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Official Report Provides No Conclusions About Cause of SilkAir B-737's Fatal Plunge from 35,000 Feet

Report by Indonesian investigators cited lack of data and rejected U.S. National Transportation Safety Board suggested conclusions that the airplane's descent was caused by intentional, sustained manual flight control inputs that most likely were made by the captain.

FSF Editorial Staff

At 1613 local time Dec. 19, 1997, a SilkAir Boeing 737-300 descended from Flight Level (FL) 350 (35,000 feet) and struck the Musi River 30 nautical miles (56 kilometers) north-northeast of Palembang, South Sumatra, Indonesia. The 104 occupants were killed. Daylight visual meteorological conditions prevailed. The cockpit voice recorder (CVR) and the flight data recorder (FDR) had stopped recording before the descent began. The crew had not declared an emergency before the descent or during the descent.

The Indonesian National Transportation Safety Committee (NTSC), in its final report on the accident, said, "Given the limited data and information from the wreckage and flight recorders, the NTSC is unable to find the reasons for the departure of the aircraft from its cruising level of FL 350 and the reasons for the stoppage of the flight recorders.

"The NTSC has to conclude that the technical investigation has yielded no evidence to explain the cause of the accident."

The airplane was being operated as SilkAir Flight MI 185, a scheduled passenger flight from Singapore to Jakarta, Indonesia, and back to Singapore.

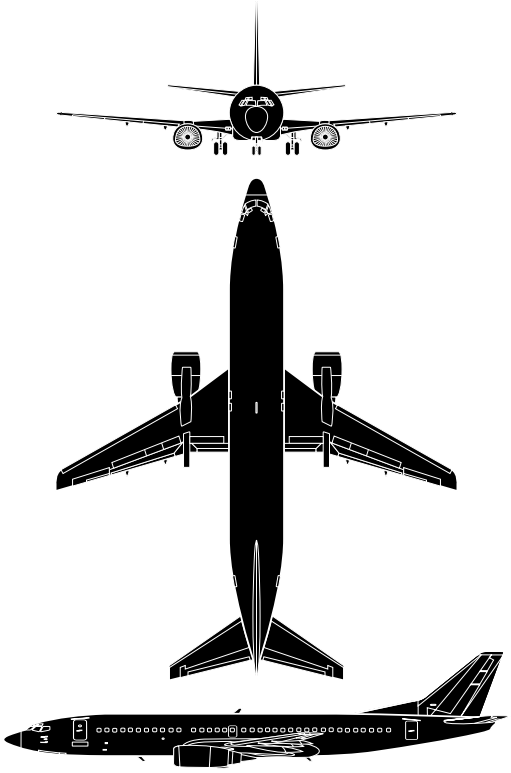
The captain, 41, was the pilot flying. He had an airline transport pilot license (ATPL) and 7,173 flight hours, including 3,615 flight hours in type. Before he was employed by SilkAir in March 1992, the captain was a pilot in the Singaporean air force and a member of the air force Black Knights flight demonstration team.

He was appointed a B-737 captain by SilkAir in January 1996 and completed training to become a line instructor pilot in May 1997.

"On 3 July 1997, SilkAir wrote to the [captain] to advise him of his de-appointment as [a line instructor pilot] following a company inquiry into an operational incident that occurred on 24 June 1997," the report said.

The incident involved pulling the CVR circuit breaker.

"For non-technical reasons, the [captain] infringed a standard operating procedure, i.e., with the intention to preserve a conversation [with his first officer, the captain] pulled out the CVR circuit breaker, but the [captain] reset the circuit breaker in its original position before the flight," the report said. "This was considered a serious incident by [SilkAir] management,



Boeing 737-300

The Boeing Co. in 1965 announced the decision to build a short-range, twin-turbofan transport. The aircraft, designated the 737, was designed to use many components and assemblies from the tri-engine B-727. The first B-737 flew in April 1967, and deliveries of the first production model, the B-737-200, began before the end of 1967.

