MS McMURDO: FLTLT Scott Seefeld.

45 INQUIRY ASSISTANT: Not present.

MS McMURDO: Thank you. D10.

INQUIRY ASSISTANT: Not present.

5 MS McMURDO: Ms Katrina Musgrove.

MS MUSGROVE: Yes, thank you.

10 MS McMURDO: Daniel Welsh.

MR WELSH: Yes.

MS McMURDO: Lucy McDonald.

15 MS McDONALD: Yes.

MS McMURDO: COL James Murray.

20 LTCOL MURRAY: Yes, ma'am.

MS McMURDO: COL Tracy Allison.

LTCOL ALLISON: Yes, ma'am.

25 MS McMURDO: LTCOL Samantha Duffy.

LTCOL DUFFY: Yes, ma'am.

30 MS McMURDO: SQNLDR Anton Churchyard.

SQNLDR CHURCHYARD: Yes, ma'am.

MS McMURDO: GPCAPT Naomi Gill.

35 GPCAPT GILL: Yes, ma'am.

MS McMURDO: CMDR Bradley Jones SC.

40 CMDR JONES: Aye, ma'am.

MS McMURDO: LCDR Mark Hay.

INQUIRY ASSISTANT: Not present.

45

MS McMURDO: Was that present?

INQUIRY ASSISTANT: Not present.

5 MS McMURDO: Not present. D19? Not present?

INQUIRY ASSISTANT: Not present.

10 MS McMURDO: COL Steve Thompson.

COL THOMPSON: Ma'am.

MS McMURDO: MAJ Michelle Barnes.

15 MAJ BARNES: Yes, ma'am.

MS McMURDO: LEUT Russell Clutterbuck.

INQUIRY ASSISTANT: Not present.

20

MS McMURDO: LTCOL David Healey.

LTCOL HEALEY: Yes, ma'am.

25 MS McMURDO: SQNLDR Travis Schmitt.

SQNLDR SCHMITT: Yes, ma'am.

MS McMURDO: BRIG Fern Thompson.

30

INQUIRY ASSISTANT: Not present, ma'am.

MS McMURDO: Thank you. WO1 Paul Simpfendorfer.

35 WO1 SIMPFENDORFER: Ma'am.

MS McMURDO: LTCOL Alison Causley? Not present. Ms Caitland Lyon.

40 MS C LYON: Here, ma'am.

MS McMURDO: Mr Ron Curnow.

MR CURNOW: Yes, ma'am.

45

MS McMURDO: Ms Lynnette Curnow.

MS CURNOW: Yes, ma'am.

5 MS McMURDO: Ms Tanya Standley.

MS STANDLEY: Yes, ma'am.

MS McMURDO: Ms Sue Lyon.

10

MS S LYON: Yes, ma'am.

MS McMURDO: Mr Dan Nugent.

15 MR NUGENT: Yes, ma'am.

MS McMURDO: Ms Marianna Nugent.

MS M NUGENT: Yes, ma'am.

20

MS McMURDO: Ms Samantha Nugent.

MS S NUGENT: Yes, ma'am.

25 MS McMURDO: Ms Chadine Whyte.

MS WHYTE: Yes, ma'am.

MS McMURDO: Ms Sarah Loft.

30

MS LOFT: Yes, ma'am.

MS McMURDO: Fred, a pseudonym.

35 FRED: Ma'am.

MS McMURDO: Mr David Naggs.

MR NAGGS: Yes, ma'am.

40

MS McMURDO: Ms Kim Harris.

INQUIRY ASSISTANT: Not present.

45 MS McMURDO: Not present. Ms Mary Holloway. Not present?

Mr John Holloway.

INQUIRY ASSISTANT: No, ma'am.

5 MS McMURDO: Not present. Mr Nick Athiniotis.

MR ATHINIOTIS: Yes, ma'am.

10 MS McMURDO: Owen Hitchens.

MR HITCHENS: Here.

MS McMURDO: Isaac Sanchez.

15 MR SANCHEZ: Yes, ma'am.

MS McMURDO: BRIG Tracey Garrett. No, not present. COL Jens Streit.

20 COL STREIT: Yes.

MS McMURDO: GPCAPT Simon Braun.

GPCAPT BRAUN: Yes, ma'am.

25 MS McMURDO: WGCDR Kylie Graham.

WGCDR GRAHAM: Yes, ma'am.

30 MS McMURDO: LTCOL Hannah Mackenzie.

LTCOL MACKENZIE: Ma'am.

MS McMURDO: WGCDR Deanna Nott.

35 WGCDR NOTT: Yes, ma'am.

MS McMURDO: LTCOL Glen O'Brien.

40 LTCOL O'BRIEN: Yes, ma'am.

MS McMURDO: LCDR Tim Craig.

45 LCDR CRAIG: Yes, ma'am.

MS McMURDO: FLTLT Alexandra Rose.

FLTLT ROSE: Yes, ma'am.

5 MS McMURDO: Ms Siobhan Harrison.

MS HARRISON: Yes.

MS McMURDO: And SGT Kevin Woodbury.

10 SGT WOODBURY: Ma'am.

MS McMURDO: Thank you. So anybody whose name has not been called must now leave the room. I understand that we don't expect anybody here who wasn't on that list to be in the room. I remind everybody present that it is an offence to publish any information or evidence that is given in this private hearing, and I have made a Direction prohibiting that.

20 If anybody wants to leave the room at any time, of course they can do so and then return. And the people who have been given permission to be present in the room, but who have not entered the room at this point, can enter the room. No other people can enter the room during the hearing.

25 All right. Thank you, FLTLT Rose.

**<MR MICHAEL ROBERT GRANT, on former oath**

30 **<EXAMINATION-IN-CHIEF BY FLTLT ROSE, continuing**

FLTLT ROSE: Mr Grant, on page 12 of your statement – if you can turn that up – you state that the Defence Science Technology Group provided a Minute to the Defence Flight Safety Bureau titled, “DSTG Review of AAP Report”?

MR GRANT: Yes.

40 FLTLT ROSE: Did the DSTG actually provide that Minute to the DFSB?

MR GRANT: No.

45 FLTLT ROSE: But you did review a report prepared by Airbus Asia

Pacific; is that correct?

MR GRANT: Correct.

5 FLTLT ROSE: And DFSB did provide that report to you?

MR GRANT: Yes, they did.

10 FLTLT ROSE: Did that report contain Airbus's analysis of the flight data from Bushman 83?

MR GRANT: Yes, just 83.

15 FLTLT ROSE: And did Airbus have the flight data from 81, 82 and 84?

MR GRANT: I don't know that for a fact, but I assume probably not.

FLTLT ROSE: Did you discuss your review of the AAP Report or the Airbus Australia Pacific Report with the DFSB?

20

MR GRANT: I think only to the extent that we broadly agreed with what was in that report.

25 FLTLT ROSE: So that was in some meetings between the DSTG and the DFSB?

MR GRANT: Yes.

30 FLTLT ROSE: In the sense of what the DSTG concluded about your review of the Airbus Asia Pacific's Report was that you were agreed with the findings they had; is that correct?

35 MR GRANT: That we agreed with the numbers that were in that report. Yes, there were no real conclusions as such from that report, but they were just saying that we didn't have any vehement disagreement with what was provided.

40 FLTLT ROSE: In terms of no significant difference of opinion with regards to the review of the flight data from Bushman 83?

MR GRANT: Yes, the data channels we saw in the AAP Report matched the data we had for the channels review, yes.

45 FLTLT ROSE: Did you have any further questions that you wanted answered that arose from your review of Airbus Asia Pacific's Report?

MR GRANT: No, we didn't really have questions. I mean, no, there was I think only one question, really, that we would've liked to have known, but we didn't push it or press it. Yes.

5

FLTLT ROSE: So, in a sense, it's actually incorrect in your statement on page 12 where you say that you provided the DFSB with a Minute of your review of the AAP Report?

10 MR GRANT: Yes, no. We started writing a Minute, but I think events overtook the writing of that Minute we provided. There was nothing really to write in the Minute apart from that we agreed generally with it. We might have made some commentary about one of the things that were said in the report but that was about it, really.

15

FLTLT ROSE: So was the correct statement then, that the DSTG discussed its review of the Airbus Asia Pacific Report with the DFSB?

MR GRANT: Yes.

20

FLTLT ROSE: Now, if you go to page 7 of your statement, on the fourth bullet point – the bullet points are down the bottom of that page.

MR GRANT: Yes.

25

FLTLT ROSE: So sorry, it's the fourth bullet point from the bottom. So if you count up from the bottom?

MR GRANT: Yes.

30

FLTLT ROSE: You state that the DSTG emailed a Minute to the DFSB on 6 September 2023”?

MR GRANT: Yes.

35

FLTLT ROSE: And that would have reviewed the flight data from Bushman 83.

MR GRANT: Yes.

40

FLTLT ROSE: I'll hand you a copy of that Minute.

MR GRANT: Yes.

45 FLTLT ROSE: Is this the Minute that you're referring to in your

statement?

MR GRANT: Yes, it is.

5 FLTLT ROSE: Now, you signed on page 2. If you turn to page 2, dated 6 September 2023.

MR GRANT: Yes.

10 FLTLT ROSE: And it's "Official: Sensitive"?

MR GRANT: Yes.

15 FLTLT ROSE: It's addressed to CMDR Dom Cooper, the Deputy Director of the DFSB and the Investigator in Charge of the investigation into the crash of Bushman 83?

MR GRANT: Yes, it is.

20 FLTLT ROSE: I tender the Minute.

MS McMURDO: It's Exhibit 174. Thank you.

25 **#EXHIBIT 174 - MINUTE ADDRESSED TO CMDR COOPER**

FLTLT ROSE: Now, you see there's a little tab on your Minute, it says "1". Just keep that there for now because it may be that I'll need to flip  
30 back to various items and it's easier to refer to it that way.

MR GRANT: Okay.

FLTLT ROSE: Now, at paragraphs 1 and 2 of that Minute you set out the  
35 preliminary steps that the DSTG had taken to reconstruct the flight path from 28 July '23 using the CSV formats.

MR GRANT: Yes.

40 FLTLT ROSE: And then at paragraph 3 you refer to a timeline of the flight of Bushman 83 in an enclosure which starts on page 4?

MR GRANT: Yes.

45 FLTLT ROSE: And all the timings are in UTC?

MR GRANT: Yes.

FLTLT ROSE: Now, "UTC" stands for Coordinated Universal Time?

5

MR GRANT: Yes.

FLTLT ROSE: And it's the primary time standard used globally that's used to regulate clocks and time?

10

MR GRANT: Yes.

FLTLT ROSE: Does the flight data recorder turn on or commence when the Auxiliary Power Unit, or the APU, is turned on in a helicopter or does the flight data recorder commence when the engines are turned on?

15

MR GRANT: No. It's when the APU begins. That's my understanding.

FLTLT ROSE: So the data set starts recording when the aircraft is on the ground?

20

MR GRANT: Yes, correct.

FLTLT ROSE: And is it the fact that the Bushman 83's FDR, or flight data recorder, the recording lasts for about two hours with no noticeable change to its position?

25

MR GRANT: Yes, that's correct. I think CVR might stop recording after about 10 minutes of just APU. Yes, the CVR would collect data.

30

FLTLT ROSE: I'm talking about – leaving the voice recording aside for the moment.

MR GRANT: Right, yes.

35

FLTLT ROSE: Just thinking about the flight data recorder.

MR GRANT: Yes.

FLTLT ROSE: When you analysed the flight data that came out of the Crash Survival Memory Unit, is it the case that the helicopter appeared to be stable or static on the ground for about two hours before different inputs could be seen?

40

MR GRANT: I'm not 100 per cent sure, actually. I would have to

45

recheck. We focused on the time of take-off, really. Yes, I didn't look at the data prior to take-off time, really. So we used the - - -

5 FLTLT ROSE: But as a general - - -

MR GRANT: Yes, there was certainly weight on wheels, weight off wheels being recorded at certain times but, honestly, I can't tell you whether I know that it was collecting height data. Maybe, yes. I'd have to look, sorry.

10 FLTLT ROSE: No, that's okay. But as a general proposition, if a helicopter is stationary on the ground but the APU is on but they haven't lifted off yet, then you wouldn't see any data about changes in altitude, changes in airspeed?

15 MR GRANT: That's correct, yes.

FLTLT ROSE: So if you're looking at page 4, it say, "At 1145, UTC". Can you see that?

20 MR GRANT: Yes, "At 11:45:40".

FLTLT ROSE: The engines start running and Bushman 83 is refuelled, 1145.

25 MR GRANT: I have here:

*At 11:45:40, weight-on-wheels indicated turns false. Aircraft 3 begins to hover at 30 to 35 feet.*

30 FLTLT ROSE: So in terms of local time, just so we can translate from UTC to local time, this is North Queensland in July, in winter. So is it the case that local time is 10 hours ahead of UTC?

35 MR GRANT: Correct.

FLTLT ROSE: So say if the engines start running at 2145 local time or 9.45 pm.

40 MR GRANT: That's correct, yes.

FLTLT ROSE: Now, if you look to 1214, which is UTC, I understand that that was when Bushman 83 takes off and begins the sortie.

45 MR GRANT: Yes.

FLTLT ROSE: And it's cruising in formation with the three other MRH-90s.

5 MR GRANT: Yes.

FLTLT ROSE: And it's less than 500 feet to an area near Hamilton Island and Lindeman Island where they perform a racetrack pattern. That's the general process of the sortie?

10 MR GRANT: Yes.

FLTLT ROSE: Now, you've concluded that the indications of Bushman 83 appear normal for most of the flight?

15 MR GRANT: Yes.

FLTLT ROSE: There were some warnings that popped up about hydraulic pumps having low pressure and the temperature being high and the landing gear pressure being low?

20 MR GRANT: Yes.

FLTLT ROSE: But you hadn't assessed the significance of these warnings at the point in time that you wrote this Minute?

25 MR GRANT: That's correct.

FLTLT ROSE: Did you ever assess the significance of those warnings?

30 MR GRANT: No.

FLTLT ROSE: And was there a reason why you didn't?

35 MR GRANT: I think probably after reading the Airbus Report, they commented on a master caution warning that occurred just before the crash with the water, so I sort of assumed from that, that that was a more serious warning than the others. The others were just temperature. Well, we didn't really ask, I suppose, but no one seemed to be concerned.

40 FLTLT ROSE: "No one" meaning Airbus didn't seem concerned?

MR GRANT: DFSB.

45 FLTLT ROSE: The DFSB?

MR GRANT: Yes. They had the Minute, yes. So - - -

5 FLTLT ROSE: So they were also aware that there were those warnings that came up during the flight?

MR GRANT: No comment was ever asked of me.

10 FLTLT ROSE: To follow that up?

MR GRANT: Regarding – yes, or to follow it up. That’s correct.

15 FLTLT ROSE: Now, at the bottom of page 4, the final paragraph, you state that the first noteworthy occurrence is at 1235 UTC, at 55 seconds before impact.

MR GRANT: Yes.

20 FLTLT ROSE: So 1235 UTC is 2235 in local time.

MR GRANT: Correct.

FLTLT ROSE: You stated:

25 *There was an abrupt change in the pedal input just prior to the second turn of the racetrack pattern.*

MR GRANT: Yes.

30 FLTLT ROSE:

*And this pedal input was different to the pedal inputs that the pilots used in the first turn.*

35 MR GRANT: Yes, that was discussed. And the reason we found it interesting was when we compared it to the other three aircraft that weren’t using rudder, and in discussions with DFSB someone had suggested that they shouldn’t be using the rudder full stop in that mode. So one possibility was the pilot inadvertently activating the rudder.

40 Was it significant? Was he trying to achieve some effect? I don’t know.

45 FLTLT ROSE: Now, we’ll just take that back a little bit. So obviously you’re not a helicopter pilot.

MR GRANT: That's correct.

FLTLT ROSE: Was one of the people from the DFSB in the room with you a helicopter pilot?

5

MR GRANT: Correct. Yes, an MRH pilot – 90 pilot.

FLTLT ROSE: MRH pilot.

10

MR GRANT: Yes.

FLTLT ROSE: And they were saying to you it was unusual that the pilots in the second racetrack turn would be using rudder in that mode. Is that what you recall?

15

MR GRANT: I believe the quote was that, "They're trained to not use the pedals" and yes.

FLTLT ROSE: And in that mode, what mode are you referring to – or were they referring to?

20

MR GRANT: They weren't referring to a mode. So, I don't know the extent to which that statement is true but that's - - -

25

FLTLT ROSE: But, in any case, you noticed from the data that the inputs that the pilots in 83 were making in that second turn were different than the inputs that the pilots in 81, 82 and 84 were making at that second turn.

30

MR GRANT: That's correct, yes.

FLTLT ROSE: And it was also different from the inputs that the 83 pilots were using from the first turn.

35

MR GRANT: Yes, that's correct.

FLTLT ROSE: Now, three seconds prior to impact with the water you state:

40

*The rudder pedal input for Bushman 83 returns to similarity with the other aircraft in the formation.*

MR GRANT: Yes.

45

FLTLT ROSE:

*But by then Bushman 83 had considerable pitch and is descending toward the water at about 2000 to 3000 feet per minute.*

5 MR GRANT: Yes.

FLTLT ROSE: Now, knowing that you are not a helicopter pilot, what's your understanding of why pilots use rudder pedals?

10 MR GRANT: Obviously for directional control. Typically, in fixed-wing you can use rudder and aileron for cross-wind could potentially be used to – in the case of a helicopter, to perhaps point the aircraft in a certain direction that is different to the direction and motion of the helicopter. So it could be used to view something, potentially, in a different  
15 way.

FLTLT ROSE: So it's a movement control. So the pedals control movement.

20 MR GRANT: Yes. You essentially can crab the aircraft around its centre of gravity, so that you can point the aircraft nose in a different direction to where the aircraft is headed. Also used to trim - - -

FLTLT ROSE: And in terms - - -

25 MR GRANT: Also used to trim the aircraft in a certain attitude.

FLTLT ROSE: Now, this is different to the cyclic, which is also a movement control, but it can tilt – is it your understanding that that tilts the  
30 aircraft forward or backward or sideways?

MR GRANT: Yes, that's correct.

FLTLT ROSE: And then there's the collective which also controls  
35 movement up or down, vertically?

MR GRANT: Yes.

FLTLT ROSE: And pedals, they're controlled by the pilot's feet?  
40

MR GRANT: Yes.

FLTLT ROSE: And the cyclic and collective are controlled by the  
45 pilot's hands?

MR GRANT: Yes.

5 FLTLT ROSE: Could we put Figure 1 on page 5 of this Minute up on the screen? Now, if you could just turn to page 5 of your Minute, or you can refer to the one on screen?

MR GRANT: Yes.

10 FLTLT ROSE: Is this a graphical depiction of the pedal inputs for all four aircraft?

MR GRANT: Yes.

15 FLTLT ROSE: And is the inputs for Bushman 83 in the cyan or the light blue colour?

MR GRANT: That is correct, yes.

20 FLTLT ROSE: I do have a mouse here. So I also have a laser pointer for you if you need to point anything to me. But we'll see how we go with the mouse because I understand it's useful to display on all screens. So the cyan is this line here.

MR GRANT: Yes.

25 FLTLT ROSE: So at the far side, right of the graph you can see that the pedal inputs are different here for Bushman 83 than they are for the other aircraft in the last minute or so of the crash, before the crash.

30 MR GRANT: Yes.

FLTLT ROSE: Now, page 5, paragraph 2, you explain what happened to the inputs just prior to the impact at 12:35:30 UTC, which is about 22:35:30 local time?

35 MR GRANT: Yes.

FLTLT ROSE: Now, I'll read what you wrote here:

40 *There is a peak response of yaw rate and the pedal input to the actuation control channel ACC1 in response to the increased pedal. This means that the aircraft is responding to the pedal input and which may result in the aircraft taking up a sideslip and having a lateral acceleration. This requires further analysis.*

45

*The lateral acceleration is present and increasing up to the time of the accident and is different to that of the other aircraft in the formation. This indicates a sideslip was present up to the time aircraft 3 impacts the water.*

5

MR GRANT: Yes.

FLTLT ROSE: So aircraft 3 is Bushman 83?

10

MR GRANT: That is correct.

FLTLT ROSE: And what do you mean, that “the aircraft is responding to the pedal input”?

15

MR GRANT: What that meant was that the input from the controls was being used by the aircraft, as best we could see.

FLTLT ROSE: So whatever the pilot was using with their hands and feet, the aircraft was responding to those?

20

MR GRANT: Yes. And all I would add to that would be we weren't sure what level of pedal input that equates to. So, you know, is that significant depression on the rudder or is it just an effect that could be a light tap and therefore, you know, potentially just leaning on the pedal might create some yaw? That was one of our questions.

25

FLTLT ROSE: Because there was no one in the DSTG that was an MRH-90 pilot?

30

MR GRANT: Correct.

FLTLT ROSE: Did you ask the MRH-90 pilot who worked for the DFSB about that question?

35

MR GRANT: It was raised, but I don't remember the response.

AVM HARLAND: I'm assuming the bottom horizontal scale is time on this graph.

40

MR GRANT: Yes.

AVM HARLAND: Could you please explain what the vertical axis means?

MR GRANT: Yes. So this is the – yes. So for rudder that is just being – the rudder pedal input is being taken from flight data recorder, and I think it’s just having – it’s a scale – like, I can’t – what’s the scale? Because I think the scale is - - -

5

FLTLT ROSE: 40, 45, 50, 55, 60, 65, 70.

MR GRANT: Yes. So because it’s a fly-by-wire aircraft, every control input is just turned into an electrical signal. So we don’t know whether that’s, you know, a significant movement of the pedal that creates – but what we have is a scale from either minus 50 to plus 50, about the travel of the pedal or the other control, whether it be cyclic or whether it be pedals. We get a number between minus 50 and 50. And I think in that case we’ve just added 50 and it’s a number between 0 and 100. So, yes, it’s basically the minimum and the maximum of the travel.

10

15

AVM HARLAND: So is this a left pedal input or a right pedal input?

MR GRANT: So I think positive – because it’s positive and negative. It’s treated together and it’s plus 50 for the right, minus 50 on the left.

20

AVM HARLAND: So in this case, is that a left pedal input?

MR GRANT: It’s right pedal.

25

AVM HARLAND: Right pedal.

MR GRANT: It’s right pedal, yes.

AVM HARLAND: Okay, thank you.

30

FLTLT ROSE: You referred to “sideslip” in your analysis. What is sideslip?

MR GRANT: Sorry, can I just correct myself there. It’s left pedal, I’m sorry. Yes, it’s left pedal. I’m sorry.

35

AVM HARLAND: That makes sense.

MR GRANT: Sorry. That’s – yes.

40

AVM HARLAND: Okay, thank you.

MR GRANT: Sorry, can I get your - - -

FLTLT ROSE: What is sideslip?

45

MR GRANT: Sorry, sideslip. So sideslip is kind of like what I was saying before, where the direction that the aircraft is travelling in terms of its trajectory is different to where it's pointing. When you put in the left rudder, you can turn the nose to the left but your motion of travel is still in that same direction. So if that's the nose of the aircraft, you can do that. So that's sideslip.

FLTLT ROSE: And what is "lateral acceleration"?

MR GRANT: So lateral acceleration means that there is a force being generated that is pushing it to the side of the flight path or to the – if we're talking about the helicopter, to one side of the helicopter.

FLTLT ROSE: And do the sideslip and lateral acceleration always go together?

MR GRANT: Sorry, say that - - -

FLTLT ROSE: Is sideslip a repercussion of lateral acceleration?

MR GRANT: Yes, you would expect a sideslip to create a lateral acceleration.

FLTLT ROSE: On page 5, at paragraph 3, you state that:

*At 12:35:36, UTC –*

so this is six seconds later you say this, and this is a quote:

*The aircraft are continuing their second turn of the racetrack and aircraft 3 appears to be no longer able to maintain the same position it has held for nearly all the flight or, alternatively, this may possibly be a commanded or intentional change by the pilots of aircraft 3. The position of aircraft 3 in the formation hitherto was relatively in longitudinal alignment with the lead aircraft, aircraft 1, albeit slightly left of the lead aircraft's flight path.*

MR GRANT: Yes, that's correct.

FLTLT ROSE: Now, on page 6 you include an image of the four aircraft flying in formation conducted in a racetrack. I think we have an image of that to put on the screen. Bushman 83 is the cyan colour again, the light blue.

45

MR GRANT: Yes, that's correct.

FLTLT ROSE: So if we see I can manipulate the mouse, the cyan colour as I'm following it around, this is the track of my mouse.

5

MR GRANT: Yes.

FLTLT ROSE: I do apologise, for some reason, the mouse is difficult to control. And then it crosses over about here. It's difficult to see under this line. And then we see it here, the end point.

10

MR GRANT: Yes.

FLTLT ROSE: Is that more or less?

15

MR GRANT: Yes, that's what I'm saying, that for most of the flight you can see quite a neat set of lines on a bird's-eye view like that, and then we notice that around the same time that the input of the rudder occurs is the aircraft starts to shift from left to right.

20

FLTLT ROSE: So 83, for the majority of the flight, was behind and to the left of Bushman 81?

MR GRANT: Yes.

25

FLTLT ROSE: And now Bushman 81 is the green?

MR GRANT: Yes, the green.

30

FLTLT ROSE: And 82, was for the majority of the flight, to the left of Bushman 82 – sorry, 83 was to the left of Bushman 82?

MR GRANT: Yes.

35

FLTLT ROSE: And Bushman 82 is the darker blue?

MR GRANT: Yes.

