AIRCRAFT ACCIDENT REPORT 05/91

Department Civil Aviation Malaysia

Report on the incident to Dupont De Memours Gulfstream II 31 miles of Kota Kinabalu Airport on 04 September, 1991

This investigation was carried out in accordance with
The Civil Aviation (Investigation of Air Accidents) Regulations 1953

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Air Accidents Investigation

Aircraft Accident Report NO. : 05/91

Registered Owner and Operator:		DUPONT DE MEMOURS
Aircraft:	Type and Model:	Gulfstream II
	Nationality:	United States of America
	Registration:	N204C
Place of Accident:	:	31 Nautical Miles South of Kota Kinabalu Airp Lattitude: 05 degrees 22min North Longitude: 115 degrees 59 min East. Height above sea level: 4,180 feet.
Date and Time:		04 September 1991, at 1411 Hours

NOTE : All times in this report are UTC + 8 Hours.

SYNOPSIS

At 1411 hours, on 04 September 1991, a Gulfstream II, registered as N204C belonging to Dupont De Memours crashed on a ridge while executing an intermediate approach to land on runway 02 Kota Kinabalu Airport, Sabah, Malaysia. The aircraft collided with the top of a mountain in the Crocker Range, at a spot height of 4,180 feet, 31 Nautical Miles South of the airfield. The aircraft disintegrated on impact and fatally injured 3 crew and 9 passengers.

The Area Control Centre (ACC) Kota Kinabalu notified the accident to the Chief Inspector of Aircraft Accidents, Department Civil Aviation (DCA) Malaysia on the same day and the investigation began on the following day. The investigation team comprised of an Inspector Incharge and 3 members from the same Department. In addition, a representative each from the National Transport Safety Board, USA and Federal Aviation Authority (FAA), USA, participated as Accredited Representatives in the early stages of the investigation.

The most probable causes of the accident were: the approach controller's decision to descend the aircraft below the minimum sector altitude of 9,500 ft. and the flight crew's failure to examine, discover and object the Air Traffic Controller's cleared altitudes that were below minimum safe sector altitude.

1 FACTUAL INFORMATIONS

1.1 History of the flight

The aircraft, operated by Conoco the current holder of the Certificate of Registration, was on a corporate executive non scheduled flight from Narita, Japan to Jakarta, Indonesia. Kota Kinabalu, Malaysia was its technical stop airport. The aircraft departed Narita in the early morning of the day, on an Instrument Flight Rule (IFR) flight plan to Kota Kinabalu with 9 passengers and a crew of 3. The commander was flying the aircraft and as planned cruised at Flight Level (FL) 430.

At 1334:50 hours, the pilot established radio communication with and informed Kota Kinabalu Area Sector One Controller that they were over reporting position "PR" at time 0525 at Flight Level (FL) 430 and he estimated to be at Flight Information Region (FIR) boundary at time 0544. His next reporting position would be Kudat.

At 1346:06 hours, the aircraft reported entering the Kota Kinabalu FIR to Sector One Controller who shortly thereafter, advised the aircraft to report when the it was ready to descend. The Sector One Controller added that the aircraft was number two in traffic sequence and the expected approach time was 0605 (UTC) for Kota Kinabalu runway zero two.

At 1347 hours, the Sector One Controller advised to the aircraft that the Kota Kinabalu weather was:

Surface wind velocity: 290 degrees 10 knots,
Visibility: 10 kilometers or more, hazy,
Cloud cover: one octas (1/8) at 1600 feet, one octas Cumulonimbus 1700 feet, at North East of the airport,
Regional Barometric Pressure (QNH) setting: - 1009, and
Surface temperature - 31 degrees. Celsius.

At 1350 hours, from the tape transcript, the Sector One Controller coordinated with the Approach Controller and agreed to descend the aircraft to minimum height of 5,000 feet. The Sector One Controller also informed the Approach Controller, "Release contact you passing flight level two five zero (FL 250), estimate zero one, given expected approach time zero five, runway zero two".

After establishing the aircraft was on radial 035 degrees from VJN VOR (a navigational aid located at Kota Kinabalu Airport), the Sector One Controller cleared the aircraft to descend to FL 260. At 51 NM from VJN VOR, the Controller further cleared the aircraft to descend to FL 170.

At 1400 hours, the Controller further cleared the aircraft to descend to FL 150. Shortly after confirming that the aircraft had passed FL 250, the Sector One Controller transferred the control of the aircraft to Approach Control. Immediately

after establishing radio contact on Approach Control frequency of 118.3 Mhz, the Controller instructed the aircraft to maintain FL 150. At about this time, the flight crew asked the Approach Controller whether the Controller wanted them to track outbound on 258 degrees radial or hold over the VJN VOR. The Approach Controller replied and instructed the crew to maintain radial 025 degrees. From the Cockpit Voice Recorder (CVR), both flight crew mentioned to each other "I didn't hear what he said on it" and "I didn't either".