Boeing in 1980 announced plans to build the B-737-300, a larger version that would accommodate more passengers and baggage, and have quieter and more fuel-efficient engines. Fuselage plugs were installed forward of the wing and aft of the wing carry-through structure to increase length by 8.7 feet (2.7 meters). The airplane can accommodate 128 passengers to 149 passengers and 1,068 cubic feet (30.2 cubic meters) of freight, compared with accommodations in the B-737-200 for 115 passengers to 130 passengers and 875 cubic feet (24.8 cubic meters) of freight.

The Pratt & Whitney JT8D-9A engines, each producing 14,500 pounds thrust (64.5 kilonewtons), on the B-737-200 were replaced with CFM International CFM56-B engines, each producing 20,000 pounds thrust (88.97 kilonewtons) on the B-737-300.

The prototype made its first flight in February 1984, and deliveries of production B-737-300s began in November 1984. Maximum standard takeoff weight is 124,500 pounds (56,473 kilograms). Maximum landing weight is 114,000 pounds (51,710 kilograms).

Maximum operating speed is Mach 0.84. Maximum cruising speed at an average cruise weight of 100,000 pounds (45,360 kilograms) at 33,000 feet is 462 knots (856 kilometers per hour [kph]). Economy cruising speed at 33,000 feet is Mach 0.73. Stalling speed in landing configuration at 103,000 pounds (46,720 kilograms) is 102 knots (189 kph).

Source: *Jane's All the World's Aircraft*

and the [captain] was relieved of his [line instructor pilot] appointment."

The conversation was about a flight that the captain and first officer had made together on March 3, 1997, and had resulted in a go-around that was being investigated by SilkAir. The report said that the captain pulled the CVR circuit breaker to preserve the conversation "as evidence for the ongoing investigation" but then decided to reset the circuit breaker before takeoff.

The captain had been involved in securities trading since 1990. The report said that his net worth decreased from 1994 to 1996 and increased "marginally" in 1997.

"The [captain's] trading activities were stopped on two occasions due to the non-settlement of his [securities-trading] debt," the report said.

His trading activities were stopped from April 9, 1997, through Aug. 15, 1997, and again on Dec. 9, 1997.

"On the morning of 19 December 1997, the [captain] promised … to make a payment when he returned from his flight," the report said. "The [captain] had several loans and debts at the time of the accident. The [captain's] (and immediate family's) monthly income was calculated to be less (about 6 percent) than their monthly expenditure at the time of the accident."

The captain had several insurance policies that provided benefits in the event of his death. The report said that most of the policies were acquired many years before the accident. He was in the process of acquiring a mortgage-insurance policy when the accident occurred.

The captain's family said that his behavior and activities were normal in the days preceding the accident.

"The [captain] was reported to have slept and eaten normally," the report said. "There were no reported changes in his recent behavior. He was organizing his father's birthday party that was planned for 21 December 1997."

The first officer, 23, had a commercial pilot license and 2,502 flight hours, including 3,212 flight hours in type. Before he was employed by SilkAir in September 1996, the first officer studied aviation at Massey University, New Zealand, in 1992 and 1993, and then flew as a B-737 first officer for Garuda Indonesia.

"Other SilkAir pilots described him as an above-average pilot with very good [airplane] handling skills," the report said. "Command trainees sought after the [first officer] to be a support pilot during training because of his skills and good situation awareness. He was described as someone who was professional, followed procedures and was willing to learn."

The first officer owed money to his parents for initial flight training, but the amount was less than the amount he had accumulated in savings.

"There were no specified repayment terms," the report said. "He was reported to be saving money to further his flight training to qualify for an ATPL."

Associates and friends said that the first officer's activities and behavior were normal in the days preceding the accident.

"On the morning [of the accident], two engineers who knew the [first officer] socially talked with him when the aircraft was being prepared for departure from Singapore," the report said. "They made plans to meet that night. They reported that the [first officer] appeared to be normal and in good spirits."

The captain and the first officer flew together on seven flight sequences in the year preceding the accident.

"The investigation found no evidence to indicate that there had ever been any difficulties in [their] relationship," the report said.

The accident airplane was manufactured in February 1997. At the time of the accident, the airplane had accumulated 2,239 airframe hours and 1,306 airframe cycles, all during operation by SilkAir.

SilkAir (formerly called Tradewinds) is a subsidiary of Singapore Airlines. At the time of the accident, SilkAir operated six B-737s and two Fokker F70s, and employed about 60 pilots and 150 flight attendants.