40

FLTLT ROSE: And then Bushman 84 was on the far left side of the entire formation. That's in yellow?

MR GRANT: Yes.

45

FLTLT ROSE: Now, if you go to page 6, there's a Figure 3, another image of the racetrack. If we could put that on screen? Now, you can see

where the cyan line, or the light blue line, starts to drift right after the second turn and eventually Bushman 83 ends up to the right of both of Bushman 81 and 82?

5 MR GRANT: Yes.

FLTLT ROSE: And in terms of the pilot's inputs, you note this on the bottom of page 6, and this is a quote:

10 *Aircraft 3 is using less bank angle than aircraft 1 and aircraft 2 in the turn.*

MR GRANT: Yes.

15 FLTLT ROSE:

*Aircraft 3 maintains the noticeable difference in pedal and lateral acceleration previously mentioned, indicating the presence of sideslip in the turn.*

20

MR GRANT: Yes.

FLTLT ROSE: Does this mean that Bushman 83 is rolling less than Bushman 81 and 82?

25

MR GRANT: The roll angle is lower, yes.

FLTLT ROSE: In 83?

30 MR GRANT: In 83, yes.

FLTLT ROSE: If you go to page 7, you state:

*At 12:36:08 –*

35

so just to convert that to local time, 22:36:08, which is 32 seconds later than the point we just talked about before –

40

*Bushman 83 is just completing turn 2 of the racetrack and then there is a change in collective and Bushman 83 begins to climb out of the formation.*

MR GRANT: That's right.

45 FLTLT ROSE: And you offer some reasons as to why the pilots may

have done that, but you can't be sure of the reasons.

MR GRANT: That's correct.

5 FLTLT ROSE: But the flight data obtained from Bushman 82 does show that Bushman 82 momentarily increased its speed relative to the rest of the formation just prior to Bushman 83 initiating its climb.

MR GRANT: Yes.

10

FLTLT ROSE: So if you go to page 7 again, Figure 4? If you could put that up on screen as well? Now, it's a bit difficult to see because it's quite dark. Is this a snapshot of an animation that your team created depicting where Bushman 81, 82 and 83 were just before 83 climbed out of the formation?

15

MR GRANT: Yes.

20 FLTLT ROSE: And you state in the paragraph above that that Bushman 82's flight path is seen crossing in front of Bushman 83 just prior to the initiation of 83's climb.

MR GRANT: Yes.

25 FLTLT ROSE: Sorry, how does this figure we're looking at depict that? You said before that there's a generic HUD that you use in your animations.

MR GRANT: Mm-hm.

30 FLTLT ROSE: Is this the information from 82 or 83?

MR GRANT: This will be the information from 83.

FLTLT ROSE: So just as we're here, there's the UTC time.

35

MR GRANT: The time, yes.

FLTLT ROSE: Then what does this indicate?

40 MR GRANT: This is the heading. So that's where the aircraft will be pointing. Not necessarily the flight path direction. So the flight path is indicated by the white lines under each helicopter. That's its direction of motion. But the aircraft could be – and, in this case, you can see the easiest way to see it with all these lines is to note that on 83 there's an axis. There's  
45 a green, a blue and a red line. Yes, the red - - -

FLTLT ROSE: Sorry, just to make sure, this is 83 here, this larger figure?

5 MR GRANT: Yes, 83.

FLTLT ROSE: So you're talking about this blue line, this green line and this red line.

10 MR GRANT: Yes. So that's the axis system of each aircraft, the vertical, horizontal, and forward and back. And if you look at the red line, yes, and you look then at the white stream coming below, you can see that the aircraft is sideslipped there. And if you look at the other two, you can see they're a bit closer. The red line sits on the white - - -

15 FLTLT ROSE: Here? Because this is Bushman 82, is it?

MR GRANT: Yes. Yes, like, you look at Bushman 82.

20 FLTLT ROSE: So that red line is closer to the white line, so it's showing - - -

MR GRANT: Yes, it's sitting on the white, so it's in a more trimmed turn. And this is our way of indicating that this is not really a trimmed turn. He's skidding, perhaps.

25 FLTLT ROSE: Which aircraft is this? 81?

MR GRANT: 81, yes.

30 FLTLT ROSE: Where's the red line on 81?

MR GRANT: It's there. It's just - - -

35 FLTLT ROSE: Tiny little one, just there?

MR GRANT: Yes.

40 FLTLT ROSE: And is that going straight on top of the white line?

MR GRANT: Yes, it should be sitting straight. Like, ideally in a trimmed turn you'd see it sitting straight on the white, but because 83 is sort of pointing left but the flight path is a little bit right of that, you're seeing that sideslip.

45

FLTLT ROSE: Just so we understand every other item on this page - - -

MR GRANT: Yes, sure.

5 FLTLT ROSE: - - - what does this indicate, these numbers?

MR GRANT: On the top of that column is the airspeed, which is - - -

FLTLT ROSE: A.

10

MR GRANT: "A" for airspeed. The "G" is for ground speed.

FLTLT ROSE: Yes.

15 MR GRANT: And the two numbers below are the two engines, and it's a percentage of maximum torque.

FLTLT ROSE: Does that say "61"?

20 MR GRANT: And 62, yes.

FLTLT ROSE: And 62.

MR GRANT: They're not always, yes, the same.

25

FLTLT ROSE: And the engines can have different power coming from them or do they usually coincide?

MR GRANT: Yes, they're not always the same, no. But they should be  
30 close, but they're just - - -

FLTLT ROSE: And over the side, this - - -

MR GRANT: You can ignore the white, it's not really used. But the  
35 important is the number there which is the RADALT. So we're using and reading the RADALT channel for this recreation. There's a few other measurements of altitude on the aircraft, but we use RADALT.

FLTLT ROSE: Does that mean that RADALT hold was engaged for you  
40 to be able to get a RADALT figure?

MR GRANT: No, that just means that that's what we're reading from the RADALT channel.

FLTLT ROSE: And radar altitude, so it's based on the altitude bouncing off whatever's below the aircraft?

5 MR GRANT: That is correct, yes.

FLTLT ROSE: And it was ocean at this point?

MR GRANT: So say - - -

10 FLTLT ROSE: It was water underneath it?

MR GRANT: Yes.

15 FLTLT ROSE: And in the top right-hand corner it says "353 feet"?

MR GRANT: I haven't noticed that before; I'm not sure.

FLTLT ROSE: So you're not sure what that means?

20 MR GRANT: No.

FLTLT ROSE: We'll ignore that for now. But what does this box, this graph down the bottom, represent?

25 MR GRANT: On the left?

FLTLT ROSE: Yes.

30 MR GRANT: That's the collective. And in the centre is the cyclic stick forward and back, and cyclic left and right.

FLTLT ROSE: So this is slightly forward of centre.

35 MR GRANT: Yes.

FLTLT ROSE: And slightly to the left at this point in time?

MR GRANT: Yes.

40 FLTLT ROSE: And now at the bottom?

MR GRANT: Is the rudder pedals.

45 FLTLT ROSE: Rudder pedals.

MR GRANT: Yes.

FLTLT ROSE: Slightly to the right.

5 MR GRANT: Yes.

FLTLT ROSE: And what are these two bars?

10 MR GRANT: They're a repeat of the two numbers on the left-hand side, just showing the torque.

FLTLT ROSE: Engine power?

15 MR GRANT: Yes. Yes, engine torque.

FLTLT ROSE: So engine 1 is the left, engine 2 is the right?

MR GRANT: Yes.

20 FLTLT ROSE: And these numbers here, so you've got 0-100 on the scale for the cyclic.

MR GRANT: Yes.

25 FLTLT ROSE: And the same for the vertical scale.

MR GRANT: But that's just defining the maximum travel. Yes.

30 AVM HARLAND: So just on the rudder down the bottom, is the right-hand side of the white box, is that for deflection of the rudder to the right?

MR GRANT: So where the dot is now?

35 AVM HARLAND: Yes. Does that represent a full deflection?

MR GRANT: That would be a full deflection, yes.

40 AVM HARLAND: And the middle of the box, roughly aligned with a cross, represents the collective would be centred?

MR GRANT: Yes. Yes, it would – no input.

45 AVM HARLAND: So that represents only a minor – or does that represent only a minor input on the rudder?

5 MR GRANT: Yes. Well, I guess that's a question probably more for Airbus, but it doesn't look significant, particularly given that the travel could be so much more. It doesn't appear to me to be significant, yes.

AVM HARLAND: And yet the rudder input we talked about, going back to Figure 1, and the difference between the vertical white trace and the red line, indicates a significant sideslip compared to the other aircraft.

10 MR GRANT: Certainly, yes.

AVM HARLAND: Okay.

15 MR GRANT: Well, more significant. But again, I'm not sure of the total significance, yes.

AVM HARLAND: And it looks to me like a right rudder input, and I thought you said that that input was a left rudder input.

20 MR GRANT: Okay. I'd have to go through the data and the numbers to understand why that might be. So - - -

AVM HARLAND: Okay.

25 FLTLT ROSE: Do you recall having discussions similar to this with the DFSB when you were discussing the analysis?

30 MR GRANT: It certainly was mentioned to them, but I don't remember significant discussions, other than they're not supposed to be using the pedals. That's my recollection.

35 FLTLT ROSE: In terms of assisting you with your analysis and what you were asked to do, in your previous accident investigations have you had the advantage of a pilot on that particular airframe help you interpret some of the data you were seeing, or was it generally that you just interpret the data and you handed over to the accident investigation authorities?

40 MR GRANT: Yes, that's correct. Yes, and they ask for things. We provide those as best we can.

FLTLT ROSE: And do you expect that if they needed expertise of a pilot from that platform, they would have obtained that?

45 MR GRANT: Yes.

MS McMURDO: So the 243, is that the height of the water?

MR GRANT: Yes, that should be 243 feet above the water.

5 MS McMURDO: And so we don't know why that's got 353 on there?

MR GRANT: Yes, I'll be honest, I've never seen that – noticed that before.

10 MS McMURDO: No, that's all right. I just wanted to check that it was 243, the height. Thank you.

AVM HARLAND: Could I just ask one more question, just about the bottom right-hand picture there with the red dashes on it? Do the red dashes  
15 indicate the position of the control or do they represent an input made to the control?

MR GRANT: Position.

20 AVM HARLAND: Position.

MR GRANT: Yes.

AVM HARLAND: Okay, thank you.

25 FLTLT ROSE: So if we just understand, just to go back so we put ourselves in context here, this is where 83 was just completing turn 2 of the racetrack?

30 MR GRANT: Yes.

FLTLT ROSE: And it's where they're just – just before that, 83 starts to climb out of formation?

35 MR GRANT: Yes. Yes, or it's just begun to - - -

FLTLT ROSE: To climb?

40 MR GRANT: Yes, there's a bit of variation even at cruise altitude. They sort of move up and down, like 10, 20 feet quite often. So yes.

FLTLT ROSE: In terms of separation between Bushman 82 and 83, you state that it remained at about 300 to 400 feet during the racetrack. And was that just altitude, I take it?

45

MR GRANT: Sorry. Yes, that's what's that – yes.

FLTLT ROSE: Altitude or was it separation 200 to 400 feet?

5 MR GRANT: At this stage, there would be - - -

FLTLT ROSE: Just a length back from the tail of 82 to the nose of 83?

MR GRANT: Yes, that would be more a lateral separation.

10

FLTLT ROSE: Lateral separation, okay. So you state that:

*It remained at about 300 to 400 feet during the racetrack and was  
at 350 feet separation when 83 started to initiate the climb.*

15

MR GRANT: Yes.

FLTLT ROSE: That's what you state in your - - -

20 MR GRANT: Yes, that's what I stated.

FLTLT ROSE: But you're not sure why 83 started climbing. That's  
outside your understanding?

25 MR GRANT: No. I should point out that when we did the preliminary  
reconstruction, we didn't have the cockpit voice recorder data overlaid. We  
didn't have it at all. So we're just seeing a silent animation. So we don't  
know – there's nothing – and perhaps this is the reason for the fascination  
with the rudder. Was there a control issue? Was the climb an attempt to  
30 rectify some issue within the cockpit? And then the descent may be an  
attempt to rejoin. We didn't know.

FLTLT ROSE: If you go to page 7, the last paragraph, you said:

35 *At 12:36:13 –*

we'll convert to local time, is 22:36:13, about five seconds later from the  
point we were just referring to before.

40 MR GRANT: Yes.

FLTLT ROSE:

*Bushman 83 is about 100 feet above the rest of the formation, at a radar altitude of 306 feet, but separation between Bushman 82 and 83 remains at 350 feet.*

5 And we just discussed before, that's a lateral separation.

MR GRANT: Yes. But as the aircraft ascends, it's less lateral and more - - -

10 FLTLT ROSE: Diagonal.

MR GRANT: Yes.

15 FLTLT ROSE: Now, you have another image of this in Figure 5 on page 8. If we can put that on the screen. So 83 is this aircraft?

MR GRANT: Yes, the centre.

20 FLTLT ROSE: 82 is this one.

MR GRANT: That's 81.

FLTLT ROSE: That's 81, sorry. And this is 82.

25 MR GRANT: Yes, 82.

FLTLT ROSE: Because they're flying in a particular formation style. So once again we have airspeed, ground speed, engine output. Does that say "82" and "79"?

30 MR GRANT: Yes.

FLTLT ROSE: Significantly more - - -

35 MR GRANT: The torque is increasing.

FLTLT ROSE: The torque. Is this the red line from Bushman 83?

40 MR GRANT: Yes. Okay, so this red line we used GRS to provide a running separation distance between these two aircraft. So the red line you're seeing is the closest point of one aircraft to the other aircraft. This is not the information that we later used to calculate separation. This was our initial attempt in the early days, when they needed an animation quickly and a quick estimation of the separation distance. This was the tool we used.

45

5 We subsequently went away from using this tool because helicopters – big moving rotors might provide separation distances that aren't – they're a bit founded in luck of what bit is actually closest to the other aircraft. So we stopped using that as a measure of the separation distance. And all the work we did later, the separation distance became the distance between the two antennas, typically, rather than this method.

10 FLTLT ROSE: So we ignore the red lines now.

MR GRANT: Ignore the red line, yes.

15 FLTLT ROSE: Now, we've got 306 radar altitude, and we have the pedal inputs again – and the collective, cyclic inputs – collective inputs, pedal inputs, engine torque.

MR GRANT: Yes.

20 FLTLT ROSE: We'll come back to those graphs when we have other items to put on the screen.

25 AVM HARLAND: Just before we advance, could I just ask a question about that number in the top right-hand screen. Just reading through 3 and 4, and in particular on page 11, is that the separation distance between Bushman 82 and Bushman 83?

30 MR GRANT: I don't know, because we stopped using it, that separation calculator. So it may be that, yes. Yes, so a colleague of mine did the initial reconstruction, so I – maybe that is an artefact of the separation.

AVM HARLAND: Okay.

FLTLT ROSE: At the last paragraph of page 7 you said:

35 *Between 12:36:13 and 12:36:19, the pilots of Bushman 83 roll 30 degrees left and then they roll 45 degrees right.*

MR GRANT: Yes.

40 FLTLT ROSE: You proffer some reasons why this might be, but you can't be sure why they rolled so dramatically from left and then right.

45 MR GRANT: And I'd just make a correction. There's a misinterpretation of the scale there. I think that should be 20 and 30, not 30 and 45. Because those scales are 10 degrees, not – I think I was thinking of

15 at the time. But, no, so there was a turn to the left at 20 and a roll of 30 before the descent.

5 FLTLT ROSE: So instead of 30 degrees left and 40 degrees right, you're saying it's 20 degrees left?

MR GRANT: Yes.

10 FLTLT ROSE: And what was the next - - -

MR GRANT: And 30 right.

FLTLT ROSE: And 30 right. Okay.

15 MR GRANT: Yes.

FLTLT ROSE: So if you go to page 8 now? You state:

20 *At 12:36:15, Bushman 83 is at radar altitude of 332 feet.*

So they're still climbing at this point?

MR GRANT: Yes.

25 FLTLT ROSE: And while the other aircraft remained at 200 feet altitude.

MR GRANT: Approximately, yes.

30 FLTLT ROSE:

*Bushman 83 is travelling at 92 knots indicated airspeed while Bushman 81 and 82 are cruising at approximately 80 knots.*

35 MR GRANT: Yes.

FLTLT ROSE: But Bushman 83 starts to level out of the climb at this point?

40 MR GRANT: Yes.

FLTLT ROSE: And separation between Bushman 82 and 83 remains at 360 feet.

45 MR GRANT: Yes.

5 FLTLT ROSE: Now, you have another image of this in Figure 6 on page 8. So we're ignoring that red line as you said before you didn't use it at this point. But this is Bushman 83, this is Bushman 81, this is Bushman 82 out here. Is that correct?

MR GRANT: Yes.

10 FLTLT ROSE: So you can see radar altitude from the water is 332 feet. Is that correct?

MR GRANT: Yes, the RADALT is 332 on 83.

15 FLTLT ROSE: RADALT. 92 airspeed, 74 ground speed, and then engine torque, is that 82 and 81?

MR GRANT: Yes.

20 FLTLT ROSE: And you can see the pedal inputs for Bushman 83 here, and collective and the cyclic in the middle.

MR GRANT: Yes. So right cyclic and forward cyclic, yes.

25 FLTLT ROSE: And the pedals are basically in the middle?

MR GRANT: Yes.

FLTLT ROSE: On page 9 you state that:

30 *At 12:36:16, Bushman 83 rolls back and is momentarily straight and level at 94 knots indicated airspeed and 342 radar altitude.*

MR GRANT: Yes.

35 FLTLT ROSE: But then it rolls 20 degrees to the right and increases its airspeed.

MR GRANT: Yes.

40 FLTLT ROSE: Is that 20 degrees still correct or is that on a different scale now?

45 MR GRANT: I don't remember seeing that. I'd have to run the video again to see, yes. If we run the video, I'll be able to correct it. Yes.

FLTLT ROSE: Well, that will come later. But you state that the sideslip is still to the left.

MR GRANT: Yes.

5

FLTLT ROSE: Because I just note that there is a red – see here, the red line?

MR GRANT: Yes.

10

FLTLT ROSE: That is indicating a sideslip.

MR GRANT: It's closer, yes.

15

FLTLT ROSE: And that's the white line.

MR GRANT: That's the white path trajectory.

FLTLT ROSE: So it's almost on top of each other, this image.

20

MR GRANT: Yes.

FLTLT ROSE: So they've regained, potentially, some of that sideslip?

25

MR GRANT: That may be the point at which the pedal inputs stopped, yes.

FLTLT ROSE: So the cyclic at this point is forward. We can see that in the image down here.

30

MR GRANT: Yes.

FLTLT ROSE: And the collective and the torque are higher, or quite high, in relative terms, from the middle?

35

MR GRANT: Yes.

FLTLT ROSE: And does that explain why the airspeed is still increasing?

40

MR GRANT: Yes, the climb has stopped but the speed is increasing because the power is high.

FLTLT ROSE: Can you tell from the flight data what inputs each pilot is making to the pedals, the collective or the cyclic? So can you differentiate between right-hand pilot, left-hand pilot?

5 MR GRANT: No. No, they're mechanically linked. So there is measurements taken on both sides of the cockpit for the pedals and for the cyclic sticks. But you can get differences between the two. But essentially you'll get a reading from both sides, but they're essentially always the same.

10 FLTLT ROSE: Because they're linked to each other.

MR GRANT: Because they're mechanically linked.

15 FLTLT ROSE: So does that mean, in your understanding, it's not as if the left-hand pilot can be doing one thing and the right-hand pilot can correct it by pulling back?

MR GRANT: So the Airbus report points to a time in the descent where they were getting significantly different – when I say “significantly”, not 20 expecting to see a difference but there was a noticeable difference in the two stick positions.

FLTLT ROSE: Did they provide a reason as to why that might be?

25 MR GRANT: No, they didn't.

FLTLT ROSE: And did you see the same difference in your data analysis?

30 MR GRANT: At that stage, we were only reading the CSV and therefore we didn't have access to those channels. So I could only see what was in the AAP Report at that time.

35 FLTLT ROSE: So this is one of your earliest reports that we're looking at now.

MR GRANT: This is the first – yes, this is early September.

40 FLTLT ROSE: So when we get to some of your later products, they've been refined and proved in terms of your understanding of what was occurring in the cockpit at that time?

MR GRANT: We didn't really revisit the reconstruction because the reconstruction that we – were similar in the sense we used the CSV for these 45 reconstructions. We used the binary format for finding things that weren't

in the CSV data format, so the decision heights, settings, the Flight Control System settings, yes. So they're not in the CSV, so - - -

5 FLTLT ROSE: So as we said before, there was an iterative process that you developed for the DFSB, so this is stage 1.

MR GRANT: Yes. So we're not investigators. We just provide what we're asked to provide.

10 FLTLT ROSE:

*At 12:36:17, Bushman 83 has rolled almost 30 degrees to the right. The airspeed is above 100 knots indicated, and the altitude is approximately 350 feet.*

15

MR GRANT: Yes.

FLTLT ROSE: And the separation between 82 and 83 is about 317 feet.

20 MR GRANT: Yes.

FLTLT ROSE: So slightly closing at this point?

MR GRANT: Yes.

25

FLTLT ROSE: If you go to page 9, last paragraph? You state:

*At 12:36:19, Bushman 83's path has crossover with Bushman 82's, and separation is at 272 feet.*

30

MR GRANT: Yes.

FLTLT ROSE: And Bushman 82 is at 218 feet altitude?

35 MR GRANT: Yes.

FLTLT ROSE: But Bushman 83 is at 356 feet altitude.

MR GRANT: Yes.

40

FLTLT ROSE: And relative to Bushman 82, you say that Bushman 83 has considerably more collective and torque.

MR GRANT: Yes.

45

FLTLT ROSE: And you state that, well, “Aircraft 2” – or Bushman 82 – “now has indicated airspeed of” – sorry, is that meant to be aircraft 3 at that point, so it’s Bushman 83? Not aircraft 2.

5 MR GRANT: Aircraft 3 has considerably more collective resulting in aircraft 2 now having – sorry, that is correct. That should be aircraft 3.

FLTLT ROSE: Do you have that pen with you?

10 MR GRANT: Yes, I do.

FLTLT ROSE: Could you make that correction and initial next to it? Sorry, so that means that aircraft – Bushman 83 now has an airspeed of 111 knots indicated?

15 MR GRANT: Yes.

FLTLT ROSE: And aircraft 2 is still at typical formation speed of 74 knots indicated.

20 MR GRANT: Yes.

FLTLT ROSE: So if you go to Figure 8 on page 10? If we can put that up on the screen as well. You state that this shows Bushman 83 approaching Bushman 82 from the rear, although Bushman 83 is still 150 feet above Bushman 82 at this point.

25 MR GRANT: Yes. And you can see that the flight path of 83 is now crossing 82’s.

30 FLTLT ROSE: So it’s crossing it because – is this the flight path straight underneath 82?

35 MR GRANT: Yes, the white lines.

FLTLT ROSE: And you’re saying if we still went off this graph, it would start to cross over for Bushman 82’s flight path. Is that Bushman 82’s flight path here?

40 MR GRANT: Yes. Down below, yes.

FLTLT ROSE: So that’s Bushman 82, this is Bushman 83, and this is Bushman 81 up here.

45 MR GRANT: Yes.

FLTLT ROSE: And this red line again is showing – it’s a little bit spaced away from this white line, so there’s still some sideslip here?

5 MR GRANT: Yes. I should say it’s quite a noisy channel, so it moves around quite a lot. So it doesn’t surprise me if there are times when it’s not there but it’s not aligned, sometimes it’s aligned.

10 FLTLT ROSE: And if we look at the 111 airspeed, sorry, does that say 86 ground speed?

MR GRANT: Yes.

15 FLTLT ROSE: And then - - -

MR GRANT: 96.

FLTLT ROSE: Sorry, what does that say there?

20 MR GRANT: 96.

FLTLT ROSE: 86?

25 MR GRANT: 86.

MS McMURDO: 86.

FLTLT ROSE: Both 86?

30 MR GRANT: 86.

FLTLT ROSE: For two engines, right. And then you’ve got 356 feet RADALT and then in the corners here you see there’s quite a lot of cyclic forward, cyclic left, collective forward, and you’ve got high engine torque, but the rudders are about the same, in the middle.

MR GRANT: Yes.

40 AVM HARLAND: So for the uninitiated, what does “cyclic forward” represent in terms of what the aircraft is being commanded to do?

MR GRANT: It’s just a nose down. Like, so if you look side-on, push the nose down, forward cyclic, yes.

45 AVM HARLAND: Yes.

MR GRANT: Cyclic backward, pitch the nose up.

5 AVM HARLAND: So, effectively, with that cyclic in the forward position, the pilot is commanding a nose down position on the aircraft?

MR GRANT: Yes, and I think – it's hard from here to see, but you would notice the pitch, the nose would go below the horizon bars.

10 AVM HARLAND: Yes.

MR GRANT: So, essentially, you're starting to do that.

15 AVM HARLAND: Yes. So at that stage, the pilot is inputting a nose down attitude?

MR GRANT: Yes.

20 AVM HARLAND: Yes, okay. Thank you.

FLTLT ROSE: So if you go to page 10:

*At 12:36:20, Bushman 82 momentarily becomes straight and level at 350 feet, travelling at 107 knots.*

25 MR GRANT: Yes.

30 FLTLT ROSE: And it is drifting to the right of the formation, and Bushman 83's flight path is now to the right of Bushman 82's flight path.

MR GRANT: Yes.

35 FLTLT ROSE: Bushman 83's collective and torque remains high, but the pedal is more centred.

MR GRANT: Yes.

