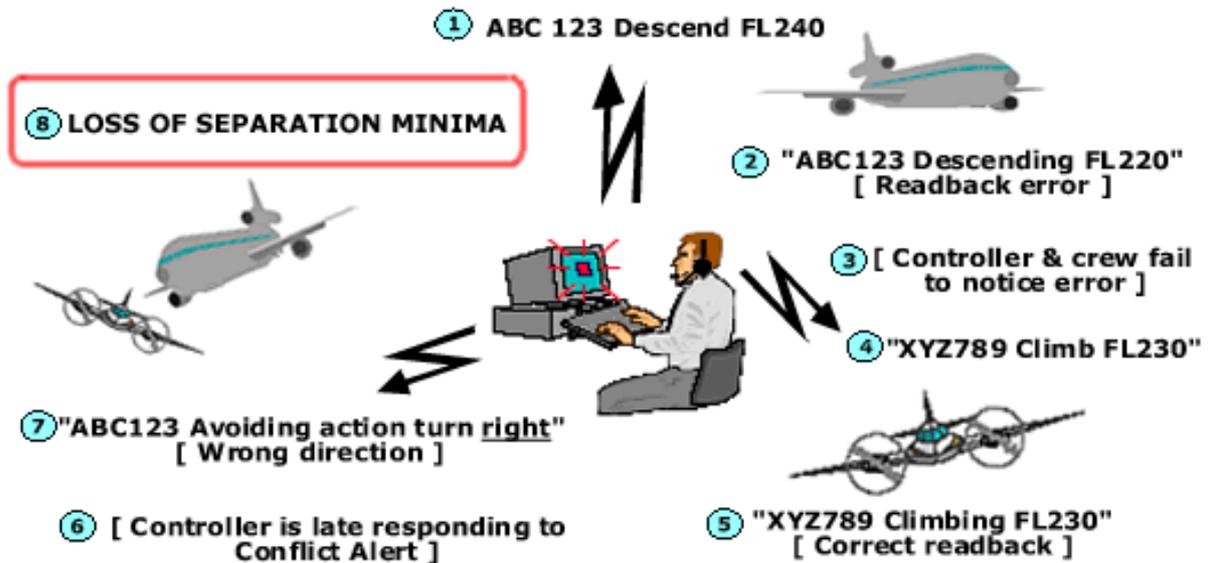**VIRGINIA FLIGHT SCHOOL SAFETY ARTICLE – NO 03/09**

THE ERROR CHAIN

INTRODUCTION

In aviation the term "Error Chain" refers to the concept that many contributing factors typically lead to an accident rather than one single event causing the accident. These contributing factors stem from human-factor related errors rather than mechanical malfunctions.

To ensure organisational and therefore personal integrity the error chain has to be effectively managed.

TENERIFE DISASTER

The Tenerife Disaster in 1977, the worst accident in aviation history, is a prime example of an accident in which a chain of events/errors can be clearly identified which lead up the eventual disaster.

SOME ERROR CHAIN EVENTS IN THE TENERIFE DISASTER

Las Palmas Bombing. Original destination - Las Palmasclosed due to terrorist bombing. Incoming flights diverted to a much smaller airport – Los Rodeos.

Los Rodeos Congestion. Los Rodeos is a regional airport unable to cope effectively with a sudden influx of diverted aircraft – especially large 747's.
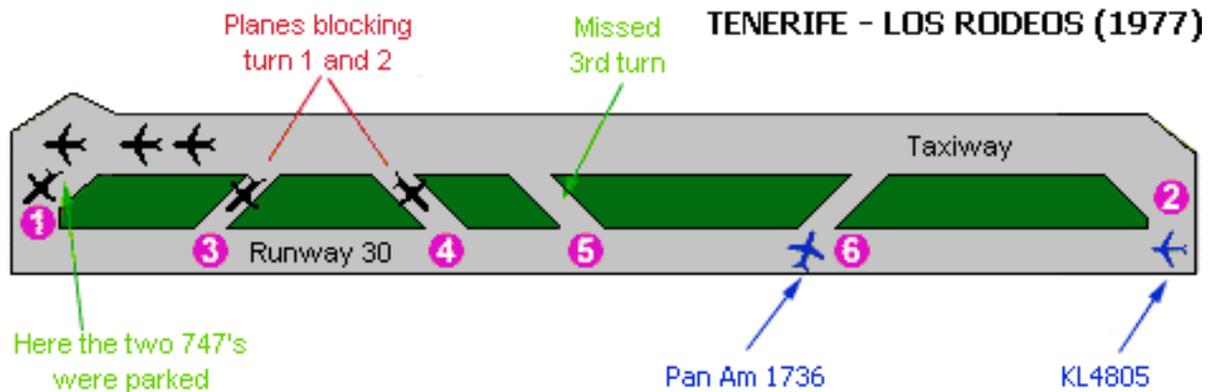
REFUELLING. KLM 747 decides to refuel at Los Rodeoson the taxiway. Las Palmas had re-opened in the meantime.The refuelling blocks the taxiway making take off for aircraft impossible leading to congestion and frustration amongst other aircrew.

Taxying. As the taxiway was congested with aircraft , the KLM and Pan Am had to backtaxi on the runway to the take off thresh hold and make a 180^0 turn at the thresh hold. Difficult for a 747 on a 45m wide runway.

Pan Am follows KLM down the runway. They are instructed to vacate the runway on taxiway exit 3. No markings identify taxiway exits.