At 1402 hours and on passing the VJN VOR, the flight crew again asked the Approach Controller whether they were to go outbound on radial 258 degrees VJN. Since there were other traffics within Kota Kinabalu area, the Controller told the crew to **descend over the VJN VOR to Nine Thousand Five Hundred feet.** The crew immediately acknowledged that they **understood they were to descend to 9,500 ft'.** The commander remarked " I still did not understand, did he say we could **go outbound on the VJN VOR or did we have to hold".** By then the aircraft had departed the VJN VOR and was already to the South of the airfield. The crew partially missed the instruction by the approach controller to **descend over the VJN VOR.**

At 1404 hours, the flight crew again seek clarification and asked the air traffic controller "We are still uncertain you want us **to go outbound** on the 258 degrees radial or you want us **to hold".** The approach controller responded "N204C **descend South** of the airfield to 9500 now". The crew acknowledged the instruction and made no other remarks regarding the clearance.
At 1406:47 hours, the aircraft descended through 10,000 feet and was further cleared to descend to 6000 feet.

At 1408:16 hours, the Approach Controller asked the crew to report its distance from the field . The Approach Controller after having verified that the aircraft was 21 NM from the field, instructed it to turn inbound after passing four thousands feet. From the Voice Recorder, the First Officer remarked "We are coming close to the hills". At 1410:20 hours the aircraft was passing 4,000 feet, and was at approximately 29 NM from the field. At this calculated point, the aircraft was only 44 seconds or 3 NM from point of impact. The Approach Controller cleared the aircraft to join Final Runway Zero Two and to descend to 2,500 feet.

At 1410:46 hours or 15 seconds before impact the first officer remarked "God' I tell you' and this was followed by the commander's comment "I don't like what we got here I'm climbing this socket out of here". There was an increase in the engine noise in the Cockpit Voice Recorder (CVR).

At 1411:01 hours the sound of impact was recorded. The accident occurred at about 1411.01 hours, on a mountain, 4,180 feet above sea level, about 31 NM from Kota Kinabalu airport. It was also determined that the impact speed was around 221 Nautical Miles per hour.

1.2 Injuries to person

Injuries	Crew	Passengers	Others	Total
Fatal	3	9	0	12
Non Fatal	0	0	0	0
None	0	0	0	0

1.3 Damage to Aircraft

The aircraft was destroyed.

1.4 Other Damage

None

1.5 Personnel Information

The two flight crew members were qualified and certificated in accordance with the existing FAA requirements.

1.5.1 Crew Information

Types of licenses held by the flight crew, including ratings and validity are:

1.5.1.1 Commander

Type of Licence:	Air Transport Pilot; 1636766
Ratings:	Airplane Multi Engine Land Commercial Privileges
	Airplane Single Engine Land
	Hawker Siddley 125, as of 17 March 1989
	Gulfstream GI as of 25 August 1976
	Lockheed Jetstat as of 21 November 1984
	Cessna Citation 3 as of 1987
	Gulfstream GII as of 19 May 1989
	Gulfstream GIII as of 19 May 1989
Validity:	Air Transport Pilot recertification on 28 September 1990
Flying Time:	
Total All Types:	14,439 hours
Total Turboprop:	8,980 hours
Total Jet :	1,976 hours

Total Night	2,113 hours
Total Instrument:	621 hours
Total Instructor	2,675 hours
Total in Gulfstream GI	3,857 hours
Total in Gulfstream GII/III	240 hours
Total in Lockheed Jetstar	1,178 hours

1.5.1.2 First Officer

Type of Licence :	Air Transport Pilot; 1335939
Ratings:	Airplane Multiengine Land Commercial Privileges Airplane Single Engine Glider Hawker Siddley 125 as of 12 October 1989
Validity:	Air Transport Pilot recertification on 7 July 1991
Flying Time:	
Total Flying All Types:	11,103 hours
Total Night Flying:	1,277 hours
Total Instrument Flying:	293 hours
Total Turboprop Flying:	2,897 hours
Total Jet Flying:	5,081 hours
Total in Gulfstream GII:	1,341 hours
Total in Gulfstream GIII:	225 hours
Total in Hawker Siddley 125 :	234 hours
Total in Lockheed Jetstar:	1,041 hours
Total in Cessna Citation:	609 hours
Academic Instruction on Gulfstream GII	15 hours
Simulator Gulfstream 1159 (Gulfstream GII at Flight Safety International, Savannah, Georgia, USA, on 1 -5 October 1990.	12 hours

1.5.1.3 Flight Mechanic

Date and Place of Birth:	9 July 1957, in Seymour, Indiana, USA.
Hired by Conoco Oil Company on:	16 December 1981
Type of Licence:	Airframe and Powerplant.
Number:	407,723,774

1.5.1.4 Approach Controller

Licence No:	DCA/ATC/L141
Validity:	Valid
Type of Validation:	Aerodrome Control Approach Control Area Control
Joined Department Civil Aviation Malaysia	18 June 1976
Apppointed as Air Traffic Controller Officer:	01 November 1981
Confirmed in his appointment:	17 December 1985
Promoted to Watch Supervisor	November 1990
Courses Attended:	
ATC Primary	1,981
Aerodrome / Approach	1,981
Area Control	1,983
ATC Radar	1,984
Search and Rescue	1,984

1.6 Airraft Information

Type:	Gulfstream II
Serial No:	147
Date of Manufacture:	1,977
Registration No:	N204C
No & Type of Engine:	2 Roll Royce Spey Mk 511-8
Owner:	Dupont De Memours
Certificate of Airworthiness:	Private Category
MTOW	62,000 lbs.

Total Airframe Hours/Cycle (as on 4-9-91)	6,800 / 4,072 land
APU Hours as on 4-9-92	3,684 hours.