40 FLTLT ROSE: The pitch, which has up until this point been somewhat constant, between four to six degrees, now is 10 degrees down because the pilot has put the cyclic forward to its maximum position.

MR GRANT: Yes.

45 FLTLT ROSE: Is this an indication of the cyclic being in its maximum position or it seems there's a little bit left – of room.

MR GRANT: There's a little bit left, yes. The next picture might show it better.

5 FLTLT ROSE: We'll get to that in a moment.

MR GRANT: Yes, the next picture.

10 FLTLT ROSE: So then Bushman 83 begins to descend at a rate of 500 feet per minute, and the separation between Bushman 82 and 83 is now 234 feet. So that's still closing?

MR GRANT: Yes.

15 FLTLT ROSE: If we put that figure up now, Figure 9, on page 10, please? So this is an image of Bushman 83, just before it starts that descent.

MR GRANT: Yes.

20 FLTLT ROSE: So this is Bushman 83, Bushman 82, Bushman 81. And you were talking before about having the cyclic fully forward. That's that red bar now, isn't it, in its full forward position?

MR GRANT: Now forward, yes.

25

FLTLT ROSE: But it's almost centred, but forward?

MR GRANT: Yes. The stick is almost centred and left and right, but it's - - -

30

FLTLT ROSE: Fully forward. And full engine power.

MR GRANT: And high collective, yes.

35 FLTLT ROSE: Very high collective, but pedals stationary, almost in the middle.

MR GRANT: Yes.

40 FLTLT ROSE: If you go to page 11 you state that:

*At 12:36:21, Bushman 83 pitches down 17 degrees. The cyclic is nearly full forward.*

45 Which you state suggests that it's responding to a pilot input to pitch

down.

MR GRANT: Yes.

5 FLTLT ROSE: That's what you just discussed with AVM Harland.

MR GRANT: Yes.

10 FLTLT ROSE: So it's the pilot commanding the aircraft to pitch down.

MR GRANT: Yes, just probably something to be aware of, there's probably, like, a second, a second and a half latency between the input over command on the Flight Control System and actually noticing a significant change in the attitude of the aircraft. It's not instantaneous. The same sort of time in roll as well. So you can see, in effect, one second and it might not pop up until the next – like, the actual noticing of change in attitude won't pop up and you won't see that until a second and a half later.

20 FLTLT ROSE: So the angle of bank is 10 degrees right. Speed is increasing to 115 knots. The collective is high. Bushman 82 is at 344 feet altitude, but the vertical speed down is now increasing from 780 to 1700 feet per minute. So this is on page 11.

25 MR GRANT: Yes. Yes, got it. Yes, that's correct. Yes, it's rapidly increasing.

FLTLT ROSE: And the cyclic is almost fully forward.

30 MR GRANT: Yes.

FLTLT ROSE: Separation between Bushman 82 and 83 is now 195 feet. So decreasing again. So if we put Figure 10 on page 11 up, this is an image of Bushman 83 as it's descending.

35 MR GRANT: Yes.

FLTLT ROSE: Sorry, the mouse up. That's Bushman 83. Is this Bushman 82?

40 MR GRANT: Yes.

FLTLT ROSE: And that's Bushman 81.

45 MR GRANT: That's correct.

FLTLT ROSE: We're more in that red line still because that's not the separation distance you used by the end?

5 MR GRANT: This is the separation – my recollection is improved and, yes, I think that is the number that that red line is computing.

FLTLT ROSE: Up here, 195?

10 MR GRANT: Yes.

FLTLT ROSE: So we'll just - - -

15 MR GRANT: But I would state that for separation distances, if someone – I would be quoting another piece of evidence than this.

FLTLT ROSE: Yes, I understand there's something coming later where you actually do give your definitive answer of what you think the separation distance was.

20 MR GRANT: Yes.

FLTLT ROSE: So we won't use this for that part of your evidence.

25 MR GRANT: Yes, but that's where those numbers you're reading are coming from.

FLTLT ROSE: We've got 115 knots airspeed, 96 knots ground speed. Sorry, am I reading that right?

30 MR GRANT: Yes.

FLTLT ROSE: And then about 92 and 93 on the engines.

35 MR GRANT: Yes.

FLTLT ROSE: And then you see here, cyclic full forward but centred. High collective. The pedals, the rudders slightly to the right now, but engines almost at full torque, full power.

40 MR GRANT: Yes.

FLTLT ROSE: So on page 11, you state that:

45 *At 12:36:22, the angle of bank is temporarily greater than 45 degrees right.*

MR GRANT: Yes.

FLTLT ROSE:

5

*Bushman 83 is pitching down at over 25 degrees. The collective is high. The airspeed is 129 knots. Altitude is 331 feet and the separation between Bushman 82 and 83 is now 158 feet.*

10 MR GRANT: Yes.

FLTLT ROSE: Now, this is depicted in Figure 11 on page 12. So that can go on the screen. So what we just discussed here, there's a slight change from what we showed in the previous – in terms of where the controls were. Now, the cyclic is not so full forward; is that correct?

15

MR GRANT: Yes.

FLTLT ROSE: The collective is much in the same position, but you've got the pedals slightly more to the right.

20

MR GRANT: Yes.

FLTLT ROSE: And you've got a little bit less power.

25

MR GRANT: Yes.

FLTLT ROSE: Page 12 of your Minute:

*At 12:36:23, the angle of bank is 41 to 43 degrees right. Pitch is still 25 degrees down. Collective is high. The airspeed is 126 knots. Altitude is 290 feet.*

30

But at this point the cyclic is momentarily moved back, almost to the centre before it is moved full forward again.

35

MR GRANT: Yes.

FLTLT ROSE: Does that mean that the pilot is commanding those inputs? Can you be sure of that?

40

MR GRANT: Yes. The pilot has made a change and then suddenly readjusted and put it forward again.

45 FLTLT ROSE: And this is the point where you said the master red

light control light activated at 12:36:23.

MR GRANT: Yes.

5 FLTLT ROSE: Was that based on Airbus's analysis or yours as well?

MR GRANT: No. On the CSV at that time, we would have had the master caution alarm. We found out from that report what that was a response to.

10 FLTLT ROSE: It says here, it's a red light. So I imagine there's some red light – are you aware if it's a red light that comes up?

MR GRANT: So on the flight data, it just comes up as a "1" in binary flight data. It just says, for us, that it came on.

15 FLTLT ROSE: So you would need an MRH-90 pilot to tell you actually what the master control looks like within the cockpit?

MR GRANT: What it looks like in the – yes, correct.

20 FLTLT ROSE: Do you know if it's an aural sound as well as a visual indicator?

MR GRANT: I could look up the Flight Manual and find out. But, yes, I don't know offhand, no.

FLTLT ROSE: And you state that this master red light control stays on until the end of the recording.

30 MR GRANT: Yes.

FLTLT ROSE: At this point, separation between Bushman 82 and 83 – sorry, is that 115 feet?

35 MR GRANT: Aircraft 3 is now 115 feet, yes.

FLTLT ROSE: So if you can put on screen Figure 12 on page 12, that should indicate that position.

40 MR GRANT: Yes.

FLTLT ROSE: Is this Bushman 83 here to the right?

MR GRANT: Yes.

45

FLTLT ROSE: And then you have Bushman 82 down here?

MR GRANT: Yes.

5 FLTLT ROSE: And Bushman 81 here?

MR GRANT: Yes.

10 FLTLT ROSE: At this point, though, the cyclic is still full forward.

MR GRANT: The stick is fully forward, yes.

FLTLT ROSE: So this is not depicting where the cyclic came back to the centre; it's a different image.

15 MR GRANT: No. So a lot of this is – we're doing it at one-second intervals. This might have occurred halfway between that one-second interval. Some channels are measured at eight hertz, so doing it at one-second intervals means you might not see everything.

20 FLTLT ROSE: But you know that the data was indicating that to you, regardless of how it was depicted on these animations?

MR GRANT: Yes, correct.

25 FLTLT ROSE: If you go to the bottom of page 12 and then follow on to the top of page 13? This is where you state that:

30 *At 12:36:24, Bushman 82 passes through the height of the rest of formation, which was at about 200 feet. So that is almost abeam to Bushman 82.*

MR GRANT: Yes.

35 FLTLT ROSE: What does being “abeam” mean?

MR GRANT: It means laterally to the side of the other aircraft.

40 FLTLT ROSE: Now, you estimate that the missed distance at this time between Bushman 82 and 83 was 90 feet in this report, at least?

MR GRANT: Yes. This calculation method comes up as the closest points between those two aircraft as 90 feet, yes.

FLTLT ROSE: And we'll come back to that in a moment, to see whether your estimations change. But this is what this report says.

MR GRANT: That's correct.

5

FLTLT ROSE: And is there another term for separation that you use in your - - -

MR GRANT: Missed distanced.

10

FLTLT ROSE: Missed distance?

MR GRANT: Yes.

15 FLTLT ROSE: So you state that:

*Bushman 83 is pitching 20 degrees down and the bank angle is 45 degrees to the right.*

20 And that's depicted in Figure 13 on page 13, if we can put that up on the screen? To be clear, this is 83 here?

MR GRANT: Yes.

25 FLTLT ROSE: 82 and 81.

MR GRANT: 81, yes.

30 FLTLT ROSE: Now, when you talk about the bank angle being 45 degrees to the right, is that what you can see depicted in the position of the aircraft, how it's tipped to the right?

MR GRANT: Yes.

35 FLTLT ROSE: And we can see the inputs here: engine still high, but not as high as it once was; full forward on the cyclic; the collector has been pulled back a bit. But we now have this cyclic is going to the left.

MR GRANT: Yes.

40

FLTLT ROSE: Even though we're banking right.

45 MR GRANT: So I mentioned that previously this is the second, second and a half sort of latency and control input leading to a noticeable change in the aircraft's attitude. At this time, we didn't know it at the time but we

subsequently know that this is probably about the time where the pilot is now starting to push the stick to the left. So to correct that roll that is, yes, at 45 degrees.

5 FLTLT ROSE: And we start to see the pedals, there's a bit more of an input on the pedal here too.

MR GRANT: Yes.

10 FLTLT ROSE: But it's still right.

MR GRANT: Yes.

15 FLTLT ROSE: If you go to page 13, you state that:

*The last quality data point from the CSV data is at 12:36:25.*

MR GRANT: Yes. To be very succinct, it's 12:36:24 and seven-eighths of a second is the last valid timestamp. Just prior to – because some things are being measured at eight hertz, so one-eighth of a second.

20 FLTLT ROSE: And at this point, that last data point, Bushman 83 is travelling 134 knots indicated airspeed.

25 MR GRANT: Yes.

FLTLT ROSE: With a vertical ground speed at 5197 feet per minute.

MR GRANT: Yes.

30 FLTLT ROSE: The radar altitude is 157 feet.

MR GRANT: Yes.

35 FLTLT ROSE: The pitch is at 23 degrees down.

MR GRANT: Yes.

40 FLTLT ROSE: And the roll is 31 degrees right.

MR GRANT: Yes.

45 FLTLT ROSE: And Bushman 83 impacts the water one second after that.

MR GRANT: Yes. I'd probably say one to two seconds after that timestamp would be – we did have some data of that last-second, but it was not complete. So we can't have full confidence that the data in that last second is valid.

5

FLTLT ROSE: So when you say the flight data after that begins to corrupt, is that what you mean, it's just not complete?

MR GRANT: Yes, not every channel is being populated. But some of the important ones were – so there was a pressure alarm, and it was a radar altitude provided. There was a SB provided as well, and a vertical speed.

10

FLTLT ROSE: But you didn't include that in any of the animations?

MR GRANT: No, we didn't include it because we didn't know whether it could be trusted, whether it was valid or not.

15

FLTLT ROSE: If you put up Figure 14, which is on page 13 on the screen. This is your last frame from the reconstruction of Bushman 83's flight path. So before the data becomes corrupted, we have Bushman 83 in the centre, Bushman 82 here and Bushman 81 here. Is that correct?

20

MR GRANT: Yes.

FLTLT ROSE: And then we see the inputs on the side.

25

MR GRANT: Yes.

MR GRANT: Engine power is being reduced to about 46, 45.

30

MR GRANT: Yes.

FLTLT ROSE: That's a percent, isn't it?

MR GRANT: Yes. That's percentage of maximum.

35

FLTLT ROSE: Of engine, yes. And then we see there's still cyclic Forward, but cyclic fully to the left here.

MR GRANT: Yes.

40

FLTLT ROSE: Always fully to the left.

MR GRANT: Yes. So we would assume that now he's trying to correct that significant right bank, and the stick is almost fully to the left.

45

FLTLT ROSE: There's still high collective.

MR GRANT: Still high collective, yes. And high forward.

5

FLTLT ROSE: And high forward cyclic.

MR GRANT: Forward stick, yes.

10

AVM HARLAND: And the engine throttle?

MR GRANT: Yes, quite moderate. Like, 44 per cent maximum.

AVM HARLAND: And was that a big change since the last one?

15

MR GRANT: Yes.

FLTLT ROSE: Now, if we go back to page 1 of that document, paragraph 3, you set out some key points on this timeline. So paragraph (a):

20

*Bushman 83 appears to fly and respond normally to the pilot inputs up until approximately 55 seconds before it impacts the water.*

MR GRANT: Yes.

25

FLTLT ROSE: And paragraph (b) you refer to Bushman 83 drifting to the right during the second left turn, which you state may indicate a difficulty in maintaining lateral station or location in the formation.

30

MR GRANT: Yes.

FLTLT ROSE: Then you refer to Bushman 83 climbing above the formation and making significant banking and pitching motions.

35

MR GRANT: Yes.

FLTLT ROSE: Before rapidly descending and impacting the water.

MR GRANT: Yes.

40

FLTLT ROSE: If you go to page 2, paragraph (b), you set out that:

*The flight data suggests that the pilots had control of the aircraft until impact.*

45

MR GRANT: Yes.

5 FLTLT ROSE: But at that stage you had not determined the pilot's ability to fully control motion of the yaw access with the pedals and the aircraft's ability to respond to yaw.

MR GRANT: That's correct.

10 FLTLT ROSE: And the yaw is the rotation around the vertical axis; is that correct?

MR GRANT: Yes.

15 FLTLT ROSE: Have you done this analysis now or since?

MR GRANT: No.

FLTLT ROSE: And why not?

20 MR GRANT: We were never asked to. I spoke to one person in our group who has done some work. He didn't seem to think that it was significant. We certainly weren't asked to - - -

25 FLTLT ROSE: So DFSB didn't ask you?

MR GRANT: No. That was just a commentary of an SME we had at the time working at DSTG. He looked at it, but he didn't - he was more interested in other things actually in pitch and roll rather than the yaw.

30 FLTLT ROSE: So who was this SME? What were they a subject matter expert in?

35 MR GRANT: Yes, his name was Reece Leeman. He wasn't working for DSTG at the time. He'd taken a secondment to work for another company, but he would still do things for us.

FLTLT ROSE: Was he an engineer like you?

40 MR GRANT: Yes. And he'd supported accident investigation before, yes. So he was just on a leave of absence.

FLTLT ROSE: Page 2, paragraph (c) you state that:

*Rolling from left to right and the increased airspeed with*

*increasing collective and forward cyclic inputs may possibly relate to the pilot attempting to determine relative proximity to Bushman 81 and 82.*

5 MR GRANT: Yes.

FLTLT ROSE: But it could also be due to other reasons?

MR GRANT: Yes.

10

FLTLT ROSE: And you can't be sure what the reasons are?

MR GRANT: No. The thing I would say, when we first created the animation, you know, one highly plausible scenario was there was something in the cockpit that required him to get out of the formation, that maybe something wasn't quite right and then these turns were potentially an attempt to get back down into the formation, but - - -

15

FLTLT ROSE: But this is supposition because you're just inferring from what the data's telling you, but you can't tell.

20

MR GRANT: I can't tell. No, correct.

FLTLT ROSE: Now, if you go to paragraph (d), that same page, you state that:

25

*Bushman 83 entered the water at an airspeed likely to be greater than 130 knots.*

30 MR GRANT: Yes.

FLTLT ROSE: With a descent rate of 5000 feet per minute.

MR GRANT: Yes.

35

FLTLT ROSE: With greater than 20 degrees pitch down.

MR GRANT: Yes.

40 FLTLT ROSE: And a bank angle of 30 degrees right.

MR GRANT: Yes.

FLTLT ROSE: With considerable lateral acceleration indicating the presence of sideslip.

45

MR GRANT: Yes.

5 FLTLT ROSE: Is it consistent that they were in a sideslip for those final 55 seconds?

10 MR GRANT: If we go back to the – we don't have the lateral acceleration, we've got the rudder input. It's a very noisy channel, but there is a lateral acceleration for most of that last 55 seconds noticeable.

FLTLT ROSE: You also state that the last data point shows a significant forward input on the cyclic despite the aircraft having significant forward speed already and a very high vertical speed downwards.

15 MR GRANT: Yes.

20 FLTLT ROSE: So if you go to paragraph 4 on that page, you then set out some potential lines of enquiry for the DFSB to pursue to explain these data points.

MR GRANT: Yes.

25 FLTLT ROSE: And you say it could be a significant loss of situational awareness.

MR GRANT: Yes.

FLTLT ROSE:

30 *(a) Significant pilot distraction due to perceived or real events in the cockpit or to the aircraft that could include warnings and cautions or mechanical system failures.*

35 MR GRANT: Yes, that's correct.

FLTLT ROSE: Just in terms of that though, you said that you did see that there was that master caution and a few other cautions earlier in the flight about hydraulic fuel pumps and things like that.

40 MR GRANT: Yes.

FLTLT ROSE: But did anything in the data suggest to you that there were warnings or mechanical system failures?

45 MR GRANT: No.

FLTLT ROSE: At paragraph (c) you say:

5 *They should also look into an inability of the pilot or the aircraft to respond to the change in flight conditions appropriately or as intended.*

MR GRANT: Yes.

10 FLTLT ROSE: What do you mean by that?

MR GRANT: Whether there's incapacitation of the pilot, was there something going on. That's, I guess, where we're suggesting - - -

15 FLTLT ROSE: And, of course, you hadn't listened to the cockpit voice recorder at the time you wrote this?

MR GRANT: No, not at this stage.

20 FLTLT ROSE: Were you asked by the Defence Flight Safety Bureau to offer an opinion as to the cause of the accident?

MR GRANT: No. We just provide, I guess, what we see and what, in a general way, this was indicating.

25 FLTLT ROSE: So these suggestions in this Minute are based on your years of experience in assessing aircraft performance and aerodynamics and flight dynamics, modelling and simulation and flight path reconstruction?

30 MR GRANT: I would say it was the consensus of the group who worked on this, yes.

35 FLTLT ROSE: Now, you gave evidence in the public hearing about the difference between the CSV format and the binary format, and that over time you were able to obtain more channels of data from the binary formation.

MR GRANT: Yes.

40 FLTLT ROSE: Does this mean that the analysis of the flight data that you've provided in this document dated 6 September 2023 has evolved over time, because you said before that there are certain things that you didn't rely on in later analysis.

MR GRANT: Yes. Most of the things we – there are some things I know now that I didn't know back in September. The binary file provides us with a whole list of channels that we can investigate with that we didn't and couldn't investigate at this time. So if somebody wanted us to look up a channel, we could look that up now. But just to give you an idea, there's 756 channels on the binary flight data. So it is quite a lot of channels.

You need, I guess, an indication to go looking into particular channels, yes.

FLTLT ROSE: So do you think it's fair to say that the analysis in this Minute that we've just worked through still stands as accurate as it could be?

MR GRANT: Yes.

FLTLT ROSE: I want to move to a different item. So on page - - -

MR GRANT: I'm sorry, is it possible I could take a break?

MS McMURDO: Of course.

FLTLT ROSE: Of course.

MR GRANT: Sorry, I need to go to the toilet.

MS McMURDO: We'll have a 10-minute break.

MR GRANT: Fantastic. Thank you.

**HEARING ADJOURNED**

**HEARING RESUMED**

MS McMURDO: Yes, FLTLT Rose.

FLTLT ROSE: We're moving to a different item now on page 12 of your statement, so you can put that Minute away. If you go back to your statement? You state that the DSTG provided a Minute to the DFSB on missed distance.

MR GRANT: Yes.

FLTLT ROSE: And I hand you a Minute. Is this the Minute that you're referring to on page 12 of your statement?

MR GRANT: Yes.

5

FLTLT ROSE: And it's titled, "MRH-90 A40-040 Collision With Terrain 28 July 2023 Missed Distance Calculation from DSTG Preliminary Review of Flight Data".

10 MR GRANT: Yes.

FLTLT ROSE: And you signed it on page 2.

MR GRANT: Yes.

15

FLTLT ROSE: And the date was 14 September 2023.

MR GRANT: Yes.

20 FLTLT ROSE: Now, that's "Official: Sensitive" as well. It's addressed to CMDR Dom Cooper, the Deputy Director of the DFSB and the Investigator in Charge of the investigation.

MR GRANT: Yes.

25

FLTLT ROSE: I tender the Minute.

MS McMURDO: That'll be Exhibit 175.

30

**#EXHIBIT 175 - MINUTE OF MRH-90 A40-040 COLLISION WITH TERRAIN AND MISSED DISTANCE CALCULATION FROM DSTG PRELIMINARY REVIEW OF FLIGHT DATA**

35

FLTLT ROSE: If you go to page 1, paragraph 1, you state that:

40 *The DSTG used Graphical Replace Software, the GRS, to not only animate the flight of the formation and the aircraft digital flight data recorder information, but also to estimate the separation of missed distance between all aircraft in the formation.*

MR GRANT: Yes.

FLTLT ROSE: And then paragraphs 1 and 2, you note that when you estimated the missed distance between Bushman 82 and 83 is 90 feet – and that was in that previous Minute we were talking about.

5 MR GRANT: Yes.

FLTLT ROSE: At the point, when 83 passed 82 in a rapid descent, that was based on data from the CSV data file which only provided you with one source of information at that time.

10

MR GRANT: Yes.

FLTLT ROSE: And you were unsure how synchronised the times were between information from Bushman 82 and 83.

15

MR GRANT: Yes.

FLTLT ROSE: So you took into account the Gungahlin Police Station, 31 Anthony Rolfe Avenue, Gungahlin, Australian Capital Territory locations of both aircraft at the relevant time to revise your missed distance estimate to a range between 82 feet and 147 feet.

20

MR GRANT: Yes.

25 FLTLT ROSE: But you noted that this still didn't take into account the aircraft geometry which would reduce the separation distance.

MR GRANT: Yes. Which is why, yes, we removed the geometry.

30 FLTLT ROSE: Sorry, I couldn't hear that response.

MR GRANT: So we removed the geometry from the enquiry from DFSB. They wanted to know what the errors and bounds were for the numbers we provided. This was an attempt to provide an error bound or a range.

35

FLTLT ROSE: In terms of the aircraft geometry, does that include the diameter of the rotor blades?

40 MR GRANT: Yes. So the missed distance calculator that you saw previously in GRS takes the nearest point of the geometry from one aircraft to the next.

45 FLTLT ROSE: So that's one tip of the rotor blade of 82 to the nearest tip of 83's rotor blade?

MR GRANT: Whatever's closest.

5 FLTLT ROSE: Whatever's closest. So it could be the tail rotor if it happened to be - - -

MR GRANT: Depending on which direction pointing here.

10 FLTLT ROSE: You said earlier in your evidence – I understood it you revised that to take the missed distance from the centre of the aircrafts?

15 MR GRANT: Yes. So the revision is, in a sense, we took the geometry away because now in this work we are using the GPS locations as provided by each aircraft and we are providing the distance between those two reference positions for each aircraft.

FLTLT ROSE: And are the GPS positions in the aircraft taken from the centre of the top rotors?

20 MR GRANT: We've assumed that the GPS location, although the antenna is in a different location, it's towards the back, that it's referenced back to the aircraft reference point which would be assumed near the rotor.

25 FLTLT ROSE: So you've got a range now between 82 feet and 147 feet.

MR GRANT: Yes.

30 FLTLT ROSE: And you're comfortable with that range as opposed to giving a specific point?

MR GRANT: Yes. And I suppose the big reason for that is because the GPS data is measured at one hertz. The significance of that is that we can't get any more accurate an update than the flight data provides. So we were relying on when the two times we're in agreement that those two GPS locations are the locations at that time. However, there is reason to believe that there could be some inaccuracy, and depending on when the data is logged – we're not experts on exactly when that data is logged onto the flight data recorder – that it would be reasonable to suggest, well, what if it was a second out either side, and that is how we've come up with the range of that, yes.

FLTLT ROSE: And why is it important, in your mind, to calculate this missed distance?

45 MR GRANT: It was a request from DFSB. They wanted to know just

5 how close they may have got towards the end. So the reconstruction had highlighted that they got closer than – certainly, the language in the Minute was they got quite close, probably closer than two rotor di's, so could we refine that number? Could we get closer? Could we provide what the error range might be for that value? And that's what this work was achieving.

FLTLT ROSE: Do you know off the top of your head what rotor di is in terms of - - -

10 MR GRANT: 54 feet.

FLTLT ROSE: 54 feet?

15 MR GRANT: Yes. Or 16.3 metres.

FLTLT ROSE: So if we're looking at the lower end of this range of 82 feet, so it was about one and a half rotor di's at this closest point?

20 MR GRANT: Yes. So they measure - - -

FLTLT ROSE: Or one and three-quarters.