The report said that the first leg of the accident flight, from Singapore to Jakarta, was normal.

"After completing a normal turn-around in Jakarta, the aircraft departed Soekarno-Hatta International Airport [at 1537] for the return leg," the report said.

The flight crew was told by air traffic control (ATC) to climb to FL 350 and to fly directly toward Palembang. The airplane was above 24,500 feet at 1547 when the crew requested clearance to fly directly to PARDI, a reporting point north of Palembang. ATC told the crew to continue flying directly to Palembang and to report reaching FL 350.

At 1553, the crew reported reaching FL 350 and was cleared by ATC to fly directly to PARDI. The crew conducted the cruise portion of the flight at 0.74 Mach.

At the time, most of South Sumatra was covered partially by cumulus clouds, altocumulus clouds and cirrus clouds. The northern part of South Sumatra was covered by cumulonimbus clouds.

The pilot-in-command (PIC) of an airplane en route from Jakarta to Batam at FL 310 (flying approximately two minutes ahead of the accident airplane) said that, because of weather conditions, he requested clearance to fly direct to PARDI.

The PIC of an airplane en route from Jakarta to Singapore at FL 410 (flying approximately eight minutes behind the accident airplane) said that the weather was good, except for a few isolated thunderstorms about 10 nautical miles (19 kilometers) east of the flight track near Palembang.

"He also reported that no turbulence was encountered during his flight, except for the last 5,000 feet of the descent into Singapore," the report said.

The transcript of the CVR recording (see Appendix, page 7) showed that at 1604:55, the captain said, "go back for a while, finish your plate." The report said that this statement indicated that the captain intended to go to the passenger cabin and that he wanted the first officer to finish eating a meal that had been served by a flight attendant. Five seconds later, the captain offered the first officer "some water."

After the CVR stopped recording, the airplane continued flying at FL 350 for six minutes and 56 seconds.

"At about the same time, several metallic snapping sounds were recorded," the report said. "Analysis of the recording indicated that the metallic snapping sounds were made by a seat-belt buckle striking the floor."

Thirteen seconds later, at 1605:15, the CVR stopped recording. The airplane continued flying at FL 350 for six minutes and 56 seconds.

A transcript of recorded air-ground communications showed that at 1610:18, ATC told the crew that the airplane was abeam Palembang and to contact Singapore Control upon reaching PARDI.

Voice-spectrum analysis showed that the first officer acknowledged the instruction at 1610:26. No further radio transmissions from the crew of Flight MI 185 were recorded.

The FDR stopped recording at 1611:37. Jakarta ATC radar records showed that the accident airplane was at FL 350 at 1612:09.

"The next radar return, eight seconds later, indicated that MI 185 was 400 feet below FL 350, and a rapid descent followed," the report said. "The last recorded radar data, at [1612:41], showed the aircraft at FL 195."

The report said that the airplane's descent trajectory was "extreme" and that parts of the empennage separated, possibly because of aerodynamic flutter, "at a low altitude near [12,000 feet] or below 12,000 feet, while the aircraft was flying at a

high Mach number." The estimated descent speed exceeded 1.2 V_D [1.2 times the airplane's design dive speed].

Portions of rudder skin, sections of the elevators and the outboard sections of the horizontal stabilizers were found on land. The furthest piece of wreckage was found about four kilometers (two nautical miles) from the accident site.

"Except parts of the empennage found on land, most of the wreckage was found buried in the bottom of the Musi River," the report said. "About 73 percent by weight of wreckage was recovered."

The river was about 700 meters (2,297 feet) wide and eight meters (26 feet) deep at the accident site. Most of the aircraft wreckage was found in an area measuring about 60 meters by 80 meters (197 feet by 263 feet).

"Recovery of the wreckage was extremely difficult due to the poor visibility in the water and the fact that a lot of the wreckage had settled and got buried in the mud at the bottom of the river," the report said. "Moreover, there was also a strong tidal current flow.

"Wreckage recovery during the early phases of the recovery operation was done manually by divers from the Indonesian [navy] and Singapore [navy]. The divers had to search for the wreckage by touch and use ropes to bring it to the surface. After a two-week period, dredging was employed for the recovery operation."