1.7 Maintenance History

Inspection No. 1	Done on 18/3/92 at
TSN:	6,581 hours
CSN:	3,961 lands
Inspection No. II:	Done on 9/7/90 at
TSN:	6,165 hours
CSN:	3,780 ;amds
Maintenance Requirements:	As per the FAR 91.409-F-4

1.8 Meteorological Information

The weather report (METAR) for Kota Kinabalu airport issued at 1400 hours and 1430 hours:

Wind Velocity:	290/07 knots
Visibility:	more than 10 KM
Weather:	Thunderstorm
Temperature:	30 degrees Celsius
Dewpoint:	26 degrees Celsius
Clouds:	1 oktas Cu at 1600 feet. 2 oktas CB at 1700 feet. 3 oktas AC at 14,000 feet and 7 oktas CS at 27,000 feet.
QNH	1,009

According to witnesses, weather conditions in the area at the time of accident were relatively good. They saw clouds on mountain tops especially near the crash site, but from the CVR the crew did not remark any adverse weather conditions.

1.9 Aids to Navigation

The navigational facility VOR/DME (VHF Omni-directional Range/Distance Measuring Equipment) located approximately 2 kilometers South of runway 02 threshold, transmitting navigational information on 113.1 Mhz with VJN identification, was operating correctly on the date of the accident. There were no

reported malfunction from aircraft either on the ground or in flight. However, the ILS runway 02 was unserviceable at the time of the accident.

1.10 Communication

Radio Communications between the aircraft and the Air Traffic Control Services functioned normally as indicated by the tape transcript (attachment 1)

1.11 Aerodrome and Ground Facilities

Kota Kinabalu International Airport had one asphalt runway aligned as 02/20, 9,800 feet long, and 150 feet wide. The airport elevation is 10 feet above mean sea level. There were several letdown procedures available for approaches into Kota Kinabalu airfield. The minimum sector altitudes for 20 NM radius were:

a) 030 degrees to 190 degrees radial - 9500 feet
b) 190 degrees to 030 degrees radial - 3000 feet
(Refer Attachment 2)

The investigation team found that the Aerodrome and ground facilities were not factors in this accident.

1.12 Flight Recorder

Not applicable.

1.13 Wreckage and Impact Information

A Search and Rescue Helicopter crew located the accident site at Latitude 05 22N and Longitude 115 59'E. The mountainous and primary jungle covered terrain around the impact area had peaks reaching 5,000 feet above mean sea level, and slopes exceeding 70 degrees. The aircraft wreckage was spread over an area covering a total distance of about 1 kilometer.

The investigators discovered through observation and measurement: the aircraft initial collision was with tree tops about 30 feet above the steep sloping ground; its path was along a line of 210 degrees magnetic; the aircraft right wing was about 20 degrees below the horizon indicating that the aircraft was changing direction; and its attitude was about two degrees above horizon indicating an attempt to gain height. After about 300 feet of travel through the trees, the aircraft struck the mountain top approximately 4,180 feet above mean sea level. The aircraft disintegrated and most of its components were thrown forward over the ridge, and along the mountain slope. The main part of the aircraft fuselage, comprising of the cabin floor, seats and under-carriage were found close to a stream about 200 meters from the spot height. The team found the fuselage was heavily contaminated with human fragments, and observed numerous debris in the tree tops along 210 degrees course from the ridge top.

Although the impact destroyed the aircraft completely, the team however located sections of the fuselage, engine and tail. From the gathered evidence, the team concluded that the engine was developing power as the aircraft impacted the trees and the mountain top.

1.14 Medical and Pathological Information

The Commander completed FAA Class I flight physical examination on 07 August 1991. He completed a Dupont/Conoco sponsored flight physical examination on the same day. His last screening for illicit drugs was on 25 January 1991.

The first Officer completed FAA administered Class I flight physical examination on 10 October 1990. He completed a Dupont/Conoco flight physical examination on the same date. His last screening for illicit drugs was on 14 August 1990.

The flight Mechanic completed FAA administered Class II flight physical examination on 11 September 1988. He completed a Dupont/Conoco sponsored flight physical examination on 18 September 1990, and was last screened for illicit drugs on 09 November 1988.

1.15 Fire

Fire, which resulted from the extremely violent impact with the mountain top, broke out after the aircraft disintegrated. However, there were no traces of fire in flight nor explosion before the final impact.

1.16 Survival Aspects

The final violent impact with the mountain top and the subsequent total aircraft disintegration made the accident not survivable. Subsequently, there were no survivors.

The last communication between the aircraft and the Kota Kinabalu Approach Controller was at 1410:30 hours. The Approach Controller made several attempts to communicate with the aircraft between 1412 hours and 1430 hours, but there were no replies from the aircraft.

The Area Control Centre initiated the air traffic emergency procedure at 1440 hours. The search and rescue operations directed by Kota Kinabalu Search and Rescue Coordinating Centre commenced immediately. The wreckage was spotted on 06 Sept 1992 at time 1320 hours and the search and rescue operations was called off on the 15 September 1992 at about 1730 hours.

1.17 Test and Research

Nil

1.18 Additional Information

Nil

1.19 New Investigation Techniques

Nil

2 ANALYSIS

2.1 General

The investigating team could not find any evidences to suggest that the accident had been caused by either mechanical, technical, or system failures.