25 MR GRANT: Yes. So just to be clear, the number we have there is the number between the centres of the two aircraft. Whereas the rotor di that they – my understanding when they're talking – the pilot is talking about being two rotor di, that that's a tip-to-tip rotor diameter. So that would be between the two moving rotor blades there would be 54 times two.

30 FLTLT ROSE: And you weren't asked to actually simulate or do that maths on what it would have been in terms of rotor di's?

MR GRANT: No, we provided whole numbers.

35 FLTLT ROSE: Has the DSTG been able to refine this missed distance calculation any further since the date of this Minute in September 2023?

MR GRANT: No.

40 FLTLT ROSE: I'm going to move to a different topic. It's the field of regard image. So on page 12 of your statement again, this is where you refer to two sets of the PNG files or images, showing the position of Bushman 81 and 82 in the field of range of the left and right side aircrew positions in Bushman 83.

45 MR GRANT: Yes.

FLTLT ROSE: And that's spanning the last 24 seconds of flight for Bushman 83.

5 MR GRANT: Yes, that's correct.

FLTLT ROSE: And then there's one image per second.

10 MR GRANT: Yes. We did two sets of analysis for both the left and the right-hand side for the cockpit of 83 for two different eye positions in each location: the 5th percentile female, 95th percentile male. But we did it at one-second intervals, but then a question came back from DFSB saying that the information provided didn't indicate that there was a time when, in the descent, where aircraft 82 comes back into view, and it wasn't captured by  
15 the previous analysis.

So we re-ran the analysis at a higher rate at the key time to show that there was an instance where 82 would've come back into the field of regard of the pilots in 83.

20 FLTLT ROSE: I just want to expand on some things that you raised then. In terms of the design eye position – and we did talk about this briefly in the public hearing – you said that you used the tallest male and the shortest female, and those are the two design eye positions you can use that  
25 you could do an average in the middle, but you didn't; you used the 99th per cent male.

MR GRANT: Yes.

30 FLTLT ROSE: Is it your understanding that within the MRH-90 cockpit pilots can actually adjust the height of their seat so that they can all be in an ideal eye position – or design eye position?

MR GRANT: I assume you can adjust the seat, but I don't know what the  
35 requirement is when you're adjusting your seat as a pilot - - -

FLTLT ROSE: So that information wasn't given to you by the DFSB, I take it?

40 MR GRANT: No. Yes, I think what tends to happen is that if you're a smaller person, when you adjust your seat you come forward to be closer to the controls, but your eyes also move up and stay within that range of the two design eye points, yes.

FLTLT ROSE: So, in total, when you were talking about the images you provided to DFSB, it was 156 files.

MR GRANT: Yes.

5

FLTLT ROSE: I'll just hand you a - - -

MS McMURDO: Just on that first point that FLTLT Rose was asking you about, were you ever given the heights of the pilots and would that have helped?

10

MR GRANT: No, we weren't given the heights of the pilot. It would have to be their sitting height, I think, anyway. But we didn't ask for it. We thought it was reasonable to provide a range mainly because, again, the field of regard is showing what can be seen outside the cockpit. I mean, it doesn't account for what the pilot may or may not be able to do in flight about moving his head, moving forward, moving - - -

15

MS McMURDO: Yes.

20

MR GRANT: So, again, it's an approximation, I suppose.

MS McMURDO: Yes, thank you.

FLTLT ROSE: When you calculate the view of the 99th percentile for height of a male, I take it that's a very tall male.

25

MR GRANT: Yes, it's just given as a position. We got a document from Airbus or NHI – I can't remember which – which stated what that 5th percentile of female and the 95th percentile male position was relative to an aircraft reference point.

30

FLTLT ROSE: Is that what you use in your previous accident investigation recreations? Is that the same if you're in a fixed-wing aircraft that you're given from the OEM, that sort of information for field of regard analysis?

35

MR GRANT: I think this is the first time we've actually used manufacturer's design eye points, yes. In previous instances, it's been enough to just generally approximate the viewing location to be what appears to be somewhere in the cockpit and, yes, each accident is a little bit – or incident, is a bit different and different things get used. So this is the first time I can remember where we used design eye points, yes.

40

FLTLT ROSE: I'll hand you a sample image of one of the PNG files.

45

MR GRANT: Thanks.

5 FLTLT ROSE: There's an image of this that can be put on the screen as well. All right, we might have to come back to that. I think it's on a different disc, I understand. So this particular image – sorry, can I just have one moment just to check? I think it would be really helpful to have it on screen, so I just want to - - -

10 MS McMURDO: That's what we're looking for.

MR GRANT: Thanks.

15 FLTLT ROSE: So I think it'll just be 30 seconds or so, to allow time for that to come on screen. I'll deal with a different issue then, instead of looking at that file. Can I just clarify for you my understanding of the difference between "field of regard" and "field of view".

MR GRANT: Sure.

20 FLTLT ROSE: So if I'm standing here looking at you now, my field of regard is about 180 degrees. I've got my peripheral vision, I've got my forward vision. Is that correct?

25 MR GRANT: Yes. Yes, that could be your field of regard and would also be your field of view.

30 FLTLT ROSE: And my field of view – sorry, this is my field of regard. I suppose I could turn my head. I could have a bigger field of regard if I turned my head; is that correct?

35 MR GRANT: Yes. Well, we're talking about when things are obscuring perhaps what you would otherwise see. So field of regard is what you can see through the cockpit. So you obviously have a greater field of view than your field of regard in this case because things are blocking what you can see.

40 FLTLT ROSE: Also, the pilots are wearing night-vision devices, so they've got IITs; is that correct?

MR GRANT: Yes.

45 FLTLT ROSE: And is it your understanding that a pilot's field of view is reduced by the use of night-vision devices?

MR GRANT: Yes.

FLTLT ROSE: Is it about 40 degrees as a common - - -

5 MR GRANT: 45 degrees, yes.

FLTLT ROSE: 45 degrees.

10 MR GRANT: That's what I've heard, yes.

FLTLT ROSE: So the IITs, we understand, sit on the side of the helmet?

MR GRANT: Yes.

15 FLTLT ROSE: But, in essence, that gives the pilots a view as if you're looking through your own eyes with binoculars.

MR GRANT: Yes. But I would call that a reduced field of view, yes, due to the use of HMSD.

20 FLTLT ROSE: Thank you. It's on screen now.

MS McMURDO: So you're wanting to tender that?

25 FLTLT ROSE: Yes, I will tender that.

MS McMURDO: That will be Exhibit 176.

30 **#EXHIBIT 176 - IMAGE OF PNG FILE DEPICTING  
RIGHT-HAND PILOT'S FIELD OF REGARD AS AT 12:36:01**

35 FLTLT ROSE: So does this sample – this is only one of the 156 files that you provided to DFSB. It's the right-hand pilot's field of regard as at 12:36:01 UTC?

MR GRANT: Yes.

40 FLTLT ROSE: What does the blue shading represent?

MR GRANT: Yes, so this is a mapping. This work was done years ago by DST where they laser scanned both the right and the left – well, they scanned the cockpit of the MRH-90 and it is representing – in a

hemispherical mapping, the blue area is what can be seen from the design eye points in the MRH-90 for the right-hand cockpit.

5 FLTLT ROSE: At daytime?

MR GRANT: It's irrelevant of daytime/night-time; it is the entire field of regard. It is what you can see through the windows. So, again, with a diminished field of view caused by night-vision goggles, it would be a subset of that blue and dependent on the eye being pointed, yes.

10 FLTLT ROSE: So in terms of your analysis, going forward from not only this particular sample but in the animations, what we can see through the pilot's eyes is actually the full field of regard as if they're not wearing their night-vision devices.

15 MR GRANT: That is correct, yes.

FLTLT ROSE: So we will have to imagine that whatever we see is actually not what the pilots were seeing because they would only have had a 45 degree reduced field of view because of their IITs?

20

MR GRANT: Yes, that's correct.

FLTLT ROSE: What do the red dots with 81 and 82 in them represent?

25

MR GRANT: So they represent the location on the hemispherical mapping for the right-hand pilot in 83 of where 81 and 82 would be.

FLTLT ROSE: So we're looking at the right-hand pilot at this particular point in time.

30

MR GRANT: Yes.

FLTLT ROSE: What he could have, if he wasn't wearing night-vision devices, possibly have seen in his field of regard.

35

MR GRANT: Yes. If he was pointing his eyes, and hence his night-vision equipment, at the right location through the windshield, he would see both 81 and 82, yes.

40

FLTLT ROSE: When you say "the right location", you mean it's not necessarily right or wrong wherever the pilot is looking - - -

MR GRANT: No.

45

FLTLT ROSE: - - - it's just a point in time where they were looking?

MR GRANT: Yes. At that point in time, he would need to be looking in the right direction, yes.

5

FLTLT ROSE: To see 81 and 82.

MR GRANT: 82. But it would be visible, able to be seen, yes.

10 FLTLT ROSE: And why is the wording in the bottom left-hand side back to front? It says, "View from front"?

MR GRANT: Yes, so what we had was image from a report. So, we had the left-hand side, so we reversed the image for the right-hand side to get a mapping for the right-hand side.

15

FLTLT ROSE: So if we saw a left-hand pilot view, it would be - - -

MR GRANT: It's the mirror.

20

FLTLT ROSE: The mirror?

MR GRANT: Yes, vertical.

25 MS McMURDO: And, of course, that doesn't show what you would necessarily see in dark conditions, rainy conditions?

MR GRANT: Yes.

30 MS McMURDO: That would also affect it on top of the night-vision devices?

MR GRANT: Yes. I would characterise it – the eyes must be – this is only what is possible to be seen through the windshield.

35

MS McMURDO: Yes.

MR GRANT: So obscurance, pointing eyes at the right direction, still need to be considered.

40

FLTLT ROSE: So tell me if I'm reading this chart correctly. If the red discs for 81 and 82 are in the shaded blue area, then there's a high likelihood that a 99th percentile man, a very tall man, in the right side of the cockpit seat would have possibly been able to see Bushman 81 or 82 at this particular point in time, 12:36:01, through the windshield.

45

MR GRANT: That is correct.

5 FLTLT ROSE: Now, the rest of the PNG images that you provided to the DFSB are similar charts to this one?

MR GRANT: Yes.

10 FLTLT ROSE: They're just at different times?

MR GRANT: Yes. And the red dots for 81, 82 are moving around, yes.

15 FLTLT ROSE: And then you also have a full set for the right-hand side pilot and a full set for the left-hand side pilot?

MR GRANT: That's correct.

20 FLTLT ROSE: And you then interpret this data from these still images and they are replicated in the animations that you made?

25 MR GRANT: So the question was around the animations had suggested that – and subsequent cockpit voice recorder had suggested that the aircrew had lost sight of 82 at some point, and the animation agreed, to some extent. So this was a more detailed analysis to establish exactly when they would have lost – or which side of the cockpit lost sight of 82 first and then – yes, that's what this analysis is trying to show.

30 FLTLT ROSE: So you gave evidence about needing the geometry of the cockpit in the MRH-90 to be accurate so that you could analyse the field of regard. Can you recall that?

MR GRANT: Yes.

35 FLTLT ROSE: So that you could analyse – it's what each pilot is likely to have – or possibly could have seen in those last 24 seconds of flight. That's what this analysis looks at?

MR GRANT: Yes.

40 FLTLT ROSE: Did you have the audio, or the cockpit voice recordings from Bushman 83 by the time you were conducting this analysis?

MR GRANT: Yes.

FLTLT ROSE: We'll come back to some questions about that. I think it's more helpful to discuss it when we actually have the cockpit voice recording overlaying the animations.

5 MR GRANT: Okay.

FLTLT ROSE: I'll move to a different item now. On page 9 of your statement, you'll see the first bullet point.

10 MR GRANT: Yes.

FLTLT ROSE: You say that you provided a storyboard of the accident to the DFSB with timings attached using PowerPoint, and that the first one was titled "2023-02-27 PD-FADS MRH-90 Whitsunday's Accident Storyboard Times".

15 MR GRANT: Yes.

FLTLT ROSE: That's just the file name you used.

20 MR GRANT: Yes.

FLTLT ROSE: Now, does that mean that the storyboard was finalised by the DSTG on 27 February 2024?

25 MR GRANT: No, I think probably more when it was started. We started the work around that time, and the request came out from a meeting we had that it might be beneficial for us to create a storyboard of key events. Because we had the animation, we had the CVR, we had some other tools, so we started creating some storyboards so that they would be, I guess, the basis of understanding of what occurred in the last three minutes, particularly.

30 It was one of the things I noted when we were talking to them, that we were, at times, sort of thinking things happened at different times – and the timing is quite important – and some people would remember something happened before something else. So this was an attempt to get everybody, I guess, on the same page about when certain events had occurred.

35 FLTLT ROSE: Did you provide the final storyboard then to the DFSB on 28 May 2024?

40 MR GRANT: Sorry, on what - - -

FLTLT ROSE: You said you probably started it in February '24. Did you hand over the storyboard to the DFSB on 28 May 2024?

5 MR GRANT: Yes, that sounds about right.

FLTLT ROSE: I hand you a document.

10 MR GRANT: I should add, I think at the time my understanding was DFSB would take those and perhaps pretty them up, so if they weren't quite – a bit rough, it was because we were anticipating the DFSB might edit those PowerPoints.

FLTLT ROSE: But this is your material unedited?

15 MR GRANT: This is exactly right. That is my material, yes.

FLTLT ROSE: If you go to the front page of that presentation, it's "MRH-90 Accident 28 July 2023 - Accident Sequence"?

20 MR GRANT: Yes.

FLTLT ROSE: And that's your name at the bottom?

25 MR GRANT: Yes.

FLTLT ROSE: So you created this storyboard?

MR GRANT: Yes.

30 FLTLT ROSE: And it is 10 slides in total?

MR GRANT: Yes.

35 FLTLT ROSE: I tender the storyboard.

MS McMURDO: Exhibit 177.

40 **#EXHIBIT 177 - STORYBOARD OF MRH-90 ACCIDENT SEQUENCE**

FLTLT ROSE: If you go to slide 2 – and we should be able to have this on the screen. We'll just load it. I think that's slide 3. You set out some

facts about the accident, including that it crashed at approximately 2236 local time.

MR GRANT: Yes.

5

FLTLT ROSE: Now, the following slides use UTC further on, but we've already established that's 10 hours behind local time.

MR GRANT: Correct.

10

FLTLT ROSE: So if we go to slide 3, there's a satellite image of the area over which the formation flew on 28 July 2023.

MR GRANT: Yes.

15

FLTLT ROSE: What's the red line?

MR GRANT: So this is how we – so we take a snapshot from Google Maps, and then what we do is we mark the corners with the red line, and then from that red line we know what the latitude and longitude of the corners are because we then have to put that into our Cartesian coordinate system in the graphical replay system.

20

FLTLT ROSE: So it's for your benefit to do some mathematics. Can we ignore it effectively?

25

MR GRANT: Please, yes.

FLTLT ROSE: Then we've got the green line. What's that?

30

MR GRANT: That's the flight path of the formation.

FLTLT ROSE: Is it Proserpine Airport on the far left, where the flight begins?

35

MR GRANT: Yes, on the far left. Yes, that's where the flight begins.

FLTLT ROSE: Then you've got Lindeman Island to the far right.

40

MR GRANT: Yes, that's Lindeman there.

FLTLT ROSE: Then there's a racetrack where the formation flew.

MR GRANT: Yes.

45

FLTLT ROSE: Now, if you go to slide 4, now you see times are in UTC, so everyone, if they're watching, needs to add 10 hours for local time. So Bushman 83 took off at 12:14:13, in the far right.

5 MR GRANT: Yes, that's the weight-off – we're using the weight-off-wheels indicator.

FLTLT ROSE: That's when the first weight-off-wheels – so does that include when they lifted to fuel?

10 MR GRANT: No, this is the weight-off-wheels, and then they're in flight.

FLTLT ROSE: Then you see the next point along is where Aircraft 3 got feet wet at 12:21:03.

MR GRANT: Yes.

FLTLT ROSE: In the middle.

20 MR GRANT: Yes.

FLTLT ROSE: Does that mean when it started flying overwater? Is that what you mean, "feet wet"?

25 MR GRANT: I believe there's a call on the CVR.

FLTLT ROSE: That says, "feet wet"?

30 MR GRANT: "Feet wet", yes.

FLTLT ROSE: Then when the Aircraft Captain of Bushman 83 took over control from the co-pilot, that's at 12:33:36.

35 MR GRANT: Yes.

FLTLT ROSE: So that's just before they entered the racetrack.

40 MR GRANT: Yes.

FLTLT ROSE: Now, you use the terms "Aircraft Captain" and "co-pilot" in your analysis here. Is that because you didn't know the names of the aircrew at that point or is that a standard way of referring to persons in aircraft analysis?

45

MR GRANT: I guess we knew the names. So, yes, we knew who the Captain was of the ship.

5 FLTLT ROSE: Then the time that Bushman 83 impacted the water was 12:36:26, so just as they've completed the second turn of the racetrack.

MR GRANT: Yes.

10 FLTLT ROSE: You said you gained that information from the flight data recorder. We've established that before.

MR GRANT: Yes.

15 FLTLT ROSE: In effect though, you're not exactly sure when they entered the water.

MR GRANT: No, I would say that to be precise, at some time between 12:36:26 and 12:36:27.

20 FLTLT ROSE: If you go to slide 5, now timings are in UTC for these various events, and it's tracking significant events in the last three minutes of flight; is that correct?

MR GRANT: Yes.

25

FLTLT ROSE: Now, this is a combination of data from both the flight data recorder and the audio from the cockpit voice recorder.

MR GRANT: Yes.

30

FLTLT ROSE: I just want to go through some of the significant events here. Can you see 12:33:36? Perhaps if GPCAPT Braun – it's down the bottom.

35 MR GRANT: Yes, I can see it.

FLTLT ROSE: It states:

40

*CAPT Lyon of Aircraft 3 takes control from co-pilot at 12:33:36.*

Then if we can go to 12:33:44? You don't need to highlight it, sir. It's significant just to put the cursor next to it. It says:

45

*Lyon: "See how the RADALT can really be useful".*

Can you see that?

MR GRANT: Yes.

5 FLTLT ROSE: Then can we go to 12:35:30? At the top CAPT Lyon states:

*Just while we're dealing with this rain shower, I will deal with this. All right?*

10

MR GRANT: Yes.

FLTLT ROSE: It's also when rudder pedal begins to be substantially used.

15

MR GRANT: Yes.

FLTLT ROSE: 12:33:56, CAPT Lyon states:

20

*Right, now this is quite a comfortable position.*

Do you see that?

MR GRANT: Yes.

25

FLTLT ROSE: Then:

*12:36:06, Aircraft 3 begins to climb out of the formation.*

30

And then:

*12:36:14, co-pilot Nugent says, "You still got them?"*

*12:36:16, CAPT Lyon replies, "Yes, still got them, mate".*

35

*12:36:17, Aircraft 3 is at 365 feet, which is 120 feet above Aircraft 2. The RADALT of 216 feet.*

*12:36:19, Aircrewman Laycock reports losing sight of Aircraft 2.*

40

*12:36:22, Aircraft 3 begins rapid descent.*

*12:36:24, Aircraft 4 calls 83, "Pull up. Pull up. Pull up".*

45

*And roughly at about 12:36:26, Aircraft 3 impacts the water.*

MR GRANT: Yes.

5 FLTLT ROSE: In terms of identifying who was speaking at which times, how did you determine that?

10 MR GRANT: We had the CVR. The team listened to it. The three of us – there was three of us who did separate analysis, listening to the CVR, and we came up with, just by listening to the CVR, who was who. Names are – they identify themselves at start-up, so we could understand which voice. Having said that, we’re not experts at it, so this is, I guess, my work and/or the work of the team.

15 FLTLT ROSE: Did the DFSB ever assist you to help identify who was speaking when?

MR GRANT: No, only to ask us who we thought was speaking certain things. Yes.

20 FLTLT ROSE: So, in fact, the DFSB were relying on you to tell them who was speaking when?

25 MR GRANT: I wouldn’t say that, no. Just that they asked us, “Do you think” – like, I suspect when they were asking, they knew. They just wanted a second opinion.

30 AVM HARLAND: While we’re on this diagram – and it describes the aircraft at 365 feet at 12:36:17, and then shortly afterwards, 12:36:22, it begins a rapid descent. During that time, are you able to provide any guidance on what G-force the aircraft was experiencing at the transition from climb to rapid descent?

35 MR GRANT: Yes. So the acceleration is measured at eight hertz, and there is a one hertz. There is one one-eighth of a second time step where we get – the way the signage works is positive zero, positive small amount zero. Normally in straight and level flight, it would be around -1. That’s just the nature of the Axi system, that 1 G is measured as -1 in their Axi system. So during the bunt there is a positive .2, which is what we would call a negative G event, registered.

40 AVM HARLAND: So that would be a negative .2 G?

MR GRANT: Point 02.

45 AVM HARLAND: Point 02 G.

MR GRANT: Yes.

5 AVM HARLAND: Which effectively means that as the aircraft goes over the top, the G-force experience is zero G.

MR GRANT: Weightless, yes.

10 AVM HARLAND: Which is weightless.

MR GRANT: Yes.

15 AVM HARLAND: Would it be fair to say – or do you understand how the crew would feel at that time when they're experiencing that zero G?

MR GRANT: Yes, like a sudden drop. Yes. I assume like a sudden drop, you would feel.

20 AVM HARLAND: A drop, or would they feel like they're floating?

MR GRANT: Yes, they'd be floating up, but like the floor beneath them is dropping, I should say.

25 AVM HARLAND: So there'd be a feeling of weightlessness from the crew as they transitioned through that zero G when they went from the apex of the climb into the rapid descent?

MR GRANT: Yes.

30 AVM HARLAND: Thank you.

35 MS McMURDO: Could I just ask you while we've interrupted, I thought you mentioned that you said the aircrew identified themselves. Did you have some voice identification?

MR GRANT: Only because, at start-up, you hear some words.

MS McMURDO: You hear some words?

40 MR GRANT: Yes, they say, "So-and-so here".

MS McMURDO: So they say who they are?

45 MR GRANT: And then they're going, "Where's So-and-so?"

MS McMURDO: So you hear their voice?

MR GRANT: Yes, you hear their voice.

5 MS McMURDO: And identifying the name and the voice at the beginning of the take-off?

MR GRANT: Yes.

10 MS McMURDO: Thank you.

FLTLT ROSE: Just on that point, are you aware that the Inquiry has asked the DSTG to prepare a transcript of the cockpit voice recordings from Bushman 83?

15 MR GRANT: Yes.

FLTLT ROSE: But you didn't yourself prepare those transcripts?

20 MR GRANT: No. The team did their own transcript, just by what they heard. There's a group in Adelaide – not where I'm based, because I'm based in Melbourne – but the group in Adelaide have other tools, software tools, and expertise in that field.

25 FLTLT ROSE: And it was that team that created, to your understanding, the transcripts for the Inquiry's purposes?

MR GRANT: Yes.

30 FLTLT ROSE: So if we can go to slide 6? Now, you've plotted here where the aircraft was at various times throughout the flight, but otherwise the information in this slide is quite similar to the information that was in slide 4?

35 MR GRANT: Yes.

FLTLT ROSE: Now, if you go to slide 7, you've plotted where the aircraft was during the latter parts of the flight when they were flying the racetrack.

40 MR GRANT: Yes.

FLTLT ROSE: Slide 8, here you've plotted where the aircraft was during the last 30 seconds of the flight, after coming out of that second turn.

45

MR GRANT: Yes.

5 FLTLT ROSE: Slide 9, now this is a still from animation that you created, showing where Bushman 83 was in terms of altitude and position during the last 30 seconds of flight.

MR GRANT: Yes.

10 FLTLT ROSE: So it starts at 12:36:09, and shows 83 climbing above the formation, and then rapidly descending.

MR GRANT: Yes.

15 FLTLT ROSE: And the final time as it impacts the water is listed. As you said before, it says 12:33:25 on this slide.

MR GRANT: Yes.

20 FLTLT ROSE: Should it be 12:36:25?

MR GRANT: Yes, it should.

25 FLTLT ROSE: If you can change that, and then initial next to it? Then if we go to slide 10, you note that the flight data cut off, as you said before, at 12:36:25 UTC. So you're not sure whether the aircrew made any attempts to prevent the impact with water in those last few seconds, as it's even more difficult to know if the aircraft was responding to those inputs at the same time.

30 MR GRANT: I would indicate that the last time step – which question whether it's valid or not – is showing increasing rate of descent, and the speed is increasing, so if that is to be believed, I would suggest that – and noting there's possibly, you know, a second and a half of latency before flight control input is converted to attitude change, I would say it's highly likely there was not at this point an attempt to rectify the pitch down.

MS McMURDO: Have you finished with that exhibit?

40 FLTLT ROSE: Yes.

MS McMURDO: Yes, I think we'll - - -

FLTLT ROSE: Take a break?

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MS McMURDO: - - - have a lunch break, a lunch adjournment now, and resume at 1.55.

FLTLT ROSE: Thank you.

5

**HEARING ADJOURNED**

**HEARING RESUMED**

5 MS McMURDO: I understand that checks have been made, and there is no one present in the room who is not authorised to be in the room. Yes, FLTLT Rose.

10 FLTLT ROSE: Mr Grant, just before we move on, there was a question I wanted to clarify with you. Are you aware or do you know if the aircrew had to push a button on their mike to talk, or whether the cockpit voice recorder recorded automatically without the pilots having to go click, then speak?

15 MR GRANT: For internal communication or - - -

FLTLT ROSE: Internal communications.

MR GRANT: I don't know.