The flight deck instrument panels and circuit-breaker panels were not recovered. Few human remains were recovered; investigators made six positive identifications of airplane occupants.

Tests conducted on the CVR failed to show why the unit stopped recording about seven minutes before the airplane began descending from FL 350.

"The CVR stoppage could have occurred due to a malfunction of the unit, itself, or a loss of power to the unit," the report said. "The loss of power to the unit could [have been caused by a] power interruption to the electronics bus that supplied power to the CVR, a short circuit or overload, CVR circuit breaker pulling or a break in the wiring."

Examination of the CVR by the manufacturer showed that the unit was functioning properly. The electronics bus that supplied power to the CVR continued to supply power to other systems, including the FDR, after the CVR stopped recording.

"Had there been an overload or short circuit, the resultant popping of the CVR circuit breaker in the cockpit would have been recorded as a unique and identifiable sound signature by the CVR," the report said. "There was no such sound signature in the MI 185 CVR recording. This indicates that … no short circuit or overload [caused] the CVR circuit breaker to pop out."

Tests showed that the CVR sound signature associated with manual pulling of the CVR circuit breaker is obscured by ambient noise on the flight deck.

"From the limited quantity of wiring recovered, it could also not be determined if a break in the wiring had caused the CVR to stop," the report said. "Thus, the cause of the CVR stoppage could not be concluded."

The report provided no conclusion about what might have caused the FDR to stop recording. The FDR stopped recording about six minutes and 18 seconds after the CVR stopped recording and about 35 seconds before the aircraft began to descend.

"The FDR stoppage could have occurred due to a loss of power supply [or to a] malfunction of the unit, itself," the report said. "The [cause of] stoppage of the FDR could not be determined from the available data."

The airplane's empennage was reconstructed and examined for indications of an in-flight fire or explosion.

"No such evidence was found or observed," the report said. "However, fractures that were examined exhibited overload characteristics."

FDR data showed that the horizontal stabilizer was trimmed to an average of 4.5 units while the airplane was cruising at FL 350. This trim setting causes a nose-up attitude.

"The horizontal stabilizer jackscrew was found in a position equivalent to a horizontal stabilizer trim position of 2.5 units," the report said. "The difference in the trim positions indicated a change of about 2.0 units (degrees) of the horizontal stabilizer position."

Flight-simulator tests showed that a trim change from 4.5 units to 2.5 units would change the airplane's attitude from nose-up to nose-down and that, without action by the flight crew, the airplane would descend from 35,000 feet to 19,500 feet in one minute, 23 seconds.

"The last five ATC radar points showed a much faster descent of the accident aircraft, i.e., 32 seconds from 35,000 feet to 19,500 feet," the report said. "Therefore, if the simulation was correct, the change of horizontal stabilizer trim position, alone, would not have resulted in the fast descent."

The report said that a horizontal stabilizer trim position of 2.5 units is the maximum nose-down trim position that can be achieved by use of the electric pitch-trim switches on the pilots' control wheels.

Flight simulator tests and computer studies were conducted to determine what might have caused the flight trajectory shown by ATC data recorded during the airplane's descent. The report

said that the results of the flight simulator tests and computer studies were as follows:

- "Any single failure of the primary flight controls, such as hard-over or jamming of aileron, rudder or elevator, did not result in a descent-time history similar to that of the last ATC radar points. In simulations of these flight-control-failure conditions, the aircraft could be recovered to normal flight manually;

- "Any single failure of the secondary flight controls, such as hard-over or jamming of the yaw damper or runaway of the stabilizer trim, would not result in a descent-time history similar to that of the last ATC radar points. In simulations of these flight-control-failure conditions, the aircraft could be recovered to normal flight manually;

- "Manipulation of the primary flight controls without horizontal stabilizer trim would result in a descent-time history similar to that of the last ATC radar points. But this required large control-column-input forces and the aircraft was subjected to a loading exceeding 2g [two times standard gravitational acceleration]. However, if the control-column-input forces were relaxed, in the simulations the aircraft would recover from the steep descent due to its inherent stability; [and,]

- "Among other possibilities, a combination of changing the stabilizer trim from about 4.5 [units] to 2.5 units and an aileron input could result in a descent-time history similar to that of the last ATC radar points. This simulated descent trajectory would result in the aircraft entering an accelerating spiral and being subjected to a loading of less than 2g. Furthermore, the aircraft would continue in the spiral even when the control forces were relaxed. This would result in a descent at a speed exceeding 1.2 V_D, in agreement with the analysis of the breakup of the empennage."

