

A graphic for the ECCAIRS 4 Reporting System. It features the text "ECCAIRS" in large, bold, black letters, with a large, stylized orange "4" to its right. Below this, the words "Reporting System" are written in a smaller, black, sans-serif font. The background of the graphic is a light blue and white abstract pattern with some yellow and orange accents.

ECCAIRS4

Reporting System

ECCAIRS 4 in Practice

—

**ECCAIRS 4 Applications
ADREP 2000 Taxonomy**

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For End-Users

EXERCISE BOOK

Introduction

Exercises within this book are based on reports and relevant material available from public sources. Various partners of the ECCAIRS community, among which the *International Civil Aviation Organisation* (ICAO), the French *Bureau d'Enquêtes et d'Analyses pour la Sécurité de l'Aviation Civile* (BEA), the German *Deutsche Flugsicherung* (DFS) and the *European Aviation Safety Agency* (EASA) have collaborated in providing the necessary amendments and suggestions to the initial draft in order to provide a wide spectrum of occurrences that address the many issues in the reporting in civil aviation.

The exercises describe fictitious scenarios of aviation accidents and/or incidents with the sole purpose of providing guidance and training material for the coding of events of such occurrences in the ECCAIRS system. Some scenarios were downloaded from publicly available web sites.

The book has been organised in different sections related to occurrence data entry:

- General Exercises
- Occurrence Category Exercises
- Events/Factors Exercises
- Separation Exercises
- Air Traffic Management Exercises

For some of the sections, solutions are provided printed in a separate volume or electronically in a file. These solutions represent an interpretation of the narrative or of the facts by the authors. In the event, the reader might gather a different opinion about the facts exposed which is, in itself, positive and rather stimulated by the same authors. An introductory and guided exercise may be present in each section for acquiring some extra skills and usage tips about the tool.

Two additional sections have been added that address the following tools:

- Query Builder
- Grapher

Purpose and Objectives

The objectives of encoding aviation accidents and incidents are various: memory of accidents, dissemination of safety data, elaboration of safety indicators and safety studies. Another key issue is to identify recurrent factors or patterns in accidents to prevent future occurrences.

The use of a common taxonomy (ADREP 2000) and common software (ECCAIRS release 4) are necessary but not sufficient. The method described through examples is supposed to provide a consistent approach for the encoding of incidents and accidents.

The results of the investigation are discussed in the analysis of the report that very often follows the chronological sequence of events (causation chain). The analysis of the report can also support the safety recommendation found in section 4 of ICAO standard reports.

Non-contributory factors can also appear throughout an investigation and it is important to keep track of them and therefore record the factors that led or can lead to recommendations. It could be helpful for future safety studies.

The user may find case studies all along this document provided for giving an in-depth look into occurrence reporting and coding performed by an investigation body using the convened coding techniques. Although in practice it is not mandatory to provide such level of detail in every incident, it is based on the assumption that 'you code what you know' and whatever is not coded is inevitably lost.

Comments and Suggestions

The beneficiaries of this book are the users of the ECCAIRS system. Comments and suggestions that would allow the authors to enrich this publication are therefore welcome at any time. Contact the authors at the e-mail address 'eccairs.documentation@jrc.it' or 'eccairs.training@jrc.it' citing the title of this book in the message's subject.

General Exercises



General Notes

Measurement units in use reflect US Standard in respect to the separator used for indicating the thousands and the decimals. Solutions are in a separate book.

Example Exercise

Enter a new report based on the notification below. This is the initial information received. The exercise will require entering, based on the factual information, the following data:

- Filing information and Management data
- Date and Location
- Aircraft data
- History of flight
- Narrative
- Initial sequence of events

Although the data available will only require using an «ADREP Preliminary» type of view, experienced users might very well use the «ADREP Full» type view and input additional values that can be deducted from the given information.

Please note that a particular view must be selected before adding the new record.

OCCURRENCE SUMMARY

State Reporting:	Canada
Occurrence Number:	2003-6510
Occurrence Type:	Accident
Location:	CKD6 THOMPSON, MANITOBA
Occurrence Date:	23-Jun-2003
State:	Canada
Time/Zone:	12:42 CDT

Aircraft Details

Aircraft Manufacturer:	DE HAVILLAND				
Aircraft Model:	DHC-2 (BEAVER)				
Aircraft Registration:	C-ABCD				
Operator's Name:	BUSHFLIERS INTERNATIONAL				
Type of operation:	COMMERCIAL AIR TAXI				
Injuries:	Fatal	Serious	Minor	None	Total
Total				7	

FACTUAL INFORMATION

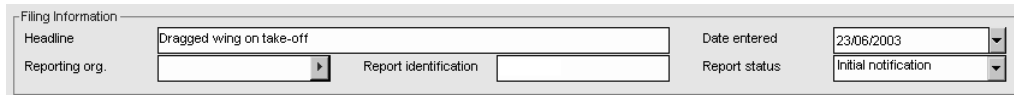
The float-equipped De Havilland DHC-2 Beaver, C-ABCD, was taking-off from the Burntwood River at Thompson, MB. When the aircraft came up onto the 'step', a wind gust lifted the right wing and the left wing entered the water causing the aircraft to cartwheel. Reportedly, application of full right aileron did not stop the wing movement. All seven occupants evacuated the aircraft without injury. Reported winds were 13 gusting to 22kts.

SOLUTION

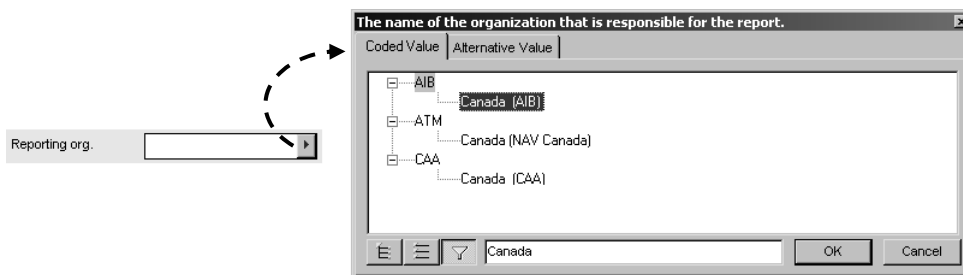
Start the ECCAIRS Browser, select an «ADREP Preliminary» view type and from the Browser's menu select the option **Occurrence** and then the option **New**.

Filing information and Management data

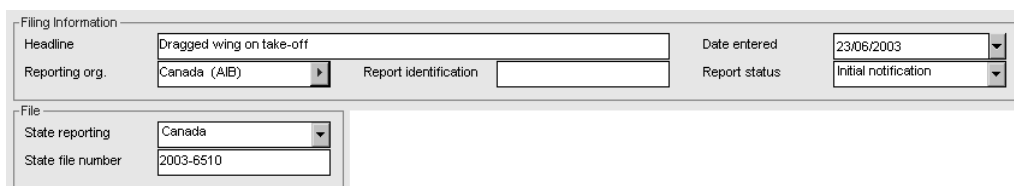
As the **Headline**, enter a short description that will allow for recognising this occurrence. Here, the **Date entered** is chosen to be the day of the occurrence. In practice, however, one would enter the date in which the occurrence is entered in the ECCAIRS system (e.g. 'today').



The **Report identification** can be set to any value uniquely identifying the report, the **Report status** is set to «Initial notification». Select the **Reporting org.** from a list by using the button at the right edge of the field:

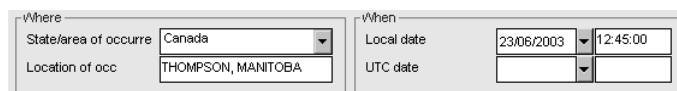


Locate the organisation by clicking on the filter button, type the country and press [Enter]. Select the organisation from the filtered list and click **OK**. The **State reporting** and the **State file number** are given above.



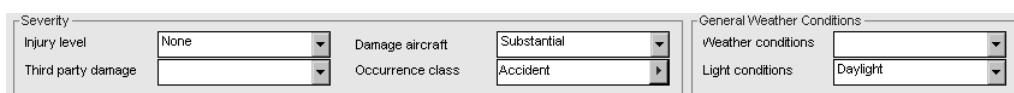
Date and Location

The **Location of occurrence** is a free format text field; in absence of a real location, one can use land marks or geographical references. Within the **When** section, one can enter local dates and/or UTC dates. Please take care that when looking for occurrences by using the local date, this value must be available. ECCAIRS cannot derive local dates from UTC dates.



Occurrence severity and General weather

The **Injury level** is 'None' and the **Occurrence class** is 'Accident' (both given), while the **Damage aircraft** will be 'Substantial' (derived from the above). The **Light conditions** in the General Weather Conditions section can be set to 'Daylight' (derived from time – 12:45hrs).



Aircraft data and History of flight

In order to add aircraft data to this occurrence, the **Add** button must be pressed. This will make the necessary data entry fields available:

Enter the aircraft identification and operation. The aircraft can be located by filtering the list using the model designator ('DHC-2' – the string 'dhc2' was used to locate the entry because of the way the make/models are coded in ECCAIRS):

The operator must be chosen as a manual entry, because the value is not part of the [Canadian] operators that are available as coded values in the ECCAIRS system. Therefore, after opening the list, click on the **Alternative Value** tab and enter the given value:

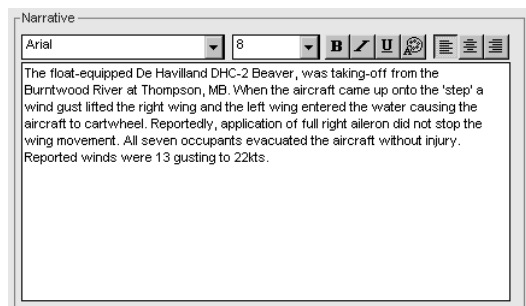
After adding the remaining information at hand, the following result is obtained. The departure point is another manual input. Planned destination was not specified. Phase was 'Take-off'.

Although the number of injuries is known at this point (7 'none'), it is not possible to enter this data here using the «ADREP Preliminary» view, because the initial notification does not specify the distribution of crew/passengers. By using the «ADREP Full» view, however, it is indeed possible to store this information into the ECCAIRS system, because the mentioned view does provide a specific section containing the necessary data fields for inputting injuries by level of severity and by the position of the transported person.

Please note that the **Ground** field in the **Itinerary** section must be checked only if the aircraft is not airborne, in other words if the event is taking place during a phase where there is contact between wheels and ground. In this exercise the aircraft is assumed to be airborne so this flag is left unchecked.

Narratives

If available electronically, then the narratives can be added via copy/paste, otherwise this free format text field allows for entering a large size of text describing the occurrence. In practice, narrative text should contain, whenever possible, factual information that cannot be coded elsewhere. For instance, it is not necessary to repeat aircraft make/model, registration, etc. if this can be obtained from other data fields.



The screenshot shows a window titled "Narrative" with a text area containing the following text: "The float-equipped De Havilland DHC-2 Beaver, was taking-off from the Burntwood River at Thompson, MB. When the aircraft came up onto the 'step' a wind gust lifted the right wing and the left wing entered the water causing the aircraft to cartwheel. Reportedly, application of full right aileron did not stop the wing movement. All seven occupants evacuated the aircraft without injury. Reported winds were 13 gusting to 22kts." The text area has a standard toolbar with options for font face (Arial), size (8), bold, italic, underline, and bulleted list.

Initial sequence of events

Initial assignment of event types (pending the results of the investigation and for initial classification only); the relevant items are highlighted in the narrative text:

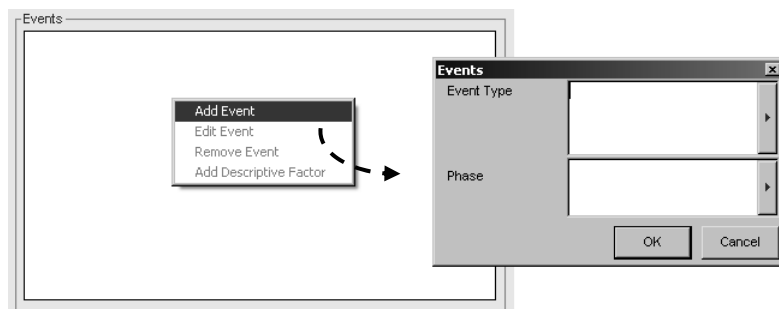
Narrative: The float-equipped De Havilland DHC-2 Beaver, C-111, was **taking-off** from the Burntwood River at Thompson, MB. When the aircraft came up onto the 'step', **a wind gust lifted the right wing and the left wing entered the water** causing the **aircraft to cartwheel**. Reportedly, application of full right aileron did not stop the wing movement. All seven occupants evacuated the aircraft without injury. Reported winds were 13 gusting to 22 kts.

Diagram labels: A points to "taking-off", B points to "a wind gust", C points to "a wind gust lifted the right wing and the left wing entered the water", and D points to "aircraft to cartwheel".

This translates into:

- Event 1:** event type: weather counters – crosswind (B); phase: take-off run (A)
- Event 2:** event type: dragged wing/rotor/float (C); phase: take-off run (A)
- Event 3:** event type: unintentional swerve (D); phase: take-off run (A)

In the **Events** section, click with the right button of the mouse and select **Add Event**:



The screenshot shows the "Events" window with a context menu open. The context menu has four options: "Add Event", "Edit Event", "Remove Event", and "Add Descriptive Factor". The "Events" window has two main sections: "Event Type" and "Phase", each with a list box and a right arrow button. At the bottom are "OK" and "Cancel" buttons.

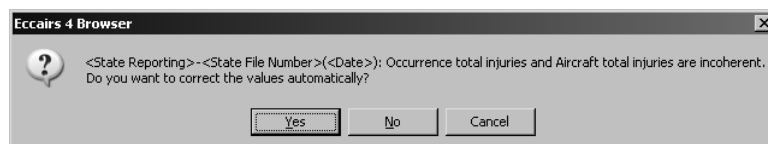
After adding all events, and their phases, the final data entry screen obtained might look like in the next figure:

Saving

By clicking on **File** and then on **Save**, the occurrence record can be saved.

➤ Injury warning information message

If injury information was entered (on page 9), then the system might show this warning message on screen:



It is triggered for the following reason: within the occurrence, data about injuries can be collected. The taxonomy¹ used by ECCAIRS allows storing injury data at general level (i.e. the occurrence itself) but also

¹ Taxonomy (from Greek *taxis* meaning arrangement or division and *nomos* meaning law) is the science of classification according to a pre-determined system, with the resulting catalogue used to provide a conceptual framework for discussion, analysis, or information retrieval.

allows distinguishing injuries by aircraft involved. In the «ADREP Preliminary» view, only the injuries for a specific aircraft can be collected.

During save, ECCAIRS will verify the injuries entered at aircraft level with the injury information at general level. If there is a mismatch, then the user is prompted with the above message.

By selecting **Yes**, the system will recalculate the general total based on the individual aircraft injuries. By select **No**, the Browser will simply ignore the discrepancy and leave it to the operator to take appropriate action in the future.

➤ Occurrence destination information message

For every new occurrence record, the system needs to understand where the operator wants to store the entered data, and does it by posting the following dialogue box:

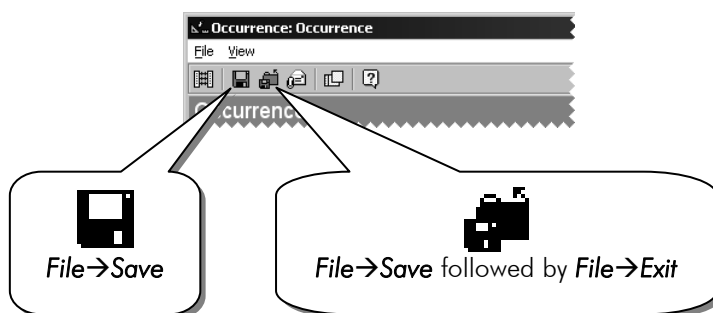


By default, the option **Insert in database** is selected. This will send the occurrence record to the database allowing all other ECCAIRS users to see the data. If **Save in file** is selected, then the occurrence is saved in a temporary file that must be saved before closing the Browser.

Notes

Clicking **File** and **Save** will not close the data entry session. Only by clicking on **File** and then **Exit** the Editor will be closed.

If modifications are made after the last save, then ECCAIRS will trigger a corresponding message.



Exercise 1

OCCURRENCE SUMMARY

Occurrence Number:	2003-0611
Occurrence Type:	Accident
Location:	WESTWOLD, BRITISH COLUMBIA
Occurrence Date:	20-Jun-2003
State:	Canada
Time/Zone:	13:34 PDT

Aircraft Details

Aircraft Manufacturer:	CESSNA				
Aircraft Model:	U206G				
Aircraft Registration:	N9880Z				
Type of operation:	PRIVATE				
Injuries:	Fatal	Serious	Minor	None	Total
Total				2	

FACTUAL INFORMATION

The US registered Cessna U206G amphibious aircraft, N9880Z, was being ferried from Alaska to Kelowna for a pre-purchase inspection. The pilot held a Canadian commercial license and a United States limited commercial license.

On the last leg from Prince George to Kelowna the pilot encountered subsiding air on the downwind side of a ridge. Despite applying full power of 28 inches MP and 2850 RPM the aircraft continued to descend in a flat attitude. No stall warning activated at any time.

As ground contact appeared inevitable, the pilot selected a clearing at about 5,000 feet ASL and prepared for a forced landing with wheels up. Full power was maintained until just before touchdown. When the floats made contact with the ground, the aircraft turned over on its back. The two occupants were uninjured. The aircraft was substantially damaged.

Exercise 2 – Preliminary

OCCURRENCE SUMMARY

Occurrence Number:	NTSB NYC03LA104
Occurrence Type:	
Location:	New Market, VA
Occurrence Date:	Wednesday, May 07, 2003
State:	Canada

Aircraft Details

Aircraft Manufacturer:	Boeing				
Aircraft Model:	B767-300				
Aircraft Registration:	N650UA				
State of registry:					
Operator's Name:	UNITED AIRLINES (D.B.A. United Airlines)				
Injuries:	Fatal	Serious	Minor	None	Total
Total		1		147	

FACTUAL INFORMATION

On May 7, 2003, about 1615 eastern daylight time, a Boeing 767-300, N650UA, operated by United Airlines as flight 188, was not damaged during an encounter with turbulence near New Market, Virginia. The 2 pilots, 5 flight attendants, and 140 passengers were not injured; however, 1 flight attendant was seriously injured. Visual meteorological conditions prevailed, and an instrument flight rules flight plan was filed for the flight destined for Dulles International Airport (IAD), Dulles, Virginia. The scheduled passenger flight departed San Francisco International Airport (SFO), San Francisco, California, at 0914 Pacific daylight time, and was conducted under 14 CFR Part 121.

According to a representative of the airline, when the flight was 90 miles west of Dulles, at flight level 210, thunderstorm cell activity was noted on the weather radar. The flight was given clearance to descend to 11,000 feet, and during the descent, an area of 'moderate turbulence' was encountered, which lasted about 20-30 seconds. During the encounter, a flight attendant fell and twisted her ankle.

Upon arrival at Dulles, the flight attendant was transported to a local hospital and diagnosed with a triple fracture to her right ankle.

Weather reported at Dulles Airport, at 1621, included winds from 130 degrees at 4 knots, 10 miles visibility, thunderstorms and light rain, a few clouds at 900 feet, scattered cumulonimbus clouds at 2,300 feet, a broken cloud layer at 4,000 feet, and another broken cloud layer at 14,000 feet. The temperature was reported as 75 degrees Fahrenheit, the dew point was 64 degrees Fahrenheit, and the barometric pressure was 29.81 inches Hg.

Exercise 3 – Preliminary

OCCURRENCE SUMMARY

Occurrence Number:	NTSB Identification NYC03LA097
Occurrence Type:	Accident
Location:	Buffalo, NY
Occurrence Date:	Monday, May 05, 2003
State:	United States

Aircraft Details

Aircraft Manufacturer:	Piper				
Aircraft Model:	PA-23-250				
Aircraft Registration:	N448VP				
State of registry:					
Type of operation:	Non-scheduled 14 CFR Part 135: Air Taxi & Commuter				
Injuries:	Fatal	Serious	Minor	None	Total
Total				2	

FACTUAL INFORMATION

On May 5, 2003, at 1929 eastern daylight time, a Piper PA-23-250, N448VP, operated by Northeast Aviation, as flight 606, was substantially damaged while landing at the Buffalo Niagara International Airport (BUF), Buffalo, New York. The certificated commercial pilot and additional crewmember were not injured. Visual meteorological conditions prevailed for the non-scheduled cargo flight, which originated from Dutchess County Airport (POU), Poughkeepsie, New York. Flight 606 was conducted on an instrument flight rules (IFR) flight plan under 14 CFR Part 135. According to the operator, the additional crewmember was onboard to observe operations and assist with the cargo. He held a commercial pilot certificate, and was in consideration for employment.

The pilot reported that the flight to Buffalo was without incident. When he initially obtained the ATIS (Airport Terminal Information Service), the winds were 'gusty'. The airplane was radar vectored for the ILS 23 approach. At the outer marker, the landing gear was lowered, and the pilot performed a 'GUMP' check. The airplane crossed the threshold, at an estimated height of 30 feet above the ground, and airspeed of between 110 and 100 mph. The pilot reported that at that point "...the airplane dropped out from under me...". He added power but did not achieve full power prior to the airplane striking the runway. The airplane skidded to the left side of the runway and stopped. The additional crewmember opened the main cabin door and said there was a fire. The pilot and additional crewmember then exited the airplane.

The additional crewmember reported that as the airplane crossed the threshold for runway 23, it just stopped flying and struck the ground. The pilot added power, but there was insufficient time to prevent runway contact. He was not observing the airspeed and was unaware of the airspeed at the time the airplane encountered what he described as 'wind shear'. In addition, he reported that he did not touch the flight controls during the approach or landing.

According to an inspector from the Federal Aviation Administration (FAA), the airplane struck the runway, on centreline, about mid-way from the approach end of runway 23 and taxiway BRAVO. It slid for about 500 feet, and came to rest at the intersection of taxiway BRAVO, with the airplane partially off the runway. The landing gear had collapsed rearward. The outboard section of the left wing had scrape marks on the underside. There were no scrapes on the underside of the right wing. A small post-crash fire developed in the left engine nacelle, and was extinguished by airport fire fighting personnel.

The recorded weather at BUF included winds from 160 degrees at 15 knots, with gusts to 19 knots, at 1854, and winds from 150 degrees at 7 knots, at 1954. The pilot reported his total flight experience as 2,100 hours, with 400 hours in make and model, which included about 210 hours in the preceding 90 days.

Exercise 4 – Preliminary

OCCURRENCE SUMMARY

Occurrence Number:	NTSB Identification NYC03LA114A
Occurrence Type:	
Location:	Flushing, NY
Occurrence Date:	Wednesday, May 21, 2003
State:	United States

Aircraft Details

Aircraft Manufacturer:	Saab-Scania AB (Saab)				
Aircraft Model:	340B				
Aircraft Registration:	N277MJ				
Operator's Name:	COLGAN AIR INC (D.B.A. Colgan Air)				
Type of operation:	Scheduled 14 CFR Part 121: Air Carrier				
Injuries:	Fatal	Serious	Minor	None	Total
Total			1	17	

FACTUAL INFORMATION

On May 21, 2003, at 2210 eastern daylight time, a Saab 340B, N277MJ, operated by Colgan Airways Inc., as flight 5056, was substantially damaged when it was struck by another airplane, while taxiing at La Guardia Airport (LGA), Flushing, New York. The other airplane, a Dassault DA-50, N664B, sustained minor damage.

Onboard the Saab, the flight attendant received minor injuries, while the two pilots and six passengers were not injured. Onboard the Dassault, the two pilots and seven passengers were also not injured. Night visual meteorological conditions prevailed at the time of the accident.

The Saab was operating as a scheduled passenger flight conducted under 14 CFR Part 121. The Dassault was operating as business flight conducted under 14 CFR Part 91.

According to the pilot-in-command (PIC) of the Dassault, his airplane was parked at the 'five towers' area, located on the west side of the airport. At 2205, the PIC received taxi instructions from the ground controller, which the PIC understood as, "...make two left turns and taxi to runway 13 for takeoff, via taxiways F and BB...".

While taxiing north on taxiway BB, the Dassault collided with the Saab at the intersections of BB and E.

According to the captain of the Saab, the airplane was pushed off from the gate to spot 22, where the first officer then called for taxi clearance. The taxi instructions were to proceed "...A short of K..." for an inbound Boeing 737. The flight was then cleared from "...A to E, short of runway 4...".

The flight received further instructions to cross runway 04, and turn right at 'CC' to taxi to runway 13. After crossing runway 04, the captain noted a Dassault airplane taxiing on 'BB', but heard his "...hold short..." instructions, and called for the taxi checklist. As the Saab flight crew was in the process of completing the taxi checklist, the Dassault struck their airplane from the left.

Exercise 5 – Preliminary

OCCURRENCE SUMMARY

Occurrence Number:	NTSB Identification FTW03TA156
Occurrence Type:	Accident
Location:	Franklin, LA
Occurrence Date:	Monday, May 19, 2003
State:	United States

Aircraft Details

Aircraft Manufacturer:	Bell				
Aircraft Model:	407				
Aircraft Registration:	N991SP				
Operator's Name:					
Type of operation:	14 CFR Public Use				
Injuries:	Fatal	Serious	Minor	None	Total
Total				2	

FACTUAL INFORMATION

On May 19, 2003, at 0945 central daylight time, a Bell 407 helicopter, N991SP, registered to and operated by the Louisiana Department of Public Safety, was substantially damaged during a precautionary following a loss of tail rotor pitch control near Franklin, Louisiana. The commercial pilot and his passenger were not injured. Visual meteorological conditions prevailed and a Company VFR flight following plan was filed for the Title 14 Code of Federal Regulations Part 91 Public Use flight. The local flight originated from Baton Rouge Airport (BTR), Baton Rouge, Louisiana, at 0900, and was destined for Franklin, Louisiana.

The pilot reported in the Pilot/Operator Aircraft Accident Report (NTSB Form 6120.1/2) that while he was approaching a helipad for landing, he realised that the anti-torque pedals were not effective. Due to obstacles, the pilot aborted his approach to the helipad and turned eastbound toward a sugar cane field. Subsequently, the helicopter started to rotate and the pilot realised he had no control of the tail rotor with the anti torque pedals. The pilot then rolled the throttle to idle, and initiated an autorotation from approximately 75 feet AGL. The pilot further reported that a high sink rate developed and the helicopter impacted the ground hard on the main landing skids.

An FAA inspector, who examined the helicopter at the accident site, reported that the main landing skids were compressed nearly flat. Further inspection revealed that the pivot bolt (P/N: NAS6604D31), bushing (P/N: 206-011-726-005), nut (P/N: MS14144I4), and cotter pin (P/N: MS24665-155), that connects the rotor control idler assembly (P/N: 406-012-127-101) to the tail rotor control housing assembly was not found. All part numbers were verified with the Bell Helicopter Textron 407 Illustrated Parts Bulletin (BHT-407-IPB).

Examination of the aircraft logbooks indicated that there was an annual maintenance inspection performed on the helicopter 7 days hours prior to the accident. The helicopter accumulated 4.9 hours of flight time since time of inspection.

Exercise 6

OCCURRENCE SUMMARY

Occurrence Number:	2003-0610
Occurrence Type:	INCIDENT
Location:	CYWG WINNIPEG INTL, MANITOBA
Occurrence Date:	24-Jun-2003 14:30 CDT
State:	Canada

Aircraft Details

Aircraft Manufacturer:	FAIRCHILD				
Aircraft Model:	SA-226-TC				
Aircraft Registration:	C-ABCD				
Operator's Name:	ECCAIRS Flyer				
Type of operation:	COMMERCIAL COMMUTER				
Injuries:	Fatal	Serious	Minor	None	Total
Total				15	

FACTUAL INFORMATION

The ECCAIRS Flyer SA226-TC, C-ABCD, was on final approach to Winnipeg, MB. Both left and right hydraulic lights illuminated and the hydraulic pressure gauge dropped below 1,000psi. An overshoot and emergency gear extension were accomplished. The aircraft landed without further incident with ERS on standby. Reportedly, a hydraulic line had cracked.

Exercise 7

OCCURRENCE SUMMARY

Occurrence Number:	2003-1610
Occurrence Type:	INCIDENT
Location:	CYTH THOMPSON, MANITOBA
Occurrence Date:	22-Jun-2003 19:00 CDT
State:	Canada

Aircraft Details

Aircraft Manufacturer:	CANADAIR				
Aircraft Model:	CL-215				
Aircraft Registration:	C-ABCF				
Operator's Name:	EFF – ECCAIRS FIRE FIGHTERS UNLIMITED				
Type of operation:	GOVERNMENT				
Injuries:	Fatal	Serious	Minor	None	Total
Total				2	

FACTUAL INFORMATION

The EFF (ECCAIRS Fire Fighters) Unlimited Canadair CL215, C-ABCD, was returning to Thompson, MB, from a fire suppression flight. The left main gear did not indicate down and the emergency system was activated. The left main gear still did not indicate down; however, its position was determined visually and the aircraft landed uneventfully. The uplock/downlock micro switch was found stuck and functioned normally after post incident lubrication.

Exercise 8

OCCURRENCE SUMMARY

Occurrence Number:	2003-6518
Occurrence Type:	ACCIDENT
Location:	WASAGA BEACH, 2.5 NM W, ONTARIO
Occurrence Date:	24-Jun-2003 07:23 EDT
State:	Canada

Aircraft Details

Aircraft Manufacturer:	MOONEY				
Aircraft Model:	M-20 E				
Aircraft Registration:	C-ABCD				
Operator's Name:					
Type of operation:	PRIVATE				
Injuries:	Fatal	Serious	Minor	None	Total
Total	1				

FACTUAL INFORMATION

C-ABCD – a Mooney M20E aircraft – was en route from Midland to Port Huron, Ontario. Shortly after filing an airborne flight plan with London FIC, the pilot declared a mayday, reporting a rough running engine and that he would not be able to reach the nearest airport for a landing. SAR was immediately contacted and dispatched to the aircraft's last known position. SAR divers located the aircraft but not the pilot. After SAR departed, control of the site was transferred to OPP Collingwood and their divers were dispatched to the scene. The fatally injured pilot was found by OPP at approximately 19:30 EDT. The aircraft is located in the waters of Georgian Bay, approximately two and one half miles west of Wasaga Beach at a depth of 58 feet. The insurance company is arranging for aircraft recovery.

Exercise 9

OCCURRENCE SUMMARY

Occurrence Number:	2003-0738
Occurrence Type:	INCIDENT
Location:	CYHZ HALIFAX INTL, NOVA SCOTIA
Occurrence Date:	23-Jun-2003 02:01 ADT
State:	Canada

Aircraft Details

Aircraft Manufacturer:	EMBRAER				
Aircraft Model:	EMB-145				
Aircraft Registration:	N13553				
Operator's Name:	ECCAIRS FLYERS				
Type of operation:	COMMERCIAL				
Injuries:	Fatal	Serious	Minor	None	Total
Total					0

FACTUAL INFORMATION

The EMBRAER 145 operating as ECC2468 was on Final Approach Runway 06 into Halifax Intl Airport. When the pilot lowered the landing gear an unsafe landing gear condition was observed (did not receive 'three green' lights). The pilot declared an emergency, and the aircraft was vectored for another approach with AFF standing by. The aircraft landed without further incident. The company advises that there was a bulb burnt out. The bulb was replaced, and the aircraft returned to service.

Exercise 10

OCCURRENCE SUMMARY

Occurrence Number:	2003-9510
Occurrence Type:	INCIDENT
Location:	CYTH THOMPSON, MANITOBA
Occurrence Date:	20-Jun-2003 10:23 CDT
State:	Canada

Aircraft Details

Aircraft Manufacturer:	CESSNA				
Aircraft Model:	441				
Aircraft Registration:	C-ABCD				
Operator's Name:	ECCAIRS FLYERS				
Type of operation:	COMMERCIAL AIR TAXI				
Injuries:	Fatal	Serious	Minor	None	Total
Total				2	

FACTUAL INFORMATION

The ECCAIRS FLYERS Cessna 441, C-ABCD, was on a maintenance test flight in the vicinity of Thompson, MB. During a required engine shutdown check the un-feathering pump failed and a single engine landing was required. ERS was placed on standby.