20 FLTLT ROSE: You're not sure. Now, at the bottom of page 11 of your statement, the second-last storyboard you refer to is a PowerPoint presentation. Sorry, I'll just wait until you get there. So the second-last storyboard is titled, "2024-02-27 PD-VADS MRH-90 Whitsundays Accident Storyboard".

25 MR GRANT: Yes.

FLTLT ROSE: Now, as you evidenced earlier, it was created on 27 February 2024, or initiated.

30 MR GRANT: Yes.

FLTLT ROSE: Now, it's not clear from your timeline in your statement on pages 7 to 9 when this particular storyboard was provided to the DFSB. Would it have been at the similar time as the other storyboard you provided?

35 MR GRANT: Without having the benefit of my email, I'm not quite sure because most of these were emailed. I think invariably I guess the way it worked was I was showing some of the storyboards, and going, "Is this what you like? Would you like to see something else?" And so there was a bit of toing and froing, yes.

FLTLT ROSE: But it was sometime in 2024?

45 MR GRANT: Yes.

FLTLT ROSE: I hand you a document. On the front page of this document – is this a presentation titled, “MRH-90 Accident 28 July 2023 – Accident Sequence”?

5

MR GRANT: Yes.

FLTLT ROSE: Is it your name at the bottom?

10

MR GRANT: Yes.

FLTLT ROSE: Did you create this storyboard?

15

MR GRANT: Yes, I did.

FLTLT ROSE: Is it 28 slides in total?

MR GRANT: Yes.

20

FLTLT ROSE: I tender the storyboard.

MS McMURDO: Exhibit 178.

25

**#EXHIBIT 178 - STORYBOARD OF MRH-90 ACCIDENT SEQUENCE**

30

FLTLT ROSE: That’s the storyboard labelled number 5. If I can ask that slide 4 be brought up? That’s number 4, I think. So it should be number 5, and slide 4. So this is a snapshot of an animation of a helicopter.

MR GRANT: Yes.

35

FLTLT ROSE: Is it Bushman 83 in the centre?

MR GRANT: Yes.

40

FLTLT ROSE: And then in the distance you can see Bushman 81, or is it 82 straight ahead of it?

MR GRANT: Yes, straight ahead is 82, and then above and to the right is 81.

45

FLTLT ROSE: And the heading is, “Aircraft 3 takes off at 12:14:13

UTC”.

MR GRANT: Correct.

5 FLTLT ROSE: So this shows the sortie, or the formation, taking off in a stream from Proserpine?

MR GRANT: Yes.

10 FLTLT ROSE: If you go to slide 5, so the heading states that we are now at 12:36:04, and that’s the last 20 seconds of the flight, when the formation is conducting the second turn in the racetrack in level flight.

MR GRANT: Yes.

15 FLTLT ROSE: You include some flight data information. So is that from Bushman 83’s flight data recorder?

20 MR GRANT: Yes, this is the data for 83 being shown here on the generic Heads-Up Display, and what’s written above.

FLTLT ROSE: So Bushman 83 is at 223 feet radar altitude.

MR GRANT: Yes, that’s correct.

25 FLTLT ROSE: With a climbing rate of 70 feet per minute.

MR GRANT: Yes.

30 FLTLT ROSE: The roll is 15.3 degrees left.

MR GRANT: Yes.

FLTLT ROSE: Pitch is 5.8 degrees up.

35 MR GRANT: Yes.

FLTLT ROSE: Cyclic is forward.

40 MR GRANT: Yes.

FLTLT ROSE: Does that mean it was fully forward, or just slightly forward?

45 MR GRANT: Yes, anything forward of the centre.

FLTLT ROSE: And the ground speed is 69 knots.

MR GRANT: Yes.

5

FLTLT ROSE: So all of that information in the bottom right-hand corner, there's that graph again, and now we determined from previous slides that the vertical in the centre of the cross, that's the cyclic?

10 MR GRANT: Yes.

FLTLT ROSE: And you can see it's slightly forward.

MR GRANT: Yes.

15

FLTLT ROSE: And then you've got, in terms of horizontal bar, it's slightly to the right, only just slightly off centre.

MR GRANT: Are you talking about the - - -

20

FLTLT ROSE: The right. So the cyclic movement, left/right?

MR GRANT: Yes, slightly left.

25 FLTLT ROSE: So it's left. Sorry, did I say right? You are correct.

MS McMURDO: Yes.

FLTLT ROSE: Then you've got the collective is sort of around the centre.

30

MR GRANT: Yes.

FLTLT ROSE: Pedals are slightly to the right.

35 MR GRANT: Yes.

FLTLT ROSE: And you've got "Engine" – does it say, "31/32 per cent of maximum torque"?

40 MR GRANT: 31/32, yes.

FLTLT ROSE: Before we move through the slides, just to explain, slides 6 to 26, they're snapshots of animations you created of the formation's flight path taken at one-second intervals until about 12:36:24.

45

MR GRANT: Yes.

FLTLT ROSE: Now, this takes us up to the point where 83 impacted the water.

5

MR GRANT: Yes.

FLTLT ROSE: If we move through the slides sequentially, at about a two or three-second pace in between each slide, up to slide 20, please? So on slide 20 you will see that the time is 12:36:19.

10

MR GRANT: Yes.

FLTLT ROSE: And Bushman 83 is at 358 feet RADALT.

15

MR GRANT: Yes, 356.

FLTLT ROSE: I think it says on the top "358", but are you - - -

MR GRANT: I'm looking at these. Yes, 356 on the – yes, that's fine.

20

FLTLT ROSE: So this is at the top of the climb, before it starts descending.

MR GRANT: Yes.

25

FLTLT ROSE: And the descent rate at this point is 247 feet per minute.

MR GRANT: Yes.

30

FLTLT ROSE: And no significant roll.

MR GRANT: No.

FLTLT ROSE: Pitch is 4.8 degrees down.

35

MR GRANT: Yes.

FLTLT ROSE: Cyclic is forward.

40

MR GRANT: Yes.

FLTLT ROSE: More forward than the previous screen.

MR GRANT: Yes.

45

FLTLT ROSE: We can see, looking at that vertical axis and across that, the cyclic is forward about three-quarters.

5 MR GRANT: Yes.

FLTLT ROSE: Ground speed is 88 knots.

MR GRANT: Yes.

10

FLTLT ROSE: Then we can see Bushman 81 to the far right, and Bushman 82 about centre.

MR GRANT: Yes.

15

FLTLT ROSE: If you go to slide 21? So this is an image made of the flight path at 12:36:20. We see that Bushman 83 is at 350 feet RADALT. The descent rate is 209 feet per minute.

20 MR GRANT: Yes.

FLTLT ROSE: Roll is 5.3 degrees left.

MR GRANT: Yes.

25

FLTLT ROSE: Pitch is 6.5 degrees down.

MR GRANT: Yes.

30 FLTLT ROSE: Now, the cyclic, you say, is significantly forward.

MR GRANT: Yes.

FLTLT ROSE: And the ground speed is 92 knots.

35

MR GRANT: Yes.

FLTLT ROSE: Slide 22, this is taken at 12:36:21.

40 MR GRANT: Yes.

FLTLT ROSE: 83 is at 345 feet RADALT.

MR GRANT: Yes.

45

FLTLT ROSE: The descent rate is now 778 feet per minute.

MR GRANT: Yes.

5 FLTLT ROSE: Roll is 8.7 degrees right.

MR GRANT: Yes.

10 FLTLT ROSE: Pitch is 17.7 degrees down.

MR GRANT: Yes.

FLTLT ROSE: Ground speed is 96 knots.

15 MR GRANT: Yes.

FLTLT ROSE: Can I just ask why you are referring to ground speed at this point, and not indicated airspeed?

20 MR GRANT: No particular reason. You could use either. The pilot would be reading indicated in the cockpit. Did I interchange? I think I used consistently ground speed throughout this.

FLTLT ROSE: You did.

25 MS McMURDO: You did.

MR GRANT: Yes. Probably if I had my time over, I'd probably use indicated speed. It would probably be better.

30 FLTLT ROSE: There's no reference to the cyclic position in the heading on this slide.

MR GRANT: No, that's correct.

35 FLTLT ROSE: But you can see from the graph that it's full forward.

MR GRANT: It's full forward, yes.

40 FLTLT ROSE: Slide 23, this is an image from 12:36:22.

MR GRANT: Yes.

45 FLTLT ROSE: 83 is at 331 feet RADALT.

MR GRANT: Yes.

FLTLT ROSE: The descent rate is now 1953 feet per minute.

5 MR GRANT: Yes.

FLTLT ROSE: Roll is at 25 degrees right.

MR GRANT: Yes.

10

FLTLT ROSE: Pitch is at 27 degrees down.

MR GRANT: Yes.

15

FLTLT ROSE: The cyclic is forward. You say it's significantly forward. Is there a reason why you've chosen to say "significantly forward" here, as opposed to the slide before when it was fully forward?

20

MR GRANT: I think if I probably had my time over again, I would have put fully forward in the slide previously, yes.

FLTLT ROSE: And you'd still consider this significantly forward?

25

MR GRANT: I'd still call this significantly forward, yes.

FLTLT ROSE: Ground speed is at 105 knots.

MR GRANT: Yes, that doesn't look quite accurate. It should be 98, yes.

30

FLTLT ROSE: Yes, so potentially that's an error in the heading?

MR GRANT: Yes.

35

FLTLT ROSE: It should be 98. Do you want to mark that, and initial?

MR GRANT: Yes.

40

FLTLT ROSE: Sorry, in the heading I think you should change 105 knots to – was it 98?

MR GRANT: 98.

FLTLT ROSE: As the ground speed, yes.

45

MR GRANT: Yes.

MS McMURDO: The one above doesn't look right either, the previous slide.

5 FLTLT ROSE: The previous slide might be an error as well. If you go back to slide 21, it should be 92 knots.

AVM HARLAND: The previous slide is incorrect as well.

10 FLTLT ROSE: So what is it, slide 20 now are we on? It should be – sorry, I can't read that. That seems right – 88.

MS McMURDO: It should be 88 instead of 92.

15 AVM HARLAND: Sorry, the next one.

FLTLT ROSE: Which one do you mean, sir?

AVM HARLAND: The next slide.

20 FLTLT ROSE: 21 or - - -

AVM HARLAND: We've already corrected that one; is that - - -

25 FLTLT ROSE: We've corrected that one.

AVM HARLAND: My apologies.

30 FLTLT ROSE: I think we were on slide 23. So if now we go to slide 24? We'll just check the ground speed. That's correct on that one, 101 knots? Do you agree?

MR GRANT: Yes.

35 FLTLT ROSE: The image is:

*At 12:36:23, Bushman 83 is at 209 feet RADALT.*

MR GRANT: Yes.

40 FLTLT ROSE: The descent rate is 3503 feet per minute.

MR GRANT: Yes.

45 FLTLT ROSE: Roll is 44 degrees right.

- MR GRANT: Yes.
- 5 FLTLT ROSE: Pitch is 21 degrees down.
- MR GRANT: Yes.
- FLTLT ROSE: Cyclic is fully forward.
- 10 MR GRANT: Yes.
- FLTLT ROSE: Ground speed is 101 knots.
- MR GRANT: Yes.
- 15 FLTLT ROSE: Slide 25, it was taken at 12:36:24. Bushman 83 is at 222 feet RADALT.
- MR GRANT: Yes.
- 20 FLTLT ROSE: The descent rate is now 4479 feet per minute.
- MR GRANT: Yes.
- 25 FLTLT ROSE: Roll is 31 degrees right.
- MR GRANT: Yes.
- FLTLT ROSE: Pitch is 23.4 degrees down.
- 30 MR GRANT: Yes.
- FLTLT ROSE: Cyclic is fully forward again.
- 35 MR GRANT: Yes.
- FLTLT ROSE: Ground speed should be 104 knots. I think perhaps that's written "105". Is that a correction?
- 40 MR GRANT: I can correct it.
- FLTLT ROSE: Slide 26, the image was taken at 12:36:25, and we have Bushman 83 at 157 feet RADALT. Is that correct?
- 45 MR GRANT: Yes.

- FLTLT ROSE: The descent rate is 5197 feet per minute.
- MR GRANT: Yes.
- 5 FLTLT ROSE: Roll is 31 degrees down.
- MR GRANT: Yes.
- 10 FLTLT ROSE: Pitch is 23.4 degrees down. Sorry, I made an error. The roll is 31 degrees right.
- MR GRANT: Yes.
- 15 FLTLT ROSE: Pitch is 23.4 degrees down.
- MR GRANT: Yes.
- FLTLT ROSE: Now, you say the cyclic is significantly forward here.
- 20 MR GRANT: Yes.
- FLTLT ROSE: That's because it's not fully forward.
- 25 MR GRANT: Correct.
- FLTLT ROSE: Ground speed – I think that says “104 knots” in the image, but you've got “105 knots” in the heading.
- 30 MR GRANT: Yes.
- FLTLT ROSE: Could you correct that?
- MR GRANT: Yes, I've corrected it.
- 35 FLTLT ROSE: Slide 27 – this is the final slide I'll take you to. This is from a different angle than what we've been looking at previously; is that correct?
- 40 MR GRANT: Yes, this is Aircraft 4 now.
- FLTLT ROSE: So we're looking from behind Aircraft 4?
- MR GRANT: 4, yes.
- 45

FLTLT ROSE: And you can see Bushman 83 to the right, just the green line.

MR GRANT: Yes.

5

FLTLT ROSE: And you see Bushman 82 above the horizon, and then Bushman 81 to the centre.

MR GRANT: Yes, that's right. Yes, that's correct.

10

FLTLT ROSE: And that's the positioning of the formation at 12:36:25 UTC.

MR GRANT: 12:36:25, yes.

15

FLTLT ROSE: Sorry, I misspoke. It corresponds with the cockpit voice recorder from Bushman 84 where the pilot says, "Pick up. Pick up. Pick up. Pick up".

20

MR GRANT: Yes.

FLTLT ROSE: Now, you say, "Pick up. Pick up. Pick up". Was that from memory, or did you re-listen to the cockpit voice recorder at that time and confirm that's what was said?

25

MR GRANT: I think, "Pick up. Pick up", is said within the cockpit. I think the call from 84 was, "Pull up. Pull up. Pull up".

30

FLTLT ROSE: So this is from the cockpit voice recorder of Bushman 83?

MR GRANT: Yes.

35

FLTLT ROSE: From memory, it's from the Bushman 83 cockpit voice recorder?

MR GRANT: Yes, you can hear 84, yes, from 83's.

40

FLTLT ROSE: So I'm just confirming that – I'm not trying to trick you here. I'm just trying to understand was your evidence that, "Pick up. Pick up. Pick up. Pick up," was somebody said that within Bushman 83 or someone said that from within Bushman 84?

MR GRANT: Yes, I think there's someone in the cockpit of 83 says, "Pick up. Pick up," but on the 83 CVR you can hear 84 say, "Pull up. Pull up. Pull up".

5 FLTLT ROSE: I understand. Now, if you could take that storyboard down? If you could turn back to page 11 of your statement? You refer to another PowerPoint presentation. This one is titled, "2024-02-27 PD-VADS MRH-90 Whitsundays Accident Storyboard - Aircraft 1 Looking Rear View Wingman".

10 MR GRANT: Yes.

FLTLT ROSE: Does that mean it was initiated on 27 February 2024?

15 MR GRANT: I just copied different versions over the initial version, hence why the name starts with "2024-02-27". So the starting time of all these storyboards was that date – was around that date.

20 FLTLT ROSE: If you go to page 8 of your statement, the sixth bullet point down, and then the fifth arrow down?

MR GRANT: Yes.

25 FLTLT ROSE: You refer to a storyboard you provided to the DFSB on 11 April 2024 called, "View of Formation Looking Rear From the Front of Bushman 81".

MR GRANT: Yes.

30 FLTLT ROSE: Is that the same storyboard?

MR GRANT: Yes.

35 FLTLT ROSE: I hand you a document. On the front page of this presentation is it, "MRH-90 Accident 28 July 2023 - Accident Sequence"?

MR GRANT: Yes.

40 FLTLT ROSE: Is that your name at the bottom?

MR GRANT: Yes.

FLTLT ROSE: Did you create this storyboard?

45 MR GRANT: Yes.

FLTLT ROSE: Is it 29 slides in total?

MR GRANT: Yes, 29.

5

FLTLT ROSE: I tender the storyboard.

MS McMURDO: Exhibit 179.

10

**#EXHIBIT 179 - STORYBOARD OF MRH-90 ACCIDENT SEQUENCE**

15 FLTLT ROSE: If we can go to slide 6? It's numbered 6. Item number 6, slide 6. Is this a snapshot of an image of an animation that you created from the view in front of the formation?

MR GRANT: Yes, a translating point in front of Aircraft 81.

20

FLTLT ROSE: So 81 is the centre aircraft, and it's difficult to see, but that's the centre aircraft in the frame?

MR GRANT: Yes, and all the information on the HUD would be for 81.

25

FLTLT ROSE: Just to orientate ourselves first, we've got Bushman 82 to the left.

MR GRANT: Yes.

30

FLTLT ROSE: And then it's difficult to see, but 83 is just visible to the right of 81, behind.

MR GRANT: Yes, right behind.

35

FLTLT ROSE: So in terms of the graph on the bottom right-hand corner, these are the inputs from the pilots of Bushman 81?

MR GRANT: Yes.

40

FLTLT ROSE: The same as you said before, the HUD. So we've got the airspeed, ground speed, engine power, are all from the flight data recorder for 81?

45

MR GRANT: Yes, that's right.

FLTLT ROSE: Now, there's no information included in the headings like there were on your previous slideshows for this particular presentation.

5 MR GRANT: Yes.

FLTLT ROSE: It's a different format. If you can scroll through at about a two-second pace each slide until slide 12? Now, slide 12, we've just got Bushman 84 coming into the frame on the right of the image; the far right  
10 where there's a green dash - - -

MR GRANT: Yes, we do.

FLTLT ROSE: And now 83 is above 81 here. So if you go back to the  
15 centre frame – that's it. Is that Bushman 83?

MR GRANT: Correct, yes.

FLTLT ROSE: As we've just scrolled through those slides, we haven't  
20 seen much change in that graph in terms of where the cyclic is. It's remained quite stable?

MR GRANT: Yes, that's correct. And that's to be expected because the  
25 lead aircraft would probably have a lot of his automatic flight control modes – he potentially has got a speed control mode and a RADALT hold mode. So if you're going to lead a formation of four aircraft at night, you need to maintain a really steady and predictable flight path. So using those modes would certainly help do that, so that's why you're not going to see much change.

30 MS McMURDO: So that graph is still Aircraft 1 now? Still Aircraft 1?

MR GRANT: Yes, this is Aircraft 1.

35 MS McMURDO: Yes, thank you.

MR GRANT: Because it's the lead aircraft.

FLTLT ROSE: From your analysis of 81, 82, 83 and 84, did you see 81  
40 having a different set of inputs because it was mostly using automatic flight modes compared to 82, 83 and 84?

MR GRANT: Yes, that's my assumption. Yes, it was certainly  
45 noticeable on the graphs. You could see it's a lot more predictable, a lot steadier in holding speed and holding altitude. Yes. The other aircraft,

obviously they're continually making inputs to maintain a station, not necessarily to maintain a precise airspeed or precise altitude. They're maintaining a precise location in the formation.

5 FLTLT ROSE: So GPCAPT Braun, if you could travel through to slide 22 at a two-second pace, and we'll just keep an eye on that graph in the bottom right-hand corner to observe any changes, or very little changes.

MS McMURDO: Are we going to slide 22 now?

10

FLTLT ROSE: 22.

MS McMURDO: Thank you.

15 FLTLT ROSE: Now, is that Bushman 83 at the peak of its climb at the top there, in the top left? It might be easier if you look on the screen.

MR GRANT: Yes.

20 FLTLT ROSE: Then you can just make out Bushman 84 at the bottom, near the horizon line?

MR GRANT: Yes.

25 FLTLT ROSE: Could you please scroll through to slide 27? This is the point just before Bushman 83 impacted the water.

MR GRANT: Yes.

30 FLTLT ROSE: And Bushman 81 is in the centre.

MR GRANT: Yes.

FLTLT ROSE: Bushman 82 is to the left of the screen.

35

MR GRANT: Yes.

FLTLT ROSE: And Bushman 84 is in the background.

40 MR GRANT: Yes.

FLTLT ROSE: If we just look at the inputs in the bottom right-hand corner, we can still see Bushman 81's cyclic steady, only slightly forward.

45 MR GRANT: Yes.

FLTLT ROSE: If we go to slide 28, so this is the same slide we've seen before showing the view from behind Bushman 84.

5 MR GRANT: Yes.

FLTLT ROSE: This is just before Bushman 83 entered the water.

MR GRANT: Yes.

10

FLTLT ROSE: Now, we don't have a separate slideshow to depict the movements of Bushman 82 and 84; is that correct? Did you create slideshows - - -

15 MR GRANT: No, I wasn't asked to. Yes.

FLTLT ROSE: So we don't have a depiction that we can see of a graph showing the inputs in terms of the cyclic, collective, and engine power for 82 and 84?

20

MR GRANT: We don't have one. We could make one, but we just didn't make one. Yes.

25 FLTLT ROSE: If you could take that slide show down? We're about to move on to some animations. Just a warning, if anybody wishes to leave the room, we're moving on to the animations now.

On page 7 of your statement, you see the fourth bullet point?

30 MR GRANT: Yes.

FLTLT ROSE: You state that on 27 September 2023 the DSTG provided the DFSB with various video animations with front left and right-side cockpit views from Bushman 83.

35

MR GRANT: Yes.

FLTLT ROSE: And they also had a plan view, and an inside racetrack turn view, for the last three minutes before Bushman 83 impacted the water?

40

MR GRANT: Yes.

FLTLT ROSE: Was one of those animations saved as "MRH-90 RH Cockpit Smoothed UTC 12:33:25"?

45

MR GRANT: Yes.

FLTLT ROSE: Now, “RH”, does that mean right-hand?

5 MR GRANT: Yes, right-hand cockpit.

FLTLT ROSE: And “Smoothed”? You gave some evidence earlier that one of your colleagues tried to smooth out the jitteriness of the animations.

10 MR GRANT: Yes.

FLTLT ROSE: So when we watch this animation, should we understand that it’s perhaps had some software – gone through some software that’s made it join up in a more user-friendly way?

15 MR GRANT: Yes, the numbers would still be from the flight data recording. It’s just some smoothing of those time steps between the actual recorded data. So the low-rate channels need something to be input, so there’s been smoothing around those data points.

20 FLTLT ROSE: Can I just ask you to keep making sure you talk into the microphone?

MR GRANT: Sorry. Yes.

25 FLTLT ROSE: You might want to move it so it’s actually in front of your body; that would help. Thank you. In terms of the file name, we understand when it says, “UTC 12:33:25”, that’s the time at which it starts?

30 MR GRANT: Yes, correct. Yes, so initially a three-minute – yes.

FLTLT ROSE: I’m going to ask – it’s item number 7 – ask that the full animation be played, but I’ll ask you to pause it at 11 seconds.

35

### **RECORDING PLAYBACK**

40 FLTLT ROSE: Just so we orientate ourselves before we watch the rest of it, this view is from the right-hand side of the cockpit of Bushman 83?

MR GRANT: Yes.

45 FLTLT ROSE: And Bushman 81 is in the – it’s to the right? Sorry, Bushman 82 is to the far right?

MR GRANT: Yes, that's Bushman 82.

5 FLTLT ROSE: And Bushman 81 is just visible - - -

MR GRANT: Yes.

10 FLTLT ROSE: - - - before the frame of the window. And is that Lindeman Island you've put in the background there, or a different island?

MR GRANT: Yes, this would - if there's three minutes to go, yes, that would be Lindeman Island.

15 FLTLT ROSE: And the blue checkerboard pattern represents the water below the formation?

MR GRANT: Yes.

20 FLTLT ROSE: You can see at the top the time in the animation moves, and at the moment we've just paused it - and it's 12 - I can't see that - 33:36, is it? Is that correct? You can't see it either?

MR GRANT: I can't see it from here.

25 FLTLT ROSE: Okay, that's all right. Then the HUD is this generic HUD that you've used to show, as all the other animations - you've got airspeed, ground speed, engine power, and then to the right you've got RADALT. Is that correct?

30 MR GRANT: Yes, RADALT on the right.

FLTLT ROSE: And you've got the inputs that the pilots were using in the bottom right-hand corner graph.

35 MR GRANT: Yes.

FLTLT ROSE: At the moment, the cyclic is in the middle.

MR GRANT: The cyclic is, yes, dead in the middle.

40 FLTLT ROSE: And slightly to the left.

MR GRANT: Yes.

45 FLTLT ROSE: Very little collective.

MR GRANT: And very little power, yes.

5 FLTLT ROSE: Very little power.

MR GRANT: It's in descent at this point, so that's part of the reason for that, yes.

10 FLTLT ROSE: Now, we know that the formation was flying at night, and they were using night-vision devices.

MR GRANT: Yes.

15 FLTLT ROSE: You gave some evidence before that you haven't incorporated that necessarily into this animation, those restrictions.

MR GRANT: That's correct.

20 FLTLT ROSE: So this is a depiction potentially what pilots may have seen during the day, if they were flying the same sortie?

MR GRANT: Yes.

25 FLTLT ROSE: So we just need to take into account that they would've had a 45 degree field of view because of the restrictions of the IITs on the night-vision devices?

MR GRANT: Yes.

30 FLTLT ROSE: And it would've been dark because it was night-time.

MR GRANT: Dark, potential obscurance, yes.

FLTLT ROSE: Potentially rain?