2.2 Airworthiness

The aircraft had been correctly certified and the maintenance was according to the FAA approved procedures.

The flight crew and the involved air traffic controller were qualified to perform their assigned duties. There were no evidences to indicate that medical factors had caused this accident. The flight crew had the necessary dispatch data and weather information before they departed Narita, Japan.

2.3 Operation and Navigation

Shortly after establishing radio contact with the Kota Kinabalu Approach Controller, the flight crew seek confirmation from the Controller whether he required them to hold over the VJN VOR or to track on 258 degrees radial from VJN VOR. The crew received instruction to maintain 025 radial from VJN VOR only. When the crew reported overhead VJN VOR, the controller instructed the crew **to descend over the VJN VOR to nine thousand five hundred feet.** The First Officer did not repeat the instruction to descend over the VJN VOR to nine thousands five hundred feet but said he understood they could descend to 9,500 feet. The aircraft commander's uncertainty prompted the First Officer again asked the Controller whether they were **to go out bound** on the 258 degrees radial **or to hold.** The controller responded that they were to **descend South of the airfield** to nine thousand five hundred feet".

Evidently, the aircraft departed VJN VOR on the Southerly direction from VJN VOR. On the descent the flight crew responded to Controller's request for DME distances, 21 DME South and 29 DME South. They received further instructions to descend to 6,000 feet, 3,000 feet and 2,500 feet, and was cleared to join final runway 02.

At about 30 NM DME and passing approximately 4,000 feet, the flight crew became apprehensive over their proximity with the terrain. At 15 seconds to collision the Commander initiated a climb out but impact was imminent.

The above brief describes the events that happened with respect to the aircraft crew, the reasons perhaps can only be explained logically as follows: Why did the crew asked the Controller ".. you want us to track outbound on two five eight degrees radial or hold over the VOR?" The crew was not previously given the approach clearance procedure except over the VJN VOR. They called to ensure they had correct approach procedure. 258 degrees Radial from VJN VOR is an airway for

aircraft from west and south west to maintain or to intercept the ILS or VJN VOR radial for Runway 02. The crew was hoping to intercept this radial from over the VJN VOR, maintain and turn inbound at 16 DME Arc to intercept the ILS or VJN VOR radial to the field. If the 258 degrees radial was not acceptable to the Controller, he of course would hold over the VJN VOR, or proceed outbound on a radial directed by the Controller.

Why did the crew miss part of the Controller's instruction ".... descend over the VOR" and accepted Southerly descend clearance ?

The crew missed evidently the Controller's instruction they were to descend over the VJN VOR, but repeated his request to confirm with the Controller who then renew his previous instruction from descend over the hold, to, descend South of the airfield to nine thousand five hundred feet . As requested by the Controller, the crew reported passing ten thousands, and was further cleared to sixthousand feet. The crew accepted six thousand feet which is below the safe sector altitude of nine thousand five hundred feet. As there were no indications from the cockpit voice recorder of any mention, protest or discussion among the crew with respect to minimum safe altitude for the airfield, we can logically deduce they were not aware of the hazards existing in the southerly descent. Had they observed carefully the approach charts, and assessed the southerly descent, they could have noted the danger ahead and rejected further descent.

Southerly heading is acceptable if the aircraft remain above the minimum safe altitude in this case 9,500 feet. "Descend south" for pilot familiar with this airfield will always mean south west of the airfield, or Radial 190 degrees from VJN VOR or greater, but however to this crew the new instruction seemed as definite as in a radar environment which he had always known and depended upon. But Kota Kinabalu had never had radar services, nor it has ever been mentioned in the Aerodrome Information Publication produced by Department Civil Aviation Malaysia. The requests for DME distances should have alerted the crew that such service is not available in Kota Kinabalu airfield.

2.4 Air Traffic Services and Clearances

Shortly after establishing radio contact, Kota Kinabalu Approach Controller received the flight crew's request to confirm whether the Controller wanted them to track outbound on two five eight degrees radial or hold over the VJN VOR. The aircraft was passing flight level two three zero descending for one five zero, on radial zero two five. The Controller in reply for the crew's request, instructed them to maintain radial zero two five to VJN VOR. Again he received crew's request whether the Controller wanted them to go outbound on the two five eight radial. The aircraft was then over the VJN VOR. Shortly after, the Controller cleared the aircraft to descend over the VJN VOR to nine thousand five hundred feet. The crew replied he understood he could descend to nine thousand five hundred feet and the Controller confirmed so. At thirty seconds later the Controller received the crew's uncertainty - did the Controller want them to go outbound on the two five eight degree radial or to hold. The Controller said, "N204C descend south of the airfield to nine thousand five hundred now". The crew repeated the clearance and was then passing one five

thousand feet. The Controller further cleared the aircraft to six thousand feet when the aircraft called passing ten thousand feet; at two one DME, the aircraft was passing seven thousand feet; at 29 DME the aircraft was passing four thousand feet and was further cleared to join final runway zero two and to descend to two thousand five hundred. About thirty seconds later the Controller called the aircraft for its radial inbound. There were no more replies from the aircraft.

Why didn't the Controller instruct the aircrew to conduct the published instrument letdowns procedures ?

There are several letdown procedures available for Kota Kinabalu runway 02, namely, ILS/DME & VOR/DME ARC, VOR/ILS DME, LOC ILS/DME, VOR/DME, Locator DME, VOR, Cat A & B, VOR Cat C & D, Locator Cat A & B and Locator Cat C & D.