Exercise 11 – Final Report

OCCURRENCE SUMMARY

Occurrence Number:	NTSB Identification DEN00FA095
Occurrence Type:	Accident
Location:	BUENA VISTA, CO
Occurrence Date:	Friday, May 26, 2000
State:	United States

Aircraft Details

Aircraft Manufacturer:	Cessna				
Aircraft Model:	T210K				
Aircraft Registration:	N9457M				
Operator's Name:					
Type of operation:	14 CFR Part 91: General Aviation				
Injuries:	Fatal	Serious	Minor	None	Total
Total	3				

FACTUAL INFORMATION

The pilot filed a flight plan, and was briefed of mountain obscuration and that VFR flight was not recommended. A witness driving over a mountain pass observed the airplane flying at an estimated 300 to 400 feet AGL. The witness said that the fog and snow showers allowed him to follow the airplane only for a few seconds. Search and rescue personnel located the wreckage on a heavily forested mountainside two days later. Examination of the wreckage revealed no pre-impact engine or airframe abnormalities that might have affected the airplane's performance. Toxicological reports indicate that the pilot had the metabolites of Valium and Prozac in his body. The FAA does not approve these prescribed medications for pilots, while they are on flight statuses.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows: the pilot's disregard of the weather forecast, and his VFR flight into IMC. Contributing factors were snow showers, fog, and the mountainous terrain.

History of Flight

On May 26, 2000, at approximately 1515 mountain daylight time, a Cessna T210K, N9457M, was destroyed when it impacted terrain in Cottonwood Pass, near Buena Vista, Colorado. The non-instrument rated private pilot and his two passengers were fatally injured. The pilot was operating the airplane under Title 14 CFR Part 91. Instrument meteorological conditions prevailed at the accident site at the time of the accident. The cross-country personal flight originated from Jefferson County Airport, approximately 55 minutes before the accident. A VFR flight plan had been filed.

The pilot called Denver Automated Flight Service Station (AFSS) on five separate occasions to get weather information and to file a VFR flight plan. On four of the calls, starting at 1030 on the day of the accident, the FAA briefer told the pilot of mountain obscuration and that VFR flight through central Colorado was not recommended. At 1107, the pilot filed a VFR flight plan from Jefferson County Airport, Broomfield, Colorado, direct to Halls Crossing, Utah, at 14,500 feet. He said that the estimated time en route was 2.5 hours, and that he had 5 hours of fuel onboard.

At 1353, the pilot again talked with an FAA briefer for a weather update. During that conversation, the pilot indicated that he would fly south to Pueblo, over La Veta Pass to Alamosa, and then west to Lake Powell. When the pilot called Denver AFSS, to open his flight plan at 1420, the controller again informed him of turbulence and mountain obscuration through central Colorado, and that VFR flight was not recommended.

At approximately 1500, a witness observed an airplane flying up Cottonwood Pass (N38 degrees, 48.29'; W106 degrees, 22.35'; elevation 10,640 feet) at approximately 300 to 400 feet above the ground on an

estimated 240 degree heading. He had just driven over the pass and reported that visibility, at the top of the pass, was only 3 to 5 car-lengths. The witness said he observed the airplane only for a few seconds due to fog and snow showers.

When the pilot did not close his flight plan, the FAA reported the airplane missing at approximately 1700 on May 26. Search and rescue personnel located the wreckage at approximately 0900 on May 27.

Personnel Information

According to FAA records, the pilot reported on his last FAA medical application, dated June 23, 1998, that he had 2,000 hours of flight experience with 40 hours during the last 6 months. According to the pilot's flight logbook and airplane maintenance records, the pilot had an estimated 2,417 hours of flight experience at the time of the accident. The pilot indicated in his flight logbook that he started flying in 1960, and he received his private pilot certificate in 1964.

The pilot's flight logbook indicated that he successfully completed his last FAA required flight review on February 16, 2000.

Aircraft Information

The airplane was a single engine, propeller-driven, six seats airplane which was manufactured by Cessna Aircraft Company, in 1970. It was powered by a Continental TSIO-520-H, six cylinder, reciprocating, horizontally opposed, direct drive, air cooled, fuel injected, turbo-charged engine, which had a maximum takeoff rating of 285 horsepower at sea level. At the last annual inspection on February 24, 2000, the documented airframe total time was 2,427 hours, and the engine had 441 hours since major overhaul.

The airplane was certificated for a maximum gross weight of 3,800 pounds. It had a service ceiling of 28,500 feet; it was equipped with an internal personal oxygen system.

Meteorological Information

At 1353, the weather conditions at the Buena Vista Municipal Airport (elevation 7,945 feet), 080 degrees 10 nautical miles (NM) from the accident site, were as follows: wind 270 degrees at 16 knots gusting to 28 knots; visibility 20 statute miles; cloud condition 8,000 feet scattered 16,000 feet broken; temperature 68 degrees Fahrenheit; dew point 34 degrees Fahrenheit; altimeter setting 29.90 inches. They further reported scattered light rain showers in the vicinity of the airport, and standing lenticular clouds over the mountains. The density altitude was 10,475 feet.

Wreckage and Impact Information

The airplane was found on a mountain side (N38 degrees, 47.28 minutes; W106 degrees, 24.17 minutes; elevation 11,490 feet) in a box canyon on the north side of Jones Mountain in the Collegiate Mountain range. The terrain was an up slope and heavily forested. A red, left-wing navigation light was found at the beginning of a 30 foot long ground scar that led to several damaged trees (the debris path had a 140 degree orientation). Three trees were slashed in half with black paint transfers on their trunks. Another tree, approximately 2 feet in diameter, had its bark removed for an estimated 6 feet of vertical height. On the right side of this witness mark, two seat rails were found impaled into the tree. The aft portion of the cabin, the aft fuselage, and the empennage were found on the right side of the tree. The remaining forward portion of the airplane was found on the left side of the tree. The forward cabin area and instrument panel were fragmented and burned by fire.

All of the airplane's major components were accounted for at the accident site. The flight control surfaces were all identified, but control cable continuity could not be established due to impact damage. The flap actuator in the right wing indicated that the wing flaps were up. The landing gear was in the up position.

The engine was found separated from the airframe and in an inverted orientation; it was fire damaged. Its connecting cables, hoses, and wires were stretched, but still attached. The propeller remained attached to the crankshaft flange. It was rotated and 'thumb compression' was obtained on all cylinders. Both magnetos were burned; the spark plugs appeared heat damaged but with little indication of wear.

The propeller blades were damaged as follows:

A. the blade evidenced a slight 'S' wave, its tip was bent back about 20 degrees;

B. the blade was bowed forward about 15 degrees;

C. the blade was bent in a series of 'S' waves, and paint abrasion was observed.

No pre-impact engine or airframe anomalies, which might have affected the airplane's performance, were identified.

Medical and Pathological Information

The St. Mary-Corwin Regional Medical Center, Pueblo, Colorado, performed an autopsy on the pilot on May 28, 2000.

The FAA's Civil Aeromedical Institute (CAMI) in Oklahoma City, Oklahoma, performed toxicology tests on the pilot. According to CAMI's report (#200000119001), carbon monoxide and cyanide tests were not performed. No volatiles were detected in the vitreous. The drugs nordiazepam, the metabolite of the prescription drug diazepam (commonly known by the trade name Valium), and norfluoxetine, the metabolite of the prescription drug fluoxetine (commonly known by the trade name Prozac), were found in both the liver and kidney.

The pilot did not report, on his FAA medical application dated June 23, 1998, that he was taking these prescribed medications. The FAA does not approve these medications for pilots, while they are on flight status.

Exercise 12 – Final Report

OCCURRENCE SUMMARY

Occurrence Number:	DEN00FA063
Occurrence Type:	
Location:	
Occurrence Date:	20-Mar-2000 07:31MT
State:	United States

FACTUAL INFORMATION

History of Flight

On March 20, 2000, approximately 0731 Mountain Standard Time, a Dornier Luftfahrt GmbH 328-100, N329MX, operated by Air Wisconsin, Inc., and doing business as United Express flight 7128, was substantially damaged when the right main and nose landing gears retracted during landing at Denver International Airport, Denver, Colorado. There were no injuries to the airline transport certificated captain and first officer, one flight attendant, and 21 passengers. Visual meteorological conditions prevailed, and an IFR flight plan had been filed for the scheduled domestic passenger flight being operated under Title 14 CFR Part 121. The flight originated at Bismarck, North Dakota, approximately 0534.

According to the flight crew, during the approach they confirmed the landing gear was down and locked. They broke out of the overcast some distance from the runway and had good visibility, so both pilots were looking outside. The first officer landed the airplane on runway 35L in a slight left crosswind. When the airplane touched down, the landing gear warning horn sounded. The right main and nose landing gears retracted. The airplane slid to a halt on the right side of the runway.

Personnel (crew) Information

The captain, age 37, held an airline transport pilot certificate, dated December 16, 1998, with an airplane multiengine land rating; commercial privileges, airplane single engine land, and a type rating in the Dornier DO-328. He also held a flight instructor certificate, dated July 22, 1999, with airplane single, multiengine, and instrument ratings, and a ground instructor certificate, dated November 7, 1994, with an advanced rating. His first class airman medical certificate, dated October 5, 1999, contained the restriction: «Holder shall wear corrective lenses while exercising the privileges of his airman certificate». His last biennial flight review or equivalent (proficiency check) was dated January 13, 2000, and was accomplished in the Dornier 328-100.

The first officer, age 34, held an airline transport pilot certificate, dated December 4, 2000, with an airplane multiengine land rating; commercial privileges, airplane single engine land, and type ratings in the Dornier DO-328 and Shorts SD3. He also held an expired flight instructor certificate, dated June 12, 1996, with airplane single engine land and instrument ratings, and a ground instructor certificate, dated February 2, 1996, with an advanced rating. His first class airman medical certificate, dated September 1, 1999, contained no restrictions or limitations.

According to Air Wisconsin records, the flight attendant was certified to serve on both the Dornier 328-100 and the British Aerospace BAe 146.

Aircraft Information

N329MX, a Dornier Luftfahrt GmbH 328-100 (s/n 3049), was equipped with two Pratt & Whitney PW119C turboprop engines (s/n PCEAB0010, PCE116051), each rated at 2,180 horsepower. The engines had accrued 7,265:14 and 9,070:02 hours of operation, respectively, at the time of the accident. The airplane was being maintained under a continuous airworthiness inspection program, and had accrued 7,596:18 hours at the time of the accident.

Meteorological Information

The following weather observation was recorded at Denver International Airport 1 minute after the accident: Wind 350 degrees at 19 knots, gusts to 28 knots; visibility 9SM, ceiling 1,400 feet overcast; temperature 28 degrees F, dew point 21 degrees F; altimeter setting, 29.74 inches of mercury.

Aerodrome Information

Denver International Airport is at an elevation of 5,431 feet msl. Runway 35L is 12,000 feet long and 150 feet wide. It is concrete and grooved. It is served by an ALSF-2 approach light system, precision approach path indicator, high intensity runway lights, and runway centreline lights.

Flight Recorders

The airplane was equipped with a Fairchild A-100A cockpit voice recorder (CVR) and a digital flight data recorder (DFDR). Data from both recorders were downloaded at NTSB headquarters on March 23, 2000.

According to the CVR transcript, the first officer requested that the landing gear be lowered at 0729:34. Two seconds later, a sound similar to the landing gear being operated was recorded. At 0730:28, the captain reported "gear down, three green" to which the first officer replied, "down, three green, I see it". At 0730:43, the captain reported, "gear down, three green...before landing checklist is complete". At 0731:53, a sound similar to a decrease in engine RPM was recorded and the captain remarked, "Nice". At the same time, a sound similar to the landing gear warning horn started. The captain said, "Oh, *" and the first officer asked, "What the #'s that?" The captain replied "#, I don't know". At 0731:59, the sound of a thump was recorded and the captain said, "Hang on". The captain reported to the control tower that the gear had collapsed at 0732:03. At 0732:08, the sounds of impact and grinding noises started and continued to 0732:29. At 0733:00, after the passengers had been evacuated, the captain asked "We had three green, didn't we?" The first officer replied "We did. We called for the..." The captain then said "Don't ask me, dude. I have no idea. I should have had you go around". The first officer said, "We touched down but..." This was the end of pertinent conversation.

Some of the findings of the DFDR group chairman's factual report were:

- (1) At 0729:44, while descending through 7,000 feet pressure altitude, the airplane's landing gear discrete changed state from 'up' to 'down and locked' (the landing gear was extended and indicated down and locked, the source data being the position of the nose landing gear);
- (2) At 0731:17, the autopilot engage discrete changed from 'engaged' to 'not engaged' (the autopilot was disengaged);
- (3) At 0731:50, vertical acceleration was recorded at a local maximum of 1.080 g. At 0731:51, the landing gear discrete changed state from 'down and locked' to 'up' while at an airspeed of 120.0 knots (the nose landing gear became 'unlocked', or unsafe, about 2 seconds after the radio altitude reached 0 feet);
- (4) During the approach, hydraulic pressure was recorded at 3,024-3,029 pounds per square inch (psi). At 0731:51, hydraulic pressure was 3,009 psi, dropped to a local minimum of 2,683 psi at 0731:53, then 3,024 psi at 0731:55.
- (5) At 0731:51, roll attitude was recorded at a local minimum of -2.37 degrees (left wing down). Roll values increased to about zero at 0731:55 and then increased to a local maximum of 4.83 degrees (right wing down) at 0731:57, decreased to another local minimum of -0.26 degrees at 0731:59, then increased and remained at or about a maximum of 18.02 degrees at 0732:27 through the end of the recorded data (uncommanded right main landing gear retraction).
- (6) The left and right engine torque and propeller speed values approximated each other during the descent and landing. At 0732:07, however, the left and right engine torque values diverged, 7.53% and 11.59% left and right engine respectively. [According to Fairchild Dornier, flight idle is 12% which «is enough to produce considerable lift, thus reducing the load on the landing gear and WOW (weight on wheels) onset.»] Over the next several seconds the left engine values continued a gradual increase whereas the right engine values increased to a local maximum of 33.12% at 0732:11 and then decreased to zero at 0732:16. The left and right engine propeller speeds were approximately equivalent until 0732:10 when the values diverged. The right propeller speed values dropped to zero at 0732:16.

Wreckage and Impact Information

The airplane was examined in a hangar after it had been towed off the runway. Damage was confined to the right side skin and bulkheads, aft of the co-pilot's station and forward of the wing.

Examination of the cockpit shortly after the incident disclosed the landing gear control lever was in the DOWN position, and the landing gear status lights indicated the left main landing gear to be DOWN AND LOCKED (green) and the right main and nose landing gears to be UNSAFE (red). After the airplane was jacked up and the right main and nose landing gears were lowered and pinned in place, it was towed back to a hangar where initial tests were conducted. The airplane was placed on jacks and the landing gear was cycled 30 times without difficulty. The up and down locks were undamaged and moved freely. The proximity switches tested satisfactorily. The landing gear stopped once a WOW (weight on wheels) condition was simulated.

The landing gear control lever and lever lock solenoid were tested and found to operate normally. Attempts were made to get the handle stuck in the middle position, but the over-centre lever prevented this. The handle could not be forced past the lever without going into manual override.

The landing gear selector valve was undamaged and operated normally. The hydraulic pressure-sensing valve was unremarkable. The hydraulic system was full of fluid and none of the filters had been bypassed. Several gear extensions were made utilising the emergency gear extension system. No anomalies were noted.

The proximity switch electronics unit (PSEU) tested normally. A complete PSEU IBIT was performed. All systems tests were satisfactory. The PSEU non-volatile memory (NVM) was downloaded and revealed numerous faults, none of which were relevant to the accident.

Tests and Research

On April 12, 2000, the PSEU (p/n 8-700-04, s/n 77) and the right main landing gear harness and proximity switches were tested at the facilities of Eldec Corporation in Lynnwood, Washington. The PSEU tested satisfactorily. It was then subjected to temperature extremes (cooled to -40 degrees C. for 2 hours, then heated to 65 degrees C. for 1.5 hours, then returned to ambient temperature). Again, it tested satisfactorily. The harness and sensors tested satisfactorily.

On May 10, 2000, the landing gear selector valve (p/n HP848800-4, s/n 1487), hydraulic pressure sensing valve (p/n QA07376-01, s/n RC22515), and the landing gear control assembly (p/n 717801-1, s/n 118) were tested at the facilities of Fairchild-Dornier in San Antonio, Texas. The landing gear selector valve functioned normally. It was then partially disassembled and examined. No anomalies were noted. The pressure-sensing valve functioned normally but was slightly below maximum flow. Continuity checks through all switch positions were then performed on the landing gear control lever. No anomalies were noted.

On August 10, 2000, the landing gear control assembly was subjected to more elaborate tests at the facilities of the Eaton Corporation in Costa Mesa, California. No pertinent faults were noted.

Hydraulic fluid samples drawn from the filter pack, right main landing gear down lock assist actuator, and the return line for the landing gear selector valve were analysed at Aviation Laboratories, Kenner, Louisiana. According to their report, the samples were normal for wear metal, particle size distribution, viscosity, total acid number, Karl Fisher water, and total chlorinated solvents by volume. An insufficient fluid quantity precluded a particle count and viscosity analysis of the sample taken from the filter pack. A German military laboratory, WEWIB, made an infrared spectrometer analysis of the sample and found it contained an insignificant amount of MIL-PRF-83282D. Partial systemic wiring tests were made while the airplane was undergoing repairs. No anomalies were noted. The integrated avionic computer system (IAC), which provides a readout capability of systems status, was checked and no relevant faults were noted.

Additional Data/Information

Fairchild Dornier provided the following systems information: The gear safe/green light indication is dependent on each individual downlock sensor, and is not influenced by WOW signals.

The PSEU logic for illuminating the gear unsafe/red light would require a retract command and each uplock would have to be unlocked. Once a WOW signal is sensed, the ground dislock in the gear lever is activated, preventing landing gear retraction by inadvertently raising the landing gear handle. It can only be moved by manually overriding the dislock solenoid by pushing a button on the landing gear selector panel.

There are three microswitches in the landing gear control unit that provide gear position input: one to the extend side of the landing gear selector valve solenoid (28 VDC), one to the retract side (28 VDC), and one providing input to the PSEU. In order for the landing gear to retract, there must be an input from the PSEU and an input from the landing gear selector panel, and both inputs must be in agreement in order for the circuit to close. Output from the PSEU enables or inhibits gear retraction (DO41). DO41 is processed in the PSEU depending on the microswitch that provides gear lever position information to the PSEU (retract command input) in conjunction with WOW sensor inputs. The retract command signal-ground is enabled only by the PSEU if at least one of both WOW switches of all three gears indicates WofW (weight off wheels). DO41 uses its own logic, and will allow gear retraction when at least one sensor of each landing gear indicates WofW.

The WOW signal is derived from proximity switches that are in a NEAR position if there is no load on the landing gear. In order to get a FAR signal, there has to be some movement of the shock absorber caused by a load on the landing gear (or WOW). When the left main landing gear proximity switches senses WOW, the PSEU removes the ground signal from the retract solenoid of the landing gear selector valve, thus stopping gear retraction. In addition to the Federal Aviation Administration, parties to the investigation included Dornier, Fairchild-Dornier, Eldec Corporation, Air Wisconsin, Inc., Messier Services, and the Air Line Pilots Association.

Exercise 13 – Preliminary Report

OCCURRENCE SUMMARY

State Reporting:	Timor Leste
Occurrence Number:	BO/20030263
Occurrence Type:	Accident
Location:	2Km north-northwest of Cakung Airport, Baucau, Timor Leste
Occurrence Date:	31-Jan-03
State:	East Timor
Time/Zone:	1521 hours (Local)
Weather in area of occurrence:	Instrument meteorological conditions
Light conditions	Daylight

Aircraft Details

Aircraft Manufacturer:	Ilyushin				
Aircraft Model:	IL-76TD				
Aircraft Registration:	RDPL-34141				
State of registry:	Laos				
Operator's Name:					
Type of operation:	Cargo, Non scheduled, International				
Departure Point:	VMMC Macau International Airport, Macau				
Destination:	WPEC Cakung Airport, Baucau, Timor Leste				
Damage to aircraft:	Destroyed				
Injuries:	Fatal	Serious	Minor	None	Total
Crew	6				
Passenger	Nil				
Ground	Nil				
Total					

FACTUAL INFORMATION

On 31 January 2003 at 0621 UTC (1521 local time), an Ilyushin 76TD, registered RDPL-34141, impacted the ground during an approach to runway 14 at Cakung Airport, Baucau, Timor Leste. The impact site was about 2Km to the north-northwest of the airport. Impact forces and post-impact fire destroyed the aircraft, and the six occupants were fatally injured.

The aircraft was operating an international non-scheduled cargo flight from Macau International Airport, Macau, to Cakung Airport, Baucau, Timor Leste, and was carrying about 31 tonnes of telecommunications equipment.

The area forecast for Timor Leste and surrounding waters, valid at the time of the occurrence, contained information that isolated thunderstorms were expected about the ranges and northern slopes during the afternoon and evening. Broken stratus cloud was forecast between 800ft and 2,000ft above mean sea level, with scattered cumulus and stratocumulus cloud between 2,000 and 20,000ft. Aerodrome forecasts were not issued for Baucau. The published elevation of Cakung Airport, Baucau, was 1,800ft above mean sea level.

Witnesses reported seeing the aircraft overfly the airport twice prior to its impact with the ground. One witness reported that on both occasions, the aircraft appeared to be flying in the direction of runway 14, at about 600ft above ground level, and was partly obscured by cloud. Witnesses also reported that a few

minutes after the aircraft's second overflight, they heard an explosion to the north of the aerodrome and noticed flames and smoke in that vicinity.

Air traffic services were not available at Baucau at the time of the occurrence. A notice to airman was valid at the time of the occurrence, advising that air traffic control was available only for aircraft conducting United Nations troop rotations at Baucau.

An instrument approach and landing procedure for the Baucau non-directional beacon was available on request from the Civil Aviation Division, Timor Leste. It is not known whether the crew had that procedure.

Rescue and fire fighting services from the airport were immediately notified, and were reported to be at the accident site within about 5 minutes. The investigation is continuing.

SAFETY ACTION

As a result of the occurrence, the Australian Accredited Representative to the investigation made the following recommendations to the Government of Timor-Leste in the interest of flight safety.

Recommendation 1

The Australian Accredited Representative and advisers recommend that the Government of Timor Leste liaise with United Nations Air Operations to develop and promulgate approved instrument approach and aerodrome charts for Baucau, Timor Leste, as a matter of urgency, to enhance flight safety of aircraft operations into Baucau.

Recommendation 2

The Australian Accredited Representative and advisers recommend that the Government of Timor Leste liaise with Jeppessen Sanderson to ensure that Jeppessen Sanderson is provided with current, approved data for appropriate instrument approach and aerodrome charts for Baucau, Timor Leste, and that charts approved by the Government of Timor Leste are promulgated by Jeppessen Sanderson, to enhance flight safety of aircraft operations into Baucau.

Recommendation 3

The Australian Accredited Representative and advisers recommend that the Government of Timor Leste review the appropriateness of the current provision of Air Traffic Services and facilities to non-United Nations aircraft operations into Baucau, Timor Leste in the interest of enhancing flight safety of aircraft operations into Baucau.

As a result of the occurrence, the Australian Accredited Representative to the investigation made the following recommendation to United Nations Air Operations, Timor Leste in the interest of flight safety.

Recommendation 4

The Australian Accredited Representative and advisers recommend that United Nations Air Operations assist the Government of Timor Leste to develop and promulgate approved instrument approach and aerodrome charts for Baucau Timor Leste, as a matter of urgency, to enhance flight safety of aircraft operations into Baucau.

Occurrence Category Exercises



Exercises with Solutions

The following exercises provide narrative from which the reader must extract information about 'Occurrence categories' only. Since these exercises do not focus on the occurrence but only on the occurrence category, to code these exercises into the ECCAIRS system the user can select any of the available views and use a dummy aircraft in place of the given one. Solutions are in a separate book.

Exercise 14

During take-off run parts of the runway surface hit the stabiliser and the elevator of the Aero Flite Ltd. operated Airbus A319 registration F-LITE. No injuries reported.

Exercise 15

A B767-300 (Happy Landing SA, G-WXYZ) and a B757-200 (NJOY Flying, 4X-AAA) were flying on the respective airways at FL360. In proximity of SUBUN point, interception of UM622 and UM603, both aircraft had TCAS Resolution Advisories. The Short Term Conflict Alert (STCA) radar function activated well before the two aircraft reported TCAS-RA, but the controller did not notice it until one of the crew of the two converging aircraft made a communication to the controller advising him of the possible conflict. After TCAS-RA manoeuvre of both aircraft separation was obtained.

Exercise 16

While waiting on the ramp after landing at Flushing NY, the flight crew of an MD80 (N000MD) started the airplane's auxiliary power unit (APU) and about 30 seconds later, the cabin began to fill with smoke. The captain ordered an emergency evacuation utilising the airplane's four evacuation slides. All slides functioned normally; however, during the egress, a passenger sustained a fractured bone in her right foot, while one of the pilots and 5 passengers reported respiration difficulties. The other 4 crew members and 68 passengers suffered no injuries. Examination of the airplane revealed a broken hydraulic line, which allowed hydraulic fluid to accumulate in the area of the APU inlet.

Exercise 17

During cruise flight at 12,000 feet mean sea level (MSL), the right engine lost power. The pilot of the Piper PA-31 reported the loss of engine power to the Atlanta Air Traffic Control Centre. The pilot was instructed by the controller to turn around and to proceed to the Ashville Regional Airport. As the pilot manoeuvred, the left engine also lost power. The pilot was directed by the controller to a highway intersection between IS 19 & 23. The airplane collided with trees short of the highway and sustained substantial damage. The pilot and his passenger were uninjured.

Examination of the fuel system found both fuel tanks void of fuel and no visible of fuel loss at the accident site. The pilot reported departing with approximately 90 gallons of fuel on board. According to PA-31-325 specifications, the standard fuel quantity is 183 gallons, and the optional fuel capacity is 237 gallons.

Exercise 18

A Sikorsky S58T helicopter was flying over a lake at a low altitude when it struck power transmission lines, lost control and impacted the lake. The pilot stated that he checked his charts and was aware of power transmission lines to the east but was not aware of any power transmission lines to the west. He stated that he saw the power transmission lines and attempted to pull up to clear the power transmission lines. He stated that the helicopter was running alright and everything appeared to be operating okay. The power transmission lines that were struck measured 124 feet above the water. The helicopter sustained substantial damage; the pilot and a flight engineer were seriously injured, the other pilot did not survive the impact.

Exercise 19

The Boeing 767-200 aircraft (C-ABCD) was on a right hand downwind leg for runway 23 at Toronto LBPIA (CYYZ). An Airbus A320 (C-DCBA) aircraft was turning onto final approach for runway 23 from the south. The Boeing 767 was instructed to turn to a 090 degree heading. The pilot read back the clearance to ATC correctly but continued the right turn to a heading of 190 degrees. This heading resulted in a loss of separation between the two aircraft; spacing was reduced to 2 NM and 700 feet where minimum separation for the terminal area is 3 NM and 1000 feet. Corrective action was taken by ATC and both aircraft landed without further incident.

Exercise 20

On August 12, 2004, at 1910 eastern daylight time, an Embraer EMB-145-LR, operated by Happy Landings as flight 3167, was substantially damaged when it was struck by a ground vehicle, while parked at the General Edward Lawrence Logan International Airport (BOS), Boston, Massachusetts. There were no injuries to the 2 flight crew, 1 flight attendant, or 48 passengers while the driver of the ground vehicle sustained minor injuries. Instrument meteorological conditions prevailed, and an instrument flight rules flight plan was filed for the planned flight to Greater Rochester International Airport (ROC), Rochester, New York.

The scheduled passenger flight was conducted under 14 CFR Part 121. The airplane was parked at gate 9A, with the engines off, while the flight crew was waiting for pushback. At that time, a tug was transitioning the ramp area, and collided with the left wing of the airplane. The collision resulted in substantial damage to the left wing.

The reported weather at BOS, at 1852, was: wind from 050 degrees at 13 knots; visibility 1/4 mile in fog; indefinite ceiling 100 feet; temperature 50 degrees, dew point 48 degrees; altimeter 29.93 inches Hg.

Exercise 21

The LA Local Airline Corp. Saab 340 (C-SAAB) aircraft was on an IFR flight from St. Anthony to St. John's. Approximately 25 NM North of St. John's, the aircraft cancelled IFR and landed VFR on runway 29. The aircraft was then cleared to backtrack runway 29 and hold short of runway 34. A PSA Private Safe Air Ltd. operated Piper PA-28-140 (C-UCME) aircraft was then cleared to take-off on runway 34 and had just commenced the take-off roll when the tower controller observed the Saab 340 enter runway 34. The tower controller cancelled the take-off clearance for C-UCME and the pilot rejected the take-off. The aircraft were approximately 3000 feet apart when C-UCME came to a stop.

Exercise 22

A confused passenger attacked pilots with an axe during approach. A pilot got seriously injured by this attack. Minor injuries were sustained by the second flight crew member as the aircraft dived, but control was recovered close to the ground. The attacker was overmanned by some of the other 6 passengers. One passenger sustained a bleeding nose and some brews. A flight attendant was going to hospital for examination but it is unknown whether she sustained reportable injuries. The aircraft safely landed at ENBO.

Exercise 23

The Boeing 737-210C (C-ABCD) was operating as Flight 6501 from Lupin, Nunavut, to Edmonton, Alberta. The runway visual range (RVR) provided to the flight crew prior to commencing the approach to Runway 12 at Edmonton was 1200 RVR, with a runway light setting of 5. The crew flew the ILS approach in darkness and touched down on the infield to the left of the runway surface, at 0544 Mountain Standard Time.

The aircraft travelled approximately 1600 feet before returning to the runway. After the aircraft was brought to a full stop, aircraft rescue and fire fighting was requested by the flight crew. One runway light, four taxiway lights, and one hold sign were struck by the aircraft. The aircraft was substantially damaged. There were no injuries and all the 6 crew members and the 30 passengers deplaned via the rear airstairs door.

Exercise 24

On August 20, 2003, about 2345 Alaska daylight time, an Aerospatiale ATR-42-300 airplane, N00AB, sustained substantial damage resulting from a lightning strike during a normal descent, about 32 miles north of Anchorage, Alaska. The airplane was being operated as an instrument flight rules (IFR) non-scheduled cargo flight under Title 14, CFR Part 121, when the accident occurred. The two flight crew members and a company maintenance person were not injured. Instrument meteorological conditions prevailed, and an instrument flight plan was filed.

The flight originated at Fairbanks International Airport, Fairbanks, Alaska, about 2241. During a telephone conversation with the National Transportation Safety Board (NTSB) investigator-in-charge (IIC) on September 16, the Director of Safety for the operator said the flight was in meteorological conditions (IMC) and descending normally into the Ted Stevens Anchorage International Airport, Anchorage, when it was struck by lightning. He said the airplane was equipped with functioning radar, which was knocked off-line along with several other electrical systems, but most of the systems were restored in-flight. He said the airplane landed without incident, but sustained structural damage to the left aileron, requiring replacement of the aileron.

In a written statement the pilot wrote that after takeoff, they deviated to the southwest around a thunderstorm, and that there were numerous thunderstorms north of the Alaska Range, and in the Fairbanks area. The pilot

wrote that after clearing the thunderstorm he was cleared to Talkeetna, Alaska, and that most of the observed thunderstorms were behind them. He stated that after flying through clear air, they entered instrument meteorological conditions, and after receiving clearance from Anchorage Centre, started a normal descent for the destination airport in smooth air.