The report said that examination of the airframe wreckage showed that the airplane was structurally intact until parts of the empennage separated during the descent.

"Examination of the recovered passenger oxygen generators revealed no evidence of activation, from which it is concluded that the aircraft did not experience depressurization in flight," the report said.

About 85 percent by weight of both engines, including all major rotating components, was recovered. Examination of the recovered components showed that the engines were operating at high speed at impact and that no in-flight fire had occurred.

Examination of the recovered components showed that the engines were operating at high speed at impact and that no in-flight fire had occurred.

The report said that the findings of the accident investigation were as follows:

- "There was no evidence found of in-flight fire or explosion;

- "From flutter analysis and [from a] wreckage-distribution study, the empennage breakup could have occurred in the range between 5,000 [feet] and 12,000 feet altitude;

- "Examination of engine wreckage indicated that the condition of the engines at impact were not inconsistent with high engine-rotation speed. No indications were found of in-flight high-energy uncontained engine failures. Therefore, the engines were considered to be not a factor contributing to the accident;

- "Examination of the actuators of flight [spoilers] and ground spoilers, trailing[-edge flaps] and leading-edge flaps, as well as engine thrust reversers indicates retracted [positions] or stowed positions of the respective systems;

- "Examination of the main rudder power control unit [PCU] (including the servo-valve), the yaw damper modulating piston, the rudder trim actuator, the rudder trim and feel centering unit, the standby rudder PCU, the aileron PCUs, the elevator PCUs, and horizontal stabilizer jackscrew components revealed no indications or evidence of pre-impact malfunctions;

- "Examination of the 370 kilograms [816 pounds] of recovered electrical wires, connectors and circuit boards showed no indication or evidence of corrosion, shorting, burning or arcing in these wires or parts;

- "The CVR stopped recording at [1605:15.6], and the FDR stopped recording at [1611:33.7]. The examination of the CVR and FDR showed no malfunction of the units. The stoppages could be attributed to a loss of power supply to the units. However, there were no indications or evidence found to conclude on the reasons for the stoppages due to the loss of power. The cause of the CVR and FDR stoppages and the reason for the time difference between the stoppages could not be concluded;

- "The inspection of the aircraft maintenance records did not reveal any defects or anomalies that could have affected the airworthiness of the aircraft or that may have been a factor contributing to the accident;

- "The horizontal stabilizer trim was found to be in the 2.5-units position, which matched the forward limit of the manual electrical trim;

- "Weather and [ATC] were not factors contributing to the accident;

- "Audio spectral analyses [of ATC] communications and the accident CVR indicate that the last communication from MI 185 at [1610:26], occurring at a position approximately abeam Palembang, was performed by the [first officer];

- "The examination of the flight deck noise and sounds concludes that the metallic snap recorded on the CVR was made by a seat-belt buckle hitting against a metal surface;

- "Based on flight simulations, it was observed that the simulated descent trajectory resulting from any single failure of flight control or autopilot system would not match the radar data;

- "Based on the same flight simulations, it was also observed that the trajectory shown by the radar data could have been, among other possibilities, the result of the combination of lateral [control inputs] and longitudinal [control] inputs together with the horizontal stabilizer trim input to its forward manual electrical trim limit of 2.5 units;

- "Both pilots were properly trained, licensed and qualified to conduct the flight;

- "There was no evidence found to indicate that the performance of either pilot was adversely affected by any medical [condition] or physiological condition;

- "Interviews with respective superiors, colleagues, friends and family revealed no evidence that [the] flight crewmembers had changed their normal behavior prior to the accident;

- "There was no evidence found to indicate that there were any difficulties in the relationship between the two pilots either during [the accident flight] or before the accident flight, or [that they] had been experiencing noteworthy difficulties in any personal relationships (family and friends);