The Kota Kinabalu Area and Approach Air Traffic Controllers both conducted the arrival procedures and descent clearances, in this occasion using VJN VOR, and not the DME steps as published in the Aeronautical Information Publication, Malaysia.

However, during the arrival and approach, the Controller:

assigned all decent levels higher than those of the DME steps;

instructed the aircraft, upon reaching the VJN VOR, "descend south of the airfield";

requested the aircraft's distance and received crew's response - 21 DME and 29 DME South.;

assigned progressively lower altitudes, 6,000 feet, 3,000 feet and 2,500 feet respectively;

did not check the aircraft positions and flight conditions;

meant, as he claimed, to descend the aircraft visually to the South of the airfield, but the aircraft cockpit voice recorder and the tape transcript did not record any such clearance;

did not at any time advise the flight crew to maintain the aerodrome in sight to conduct a visual approach;

stated, during an interview with the investigating team, that the objective of the air traffic control service as prescribed in Annex 11 does not include prevention of collision with terrain, thus it is the pilot's responsibility to ensure terrain clearance in accordance with the appropriate legislation. However, the Director shall ensure that all clearances issued by him are in accordance with the following requirements: Intermediate approach - Within the desired lateral limits of a controlled airspace the aircraft shall always be cleared to level at or above the lowest level specified in the AIP (Aeronautical Information Publication) for flight in the controlled airspace.

The Manual Of Air Traffic Services (MATS) issued by the Department of Civil Aviation Malaysia, states that:

"3.4. TERRAIN CLEARANCE

An IFR flight shall not be cleared for an initial approach below the appropriate minimum altitude as published in the AIP nor to descend below that altitude unless:-

(a) The pilot has reported passing an appropriate point defined by a radio navigation aid; or

(b) The pilot report that he has and can maintain the aerodrome in sight; or

(c) The aircraft's position has been positively determined by the use of radar."

The various sector altitudes for Kota Kinabalu airport are published in the AIP and the minimum safe sector altitude from 030 degrees radial to 190 degrees radial for 20 NM radius is 9,500 feet.

2.5 Weather Conditions And Limitations

Witnesses reported that the weather in the accident area was fine with however, cloud patches over the mountain peaks and ridges. These clouds patches must have obscured partially or completely the flight crew's sight of the ground particularly the mountain ridges and peaks. The investigating team believed the aircraft entered a patch of cloud covering the mountain top prior to impact.

2.6 Flight Operational Factor

A brief study of the appropriate approach charts should have alerted the flight crew that minimum sector altitude south of the field is 9,500 feet. However, the flight crew's comment regarding their proximity to the terrain indicated that they were aware they were approaching high grounds. The flight crew realised that they were "coming close to the hills" 44 seconds or 3 NM from impact point. They reacted to the situation 29 seconds later, that is 15 seconds, 1 NM or less to impact at speed of 220 kts. Had the flight crew acted positively 15 seconds earlier, or 1 NM to impact or more, this accident might have been averted.

The flight crew must have believed that, under ATC arrival environment, they had to comply to all ATC instructions and clearances. They must have expected that all ATC clearances involving assigned levels included terrain clearance consideration.

3 CONCLUSIONS

The ivestigating team found from the Factual Information and the Analysis the following Findings and Causal Factors:

3.1 Findings

The Investigating team found the following:

There was no failure or malfunction of the aircraft, powerplants or other systems.

The approach controller was properly rated and licensed to perform the duty of an Approach Controller.

The flight progressed normally until the flight established radio contact with the approach control.

The flight crew requested whether they could proceed outbound on the 258^0 radial. The approach control answered, but did not specifically answer the request.

On reaching overhead VJN VOR, the Approach Controller instructed the aircraft to **descend over the VJN VOR** to 9.500 feet. The **flight crew missed the instruction to descend over the VJN hold** but understood that they could descend to 9,500 feet.

After reaching overhead the VJN VOR, the flight crew asked the Approach Controller whether they were to go outbound or to hold over the VJN VOR. The Controller instructed the aircraft to descend to the South to 9,500 feet.

The instruction to **descend to the South to 9,500 feet** is not consistent with the IFR arrival and instrument letdown procedures published in the AIP.

The Approach Controller's assigned altitudes of 6,000 feet, 3,000 feet and 2,500 feet were below the minimum sector altitude of 9,500 feet.

The flight crew did not object to the descent clearance below the minimum sector altitude.

There was a lack of understanding amongst Air Traffic Controllers in Kota Kinabalu concerning the interpretation of air traffic control procedures involving terrain clearance for IFR flight.

Neither the flight crew nor the Approach Controller understood what the other was thinking and planning. The Approach Controller expected the flight crew to conduct a visual approach however the flight crew thought otherwise. Thus the flight crew complied strictly to the ATC instruction as expected in all IFR flights. The Approach Controller's interpretation of teraain clearance lessen the safety margin.

The clouds must have obscured the flight crew's sight of the ground.

3.2 Causal Factors

The investigating team found the following causal factors to the accident:

The Approach Controller's inattentive descent clearance for the aircraft below the minimum sector altitude of 9,500 feet, his failure to recognize the safety hazard and to take corrective actions contributed to the cause of the accident.