He wrote that he and the first officer simultaneously noticed that the radio magnetic indicator needles *"...spun around in different directions..."* but did not indicate what was observed on the radar screen. He continued saying *"...an instant later, we were struck by lightning..."*.

Exercise 25

The Boeing 737-700, privately owned by Prectis Corp. (C-ABCD) was being utilised for a flight attendant group line indoctrination flight. The lead flight attendant advised the cockpit crew that they were ready for the 'moderate turbulence' demonstration and that they were taking their jump seats. The captain waited approximately one minute and then made the 'Flight Attendant Be Seated' announcement; a couple of seconds later the pilot started to simulate turbulence. The exercise was halted when the cockpit crew was informed that the lead flight attendant was hurt. After landing the captain was advised that the lead flight attendant delayed returning to the jump seat in order to instruct the student flight attendants to secure their manuals.

Exercise 26

A flight attendant of an Airbus A320 flying from Dulles to Dallas was seriously injured when struck by a galley service cart during initial climb after takeoff. According to company personnel, the galley service cart was not secured properly prior to departure and became detached from the forward galley during climb out. The galley service cart travelled down the centre aisle and struck a flight attendant in the aft galley, fracturing his ankle. No anomalies were found with the galley service cart or the galley in which it was stationed prior to takeoff. All restraint levers were intact and functioned as designed.

Exercise 27

At 10 NM on final IFR approach, the flight crew of a 767-300 received a cargo fire warning. The flight crew followed QRH procedures, activated the cargo bay fire extinguishers and declared an emergency. The flight landed and stopped on the runway to allow a/p ERS to inspect the a/c for fire. No external fire damage was observed, but the flight and cabin crew noticed a significant smoke odour in the cabin. The flight crew taxied to the terminal, where ERS personnel opened the C2 and bulk cargo compartments and discovered a significant amount of smoke in both areas.

During the investigation, substantial soot and fire damage was found on the floor of the a/c cargo bay. A heating blanket around a water line had shorted causing a local fire melting parts of the keel beam. The 8 crew members and the 177 passengers had evacuated the a/c via the slopes.

Exercise 28

The Beach 1900 C aircraft was turning into a parking spot on the ramp. When the a/c was part way through the turn, and broadside to a 30kts wind, it began to slide sideways. The crew added engine power but were unable to prevent the a/c from contacting a military Hercules 382B/100 aircraft that was parked on the ramp. The Beach 1900 C sustained substantial damaged. The damage to the Hercules was limited to a foot long shallow dent on the leading edge of the left wing outboard of the #1 engine.

Exercise 29

The pilot of a De Havilland - DHC2 MK I Beaver stated he lost directional control of the float equipped airplane during the initial takeoff run. He indicated the airplane was just coming up on the 'step' and that he was taking off upstream to ferry his a/c to the nearest maintenance bay, with an 8kts quartering tailwind from the left. He said the airplane swerved left, and the left wing struck a tree on the river bank.

Exercise 30

The Learjet 35 Transcontinental was approaching VOR, located at the Tiflis International a/p in Georgia, from the northwest. The a/c was cleared for an ILS app on runway 31L, with L/H procedure. When the a/c came below the clouds, the pilot requested a visual approach for runway 31L and ATC confirmed. 3 NM ahead of runway 31L, a little bit right of its centre line, is where a closed military a/p is located. The pilot confused this military a/p with the Tiflis a/p and landed on it. When he realised it, he took off again and flew to Tiflis.

Exercise 31

While executing an instrument approach, the Cessna 421 was in instrument meteorological conditions until reaching about 700 feet above ground level. Once clear of the clouds, it was lightly raining, there was no turbulence, and both pilots could clearly see the airport. The pilot was advised by the tower controller that it was raining heavily at the airport. The pilot selected landing flaps, and slowed the airplane to approximately 100 knots. The intensity of the rain increased, and the airplane touched down 'smoothly' near the runway aiming point and 'slightly' left of centreline. The pilot lowered the nose, and 'lightly' applied the brakes.

The airplane started to hydroplane, to yaw left, and then exited the left side of the runway. The airplane slid several hundred feet, and was substantially damaged before it came to a stop close to the left side of the runway. Examination of the wreckage revealed no pre-impact failures or malfunctions. No indication of injuries to the 5 persons on board.

Exercise 32

The Boeing 737-200 had just departed runway 24L at Toronto LBPIA (CYYZ) for a regular scheduled IFR flight to Quebec City (CYQB). Upon final flap retraction, the flight crew observed a 'Flap retract – leading edge' warning light and a 'Flap Transit' light on the left side. The flight crew completed the abnormal checklist, but could not retract the leading edge device (LED). The crew also noted an uncommanded roll tendency and requested and obtained to return to Toronto. The approach and landing were uneventful and all 5 crew and 68 pax exited the a/c regularly. Company Maintenance personnel discovered that the number one slat actuator had failed. The part was replaced and the aircraft returned to service.

Exercise 33

The air carrier passenger flight Evasive Air N000AC B757-200 encountered severe turbulence while in cruise flight from New York to Toronto. Three passengers were seriously injured and nine passengers and three flight attendants received minor injuries during the turbulence encounter. The remaining 106 passengers and 5 crew members were not injured. The airplane was travelling in a predominately northern direction at 37,000 feet altitude during the encounter. Weather products obtained showed that extreme intensity thunderstorms existed in the area where the turbulence was encountered. Weather data and aircraft position radar data show that the airplane was 9 miles south-southwest of a cloud build-up that extended to 39,000 feet. Additionally, the airplane was 5 miles west of an extreme intensity radar echo associated with the thunderstorms in the area.

The airline's General Operations Manual states that thunderstorms which are identified as severe or giving an intense radar echo should be avoided by at least 20 miles. No National Weather Service aviation weather advisories were in effect for the location and time of the turbulence encounter. Communications transcripts show that the flight crew requested and were granted a course deviation for weather about 10 minutes prior to the upset. However, the Digital Flight Data Recorder shows that the seat belt sign was illuminated only 10 seconds prior to the encounter.

Cause: the flight crew's failure to follow weather avoidance procedures and their delay in activating the seat belt sign. Factors were the turbulent thunderstorm weather conditions, and the failure of the National Weather Service to issue an applicable in-flight weather advisory.

Exercise 34

A Fokker F-28 touched down 6 metres short of runway 15/33 and struck the raised lip of the runway threshold. The left hand main gear collapsed, causing the plane to skid for 450 m before coming to rest. It veered to the left and hit the wall of a company building. No injuries reported amongst the 6 flight crew and 60 passengers.

Exercise 35

The departure, climb, en route, and descent portions of the flight operated on a Canadair CL600 were conducted without incident. The airplane was vectored onto the final approach course for the ILS 19 approach at Teterboro, New Jersey, and the captain configured the airplane to land. He flew the approach at Vref plus 30 knots because of turbulence and reported wind gusts.

As he initiated a flare to land on runway 19, the airplane encountered wind shear. It touched down hard on the main landing gear, bounced, and then touched down again on the nose wheel. The captain stabilised the airplane, slowed to taxi speed, and exited the runway. Examination of the airplane revealed substantial

damage to the pressure bulkhead in the vicinity of the nose gear box. The wind, 26 minutes prior to the accident, was recorded as 150 degrees at 26 knots, gusting to 37 knots.

Exercise 36

The crew of a Cessna 550 Citation, with the first officer as the handling pilot, carried out an attempted landing at Aberdeen a/p in conditions of gusting crosswinds from the left. The a/c bounced on the first landing and entered a series of divergent bounces, from the last of which a go-around was made. The a/c sustained damage to the nose landing gear and diverted to land successfully at another a/p where the wind conditions were more favourable. Data recordings were recovered, however, the circuit breaker for the CVR was not pulled and thus the recording of the event was overwritten during the remaining flight.

Exercise 37

On August 11, 2002, at 1020 Central Daylight Time, a Cessna 310R twin-engine airplane was destroyed upon impact with terrain while on approach to the Ilopango International Airport, near San Salvador, in the republic of El Salvador. The commercial pilot and his 4 passengers were fatally injured. The airplane was owned and operated by a private individual in Guatemala City, Guatemala. Visual Meteorological Conditions prevailed for the executive flight for which an instrument flight rules (IFR) flight plan was filed.

The flight originated at the Aurora International Airport, in Guatemala City, at approximately 0930, with the Ilopango International Airport as its intended destination. The authorities reported that at 10:16, approximately 4 minutes before the accident, the pilot reported to approach control that he was 12 miles out and descending out of 4,000 feet. 48 hours later, the wreckage of the airplane was located by search crews on the slopes of the El Salvador volcano, at 3900 ft elevation. The mountains were reported as obscured at the time of the accident.

Exercise 38

A DC-4 Skymaster carrying mechanical equipment struck the app lights and touched down about 50 ft short of the threshold of runway 10 at the Diavik a/p, North West Territories Canada. The a/c spun around, the right wing separated, and fire erupted in the wreckage, which came to rest on the runway about 1 000 ft from the threshold. The crew rapidly evacuated the a/c with minor injuries, and AFF which was on the scene within five min extinguishing the remainder of the fire which had at that point destroyed the a/c and the load.

Exercise 39

On April 17, 2001, about 1825 Eastern Standard Time, an Empresa Brasileira de Aeronautica, S/A (Embraer) EMB-120 encountered icing conditions while in cruise flight at 17,000 feet mean sea level (msl) and departed controlled flight, descending to an altitude of about 10,000 feet. The pilots recovered control of the airplane and diverted to West Palm Beach, Florida, where they landed without further incident. The 2 flight crewmembers, 1 flight attendant, and 25 passengers were uninjured, and the airplane sustained substantial damage to the elevators and the horizontal stabiliser. The flight was operating under 14 Code of Federal Regulations Part 121 as a scheduled international passenger flight from Nassau International Airport, Bahamas, to Orlando International Airport, Florida.

The flight departed in visual meteorological conditions (VMC). In post accident interviews, the captain stated that while in VMC, the airplane flew normally. Flight data recorder (FDR) data indicate that about 7 minutes before the upset occurred, the airplane was at about 17,000 feet msl, with the autopilot engaged and airspeed stabilised near 200 knots indicated airspeed (KIAS). These data indicate that beginning about 1818, the airspeed slowed to 185 KIAS over a 1(?) minute period as the autopilot began trimming airplane nose-up (ANU) to maintain altitude. The airspeed then decreased to about 137 KIAS over the next 3 minutes. The airplane continued to maintain a constant altitude as the autopilot trimmed the airplane from about 0 to about 7 degrees ANU.

The first officer stated that immediately before the upset occurred, he switched the leading-edge de-icing system inflation cycles switch from 'light' to 'heavy' and the propeller de-icing system cycles switch from 'norm' to 'cold' because he saw '*...more ice accumulation than he had ever seen...*' on the wing and spinner. FDR data indicate that when torque indications for both engines were about 55 percent and the airspeed was about 141 KIAS, the autopilot was disengaged. The airplane then pitched down and rolled about 80 degrees to the left, then rolled back to near level.

During the next 20 seconds, engine torque increased to about 98 percent on both engines, the airplane rolled about 110 degrees to the left, returned to level flight, rolled about 130 degrees to the right, returned

to level flight, then rolled 360 degrees to the right before returning to near wings level, with torque on both engines stabilised at about 22 percent. The airplane's behaviour during the upset is consistent with an ice-induced stall event.

The first officer stated in post accident interviews that the stick shaker and aural stall warning, which is part of the airplane's stall warning/protection system, activated but did not indicate whether it was before, during, or after the upset. The Safety Board's investigation could not precisely determine whether or when the stick shaker and aural stall warning activated.

Meteorological data at the time of the accident indicate that the flight may have encountered an area of icing conducive to the formation of super-cooled large droplets (SLD). The EMB-120 is not certified for flight in SLD conditions. FDR data indicate that airspeed had decreased to only about 137 KIAS before control of the airplane became difficult and altitude was no longer maintained. However, according to the Embraer EMB-120 Airplane Flight Manual (AFM) performance section, the airplane stalling speed is about 115 knots calibrated airspeed for an airplane at the accident airplane's approximate gross weight at the time of the event (23,800 pounds).

Cause: the failure of the flight crew to maintain airspeed during an encounter with severe icing conditions, which resulted in an inadvertent stall, loss of control, and structural damage to the airplane.

Exercise 40

The aircraft received permission to take off from runway 01 at Guatemala City Airport. The aircraft climbed to height of about 200 feet when it banked to the right and left. The airplane stalled and crashed. The aircraft came to rest on the grass just to the left of the runway, between taxiways X and Y, about 550m short of the departure end. The accident happened in daylight (0730L) and apparently in normal weather. Wind 030DEG/6kt.

The aircraft was operating a flight to San Pedro Sula, Honduras. Three passengers survived with serious injuries, while the two crew and six other passengers were fatally injured. It appeared that the distribution of the passengers in the cabin had caused the centre of gravity to be outside the limits. Also, the co-pilot did not have a type rating for the LET 410 aircraft.

Exercise 41

The B737-800 (EI-BECE) departed Charleroi Airport in Belgium on a scheduled flight to Stanstead, UK. Shortly after take off the First Officer noted that the Captain had leaned to one side and did not respond to prompting. Realising that the Captain was incapacitated, the First Officer advised Brussels ATC that he had a pilot incapacitation problem and requested a return to the departure airfield, Charleroi. An Emergency was declared.

The No. 1 Cabin Crew Member (CCM) (1) was summoned to the cockpit and put a therapeutic oxygen mask on the unconscious Captain. It appeared that the Captain was lifeless. The aircraft returned immediately and landed safely at Charleroi. A husband and wife medical doctor team on board the aircraft attempted to revive the Captain. Eventually with the aid of the airport and Local Authority Emergency Services, the Captain responded to intensive revival efforts and was removed to hospital in a critical condition. The investigation was delegated to the State of Registry.

Exercise 42

The first officer landed the airplane upon completion of a night ILS approach. Just after touchdown, the airplane struck a deer in the vicinity of the left engine. The deer had been crossing the runway from left to right. The captain shut down the engine and taxied to the gate. Post-accident examination of the airplane revealed that the engine firewall was cracked, one propeller blade was bent, and another blade had separated near the hub. The separated portion of the blade was found about 300 feet from where the collision occurred. Weather at the time included a 600 ft overcast layer. The fence around the aerodrome had not been maintained properly.

Exercise 43

As the Boeing 747-400 rotated during takeoff from Changi International Airport, Singapore, the crew heard a loud bang and the aircraft yawed left. After confirming the failure of the No.2 engine, the flight crew shut down the engine and, after dumping fuel, returned to the airport. Number of passengers/crew not reported.

Inspection of the Rolls Royce RB211-524G2-T-19 turbofan engine found that a single blade had detached from the first-stage high-pressure compressor (HPC 1) disc. The remaining HPC 1 blades were extensively damaged. The HPC 1 module had been in operation for a total of 14,166 hours and 1,456 cycles.

Laboratory investigation attributed the liberation of the blade from the compressor disc to the high-cycle fatigue cracking of the blade's dovetail root corners, as a result of galling and uneven bedding along the dovetail surfaces. Evidence established by the engine manufacturer regarding previous instances of blade dovetail root cracking was consistent with this conclusion. A service bulletin introducing improvements in the dry film lubrication system used on the blade dovetail surfaces had been promulgated by the engine manufacturer in response to the earlier failures. The manufacturer recommended incorporation of the service bulletin at the next overhaul or disassembly. However, the engine had not become due for refurbishment or overhaul since the bulletin was issued.

Exercise 44

The ATR42-300 took off on a regular cargo night flight. The ATC Curitiba Center lost VHF communications with the aircraft during cruise flight (FL170). The wreckage of the aircraft has not been found. Fatalities presumed.

Exercise 45

While climbing through FL120 after take-off from Düsseldorf, the Tupolev TU-154 encountered a severe hail storm. The flight continued and landed safely at Moscow airport.

Events/Factors Exercises



Small Exercises with Solutions

The following exercises provide narrative from which the reader must extract information about 'Events' and 'Phases' only. Since these exercises do not focus on the occurrence but only on events and phases, to code these exercises into the ECCAIRS system the user can select any of the available views and use a dummy aircraft in place of the given one. Solutions are in a separate book.

Example

Narrative: The a/c accident involving the YAK-40 UK-87985 of the national airline Uzbekistan Havo Jullary occurred in difficult meteorological conditions causing the a/c to touch down beyond the runway. This led to a collision with obstacles and the destruction of the a/c, as a result of which all crew members and pax on board died.

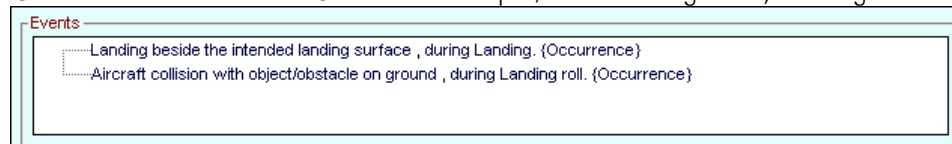
Approach

Narrative: The a/c accident involving the YAK-40 UK-87985 of the national airline Uzbekistan Havo Jullary occurred in difficult meteorological conditions causing the a/c to touch down beyond the runway. This led to a collision with obstacles and the destruction of the a/c, as a result of which all crew members and pax on board died.

Solution

Touch down beyond the runway → Off landing surface²; Landing

Collision with obstacles → Collision with object/obstacle on ground; Landing roll



Exercise 46

Narrative: The ECCAIRS AIRLINES Cessna 208B Caravan, C-ABCD, departed Pelee Island airport for Windsor Airport with a total of 10 souls on board. Shortly after take-off the aircraft crashed on the ice-covered surface of Lake Erie, about 0.5 NM west of the coast of Pelee Island. All aboard the aircraft were fatally injured and the aircraft was destroyed. Some of the aircraft debris was found on the ice, but much of the aircraft sank.

Exercise 47

Narrative: At 3NM on VOR/DME app to Sharjah a/p, in fine daylight conditions, the a/c pitched down and entered a left turn from which it did not recover. Initial FDR indicates the propellers pitch moved into a ground control range. The manufacturer and state of design/manufacture have issued advice to observe a/c flight manual warning on selection of ground idle in flight. The aircraft was destroyed by post-impact fire.

Exercise 48

Narrative: The a/c took off at 04:00 UTC from Rome Ciampino. During the descent inbound to Capo Carbonara VOR on radial 219 deg, the crew requested authorisation for a visual approach on runway 32. About 25NM before Carbonara VOR and 8,400ft, the a/c turned right on heading 246 deg. Shortly after, the a/c over flew a mountainous area east of the field, where the Min Sector Altitude is 5,700ft. At 04:48 the crew contacted Cagliari TWR for the last time. At 04:49 the a/c hit an isolated peak 3,332ft, 80ft below the top, 18NM from the a/p.

Exercise 49

Narrative: JA9910 took off from Nagano heliport with a captain and a mechanic on board to cover a traffic accident and it picked up a reporter and cameraman on its way to the accident site. Just before arriving at the accident site, the helicopter struck power lines and fell into the river bed. Post accident fire broke out and all occupants were killed.

² In the events tree, this option may display as 'Landing beside the intended landing surface'. Here, the meaning of 'beside' is not limited to 'left' or 'right' of the landing surface but also includes 'beyond'.

Exercise 50

Narrative: An ERA Aviation, Inc Sikorsky 76A helicopter lost contact on its way to an off-shore drilling ship in the Gulf of Mexico. There were 2 crew members and 8 passengers on board. An oil slick has been reported but the helicopter has not been located.

Exercise 51

Narrative: the a/c landed on the wet runway at a slight angle to the right of the runway heading. After some 400m (1,300ft) on this heading, the a/c left the runway and continued on soft ground close to the right side of runway. The a/c bogged down after travelling about 305m (1,000ft).

Exercise 52

Narrative: during take-off, the a/c did not respond to pitch control input. At VR, the pilot trimmed the stabiliser but this was unsuccessful. He aborted the take-off and the a/c overran. The gear sank into the soil and the nose gear collapsed. Number two and three engines were damaged by contact with the ground. Findings: lack of up-to-date records and documents.

Exercise 53

Narrative: on 10 April 1999, at 1317h pacific daylight time, a Boeing 737-300, N387UA, aborted the take-off roll at McCarran field, Las Vegas, Nevada, due to an un-commanded yaw. The a/c was operated by United Airlines, Inc., as flight 2559, a regularly scheduled domestic passenger flight to Los Angeles, California. The a/c was not damaged, and after the yaw coupler was replaced as a precautionary measure, the a/c continued on to its original destination. The flight crew of two, one jump seat rider, three flight attendants, and 134 pax were not injured. The flight was being conducted under 14 CFR part 121 and an IFR flight plan was filed. VMC prevailed at the time of the incident. According to the pilots, as the a/c passed through 120-130kt in the ground roll, the a/c yawed slightly. The crew indicated that they had no unusual cockpit indications prior to the yaw event. After the a/c returned to the gate, the a/c was delayed at Las Vegas for 5h and 10min. After the maintenance delay, the a/c departed for Los Angeles, and landed at 1929. After the a/c landed at Los Angeles, a mechanic for the United Airlines noticed that the nose gear made an "...unusual bump and rattle..." during turning while the a/c was being taxied to the hanger. A ferry permit was obtained and the a/c was ferried from Los Angeles to their maintenance base in San Francisco. After the a/c arrived in San Francisco, the nose landing gear trunnion bearings were replaced.

Exercise 54

Narrative: the crew experienced an un-commanded roll to the left at FL310. There was a 'light chop' at FL310 and the crew was going to request a descent. The roll was described as a "...rudder kick, a sharp quick un-commanded kick to the left...". The auto-pilot was on during the 20- to 30-deg roll excursion.

Exercise 55

Narrative: The amphibious float-equipped Cessna A185F aircraft was being flown the short distance from the Kenora airport to the Kenora water base. The pilot called Winnipeg FIC to advise that the aircraft was on approach and would be landing at the Kenora water base. The aircraft touched down with the amphibious wheels extended and the aircraft overturned on landing. The uninjured pilot was taken to hospital, examined, and subsequently released. The aircraft was towed to a dock for recovery.

Exercise 56

Narrative: The aircraft, took off from Vancouver for Prince George. Soon after take-off the #2 rudder hydraulic pressure caution light illuminated. The rudder full pressure light was off. The crew completed the appropriate QRH checklist and, since the aircraft would be grounded on landing, decided to return to Vancouver. No emergency was declared but ERS was activated on standby as a precaution. The aircraft landed without further difficulty. Repairs to the hydraulic system are ongoing.

Exercise 57

Narrative: The Embraer 110 aircraft took off from Port Hardy for Bella Bella and was cleared to maintain 6,000 feet. The aircraft levelled off at 6,000 feet. An operating irregularity occurred when the aircraft subsequently began to climb out of 6,000 feet. The controller observed the aircraft climbing through 6,300 feet and alerted the crew. The aircraft returned to 6,000 feet.

Exercise 58

Narrative: During the takeoff roll at XXX, the crew of a DC-3 smelled smoke and rejected the takeoff. Maintenance inspection revealed that a can of hydraulic fluid which had been stored on a relay cover had shifted and shorted across the poles of the winch relay.

Exercise 59

Narrative: The Piper PA22 was landing at XXX, a private airstrip. While on the landing roll, a gust of wind lifted the left wing up and the aircraft flipped over to the right, landing upside down in a snow bank. The two occupants of the aircraft exited with minor injuries. Emergency personnel did not attend. The aircraft sustained substantial damage.

Exercise 60

Narrative: The Airbus A320 was taking off from XXX. During the initial climb the crew was unable to retract the landing gear. They elected to continue to YYY. An emergency was declared. The aircraft landed safely and without any further incident. Maintenance found that the proximity sensor link had been bent. The sensor link was replaced as per AMM 32-21-27-400. A gear retraction test was carried out and checked OK. The aircraft was returned to service.

Small Exercises without Solutions

The following exercises provide narrative from which the reader must extract information about 'Events' and 'Phases' only. Solutions are not provided.

Exercise 61

Narrative: The aircraft was on a 2 mile final into XXX Airport when the crew declared an emergency due to an indication of a possible fire in the right engine (GE CF-34-3A1). The flight landed without further incident with CFR standing by. The engines were shutdown and passengers de-planed on the runway. Company maintenance advised that the cause was a faulty overheat warning sensor in the number 2 engine. The sensor was replaced and aircraft returned to service.

Exercise 62

Narrative: Flight XXX, an SA227-DC, was en route north bound from RRR to SSS at 16,000 feet, and was given clearance to descend to 8,000. Flight YYY, a PA31, was en route south bound from SSS to TTT at 9,000 feet. The flights passed with 1.4NM lateral and 500 feet vertical separation where required separation was 3NM or 1,000 feet.

Exercise 63

Narrative: Aircraft AAA was cleared to land when on a five mile final approach for runway 27 at XXX. Aircraft BBB was cleared to position on runway 27 at the same time to await take-off clearance. The crew of aircraft AAA and of BBB, as well as the tower controller, noticed the potential conflict and took corrective action independently. BBB proceeded no further than the runway edge, and the tower controller instructed AAA to conduct a missed approach which had already been initiated by the aircraft crew when it was two miles from the runway. Aircraft BBB subsequently departed and aircraft AAA landed without further incident. The weather was clear with unlimited visibility at the time of the occurrence.

Exercise 64

Narrative: The Jetstream 3112, operating as flight XXX was en route from ZZZ to YYY, when fumes were detected in the cockpit. The aircraft returned to ZZZ with no requirement for ARFF. Maintenance determined the source of the fumes to be Varsol which had been used to clean the belly of the aircraft, and had entered a cabin air intake.

Exercise 65

Narrative: The Aeronca 7AC aircraft was taxiing to the runway when the engine quit. The pilot, the sole occupant, exited the aircraft and attempted to hand start the engine. The engine started and the aircraft began to move forward on its own. The pilot was unable to stop the aircraft and it struck a taxiway light, entered a ditch turned and struck a directional sign. The aircraft was substantially damaged before it came to a stop. This aircraft was not equipped with a parking brake, and the wheels were not chocked to prevent the aircraft from moving forward. The pilot was not injured.

Exercise 66

Narrative: The Embraer E145 was en-route from XXX to YYY at FL340 when the crew declared an emergency due to a cracked windshield. The aircraft then descended to 10,000 feet and the crew elected to continue to destination.

Exercise 67

Narrative: During the take-roll from ZZZ, into wind, about 400 feet down the grass/gravel runway and at about 30 knots, the Cessna T210 veered left and the pilot could not prevent it with full right rudder. The aircraft then struck trees at the side of the runway, spun around, and collided with a fence. The aircraft was substantially damaged but there were no injuries to the 3 occupants.

Exercise 68

Narrative: Shortly after take-off from runway 2C at less than 200ft AGL (above ground level), the pilot of a Beech 90 King Air reported an engine failure and requested to return to the a/p. The tower controller cleared the pilot to land on any runway and notified a/p crash fire rescue personnel. The controller saw the a/c in a right turn, descending, and observed the a/c level its wings just prior to impact with the tops of trees. The a/c was consumed by the post-crash fire and all occupants were killed.

Exercise 69

Narrative: On taxi out, the crew of an Airbus 319 received an ECAM message – #2 engine low oil pressure. The crew shut down the engine (CFM56-5C) and returned the aircraft to the gate. Initial trouble shooting indicated that the engine oil had been contaminated with jet fuel. The main fuel/heat exchanger was replaced as per AMM 79-21-20. The system was flushed, replenished and leak checked serviceable.

Exercise 70

Narrative: The aircraft was taxiing on the apron at XXX when the flight crew observed a snow plough approaching from the left that did not appear as if it was going to yield or stop. The captain applied full braking but had difficulty stopping due to the contaminated surface. He was continuing to brake and veered to the right when the snow plough driver finally saw the aircraft and began braking and sliding toward the aircraft. The aircraft and snow plough stopped about 30-40 feet apart.

Case Studies

The cases contained represent an attempt to develop a common method for encoding events and factors in ADREP 2000. The main guideline consists of analysing and encoding in parallel since both processes can benefit from one another. This cross-fertilisation seems key to getting consistent data in the long run.

The cases described in this section are articulated around a general methodology that presents many advantages but also drawbacks. It only deals with the 'events and factors' section and with the 'potential factors and safety issues' section. Screen shots will be found along these cases for visual support.

- Case 1: Accident on 17 January 2001 at Quetigny (France) to the Beechcraft 58 registered F-BUTZ
- Case 2: Accident on 25 July 2000 at Gonesse (France) to the Concorde registered F-BTSC operated by Air France
- Case 3: Accident on 5 November 2000 at Paris Charles de Gaulle airport (France) to the Boeing 747-200 registered TJ-CAB operated by Cameroon Airlines
- Case 4: Accident on 1st November 1997 at Laon (France) to the Pilatus PC6 registered F-GHXS
- Case 5: Accident on 31 October 2002 at Cancale (France) to the Agusta 109 registered F-GTLP

CASE 1

Accident on 17 January 2001 at Quetigny (France) to the Beechcraft 58 registered F-BUTZ

Summary of the accident

On a VORTAC approach to runway 18 at Dijon Longvic, at night, the airplane came down and crashed on a carwash area located 3Km from the threshold of runway 18. The aircraft crashed into a lamppost, came to a stop and caught fire.

Elements brought to light

During the investigation, the following elements were brought to light:

- The change in the approach procedure was made late and in an improvised manner. In fact, the pilot made a classic runway 18 approach, unusual for him, in degraded meteorological conditions, when he could have performed a precision approach to runway 36. Time pressures linked to economic factors (a shortened approach procedure which reduced flight time) doubtless contributed to this choice of approach procedure.
- A lack of flight preparation and improvisation when carrying out this procedure: the airplane did not pass over the initial approach fix (IAF), the pilot apparently confused the inbound track with the outbound track, the approach was performed at high speed, down to very low heights in relation to the ground, and finally the position of the captain (located in the right seat) did not allow for optimal surveillance of the navigation instruments.
- During transition from instrument flight to visual flight and during the passage under the minima for the procedure, the pilot very likely confused the line of lampposts with the runway lighting.
- The airplane collided with the ground without a loss of control.

Note: the two front seats in the airplane were occupied by a pilot qualified to perform the flight (right seat) and a passenger with aeronautical qualifications (left seat). The investigation was not able to determine who, whether the pilot or the passenger, was effectively in control of the airplane at the time of the accident.

It is, however, probable that the two pilots were cooperating and that they shared the tasks to be performed on board the airplane as well as the decisions to be taken during the flight. For the encoding, the pure piloting (flying the airplane) was attributed to the pilot and the decision-making inherent to the flight and which can be taken in a collective manner were attributed to the flight crew.

