Fatal Accidents in Advanced Technology Aircraft: A Critical Survey

Description: Fatal Accidents in Advanced Technology Aircraft: A Critical Survey was prepared by Captain Livni Gideon who is a very experienced pilot and investigator, flying B-757, B-767 and B-777, mentor to the former Israeli Air Force Commander Gen (Ret) H. Bodinger.

The new study helps in identifying potential reasons for "Advanced Technology Aircraft" accidents and suggests acts to prevent them.

During an era when the outcome of one fatal accident often leads to the airline's bankruptcy, this study possesses a unique significance due to the general perception and to the irregular approach of the analysis concerning the phenomena common to the overall accidents.

In addition to the conclusions and recommendations, and to prevent the recurrence of similar accidents, the research outlines a strategy for future preparation to the replacement of future aircraft technology, in order to prevent accidents defined as “the childhood diseases of the new technology”.

Computerizing the cockpit and using advance technologies brought a dramatic decrease of aircraft accidents during the last 20 years. However, the new Glass Cockpit created different kinds of safety problems and caused some fatal accidents in which thousands of people lost their lives and the damages were enormous.

This applied research tests, in great depth, the reasons why 27 fatal accidents occurred while involving advanced technology aircraft. The research analyzes the acute phenomena, which characterizes the human factor in Glass Cockpit aircraft:

- Misunderstanding the behavior of the aircraft, including its systems
- Canalizing events
- Spatial orientation failures
- Aircraft maneuvering envelopes exceedance
- The unique mental factors

The research analyzes the deterioration of acute technical failures, leading to loss of control of the aircraft, and to the contribution of the "organization" factors (manufacturer, airlines and the civil aviation authorities) to the chain of failures, which led to the occurrence of the accidents, relating to the aircrafts' design, maintenance, operation and the policy involving aircrew handling.

Who would find the report useful?
- Air line operators
- Civil Aviation Administration
- Aircraft Manufacturers
- Air Forces authorities
- Universities and Research Institutions for Aviation Safety and Accidents investigation

I. Methodology

2. Objectives

a. The question addressed in this investigation is: "What are the critical weak points in the safety of advanced technology aircraft operated by the airlines".
b. Its aim is to characterize and analyze the fatal accidents involving passenger and cargo aircraft - defined as "advanced", which have occurred between the years 1990-2002.
c. The analysis of each accident is focused on the following questions:
   I. What happened? – Characterizing the categories of risk.
   ii. How did it happen? – Characterizing the individual processes within the chain of failures.
   iii. Who or what were the causes?
   v. How can the recurrence of similar accidents be prevented? Does a correlation exist between the occurrence of the accident and the “Glass-Cockpit” concept?
d. The conclusions drawn from this research are intended to provide a basis for recommendations designed to minimize the risk of fatal accidents to advanced Technology aircraft on commercial flights.

3. Research Population

The research population comprises:

a. Aircraft of the Glass Cockpit type defined as Advanced Technology aircraft ("Advanced Aircraft"). The precise definition and related considerations will be presented in detail below.
b. Western manufactured aircraft only, due to the unavailability of information considering the structure and design of non-western manufacture or of their methods of operation.
c. Passenger aircraft with a minimal capacity of 50 passengers.
d. Cargo aircraft.
e. Commercial/operational scheduled flights only.
f. International airline and charter airlines...
g. Accidents resulting in fatalities that occurred between the years 1983 and 2002.

Remark: The main reason for the restrictions listed in paragraphs 3, 4, 5 above is the necessity to establish a common denominator based on the threshold of aviation standards.

This research does not concern itself with:

a. Fatal accidents caused by an act of violence perpetrated by an external agent, e.g., passengers, sabotage, a terrorist act, etc.
b. Fatal accidents that occurred during experimental flights, air-show flights or demonstration flights.

Definition of Glass Cockpit Aircraft

The criteria used for the definition of glass cockpit aircraft for the purposes of this survey reflect the upgrade in the perception of how aircraft of the new generation should be operated. This stands in contradiction to the older operational perception, for aircraft in the systems of which digital computation was not incorporated.

These criteria include the following features*:

1. EADI, EHSI, NAV MAP displays and Flight Director displays on electronic screens (CRT, LCD).
2. Auto Flight controlled by FCC, as well as subordinated to the task computers.
3. Computerized engine power control, including an automatic functioning mode (Auto Thrust / Auto Throttle).
4. FMS for flight management by means of a task computer.

*The systems terminology is that used by Boeing

The research population includes the following types of aircraft:

AIRBUS: A300-600, A310, A318, A319, A320, A321, A330, A340
BOEING: B-737-400 to 900, B-757, B-767, B-777, B-747-400
MCDONNEL (BOEING): MD-11, MD-83, MD-87-90
AVRO: Avro RJ100
BAe: BAe 146-300
FOKKER: Fokker F-70 / F-100
CANADAIR: CRJ-700/-900

Definition of Fatal Accident

The Definitions adopted are based primarily on the corresponding ICAO terms.

a. Fatal Accident: An accident that results in fatal injury.
b. Fatal Injury: An injury that results in death within 30 days as a result of an accident.

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