The air crew's confusion with the air traffic system, failure to examine the sector altitude, and their high dependence on the ATC clearances contributed to the cause of the accident.

The Navigational facilities in Kota Kinabalu aerodrome was sufficient to cope with the current traffic but will very soon require new and advanced technological facilities for the fast growing traffic .

Some inconsistency with the interpretation of the Air Traffic Services and its standard operating procedures thus creating a gap between the Controller and the air crew.

4 SAFETY RECOMMENDATIONS

The investigating team recommends that :-

An independent regulatory team to remind, ensure and monitor effectively all Air Traffic Services to adhere strictly to the procedures (especially controlled airspace terrain clearance) as stipulated in the Air Traffic Services Manual and other relevant documents, be established;

The requirements of Annex 6 concerning turbine engine aeroplanes - Ground Proximity Warning System (GPWS) as stipulated in para 6.9.1 of the Annex 6, be adopted;

The standards, procedures, and organization in relation to personnel, airways and auxiliary services including aerodrome air navigational facilities such as RADAR that can provide altitude readout and terrain clearance warning system, be enhanced;.

The Aircrew and Air Traffic Controller's international terrain avoidance procedures and their responsibilities for the regularity and uniformity of International Air Navigation, be reviewed.

Capt. Abd. Shukor bin Abd. Aziz,

Chief Inspector of Air Accidents,
Department Civil Aviation,
Malaysia.

TRANSCRIPT ON N204C ON 04.09.1991

A - N204C
T - Control Tower
S1- Sector One
S2- Sector Two

TIME	UNIT	TEXT
053450	A	: Kinabalu Control Gulfstream N204C position.
053456	S1	: N204C go ahead position.
053504	A	: N204C we're over PR 0525 flight level 430 estimating at time FIR 0544 next will be Kudat.
053519	S1	: N204C request estimate for Kinabalu.
053524	A	: Ok standby.
053544	A	: Kinabalu N204C estimating Kota Kinabalu at ...0601.
053552	S1	: 204C report FIR boundary.
053603	A	: ...Roger, will report the boundary 04C.
053606	T	: Go ahead.
053610	S1	: Revision on 204C estimate Kinabalu 0601 now.
	T	: 01...ok copy.
	S1	: Affirmative.
054606	A	: Kinabalu N204C FIR 0544 flight level four three zero.
054645	S1	: N204C report for descend, you are number two in traffic expected approach time 0605 runway zero two.
054657	A	: Ok expected approach time 0605 for runway zero two.
054700	S1	: That's correct runway 02 . Kinabalu weather surface wind 290 degrees 10 knots 10 kilometers or more hazy one obtas 1600, one obtas cb 1700 direction north east QNH 1009 Temperature 31.
054724	A	: 04C.
055023	S1	: N204C will be number two . Your lowest for him.
	T	: Number two for... Ok lowest is five thousand ft.
	S1	: Five thousand ...Ok. Release contact you passing flight level two five zero estimate zero one given expected approach time zero five runway zero two.
	T	: Ok copy.
055406	A	: Kinabalu Control Gulfstream N204C we would like to start down for descend.
055409	S1	: N204C descend to flight level one eight zero.
	A	: Flight level one eght zero.
	S1	: N204C request radial inbound to Victor Juliet November ?
055430	A	: We are on the zero three five radial.
	S1	: Reclear flight level two six zero.
055440	A	: Ok understand two six zero...flight level ?

055542	S1	: N204C release contact passing flight level two five zero descending to flight level one five zero estimate at time zero six zero eight also given expected approach time one eight runway zero two.
	T	: Roger.
055607	S1	: 204C report DME from Victor Juliet November ?
055617	A	: Ok we are showing ...five one DME.
055625	S1	: N204C.
055752	S1	: N204C descend to flight level one seven zero report DME now ?
055757	A	: Ok three seven DME clear down to 17DME....for flight level.
055805	S1	: Roger N204C.
055822	S1	: N204C slow down approach speed number two in traffic expected approach time now one eight runway zero two.
055828	A	: Ok slow down expected approach...one eight.
055836	S1	: N204C.
060010	S1	: N204C descend to flight level one five zero and report level passing now ?
060018	A	: ...We're flight level two seven zero and down to one five 0.
060025	S1	: N204C report passing flight level two five zero.
060027	A	: Roger.
060045	A	: Gulfstream 204C out of two five 0 for one five 0.
060051	S1	: N204C contact Approach Control one one eight decimal three.
060058	A	: ...three.
060109	A	: Kinabalu Approach Gulfstream N204C descending to flight level one five 0 passing through two three.
060122	T	: N204C say again your lev...level passing ?
060129	A	: Passing...two three 0 descending one five 0
060137	T	: N204C runway zero two report reaching flight level one five zero.
060144	A	: Roger report reaching one five 0.
060232	A	: Approach 204C are...you want us to track outbound on two five eight degrees radial or hold over the VOR ?
060243	T	: N204C report radial maintaining now ?
060257	A	: 204C we are on the zero two five radial.
060305	T	: Maintain radial zero two five to Victor Juliet November.
060324	A	: Ok 204C we're passing over the VOR you want us to go outbound on the two five eight radial ?
060336	T	: Confirm you are overhead the Victor Juliet November VOR now ?