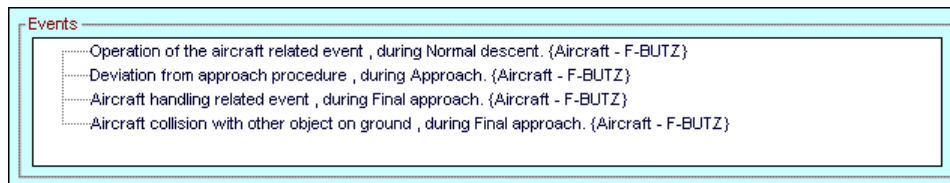
Events and descriptive factors

The preceding listing is drawn from elements identified during the investigation that proved to be the key points in the sequence of events leading to the accident. Each event corresponds to a phase of flight. The four events brought to light are here classified chronologically:

- Choice of approach procedure
- Deviation from carrying out the procedure, in relation to the published procedure

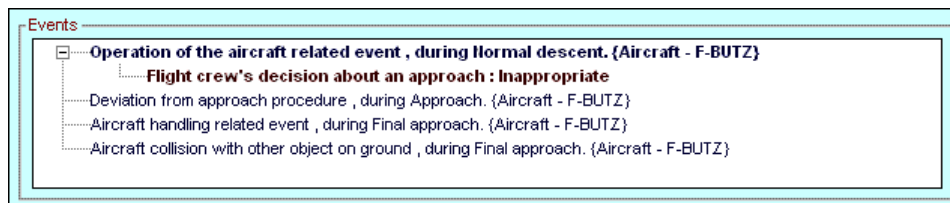
- Confusion between the light cues during passage under the minima
- Collision with the ground

These events, associated with a phase of flight, correspond to the following items in ADREP 2000:

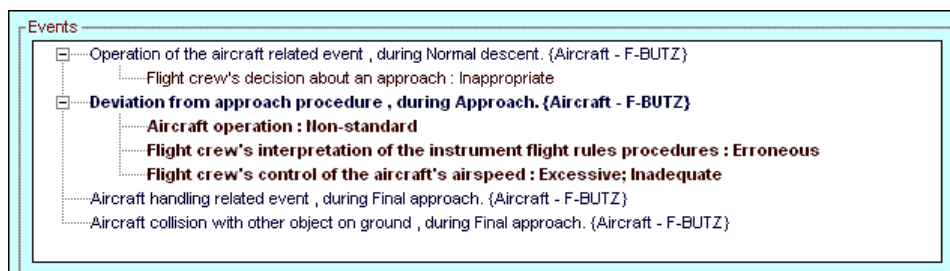


Reading these events, it is clear that the degree of precision is not sufficient, and that the introduction of descriptive factors is required to describe the sequence.

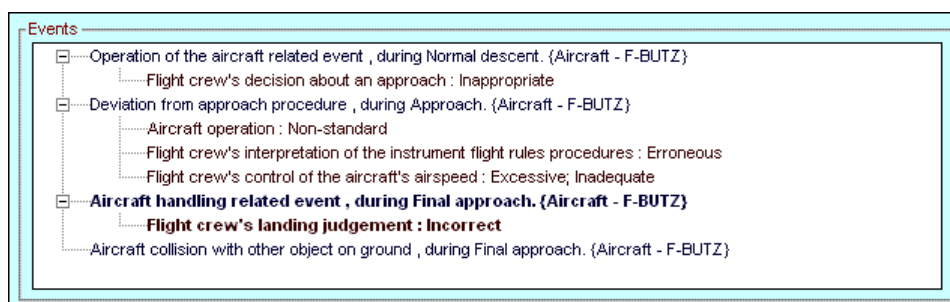
The first event corresponds to the conduct of the flight during the descent. The descriptive factors allow the introduction of the notion of decision-making during the choice of the procedure and to qualify it.



The second event records the conduct of the approach procedure. The descriptive factors allow the event to be detailed precisely: conduct of the approach, errors in reading the approach charts and excessive speed.



The third event records the incorrect choice of landing zone following confusion in the lighting cues below the minima.

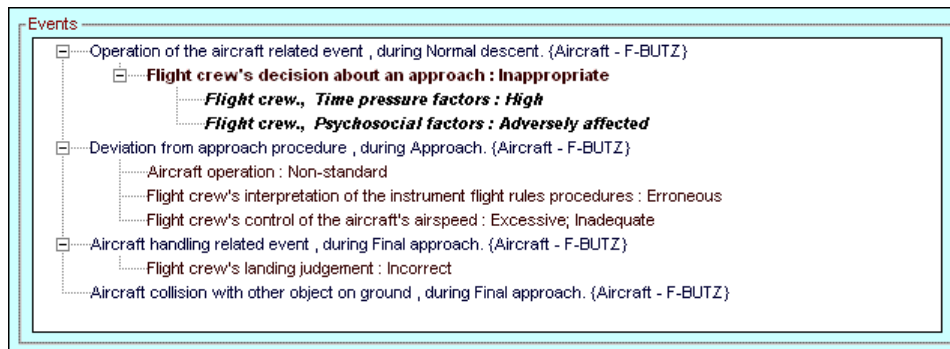


Explanatory factors

One or more explanatory factors correspond to each descriptive factor. These explanatory factors are determined with the aid of the SHELL model graphic representation and by running through the various interfaces that make it up.

According to the extent of the investigation, determination of the explanatory factors is either limited to the general chapter headings or extends to the more detailed lists included in these chapters (see SHELL tables).

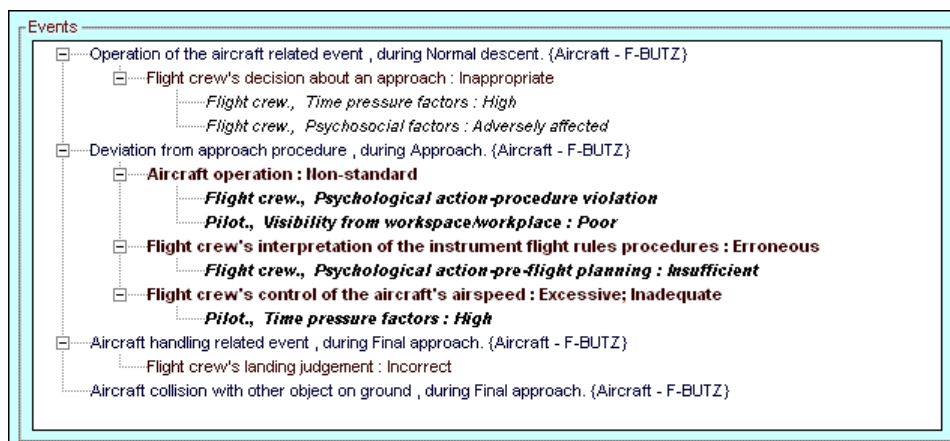
In the case of this accident, it was necessary to explain why the crew decided to change their approach strategy at the last moment. The main factor retained was the time pressure associated with the financial aspect placed on the crew and the passengers who had rented the airplane. The following encoding was the result:



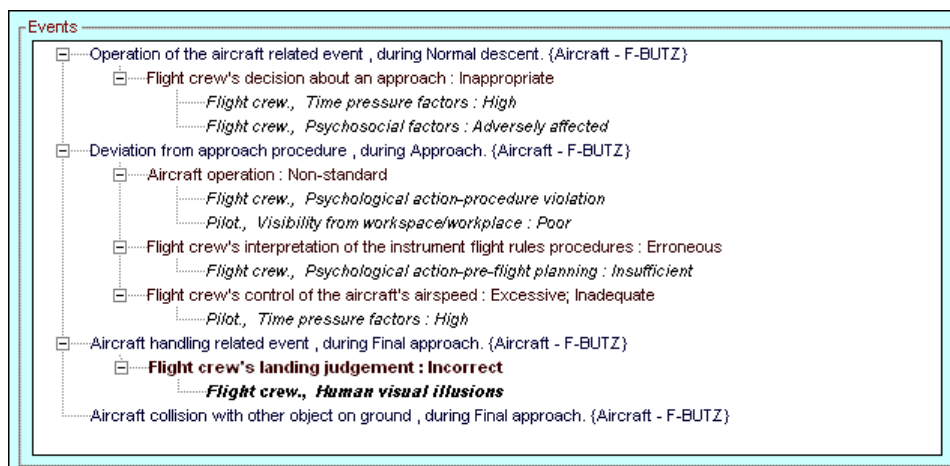
This explanatory factor corresponds to the Liveware-Environment interface in the SHELL model. Systematically running through the tables can also help the various orientations of the investigation. The determination of the other explanatory factor(s) was done using the same method.

Concerning the conduct of the approach procedure, the explanatory factors were determined on the following basis, bring to the encoding shown below:

- A violation by the crew that did not conform to the specifications of the approach procedure (passage over the IAF...)
- Surveillance of the instruments made difficult by the seat the captain was occupying
- An error in the reading of the charts (confusion between the inbound track and the outbound track) associated with insufficient flight preparation
- Further time pressure that may explain the choice of excessive speed until the last moments of the flight



Finally, concerning the last moments of the flight, and the transition from instrument flight to visual flight, the confusion between the runway lighting and the line of lampposts was encoded as follows, giving also the complete encoding of the accident:



Factors and their justification

The following table links explanatory factors to factual information of the final report:

Event [, phase of flight] / Descriptive factors	Explanatory factors	Factual elements justifying the coding
Conduct of flight, during descent		-
Inappropriate decision by the crew on the choice of the approach procedure	Strong time pressure (crew) (L-E) Psycho-social factors (crew) (L)	The procedure chosen reduced the flight time (and thus the cost of the rental) Type of operation undertaken (GA for a trip of a professional nature)
Deviation from approach procedure		-
Conduct of flight during approach, non standard	Violation (crew)(L) View of the cockpit from the pilot's seat, poor (L)	The airplane track did not correspond to the published track, no passage over IAF (radar track) The pilot was seated on the right. Not all the instruments are present on the right side and surveillance of them is difficult.
Incorrect interpretation of the published approach procedure	Inadequate pre-flight preparation (crew) (L)	The inbound track used corresponds to the outbound track in the procedure, an error on the crew's part.
Choice of an excessive approach speed	Strong time pressure (crew) (L-E)	Time pressure, reduction in flight time.
Conduct of the flight, during final approach		-
Incorrect judgment by the crew during landing	Visual illusions (L)	The airplane lined up in landing configuration parallel to a line of lampposts (witness statements, radar tracks, examination of wreckage).
Collision with ground object, during final approach		-

Note: This investigation focused more on failings in the actions performed than on systemic aspects. It is apparent in the report analysis, which develops and explains the accident scenario but does not contain a paragraph on systemic failings.

CASE 2

Accident on 25 July 2000 at Gonesse (France) to the Concorde registered F-BTSC operated by Air France

Foreword

This encoding was performed after the end of the investigation. The encoding procedure was thus not used as a tool in the investigation. It was decided to encode all of the failings identified even if they were not contributory factors in the accident. It is clear that there is not only one possible way to encode this event; this work was performed by a group of investigators and safety analysts who participated in the investigation.

Summary

During takeoff from runway 26R from Paris Charles de Gaulle airport, a short time before rotation, the front right tire (wheel n.2) on the left main landing gear ran over a metal strip, which had fallen from another aircraft, and was degraded. Tire debris was thrown against the wing structure causing a rupture in tank 5. A large fire, fed by the leak, broke out under the left wing. Problems appeared a short time afterwards on engine 2 and, briefly, on engine 1. The aircraft took off but was unable either to gain altitude or to accelerate. The crew noticed that the landing gear would not retract. At a speed of 200kts and a radio-altimeter height of 200 feet, it flew for about one minute. Engine 1 then lost thrust and the angle of attack and the bank angle increased sharply. The thrust from engines 3 and 4 fell rapidly. The aircraft crashed onto a hotel.

Elements brought to light

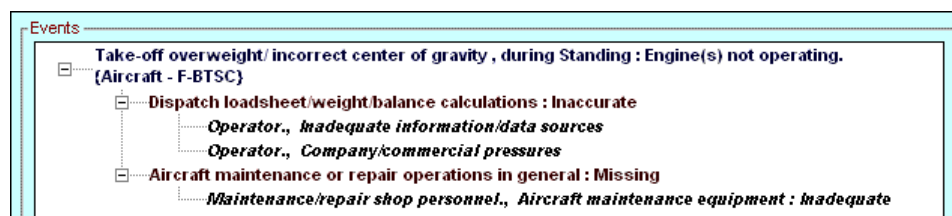
Note: some elements from the investigation were brought to light but did not directly contribute to the accident. These events were coded both in the events and factors section and in the 'potential factors and safety issues' section.

The investigation was able to establish the following sequence of events:

- Flight preparation / takeoff at maximum weight: pre-flight
- FOD (Foreign Object Debris) Collision during takeoff roll
- Damage to tires during takeoff roll
- Damage to wing during takeoff roll
- Fire
- Engine problem (surge)
- Piloting of aircraft during takeoff roll
- Aircraft performance during climb
- Controllability problem
- Collision with terrain during uncontrolled descent

The events which correspond with the ADREP taxonomy are as follows:

Event 1

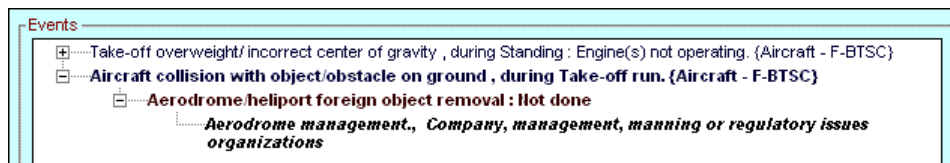


This event and these factors are not «contributory»: it was established in the performance working group that the penalty resulting from the excess weight was negligible. Explanatory factors relating to commercial pressures, procedures and flight preparation data were however accepted. They underline the specificities of that small section of the airline.

Equally, the maintenance problem linked to the absence of the spacer was not a contributory factor to the accident, but these failings were nevertheless established by the investigation and encoded in the database.

In summary, coding such information in the database sets the base for being able to trigger warning signals regarding inobservance of load procedures and maintenance rules.

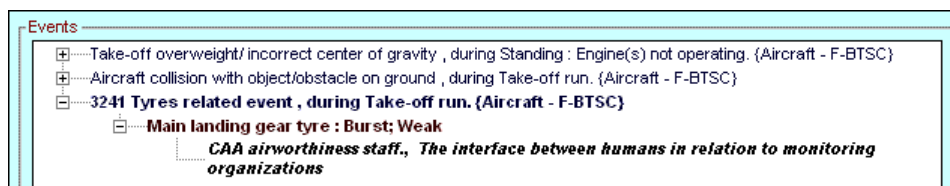
Event 2



Debris on the runway cannot, at present, be completely removed in real time. Undertaking further research into runway surveillance can be imagined. In addition, an improvement in maintenance procedures could lead to a reduction in the number of objects lost from aircraft.

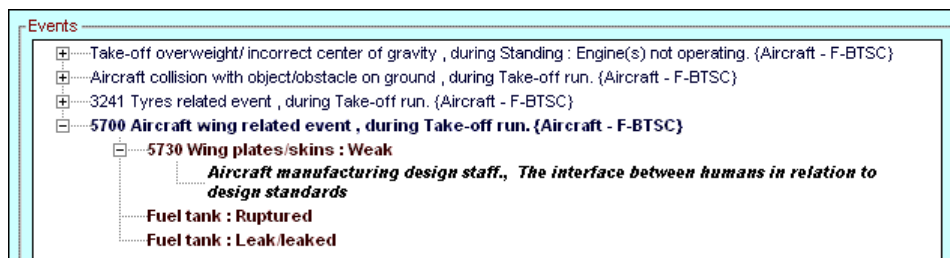
The loss of the metal strip from the aircraft which took off before is mentioned later.

Event 3



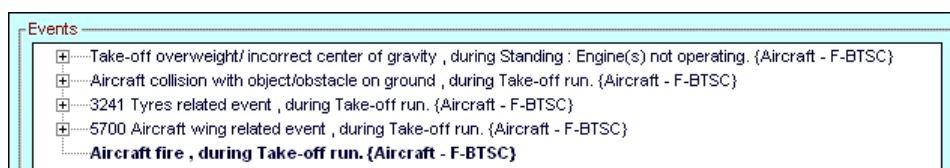
The structural resistance of fire casings is called into question here. The certification regulations pose a problem as well as the authority's oversight with regard to a known problem.

Event 4



The structural resistance of the underside of the wing poses the problem. The encoding indicates the constraints imposed on the aircraft designers. The encoding also mentions wing tank ruptures as well as the resulting leaks.

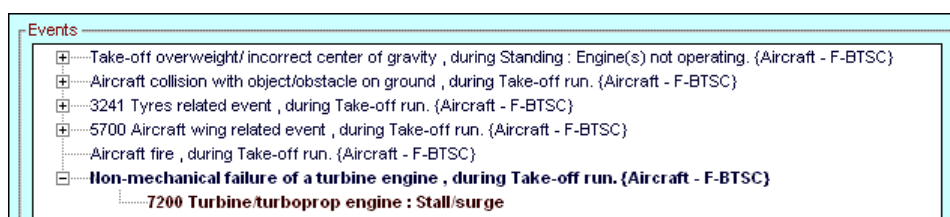
Event 5



Fire on takeoff; no descriptive factor was found to be necessary here.

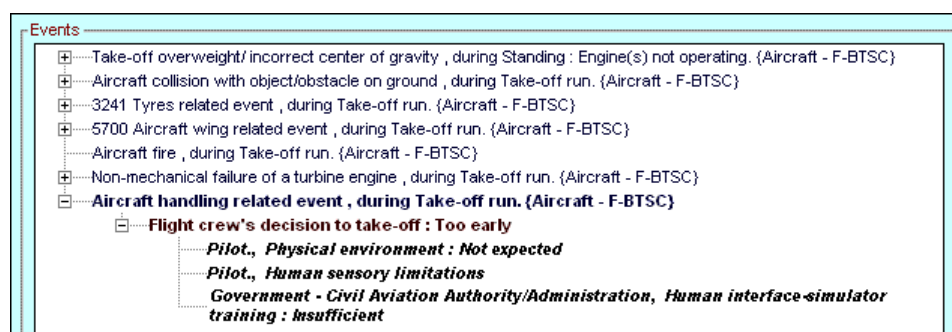
Note: Some factors are not noted with explicit details since this accident resulted from a succession of events dependant on each other.

Event 6



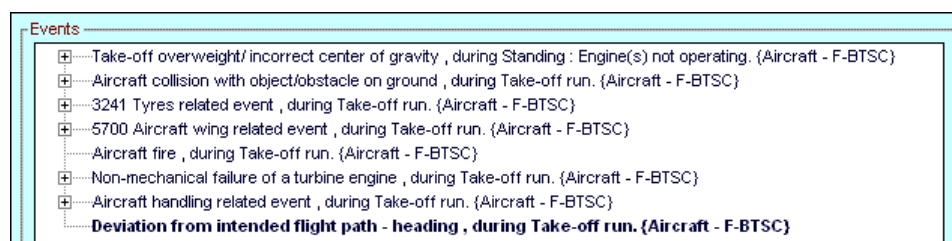
Engine problem during take-off roll; descriptive factor: engine surge.

Event 7



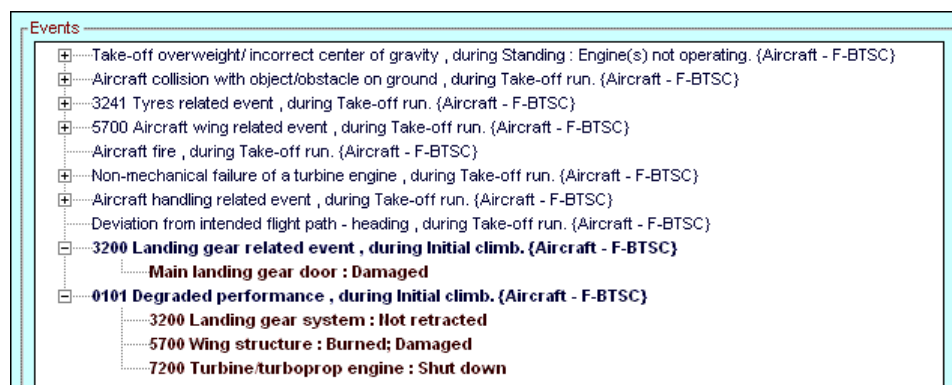
This paragraph relates to the early rotation. The constraints on the pilot's perception (sight, hearing, smell, acceleration) to his physical environment (imminent runway excursion) led him to rotate before Vr. Unexpected situation was never simulated.

Event 8



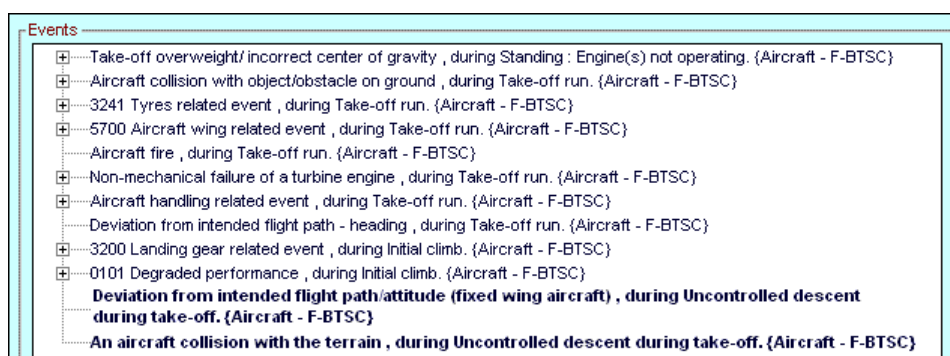
There is no explanatory or descriptive factor for this event. It simply describes the change of direction observed at the end of the takeoff roll.

Events 9 and 10



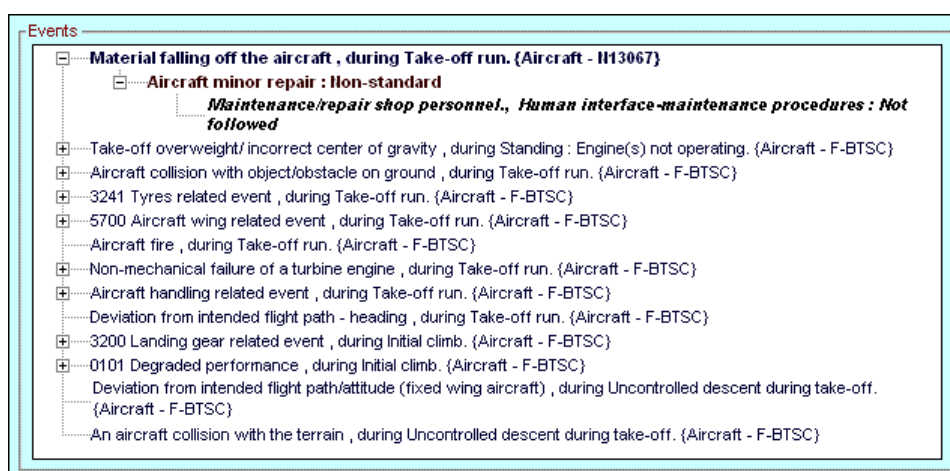
These two events cover the non-retraction of the landing gear and the engine trouble which meant that performance during the initial climb was degraded and that the airplane was not able to get out of the second flight regime.

Event 11 and 12



The airplane became uncontrollable and crashed into the ground.

Event 13



This independent event triggered the entire accident. It has been put into the first position, because it was not possible to determine if it happened before or rather after event 1.

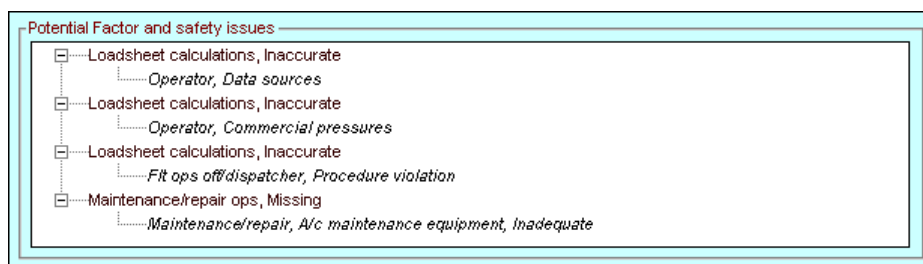
It is important to indicate that concrete justification which led to the choice of a particular factor. In the case of this accident, the elements which led to the sequence described above are detailed in the following table. This table shows the relations between the various factors and justifies their choice:

Event [, phase of flight] / Descriptive factors	Explanatory factors	Factual elements justifying the coding
Exceeding maximum takeoff weight Weight and balance calculation : imprecise	Inadequate sources of data and information (operator) (L-H) Commercial pressures (operator) (L-E) Psychological, violation (flight operations officer) (L)	Calculation made after the event of the weight and balance showing an excess (one ton). Failure to enter some baggage data into the GAETAN system, the software making the weight and balance calculation.
Inappropriate maintenance operation	Aircraft Maintenance equipment: inadequate (maintenance) (L-S)	Crew's determination to carry out the charter flight, takeover of the flight preparation. Load sheet not signed, taxi fuel over-estimated.
Ground collision with object during takeoff roll Removal of object on runway: not performed	Airport procedures inappropriate (Airport management, CAA) (L-S)	No reference for the tool in the AMM (document used for the operation). (Not a contributory event in the accident)
Non-standard repair (other airplane)	Inappropriate maintenance procedures, not checked (maintenance) (L-S)	Metal strip found on the runway which corresponds to the marks left on the tire. No program for prevention of FOD (Foreign Object Debris).
		Use of a non-standard part, procedure difficult to perform.

Event [, phase of flight] / Descriptive factors	Explanatory factors	Factual elements justifying the coding
Elements relating to the tires during takeoff roll Main landing gear tire: explosion, weakness (structure)	Oversight by authorities (CAA) (L-L)	Debris found on the runway. Rate of tire events higher than normal, corrective actions undertaken inadequate. Piece of tank found on the runway, presence of a fuel leak.
Event concerning the wing during takeoff roll Wing skin: weak Tank: punctured Tank: leak	Regulatory standard (manufacturer) (L-L)	The risk of damage to the tank was greater than that taken into account during certification.
Fire during takeoff roll		Marks left on the runway, numerous eyewitness statements and photographs.
Engine trouble during takeoff roll Turbine surge		FDR Parameters Early rotation (FDR parameters)
Element relating to the piloting of the aircraft during takeoff roll Decision to take off (crew), anticipation	Physical environment (pilot) (L-E) Sensory limitations (pilot) (L)	Double engine surge, unusual accelerations in the cockpit, visual sensation of runway excursion. Combination of unusual sensory inputs in a phase after V1 when the pilot was mentally prepared to perform the rotation. FDR parameters and marks on the runway.
Change in heading during takeoff roll		
Event linked to landing gear during initial climb Main landing gear door damaged		Deduction made on the basis of the landing gear retraction system logic. Probable cause of the non-retraction of the landing gear.
Degraded performance during initial climb Landing gear: not retracted Wing: burnt Engines: shut down		Elements from CVR and FDR, study of the wreckage.
Collision with ground during uncontrolled descent		

Potential factors and safety issues

Factors that had or could have had a role in this accident or in other accidents and that are a potential threat to aviation safety in general were entered.



Notes

This encoding was performed after the publication of the report. It is intended to be as complete as possible in order to include the greatest number of factors identified during the investigation, whether contributory or not. Its aim is to reproduce the contents of the analysis and the factors which led to safety recommendations.

The ADREP 2000 taxonomy was a useful tool since it caters for more than five events (ADREP 87) in the causation chain. In this case, eleven events were found to describe as completely as possible what happened on 25 July 2000 at Gonesse.

CASE 3

Accident on 5 November 2000 at Paris Charles de Gaulle (95) to the Boeing 747-200 registered TJ-CAB operated by Cameroon Airlines.

Events, phase of flight, descriptive factors

The encoding is based on the report analysis which is, in turn, based on three events:

- Residual thrust during flare (deactivation of the automatic braking systems)
- Positive thrust on engine 1 and runway excursion
- Retraction of thrust reverser number 2

The three events drawn from ADREP which come closest to the accident scenario are:

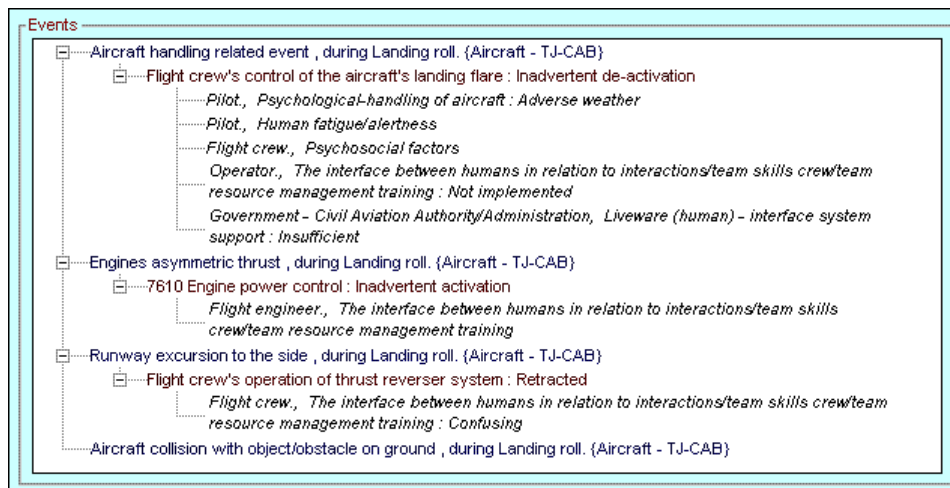
- Aircraft handling
- Engine asymmetric thrust, and
- Runway excursion

The descriptive factors clarify the events in order to get as close as possible to the logical order of the scenario. For the first event, flare and inadvertent deactivation are mentioned (in relation to the deactivation of braking systems – the result of residual thrust). Since ADREP 2000 doesn't include factors describing residual thrust or incomplete reduction, only the descriptive factor mentioned below was retained.

The second event corresponds to the first part of the scenario's second chapter heading. As to the third event, it takes the lateral runway excursion and specifies the reverser retraction with the help of a descriptive factor.

To these three events, a fourth event is added being the collision with the rainwater collector tank. This event was the result of the runway excursion and the unpredictable direction that the aircraft had taken and thus considered to be accidental: the investigation focused mainly on the triggering factors and not on the causal factors associated with the resulting event.

The phase of flight corresponding to each event is the landing roll.



Explanatory factors

The explanatory factors chosen come from the structure of the analysis which, for the first event, mentions the meteorological conditions that apparently took up part of the crew's resources along with the influence of fatigue and the presence of third parties in the cockpit.

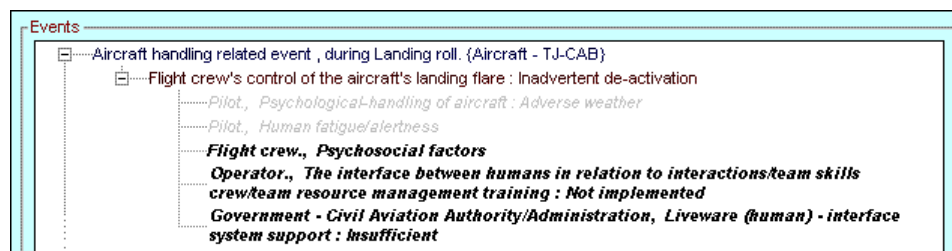
For the second event, the lack of coordination and intervention of the flight engineer are mentioned without the addition of a modifier.

For the third event, the explanatory factor linked with the retraction of reverser number 2 involves the possible reigning confusion caused by the lateral runway excursion.

Consideration of safety recommendations

According to the scenario, the report analysis develops two contributory factors which led to safety recommendations. These contributory factors are task distribution (CRM) among the crew and the presence of third parties in the cockpit.

The encoding of the presence of third parties is found in the first event (the most upstream in the accident). The most adequate explanatory factor with regard to the SHELL model is found at the level of the social context (presence of third parties). It mentions psychosocial factors (influence and disturbance from third parties in the cockpit).



As for CRM aspects, these already appear at two levels in the analysis, for events 2 and 3. The organizational aspect listed above (Operator) concerns the gaps in the company's CRM policy (recommendation for a systematic CRM-like program for all flight crew). The recommendation to the Civil Aviation Authority of the Republic of Cameroon which entails the setting up of a feedback program is translated by an encoding at the regulator level (Government-CAA).

Finally, the organizational factors are encoded at the first event level (the most upstream trigger) and in a logical order following the Reason model, that is to say the active deficiencies of the first line operators are encoded before the latent deficiencies identified during the investigation.

Comment: The use of modifiers in the explanatory factors is not systematic.

CASE 4

Accident on 1st November 1997 at Laon (France) to the Pilatus PC6 registered F-GHXS

Summary

The aircraft took off from Laon-Chambry aerodrome to drop eight parachutists from 3,000 meters. Just after takeoff, witnesses saw it flying level at about 1,000 feet, east of the field. It then seemed to bank to the right with a more and more nose-down attitude and struck the ground almost vertically 1.5Km from the field.