35

MR GRANT: Yes.

FLTLT ROSE: Cloud?

40 MR GRANT: Yes.

FLTLT ROSE: Other things obscuring their sight?

MR GRANT: Yes, that's right.

45

FLTLT ROSE: In one of the storyboards that we took you to before, you stated that CAPT Lyon took control as the flying pilot at 12:33:36.

MR GRANT: Yes.

5

FLTLT ROSE: So looking at the time at the top of this animation, it says, "12:33:36".

MR GRANT: Yes.

10

FLTLT ROSE: So it's from this time that CAPT Lyon was in control of flying Bushman 83?

MR GRANT: Yes.

15

FLTLT ROSE: If we could play the animation up to one minute 14?

#### **RECORDING PLAYBACK**

20

FLTLT ROSE: The formation has started turning left.

MR GRANT: Yes.

25

FLTLT ROSE: And it's the first turn in the racetrack.

MR GRANT: Yes.

30

FLTLT ROSE: Now, I recall from your storyboard with your timings on it, you stated that CAPT Lyon said on the radio at this point, "I will just go around the corner for you, mate".

MR GRANT: Yes.

35

FLTLT ROSE: So if we can play the animation up to two minutes seven seconds?

#### **RECORDING PLAYBACK**

40

FLTLT ROSE: Now, the formation is turning again at this point?

MR GRANT: Yes.

45

FLTLT ROSE: In the second turn of the racetrack.

MR GRANT: Certainly, it is. Yes.

5

FLTLT ROSE: And there's some other landforms that have just come into view. Do you recall what islands or peninsulas they were?

MR GRANT: That's Hamilton Island.

10

FLTLT ROSE: Right in front of us is Hamilton Island?

MR GRANT: Yes.

15

FLTLT ROSE: If we could play the animation up to two minutes 41 seconds?

**RECORDING PLAYBACK**

20

FLTLT ROSE: If you see the time on the screen, it should be 12:36:06.

MR GRANT: Okay, yes.

25

FLTLT ROSE: Now, in your storyboard with timings on it, you stated that this was when Bushman 83 starts to climb out of the formation.

MR GRANT: Yes.

30

FLTLT ROSE: So if we can play up to two minutes 49? 2'49".

**RECORDING PLAYBACK**

35

FLTLT ROSE: You see the time is 12:36:14. In your storyboard with timings, you said that this is when LT Nugent, who was sitting in the left-hand seat, says, "You still got them?"

40

MR GRANT: Yes.

FLTLT ROSE: If we can play to 2'51"?

45

**RECORDING PLAYBACK**

5 FLTLT ROSE: It should say “12:36:16” at the top, which corresponds with when you state that CAPT Lyon says, “Yep, still got them, mate”.

MR GRANT: Yes.

10 FLTLT ROSE: If we can play to 2’54”?

**RECORDING PLAYBACK**

15 FLTLT ROSE: The time is 12:36:19. In your earlier slideshow, you said that this is when WO2 Laycock reports losing sight of Aircraft 2.

MR GRANT: Yes.

20 FLTLT ROSE: And three seconds later, at 12:36:22, is when you state that Aircraft 3 began its rapid descent. So we’ll just play until the end of the animation.

25 **RECORDING PLAYBACK**

30 FLTLT ROSE: We can take that down. So that animation ended at 12:36:24, and your earlier evidence, as I understood it, you believed the impact was at about 12:36:25 or 26?

MR GRANT: More like between 26 and 27.

35 FLTLT ROSE: Sorry. Yes, you’re right. I tender the animation.

MS McMURDO: 180.

40 **#EXHIBIT 180 - ANIMATION, “MRH-90 RH COCKPIT SMOOTHED, UTC 12:33:25”**

45 FLTLT ROSE: If you go to page 11 of your statement, under question 7 you state that you sent an animation to the DFSB called, “Aircraft 3 RHS NVG 12:34:54 With Audio 12:34:54”.

MR GRANT: Yes.

5 FLTLT ROSE: Does that mean it's an animation from the viewpoint of the pilot in the right-hand side of Bushman 83?

MR GRANT: Yes, the right-hand side NVG.

10 FLTLT ROSE: And the numbers mean the animation starts at 12:34:54 UTC?

MR GRANT: Yes.

15 FLTLT ROSE: And NVG, night-vision goggles?

MR GRANT: Yes, night-vision goggles. It's the rendering as if you are looking through night-vision goggles, yes.

20 FLTLT ROSE: The best that you could do with the software you've got?

MR GRANT: Correct, yes.

FLTLT ROSE: There's audio been overlaid. It says, "with audio".

25 MR GRANT: Yes.

FLTLT ROSE: This is item number 8. If you could play the animation and pause it at 21 seconds?

30

### **RECORDING PLAYBACK**

35 FLTLT ROSE: Why is this animation in a circle?

MR GRANT: The circle is attempting to replicate the reduced field of view of wearing night-vision goggles, yes.

40 FLTLT ROSE: Sorry, I really might ask you just to put the microphone in front of you.

MR GRANT: Sorry.

45 FLTLT ROSE: It's a little bit difficult. So if someone – or you could push it?

MR GRANT: It's all right. I'll just move across.

FLTLT ROSE: Thank you.

5

MR GRANT: And I'll stop - - -

FLTLT ROSE: I might actually ask you that question again, just I'm not sure it was - why is the animation in a circle?

10

MR GRANT: Yes, the animation is in a circle, and trying to replicate the reduced field of view of wearing the night-vision goggles.

FLTLT ROSE: When we were saying before that there's two IITs, and it reduces the view to 45 degrees, obviously the pilot doesn't have two separate circles. It's the prisms put them to a single circle. Is that how it works?

15

MR GRANT: I probably better not answer that. I've never really worn night-vision goggles, but I assume it's possibly like that, but I don't know. I never looked.

20

FLTLT ROSE: Is this circle – have you done the maths on it? Does that equal 45 degrees of field of view?

25

MR GRANT: I haven't done the maths on it. A colleague of mine who did a similar recreation in 2020 had done the work on saying this was his best guess at what it might look like, so I was relying on his research.

30

FLTLT ROSE: The time at the top, it's 12:35:15.

MR GRANT: Yes.

FLTLT ROSE: And that's the generic HUD, once again showing us it's 87 degrees airspeed, 100 ground speed, and 30 and 31 per cent on the power.

35

MR GRANT: Yes.

FLTLT ROSE: 212 at RADALT.

40

MR GRANT: Yes.

FLTLT ROSE: And, of course, the graph in the bottom right-hand screen, this is the inputs from Bushman 83 pilots?

45

MR GRANT: Yes, correct.

FLTLT ROSE: And the green overlay that you chose, is that your best guess at what they might have seen through a night-vision goggle?

5

MR GRANT: Yes, there's a rendering that makes it a bit opaque, to make it look more difficult to see at night. Yes, as well as a green tint.

FLTLT ROSE: But, of course, this again doesn't have any of the inputs like weather and cloud?

10

MR GRANT: Yes, that's correct.

FLTLT ROSE: There are some clouds, it looks like, in the sky.

15

MR GRANT: Yes, you can see them in the previous animations. That's just a rendering of the sky, so that's - - -

FLTLT ROSE: Is that a generic sky, not the clouds on the night?

20

MR GRANT: No, absolutely – no, it's no representation of the weather on the night. It's just we have to have something at the top of the animation to represent the sky. It could just be blue. It could just be black. But sometimes we pick the colours just to visualise things better, not because they're actually accurate. It's just so you can see what's happening in the animation.

25

FLTLT ROSE: And that's Bushman 82 to the far right?

MR GRANT: Yes.

30

FLTLT ROSE: Bushman 81 is a bit hard to see, but is it just in front of the window frame?

MR GRANT: I can't quite see it with the reflection of the light from the room, but - - -

35

FLTLT ROSE: I can't quite see it either actually.

MR GRANT: Yes.

40

FLTLT ROSE: What I'll do is just ask for the animation to be played until the end.

45

**RECORDING PLAYBACK**

5 FLTLT ROSE: You can take the animation down. That's the audio from the cockpit voice recorder for Bushman 83.

MR GRANT: Yes.

10 FLTLT ROSE: Did you use the audio from the pilot's mike?

MR GRANT: Yes. I'd have to check that actually, but it could've come from either the pilot, the co-pilot, or the ICS combined channel. Most of - - -

15 FLTLT ROSE: I tender the animation.

MS McMURDO: 181.

20 **#EXHIBIT 181 - ANIMATION, "AIRCRAFT 3 RHS NVG 12:34:54 WITH AUDIO 12:34:54"**

25 FLTLT ROSE: On page 11 of your statement, under question 7, you state that one of the animations you sent to the DFSB was titled, "25-213-Base 2 Times Two Video Audio 9611".

MR GRANT: Yes.

30 FLTLT ROSE: You provided a shortened version of this animation to the Inquiry to remove parts that contain Protected audio.

MR GRANT: That's correct.

35 FLTLT ROSE: If I could ask that the animation be played until seven seconds, and then paused?

**RECORDING PLAYBACK**

40

FLTLT ROSE: So these are animations from a variety of views here. In the top left-hand corner of the screen, is this the view from the left-hand side of the cockpit of Bushman 83?

45

MR GRANT: Yes, it is.

FLTLT ROSE: The top right-hand corner is the view from the right-hand side of the cockpit of 83?

5

MR GRANT: Yes.

FLTLT ROSE: And the bottom left-hand corner is the view from behind 83?

10

MR GRANT: Yes.

FLTLT ROSE: So it's not from the cockpit of 84, it's just at a position behind 83?

15

MR GRANT: Yes, just a translating position behind 83. It's not representative of 84. No, just at a point.

FLTLT ROSE: Now, in the bottom right-hand corner there's a view we haven't seen before. What is this view?

20

MR GRANT: So the larger rectangle in the bottom right is an attempt at the view from the aircrewman's position, where he would be sitting, and inside that is a ground mapping of the flight path, so where the formation is in the Hamilton Island/Lindeman Island area, yes.

25

FLTLT ROSE: In the bottom right-hand corners of each of the frames, is that the controls for the pilots from 83?

MR GRANT: Yes, it is.

30

FLTLT ROSE: In all four quadrants?

MR GRANT: Yes.

35

FLTLT ROSE: Now, none of these animations have that night-vision goggle overlay that we saw previously.

MR GRANT: That's correct.

40

FLTLT ROSE: And those cloud formations in the bottom left-hand corner, they're just generic clouds?

MR GRANT: Just a generic rendering of sky, yes.

45

FLTLT ROSE: So what this depicts is the full possible field of regard the pilots from 83, or the aircrewman in 83, could have seen if it was daylight and they weren't on NVGs?

5 MR GRANT: Yes.

FLTLT ROSE: And, of course, there's no weather imbued into any of these animations – clouds, rain, things like that?

10 MR GRANT: No.

FLTLT ROSE: And this audio is from the cockpit voice recorder from Bushman 83?

15 MR GRANT: Yes.

FLTLT ROSE: I'll ask the animation be played until the end.

20 **RECORDING PLAYBACK**

FLTLT ROSE: I tender the animation.

25 MS McMURDO: That's Exhibit 182.

**#EXHIBIT 182 - ANIMATION, "25-213-BASE 2 TIMES TWO VIDEO AUDIO 9611"**

30

FLTLT ROSE: Now, there's one final animation to play. If you look at page 8 of your statement? Now, on the eighth bullet point down, from page 8 - - -

35

MR GRANT: Yes.

FLTLT ROSE: - - - you state that on 3 April 2024 you provided video animations of reconstructions viewed from the front right-side aircrew position on Bushman 84.

40

MR GRANT: Yes, we did.

FLTLT ROSE: If you turn to page 11, under question 7 you state that one of the animations you sent to the DFSB was titled, "Aircraft 4 Pilot View 12:34:54:00 With Audio 9573.25".

5 MR GRANT: Yes.

FLTLT ROSE: Is that the animation you were referring to back on page 8?

10 MR GRANT: Yes, I was.

FLTLT ROSE: Does that mean that the animation starts at 12:34:54 UTC?

15 MR GRANT: Correct.

FLTLT ROSE: And there was audio overlaid?

MR GRANT: Yes.

20

FLTLT ROSE: And that's audio from the pilot's mike and the cockpit voice recorder from Bushman 84?

MR GRANT: Yes.

25

FLTLT ROSE: Could you play the animation, but stop at 12 seconds, and this is item 10?

30 **RECORDING PLAYBACK**

FLTLT ROSE: So there appears to be a different filter on this animation than we've seen previously, making it darker.

35

MR GRANT: Yes.

FLTLT ROSE: What's that representing?

40 MR GRANT: I think we just sort of thought it was the best representation of a night sky, and the conditions of the night. No particular reason. We thought it just looked like a bit more of a professional animation. That was all. But it's not representative of the particular conditions on the night. It was just – yes, and we removed the HUD as well.

45

MS McMURDO: Sorry, you removed the?

MR GRANT: Yes, there's no HUD.

5 FLTLT ROSE: No HUD?

MR GRANT: No.

10 MS McMURDO: No HUD?

MR GRANT: Yes.

FLTLT ROSE: So there's no indication of ground speed, airspeed?

15 MR GRANT: No.

FLTLT ROSE: RADALT, power?

MR GRANT: Correct.

20 FLTLT ROSE: And there's no graph in the bottom right-hand corner that we've seen previously?

MR GRANT: Yes.

25 FLTLT ROSE: Now, you can see this is from inside Bushman 84, so directly in front is Bushman 81. Bushman 81 to the left.

MR GRANT: That would be 81 there, yes.

30 FLTLT ROSE: 83 is next.

MR GRANT: Yes.

35 FLTLT ROSE: And then 82 is to the right.

MR GRANT: 82 to the right, yes.

40 FLTLT ROSE: I am going to ask for the animation to be played until the end.

## RECORDING PLAYBACK

45

FLTLT ROSE: I tender the animation.

MS McMURDO: That's 183.

5

**#EXHIBIT 183 - ANIMATION, "AIRCRAFT 4 PILOT VIEW  
12:34:54:00 WITH AUDIO 9573.25**

10 FLTLT ROSE: Could you put those papers away, and find the report that we referred to at the beginning of your evidence? You have it there.

MR GRANT: Yes.

15 FLTLT ROSE: That was Exhibit 174. You have already stated that you prepared this report in November 2024.

MR GRANT: Yes.

20 FLTLT ROSE: That was in response to a request by the Inquiry?

MR GRANT: Yes.

25 FLTLT ROSE: Do you have the Letter of Instruction, the Annex 3? It might be at the bottom of that pile.

MR GRANT: The Letter of Instruction. Yes.

30 FLTLT ROSE: That's right. Essentially, you were asked to examine the flight data recorders from Bushman 81, 82 and 84.

MR GRANT: Yes.

35 FLTLT ROSE: And in paragraph 1, from subsections (a) to (c), you were asked to identify the radar altimeter, or RADALT, decision heights for each of the pilots in those three aircraft set prior to take-off on 28 July 2023.

MR GRANT: Yes.

40 FLTLT ROSE: And any changes they made to those decision heights during the flight.

MR GRANT: Yes.

FLTLT ROSE: Paragraph 1(d) to (f), you were also asked to identify each of the modes of flight that each of the pilots in 81, 82 and 84 used during the sortie.

5 MR GRANT: Yes.

FLTLT ROSE: And you were provided with a set of assumptions about the nature of the sortie on 28 July.

10 MR GRANT: Yes.

FLTLT ROSE: Help yourself to water.

MR GRANT: It's all right, I'm good.

15

MS McMURDO: Let me know if you need a break, won't you?

MR GRANT: Yes, I will.

20 MS McMURDO: Thank you.

FLTLT ROSE: Now, if you go back to your statement, if you still have that in front of you? Page 8, or page 9, sorry, the seventh bullet point down.

25

MR GRANT: Yes.

FLTLT ROSE: You state that on 16 September 2024 the DSTG provided decision height settings from the binary flight data from the crash survivable memory unit for all four MRH-90 aircraft in the formation during the incident flight.

30

MR GRANT: Yes, we provided that. Yes.

35 FLTLT ROSE: On page 13 of your statement, you list four Excel spreadsheets, one for each of the four aircraft in the formation, charting the decision heights for the left and right-side aircrew positions.

MR GRANT: Yes.

40

FLTLT ROSE: Could I ask about item – I think it's item 11? It should be an Excel spreadsheet. 12, sorry. Item 12. Now, is this one of the spreadsheets that you provided for Aircraft 3? It's difficult to see on the screen, but if you can see in the titles - - -

45

MR GRANT: Yes, it is.

FLTLT ROSE: - - - there's "Aircraft 3 Subset Sub". So that would be  
Bushman 83?

5

MR GRANT: Yes, that's correct.

FLTLT ROSE: Now, there's lots of columns in here, but if you could –  
we've widened the columns for column L and column M. Can you see that  
there?

10

MR GRANT: Yes.

FLTLT ROSE: It says, "Low DH PIL" in column L.

15

MR GRANT: Yes.

FLTLT ROSE: Is that decision height?

20

MR GRANT: Yes, decision height.

FLTLT ROSE: For the pilot?

MR GRANT: Yes, for the pilot.

25

FLTLT ROSE: PIL?

MR GRANT: PIL, yes.

30

FLTLT ROSE: Then column M, it says, "Low DH COP".

MR GRANT: Yes.

FLTLT ROSE: Is that the decision height set by the co-pilot?

35

MR GRANT: Yes.

FLTLT ROSE: Now, you can see in column L it's 45 feet all the way  
down from row 1 to what you can see at the moment, row 32.

40

MR GRANT: Yes.

FLTLT ROSE: And then in column M, from row 1 to row 32 it says,  
"Zero feet".

45

MR GRANT: Yes.

5

FLTLT ROSE: We could scroll down, but is it your understanding that those decision heights remain stable throughout this Excel spreadsheet?

MR GRANT: Yes, they do.

10

FLTLT ROSE: Does that mean that the decision height that was set at 45 feet by Bushman 83's pilot remained at 45 feet throughout the flight?

MR GRANT: Yes.

15

FLTLT ROSE: Does that mean that the decision height the co-pilot set in Bushman 83 remained at zero feet throughout the flight?

MR GRANT: Yes.

FLTLT ROSE: On column A you've got the timings.

20

MR GRANT: Yes, so core management. "CMC" is Core Management Computer. That's the time. So it's the time that the aircraft is using. It's updated by GPS.

25

FLTLT ROSE: It's not UTC though, is it?

MR GRANT: It should - - -

FLTLT ROSE: It says, "1848".

30

MR GRANT: Yes, sorry. Yes, that's just - - -

FLTLT ROSE: Or 19?

35

MR GRANT: You've gone - that's several days or several flights previously, I think. If you look at the - - -

FLTLT ROSE: So how far back does this particular - - -

40

MR GRANT: Well, there's up to six hours of flight data on the flight data recorders, so it could go back to - - -

FLTLT ROSE: So it could include sorties - - -

45

MR GRANT: Yes, it could be sorties.

FLTLT ROSE: - - - that weren't the one on the night?

MR GRANT: Yes.

5 FLTLT ROSE: So what we'd have to do is go all the way down to the bottom?

MR GRANT: Sorry, this should just be a subset of that entire data set. The 23 is the date. The month – so reading from the left, you've got - - -

10 FLTLT ROSE: We could enlarge it, if you need.

MR GRANT: That's all right. I can read it. So it's a subset. They're the subframe. I wouldn't – yes, so they're just – call that – what would you call that? Data recording time. The frame times are column B. At C is the reading of the Core Management Computer's day. It says UTC. That should be the - that's the '23. That's the year, sorry. It's the year. So it's 2023, and that's the month, and then that's the day, and then the next column is the hour, and the next column is minutes, and then seconds.

20 FLTLT ROSE: I understand.

MR GRANT: I believe.

25 FLTLT ROSE: Thank you. I tender the spreadsheet. I don't actually think I have a hard copy, but do we have – it's on the USB that we've actually tendered previously, a copy of that spreadsheet.

30 MS McMURDO: The USB with the spreadsheet will be Exhibit 184.

**#EXHIBIT 184 - USB CONTAINING EXCEL SPREADSHEET**

35 FLTLT ROSE: You can take that down now. Can you go back to the storyboard, the first one we had, slide 5. They had the timings with all the various – it's probably got a tab on it that says – that looks like it. Slide 5.

MR GRANT: Yes.

40 FLTLT ROSE: Just for everyone else following, that should be Exhibit 177.

45 MS McMURDO: This is tab 5.

FLTLT ROSE: Yes, tab 5 for - - -

MS McMURDO: Or is it 178?

5 FLTLT ROSE: Is it?

MS McMURDO: It doesn't mean I'm right.

10 INQUIRY ASSISTANT: 178.

MS McMURDO: 178. For once, I'm right.

FLTLT ROSE: Now, if you look at the time, as you state, that  
15 CAPT Lyon requested the RADALT engaged at 12:33:49 UTC?

MR GRANT: Yes.

FLTLT ROSE: Just before the formation commences the first turn of the  
20 racetrack.

MR GRANT: Yes.

FLTLT ROSE: Is that referring to RADALT hold?

25 MR GRANT: Correct, that is selecting a mode on the automatic Flight  
Control System. Yes.

FLTLT ROSE: So it's an upper mode that can be selected by the pilots in  
30 the MRH-90?

MR GRANT: Yes.

FLTLT ROSE: What does it do, in your understanding?

35 MR GRANT: When it's engaged, the RADALT setting you have can then  
be maintained by use of the collective automatically, not by the pilot.

FLTLT ROSE: Do you recall if this was the first time that the RADALT  
40 hold was engaged by either of the pilots in Bushman 83 during the sortie?

MR GRANT: It was the first time, yes.

FLTLT ROSE: It was the first time.

45 MR GRANT: Yes.

- 5 FLTLT ROSE: At 12:33:49. Do you recall from your analysis of the flight data recorders if the pilots of Bushman 83 were flying in attitude mode, or tactical mode, or a combination of the both?
- MR GRANT: They were flying tactical mode up until RADALT was engaged.
- 10 MS MUSGROVE: Sorry to interrupt. We don't have a hard copy of this, and I wonder if it could go up on the screen?
- LCDR GRACIE: No, we don't have.
- 15 FLTLT ROSE: That was item number 5. It can go up on the screen, slide 5. I must have that wrong. Is it item number 6? Is that what you're looking at?
- MS McMURDO: I'm not sure.
- 20 FLTLT ROSE: What does the tab say on your - - -
- AVM HARLAND: Tab 5.
- MS McMURDO: Tab 5 is what - - -
- 25 AVM HARLAND: I've got tab 4 and page - - -
- FLTLT ROSE: Perhaps it's item 4. That's what I've done; I misspoke.
- 30 MS McMURDO: Tab 4 was 177.
- FLTLT ROSE: Tab 4, slide 5. That's it. Sorry, your evidence then was that Bushman 83 was flying in tactical mode during the sortie?
- 35 MR GRANT: Yes, up to the point that RADALT was engaged.
- FLTLT ROSE: Just so that everyone can catch up, RADALT was engaged at 12:33:49 UTC.
- 40 MR GRANT: My understanding is you can't have TAC mode on and RADALT on at the same time.
- FLTLT ROSE: I'll just ask you to keep your voice raised as well.
- 45 MR GRANT: Sure.

FLTLT ROSE: Thank you. I think your evidence was you can't have RADALT hold and in tactical mode at the same time.

5 MR GRANT: That's correct.

FLTLT ROSE: If you could just now go back to your November report. I think it's in front of you. Page 16, that should be Appendix B.

10 MR GRANT: Yes.

FLTLT ROSE: You set out your Decision Height Analysis Methodology.

15 MR GRANT: Yes.

FLTLT ROSE: You state that:

20 *The MRH-90 has two inertial reference systems that combined laser, gyro, GPS and processes which are part of the navigation system.*

MR GRANT: Yes.

25 FLTLT ROSE: Halfway through that paragraph you state that:

30 *The pilots can set a decision height in the IRS to provide terrain proximity warnings when operating at low altitude, and the PFD present the decision height to the pilots with flashing characters and aural warnings to the aircrew when the aircraft is below the decision height setting.*

MR GRANT: Yes.

35 FLTLT ROSE: Is the PFD the Primary Flight Display?

MR GRANT: Primary Flight Display, yes. Correct.

FLTLT ROSE: And IRS?

40

MR GRANT: Inertial Reference System.

45 FLTLT ROSE: If you go to page 17, Appendix C. This is your Flight Control System Mode Analysis Methodology. Turn to page 18. Halfway through that first paragraph you state that:

*The MRH-90, being a fly-by-wire aircraft, has the ability to operate or configure the FCS in a range of modes that can support or enhance basic flying procedures as well as mission tasks.*

5

MR GRANT: Yes.

FLTLT ROSE: FCS, Flight Control System?

10

MR GRANT: Correct.

15

FLTLT ROSE: You then set out the four basic modes that include attitude mode and nape-of-the-earth – NOE – mode for low-level flying, which are the tactical mode or the stability and control augmentation system mode.

MR GRANT: Yes.

20

FLTLT ROSE: And NOE is nape-of-the-earth, I take it?

MR GRANT: Nap-of-the-earth, known as terrain-hugging in the, I guess, common language.

25

FLTLT ROSE: Sorry, I said “nape”. It should be “nap”.

MR GRANT: Nap, yes.

30

FLTLT ROSE: That was my mistake. So below what height do you understand low-level flying to mean?

MR GRANT: I would say anything below 500 feet. I’d classify that as low-level flying.