- "Until the stoppage of the CVR, the pilots conducted the flight in a normal manner and conformed to all requirements and standard operating procedures;

- "Although a flight attendant had been in the cockpit previously, after the last meal service and until the stoppage of the CVR, there was no indication that anyone else was in the cockpit other than the two pilots;

- "In the final seconds of the CVR recording, the [captain] voiced his intention to leave the flight deck; however, there were no indications or evidence that he had left [the flight deck];

- "Interviews and records showed that in 1997, the [captain] had experienced a number of flight-operations-related events, one of which resulted in his being relieved of his [line instructor pilot] position;

- "The [captain] was involved in stock-trading activities, but no conclusions could be made indicating that these activities had influenced his performance as a pilot; [and,]

- "From the data available to the NTSC, there was no evidence found to indicate if the mortgage policy taken out by the [captain] in connection with his housing loan has any relevance to the accident."

Based on these findings, the NTSC made the following recommendations:

- "The ICAO [International Civil Aviation Organization] FLIREC [Flight Recorder] Panel [should] undertake a comprehensive review and analysis of [FDR] and [CVR] systems design philosophy … . The purpose of the review and analysis would be to identify and rectify latent factors associated with stoppage of the recorders in flight and, if needed, to propose improvements to ensure recording until time of occurrence;

- "To facilitate the recovery of flight recorders after impact into water, a review of flight-recorder design philosophy [should] be undertaken by the equipment manufacturers to ensure that the underwater locator beacons (ULBs) are fitted to the flight recorders in such a manner that the ULBs would not be separated from the recorders in an accident;

- "The ICAO FLIREC Panel [should] recommend [that] aircraft [manufacturers] and equipment manufacturers include recording of actual displays as observed by pilots, in particular for CRT [cathode ray tube] display panels;

- "A review of flight crew training syllabuses [should] be undertaken by aircraft manufacturers to include recovery from high-speed flight upsets beyond the normal flight envelope. The purpose of developing the additional training is to enhance pilot awareness [of] the possibility of unexpected hazardous flight situations;

- "A review of aircraft autoflight systems [should] be undertaken by aircraft [manufacturers] and equipment manufacturers to provide all passenger aircraft with autoflight systems that could prevent an aircraft from

flying beyond the high-speed limit of its flight envelope. Such autoflight systems [should] limit the rate of descent of the aircraft to a certain value that [is] operationally safe; [and,]

- "A regional investigation framework for cooperation in aircraft accident investigations [should] be established to enable fast mobilization of resources and coordination of activities to support those states that do not have the resources and facilities to do investigations on their own."

The NTSC's final accident report included comments by the U.S. National Transportation Safety Board (NTSB), which participated in the investigation. NTSB's comments were based on information that was included in the NTSC's draft final accident report.

NTSB said, "Of greatest concern are the statements in the draft final report that the 'NTSC is unable to find the reasons for the departure of the aircraft from its cruising level of FL 350 and the reasons for the stoppage of the flight recorders' and that the 'investigation has yielded no evidence to explain the cause of the accident.'

"The examination of all of the factual evidence is consistent with the conclusions that no airplane-related mechanical malfunctions or failures caused or contributed to the accident and [that] the accident can be explained by intentional pilot action — specifically:

- "The accident airplane's flight profile is consistent with sustained manual nose-down flight control inputs;

- "The evidence suggests that the [CVR] was intentionally disconnected;

- "Recovery of the airplane [by the flight crew] was possible but [was] not attempted; and,

- "It is more likely that the nose-down flight control inputs were made by the captain than by the first officer."

NTSC, in its final report, said that factual information gathered during the investigation did not support NTSB's conclusions.♦

[FSF editorial note: This article, except where specifically noted, is based on the Indonesian National Transportation Safety Committee's *Aircraft Accident Report: SilkAir Flight MI 185, Boeing B737-300, 9V-TRF, Musi River, Palembang, Indonesia, 19 December 1997*. The 240-page report contains photographs, diagrams and appendixes.]

Appendix
Cockpit Voice Recorder Transcript, SilkAir Flight MI 185, Dec. 19, 1997

[FSF editorial note: The following transcript begins after the captain makes a public-address announcement. The transcript is as it appears in the Indonesian National Transportation Safety Committee (NTSC) report, except for minor column rearrangement and minor editing for consistency and style. All times are local.]