Elements brought to light

The elements brought to light by the investigation were:

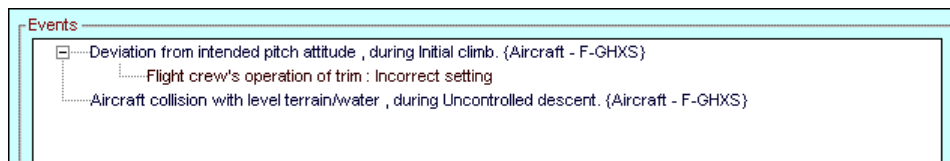
- Loss of pitch control just after takeoff.
- Pilot's difficulties in handling the elevator trim handle.
- A problem with the ergonomics of the elevator and flap trim controls.
- Excessive effort required from the pilot in certain aircraft configurations.
- The pilot's training and experience, with little experience on the aircraft type.
- The absence of a well-adapted training program on this type of aircraft which would bring to the fore the particularities of the use of the elevator trim.

Events and descriptive factors

The first stage consisted of establishing a chronological list of the events which made up the accident scenario. Two events were highlighted:

- A loss of pitch control during the initial climb.
- The collision with the ground with an uncontrolled descent.

The investigation revealed that the accident resulted directly from a problem of the pilot's setting of the elevator trim.



The collision with terrain is only the resulting event.

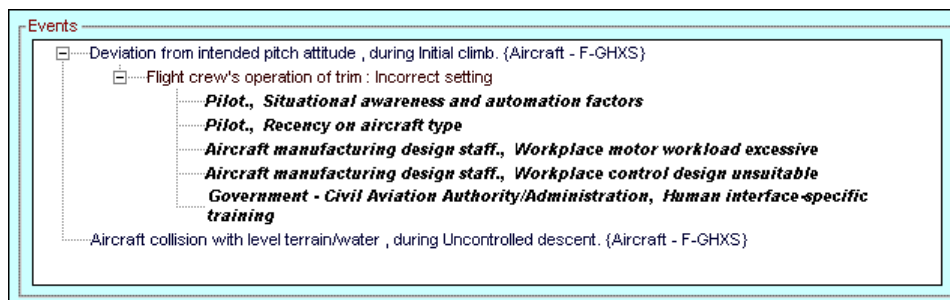
Explanatory factors

The investigation's analysis was based on explaining the pilot's error in the setting of the elevator trim. Multiple causes were determined, both in the pilot's actions (incorrect actions) and in the design of the airplane. The factors highlighted by the investigation were:

- Pilot's incorrect setting of the elevator trim.
- Little recent experience on the type of aircraft.
- The effort necessary to be applied to the controls, which becomes excessive in certain flight configurations.
- Inadequate ergonomics of the elevator and flap trim controls.
- Poorly-adapted training program on the airplane type.

Complete encoding

The resulting encoding of the entire occurrence is as follows:



The highlight has been put on the explanatory factors found in the previous paragraphs.

The analysis of the accident which constitutes the second part of the report is structured in the following manner: the first section gives a detailed scenario of the accident, explaining for each stage the failings brought to light by the investigation. This part transposes the encoding completely. The second section develops the systemic failings which were brought to light.

CASE 5

Accident on 31 October 2002 at Cancale (France) to the Agusta 109 registered F-GTLP

Foreword

The encoding was carried out after the presentation of the factual report by the investigator-in-charge of the event. At this point in time, the analysis has not yet been written and the encoding carried out following the presentation of the factual report will be used to assist in the construction and development of the analysis.

Methodology

The method consists of first identifying the various successive events, as well as the corresponding phases of flight, which led to the accident. For each event, the descriptive factors as well as the explanatory causal factors will be identified and encoded based on the ADREP 2000 taxonomy with the help of the software tool.

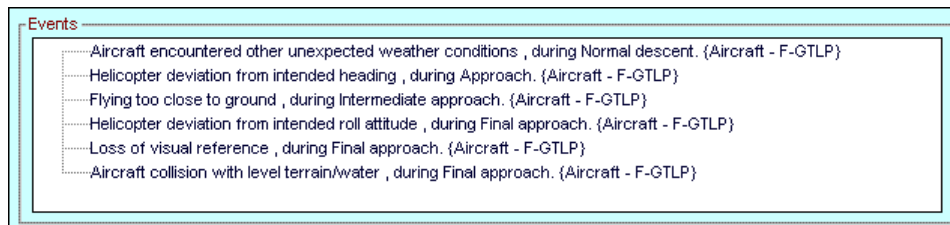
The description of these events, presented in a chronological manner, will form the basis of the accident scenario. Failings will be identified with the help of the SHELL model. Systemic failings revealed by the investigation will be ordered in line with the schematics of the REASON model.

Events and phases of flight

The elements brought to light by the investigation were:

- An encounter with meteorological conditions that were more difficult than forecast during the descent
- An inappropriate track in relation to night VFR flight and in degraded meteorological conditions during approach³
- A flight altitude and incorrect speed to make a final approach
- A turn performed at the last moment, at high speed during the final approach
- A loss of visual references on final approach
- The collision with the sea

The corresponding encoding in ADREP 2000 is as follows:

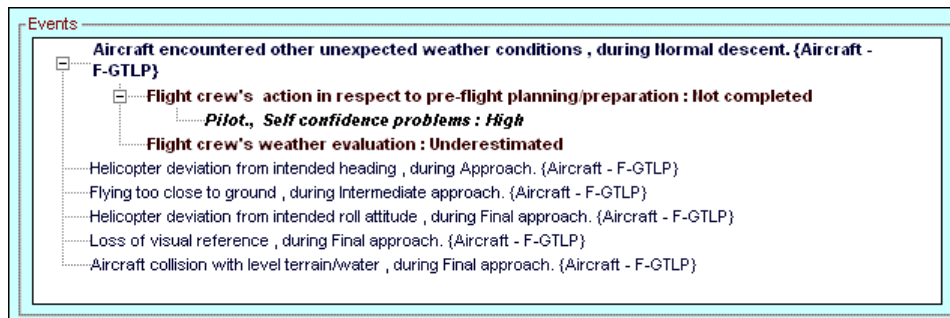


Descriptive and explanatory factors

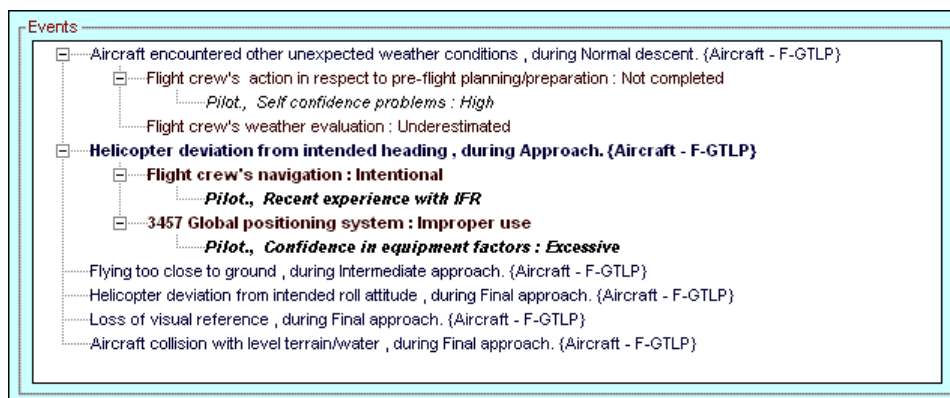
The factors linked to the first occurrence concern incomplete flight preparation before a night VFR flight without a meteorological dossier and an under-estimation of these conditions when the pilot encountered them. The pilot's personality and the excessive self-confidence were encoded as explanatory factors for the incomplete flight preparation.

The pilot also changed his decision at the last moment. He was supposed to sleep overnight at Saint Briec, after a first leg from Issy les Moulineaux, when he decided to leave for the island (which he owned).

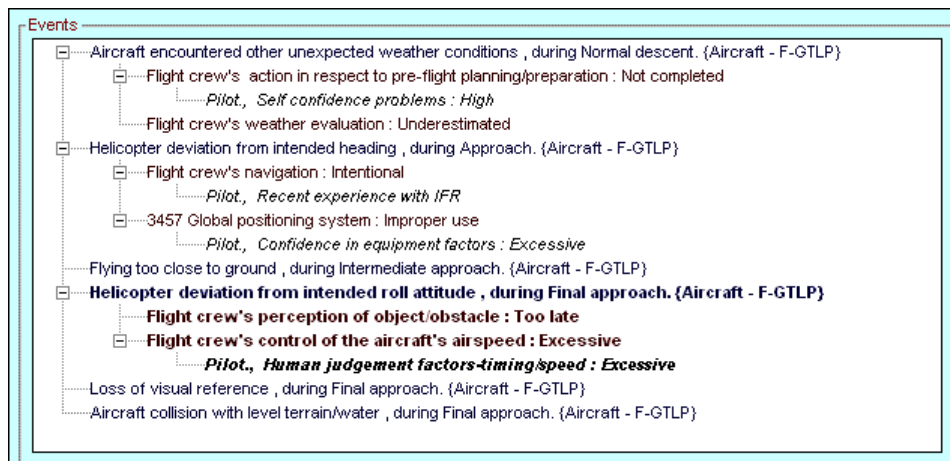
³ Here the encoding does not communicate the idea expressed very well: the causal factors will allow the pilot's decisions, his personality as well as the over-confidence generated in him by the use of instruments – in particular the GPS, to be made clear.



The factors linked to the second occurrence concern the pilot's decision to head straight for the island without using external visual cues (as he could have done by choosing a coastal route, better adapted to a night VRF flight in degraded meteorological conditions). His decision was certainly influenced by an excessive use of the instruments, in particular the GPS, as well as recent experience with IFR flight (in which he was undergoing training).



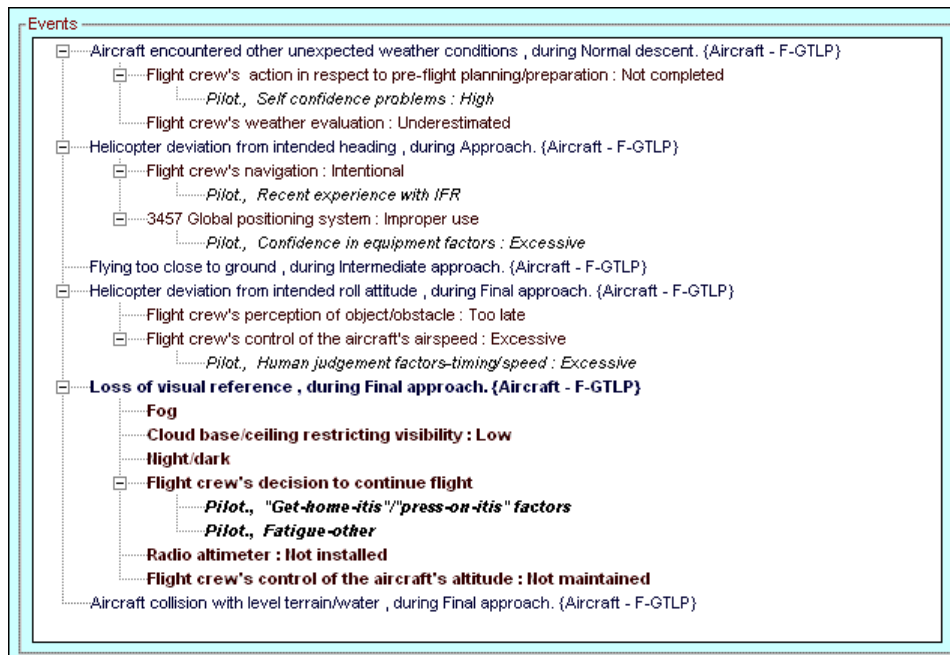
The factors linked to the fourth occurrence (right turn at high speed near the island) were related to a late perception of the island and an inappropriate flying speed at the flight altitude and the visibility conditions. The corresponding encoding is as follows:



The penultimate occurrence is characterised both by an unfavourable environment (bad visibility, at night) and by the pilot's decision to continue the flight and reach his final destination. This decision was certainly influenced by 'get-home-itis' as well as by fatigue (time he got up, etc).

The radio-altimeter was not installed on the day of the accident (maintenance) and the pilot did not have a direct view of the altitude from his seat (right side).

These factors led to a loss of altitude during the turn and a high-speed impact with the sea.



The investigation brought to light some latent underlying failings (systemic) which are not directly linked to the chain of events which led to the accident.

These failings, listed below, will make up the second part of the analysis.

- The procedure for training and qualifying trainees: training in this domain for helicopter pilots is done in a closed milieu, and deviations come to light but are not corrected.
- Some uncertainties remain, in particular concerning a possible problem of illness (the pilot complained in the morning of unusual fatigue coming over him). An autopsy could not be performed.

Note: This last occurrence illustrates a version of intermediate encoding on the basis of an ongoing investigation.

Separation Exercises



Example Exercise

OCCURRENCE SUMMARY

AAIU Report No:	2001-016
AAIU File No:	2000/0042
Name of Operators:	Swissair / American Airlines
Manufacturer:	McDonnell Douglas / Boeing
Model:	MD11 / B767-300
Nationality:	Swiss / USA
Call Signs:	SWR127 / AAL176
Place of Incident:	050N 013W, in SOTA
Date and Time (UTC):	3 July 2000, 0348 hours

FACTUAL INFORMATION

On Monday 3 July, 2000, circa 0348 hours, a Swissair MD11 aircraft, call sign SWR127, reported a near miss with another aircraft, identified as an American Airlines B767, call sign AAL176. The event occurred at 050N 013W in the Shannon Oceanic Transition Area (SOTA) (Annex A), approximately 210 nautical miles South West of the Cork VOR. SOTA is a designated Reduced Vertical Separation Minima (RVSM) area.

SWR127 was en route from Boston to Zurich and maintaining Flight Level (FL) 320. AAL176 was en route from JFK, New York, to Frankfurt and, at the time of the event, was climbing from FL290 to FL370, having received clearance from Shannon Radar. The aircraft commander of SWR127 had been observing AAL176 to his left and below him for more than five minutes when he got the impression that it had started climbing. This was confirmed by warnings on his Traffic Alert and Collision Avoidance System (TCAS). He immediately turned his aircraft 10° to his right and observed AAL176 climbing through his assigned level, within 0.5 nautical miles (NM) of his left wing.

Prior to leaving the Shannon frequency some minutes later, the commander of SWR127 advised that he intended filing an air traffic incident report involving AAL176 with the Swiss authorities.

History of Flight

AAL176 was en route from New York to Frankfurt; SWR127 was en route from Boston to Zurich. Radar service was being provided by Shannon Control. Both aircraft were part of the eastbound air traffic flow on the North Atlantic Organised Track System, routing from 50N 15W to KENUK (Annex B) and were in a group of four aircraft which passed 50N 15W in close horizontal proximity. At 0340 hours AAL176 at FL290 and SWR127 at FL320 reported 15W and were assigned discreet transponder codes thus allowing the radar and Flight Data processing system to automatically correlate the discreet code with the aircraft call sign. This causes the aircraft call sign to appear in the label attached to the aircraft position symbol on the Controller's radar display. The other adjacent aircraft were call signs TSC142 at FL 330 and AUA514 at FL390. In all, 147 aircraft were planned through 50N 15W that morning.

AAL176, AUA514 and TSC142 were advised that radar identification was established by the sector radar controller and were issued with onward clearances. The assignment of transponder codes and issuance of onward clearances were annotated on the corresponding flight progress strips by the sector Planning Controller. AAL176, which had been originally flight planned at FL290 to GAPLI (Annex B), requested FL370 and was instructed to standby for climb clearance. At 0341 hours, in position 8NM east of 15W, the SWR127 radar track and associated label data block containing, inter alia, its call sign, FL and ground speed disappeared from the radar screen. This label data block would normally be displayed on screen when the radar track representing the aircraft position is displayed. Up to this point SWR127 had not been advised that radar identification had been established and had not been issued with onward clearance. This clearance is normally issued shortly after initial radio contact when radar identification has been established, (as was the case for the other three aircraft in the 'bunch'). Air Traffic Control procedures require that the aircraft's flight progress strip be annotated when onward clearance is issued.

The sector Radar Controller did not observe that the SWR127 radar track had disappeared off his radar display. The other controller, the sector Planning Controller (working the airspace sector alongside the radar controller) who has responsibility for the management of the flight progress strips, was not alerted by the fact that SWR127 had not been advised that radar identification had been established, that onward clearance had not been issued to SWR127 and that the appropriate annotation on the flight progress strip had not been entered.

At 0346 hours the sector Radar Controller issued clearance to AAL176 to climb to FL370. At 0348 hours SWR127 advised Shannon that he observed traffic to his left and that he was diverting to the right. The sector Radar Controller did not copy the call sign and requested the aircraft reporting to identify itself. SWR127 repeated his call sign and confirmed that he was turning right, adding that the traffic to his left was at about a half mile. The radar recording shows AAL176 climbing through FL318 at this time. AAL176 responded to this transmission by identifying itself as the traffic. SWR127 asked AAL176 if he saw him. AAL176 replied in the negative saying that he had received clearance to FL370. When prompted by SWR127 to look to his right, AAL176 responded that he now had SWR127 in sight. In his report, the commander of SWR127 said that he observed AAL176 left and below him for more than 5 minutes. He then had the impression that the aircraft commenced climbing (it was half dark at the time, 20 minutes before sunrise), when he received three TCAS warnings, blue, amber and finally red and advisory 'climb'. As he was aware of the traffic above him, which was TSC142, at FL330, he decided to turn right approximately 10° and saw AAL176 passing through his assigned flight level.

The sector Radar Controller then asked SWR127 to confirm that he was squawking his assigned transponder code. SWR127 responded in the affirmative. Some 30 seconds later the SWR127 radar track and label data block reappeared on the radar screen 74NM east of 015W. The Radar and Flight Data Systems' Short Term Conflict Alert (STCA) had not activated, as at this time, the conflict no longer existed. At 0350 hours SWR127 was advised that radar identification was established and onward clearance eastwards was issued. This was approximately 10 minutes after initial radio contact was made with SWR127.

Analysis

The US Federal Aviation Administration (FAA) and the aviation industry have developed a three tiered prevention system to minimise the occurrence of near midair collisions (NMACs) and midair collisions.

The first tier is the flight crews, who carry primary responsibility for maintaining safe separation between aircraft. They are required to adhere to the principal of 'see and be seen', and their training specifically includes the use of scanning techniques to identify other aircraft as well as special procedures to be used to avoid NMACs.

The second tier is the air traffic control system, which uses air traffic control procedures and radar derived data to maintain safe separation between aircraft.

The third tier is the Traffic Collision Avoidance System (TCAS), which has been installed on all aircraft that are used by scheduled passenger airlines. TCAS senses when the flight of an aircraft may be in conflict with that of another aircraft and provides the flight crew with guidance as to what action to take to resolve the potential conflict.

1. Flight Crew

This serious incident began when, after initial radio communications with the Radar Controller, the radar data replies from SWR127 were lost and this loss was not noted by the Radar Controller, nor did the Planning Controller question the absence of transmissions from the Radar Controller to SWR127 advising that he was identified and issuing an onwards ATC clearance.

At 0340.32 hours, AAL176 requested and was given clearance by Radar to climb from FL290 to FL370. In the semi darkness, just before dawn, the commander of SWR127 was observing an aircraft below him for about five minutes. At this point he had not received any identification and onward clearance response from Radar, following their earlier initial communications. The commander of SWR127 then perceived that the aircraft below him had started to climb and this was confirmed to him by warnings on his TCAS.

Standard Operating Procedures (SOP's) in response to TCAS warnings require him to climb or descend. In this case he decided to make a level turn right through 10°, as he was equally aware that he had another

aircraft above him at FL330. Also, he had the then unknown climbing aircraft in his sight. The commander reported to Radar that this aircraft had passed within ½ NM of his position and climbing.

The investigation was unable to verify the exact passing distance between the two aircraft on a subsequent re-run of the radar tapes, due to the loss of the SWR127 signal. However, there is no reason to doubt the accuracy of the commander's assessment, which resulted from TCAS warnings and his own observations.

2. ATC

ATS Engineering report that: *"...with increasing North Atlantic traffic and also since the introduction of Reduced Vertical Separation Minima (RVSM), the incidence of aircraft in garbling situations has increased..."*. Garbling can result in the generation of false aircraft tracks, often referred to as 'ghost' aircrafts/plot/tracks. MSSR Radar systems provide processing functions that try to identify false aircraft/plot/tracks, which can be generated by the MSSR receiver, extractor or tracker processing chain. These functions are usually available as system parameters, i.e. they can be enabled or disabled if so required.

Lengthy investigation by ATS Engineering proved conclusively that the reason for the missing data replies from SWR127 was due to the 'ghost' processing function of the MSSR ERM 870 extractor. The transponder replies from SWR127 were, at the time of the occurrence, overlapping (garbling) with the replies from AAL176 and AUA514. This 'ghost' processing function was disabled on 31 August 2000 and a software change proposed by AIRSYS to remedy the incidence of false tracks, is currently under evaluation and test by ATS Engineering.

On the live-ware or human level, the breakdown in communications between the Radar Controller and SWR127 on the one hand and the Radar Controller and the Planning Controller on the other, represented an extraordinary lapse of concentration on the part of both controllers. The Radar is the controller's primary source of aircraft positional data and, in this occurrence; the data of SWR127 was missing, due to a software shortcoming. However, this necessary but missing technical input to the controllers was compounded by the non follow up call to SWR127 and by the non-questioning by either controller of each other as to what happened to SWR127.

What followed was almost eight minutes of controller silence in relation to SWR127 which, in turn, was only broken by SWR127 calling the Radar Controller. This was clearly not in compliance with the Procedures laid down in the duties of Sector and Planning Radar Controllers.

3. TCAS

The SWR127 TCAS system, which was functioning normally, alerted the commander to a possible conflict and led him to take avoiding action. The AAL176 TCAS which was placarded inoperative on 2 July 2000 was made serviceable again on 5 July 2000*. The commander of AAL176 was unaware of his close passing proximity to SWR127 as he climbed to FL370.

It was not until the commander of SWR127 spoke to him on the radio that he realised the gravity of the situation. It can be contended, in retrospect, that had the TCAS of AAL176 been functioning normally then its commander too would have been alerted to a possible conflict and appropriate avoiding action taken. However, in the event, this did not occur.

FAR 91.221 (b) states: Traffic Alert and collision avoidance system, operation required. *«Each person operating an aircraft equipped with an operable traffic alert and collision avoidance system shall have that system on and operating».*

FAR 121.356 (a) states: *«Unless otherwise authorised by the Administrator, each certificate holder operating a large airplane that has a passenger seating configuration, excluding any pilot seat, of more than 30 seats, shall equip its airplanes with an approved TCAS II traffic alert and collision avoidance system and the appropriate class of Mode S transponder according to the following schedule...».*

The investigation notes the different wording of the above two FAR's as they relate to TCAS equipment. The former being explicit that the system should be 'on and operating' while the latter presumes an implicit requirement.

(* Under American Airlines Minimum Equipment List (MEL), which complies with the NMEL as required by FAA Regulations (FAR's), the TCAS system is allowed to be inoperative for 10 flight days (Category C, MEL

item). The company has recommended that this system be upgraded to Category B, which only allows for the TCAS system to be inoperative for 3 flight days.)

Conclusions

(A) Findings

- 3.1 At 0339.28, initial radio contact was established between AAL176 and Shannon Radar. Shannon issued a discrete transponder code, 2061, which AAL176 acknowledged
- 3.2 At 0340.08, initial radio contact was established between SWR127 and Shannon Radar. Shannon issued a discrete transponder code, 2062, which SWR127 acknowledged. Shortly thereafter radar signal was lost. SWR127 was neither advised that he was identified nor issued with an onward ATC clearance. This is contrary to ATC procedures.
- 3.3 At 0340.32, AAL176 was identified by radar and onward clearance to Frankfurt was issued.
- 3.4 From the time of initial contact with SWR127 at 0340.08 no further radio communications ensued between Shannon and SWR127 until 0348.
- 3.5 At 0341.49, initial radio contact was established between TSC142 and Shannon Radar. Shannon issued a discrete transponder code, 2060, which TSC142 acknowledged.
- 3.6 At 0346.27, AAL176 was cleared by Radar from FL290 to FL370.
- 3.7 At 0348.01, SWR127 contacted Shannon advising of traffic at his left wing and that he was diverting to his right. The commander of SWR127 was responding to his own observations and TCAS warnings.
- 3.8 At 0349.47, the radar signal of SWR127 reappeared.
- 3.9 At 0349.50, Shannon identified SWR127 and onward clearance to Zurich was issued.
- 3.10 At 0356.48, prior to changing to his next frequency, the commander of SWR127 advised Shannon that he was going to file a traffic incident report with AAL176.
- 3.11 At a subsequent re run of the radar tapes in Shannon the investigation was unable to determine the exact horizontal distance between SWR127 and AAL176 due to the loss of SWR 127 radar reply for over 8 minutes and 10 seconds.
- 3.12 The Radar Controller and the Planning Controller were relieved of their duties following this incident, pending an ATS management enquiry.
- 3.13 Detailed investigation by ATS Engineering Division proved conclusively that the reason for the missing radar data replies from SWR127 was due to the 'ghost' processing function of the MSSR FRM 870 Extractor. The transponder replies from SWR127 were, at the time of the event, overlapping (garbling) with the replies from AUA514 and AAL176.
- 3.14 The 'ghost' processing function was disabled by ATS Engineering on 31 August 2000 and staff notices were issued by management warning against the use of the function.
- 3.15 Following consultation between ATS Engineering and AIRSYS ATM, the supplier of the equipment, a software change proposed by AIRSYS ATM to reduce the incidence of false tracks, is currently under ATS evaluation and test.
- 3.16 A not dissimilar loss of radar contact in the same general area of SOTA happened in August 1999. No air traffic incident occurred but, following an engineering investigation, no definite cause of that particular radar track loss was established. However, ATC management issued a memorandum to staff urging vigilance in carrying out climbs or descents in the area affected.
- 3.17 The level of situational awareness of the commander of SWR127, which led to his decisive and positive avoiding action, deserves the highest praise.

(B) Causal Factors

The primary cause of this serious incident was the loss of SWR127 radar signal due to a functional anomaly in the software, which led the Radar Controller to incorrectly give climb clearance to AAL176 from FL290 to FL370.

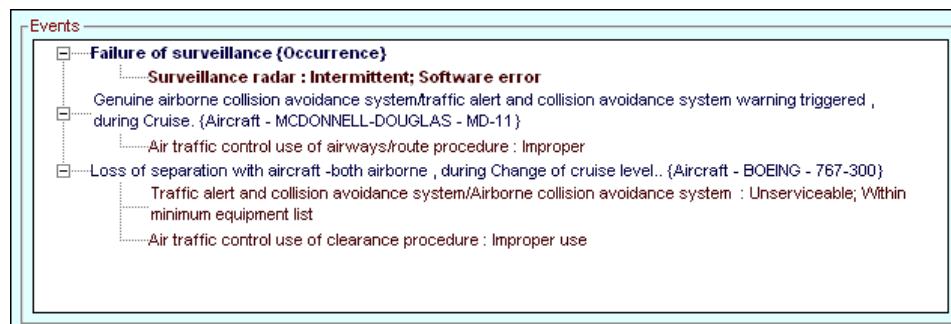
Other factors contributing to the incident include the breakdown in communications between the Radar Controller and SWR127 subsequent to their initial radio contact, the eight minutes non communication between the Radar Controller and the Planning Controller in relation to SWR127 and the inoperative TCAS on AAL176.

Solution

SEPARATION PAGE

General			
Horizontal rel mvmt	Same Tracks		
Rate of closure		m/s	
Military a/c involved	No		
Distances			
	Prescribed	Recorded	Estimated
Minimal horizontal			0.5 NM
Minimal vertical			0 m
Aircraft involved			
Aircraft involved	MCDONNELL-DOUGLAS - MD-11		BOEING - 767-300
Movement			
Vertical profile	Level		Climb
Height/altitude			
Bank angle	Wings level		Wings level
Bank direction			
Information			
Traffic Info Type/Quali	Traffic info type	Traffic info quality	
	Visual sighting	Complete	
	ACAS display	Complete	
Other a/c seen	Yes		No
Visibility restrictions	None		
Aircraft lighting			
ATM aspects			
Visual approach			
VMC climb/descent			
Actions			
Initiator avoiding act	Pilot		
A/c avoiding action	Yes		None
Risk reduction A/C	Did/would have		None/would not have
ATM action	None		None
Risk Reduction ATM	None/would not have		None/would not have
Safe landing	Yes		Yes
ACAS			
ACAS/TCAS installed	Yes		Yes
RA Geometry	Parallel Arrival		
RA Type	Climb		
Pilot response to RA	Turn		
Pilot response detail	Vertical rate change < indicated		
RA Classification	Useful		

SEQUENCE OF EVENTS PAGE



Exercise 71

OCCURRENCE SUMMARY

Occurrence Number:	2003-3150
Occurrence Type:	INCIDENT
Location:	CYYZ TORONTO/LESTER B. PEARSON INTL, ONTARIO
Occurrence Date:	21-Jun-2003 07:33 EDT
State:	Canada

1st Aircraft Details

Aircraft Manufacturer:	BOEING				
Aircraft Model:	737-700				
Aircraft Registration:	C-ABCD				
Operator's Name:	ECCAIRS Airlines				
Type of operation:	COMMERCIAL – SCHEDULED PASS				
Injuries:	Fatal	Serious	Minor	None	Total
Total					0

2nd Aircraft Details

Aircraft Manufacturer:	BRITISH AEROSPACE				
Aircraft Model:	BAE 125 (HS-125)				
Aircraft Registration:	C-EFGH				
Operator's Name:					
Type of operation:	COMMERCIAL – AIR TAXI				
Injuries:	Fatal	Serious	Minor	None	Total
Total					0

FACTUAL INFORMATION

ECCAIRS Airlines flight 653 (ECC653), a Boeing 737-700 aircraft, departed runway 33L at Toronto/LBPIA on a flight to Calgary. One minute later, SomeJet flight 550 (SMJ550), a British Aerospace BAe-125-1000 aircraft, departed on the same runway, same departure procedure, on a flight to Sudbury. ECC653 proceeded at a slower speed than expected while SMJ550 was at a higher speed. Spacing eroded to 1.5NM at the same altitude. Weather conditions were good VFR and the following aircraft was aware of the traffic ahead.

Exercise 72 – Final Report

OCCURRENCE SUMMARY

Occurrence Number:	200200094
Release Date:	23-Jan-03
Occurrence Type:	Incident
Location:	111Km NNE PUMIS, (IFR)
Occurrence Date:	31-Jan-02
Time/Zone:	1151 hours UTC
Highest Injury Level:	None

1st Aircraft Details

Aircraft Manufacturer:	Boeing Co
Aircraft Model:	747-4H6
Aircraft Registration:	VH-OED
Serial Number:	25126
Type of Operation:	Air Transport, International, Passenger, Scheduled
Damage to Aircraft:	Nil
Departure Point:	Auckland, NEW ZEALAND
Destination:	Los Angeles, U.S.A.

2nd Aircraft Details

Aircraft Manufacturer:	Boeing Co
Aircraft Model:	747-48E
Aircraft Registration:	VH-OEB
Serial Number:	25778
Type of Operation:	Air Transport, International, Passenger, Scheduled
Damage to Aircraft:	Nil
Departure Point:	Los Angeles, U.S.A.
Destination:	Auckland, NEW ZEALAND

3rd Aircraft Details

Aircraft Manufacturer:	Boeing Co
Aircraft Model:	747-400
Aircraft Registration:	ZK-SUJ
Type of Operation:	Air Transport, International, Passenger, Scheduled
Damage to Aircraft:	Nil
Departure Time:	
Departure Point:	Los Angeles, U.S.A.
Destination:	Auckland, NEW ZEALAND

FACTUAL INFORMATION

A Boeing 747-48HE registered VH-OEB (OEB) was en-route from Los Angeles, USA to Auckland, New Zealand was maintaining flight level (FL) 330 as assigned by Tahiti air traffic control (ATC). A Boeing 747-4H6 registered VH-OED (OED) was en route from Auckland to Los Angeles and was also maintaining FL330. The crew of OEB reported that they observed, on their traffic alert and collision avoidance system (TCAS), another aircraft that was on a reciprocal track at the same level (OED). The crew of OEB turned their

aircraft right 15 degrees and descended to FL325. The crew of OED later reported that they observed, on their TCAS, another aircraft that was on a reciprocal track at the same level (OEB), and climbed their aircraft to FL333. A third aircraft, a Boeing 747, was en-route from Los Angeles to Auckland at FL340. The crew of OED also observed an indication of that aircraft on their TCAS.