35

FLTLT ROSE: Go to page 19, second paragraph and the second sentence:

*The attitude mode is the default FCS –*

40

which is Flight Control System –

*mode, which provides attitude hold in the pitch and the roll axis and centres the yaw axis when in cruise, such that no inputs to the pedals which control yaw are required.*

45

MR GRANT: Yes.

FLTLT ROSE: The TAC mode, or tactical mode, is one of the nap-of-the-earth modes?

5 MR GRANT: Yes.

FLTLT ROSE:

10 *Tactical mode is identical to attitude mode except with an automatic trim follow-up feature.*

MR GRANT: Yes.

15 FLTLT ROSE: So does this mean that you have to use the pedals in tactical mode to control the yaw?

MR GRANT: I don't know. I think in – I don't know the answer to that.

20 FLTLT ROSE: If you don't know, that's fine.

MR GRANT: Yes.

FLTLT ROSE: If you go to footnote 11, if you can see that. You state that:

25 *The MRH-90 can only be in one basic or manual mode at a time.*

FLTLT ROSE: So if the aircraft is in attitude mode, it can't also be in the nap-of-the-earth mode?

30 MR GRANT: That's correct.

FLTLT ROSE: And footnote 13, just below it:

35 *Nap-of-the-earth refers to very low flying, otherwise known as ground-hugging flight.*

You said that before?

40 MR GRANT: Yes.

FLTLT ROSE: Close to the earth. So is that lower than 500 feet, or is the nap-of-the-earth something even lower?

45 MR GRANT: I'm not an operator. I wouldn't know how low is too low to avoid detection. And that's basically why you terrain-hug, is to avoid

detection. So I mean, depending on the environment, what radars are out there, I guess that would determine how low you would fly.

5 FLTLT ROSE: From your analysis of the flight data recorder, did any of the aircraft go below 200 feet during the sortie; that is, up until Bushman 83 had its rapid descent?

10 MR GRANT: I would have to check. I'm pretty sure that 84 was below 200 over the water.

FLTLT ROSE: At some point.

MR GRANT: Yes.

15 FLTLT ROSE: 84 was?

20 MR GRANT: 84 was, yes. The general configuration was that 81 was about 200 and then there was a stacking of 82 and 83, being generally another 10, 15 feet higher. Which makes sense, keep out of the wash of the aircraft in front and below you. And 84 was, I thought there'd been times it was under 200 feet.

25 FLTLT ROSE: If you go to page 20, Appendix D? This is the Automatic Flight Control System Mode Analysis Methodology.

MR GRANT: Yes.

FLTLT ROSE: First sentence:

30 *The MRH-90 aircraft also has a range of selectable Automatic Flight Control Systems (Automatic Flight Control Systems, AFCS) modes referred to as mission modes or upper modes.*

MR GRANT: Yes.

35 FLTLT ROSE: Do you see the fifth line:

40 *There are upper modes that will hold command aircraft heading, indicated airspeed, radar height or barometric height.*

MR GRANT: Yes.

FLTLT ROSE: A few sentences later you say that:

*There are 16 Automatic Flight Control System mission or upper modes.*

5 MR GRANT: Yes.

FLTLT ROSE: If you go to page 22? This is Appendix E. It's MRH-90 AFCS modes. You list RHT, is that radar height?

10 MR GRANT: Correct.

FLTLT ROSE: Which maintains the required radar height datum.

MR GRANT: Yes.

15 FLTLT ROSE: If you go to page 2 – that's digit 2, not (ii) – of your report. Do you see paragraph 2.1?

MR GRANT: Yes.

20 FLTLT ROSE: You state that:

*The pilot on the right side of Bushman 81 set his RADALT decision height to zero feet and the pilot on the left side set his to 50 feet.*

25 MR GRANT: Yes.

FLTLT ROSE: Go to paragraph 2.4.1. You state that:

30 *Bushman 81 had its Flight Control System mode set to attitude mode during the sortie.*

MR GRANT: Yes.

35 FLTLT ROSE: You explain that:

40 *Attitude mode is the default mode which provides attitude hold in the pitch and roll axis and centres the yaw axis when in cruise, such that no inputs to the pedals which control the yaw are required.*

MR GRANT: Yes, correct.

45 FLTLT ROSE: We know from the previous evidence that the formation took off from Proserpine at about 2014 UTC.

MR GRANT: 2214, yes.

FLTLT ROSE: 2214 local time.

5

MR GRANT: 2214 local, yes.

FLTLT ROSE: And 1214 UTC. If you go to paragraph 2.4.2, you state that:

10

*At 22:14:29 –*

so that's approximately 54 seconds after take-off –

15

*Bushman 83 set its collective mode to the integer of 13, and a pitch mode to the integer of 15.*

MR GRANT: Yes.

20

FLTLT ROSE:

*Then at 22:22:01 Bushman 81 increased its collective mode to an integer value of 15, which indicates that the collective was set to hold radar height at that time.*

25

MR GRANT: Yes.

FLTLT ROSE:

30

*Then Bushman 81 set some other upper modes during the flight.*

MR GRANT: That's correct, yes.

35

FLTLT ROSE: If you go to Figure 2, page 4, you have a satellite map of Proserpine and Lindeman Island, the area. And the green line is the formation flight path?

MR GRANT: Yes.

40

FLTLT ROSE: There's a green line showing 81's flight path with a triangle indicating when 81 changes its collective mode to automatically maintain radar height.

MR GRANT: That's correct.

45

FLTLT ROSE: This happened soon after Bushman 81 transitioned from flying overland to flying overwater?

MR GRANT: That's correct.

5

FLTLT ROSE: That's known as "feet wet".

MR GRANT: Yes.

10 FLTLT ROSE: So do you use the terms flying the aircraft "manually" or in "automatic mode"? Is that the two options?

15 MR GRANT: I don't know, actually. I'd say, yes, to some extent the pilots have their hands on the stick to some extent. Depending on what mode is selected depends on how much help they're getting from the Flight Control System. So that list of modes, there's all sorts of things that the aircraft can do. It can actually hover almost automatically by itself and descend by itself if properly programmed.

20 This sort of flying, I suspect the pilots are still hand on stick. While some things are being commanded by the Flight Control System, or Automatic Flight Control System, the pilot is still flying the aircraft.

25 FLTLT ROSE: But Bushman 81 essentially used the Automatic Flight Control System up until the point Bushman 83 crashed, from your analysis of their flight data?

30 MR GRANT: If you look at the flight data it's certainly a lot flatter, the altitude is a lot smoother, it's more constant, the speed's more constant than the other aircraft. That's indicative of having the AFCS supporting the pilot to fly a very specific speed and fly a very specific altitude. And that's why I think there's AFCS modes on.

35 We also have the definitive number 15 – only from the AAP report do I know that integer 15 on that channel means the collective mode, and RADALT hold was on. I have integer values, but I don't know what those integer values mean. So I'm assuming that, by what I see on the flight data, that 13 is probably a barometric height hold rather than a RADALT hold. Which makes sense; it's over land which is undulating. You want to  
40 hold a constant barometric pressure altitude.

45 FLTLT ROSE: Take it down. Just to let you know, I've probably only got about three more minutes with you, in case you were wondering. I feel some people behind me moving around in their seats. So paragraph 2.2 on page 2 of your report.

MR GRANT: Sorry, can you repeat that?

5 FLTLT ROSE: If you go to page 2, so paragraph 2.2. You state that:

*The pilots on both sides of Bushman 82 set their RADALT decision heights to 80 feet.*

10 MR GRANT: That's correct, yes.

FLTLT ROSE: If you go to 2.5.1 on page 7, this is where you state that:

15 *Bushman 82 had its flight control mode set to attitude mode during the sortie.*

MR GRANT: Yes.

20 FLTLT ROSE: Top of page 8, paragraph 2.5.2, you state that:

*82 had set its collective mode to integer value of 15 at 22:27:16 local time, which indicates that the collective is set to hold radar height.*

25 MR GRANT: That is correct, yes.

FLTLT ROSE: If you look at Figure 7 on page 8. Again, you have a satellite map of the Proserpine/Lindeman Island area, and you've got Bushman 82's flight path in the green line.

30 MR GRANT: Yes.

FLTLT ROSE: There's a green line showing 82's flight path with a triangle indicating when 82 changes the Automatic Flight Control System collective mode to automatically maintain radar height.

35 MR GRANT: That's correct, yes.

40 FLTLT ROSE: We haven't seen the evidence of when 82 went feet wet before, but we know from your previous evidence that 83 went feet wet at 22:21:03 local time. So 82 must have gone feet wet just slightly before that?

45 MR GRANT: Yes.

FLTLT ROSE: So it appears that 82 did not engage the radar height hold until about six minutes after it went feet wet?

MR GRANT: Yes.

5

FLTLT ROSE: Can you say from this evidence whether Bushman 82 was flying using the Automatic Flight Control System?

MR GRANT: Yes, from this point, 82 would be using the collective mode to hold RADALT, yes.

10

FLTLT ROSE: Because you can't put RADALT in and tactical mode at the same time.

MR GRANT: Yes, they were in ATT mode the whole time.

15

FLTLT ROSE: So if you go to page 2 again, paragraph 2.3, you state that:

20

*The pilot on the right side of Bushman 84 set his RADALT decision height to zero feet, and the pilot on the left side set his to 45 feet.*

MR GRANT: Yes, zero on the pilot side, and 45 on the co-pilot side.

25

FLTLT ROSE: If you go to page 8, paragraph 2.6.1, you state that:

*Bushman 84 changed its Flight Control System mode from attitude mode to tactical mode about 16 seconds after take-off, until changing it back to attitude mode at 22:24:16 local time.*

30

MR GRANT: Yes.

FLTLT ROSE: So at page 10 now, paragraph 2.6.2, you state that:

35

*At the same time that Bushman 84 changed back to attitude mode, it set its collective mode to integer value of 15, which again indicates that the collective is set to hold radar height.*

MR GRANT: Yes.

40

FLTLT ROSE: So if you look at that Figure 10 on that page, that's that satellite image again of the Proserpine and Lindeman Island area. So that green line represents that formation's flight path?

45

MR GRANT: Yes, correct.

FLTLT ROSE: And there's a green line for 84's flight path?

MR GRANT: I thought 84 was the yellow. But they're so tightly bunched in this image, it's hard to tell.

5

FLTLT ROSE: You did have 84 as yellow in previous analysis you did, so is that - - -

MR GRANT: I didn't indicate it because it's - yes, you can't really see because the triangles are all bunched up together.

10

FLTLT ROSE: Does it indicate where - - -

MR GRANT: It indicates the approximate position, yes, absolutely, aware of 84.

15

FLTLT ROSE: The triangle indicating where 84 goes back to attitude mode?

MR GRANT: Yes.

20

FLTLT ROSE: And changes the Automatic Flight Control System collective mode to automatically maintain radar height?

MR GRANT: Yes, that's correct.

25

FLTLT ROSE: So that's approximately three minutes after it went feet wet.

MR GRANT: Yes.

30

FLTLT ROSE: Can you say from the evidence whether Bushman 84 was flying using the Automatic Flight Control System from that point?

MR GRANT: Yes.

35

FLTLT ROSE: Because, once again, if you set RADALT height hold, you are not flying tactical mode.

MR GRANT: Correct. You can't be in the collective mode of using RADALT to hold your RADALT altitude unless you're in ATT mode, yes.

40

FLTLT ROSE: Those are my questions.

MS McMURDO: Thank you. We will have a break now, but before we have a break, how many applications are there to cross-examine? Could I have some estimate of time for the witness, please?

5 LCDR GRACIE: Five minutes, ma'am.

LCDR TYSON: Also five minutes, ma'am.

10 MS McMURDO: Did I see your hand, Mr - - -

SQNLDR THOMPSON: Five minutes.

MS McMURDO: Yes.

15 MR O'MAHONEY: Five minutes, ma'am.

MS McMURDO: That's one, two, three, four, five.

20 SQNLDR CASHA: Five minutes.

MS McMURDO: Six. Any others? So it'd be seven.

MS MUSGROVE: Perhaps.

25 MS McMURDO: Any idea how long, Ms Musgrove?

MS MUSGROVE: Five minutes.

30 MS McMURDO: Five minutes. So we've got about 35 to 40 minutes perhaps of cross-examination. We'll have a break and resume in 10 minutes. Thanks.

35 **HEARING ADJOURNED**

**HEARING RESUMED**

40 MS McMURDO: Yes, LCDR Gracie.

<CROSS-EXAMINATION BY LCDR GRACIE

5 LCDR GRACIE: Ma'am, I've advised Counsel Assisting that I'd like to take 10 minutes, if I may?

10 Mr Grant, my name's LCDR Malcolm Gracie. I represent the interests of CAPT Dannie Lyon of Bushman 83. Could I ask you to turn to – I think it's the Minute and report which is Exhibit 173. I apologise if my exhibit-taking is a little bit out, but I think it's 173. That's the Minute under cover of your signature of 6 September '23. It's your tab 1; it's my tab 7.

MR GRANT: Yes.

15 LCDR GRACIE: So there's bound to be some confusion, for which I apologise. So take your time and if I take you to the wrong parts of things, just hold me up. Can I ask you to just firstly have a look at page 4?

20 MS McMURDO: So I think that's Exhibit 174. Have I got that right?

LCDR GRACIE: Thank you, ma'am.

MS McMURDO: Page 4, did you say?

25 LCDR GRACIE: Yes. It's always good to have a junior to blame for that, but I have to take the rap, sorry. You see that there's some references there to the "hydraulic pump 2, low pressure; pump 1, pressure low" – "low pressure", however it reads – and the other items.

30 MS McMURDO: Sorry, whereabouts is this?

LCDR GRACIE: Page 4.

35 MS McMURDO: Page 4, yes.

LCDR GRACIE: Sorry, at about point 7 on the page.

MS McMURDO: Yes, got it.

40 LCDR GRACIE: I think you said that it was not followed up by DSTG, and Airbus weren't queried about that. Is that - - -

MR GRANT: As far as I know.

LCDR GRACIE: Did anyone provide you with any expert assistance in relation to significance or otherwise of those indications?

5 MR GRANT: The only thing – no assistance given, no. We noted that on the CVR there was no reference made to it. Whereas references are made to other little points that occur in the flight – ice detection fails and the like.

LCDR GRACIE: Do you know what a mission tactical computer is?

10 MR GRANT: Not really, no.

LCDR GRACIE: I just saw a reference to “MTC” and “mission tactical computer warnings” in some of the cockpit voice recordings. Did you follow that up at all?

15 MR GRANT: No.

LCDR GRACIE: Can I take you to the next page, page 4, and I know the Air Vice-Marshal touched on this, but I just want to see from a technical point of view, with your expertise. Can you reconcile that last plunge in the pedal inputs, which you can see on the very right of Figure 1, if it is possible to do it? But I didn’t think – that’s all right. Do you see where you’ve indicated there that the vertical trace marks mark the beginning of abrupt pedal input?

25 MR GRANT: Yes.

LCDR GRACIE: When you were taken by Counsel Assisting to the other figures which show various inputs which – am I correct in understanding that they don’t quite align with what’s shown in Figure 1?

MR GRANT: I’m not sure if they do or they don’t align. I’d have to sort of look at the scale that we’ve got here on this diagram and the scale that’s used on the reconstruction. Sometimes things that look big and significant on the data plotter don’t look as significant on the – and sometimes it’s just scale-related or – yes.

LCDR GRACIE: All right, okay.

40 MR GRANT: Yes. You know, it’s – yes.

LCDR GRACIE: Figure 1 is data from Airbus, isn’t it, I think you said?

MR GRANT: No, Figure 1?  
45

LCDR GRACIE: Yes.

MR GRANT: Figure 1 is from our data plotter.

5 Lcdr GRACIE: Your data plotter?

MR GRANT: Yes, the GRS data plotter.

10 Lcdr GRACIE: Now, I just want to go to page 7 and these are just exploratory questions. I'm not suggesting anything one way or the other, I'm just trying to get a better understanding of things. You've talked about, at the second line there:

*Aircraft 3 begins to climb out of formation –*

15

and then you provide some commentary. But, if I'm reading it correctly, you say:

*Aircraft 2 –*

20

if you run down into the paragraph –

*has momentarily increased speed at this time.*

25 MR GRANT: Yes.

LCDR GRACIE: So there's a correlation between aircraft 2 increasing its speed and the time at which aircraft 3 begins to climb out of the formation.

30 MR GRANT: Yes.

LCDR GRACIE: What I want to ask is this: do you know what speed aircraft 2 increased from and to?

35 MR GRANT: I can't tell you now, on here. I could certainly look at the data and say what it was. I don't remember it being anything significant. It's quite common for aircraft in formation to, you know, suddenly build up a bit of speed. They get behind, they think, in the formation, so therefore they put on the power and put their nose down and  
40 go a bit faster to sort of maintain a position in the formation. So that's why you see quite a bit of variance in the trailing aircraft.

The first aircraft is very flat, very constant speed, but the other 2, 3 and 4 vary quite a bit because their focus is not to maintain speed or as much to  
45 maintain altitude, it's about to maintain a position in formation.

LCDR GRACIE: And just on that position in the formation, tell me if my impression is incorrect, but it seems that 81 is further than two rotor di's ahead of 82 for most of the visuals that we've seen. Would that be right?

5

MR GRANT: I know we did some work on that. DFSB asked for a summary of almost – I'm not sure whether we did the whole flight, but a large section of the flight, and were specifying the actual GPS to GPS separation data for a range of combinations. I don't know if we did all, but we did 81 to 82, 81 to 83, 82 to 83 and I think, yes, so we provided that information. And my recollection was that the tightest grouping was 81 and 82. They were most consistently, so yes.

10

LCDR GRACIE: Except, do you agree with the impression I had that 81 and 82 - - -

15

MR GRANT: Weren't necessarily always two to three rotor di?

LCDR GRACIE: Yes.

20

MR GRANT: Yes.

LCDR GRACIE: But in the case of 84, and I think the cockpit voice recording, they talked about six to seven?

25

MR GRANT: Yes, 84 was well back.

LCDR GRACIE: Well back?

30

MR GRANT: Yes.

LCDR GRACIE: And you've made a comment in relation to the possibility of the crossing in front and increased speed leading to a perception that 82 and 83 were sufficiently close to warrant some evasive action as a possibility.

35

MR GRANT: Yes. At the time of the preliminary flight path reconstruction we did – without the CVR, there was, it seemed, a plausible thing or something that maybe again might have happened in the cockpit. Maybe it was a perception. It could have just been a perception that 3 was closer to 2, but when we had the CVR, we didn't hear any comment of, "Oh, you know, 82 is really close", or "He cut me off", or something. You know, so - - -

40

LCDR GRACIE: Can you explain – and if you can't, please don't worry – but can you explain why aircraft 2 has to increase its speed by making a – is it a tighter turn to the left?

5 MR GRANT: Yes, so 82, if you can imagine, is the furthest on that  
circumference of that circle in the turn. So, yes, it would seem likely they  
might have to – they are essentially flying a longer distance because they're  
on the outside of the circle. So they might have to increase the speed. He  
might have, just as a matter of course, being the outside aircraft, increased  
10 airspeed to maintain – again maintain that position in the formation.

LCDR GRACIE: And it might be that I have the colours wrong, the copy  
is not great, but if I look at Figures 2 and 3, I understand that Bushman 83's  
flight path is inside and isn't it the most external line then?  
15

MR GRANT: Sorry, no, the 82 is the dark blue, and it is the outside.

LCDR GRACIE: Yes.

20 MR GRANT: And then 81 is – so from right to left, for most of the  
formation we have 82, 81, 83 and then 84.

LCDR GRACIE: Can I suggest next time, maybe use pink.

25 MR GRANT: Yes, sure.

LCDR GRACIE: Okay, I think I've understood it. But does it mean that  
if 2 has tightened its turn and momentarily increased its speed and come  
across perhaps in front of - - -  
30

MR GRANT: Yes, possible. Yes, that's another alternative.

LCDR GRACIE: - - - 83 that it's come out of formation?

35 MR GRANT: That it's – no, I wouldn't say that. I would say that 82 is  
still maintaining its station on 81.

LCDR GRACIE: On 81?

40 MR GRANT: Yes.

LCDR GRACIE: So your possibility is that 83 has come across to the  
right?

45 MR GRANT: Yes. But there's nothing untoward about that. My

understanding is the reason you maintain those stations is so that the guy behind can swing in that arc of two or three rotor di's or what is prescribed for that mission. But they're allowed to move. It's not - - -

5 LCDR GRACIE: Yes. We've heard it called the arc of freedom.

MR GRANT: Yes, sure.

10 LCDR GRACIE: So we've got 82 increasing speed, crossing in front of aircraft 3, just prior to the climb. Now, at the point of the climb, what are the factors that, taking into account in the data analysis in terms of that climb, is it the speed of the climb, is it the collective, the cyclic? What were you mainly looking at?

15 MR GRANT: Yes, we made a comparison of the climb rate used in that climb relative to the take-off and it was then thereabouts. So it wasn't like an excessively aggressive climb. It wasn't like an excessively – or a very slow climb. It was a moderate climb. That's why we used that language, "moderate".

20 LCDR GRACIE: And then we have a levelling.

MR GRANT: Yes.

25 LCDR GRACIE: If you run over to page 9, at 12:36:19 you say:

*Aircraft 3's flight path has crossed over aircraft 2.*

There seem to be two factors in that.

30 MR GRANT: Yes.

LCDR GRACIE: One is the speed of 82 and the second is you see that the speed of – sorry, the speed of 83, I should have said, which is increased.

35 MR GRANT: Yes.

LCDR GRACIE: And a reduction in the speed of 82 to 74 knots.

40 MR GRANT: Yes. That would be a momentary thing. Like, I said, they sort of – 82 is not looking at 83, 82 is concerning himself with the position of 81.

45 LCDR GRACIE: 81, correct.

MR GRANT: So he may have slowed down, sped up, yes.

LCDR GRACIE: Or that distance has increased between 81 and 82, but we don't know what that is.

5

MR GRANT: Yes.

LCDR GRACIE: And you've made a comment on – sorry, I didn't quite get the name, but you said you had an SME – subject matter expert – engineer assist you. Was it Reece someone?

10

MR GRANT: Reece Leeman, yes.

LCDR GRACIE: Can you say that name again?

15

MR GRANT: Reece Leeman.

LCDR GRACIE: Leeman, okay. And - - -

20

MR GRANT: I can provide his notes - - -

LCDR GRACIE: No, that's all right. It was more to do with the fact – I thought you said he wasn't very interested in, I thought you said "attitude" or - - -

25

MR GRANT: No, he doesn't have attitude.

LCDR GRACIE: No, or roll or something. You said he was more interested in something.

30

MR GRANT: Yes, he took more of an interest in the pitch and the roll behaviour.

LCDR GRACIE: Right.

35

MR GRANT: And when we asked about, "Does this, you know, use of rudder look a bit odd?" and he goes, "Oh, not really, it depends on what it actually means in terms of what it might be changing in the terms of attitude", but he didn't seem to be particularly concerned.

40

LCDR GRACIE: And was that to do with the time at which there was a left and right banking of 83?

MR GRANT: This was the rudder input, rudder pedal input.

45

LCDR GRACIE: Thank you. And you also mentioned – this is at the bottom of page 4 – sorry, it was in the context of questions being asked at the bottom of page 4, you said that you were given some assistance from an MRH pilot in relation to some of these - - -

5

MR GRANT: Yes.

LCDR GRACIE: Who was that?

10 MR GRANT: That was the Investigator in Charge, CMDR Dom Cooper.

LCDR GRACIE: Cooper, and anyone else in terms of MRH flying - - -

15 MR GRANT: Yes, Sarah Rosier, I think had experience. I'm not sure if it was MRH-90, but she was an Army pilot.

LCDR GRACIE: I'll just check my notes. I don't – look, there was one other thing. I'm sure we probably can't get that either, but Exhibit 176 was the field of regard.

20

MR GRANT: Yes.

LCDR GRACIE: And there were two white lines cutting through the blue – I'm sorry, I don't have a copy of it but - - -

25

MR GRANT: Yes.

LCDR GRACIE: Thank you. You see the – it's Exhibit 176. I think I've got that right. You see that there's some intersections of white in between the blue.

30

MR GRANT: Yes.

LCDR GRACIE: Is that to do with the cockpit window struts or something like that?

35

MR GRANT: Yes, that's the window frames – the effect of the window frames.

40 Lcdr GRACIE: And so that would explain one of the images that we saw up there where 82 was often obscured by that strut. Is that the - - -

MR GRANT: Yes.

45 Lcdr GRACIE: I'm just pointing at that lower of the two lines.

Almost intersection with 82.

MR GRANT: Yes, correct. That is the junction of two window frames.

5 LCDR GRACIE: And then the vertical line that runs up from that red 82, is that the top of the cockpit, or what's that? Or is that the cowling? What is it?

10 MR GRANT: So where, in an image, where 81 and 82 are, that blue area is the windshield that they can see, plus what's not being obscured by the, I guess, front of the cockpit, the front nose cone. And the rest is the window frames out to the left on that image. It's the effect of the window frames.

15 LCDR GRACIE: And if it's raining, in terms of there being some sort of a degraded visual environment, if you're over 80 knots, you can't use the windscreen wipers, can you?

MR GRANT: I don't know. I don't know.

20 LCDR GRACIE: Do we know if they were on?

MR GRANT: My experience, at 80 knots you've usually got enough slipstream to push - - -

25 LCDR GRACIE: To clear it.

MR GRANT: Yes, push the rain away.

30 LCDR GRACIE: Okay, thank you. Those are my questions, thank you ma'am, sir.

MS McMURDO: Thank you, LCDR Gracie. LCDR Tyson.