Exit 3 requires a 145^0 "backward" turn and leave the Pan Am back in the que of aircraft waiting for take off on the taxiway. The 145^0 turn onto exit 3 is virtually impossible for a 747 to execute.
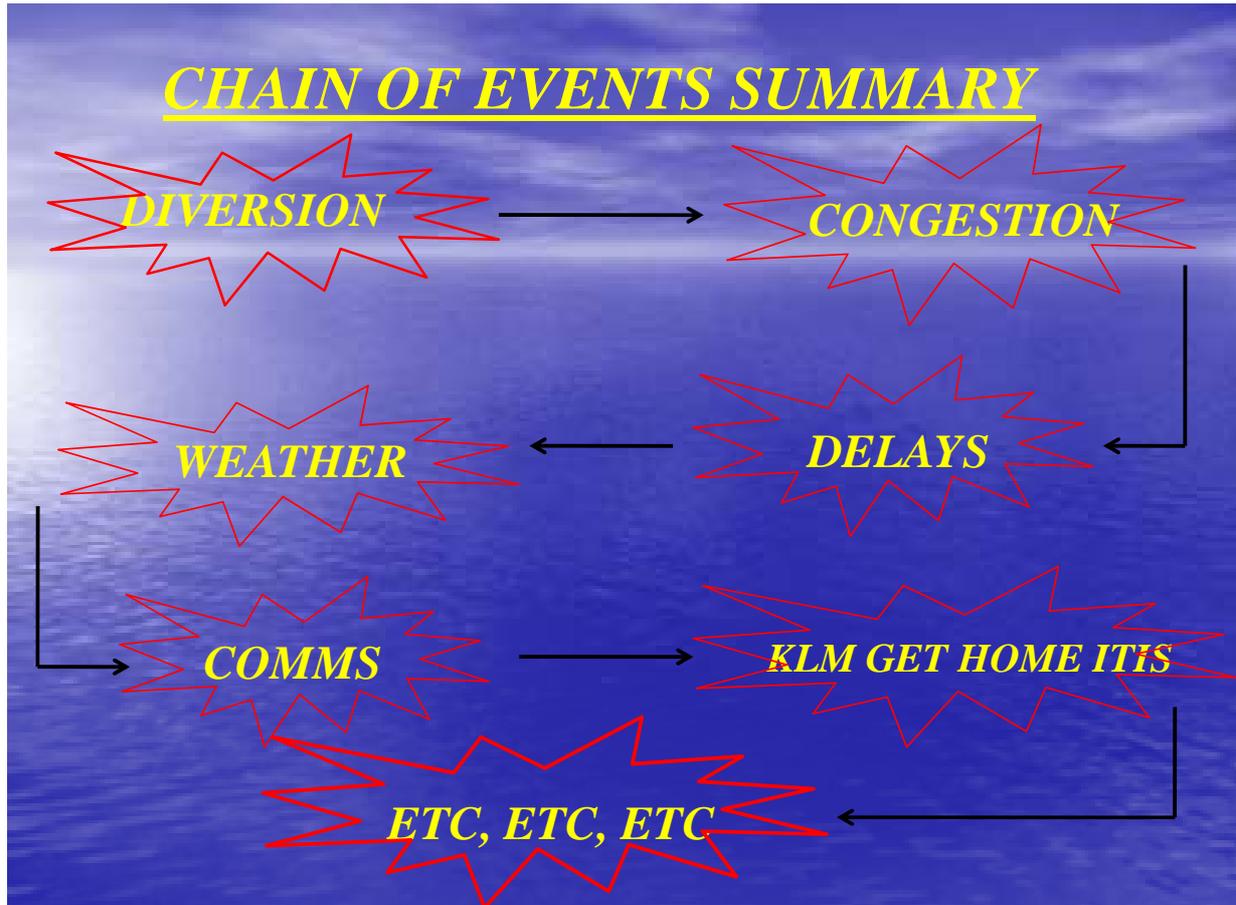
Weather. During the taxi procedures of both 747's the WX deteriorated due to low cloud. A max horizontal Visual range of 300m was reported.

Communications. The ATC clearance from the tower includes the word "takeoff". Co-pilot reads back clearance and informs tower – "we're at take off" meaning they are ready for take off. The tower responds"OK". The KLM captain interprets this as clearance to proceed with the take off and opens throttles.

The tower says "stand by for take off – I will call you".

At that moment the Pan Am realising the danger transmits to the tower that they are still taxiing down the runway blocking out the tower's call to KLM to standby for take off clearance.

The KLM flight engineer realises the situation and says to the KLM captain that the Pan Am is not clear. The Captain and co-pilot focussed on the take off simply Respond "Oh yes" and continues the take off run.

CHAIN OF EVENTS SUMMARY

DIVERSION → CONGESTION

WEATHER ← DELAYS

COMMS → KLM GET HOME ITIS

ETC, ETC, ETC

ERROR AVOIDANCE

All errors cannot be prevented but the likelihood and frequency CAN BE REDUCED :

- BRIEFINGS – Thorough pre-flight and in-flight briefings
- CHECKLITS – Proper completion of all checklists
- CALL-OUTS – Critical avionic settings and flight data call-outs
- CHECKING –Cross checking with read backs
- PROCEDURES – Strict adherence to SOP's.
- COMMUNICATION - Use of standard phraseology in clear, unambiguous messages.