The vertical separation standard was 1,000ft. The vertical distance between OED and OEB reduced to 800ft, and to 700ft between OED and the third aircraft. There was an infringement of separation standards.

The crews of OEB and OED were communicating with Tahiti ATC via both Controller-Pilot Data Link Communications (CPDLC) and high frequency (HF) radio. CPDLC was a *«means of communications between a controller and pilot using data link for [Air Traffic Control] communication»* (ICAO Doc 4444 ATM/501 14.1.1). Messages were compiled and initiated either by the crew of the aircraft or by ATC and were, in this case, pre-formatted. The use of pre-formatted messages was *«intended to reduce the possibility of misinterpretation and ambiguity»* (ICAO Doc 4444 ATM/501 14.3.4).

The crew of OEB had requested climb from FL320 to FL340 but that request was denied. About ten minutes later the crew of OED requested climb from FL330 to FL350. Tahiti ATC asked the crew of OED, via CPDLC, when they could reach FL350 and then denied the request for climb. The French *Bureau d'Enquêtes et d'Analyses pour la Sécurité de l'Aviation Civile* (BEA) produced a report on the occurrence. The BEA reported that the crew of OED then contacted Tahiti ATC via HF radio and advised that they could reach FL350 by time 1140 universal coordinated time. The controller responded via HF radio and instructed the crew of OED to maintain FL330. The crew of OEB then requested, via CPDLC, climb to FL330. The CPDLC response provided to the crew of OEB was *“...climb to and maintain FL330 due to traffic...”* even though FL330 was not available. The message was selected by the controller from the menu of pre-formatted messages available in the system.

The South Pacific Operations Manual (SPOM Part 5.5) stated that *«...when a clearance request is denied, the controller shall use the element 'UNABLE' in the uplink message...»*. The SPOM detailed the procedures and requirements applicable in the South Pacific flight information regions (FIRs) for CPDLC equipped aircraft and applied within the Tahiti FIR. The SPOM (Part 5.1) also stated that: *«...generally, when a CPDLC aircraft is operating within a CPDLC FIR, CPDLC will be the primary means of communication...»*.

Subsequent to the occurrence OEB returned to FL320 and OED returned to FL330. The crews then reported to Tahiti ATC at those respective levels. The controller had not intended to assign FL330 to the crew of OEB and did not realise that they had been assigned FL330 or that they had climbed to FL330 and subsequently returned to FL320. When the crews reported at FL330 and FL320 respectively, after the occurrence, that information was consistent with the information the controller had recorded on the flight progress strips. The controller was not aware that there had been an infringement of separation standards.

The BEA reported that the controller believed there were possibly two reasons why a climb instruction had unintentionally been assigned to the crew of OEB:

1. In reply to the request by OEB for climb to FL330, the controller pre-selected the wrong pre-formatted CPDLC message and sent the message without checking it, or
2. The controller confused the two aircraft because of their similar call signs.

The BEA reported that four controllers had been rostered for the period between 1900 hours and 0700 hours (Papeete local time) and were rostered to cover the aerodrome control position, the approach control position and the area control position. The event occurred at 0050 hours Papeete local time. The controller involved in the occurrence was alone in the tower at the time of the occurrence and was performing all three functions. That controller considered that the workload was high due to poor quality HF radio, increased coordination with other centres in relation to aircraft using 'flexible routes' and difficulty validating CPDLC messages with OED.

The controllers at Tahiti had been trained in France but that training had not included the use of CPDLC. Initial training on the use of CPDLC was incorporated into a one-week training program in Papeete that included CPDLC with other local training requirements. Ongoing CPDLC training was incorporated into on-the-job training which could take controllers around 57 weeks to complete. Controllers reported that the initial training was essential but they had not been exposed to the system sufficiently during training to master all aspects of the system.

The controller involved in the occurrence had been working Tahiti Oceanic Controlled Airspace for approximately three and a half years and was qualified on the three ATC positions being managed at the time of the occurrence.

Analysis

The negative response 'UNABLE' from the controller to the crew's request for a higher level, in accordance with the SPOM, would have reduced the possibility of error in the pre-formatted CPDLC message selected by the controller for transmission to the crew of OEB.

The use of HF radio and CPDLC combined with a high controller workload and similar radiotelephony call signs of the two aircraft involved in the communications exchanges possibly contributed to the confusion to which the controller referred and may have resulted in the transmission of the incorrect CPDLC message.

When an individual controller combines a number of positions, diverse scenarios and increasing workloads can quickly distract controllers. Controllers and supervisors need to be vigilant so that ATC positions can be separated to facilitate effective workload management.

The monitoring of TCAS and high situational awareness by all the crews involved proved to be an effective defence for the aviation system.

Significant Factors

The controller issued an incorrect climb instruction.

Exercise 73 – Final Report

OCCURRENCE SUMMARY

Occurrence Number:	A024
Release Date:	31-Jan-2002
Occurrence Type:	Incident
Location:	UIR Switzerland near TRA
Occurrence Date:	13-Sep-00
Time/Zone:	11 14 hours UTC
Highest Injury Level:	None

1st Aircraft Details

Aircraft Manufacturer:	Airbus
Aircraft Model:	A310
Aircraft Registration:	TC-JDD
Call Sign:	THY1944
Type of Operation:	Air Transport, International, Passenger, Scheduled
Departure Point:	Basel, Switzerland
Destination:	Istanbul, Turkey

2nd Aircraft Details

Aircraft Manufacturer:	Boeing Co
Aircraft Model:	B733
Aircraft Registration:	D-ADBR
Call Sign:	BAG 4608
Type of Operation:	Air Transport, International, Passenger, Scheduled
Departure Point:	Munich, Germany
Destination:	Madrid, Spain

3rd Aircraft Details

Aircraft Manufacturer:	Airbus
Aircraft Model:	A320
Aircraft Registration:	EC-FIA
Call Sign:	IBE 3514
Type of Operation:	Air Transport, International, Passenger, Scheduled
Departure Point:	Madrid, Spain
Destination:	Frankfurt, Germany

4th Aircraft Details

Aircraft Manufacturer:	McDonnell Douglas
Aircraft Model:	MD80
Aircraft Registration:	I-DAVJ
Type of Operation:	Air Transport, International, Passenger, Scheduled
Call Sign:	AZA 467
Departure Point:	Düsseldorf, Germany
Destination:	Milan Malpensa, Italy

FACTUAL INFORMATION

Four aircraft were involved in this incident:

- Aircraft 1: THY1944, an A310 arriving from Basle, flying in the easterly direction via abeam from TRA (Transadingen)
- Aircraft 2: BAG4608, a B733 arriving from the east, flying via TRA in a south-westerly direction
- Aircraft 3: IBE3514, an A320 arriving from the south-west, flying in a north-easterly direction via abeam from TRA
- Aircraft 4: AZA467, an MD80 arriving from the north, flying towards the south via TRA

These four aircraft crossed near the TRA VOR within approximately 60 seconds, BAG 4808 and IBE3514 simultaneously, almost to the second, and THY1944 and the AZA both flew over TRA approximately 30 seconds later. The air traffic control had previously made the necessary arrangements in order to ensure vertical separation for the crossing manoeuvre.

The Turkish aircraft, as the lowest of these four aircraft, reached the cleared FL (flight level) 260 by TRA, a noteworthy feature being the relatively high rate of climb of up to 3000fpm (feet per minute) in the final phase before reaching FL260. After this, THY1944 maintained a steady FL260.

Until approximately 5NM before flying over TRA, BAG4608 maintained the cleared FL270 and subsequently climbed briefly as far as FL272, following a TCAS-RA (Traffic Collision Avoidance System - Resolution Advisory).

Initially, IBE3514 likewise maintained the cleared FL280 and, shortly before TRA, climbed with a high rate of climb, up to 3,500fpm, to FL291. This climb likewise took place following a TCAS recommendation.

AZA467 – which was the last aircraft to fly into the conflict zone – initially maintained the cleared FL290 until approximately 7NM to the north of TRA, and subsequently climbed, following a TCAS-RA, at up to 2,500fpm to FL295.

The separation fell below that required because of these TCAS-RAs, which were initiated by the TCAS equipment of the affected aircraft and which the respective crews followed. The minimum separation attained by the two aircraft, IBE3514 and AZA467, flying at the highest levels was some 400ft vertical and, simultaneously, 2.9NM horizontal. The two aircrafts were flying towards one another.

Conclusions

(A) Findings

The incident occurred in controlled airspace class C.

All four of the participating aircraft flew according to IFR (instrument flight rules) and were initially in uninterrupted radio contact with the radar controller of sector U1 of the Area Control Centre Zurich.

The arrangements by the responsible air traffic controllers for ensuring the vertical separation necessary for the crossing manoeuvres of the four aircraft were made correctly and in good time.

All the level authorisations allocated by the air traffic control were correctly acknowledged by the four aircraft.

At 11:14:14, the Turkish aircraft was the first to give an indication of an incipient conflict with the report «...THY1944, we have traffic alert...». The aircraft was immediately informed by the ATC that BAG4608 coming towards it was maintaining FL270. At his moment, THY1944 passed FL255, approximately, climbing to FL260. In what followed, it steadily maintained this FL.

At 11:14:46, BAG4608 reported «...BAG4608, TCAS climb...». At this moment, it was already at FL272. It was immediately informed by the air traffic controller that there was another aircraft at FL280 on a crossing heading and the controller instructed BAG4808 to descend immediately back to FL270. BAG4608 immediately complied with this instruction.

A good minute before the beginning of the conflict phase, IBE3514 was instructed by the responsible air traffic controller of sector U1 to make contact with "Rhine Control". Approximately 90 seconds later at 11:14:54, however, the aircraft reported to sector U3 of the ACC Zurich and, on this frequency, reported «...TBE3514, we have a TCAS advise, we just...». At this moment, IBE3514 was already passing FL287 and

climbed on up to FL291. The Spanish aircraft was immediately informed by the air traffic controller that the aircraft (AZA467) flying towards it was above it with a separation of 1,000ft.

In the subsequent dialogue between the Spanish aircraft and the air traffic controller, the latter explained the traffic situation while IBE3514 indicated an "air miss" with an aircraft flying to the right of it (obviously BAG4608) which had initially caused their TCAS climb. A short time later, however, they have had to descend again in order to avoid a further aircraft (obviously AZA467).

In his "Incident Report" on this incident, the Iberia CMD stated that they had followed exactly the instructions of the TCAS with respect to their climb. They had first become aware of an intruder from the right at the same level (BAG4608) and, a short time later, opposite traffic at FL290 (AZA467), which later flew by them on their left.

In the meantime, at 11:15:23, AZA467 reported, again on the frequency of sector U1 «...AZA467, TCAS climb, AZA467, TCAS climb...». Their attention was immediately drawn by the air traffic controller to the opposite traffic IBE3514, which had already reached FL291. At this moment, AZA467 had in turn reached FL295.

(B) Analysis

The present situation appears to be a chain reaction which occurred because the crews of the three aircrafts BAG4608, IBE3514 and AZA467 followed TCAS-RAs.

The actual initiator of this chain reaction was BAG4608. The TCAS of this aircraft instructed the crew to climb, even though THY1944 flying at least 1,000ft below did not represent a danger. It can, however, be assumed that the high climb rate, of up to 3,000fpm, of THY1944 during the last 1,000ft before reaching the cleared flight level very probably provoked the false alarm on BAG4608. Knowledge (which may be assumed) of the mode of operation of TCAS equipment, however, demands from the pilots apportioned application, matched to the circumstances, of the climb performance of the aircraft.

The subsequent reaction of IBE3514 to the fact that the cleared FL270 was slightly exceeded (FL272) by BAG4608 was extraordinarily violent. The rapid 1,100ft climb manoeuvre by IBE3514 caused the separation between IBE3514 and AZA467 to be substantially less than the minimum required and this appeared even more dangerous because the two aircraft were flying towards one another.

Although the pilots of the participating aircraft rapidly informed the air traffic control about the initiation of a TCAS climb, this occurred in every case after the initiation of the manoeuvre or, indeed, after the avoidance flight level had been reached. The responsible air traffic controllers reacted to the circumstances, in an appropriately optimum manner, by immediately informing the crews affected about the actual traffic position.

The change in frequency of IBE3514 from sector U1 to sector U3 of the Area Control Centre Zurich (instead of to "Rhine Control") obviously took place erroneously because of the similarly sounding channel (U3: 133.405 MHz; "Rhine Control" 132.405 MHz).

(C) Cause

The incident may be attributed to the fact that the TCAS equipment of BAG4608 initiated an erroneous alarm in the form of an RA "climb" due to the excessively high rate of climb of THY1944, which was flying below it and in the final phase before reaching the authorised flight level (FL260).

Measures Taken

The Federal Office for Civil Aviation has published AIC 15/01 (Aeronautical Information Circular) under the date of July 19, 2001, stating guidelines for rates of descent and rates of climb to be observed.

Exercise 74 – Final Report

OCCURRENCE SUMMARY

Occurrence Number:	A98W0216
Occurrence Type:	INCIDENT
Location:	55 North 10 West
Occurrence Date:	27-Sep-98
State:	Canada

1st Aircraft Details

Aircraft Manufacturer:	BOEING
Aircraft Model:	747-238
Aircraft Registration:	C-GAGC
Operator's Name:	Air Canada
Type of operation:	COMMERCIAL – SCHEDULED PASS

2nd Aircraft Details

Aircraft Manufacturer:	BOEING
Aircraft Model:	747-400
Aircraft Registration:	C-GAGM
Operator's Name:	Air Canada
Type of operation:	COMMERCIAL – SCHEDULED PASS

FACTUAL INFORMATION

Air Canada flight number 003 (ACA003), a Boeing 747-238, departed London, England, at 1255 coordinated universal time (UTC) for Montreal, Canada. Shortly thereafter, Air Canada flight number 857 (ACA857), a Boeing 747-400, departed London, England, for Toronto, Canada. For the oceanic crossing, ACA003 was cleared to flight level (FL) 360 and ACA857 was cleared to FL350; both aircraft attained their assigned altitude.

At approximately 1332, Scottish Oceanic En Route air traffic control centre received a separation monitoring function (SMF) alert which showed that ACA003 was descending through FL350, with about 2 nautical miles (nm) lateral separation from ACA857. Because ACA003 was at the extreme limits of the very high frequency (VHF) radio range, initial attempts to communicate by both the controllers and the flight crew were unsuccessful.

At about 1343, ACA003 and Scottish Oceanic Area Control Centre (Scottish Centre) established communications on frequency 121.5 megahertz (MHz) and then on 125.675 MHz. ACA003 was re-cleared to maintain FL320 and separation with other aircraft was established.

Other Factual Information

After departure, ACA003 was initially cleared to FL330, and upon reaching that altitude, the flight crew completed the cruise checklist. The second officer, with concurrence of the captain, contacted Scottish Centre and requested oceanic track Charlie at an altitude of FL350. The centre advised that FL350 was not available, but that FL360 was available if ACA003 could accept it.

After the crew reviewed the performance charts, the second officer advised the centre that FL360 was acceptable for the oceanic crossing. ACA003 was subsequently cleared to cross 55 degrees north latitude and 10 degrees west longitude (55 N, 10 W) at FL360, the entry point to the oceanic track Charlie.

Aircraft performance during the climb from FL330 to FL360 was good, with the aircraft climbing at about 500 feet per minute (fpm). At level-off at FL360, the aircraft weight was 679,100 pounds, and the speed was just over Mach 0.85. The cruise target speed was Mach 0.84. The engine thrust levers were set at the pre-

determined engine pressure ratio (EPR) values of 1.60, and the speed was seen to be approaching Mach 0.84. The flight crew then continued with various activities on the flight deck.

As the captain, who was the pilot flying, was making a passenger address (PA) announcement, the aircraft experienced a slight ripple-type vibration. The captain checked the airspeed which was passing through Mach 0.750/248 knots indicated airspeed (KIAS) and decreasing. The first officer called airspeed, power, and maximum continuous thrust and the captain increased the engine power to maximum continuous thrust (MCT). The airspeed stabilised for a short time and then began to decrease again. The crew requested a descent clearance from Scottish Centre on VHF radio while the captain began a descent to maintain airspeed. ACA857 heard ACA003's attempted calls and relayed the request to Scottish Centre also advising that he had ACA003 visual and was maintaining separation.

ACA857 had observed ACA003 in descent visually and on the traffic collision avoidance system (TCAS), and had moved left of track to remain clear of ACA003's wake turbulence and to maintain some lateral separation. After passing through FL350, ACA003 established communications with Scottish Centre on frequency 121.5 MHz and later with Scottish Control on 125.675 MHz. Once ACA003 passed below the altitude of ACA857, the captain elected to turn left so as to remain clear of other traffic he knew was in the area. As soon as practical, the crew advised Scottish Centre of their offset. After establishing that the flight could continue to Montreal, ACA003 was cleared to maintain FL320. The remainder of the flight was uneventful.

The flight crew of ACA003 met all the training and operational requirements as prescribed for operation of the Boeing 747-238. The captain had been on the aircraft type for about two years, and had flown in the week before the incident. The first officer had been on the aircraft type for about four months, but had not flown for the previous month. The second officer had been on the aircraft type for approximately seven months, and had flown in the week before the incident. The crew had dead-headed to London and the first officer and second officer met each other the day before the flight. The captain met the first officer and second officer in the lobby of the hotel the morning of the flight. The captain and second officer had not met each other before this flight. The captain and first officer had flown together on a previous occasion.

According to the Boeing 747-200 performance charts, the aircraft is capable of maintaining FL360 under the conditions of this occurrence; however, the technique in handling the aircraft while at critical performance limits requires special attention and very careful monitoring until the aircraft is stabilised.

The aircraft departed London with 238 passengers and 10 infants. The estimated take-off weight was 716,100 pounds and the mean aerodynamic chord (MAC) was 5.3 units. The aircraft departed London within the allowable weight and centre of gravity range. On arrival at Montreal, the aircraft cargo was weighed and found to be 1,800 pounds more than indicated on the pre-take-off calculations. This weight discrepancy would not have affected the balance or cruise calculations, and is not considered a factor in this occurrence.

The upper level wind charts available to the crew indicated a veering wind from the south-south-west to generally a westerly flow in the area of 10 W. Wind speed varied from 45 knots in the south-westerly flow to 35 knots in the westerly flow. Temperatures varied from minus 51 degrees Celsius to minus 54 degrees Celsius. The aircraft was operating during daylight in visual meteorological conditions (VMC) from departure to the time of the occurrence.

The digital flight data recorder (DFDR) was removed and sent for analysis. The data from the DFDR was found to be limited for analysis purposes due to a problem with the acquisition function of the recorder. Most of the engine parameters, including engine thrust settings and altitude readouts, were missing. Airspeed, two fuel flows, pitch, static air temperature, angle of attack, magnetic heading, and some non-relevant parameters were available. The DFDR confirmed the reduction of airspeed which occurred over a period of about six minutes and a change in angle of attack from about 3 degrees nose up to about 5.5 degrees nose up. There were significant fuel flow discrepancies between the No. 1 and No. 2 fuel flow recordings. The flows are, however, indicative of the thrust setting changes which the captain reported.

At the time of the incident, Scottish air traffic control (ATC) was not monitoring the progress of ACA003 as it was beyond the 250NM range set on its monitors; however, ACA003 was still operating in the area covered by the radar. Radar data [recorded by Scottish Centre] show ACA003 in level flight with the ground speed slowly reducing. Because of its slower ground speed (decline of airspeed), ACA003 was slowly being

overtaken by ACA857, on near identical ground tracks. As ACA003 began to descend and encroach on the protected flight space of ACA857, the separation monitoring function detected the loss of separation and alerted Scottish Centre staff.

Analysis

Because of the limited value of the DFDR data, a reconstruction of the flight was not possible. Crew reports, radar data, and ATC radio transcripts were used to reconstruct events which led to the loss of separation between the two aircraft. Because the weather was clear and the TCAS was operating, the crew members of ACA857 were able to observe and monitor the progress of ACA003 and offset the aircraft track so as to avoid wake turbulence and reduce the risks of proximity flight.

After ACA003 levelled at FL360, the DFDR indicates that about six minutes elapsed before there was a reaction by the flight crew to the loss of airspeed. As the speed decreased and the pitch angle changed to about 5.5 degrees, the captain was making a PA announcement and the first officer and second officer were preparing a position report required for 55 N, 10 W crossing. Thus, there was no effective monitoring of the aircraft performance just after reaching a cruising altitude, which the crew were aware was at or near the performance limits of the aircraft. The better-than-anticipated aircraft performance during the climb to FL360 gave the crew little concern regarding the need to monitor the aircraft's performance after level-off.

Because of the problem of the acquisition function of the DFDR, it could not be determined if the thrust was set at the required levels, nor could it be determined what setting may have been selected to other cockpit systems.

After levelling at FL360, the captain had the thrust levers set to pre-determined levels for the altitude/weight/airspeed configuration. Once the altitude was captured, the autopilot compensated for the reduction in airspeed by increasing the pitch angle. The pitch angle changed slowly and was not perceived by the flight deck crew who were preoccupied with duties not associated directly with the monitoring of aircraft performance. Thus, it was not until the captain noted a slight ripple through the aircraft, which was likely a pre-stall buffet, that his attention was diverted away from the PA announcement he was making to the passengers and refocused on the aircraft. Because of the low airspeed, moving the thrust levers to MCT did not provide sufficient thrust to regain airspeed without descending the aircraft. Further complicating the recovery was the crew's inability to communicate immediately with the appropriate ATC authority. Communications were eventually established, but not until after a loss of separation occurred.

Because of the TCAS indication and because the crew of ACA857 could see ACA003, they were able to offset their track and pass ACA003 with about 2 nm lateral separation. The captain of ACA003 was aware that, by offsetting his track during the descent, he would avoid flight in proximity to other following aircraft.

Findings

The flight crew of ACA003 were certified and qualified for the flight.

ACA003 was capable of sustaining flight at FL360 under the conditions present during the occurrence.

After levelling the aircraft at FL360, the flight deck crew became preoccupied with tasks not associated with monitoring aircraft performance and the airspeed decayed to Mach 0.75; the target speed was Mach 0.84.

As the airspeed decreased, the pitch angle increased from about 3 degrees to about 5.5 degrees and buffet was felt through the airframe directing the crew's attention to the aircraft's deteriorating performance.

To regain airspeed, the thrust was increased to MCT and the nose was lowered. The lowering of the nose resulted in a loss of altitude.

The loss of altitude resulted in a loss of separation with a following aircraft, ACA857.

Because of the TCAS indication and because the crew of ACA857 could see ACA003, the crew of ACA857 moved laterally off course to avoid wake turbulence and to provide lateral separation.

Communications difficulties resulted in the appropriate ATC agency not being made aware of the intentions of ACA003 until after the loss of separation occurred.

The loss of separation was detected and displayed by the ATC separation monitoring function.

Causes and Contributing Factors

After levelling at an altitude which was at or near the performance limits of the aircraft, the crew did not adequately monitor the performance of the aircraft and the airspeed decreased to an unsafe level. The flight crew of ACA003 had to descend the aircraft to increase airspeed and a loss of separation occurred.

Safety Action

Air Canada published an internal Aircraft Technical Bulletin #405, dated 98-11-06, which discussed a recent change to the Canadian Aviation Regulations. The change requires periodic FDR correlation checks in operation, with each aircraft being checked once per C-check cycle. When a check is due, flight crew perform and record the required correlation checks during flight. Maintenance personnel then retrieve the completed form and the FDR and ensure that the FDR is recording properly.

Although this change is not related to this occurrence, the required correlation checks will ensure that an FDR is more likely to perform properly during flight.

Exercise 75 – Final Report

OCCURRENCE SUMMARY

Occurrence Number:	
Release Date:	31-Jan-2001
Occurrence Type:	Incident
Location:	13Km south of Yaizu NDB
Occurrence Date:	31-Jan-01
Time/Zone:	15 55
Highest Injury Level:	Serious

1st Aircraft Details

Aircraft Manufacturer:	McDonnell Douglas				
Aircraft Model:	DC-10-40				
Aircraft Registration:	JA8546				
Operator's Name:	Japan Air Lines - JAL				
Flight Number:	958				
Departure:	Pusan-Kimhae Airport (PUS)				
Destination:	Tokyo-Narita Airport (NRT)				
Type of operation:	International Scheduled Passenger				
Injuries:	Fatal	Serious	Minor	None	Total
Crew					13
Passengers					237

2nd Aircraft Details

Aircraft Manufacturer:	Boeing				
Aircraft Model:	747-446D				
Aircraft Registration:	JA8904				
Operator's Name:	Japan Air Lines - JAL				
Flight Number:	907				
Departure:	Tokyo-Haneda Airport (HND)				
Destination:	Naha Airport (NAH)				
Type of operation:	Domestic Scheduled Passenger				
Injuries:	Fatal	Serious	Minor	None	Total
Crew		2	10	4	16
Passengers		7	81	323	411

FACTUAL INFORMATION

On Jan. 31, 2001, JAL flight 907, a Boeing 747 had departed Tokyo-Haneda for a flight with destination Naha. JAL Flight 958, a DC-10-40 was en route from Pusan to Tokyo-Narita. A trainee controller cleared flight 907 to climb to Flight Level (FL) 390 at 15:46. Two minutes later JAL958 reported at FL370. Both flights were on an intersecting course near the Yaizu NDB.

At 15:54 the controller noticed this, but instead of ordering flight 958 to descend, he ordered the Boeing 747 to descend: «Japan air niner zero seven, descend and maintain flight level three five zero, begin descent due to traffic». Immediately after this instruction, the crew of flight 907 were given an aural TCAS Resolution Advisory to climb in order to avoid a collision. At the same time the crew of flight 958 were given an aural TCAS Resolution Advisory to descend.

The captain of flight 907 followed the instructions of the air traffic controller by descending. The 747 now approaching close to Flight 958, because the DC-10 captain descended as well, following the advisory of his TCAS. A collision was averted when the pilot of flight 907 then put his Boeing 747 into a nosedive. The 747 missed the DC-10 by 105 to 165 meters in lateral distance and 20 to 60 meters in altitude difference.

About 100 crew and passengers on flight 907 sustained injuries due to emergency manoeuvre; no one was injured on Flight 958. Flight 958 continued to Narita, while flight 907 returned to Haneda Airport.

Probable Cause

The Aircraft and Railway Accident Investigation Commission concluded that air traffic control's error in giving the wrong flight numbers when asking the pilots to change course and the pilots' decision to follow air traffic control instead of the computerised Traffic Alert and Collision Avoidance System (TCAS) were two of the main causes.

Follow-up / Safety Actions

The commission recommended amongst others that the International Civil Aviation Organization (ICAO) put priority on computer orders over instructions from controllers to prevent similar incidents.

Sources

Aircraft and Railway Accident Investigation Commission (ARAIC) final report number 02-5; Kyodo

Exercise 76 – Final Report

OCCURRENCE SUMMARY

Occurrence Number:	200006013
Occurrence Type:	Incident
Location:	East Sale, Aero – VIC, Australia
Occurrence Date:	11-Dec-00
Time/Zone:	1245 hours ESuT
Highest Injury Level:	None

1st Aircraft Details

Aircraft Manufacturer:	Sikorsky Aircraft
Aircraft Model:	S-76C
Aircraft Registration:	VH-EXU
Departure:	Longford, VIC – 1240 Hours ESuT
Destination:	Longford, VIC
Type of operation:	Non-Commercial, Corporate/Executive

2nd Aircraft Details

Aircraft Manufacturer:	British Aerospace
Aircraft Model:	HS 748 SERIES 2B
Call Sign:	HUDSON 505
Departure:	East Sale, VIC
Destination:	Nowra, NSW
Type of operation:	Military

FACTUAL INFORMATION

The pilot in command of a Sikorsky (S-76C) helicopter reported that an aircraft had passed the helicopter at the same level, with 200-300 ft lateral separation, while operating in the vicinity of East Sale aerodrome. The aircraft was subsequently identified as a RAAF HS-748, call sign Hudson 505. At the time of the occurrence, East Sale airspace was uncontrolled, and Mandatory Broadcast Zone (MBZ) procedures were in place on frequency 118.3 MHz.

The S-76C had departed Longford Heliport, located approximately 7 NM south of East Sale. It was proceeding to East Sale on climb to 2,500 ft above ground level (AGL) to conduct a practice instrument landing system (ILS) approach for runway 22. Another RAAF HS-748, call sign Hudson 24, was operating in the circuit at East Sale and preparing to conduct an ILS approach for runway 22.

As the S-76C approached East Sale, the crew of Hudson 24 broadcast that they were turning inbound on the ILS, and would be making a full stop landing. At about the same time, the crew of Hudson 505 broadcast that they were departing to the north-east of East Sale and passing 1,700 ft AGL. However, Hudson 505 was actually to the south-west of the aerodrome, and was turning to the left to track back over the East Sale non-directional beacon (NDB) prior to its departure to the north-east.

The S-76C crew (believing that Hudson 505 was north-east of East Sale and clear of their approach) continued inbound to overhead the East Sale NDB. When the S-76C was approximately 3 NM south of the East Sale NDB, maintaining 2,500 AGL, the crew observed Hudson 505 passing in front of the S-76C from left to right, at the same level and in close proximity. At the same time Melbourne Centre called Hudson 505 on frequency 124.0 MHz and advised the crew that unidentified traffic was half a mile to the south-west of the aircraft. The crew of Hudson 505 subsequently reported that they did not see the S-76C.

Local safety action

As a result of the occurrence, the Directorate of Flying Safety - Australian Defence Force advised that all East Sale and Longford-based crews were briefed on the incident. The briefing drew attention to the following:

- Terrain shielding exists between Longford and East Sale
- A need for clarity in MBZ broadcasts. Crews should not assume that previously made transmissions were received and thus make the information in each transmission appropriate; and
- An enduring requirement for vigilance in lookout, even if an assessment of no conflict exists.

The operator of the S-76C issued instructions to its crews regarding procedures to be followed for instrument training flights at East Sale when the MBZ was active. These included specific procedures for:

- Departing Longford for the runway 22 ILS approach at East Sale
- Departing Longford for the West Sale NDB approach
- Departing Longford for the East Sale and West Sale Global Positioning System non-precision approaches; and
- Crew co-ordination duties between pilot flying and non-flying pilot

Exercise 77 – Final Report

OCCURRENCE SUMMARY

Occurrence Number:	03/068
Occurrence Type:	Incident
Location:	5NM South of CLM (Paris)
Occurrence Date:	01-Aug-03
Time	20:33 UTC
State:	France

1st Aircraft Details

Aircraft Manufacturer:	Airbus Industries
Aircraft Model:	A320
Operator's Name:	Swiss International Airlines
Call Sign:	SWR371
Type of operation:	Public passenger transport
Departure:	London Heathrow
Destination:	Basle Mulhouse
Flight Plan:	IFR
Configuration:	FL380 descending
Speed:	M0.78 GS=480 knots
Radio Contact:	SU sector (Paris) 135.305MHz
Transponder:	mode A+C 2232
TCAS Alarm:	No RA or TA received
Separation (pilots):	100m horizontally; 600ft vertically
Recorded (radar):	OPERA H=0.7 NM V=344ft

2nd Aircraft Details

Aircraft Manufacturer:	Boeing Co
Aircraft Model:	B767-300
Operator's Name:	Air Atlanta Icelandic
Call Sign:	ABD2354
Type of operation:	Public passenger transport
Departure:	Rome Ciampino
Destination:	Dublin
Flight Plan:	IFR
Configuration:	FL376 descending following the RA
Speed:	GS=440 knots
Radio Contact:	UY sector (Reims) 132.630MHz
Transponder:	mode A+C 4040
TCAS Alarm:	RA "descend"
Separation (pilots):	nil horizontally; 100-200 ft vertically
Recorded (radar):	OPERA H=0.7NM V=344ft

FACTUAL INFORMATION

On Friday 1st August 2003 at 2016.20 UTC, SWR371, an A320 under IFR en route from London Heathrow to Basle Mulhouse contacted the CRNA/N (Paris) UZ sector and reported they were reaching FL270 (ceiling level for flights between London and Basle Mulhouse, as planned by the airline in respect of this 'city pair'). The controller cleared them direct BARAK.