CAM = Cockpit area microphone
RDO = Radio transmission from accident aircraft
-1 = Voice (or position) identified as captain
-2 = Voice (or position) identified as first officer
-3 = Voice identified as flight attendant
* = Unintelligible word(s)
[ ] = NTSC editorial insertion

Time	Source	Content
1546:04	**CAM-1**	I'm back with you.
1546:05	**CAM-2**	okay.
1547:01	**RDO-2**	SilkAir one eight five passing two four zero.
1547:07	**CTR**	SilkAir one eight five, contact Jakarta upper, one three two decimal seven.
1547:13	**RDO-2**	one three two seven, SilkAir one eight five.
1547:21	**RDO-2**	Jakarta, SilkAir one eight seven climbing, passing two five five, two four five correction.
1547:30	**CTR**	SilkAir one eight five, confirm.
1547:31	**RDO-2**	affirm, SilkAir one eight five climbing three five zero, requesting direct Pardi.
1547:38	**CTR**	one eight five stand by direct Pardi, direct papa lima bravo, report three five zero.
1547:43	**RDO-2**	direct Palembang, wilco, SilkAir one eight five.
1547:50	**CAM-1**	*.
1547:52	**CAM-3**	* would you like to have some sandwich.
1547:55	**CAM-1**	drinks ah.
1547:56	**CAM-3**	*.
1547:57	**CAM-1**	tau hueh chui. [soya drink]
1547:57	**CAM-3**	tau hueh chui.
1547:59	**CAM-2**	I'll have an ice lemon tea.
1548:00	**CAM-3**	ice lemon tea, do you want the sandwich too.
1548:03	**CAM-2**	what kind.
1548:04	**CAM-3**	we have egg mayonnaise and chicken *.
1548:08	**CAM-2**	just a couple thanks, nice clear day.
1548:12	**CAM**	[sound of door closing].
1548:16	**CAM-1**	yeah.

1548:33	**CAM-1**	[sound of singing].
1548:49	**CAM-1**	some water, you want?
1548:51	**CAM-2**	ah, fine, thanks.
1549:48	**CAM-1**	just go level change and get up.
1549:50	**CAM-2**	yup.
1549:51	**CAM-1**	so we can go direct Pardi.
1550:17	**CAM-2**	thirty for thirty-five.
1550:52	**CAM-1**	on speaker.
1552:18	**CAM-1**	a thousand to three five zero.
1552:40	**CAM-1**	*.
1552:49	**CAM**	[sound of altitude alert tone].
1553:08	**CAM-1**	*.
1553:15	**RDO-2**	SilkAir one eight five maintaining three five zero.
1553:20	**CTR**	silk one eight five, maintain three five zero, cleared direct to Pardi, report abeam papa lima bravo.
1553:25	**RDO-2**	three five zero, direct Pardi, wilco, SilkAir one eight five.
1553:51	**CAM-1**	that's him behind us.
1553:52	**CAM-2**	yup.
1553:53	**CAM-1**	very fast.
1557:25	**CAM-1**	he'll be ahead of us arriving in Singapore.
1557:28	**CAM-2**	yeah.
1557:28	**CAM-1**	he is, he is speeding, shit.
1557:35	**CAM-1**	at least point eight *.
1557:52	**CAM-2**	he'll be above the weather as well.
1600:48	**CAM**	[sound of door opening].
1600:51	**CAM-3**	tau huey chui.
1600:56	**CAM-1**	thanks.
1601:01	**CAM-3**	I was so busy I keep two pieces of sandwich for him, then this coming in as well [sound of laugh].
1601:12	**CAM**	[sound of door closing].
1604:09	**CAM**	[sound of rustling papers].
1604:55	**CAM-1**	go back for a while, finish your plate.
1604:56	**CAM-2**	I am.
1605:00	**CAM-1**	some water.
1605:01	**CAM**	[sound of several metallic snaps].
1605:03	**CAM**	[sound of snap].
1605:05	**CAM-2**	no thanks.
1605:15.6		[end of recording]

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