060344	A	: ...that's affirm we are over the VOR.
060345	T	: MAS391 report ...level passing ?
060346	A	: We are level one five thousand.
060351	T	: MAS391 Kinabalu!
060354	(MAS391)	: 391 go ahead!
060356	T	: Report level passing now and DME ?
060357	(MAS391)	: Level eight thousand five hundred ft one one DME leaving for six thousand ft.
060400	T	: N204C descend over the Victor Juliet November VOR to nine thousand five hundred ft.
060407	A	: ...understand descend to nine thousand five hundred ?
060409	T	: N204C that is affirmative, report passing one zero thousand.
060416	A	: Ok report out of one zero thousand .
060423	T	: Affirmative.
060425	(MAS413)	: Kinabalu Tower MAS413 Mike Bravo Kilo Bay four requesting Sandakan flight level one seven zero push start one zero minutes.
060432	T	: 413 expect runway zero two surface wind three zero zero one zero knots QNH one zero zero nine temperature three zero.
060440	(MAS413)	: Check QNH one zero zero nine for runway zero two. MAS413 thank you.
060444	A	: 04C we're still uncert... you want us to go outbound on the two five eight degree radial or you want ue to hold ?
060507	T	: N204C descend south of the airfield to nine thousand five hundred now.
060516	A	: Roger understand descend south to nine thousand five hundred we're passing ...one five thousand now.
060525	T	: Roger report passing one zero thousand.
060527	A	: Roger.
060527	(MJP)	: MJP joining final zero two.
060542	(MJP)	: MJP turning final zero two.
060543	T	: 9MMJP clear for touch and go landing surface wind three zero zero one zero knots.
060549	(MJP)	: MJP touch and go left turn.
060551	T	: MAS391 say again ?
060556	(MAS391)	: 391 is leaving five thousand five hundred now and we are visual sir.
060600	T	: Roger continue descend to two thousand five hundred feet runway zero two and report passing four thousand.
060610	(MAS391)	: 391 two thousand five hundred wilco.
060616	T	: Report DME ?
060622	T	: 391 report DME ?
060633	T	: MAS391 report DME ?

060633	(MAS391)	: 391 is five DME.
060638	T	: MAS391 position for right base runway zero two.
060646	(MAS391)	: 391 right base zero two.
060647	A	: 04C passing through ten thousand.
060653	T	: N204C continue descend to six thousand.
060657	A	: Down to six thousand.
060705	(MAS391)	: 391 has left three thousand right base runway zero two.
060712	T	: 391 clear to final runway zero two.
060715	(MAS391)	: 391 Roger clear to final runway zero two.
060811	T	: MAS391 clear to land surface wind three zero zero one zero .
060815	(MAS391)	: 391 clear to land.
060816	T	: N204C report DME south ?
060820	A	: ...two one DME south.
060828	T	: 204C continue descend to three thousand feet.
060831	A	: three thousand 04C.
060834	T	: 04C level passing now ?
060835	A	: At seven thousand.
060840	T	: N204C expect to join final runway zero two after passing four thousand .
060847	A	: Ok after four thousand clear to turn inbound to runway zero two.
060855	T	: N204C affirmative. Report passing four thousand feet.
060856	A	: Roger.
060900	(MJP)	: MJP left hand down wind runway zero two ,like to go round on this one.
060906	T	: Roger clear to final runway zero two.
060907	(MJP)	: MJP.
060908	(ANK. 563)	: Kinabalu Ankasa 563 ?
060910	T	: Ankasa 563 go ahead.
060913	(ANK.563)	: We will be shutting down ,aircraft unserviceable.
061005	T	: 391 clear to back track via G,C and Bay six.
061018	(MAS391)	: Roger clear to back track via G,C,J confirm ?
061018	T	: J affirmative.
061019	(MAS391)	: Roger G,C,J MAS391.
061020	A	: 204C is four thousand .
061021	T	: Report DME now ?
061022	A	: ...29 DME.
061024	T	: Roger clear to...join final runway zero two descend to two thousand five hundred .
061030	A	: Ok final descend for runway zero two thousand five hundred.

061112	T	: N204C report radial inbound now ?
061127	T	: N204C Kinabalu !
061139	T	: N204C Kinabalu !
061153	T	: 9MJP clear to go round.
061156	(MJP)	: MJP clear to go round.
061200	T	: N204C Kinabalu !
061210	T	: N204C Kinabalu how do you read !
061226	T	: N204C Kinabalu !
061246	T	: N204C Kinabalu !
061306	T	: N204C Kinabalu !
061321	T	: N204C Kinabalu !
061339	T	: N204C Kinabalu !
061355	T	: N204C Kinabalu !
061412	T	: N204C request your position now ?
061426	T	: N204C Kinabalu !
061437	T	: Can you help me to request Brunei to monitor this N204C ?
061449	S1	: Why ?
	T	: I call call no answer man !
061452	S1	: He contacts you or not ?
061453	T	: Eh... call me somewhere south of Kinabalu.
061455	S1	: Somewhere south of Kinabalu !
061457	T	: On ten DME lah.
061458	S1	: For one zero DME!
061458	(MJP)	: MJP left hand down wind runway zero two would like to do another round.
061506	T	: JP.
061510	T	: N204C Kinabalu !
061518	T	: JP can you give a test call to N204C ?
061520	(MJP)	: N204C ?
061524	T	: Affirmative N204C.
061530	(MJP)	: N204C N204C MJP !
061538	(MJP)	: N204C Malaysian...MJP !
061552	(MJP)	: MJP no contact 204C.
061556	T	: N204C Kinabalu!
061610	T	: N204C Kinabalu !
061623	T	: JP clear to join final runway zero two and after go round initially west of the airfield.
061627	(MJP)	: MJP clear for go round to hold west of the airfield confirm ?
061633	T	: Affirmative.
061636	(MJP)	: MJP.
061639	T	: N204C Kinabalu !
061648	(MAS413)	: Kinabalu MAS413 request to push back and start ?
061655	T	: 413 standby one.