At 2018.59, SWR371 which had requested a higher flight level (while specifying 390 as a maximum) was cleared to climb to FL310 after coordination with the Brest CRNA/O ZS/ZU sector.

At 2019.27, SWR371 was transferred to Brest ZS/ZU sector which continued to monitor the climb of SWR371 to the FL390 requested.

At 2027.31, a phone call was placed by ZU (Brest) to SU sector (Paris) in order to coordinate SWR371 to FL390. The SU radar controller accepted.

At 2029.00, ABD2354, a B767-300 under IFR, en route from Rome to Dublin, already in contact with the CRNA/N (Paris) SU sector was transferred to the frequency of the CRNA/E (Reims) UY sector, maintaining FL380. It was transferred to the UY sector in Reims before passing BRY, in accordance with the Letter of Agreement (therefore before crossing the route of SWR371 BARAK-GELTA).

At 2032.27, SWR371 contacted the SU sector (Paris), maintaining FL390. The controller cleared them for a direct route to GELTA (which placed them north of their initial route). The SU sector was undergoing training, and the organic and radar controllers had just changed posts (trainee at the radar in the presence of the instructor and first organic controller).

At 2032.54, the radar instructor for the SU sector (Paris) coordinated SWR371 to the UF sector in Reims. Both controllers agreed for SWR371 to come into Reims level at FL350.

At 2032.55, the controller for UY sector turned ABD2354 15 degrees left in order to cross with an overflying traffic (route TSU-RANUX) at the same level. (The Letter of Agreement allows for possible radar guidance prior to entry in UY sector, without changing levels). This heading put them closer to the trajectory of SWR371.

At 2033.42, the SU sector controller requested SWR371 to "...start descent FL370, best rate of descent...".

At 2034.12, the safety net was triggered.

The SU sector (Paris) controller ordered SWR371 to turn 20 degrees right immediately. SWR371 read back. The radar instructor took over the frequency and requested SWR371 to turn right, then changed his mind immediately, ordering 30 degrees left whilst at the same time giving a traffic information "...traffic in your front side, 5NM...". SWR371 asked "...left, confirm 30 degrees left?..." and specified "...we have the traffic squawking in sight...". The controller said "...according to the traffic, you maintain the flight level avoiding the traffic...".

At 2034.22, the UY sector (Reims) controller asked ABD2354 to turn 35 degrees right immediately. The pilot did not respond. The controller again issued information of traffic at 12 o'clock, in the opposite direction. ABD2354 replied "...traffic alert..." and announced that they were descending.

At 2034.53, at the request of the SU (Paris) controller, SWR371 confirmed visual contact with the traffic "...it's rather close, it's passing below us now...", then added, "...traffic is not on the TCAS, it is not on TCAS...". In their declaration, SWR371 insisted on the fact that "...we had no TCAS target on our screens..." and specified that they observed around them and levelled-off at FL376.

At 2035.03, ABD2354 notified control "...we have a traffic resolution and we are descending down to 37...".

At that moment SWR371 was descending towards ABD2354 which was also descending thanks to the TCAS.

SWR371 had passed 350 feet above ABD2354 and wrote an Airprox report.

Classification

Taking into account the minimal separation values of 0.7NM horizontally and 344ft vertically according to the radar recording, the sole RA-TCAS received and executed by the pilot of flight ABD2354 and despite SWR371 announcing visual contact, this incident is hereby classified as: Risk Of Collision "A"

Small Exercises without Solutions

The following exercises provide narrative from which the reader must extract information about 'Separation' while trying to add 'Events' and 'Phases' also. Solutions are not provided.

Exercise 78

Narrative: A Canadian military Bell 412 (CH-146 Griffon), WOLF26A, was en route from Shearwater to Halifax, and was on an IFR approach to runway 24 at Halifax. JZA8855, an Air Canada De Havilland DHC-8 had taxied to position on runway 24 for a flight from Halifax to Boston and was subsequently cleared for take off. The take off roll was slower than expected by ATC personnel and separation between the aircraft eroded to approximately one and one half miles laterally and less than 1,000ft vertically in an area where 3 miles lateral or 1,000ft vertical are required.

Exercise 79

Narrative: A Morningstar Air Express Boeing 727-100, operating as MAL8068, was on a three mile final approach to runway 02 at the Edmonton International Airport. A WestJet 737, WJA532, was on a 6 mile final approach to runway 12. Ten miles west of the airport a second WestJet 737-200, WJA41, was being vectored to runway 12.

The Arrival Controller was using speed control between MAL8068 and WJA532. The Arrival Controller pointed out traffic on approach for runway 12 to MAL8068 and they were not able to identify it. To ensure separation at the threshold, the Arrival Controller changed MAL8068's runway to 12 and vectored MAL8068 on a heading of 340° for runway 12.

The vector placed MAL8068 on a right base for runway 12, between WJA532 and WJA41. A loss of separation occurred between WJA41 and MAL8068 when the distance between the aircraft decreased to 1 mile horizontally and 500ft vertically where 3 miles or 1,000ft are required. Tower instructed WJA41 to overshoot runway 12. At the same time WJA41 received a TCAS Advisory and began to climb.

Exercise 80

Narrative: C-GANS, a De Havilland DHC-8-102 aircraft, operating as Air Canada Jazz flight 7907, was inbound to Toronto LBPIA and was inadvertently cleared to 4,000ft in an area where traffic was only being cleared to 8,000ft. The flight crew was then given two heading changes. When they tried to confirm the second heading change, their transmission was cut-off by another aircraft.

The flight crew attempted numerous times to contact the centre, but either their transmissions or the centre's transmissions were cut-off by other radio traffic. The flight crew recognised a conflict and received a TCAS RA to climb at the same time the centre contacted the aircraft and told them to climb to 8,000ft and change heading to 110 degrees.

The flight had conflicted with C-FPON, a De Havilland DHC-8-102 aircraft, operating as Air Canada Jazz flight 7755, which departed Toronto LBPIA and was cleared to climb to 7,000ft. At 5,800ft the aircraft received a TCAS RA to descend. ATC advised the flight crew of Jazz 7755 to level off at 6,000ft due to opposite direction traffic. Spacing was reduced to 2 miles lateral and 700ft vertical.

Exercise 81

Narrative: A Sunwest Home Aviation Cessna Citation 550, registration C-GAPV, operating as CNK505, was inbound to Calgary and had been cleared to descend to and maintain 13,000ft due to traffic ahead. The traffic was a North Caribou Beech King Air 100, registration C-GBVX, operating as NCB099, also inbound to Calgary.

When ATC issued a clearance to a third aircraft, a Beech King Air 100 operating as Peace Air PE557, to descend to 8,000ft, CNK505 responded to and complied with the clearance and continued the descent below 13,000. CNK505's read back of the clearance to 8,000ft occurred at the same time as PE557's read back of the clearance. ATC did not receive the CNK505 read back; however, there was a squeal on the frequency during the PE557 transmission, indicating that the CNK505 transmission was blocked.

The controller observed the deviation when CNK505 was descending through 10,800ft and NCB099 was descending through 10,200ft to 10,000ft. The controller immediately cleared NCB099 to 8,000ft and CNK505 to 11,000ft. Separation was reduced to 600ft vertical and 1.5 miles lateral where 1,000ft and 3 miles were required. CNK505 was TCAS equipped; however, the system was inoperative at the time of the occurrence.

Exercise 82

Narrative: The Air Canada Airbus A320-200, C-FKAJ, was operating as ACA140 from Calgary, AB to Toronto, ON. During the initial climb to 9,000ft, ATC instructed ACA140 to turn to a heading of 010. The read back was correct, however, a heading of 100 was entered into the flight control unit (FCU) by the flight crew. As ACA140 passed through 7,000, the controller instructed ACA140 to fly a heading of 010 and directed an inbound North Cariboo Flying Service Cessna 441 to expedite their descent through 7,000. A loss of separation occurred when separation eroded to 2.7NM laterally and 600ft vertically where 3NM or 1,000ft were required.

Exercise 83

A lost of separation near Sept Isles occurred when a Boeing 777-200 operated by British Airways under flight BAW99 was cleared to climb into the altitude of the leading aircraft, a Boeing 747-200 operated by Air France under flight AFR346. Both aircraft came within 4 miles apart at the same altitude while the minimum spacing required was 5 miles or a thousand feet.

When the controller initially monitored the spacing between the 2 flights, the PED (Positional Entry Device) indicated the aircraft were at least 8 miles apart and increasing. However the PED apparently was not perfectly centred on one of the aircraft target and the RBL (Range Bearing Line) locked onto a geographical fix over the ground instead of the aircraft, giving the controller an incorrect indication.

When the system alerted the controller that there may be a conflict, a second input was made to confirm the spacing between the 2 flights. At this time the spacing indicated that they were 4 miles apart. Separation was re-established within 1 minute and 20 seconds.

Exercise 84

A Saab 340-B, C-GTJX operated by Calm Air as flight CAV7540, was en route south-westward from Churchill to Winnipeg at FL200. A Beech King Air A100, C-FASB operated by Thunder Airlines as flight THU101, was en route north-westward from Pickle Lake to Thompson at FL200.

Both aircraft were radar identified under control of the Winnipeg ACC north low Sector, The north low sector was staffed with a trainee controller under the supervision of an on-job-instructor. Neither controller recognised a potential conflict with the two flights. The controllers were occupied with other control duties when the radar conflict alert system provided a traffic alert of an imminent conflict between CAV7540 and THU101. In response to the traffic alert the trainee instructed THU101 to descend to FL180. Horizontal spacing between CAV7540 and THU101 was reduced to 3.5NM with 800ft vertical spacing. The separation standard in effect was 5NM and 1,000ft.

Air Traffic Management Exercises



Exercise 85

OCCURRENCE SUMMARY – APP UNIT

Occurrence Type:	'Not Significant' Incident ⁴
Location:	2NM north of WUN NDB
Occurrence Date:	02 Sep 2004
State:	Germany
Time/Zone:	08:49UTC

Flight XXX

Aircraft:	E145
Departure:	EDDV
Destination:	LFPG
Notes:	On SID000 climbing to 4,000ft under control of sector AE

Flight YYY

Aircraft:	UH1
Departure:	EDDW
Destination:	ETNW
Notes:	Holding at 5,000ft under control of sector AE

FACTUAL INFORMATION

TFC volume was medium and medium complex; at the time of the occurrence flight calibration took place.

To enable XXX an uninterrupted climb and not to wait until XXX is 'free' from YYY, sector AE turned XXX after initial call and identification to the right heading 300°. Shortly after that YYY, still in the holding, started a left turn 180° from heading NE to SW. That guaranteed both flights to be on diverging headings and sector AE cleared XXX to FL100. As sector AE realised that YYY turned more slowly than expected and was therefore furthermore drifting north towards XXX, he turned XXX further right heading 330° and gave traffic information about the helicopter (i.e. YYY).

Shortly after, there was the closest proximity of 1.6NM/500ft with diverging headings. Minima's are 3NM/1,000ft. STCA alert: yes. No Information about TCAS. CISM offered but not initiated. Controller relieved.

Facts on controllers:

AE: Headset used, fully licensed ATCO since 3 years, early shift (2nd day of turn) from 07:15 till 12:10UTC.

Causes: Misjudgement – Service instead of safety – Control based on assumption

Willing to give good service to XXX by enabling him for a continuous climb the ATCO turned him to 300°. That was too less to guarantee sufficient horizontal separation to YYY in the holding. Furthermore the ATCO was misjudging/miscalculating the radius of the turn of YYY. YYY turned only more north than expected and was drifting therefore in the direction of XXX's heading. Because of the diverging headings there was no danger at any time for either one of the flights.

⁴ The classifications 'Not Significant', 'Significant' and 'Very Significant' do NOT grade the risk of collision but do ONLY grade the safety significance of ATC involvement in the relevant ATC caused incident. This judgement follows a specific NATIONAL AIR TRAFFIC SERVICES LTD (NATS)/DFS ATC 'Safety Significance Evaluation Scheme' for Separation Minima Infringements caused by ATC. This scheme is not used for Flight Crew related incidents. The final classification is obtained after summing the individual scores on the 'ATC INCIDENT EVALUATION MARKSHEET (#CA2692)'.

Exercise 86

OCCURRENCE SUMMARY – UAC UNIT

Occurrence Type:	'Not Significant' Incident
Location:	15NM east of INN NDB
Occurrence Date:	15 Sep 2004
State:	Germany
Time/Zone:	09:29UTC

Flight XXX

Aircraft:	MD90
Departure:	EKCH
Destination:	LIRF
Notes:	Heading south DCT to ADOSA at FL310 under control of sector TALE

Flight YYY

Aircraft:	CRJ2
Departure:	LFLX
Destination:	LJLJ
Notes:	Heading east DCT to ARNOS at FL320 under control of sector TALE

FACTUAL INFORMATION

TFC volume was low and medium complex. OJT was in progress for TALE (Executive/Radar Controller) and TALP (Planner/Coordinator). Shortly before the occurrence there was a position hand-over at TALE position. It was coordinated between TALP and the upper control sector UPLP that YYY should descend to FL320 DCT to ARNOS. Later on YYY was planned to be transferred to Vienna Radar in FL310 by TALE.

After YYY was clear of relevant traffic, he was cleared by UPLE to FL320 and DCT ARNOS and then sent to TALE. In the meantime the position hand-over at TALE had taken place. Assuming that YYY was already on a direct course to ARNOS and would therefore cross behind XXX, the TALE Trainee cleared YYY to descend to FL310 but actually YYY was still on HDG 110°. Only during his initial contact with TALE, YYY turned direct ARNOS. 15 seconds later TALE Trainee realised the conflict and gave avoiding headings to both flights and TFC information to YYY.

XXX had a TCAS TA. STCA did alert. The closest proximity was 4.3NM/400ft (5NM/1,000ft). XXX had passed the crossing point already. CISM was offered but not initiated. Controller was relieved.

Facts on controllers:

TALE: Headset used, fully licensed ATCO since 5 years, early shift (1st day of turn) from 03:45 till 11:55UTC.

Causes: Control based on assumption – Faulty conventional working technique – Faulty radar working technique

Both TALE Coach and Trainee assumed that YYY was already heading DCT ARNOS. The Coach judged that XXX would have passed the crossing point of both flights with 5NM distance when YYY would have reached this point. Therefore Coach and Trainee were focussed on guaranteeing the transfer FL310 to Vienna Radar for YYY and he was close to reach the transfer Fix/Point. The reaction to the conflict of the trainee was before the STCA alert.

Exercise 87

OCCURRENCE SUMMARY – TWR UNIT

Occurrence Type:	'Not Significant' Incident
Location:	EDDM Airport
Occurrence Date:	18 Sep 2004
State:	Germany
Time/Zone:	12:13UTC

Flight XXX

Aircraft:	EWG6PM (AT72)
Departure:	EGLL
Destination:	EDDM
Notes:	Heading south DCT to ADOSA at FL310 under control of sector TALE

Flight YYY

Aircraft:	BAW35W (E145)
Departure:	EDDM
Destination:	EIDW
Notes:	Heading east DCT to ARNOS at FL320 under control of sector TALE

FACTUAL INFORMATION

At 12:13 UTC a loss of separation occurred in the area of RWY 22 of the airport of EDDM between the above mentioned aircraft.

While EWG6PM was in the final approach (from EGLL to EDDM) to RWY22 of EDDM, BAW35W from EDDM to EIDW got the take off clearance. While EWG6PM was flying over the threshold of RWY22, BAW35W had taken off and was flying over the runway at a distance of about 1,690 meters in regard to EWG6PM.

By applying reduced runway separation, a value of 2,400 meters is mandatory.

Facts on controllers:

PLAN: Headset not used, fully licensed ATCO since 11 years, late shift (3rd day of turn) from 10:00 till 18:33UTC.

Causes: Distraction – Service instead of safety – Inadequate traffic monitoring

The ATCO did not observe the final approach of EWG6PM because his attention was focused on another aircraft of which the pilot asked a question. So the last chance to give the instruction to perform a go around to EWG6PM was missed.

Exercise 88

OCCURRENCE SUMMARY – APP UNIT

Occurrence Type:	'Significant' Incident
Location:	2.5NM northeast of WBE NDB
Occurrence Date:	07 Nov 2004
State:	Germany
Time/Zone:	18:12UTC

Flight XXX

Aircraft:	BRT217 (E145)
Departure:	EGUL
Destination:	EDDF
Notes:	Following ROLIS07 transition with a southerly heading in a descent to FL60, under control of Frankfurt Arrival TRAN.

Flight YYY

Aircraft:	EWG786 (F28)
Departure:	EDDC
Destination:	EDDF
Notes:	Following the GED07 transition with a south-westerly (converging) heading in a descent to FL80, under control of Frankfurt Arrival TRAN.

FACTUAL INFORMATION

Traffic volume was medium but highly complex. Not that much the amount of traffic was a problem, more the change of landing direction created the complexity of the situation.

After the initial contact with arrival of both aircraft within 20 seconds at which each aircraft received the clearance for the transition, the decision to change the landing direction was taken and initial coordination started.

Shortly thereafter, BRT217 was cleared to descend to FL60 out of FL110. EWG786 got the clearance to descend to FL 80 out of FL100. Neither of the aircraft got any restriction within the clearance and both aircrafts were proceeding to the same RNAV fix DF094 which is part of both of the cleared transitions. Shortly prior both aircraft were arriving overhead DF094, the ATCO realised the confliction and gave heading instructions to both aircrafts, BRT217 to turn right heading 270 and EWG786 to turn left heading 180.

These heading instructions were not sufficient to remain the prescribed separation minima of 3NM/1,000ft. The closest proximity was 2NM/500ft whereas BRT217 passed FL76 in the descent (below the cleared FL of EWG786) and both aircraft were performing turns to the cleared headings. Traffic information was not provided. STCA and TCAS did not alert. CISM was offered but not initiated. Controller was not relieved by own wish.

Facts on controllers:

TRAN: Headset used, fully licensed ATCO since 14 years, late shift (3rd day of turn) from 12:15 till 20:24UTC.

Causes: Faulty conventional working technique – Inadequate traffic monitoring – Distraction

Exercise 89

OCCURRENCE SUMMARY – TWR UNIT

Occurrence Type:	'Significant' Incident
Location:	Nurnberg Airport (EDDN)
Occurrence Date:	09 Dec 2004
State:	Germany
Time/Zone:	08:10UTC

Flight XXX

Aircraft:	DETOG (C172)
Departure:	EDDN
Destination:	EDTY
Notes:	

Flight YYY

Aircraft:	HLF675 (B738)
Departure:	EDDN
Destination:	HECA
Notes:	

FACTUAL INFORMATION

At 08:00UTC DETOG departed from RWY 09 following the SID KNG8K to proceed to EDTY for IFR training. After a short period of time, HLF675 reported ready for departure, planned departure route was KUDNO2N. Both departure routes are following the same track for about five miles before they are diverging by 105 degrees.

The ATCO of the approach sector was asked by the tower controller to turn DETOG at an early time, so that HLF675 could take off before the next landing which was at a 10NM final.

The tower controller (PLA) observed at his radar screen a turn to the right of DETOG which at this moment had been 4NM away from the runway. Take off clearance was given to HLF675 because the distance between the two aircraft seemed to be sufficient to the tower controller.

The tower controller was informed by the approach controller that STCA created an alert and that the separation minimum of 3NM (2.8NM) was not provided any longer.

STCA alerts are not displayed at the control tower and the tower controller had the opinion that prescribed separation was provided. No CISM. No relieve.

Facts on controllers:

PLA: Headset not used, fully licensed ATCO since 6 months, early shift (3rd day of turn) from 05:30 till 09:30UTC.

Cause: Misjudgement

Exercise 90

OCCURRENCE SUMMARY – UAC UNIT

Occurrence Type:	'Not Significant' Incident
Location:	10NM west of GRONA
Occurrence Date:	27 Sep 2004
State:	Germany
Time/Zone:	06:10UTC

Flight XXX

Aircraft:	WGT86G
Departure:	LOWI
Destination:	EDDH
Notes:	Northerly heading direct to NARUS at FL320. Under control of Main Radar BUCHE.

Flight YYY

Aircraft:	AUA56J
Departure:	EDDL
Destination:	LOWS
Notes:	Easterly heading following the route SALAS-TRETO-GRONA (crossing flight path of WGT86G). In climb to FL330 out of FL310. Under control of Main Radar BUCHE.

FACTUAL INFORMATION

Traffic amount was high and medium complex, on the job training (OJT) was performed at the working position BUCHE.

AUA56J was in the climb to FL310. To ensure a continuous climb the trainee of BUCHE re-cleared AUA56J to continue climb to FL330. 45 seconds later the pilot of AUA56J asked for a clearance to descend back to FL310. This question was answered by the trainee using the phrase: «...roger, stand by...». The clearance to climb to FL330 remained to be valid and AUA56J continued climbing with a low rate.

About 3minutes later, shortly prior to the STCA alert, the trainee realised the conflicting situation and re-cleared AUA56J to descend back to FL310 immediately. Simultaneously the coordinator did the coordination with Grona ACC because at the aircraft's position FL310 and below belongs to the sector of TFIH at Grona. Immediately thereafter the coach took over the RT and gave heading instructions to both aircraft to solve the conflict. AUA56J got traffic information about WGT86G. Another 30 seconds later WGT86G and AUA56J reported to have each other in sight.

Despite the taken measures the required separation minima of 5NM/1,000ft were lost. The closest proximity was 3.2NM/800ft whereas AUA56J was in the descent passing FL312. Neither of the pilots reported any TCAS alert. Controller was relieved. CISM was initiated.

Facts on controllers:

BUCHE: Headset used, fully licensed ATCO since 5 years, late shift (2nd day of turn) from 14:00 till 22:10UTC.

Cause: Conflict realised too late by coach.

Exercise 91

OCCURRENCE SUMMARY – ACC UNIT

Occurrence Type:	'Significant' Incident
Location:	10NM northwest of WLD VOR
Occurrence Date:	23 Sep 2004
State:	Germany
Time/Zone:	15:39UTC

Flight XXX

Aircraft:	PRQ371 (F50)
Departure:	EDMA
Destination:	EDDT
Notes:	North-easterly heading direct to EKSOS, climbing to FL100 and under control of ZR3

Flight YYY

Aircraft:	BLO3098 (AT72)
Departure:	EDDN
Destination:	EDDM
Notes:	South-easterly heading (converging to PRQ371) at FL110. Located within airspace of jurisdiction of ZR1 but under control of FRN.

FACTUAL INFORMATION

Traffic volume was medium and low complexity.

Before the clearance to climb to FL100 was delivered to PRQ371, this flight was coordinated between FRN and ZR1. After the coordination the aircraft was cleared to climb to FL100 and was transferred to the frequency of ZR3. BLO3098 was flying converging to the PRQ371 with a south-easterly heading at FL110 under control of ZR1.

After the transfer of control of BLO3098 to FRN, the pilot asked to descend to FL90. FRN cleared BLO3098 to descend to FL100 because he had crossing traffic at FL90. FRN did not consider the flight of PRQ371 at FL100 which he had had under control just a minute ago. The incident occurred in the area of jurisdiction of ZR1; all aircraft which are transferred from ZR1 to FRN are released, of course SYD (subject your discretion) known traffic.

Only when STCA generated an alert, FRN realised the confliction and gave instruction to BLO3098 to fly heading 220, to expedite descent to FL90; traffic information was provided. ZR3 acted simultaneously due to a warning of ZR1 and gave the instruction to PRQ371 to descend to FL90 and to fly heading 090. While PRQ371 followed the given instructions, which had not been coordinated with FRN and reported a TCAS descent, BLO3098 did not follow the instructions of FRN but performed a TCAS climb.

These measures could not prevent that the aircraft had a closest proximity of 3.1NM/300ft. Prescribed separation minima are 5NM/1,000ft. CISM was offered but not initiated. Both controllers were relieved.

Facts on controllers:

ZR3: Headset used, fully licensed ATCO since 5 years, swing (3rd day of turn) from 09:00 till 16:10UTC.

FRN: Headset used, fully licensed ATCO since 5 years, late shift (2nd day of turn) from 11:45 till 21:00UTC.

Causes: Inadequate traffic analysis (Radar) – Conflict not/late recognised

Exercise 92

OCCURRENCE SUMMARY – UAC UNIT

Occurrence Type:	'Significant' Incident
Location:	10NM southeast of WLT
Occurrence Date:	15 Sep 2004
State:	
Time/Zone:	10:11UTC

Flight XXX

Aircraft:	FRN324 (B738)
Departure:	EBBR
Destination:	EDDT
Notes:	En route northerly heading to intersection KULPUS at FL360. Under control of UR3

Flight YYY

Aircraft:	HFJ324 (B738)
Departure:	EHAM
Destination:	LTBA
Notes:	En route south-easterly heading to the VOR/DME KUS at FL330. Under control of UR3

FACTUAL INFORMATION

Traffic volume at the time of the incident was high and very complex.

FRN324 was planned to be transferred to the next sector NR2 at FL300. Therefore FRN324 got the clearance to descend to FL300 with a rate of descent of 1,500ft/min or more. Beside HFJ324 another aircraft was flying at FL310 at a converging course to the FRN324. When UR3 realised that FRN324 would not be at FL300 in due time to keep the aircraft separated he re-cleared FRN324 to stop descent at FL320. Rate of descent was not included in the re-clearance. UR3 realised that the vertical separation between HFJ324 and FRN324 would not be reached before lateral separation exists, so he re-cleared FRN324 again, to reach FL320 within the next 30 seconds. After this transmission already 19 seconds later, the lateral separation between these two aircraft was already 5NM whereas FRN324 was still above FL320. The closest proximity was 4.1NM/700ft (Prescribed minima: 5NM/1,000ft). STCA generated an alert, HFJ324 reported a TCAS-TA. CISM was offered but not initiated. To relieve the controller was, on his own judgement, not necessary.

Facts on controllers:

UR3: Headset used, fully licensed ATCO since 4 years, early shift (1st day of turn) from 04:00 till 12:00UTC.

Causes: Misunderstanding R/T– Inadequate traffic analysis (Radar) – Heavy workload - Conflict not / late recognised - Target Fixation

At the time of the occurrence there were 10 aircrafts on the frequency of UR3. Close to the location of the incident, there were 7 aircrafts with south-easterly HDG; three of them were relevant TFC for the descent of HFJ324. To transfer HFJ324 to the next sector in FL300, UR3 sets himself under pressure and cleared HFJ324 to descent but with a too low rate. He realised the incorrect rate too late and to keep vertical separation to a 3rd aircraft; HFJ324 was cleared to stop descend. But still with the too low rate now the separation minima to FRN324 was infringed.

Exercise 93

OCCURRENCE SUMMARY – ACC UNIT

Occurrence Type:	'Not Significant' Incident
Location:	5NM west of CTU VOR
Occurrence Date:	10 Oct 2004
State:	Germany
Time/Zone:	12:13UTC

Flight XXX

Aircraft:	CPU1017 (CL60)
Departure:	EDNY
Destination:	EDDK
Notes:	

Flight YYY

Aircraft:	VPI8744 (MD11)
Departure:	SBGL
Destination:	EDDF
Notes:	

FACTUAL INFORMATION

Both flights were under control of RODE2. OJT was in progress. Traffic volume was low and normal complex. Combined working positions: RODE1/RODE2 and RODP1/RODP2.

CPU1017 was flying in FL230 with a northerly heading. At initial contact, VPI8744 was cleared for further descend to FL230. That became only a conflict when the trainee cleared CPU1017 direct to FFM. Now both flights came close to each other with slightly converging headings. Realising this, the trainee cleared VPI8744 to descend to FL150 with a rate of 2,000ft/min or more. The coach, first wanting to give the trainee the chance to solve the conflict by himself, now intervened by turning the aircrafts apart from each other. The CPU received TFC information and was reporting to monitor the other TFC on TCAS. No TCAS RA was initiated. No STCA alarm according to parameter settings. Prescribed separation is 5NM/1,000ft. Remaining separation was 4.2NM/300ft. RODE2 was relieved and accepted CISM.

Facts on controllers:

RODE2: Headset used, fully licensed ATCO since 9 years, late shift (4th day of turn) from 13:45 till 21:54UTC.

Cause: Coach intervened too late; Trainee: Misjudgement – Cleared aircrafts to the same level – Radar vectors too late

Exercise 94

OCCURRENCE SUMMARY – APP UNIT

Occurrence Type:	'Very Significant' Incident
Location:	4NM north of TINOG
Occurrence Date:	24 Sep 2004
State:	Germany
Time/Zone:	16:10UTC

Flight XXX

Aircraft:	DGTIK (PA30)
Departure:	LOWG
Destination:	EDTL
Notes:	En route north-westerly heading direct ALB in FL100. Under control of NRX

Flight YYY

Aircraft:	HLD3195 (A320)
Departure:	UUEE
Destination:	EDDM
Notes:	South-westerly heading, crossing to DGTIK, descending to FL120 under control of TRAN

FACTUAL INFORMATION

Traffic volume was high but still medium complex. The coordination stress for the TCAN controller was high. A second control position TRBN was opened shortly before the occurrence.

TCAN was informed by the NCX controller about the slowly flying DGTIK in FL100, especially about the fact that DGTIK is relevant traffic for Munich approaches, if those are released for further descend and transferred from NCX to TRBN.