35 **<CROSS-EXAMINATION BY LCDR TYSON**

LCDR TYSON: Thank you, ma'am.

40 Mr Grant, my name is LCDR Matthew Tyson. I appear for the interests of CPL Alex Naggs. The first topic I want to ask you about is the RADALT hold function on Bushman 83. So you recall, don't you, there's a portion of the transcript where there's a conversation along these lines, "All right, engage RADADLT for me, mate", and then the co-pilot says, "Engaged",

and then about a minute later on the pilot says, "See how that RADALT can really be useful, mate"? Do you recall that?

MR GRANT: Yes.

5

LCDR TYSON: And you interpret the reference to the RADALT there as an abbreviation for RADALT hold. Correct?

MR GRANT: That's correct.

10

LCDR TYSON: Now, apart from that conversation, did you see evidence that the RADALT hold function was, in fact, engaged?

MR GRANT: The engagement that I used was the flight data recording when the integer turns to 15, that is the Flight Control System using the collective mode to command a hold on the RADALT.

15

LCDR TYSON: So you did see evidence in terms of the data that you recovered that showed that it was engaged?

20

MR GRANT: It was engaged at that time.

LCDR TYSON: And then - - -

25

MR GRANT: And it matched the time on the CVR.

LCDR TYSON: And I might've missed this, so correct me if I'm wrong, but I don't think in the sequence you suggest it was ever disengaged. Is that correct?

30

MR GRANT: No, I didn't. But, yes, you are correct. It was in the descent for Bushman 83 the RADALT was disengaged and that occurred about three or four seconds prior to the last data time step.

35

LCDR TYSON: So you haven't done an exercise in any of your simulations of showing the point when it was disengaged. That is correct, isn't it?

40

MR GRANT: I wasn't asked to do 83 by the Inquiry. I was asked to do 81, 82 and 84. But I did do 83 as well.

LCDR TYSON: I'm not, in any way, criticising. I'm just trying to work out the status of it. But that is an exercise that you could do, isn't it? You could interweave into your analysis the point when the RADALT hold was disengaged. Correct?

45

MR GRANT: Yes.

5 LCDR TYSON: And did you see any evidence for the portion of the flight sequence when the RADALT hold was engaged, is there any correlation between that and a leg of the flight where you can see that Bushman 83 was actually held at a constant altitude?

10 MR GRANT: Yes. You can see that the altitude and the RADALT does move up and down, yes. The reason that occurs is because of the continual changes in maintaining station in formation that the pilot has to – he needs to speed up. For example, he needs to add collective, he needs to put the stick forward. Those things still happen in order to maintain station.

15 LCDR TYSON: So you can actually - - -

MR GRANT: The RADALT can still be on, yes.

20 LCDR TYSON: And you can manually override it?

MR GRANT: Yes. I would probably ask an MRH pilot how exactly that's done. I've heard how it is done but, yes, it's a matter of clutching, de-clutching the collective so that the RADALT hold is temporarily disconnected. You then reset the power and then it's held again.

25 LCDR TYSON: And can you see evidence though in the flight sequence of the period when the RADALT hold was engaged and then some, what, manual overriding of it and then a period when it's disengaged?

30 MR GRANT: No. No, we don't get that information. All we get is the RADALT engaged. Like, that the AFCS system is engaging in RADALT. So you're saying when it's clutch/declutched, do we see that, like, drop off suddenly? No, the RADALT is still considered on. It's just - - -

35 LCDR TYSON: There's a period of manual override and then it takes hold again.

40 MR GRANT: Yes. That is not in the flight data recording. We did ask one question, "Is there a channel where you can get what may be the setting when it's clutched and declutched?" Well, what's that setting on RADALT. No, I don't think we could get that channel. I don't think it's a recorded channel.

45 LCDR TYSON: Do you know whether you can tell whether it's the flying pilot or the co-pilot who is manually overriding it or - - -

MR GRANT: No.

5 LCDR TYSON: And you might not be able to answer this either, but when the RADALT hold is engaged, do you actually see the implications of that in terms of the flying controls? For example, do you see less cyclic being used or something like that when RADALT hold is engaged? Does it leave a footprint in terms of the other flying controls?

10 MR GRANT: So the RADALT is only holding the collective axis. So that's the ability to go really up and down. That would mean it would hold that and if speed changed by maintaining that RADALT, then so be it. Because that's the hierarchy, I guess, that it's being – it will hold only the RADALT.

15 LCDR TYSON: Thank you. I just want to ask you a brief question about another topic. So decision height in Bushman 83. So I think you recall some evidence that the higher of the two decision height settings were at 45 feet for Bushman 83?

20 MR GRANT: Yes.

LCDR TYSON: And when you went through the transcript and the voice data recorder, et cetera, did you actually hear the audible warning when 45 feet was reached? Did you hear that at all?

25 MR GRANT: No. No, and I'm not – yes, I didn't hear it in the CVR and it wouldn't – it might be a warning on the flight data recorder, but we didn't get data. The RADALT is 157 at the most last valid time step. And a second after that, the altitude is 67 feet. So it still hasn't passed through 45 feet according to that last second of data.

30 LCDR TYSON: There were some beeps, but you don't know what the actual sound of the warning - - -

35 MR GRANT: In the descent?

LCDR TYSON: - - - is for the decision height, do you? And you didn't look for it or listen for it?

40 MR GRANT: No. We didn't, no.

LCDR TYSON: And is that something that you could do or it's not really possible because of the speed of that last part of the descent?

45

MR GRANT: From the cockpit voice recorder?

LCDR TYSON: Yes.

5 MR GRANT: I definitely don't remember hearing it. So it just cuts out. Like, the flight data recorder, it's sort of lost the last maybe one to two seconds. So I suspect it would be in those last one to two seconds.

10 LCDR TYSON: So it wouldn't be a worthwhile exercise to try to fit into the sequence of events where the audible warning for the 45 feet on the decision height went off?

MR GRANT: It would be so close to the impact. Yes.

15 LCDR TYSON: All right, understood. Thank you. I just want to ask you about another topic now about pedals. Have you got Exhibit 174 with you, Mr Grant? That's tab 1. It's your Minute of 6 September '23.

MR GRANT: Sorry, the Minute, 13 September?

20

LCDR TYSON: No, the one of 6 September, tab 1?

MR GRANT: Tab 1, thanks. Yes, I do.

25 LCDR TYSON: Could you please go, on the first page, to paragraph 3(b).

MR GRANT: Yes.

30 LCDR TYSON: And you see there, in the second sentence, you say:

*There is pilot input of pedal that is noticeably different to the other aircraft in the formation, which continues almost until the end of the flight.*

35

Do you see that?

MR GRANT: Yes.

40 LCDR TYSON: So can I just understand that. So there are two pedals. There's a left and right pedal. Correct?

MR GRANT: Yes.

LCDR TYSON: And the left pedal, what it does, if pressure is applied to that, the aircraft yaws to the left. Correct?

MR GRANT: Yes.

5

LCDR TYSON: And if you press the right pedal, the aircraft yaws to the right?

MR GRANT: Yes.

10

LCDR TYSON: And it doesn't affect pitch or roll of the aircraft, does it?

MR GRANT: I would say it does because in a helicopter all the control inputs are pretty much coupled. So if you make a change in pitch and roll, the one very different thing to a fixed-wing aircraft is you can pitch up in a fixed-wing and you don't necessarily have to add other control inputs. Whereas, for a helicopter you tend to – an input on pitch will have other effects that you have to counteract, from the limited pilot training I've done on helicopters.

15

20

LCDR TYSON: But if you just engage a pedal and the collective and the cyclic stay the same - - -

MR GRANT: Yes.

25

LCDR TYSON: - - - that merely causes the aircraft to yaw. Or is that not right?

MR GRANT: No, you can have another effect, a gyroscopic effect, because it's a helicopter. So, for example, pitching up you have to counteract typically.

30

35

LCDR TYSON: And then I think sir asked you some questions – so you see there, where that sentence I've read to you in Exhibit 174, "There is pilot input of pedal", so is that to be understood as which pedal? Left or right? Or is it to be understood as both pedals?

MR GRANT: The flight data only shows it as a scale between -50 and 50. So if it was – I'll have to check my sense, but if it's negative, it's one side; if it's positive, it's the other side.

40

LCDR TYSON: I confess, I'm not sure I understand that. But see in the preceding sentence - - -

MR GRANT: How about I explain it this way. Zero would be no pedal input. Anything that's negative would be a pedal input from one side. And anything positive would be pedal input from the other side.

5 LCDR TYSON: What with negative corresponding to the left and positive corresponding to the right, or - - -

MR GRANT: I thought so, but – yes. I've got reason to want to go back and check - - -

10

LCDR TYSON: Yes, check that.

MR GRANT: - - - the flight path reconstruction. Whether we got the sense right because we definitely can see that the aircraft is crabbing to the left. That would indicate left rudder to me. Yes.

15

LCDR TYSON: In the preceding sentence, in 3(b), you talk about:

20

*The flight data indicates the aircraft has a lateral acceleration and begins to drift to the right during a turn to the left.*

MR GRANT: Yes.

25

LCDR TYSON: That drift to the right, does that coincide to pedal input?

MR GRANT: I'm not sure how to answer that. I'm not sure. I can tell you what the input is, but – I can tell you where the direction is, but there is definitely that drift to right. So I'm not quite sure how that's achieved. That sounds like it's a combination of control inputs that's achieving that.

30

LCDR TYSON: So when you talk about “lateral acceleration and begins to drift to the right”, that could be a combination of pilot inputs rather than simply, like, pedal?

35

MR GRANT: Correct.

MS McMURDO: So by “combination of pilot inputs”, do you mean inputs from the same pilot or different pilots?

40

MR GRANT: Input from one pilot.

MS McMURDO: One pilot. Thank you.

LCDR TYSON: So then just following the sequence, so that drifting

5 occurred during a turn to the left. Then you talk about after the turn is complete – that’s when you talk about the moderate climb. And if you just go over the page, you say this, you say, “before” – and by all means look at that last sentence on page 1 of your Minute if you need to orient yourself. You say, “before significant banking and pitching motions occur”.

MR GRANT: Yes.

10 LCDR TYSON: So I just want to understand, if I can, that qualifier that you put, “significant”?

MR GRANT: Yes.

15 LCDR TYSON: What is the comparator here? Significant compared to what? For example, is it compared to the other aircraft in the formation? Is it significant compared to what Bushman 83 did earlier? Or is it significant in terms of the four men inside, that they would actually be able to appreciate this and feel it in their body? What do you mean by “significant banking and pitching motions”, please?  
20

MR GRANT: So “significant” being in the racetrack doing 15 degree turns. So I believe it was more than that. That’s, yes, my understanding of – that was why it was significant, it was quite more – one of them is - - -  
25

LCDR TYSON: So generally angle of bank of about 15 degrees - - -

MR GRANT: I thought was, yes - - -

30 LCDR TYSON: But this was a lot more than that?

MR GRANT: Yes.

35 LCDR TYSON: And then you go to your (c) and you talk about the aircraft climbing out of the formation, and then the point where there’s the pitch down.

MR GRANT: Yes.

40 LCDR TYSON: Can you just explain, what are the pilot inputs that cause the aircraft to pitch down and descend?

MR GRANT: The major thing would be the cyclic forward.

45 LCDR TYSON: So that’s physically pushing on the cyclic?

5 MR GRANT: Yes. That, and any possible chance that the – so, essentially, you create a bunt manoeuvre. Momentarily you have air rushing through the main rotor blade. The rotor blade is now no longer gripping the air, so it falls – accentuates the descent. So it could be a momentary loss of lift as well.

10 LCDR TYSON: And, sorry, just going back to my previous question which was about the significant banking and pitching motions – it might follow from your earlier answer – is that also associated with pedal inputs?

MR GRANT: I don't know. I would say it's more cyclic input. What that's trying to achieve, I'm not too sure. Yes.

15 LCDR TYSON: And now excuse the language, but you would have heard something when the recording from 84 was played. You recall there was something said just before the crash of 83. Something like, "He's doing random shit", or something like that. Do you remember that language?

20 MR GRANT: Yes.

LCDR TYSON: Are you able to say, by reference to the sequence of events, where that fits in? For example, does that correspond with your 3(c) on page 2 of your Minute? Is that in that last 17 seconds before impact with the water, or would that be your understanding?

MR GRANT: Yes, it's before the climb.

30 LCDR TYSON: So that's going back to your 3(b)?

MR GRANT: 3(b)?

LCDR TYSON: The 55 seconds before impact with the water?

35 MR GRANT: Yes, I think it refers – the only thing I can see is that from probably where flight path reconstruction actually really helps is that, from the perspective of 84, you can see that 83 moves, you know, backward. So random, it might've been just, you know, not maintaining a good station from their perspective.

40 LCDR TYSON: But that precedes the period of 17 seconds before impact with the water that you talk about at 3(c) on page 2.

45 MR GRANT: Yes.

LCDR TYSON: No further questions, ma'am, sir.

MS McMURDO: Thank you, LCDR Tyson. Yes, who's next?  
Thank you, SQNLDR Thompson.

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**<CROSS-EXAMINATION BY SQNLDR THOMPSON**

10 SQNLDR THOMPSON: Thank you. I'm SQNLDR Thompson.  
I represent the interests of WO2 Laycock. I just have a short number of  
questions for you.

MR GRANT: Sure.

15

SQNLDR THOMPSON: Earlier in your evidence today, AVM Harland  
asked you about the G-force of the helicopter at the point of descent.

MR GRANT: Yes.

20

SQNLDR THOMPSON: Do you remember that earlier today?

MR GRANT: Yes.

25 SQNLDR THOMPSON: And your answer was that as the Bushman 83  
had reached its highest point, and before it started its descent, my  
understanding was that you said that there was 0.02 Gs of force on the  
helicopter at that point, and it was effectively weightless.

30 MR GRANT: Yes.

SQNLDR THOMPSON: So is it the point that you were asked to or of  
your own volition made that calculation of what the Gs were at that point?

35 MR GRANT: I remember looking at it. It stood out because it was the  
opposite of all the other – instead of seeing -1, -0.9, -1.1 we'd see it drop  
and all of a sudden it's positive 0.02. It stands out. Even though it was,  
like, literally one-eighth of a second.

40 SQNLDR THOMPSON: And obviously then, once the Bushman 83  
started its descent, gravity would then start to take effect obviously and Gs  
would increase. Would that - - -

45 MR GRANT: Yes, I assume that, yes, it would. It was only momentary  
and then it would start to increase again, yes.

SQNLDR THOMPSON: And would the Gs increase as the helicopter descended or would they remain constant?

5 MR GRANT: So if the propeller main rotor blade digs in, starts creating lift again, then yes, the G – we could return to straight and level flying of 1 G, yes.

10 SQNLDR THOMPSON: Did anyone calculate the G-forces on Bushman 83 during its descent to the water?

MR GRANT: Wouldn't have to. There is a channel on the flight data recording that would say that, yes.

15 SQNLDR THOMPSON: It has that?

MR GRANT: Yes. The G-force in the longitudinal axis, the G-force in the lateral and, yes, G-force in the normal. Yes.

20 SQNLDR THOMPSON: So that's something that would be available?

MR GRANT: Yes.

25 SQNLDR THOMPSON: I'll take you back a short point of time where Bushman 83 is at that point of weightlessness, at its maximum height.

MR GRANT: Mm-hm.

30 SQNLDR THOMPSON: As it starts its descent, what effect would that have on any person or object that's within Bushman 83 and unrestrained?

MR GRANT: They would be going up.

35 SQNLDR THOMPSON: They would go up?

MR GRANT: Yes.

SQNLDR THOMPSON: In relation to the helicopter coming down?

40 MR GRANT: Yes. If you have something loose on the dash, it would go up, yes.

45 SQNLDR THOMPSON: And is it possible to calculate what sort of force would be involved in that?

MR GRANT: Yes, from the – yes.

SQNLDR THOMPSON: Is that something we could obtain from data that's already available, or something that would need to be calculated?

5

MR GRANT: Yes. We could calculate it, yes.

SQNLDR THOMPSON: Those are my questions, thank you.

10 MS McMURDO: With the G-force, a negative G-force of the peak of the rise of 83, if one of the pilots is not strapped in at that time, how would that affect that person?

MR GRANT: Yes, he would feel possible - - -

15

MS McMURDO: He would rise out of his seat?

MR GRANT: Yes. Yes, if he's not secured properly.

20 MS McMURDO: And what about in the rear, if the aircrew are on tether? So they're not harnessed into their seats, they're on tether. Do you know what I mean?

MR GRANT: Yes.

25

MS McMURDO: How would they be impacted at that point?

MR GRANT: Yes, they'd probably go up as well if they're not secured.

30 MS McMURDO: They'd move upwards?

MR GRANT: Yes.

MS McMURDO: Yes. Anything arising out of that?

35

SQNLDR THOMPSON: No, nothing arising.

MS McMURDO: Thank you. Yes.

40 SQNLDR CASHA: Casha.

MS McMURDO: Yes, SQNLDR Casha.

**<CROSS-EXAMINATION BY SQNLDR CASHA**

5 SQNLDR CASHA: Thank you. Good afternoon, Mr Grant.  
SQNLDR Ian Casha representing LT Nugent, co-pilot of 83. Did your data  
analysis identify – or can your data analysis identify whether LT Nugent’s  
communication equipment had failed?

10 MR GRANT: No, I don’t think we could – internally? Are you talking  
about the internal communication system or - - -

15 SQNLDR CASHA: Yes. Yes, there’s some information from the  
transcript that he may have lost communication – sorry. Sorry, his  
microphone – when in relation to communication equipment, I mean his  
microphone in his basic helmet.

MR GRANT: We would only be using whether he was speaking on the  
CVR as the test for whether his communication system was working. Yes.

20 SQNLDR CASHA: So there was nothing from, like, the data analysis  
that you were able to determine his microphone wasn’t working?

MR GRANT: No - - -

25 SQNLDR CASHA: Just the audio from the cockpit?

MR GRANT: Yes. Correct.

30 SQNLDR CASHA: Nothing further.

MS McMURDO: Thank you. COL Gabbedy.

**<CROSS-EXAMINATION BY COL GABBEDY**

35 COL GABBEDY: Thank you, ma’am.

I’ll be quick, Mr Grant. I’ve just got a couple of clarification questions.

40 MR GRANT: Sure.

45 COL GABBEDY: I’m COL Nigel Gabbedy. I appear for GEN Jobson.  
In relation to your recreation, you were asked some questions by Counsel  
Assisting in respect to the fact that it didn’t show the weather conditions.

MR GRANT: Yes.

5 COL GABBEDY: It didn't. And it also didn't show the illumination, the IRAPALs on the helicopters in front?

MR GRANT: Absolutely correct. They're not shown, yes.

10 COL GABBEDY: They didn't show the environmental lighting that would've been apparent from the islands they were flying around?

MR GRANT: Yes, no cultural lighting either. No, that's correct.

15 COL GABBEDY: So the intention of that recreation was simply to identify the locations of the aircraft in proximity from each other. It wasn't to show how visible they might be to each other. Is that right?

MR GRANT: Yes, that's correct. Are you talking about the videos, generally, or - - -

20

COL GABBEDY: The videos generally, yes.

MR GRANT: Yes, the videos generally are to provide, yes, a qualitative animation of what is likely to be seen.

25

COL GABBEDY: What you could see, but not what you would actually be able to see because of something that - - -

30 MR GRANT: You may not be able to see something because there is a rain shower in the way, correct. You may not be able to see something because the field of view, for example, of the night-vision device might mean your restricted field of view means you need to be really looking at that specific location at that specific time to see it. We only provide what could be seen.

35

COL GABBEDY: And conversely, you might be able to see something because the IRAPALs show up or you might be able to see something because there's environmental lighting?

40 MR GRANT: That's correct.

COL GABBEDY: All right, thank you. I've nothing further, ma'am.

45 MS McMURDO: Thank you. Yes, Mr O'Mahoney.

<CROSS-EXAMINATION BY MR O'MAHONEY

5 MR O'MAHONEY: Thank you, ma'am.

Sir, my name is O'Mahoney. I appear for Airbus, and I just have a small number of questions for you about a couple of topics. One is, Mr Grant, you've given some evidence about the different controls in the cockpit of  
10 the MRH-90 and, in particular, I think you've indicated there were two cyclics in the cockpit. That's right, isn't it?

MR GRANT: Yes.

15 MR O'MAHONEY: And I think you've answered some questions about whether the data you received was from one or both of those controls.

MR GRANT: Yes, I have answered questions.

20 MR O'MAHONEY: And can you just remind the Inquiry what your answer was?

MR GRANT: The cyclic controls are mechanically connected between the left and the right-hand side of the cockpit. They have separate  
25 inceptors, measure electrical transducers that pick up a change in position of the longitudinal stick and the lateral stick. But there's two systems for both sides of the cockpit.

MR O'MAHONEY: Thank you for clarifying that. That's really what I  
30 wanted to ask you about. As you understand it, tell me if you agree with this. The two cyclics are connected?

MR GRANT: Yes.

35 MR O'MAHONEY: They don't operate independently of one another?

MR GRANT: That's correct. They're - - -

MR O'MAHONEY: But - sorry, I didn't mean to interrupt.

40

MR GRANT: No, it's all right. I'll leave it.

MR O'MAHONEY: Were you about to add to that answer?

45 MR GRANT: I was just going to say, there's two sensors. So - - -

MR O'MAHONEY: Yes.

5 MR GRANT: While connected, there are separate sensors for left and right.

10 MR O'MAHONEY: And that's exactly where I was headed. So although they were, and are, connected, there are separate sensors, aren't there, that allow one who's aware of those sensors to analyse the force or the pressure that was applied to one or other cyclic?

MR GRANT: Yes.

15 MR O'MAHONEY: And have you undertaken that analysis yourself of those sensors?

MR GRANT: No. No, we didn't. We read that from an Airbus report, that they picked up the difference in the pressures there.

20 MR O'MAHONEY: I was going to ask you whether you'd received information as to those sensors and what they yielded?

MR GRANT: Yes, there was a difference.

25 MR O'MAHONEY: And what did you learn?

MR GRANT: Say again?

30 MR O'MAHONEY: What did you learn from that information?

MR GRANT: That you could have different pressure applied by the two columns, yes. And that you would get a difference, but I have no field for what the significance of the difference quoted in that report means.

35 MR O'MAHONEY: Are you able to say anything about the difference itself, the scale of it or otherwise?

40 MR GRANT: I can't remember, offhand. I think it was in per cent. I'd have to refer to the report.

45 MR O'MAHONEY: And does it accord with your knowledge, courtesy of what you've described as to the cyclics being technically connected, that in effect if in a hypothetical scenario where force is being applied to each in different directions, in effect, the strongest applier of force will prevail in terms of governing the control?

MR GRANT: That would make sense, yes.

5 MR O'MAHONEY: And just so I'm clear on this, have you undertaken yourself any analysis of any countervailing force or energy and what its impact might be for present purposes?

MR GRANT: No.

10 MR O'MAHONEY: Thank you. And just another topic, very quickly. As to the RADALT decision heights, I think you made it clear that for the pilot of Bushman 83 it was set at 45 feet?

MR GRANT: Yes.

15

MR O'MAHONEY: And for the co-pilot at zero.

MR GRANT: Yes.

20 MR O'MAHONEY: That setting at a level of zero, does it accord with your knowledge that that is, in effect, equivalent to that warning mechanism being deactivated?

25 MR GRANT: I don't know if it's the default or not, but it could possibly be that though. But if it's not set, the value shown would be zero.

30 MR O'MAHONEY: Thank you. And in terms of your analysis as to the speed of Bushman 83, I think in the lead-up – the immediate lead-up to the accident, did you record that it was travelling at between, say, 92 and around 137 knots?

MR GRANT: Yes, that's correct.

35 MR O'MAHONEY: And that equates to – tell me if you agree with this – around – just focussing on kilometres an hour – something in the order of 170 kilometres an hour to around 250? I'm not putting you on the spot.

40 MR GRANT: Yes, I must admit I don't – it would be higher, yes. I'd need a calculator to - - -

45 MR O'MAHONEY: And I'm just wondering in that context if, as you understand it, the decision height mechanism that that 45 feet or whatever level of feet is applied, that that was the trigger for a particular warning that sounded.

MR GRANT: That's correct, yes.

MR O'MAHONEY: And the warning sounded once the aircraft hit that particular height or level.

5

MR GRANT: Yes, once it, yes, descends below that level.

MR O'MAHONEY: Did you, in the course of your analysis, form any view about what assistance, say, a 45-foot decision height warning would provide to a pilot flying at 170 or 250 k's an hour?

10

MS McMURDO: In a downward direction.

MR GRANT: Yes. Not very much.

15

MS McMURDO: Not very much, no.

MR O'MAHONEY: I don't have any further questions. Thank you very much.

20

MS McMURDO: Thank you. Any other applications to cross-examine? Any re-examination?

FLTLT ROSE: No.

25

MS McMURDO: No.

Thank you very much, Mr Grant. We really appreciate the assistance you've given to the Inquiry in preparing the material and coming here today and explaining it to us. We know it must have been – well, we know a huge amount of work has gone into it, but also very difficult for you in giving evidence today about these matters. And please remember that there is assistance available, and you should avail yourself of it if it's going to assist you. Thank you.

30

35

MR GRANT: Sure.

MS McMURDO: You're free to go now. Thank you very much.

40

**<WITNESS WITHDREW**

MS McMURDO: So that's all the evidence we're hearing today, which is - - -

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FLTLT ROSE: That's correct.

5 **PRIVATE HEARING SESSION CONCLUDED**

**(Continued in Public Inquiry Hearing Session)**