061658	(MAS413)	: 413.
061703	T	: Hello can you ask Brunei whether he gets any blip I descend it to two thousand five hundred feet.
061705	S1	: Eh... nothing lah.
061711	T	: I call him a few times also no contact.
061713	S1	: Brunei also will be telling me . I told him already no transponder also given by from Manila.
061720	T	: Ok Ok.
061721	T	: N204C Kinabalu!
061749	T	: Who is your Watch Supervisor ?
061752	S1	: Oh....James Tan.
061753	T	: Can I talk to him ?
061810	T	: N204C this is Kinabalu Approach,how do you read ?
061819	T	: N204C Kinabalu Approach, how do you read ?
061830	(MAS413)	: MAS413 request push start ?
061830	T	: MAS413 standby one.
061832	(MAS413)	: Roger.
061833	T	: N204C Kinabalu Approach, how do you read ?
061843	T	: 413 Kinabalu go ahead.
061847	(MAS413)	: 413 go !
061844	T	: 413 push back and start face south runway zero two.
061846	(MAS413)	: Push back and start face south runway zero two, MAS413.
061854	T	: N204C Kinabalu !
061918	T	: N204C Kinabalu, how do you read ?
062005	T	: N204C, this is Kinabalu Approach, how do you read ?
062035	T	: N204C Kinabalu !
062055	S1	: Hello!
062056	T	: Hello, you inform Labuan lah ..th... case...
062059	(MJP)	: 9JP holding west of the airfield fifteen hundred feet.
062101	T	: JP.
062106	T	: N204C Kinabalu !
062120	T	: N4..204C Kinabalu, how do you read ?
062140	T	: Hello !
062144	S1	: Ya !
062147	T	: ATC 413 ?
062150	S1	: 413 standby....clear Sandakan W421 FL170.
062209	T	: N204C if you are receiving squak A2000 ..A2000.
062220	(MAS413)	: MAS413 POB one one zero and two four five request taxi.
062231	T	: MAS413 taxi to the holding point Juliet runway zero two.

062236	(MAS413)	: Holding point Juliet runwat zero two.
062242	T	: N204C Kinabalu !
062251	T	: N204C Kinabalu !
062301	(MJP)	: MJP may we join final ?
062320	(MJP)	: Ha Kinabalu MJP request to join final ?
062322	T	: JP Roger clear to join final and suggest you make full stop landing.
062327	(MJP)	: Ha.. MJP confirm the reason please .
062334	T	: Suspect one light aircraft on radio failure from Narita to Kinabalu.
062341	(MJP)	: Ha roger MJP.
062349	(MAS413)	: MAS413 request ATC ?
062353	T	: 413 clear to Sandakan W421 FL170.
062357	(MAS413)	: Clear to Sandakan W421 FL170 MAS413.
062403	T	: N204C Kinabalu How do you read !
062410	(MAS413)	: MAS413 ready!
062415	T	: MAS413 clear to line up runway zero two.
062417	(MAS413)	: Clear tol ine up , MAS413.
062425	T	: N204C Kinabalu !
062503	T	: N204C Kinabalu !
062505	T	: MAS413 clear for take off.
062517	(MAS413)	: MAS413 clear for take off left turn.
062520	T	: MAS413 can you make a right turn when ready ?
062524	(MAS413)	: 413 negative due to weather and take off weight. left turn please.
062528	T	: MAS413 roger.
062535	T	: N204C Kinabalu !
062606	T	: N204C Kinabalu !
062620	(MJP)	: MJP final runaway zero two.
062624	T	: JP clear to land surface wind two nine zero zero five.
062627	(MJP)	: MJP.
062646	T	: N204C Kinabalu !
062817	T	: N204C Kinabalu !
062830	T	: MAS413 Kinabalu !
062832	(MAS413)	: Kinabalu MAS413 !
062835	T	: 413 can you give a call to N204C please ?
062846	(MAS413)	: Ha roger break break N204C this is MAS413 ?
062853	(MAS413)	: N204C this is MAS413 how do you read ?
062905	(MAS413)	: N204C MAS413 do you read ?
062918	(MAS413)	: We give him a call in after about five minutes
062920	T	: Roger.
062928	(MJP)	: MJP back tracking.
062932	T	: MJP taxi via G, C , H.
062937	(MJP)	: How long delay do we expect ?
062944	T	: JP call again at zero seven zero zero for another training.

062955	T	: N204C Kinabalu how do you read ?
063008	(MAS413)	: N204C this is MAS413, if you read me please call Kinabalu is calling you.
063020	(MAS413)	: N204C MAS413 !
0632026	(MAS413)	: No joy Sir!
063043	T	: MAS413 level passing now ?
063046	(MAS413)	: 413 is out of eight thousand.
063048	T	: Roger report passing flight level one three zero.
06303056	T	: N204C Kinabalu!