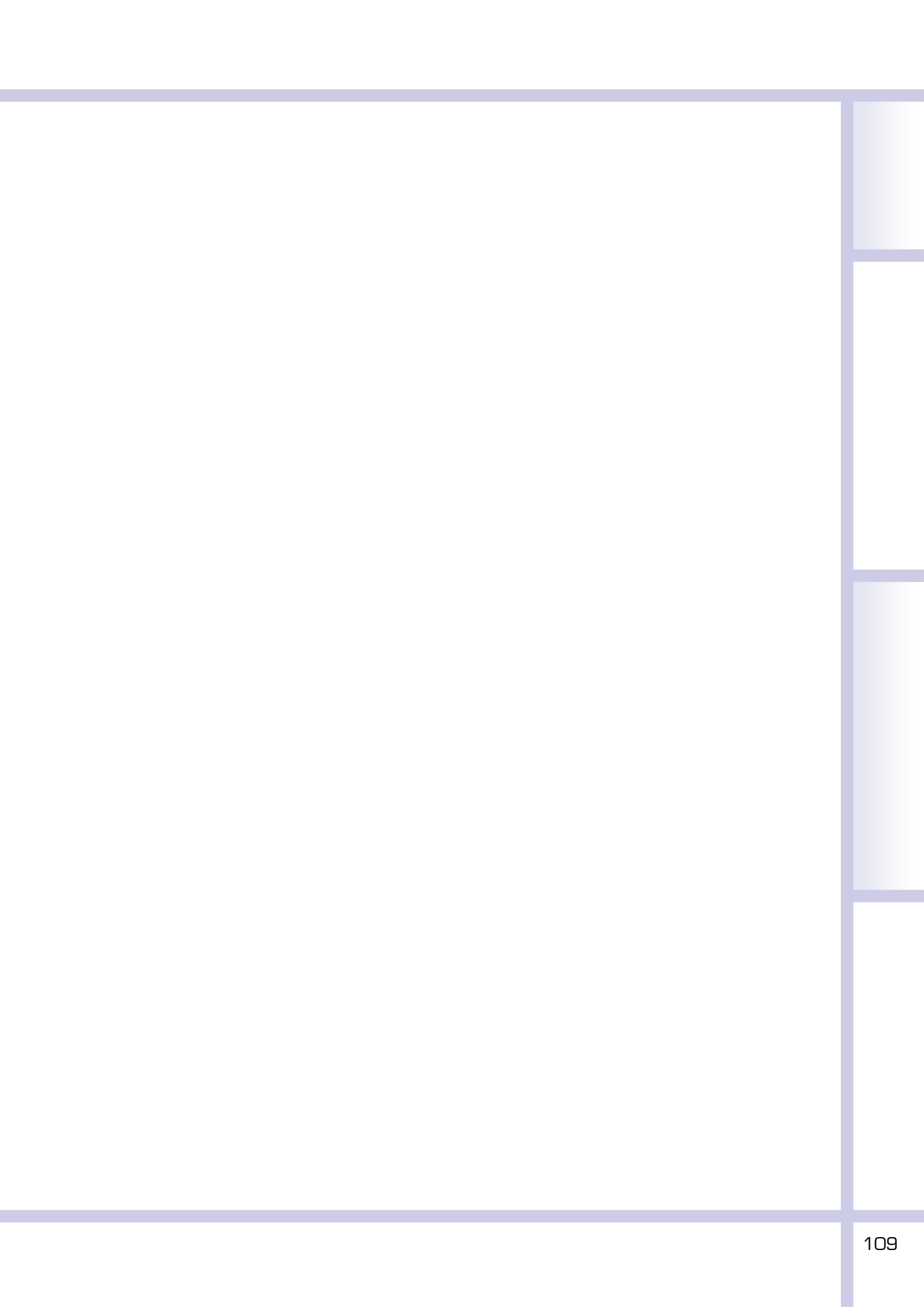
As HLD3195 was transferred from NRX to TRBN, the TRBN controller, after coordination with TRAN, cleared HLD3195 via waypoint DM438 directly to the final of RWY26R down to A6000ft, without respecting DGTIK. Then HLD3195 was transferred to Munich Director TX. During the frequency change the separation minima of 5NM/1,000ft were infringed. The closest proximity was 4NM/400ft after the HLD has crossed the flight path of DGTIK already. No TCAS alarm. No TFC information was given to either flight. STCA alarmed. CISM was offered, but not initiated. Unfortunately, right at the moment of the clearance to descend for HLD3195, the transponder signal of DGTIK disappeared shortly because he was changing the code. The controllers TRBN and TCAN were relieved. TRAN was not.

Facts on controllers:

NRX: Headset used, fully licensed ATCO since 5 years, late shift (2nd day of turn) from 14:00 till 22:10UTC.

TRAN: Headset used, fully licensed ATCO since 8 years, late shift (2nd day of turn) from 14:00 till 22:10UTC.

Cause: Inadequate coordination executive and planner – Inadequate traffic analysis (Radar)



Query Builder Exercises



Introduction

Queries can be defined as being instances of questioning to a database. In order to question a database, a language must be used that the database can understand. In the ECCAIRS system this is SQL, an acronym for Structured Query Language. SQL (pronounced as 'see-quel') is an industry-standard language for creating, updating and querying relational database management systems. SQL was developed by IBM in the 1970s for use in System R. It is the de facto standard as well as being an ISO and ANSI standard. It is often embedded in general purpose programming languages.

However, SQL is a computer language which is not easy to learn, and in order to operate with it in an efficient manner, it requires knowing the [ECCAIRS] database structure and the internal coding used. All in all, not exactly the solution the user is looking for when working with the occurrences database. For that purpose, the Query Builder is available. The Query Builder encapsulates the complex taxonomy and the database structure and takes care of translating the request for data into the equivalent SQL statements.

The following exercises provide indications for building queries that allow finding occurrences from the database that contains data the user is looking for. Some of these exercises can be used as a ready solution for retrieving occurrences, but the focus is on the selection of right attributes, operators and comparison values but also on the proper use of brackets and selections. Solutions are at the end of this exercise book.

Building queries requires, to a certain degree, knowledge about the ADREP 2000 Taxonomy. It is also necessary to have an understanding about the attributes available, since it is important to select the right attribute when looking for data. For instance, to find occurrences involving a determined type of aircraft (for example a balloon) it is easier to use the "aircraft type" attribute instead of looking for specific manufacturers and/or models.

APPROACH

Within the Query Builder, the user creates a chain of elements, reference values and operators. The combination of element (i.e. attribute), a reference value and an operator is called *criterion*. A variable number of criteria can be combined and grouped together. Brackets give, like in mathematics, priority in the execution of the query on the database.

In the Query Builder, two types of brackets exist:

- The curly brackets '{ }'
- The square brackets '[]'

There is a substantial difference between the two types of brackets. The curly bracket is the equivalent of the round bracket in math operations and operates accordingly, considering the entire occurrence record as the data container on which to operate. The square bracket considers entities in the occurrence as the data container on which to operate, such as for instance aircrafts. Refer to the ECCAIRS documentation for additional examples of entities.

For example, there is an occurrence in the database involving 2 aircrafts: a Boeing 747 and an Airbus 380. To find this occurrence, one would create a query to «...*find the occurrences having one aircraft being 'Boeing 747' and another aircraft being 'Airbus 380'...*». In Query Builder syntax, this would translate into «*Find the occurrences where {aircraft make/model equal to 'Boeing 747' and aircraft make/model equal to 'Airbus 380'}*» using the curly brackets.

The used combination of criteria has the purpose to retrieve occurrences where one of the aircrafts is the Boeing 747 and where one of the other aircrafts is the Airbus 380. It is necessary to use the 'AND' operator instead of the 'OR' here, because otherwise the system would return additional occurrences involving just the Boeing 747 or the Airbus 380 or occurrences that involve one of the two but in combination with other models of aircrafts (such as the 747 together with a 727).

If in place of the curly brackets the square brackets are used, such as in «*Find the occurrences where [aircraft make/model equal to 'Boeing 747' and aircraft make/model equal to 'Airbus 380']*», then the ECCAIRS system will look for occurrences where one of the aircrafts is a Boeing 747 and where that same aircraft is a Airbus 380. Since this is logically not possible, no record will be returned.

Although the above example may look confusing, the use of the square brackets becomes necessary when looking for instance for occurrences involving Boeing helicopters (yes, Boeing makes these as well), or for occurrences for which the aircraft category is not specified (i.e. not a mandatory attribute).

In the first example this means querying the database for «...[aircraft make/model equal to 'Boeing' **and** aircraft category equal to 'Helicopter']», in the second case this is «...[aircraft make/model has value **and** aircraft category has no value]».

Example Exercise

All exercises assume that the Query Builder is open and that a query is either being added or edited. The Query Builder can be opened from within the ECCAIRS Browser, Grapher, Exporter or any other tool that needs to operate on occurrences stored in the database.

REQUESTED QUERY

Show all the incidents occurred to Airbus aircrafts during Landing.

EXPLANATION

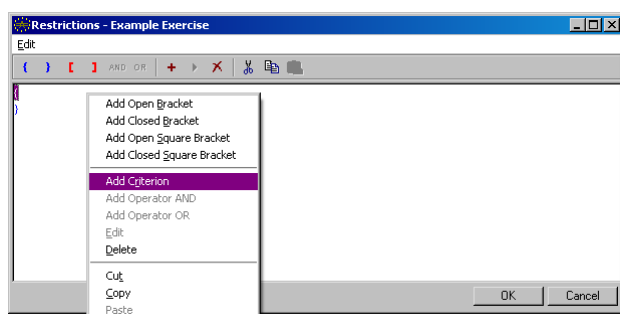
In plain English, the above query instruction can be reformulated as: «...find all occurrences having an occurrence type being 'Incident', having 'Airbus' as the manufacturer of the aircraft while the phase of flight was 'Landing'...».

The selection contains 3 elements: a) type of occurrence (i.e. 'incident'), b) specific aircraft manufacturer, and c) flight phase. For each of the elements, the reference value is also provided: a) Incidents, b) Airbus and c) Landing. For all three, the operator is 'equal to'.

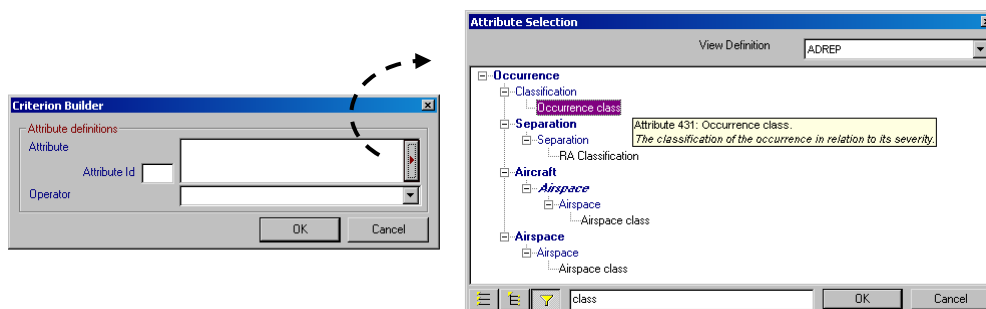
The relation between the 3 criteria is also given (they are logically linked using 'AND').

SOLUTION

The first criterion to add is related to the type of occurrence or better said to the occurrence class. This is achieved by selecting the FIRST curly bracket in the list ('{') and then right-clicking on it and selecting **Add Criterion**. Alternatively, it is possible to select **Edit → Add Criterion** or to click on the **+** button.



If the **Attribute ID** is known, then it can be typed directly. Otherwise it is necessary to open the **Attribute Selection** dialogue box by acting on the button located at the right side of the **Criterion Builder** dialogue box.

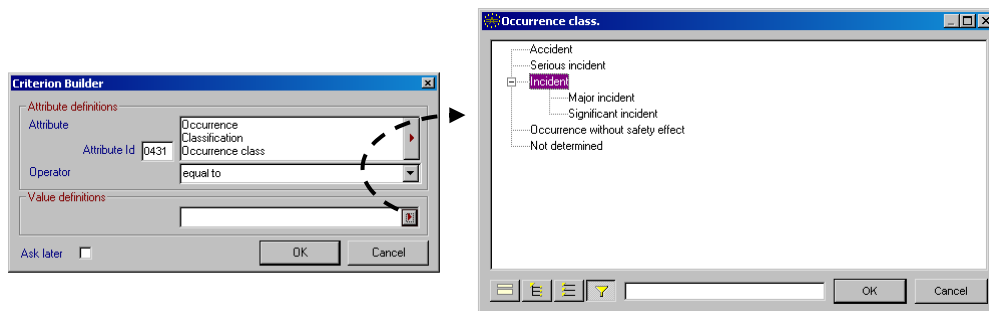


The filter function can be used for quickly locating the **Occurrence Class** in the tree, as shown above.

Please note that the presence and the position of the attribute in the tree is strictly related to the view selected (top-right of dialogue box). The chosen attribute may not be part of those allocated to a given view. Switching to another view may allow selecting the attribute.

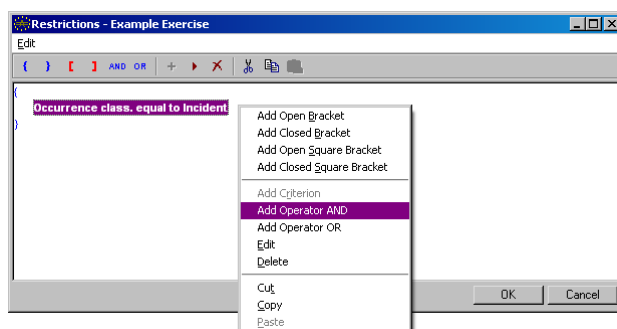
However, even in the case that the attribute is not part of the view or of any of the other available views, it is still possible to find occurrences in the database. The ECCAIRS system scans the database for occurrences based on the attribute only and totally ignores settings about views.

After selecting 'equal to' from the Operator list, click on the button at the right and select the desired occurrence class from the pick list ('Incident').

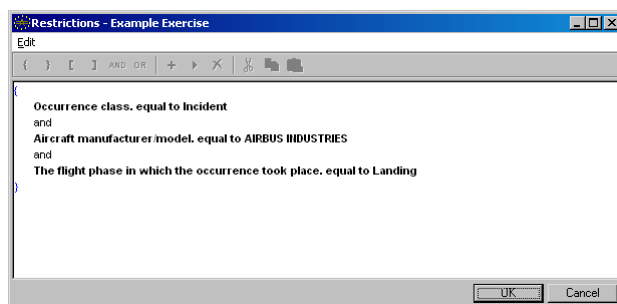


This pick list is a multi-level pick list. Multi-level means that it is organised in different levels with an increasing detail on the particular data branch. By selecting 'Incident', the ECCAIRS system will retrieve occurrences that have 'Incident' as an occurrence class, but also those that have either 'Major incident' or 'Minor incident' since the latter are both children of the main 'Incident' list entry.

Confirm the first criterion by clicking on **OK**. Next, add the Boolean 'AND' operator by right-clicking on the criterion and selecting **Add Operator AND**. Alternatively it is possible to select **Edit → Add Operator AND** or to click on the **AND** button.

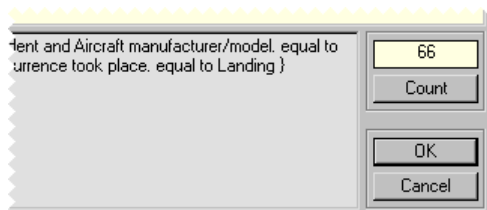


Add, following the same steps described above, the second criterion having the aircraft manufacturer/model (attribute ID 21, or 0021) equal to 'AIRBUS INDUSTRIES' – which is the name for Airbus in ECCAIRS – and finally the third criterion for the flight phase equal to 'Landing' also with the Boolean 'AND' operator. The result of the query will then be:



Click on **OK** to save the query definition.

Before executing the query, a count can be performed to verify if the database contains the occurrences one is looking for. Please note that the count of 66 – see below – corresponds to the number of occurrences found in the database when writing this manual. This number may differ from the actual values.



To execute the query, and have the application retrieve the occurrences, click on the **OK** button. In case of the Browser, the list located in the bottom part of the tool will be populated with data; within other tools, additional steps may be required to obtain data.

Editor's note: within the above query, the reader may want to add square brackets enclosing and grouping the 'aircraft' and the 'flight phase' attributes (FYI: the occurrence class 'Incident' is related to the entire occurrence). The example has been developed bearing in mind the 'Landing' for 'Airbus' only – and in that respect the consideration is valid. However, the original query stated «*Show all the incidents occurred to Airbus aircrafts during Landing*» and here this distinction was not made. At the end, both solutions are correct, the one using square brackets a little more specific.

SAVING YOUR QUERY

When the Query Builder senses a change in any of the queries, it will ask the user to save the Query Library. It is always recommended to save when asked. The system will ask for a destination folder and a filename only the first time a library is saved; in all other cases, the library is save without further notice.

Saving is necessary for maintaining a query definition over different Browser sessions, but also for making it available to other applications of the ECCAIRS system.

Exercises with Solutions

BASIC QUERIES

These exercises are provided for getting the necessary feeling with the Query Builder.

Exercise 95

Find all occurrences.

Exercise 96

Find occurrences that took place in 2001.

Exercise 97

Find occurrences involving Boeing aircrafts OR Airbus aircrafts.

Exercise 98

Find occurrences that took place in 2000 in a European country selected by the user.

Exercise 99

Find occurrences reported by United States authorities.

Exercise 100

Find occurrences that never happened.

INTERMEDIATE QUERIES

These exercises are provided for retrieving those occurrences that use a combination of fields, operators and/or brackets and that are of intermediate complexity.

Exercise 101

Find occurrences where a Boeing 747 was involved together with another aircraft selected by the user.

Exercise 102

Find occurrences involving infant or baby in commercial air transport.

Exercise 103

Find all occurrences involving aircrafts that lost control.

Exercise 104

Find occurrences involving a specific aircraft make experiencing emergency consequential to technical events or failures due to system components.

Exercise 105

Find occurrences involving 2 but only 2 aircrafts where loss of separation was an issue.

Exercise 106

Find the occurrence with the highest number of aircrafts involved.

Exercise 107

Find occurrences that you have inserted yourself in the database on a specific day.

ADVANCED QUERIES

These exercises are provided for retrieving those occurrences that use a combination of fields, operators and/or brackets and that are of advanced complexity.

Exercise 108

Find all fatal occurrences using at least 3 attributes.

Exercise 109

Find all fatal occurrences for turbine powered aircrafts operating in commercial aviation that took place in the final phases of flight and where the aircraft suffered at least substantial damage.

Exercise 110

Find fatal occurrences that where the age of the pilot is over 60 and where the cause of the accident is not related to either loss of separation, near misses or mid-air collisions.

Exercise 111

Find occurrences involving aircrafts registered in Northern America that offer all types of flights except non-revenue operations and that use single engine aircrafts or helicopters.

Exercise 112

Find all occurrences where the last event is a runway excursion.

Exercise 113

Find occurrence in which smoke, fumes or fire were involved in combination with dangerous goods.

Exercise 114

Find occurrences where the only aircraft manufacturer is Boeing but not out of the 767 series.

VERIFICATION QUERIES

These exercises are provided for retrieving those occurrences that are incomplete and that as such do not provide the necessary information for making consistent analysis sheets. Here, the aim is trying to tackle the problem of poor data quality.

Exercise 115

Find occurrences about helicopters with invalid engine types.

Exercise 116

Find all occurrences where ATM (Air Traffic Management) effect or contribution was not specified although ATM was directly or indirectly involved since both aircrafts had problems with separation.

Exercise 117

Find all occurrences with incomplete aircraft data that would prevent making graphs on mass groups.

Exercise 118

Find all occurrences with incomplete aircraft data that would prevent making reports on mass groups distinguished by type of aircraft.

Exercise 119

Find all occurrences where weather relevance was not specified although fog/mist was reported and the weather was given as IMC.

Exercise 120

Find all occurrences where the injury level is not set correctly.

Grapher Exercises

A collection of drawing instruments including a compass, two pencils, and a ruler, arranged in a cluster.

Query, X-axis, Y-axis and Z-axis

The query is used to select a determined number of records from the database. It is mandatory to set a query, and the restriction will be used to trim the amount of occurrences retrieved. For each occurrence, the Grapher will retrieve the entire data record.

The X-axis is used for distributing data in groups based on the contents of an attribute, in other words, on the value that is stored in a particular data fields. For instance, to separate the occurrences in accidents and incidents, the X-axis would have to be linked to the 'Occurrence class' attribute (ID 433) which is the attribute that stores this kind of information. The X-axis is required for producing graphs.

The Y-axis is mainly used for showing computed values, such as the number of occurrences, the total sum of fatalities, etc. The values are computed for each distinctive group created on the X-axis. The Y-axis is also required in a graph.

The Z-axis allows for separating the groups created on the X-axis into smaller groups, which contain information about a second attribute that is independent from the one used for the X-axis. Setting a Z-axis is optional. The Z-axis is often used to give [a 3D] depth to the graph.

Occurrence counting

Due to the design of the ECCAIRS system, of the taxonomy and of the occurrence records, the Grapher does not provide an out-of-the-box function that 'counts occurrences'. However, this function is available via a detour. In practice, it consists in telling the Grapher to count the property or value that is known to exist in every occurrence of a group.

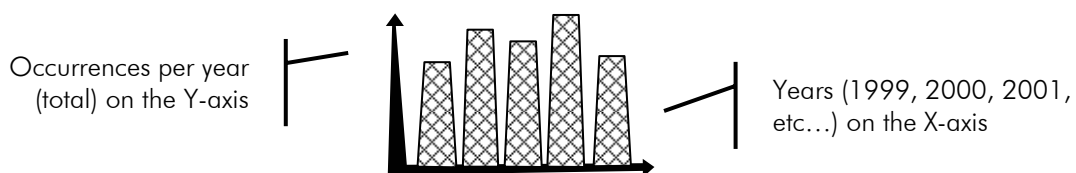
Imagine having a box containing 25 spheres of 3 distinct sizes: small, medium and large. To find out how many spheres there are for each size, they need to be separated by size first. Next, the spheres in each group need to be counted. To compute the number of spheres per size by using a common property, the solution is counting spheres for which the shape is 'round'. Since spheres are always round, counting round spheres is equivalent to counting spheres.

Counting occurrences in the Grapher is made possible by counting the existence of a mandatory field such as the State File Number or the State Reporting (required by Annex 13) or the date the record was entered in the database (required by ECCAIRS). In essence, by counting the number of times a [any] State File Number was given to an occurrence the Grapher can deduct the total amount of occurrences.

Example Exercise

OBJECTIVE

The objective of the example exercise is creating a bar chart showing data related to the total amount of accidents or incidents that take place each year.



In order to do so, a query must be created first that selects records from the database and next a mechanism must be activated that separates the occurrences per year. Finally, a function must be activated that allows counting the number of occurrences for each year.

QUERY


To consider the necessary records, a query must be created that retrieves all occurrences from the database. This is similar to the first of the Query exercises immediately following this example.

DATA DISTRIBUTION

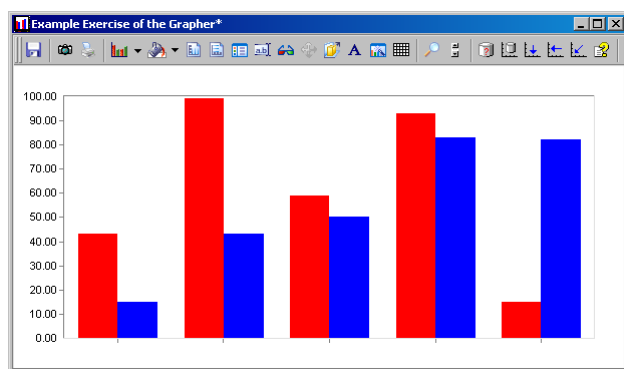
The distribution of the data records per year is performed by acting on the layout of the date that the occurrence took place (an attribute called the 'Local date' having ID 433).


EXERCISE


This exercise assumes the ECCAIRS 4 Grapher is running in memory and that a graph library is open.


Create a new graph by selecting **File → New Graph**, by clicking on **New** in the library or by clicking on the  button on the Grapher's toolbar. Keep the highlight on the **General** tab, make sure the icon named **Bar** is selected on click on **OK**. Give the graph a suitable name.

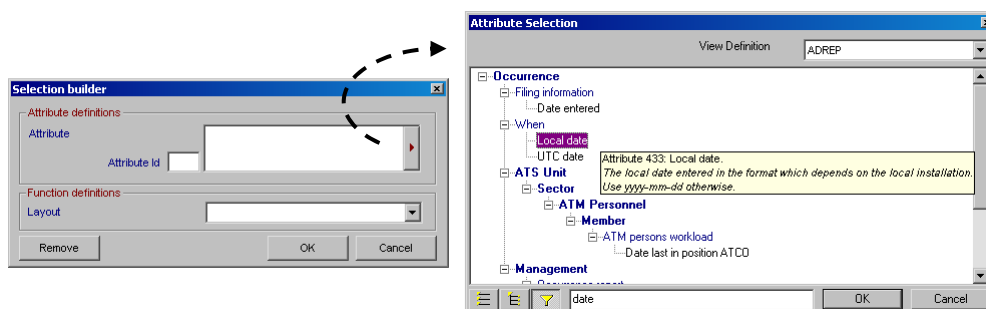
The Grapher will show a sample output of the graph. This sample is based on fake data, since none of the mandatory elements are present (query, X-axis and Y-axis). It is recommended to maximise the graph's window (and the Grapher as well) in order to see all toolbar buttons. Maximising is sometimes required to show the graph, because a small working desktop may prevent the Grapher from painting the graph.



On the toolbar, to the right, there is a button that is also present in the Browser, being the query button (the drum with the question mark, ). By clicking on this button, a query can be loaded previously prepared in the Browser. A new query can also be created on the spot.

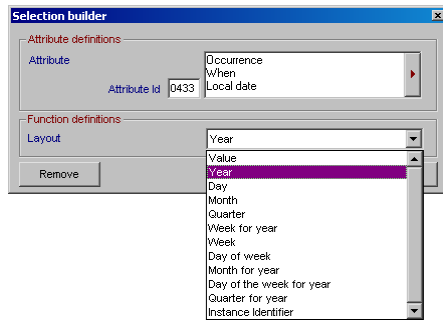
After confirmation, the Grapher will load a copy of the query in the graph. It does so because if the graph is transferred to another workstation, the query used is still at hand. The Grapher will make this evident by keeping the  button selected (technically this is called 'pressed'). This button can be pressed for editing the local copy of the query, so that a particular restriction can be added or modified.

The X-axis data is assigned by clicking the  button which is located immediately right of the above mentioned button. Now it is time to set the date, grouped by year. If the attribute is known (here 433) then it can be typed directly. Otherwise, operate on the button located at the right side of the attribute selector.




Dates have 3 elements, being the date number, the month number and the year. From all or part of these elements, a lot of additional information can be derived (quarter, week number, day of the week, etc.). For the moment, the need is to look for the year only.

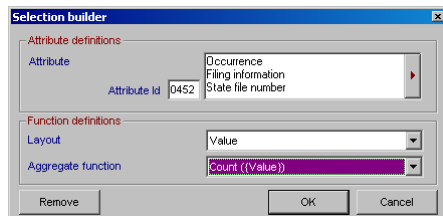
To organise and group the date by year, the Grapher must be instructed to look only at the year part of the local date. By clicking on the button at the right side of the **Layout** selector, the Grapher makes a list of layouts available. The selector list is populated with layouts that respect the type of attribute selected.




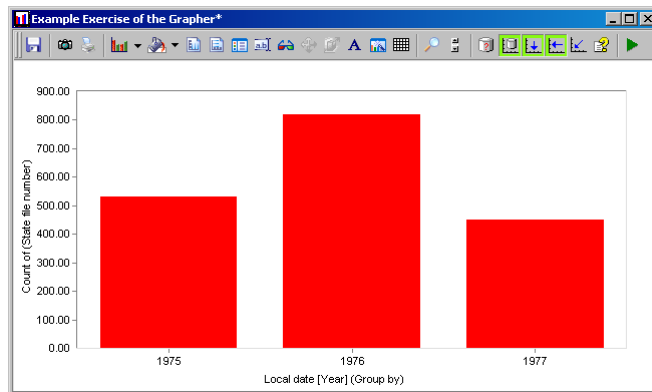
Select 'Year' and then click on OK to accept. The Grapher will now also mark the  button as 'pressed'.

The last step consists in establishing the values for the Y-axis. According to the exercise instructions, the need was for counting the number of occurrences. Following the explanation given earlier, the Grapher will now have to count the number of times the State File Number is present. Click on the  button.

Select the State File Number as the attribute (id 452), for the **Layout** keep 'Value' but as the **Aggregate function** select 'Count({Value})'. Click on OK to save. The Y-axis button will also be set to 'pressed'.

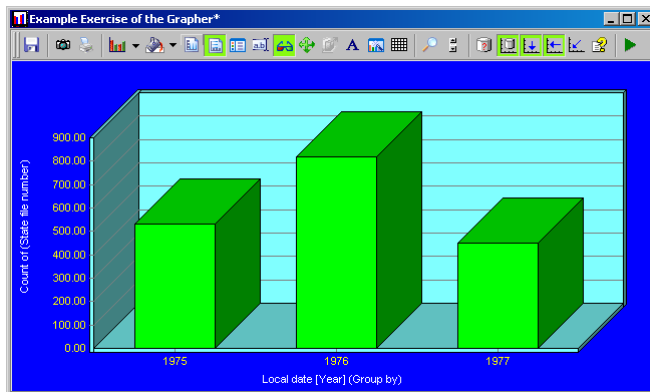


The last step consists in populating the graph with data. This phase is kept separate from the definition of the graph's query and axes, since in this way a graph can be refreshed without having to redefine its elements. The graph is populated with data by clicking on the  button located at the right on the toolbar. Below is a sample output of this bar graph, based on a database that only contained data from 1975 until 1997.



ADDING FLAVOUR TO THE GRAPH

By acting on the graph's properties, the visual impact of the graph can be improved:



The horizontal lines in the chart's wall are obtained by selecting the corresponding button (7th from the left). The 3D look is obtained by pressing the 'goggle with red/green lenses' button (10th from left). The colours were changed by selecting a colour from the chart accessible from the right click popup menu on the different sections and areas.

Exercises with Solutions

Unless otherwise specified, graphs should show the total count of occurrences.

As a rule of thumb, it is good practice to remove elements such as '#NULL#' from the graph, by acting on the visibility of the related row and/or column in the data grid.

BASIC GRAPHS

These exercises are provided for getting the necessary feeling with the Grapher.

Exercise 121

Create a bar graph showing a division by Occurrence Class.

Exercise 122

Create a bar graph showing a division by Injury Level.

Exercise 123

Create a pie chart showing the division by Mass group.

Exercise 124

Create a bar chart showing the division by Day-Of-The-Week.

Exercise 125

Create a pie chart showing the division by Occurrence Category.

INTERMEDIATE AND ADVANCED GRAPHS

These exercises are provided for creating graphs that make use of functions available in the Grapher or that make use of the Z-axis and that are of intermediate or advanced complexity. Some of the examples also include instructions that modify the presentation of the graph.

Exercise 126

Create a bar chart showing the division by year and for each year the division by "Accidents" and "Incidents". The chart must have a clustered Z-axis, a small Legend box in the right part of the area. The "Accidents" must have purple bars, while the "Incidents" must have dark red bars. The bars must have a thin black line surrounding the border. Both series must have white, 10pt bold Point Labels. The chart must be organised in such a way, that the distribution between the 2 occurrences classes are shown as a percentage and sum a 100% per annum. The back of the chart box must have a dark grey colour.

Exercise 127

Create a pie chart showing the division by day of the week for a determined year in the database, limited to working days (Monday to Friday) only. The chart must have a '3D' look with the X-axis rotated by 10° and the Y-axis by 325°. The colours of the slices must be taken from the «Chart-FX 3.0» palette. The slices should report the percentage of each slice in respect of the entire pie, using 1 decimal place.

Exercise 128

Create a bar chart showing the total fatalities for each month of a determined year. The chart should have a '3D' look rotated X:10° and Y:15°, cylinder shaped bars, a dark blue background, yellow X and Y labels having the X labels rotated upwards 60°, a white 12pt bold main title and 10pt cyan bold X and Y titles.

Exercise 129

Create a pie chart showing the sum of fatalities divided by the following type of operation for an annual period: "Aerial Work", "General Aviation", "State Flights" and "Commercial Air Transport". The chart should have a '3D' look with a dark blue background; the slices should report the percentage of each slice in respect of the entire pie; the slices related to "Aerial Work", "General Aviation" and "State Flights" – if available – should be displayed as extracted; the slice related to "Commercial Air Transport" should start preferably in proximity of the «2 o'clock» mark.

Exercise 130

Create a pie chart showing the division by year with 2 pies, the first showing of the Mass Group of 2,251Kg to 5,700Kg, the second showing all the mass groups above 5,700Kg. The visual can be set according to personal liking.

Exercise 131

Create a Gantt chart showing the Top 3 occurrence categories by Passenger Fatalities. The visual can be set according to personal liking.

Exercise 132

Create a bar chart showing the division by month for the passenger fatalities and add a smooth line that shows the trend over the year. The visual can be set according to personal liking.

Exercise 133

Create a Gantt chart showing the occurrence categories that score 50 or more occurrences for commercial air traffic and for a variable period of time, sorted from the highest to the lowest. The visual can be set according to personal liking.

Exercise 134

Create a pie chart showing the distribution by flight phase for aircrafts involved in accidents that weigh at least 5,700Kg and that are turbine powered.

Exercise 135

Create a clustered bar chart showing – for all occurrences in the database – the division by month with one row for the total number of occurrences, the second row showing the total number of fatalities. The visual can be set according to personal liking.

