

# Good aviation security report example

[Engineering](#), [Aviation](#)



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- Introduction

Aviation industry provides the only transportation networks across the globe and is thus the only dependable business for global business development and tourism. Air transportation is one of the crucial services that offer commendable social and economic benefits to a country. It provides jobs and increase tax revenue. Air transportation is evidently the fastest mechanism for movement of people and cargo shipments across the world. In terms of social factors, air transport broadens people's leisure and cultural experiences. It provides a cheaper and efficient platform for taking holiday vacations and visiting distant friends and family.

Given the magnitude of its operations globally, airplanes need to provide sufficient security measures to make sure that the lives of passengers and crew are not at stake. Failures originate from manmade error, mechanical, operational and natural calamities. Technology can provide a formidable window for detecting and averting accidents in airplanes before they happen. The use of technology and systems such as ACS, ATM, and ANS play a crucial role in aviation industry.

As shown in figure1, an airplane is propelled onward as a power-driven fixed-wing aircraft by propulsion from a jet engine or propeller. Airplanes vary configurationally in size, shape, and wing. Airplanes have become one of the most important means of mobility. Fig. 2 below shows a large size of remote-

controlled aircraft which can be used among military, research, and recreation fields.

Figure 2 (Brown)

History of airplanes

Aviation's history has extended over thousands years since the earliest trials in kites. In 1783, the first successful air-flight was in heated-air balloon by a few men whose invented the first flying machine. A hot air balloon is simply balloon attached with a container to carry anything and filled with heated-air used to pull-up or down (Oracle Education Foundation). Figure3 shows the first controllable hot air balloon.

Figure3 (" First Controllable Hot Air Balloon")

The first flown airplane was a glider and it was made by Sir George Cayel. A glider is hard to control, because it depends on weather's status and it's not a motorized flying machine (Oracle Education Foundation). Figure 4 shows an old hang glider.

Figure 4 (" hang glider history")

Airplane accidents

Airplanes accidents usually cause fatal crashes which result in death and serious consequences. The table 1 below shows the main causes of fatal accidents in percentage which have happened between 1950 and 2010.

Turbulence Detection

Define

Turbulence occurs as a result of rapid change in air direction and speed.

When the flow of air experiences a sudden change in wind speed and direction, it makes it bumpy instead of smooth. Mild turbulences also occur

in planes as it flies through the sea of air. Turbulence is caused by rising warm air, buildings, thunderstorms, strong winds flowing over the roof of mountains, and other objects on its path. Cases of extreme turbulence occur due to severe thunderstorms, tornadoes, and hurricanes. Airplanes have to divert their courses to avoid areas they are likely to experience turbulence.

### Benefits

Despite over-forecasting and conservative piloting practices, turbulences are estimated to account for 40% of all weather -related accidents. Major airlines estimate that they experience turbulence on average once per day and about 30 incidences per year. NTSB estimates that the cost of one incidence is approximately \$750, 000 and according to Volpe National Transportation System Center, an average of 43 air carrier accidents might be might be turbulent related. It is encouraging that about 20% of these accidents may be avoided by use of better detection and forecasting systems. This will result in an average annual air carrier benefit of about \$6 million. According to NASA-ASTT program drawing data from Volpe, the annual turbulence accident avoidance benefits may be as much as \$17 million annually. Real time in situ measurements of turbulent experiences and a quantitative measurement of the experiences result in vast improvement of the current pilot reports. Likewise, high resolution forecast models capable of capturing accurate and fine scale data based on updated winds and turbulent reports significantly improves turbulent forecasts. Implementing the forecasting and detection reports in a user-friendly manner foster common situation awareness among dispatches, pilots, controller and traffic managers thereby greatly reducing accidents.

According to a new research by Bazargan, (2010) at the Centre of Excellence for Climate System Science at The University of Melbourne, turbulence may be caused by thunderstorm generated gravity waves making far more serious than earlier anticipated. Previously, it was thought that turbulence outside the clouds is as a result of jet streams and changes in wind speeds at different altitudes, a phenomenon known as wind shear. The far reaching consequences of thunderstorms such as modifying airflows, strengthening the jet stream and enhancing wind shear at a significant distance from the storm area have negative impacts on the airplanes.

For instance, flights along Australian and international routes across the tropics, Asia, and regions between Australia and the US slightly deviate from storm cells but are close enough to experience gravity waves and clear-air turbulences.

#### High cost

Beyond the immediate safety concerns, it has been estimated that turbulence and related preventive designs costs the aviation industry more than \$100 million yearly. This is attributed to associated rerouting and service checks, and high resolution atmospheric modeling. Currently, the industry depends on flying guidelines similar to those produced by the US Federal Aviation Administration.

The current understanding of atmospheric turbulence process is limited. Turbulence occurs in the atmosphere on scales that are not adequately observed. Pending the fact that there are varieties of ways to generate turbulence, turbulence processes are complex and non-linear. The problem lies in the lack of reliable, accurate and timely measurements and reporting

of atmospheric turbulence locations and intensities. Currently pilot reports are extensively used in the aviation industry but have not been satisfactory. Also poor performance of turbulence forecast systems at the moment which may miss turbulence occurrences and over predict its occurrences is the cause of worry.

Lack of precision in turbulence prediction and over-forecasted pilot reports increases operation impacts. Pilot reports can effectively lead to closure of air routes without warning, limiting available air space and consequently increasing service provider workloads as well as overloading radio frequencies.

#### Air Traffic Control

##### Define

ATC is the process of managing private and commercial airlines in the sky before they take off and land in airports. The management processes gathers for safe distance between airplanes, minimal flow of traffic and guidance against bad weather. Air traffic control is a complex processes involving air traffic control system command centre, ART centers, and terminal radar approach control and air traffic control tower. All these centers work in unison to ensure safe takeoff, landing and navigation of airplanes.

##### Benefits

The use of universal language in ATC communication is important because it ensures uniformity and understanding between the ATC personnel and aircraft pilots. This increases efficiency in communication between the air traffic control and pilots. It is apparent that communication is essential for

safe landing and takeoff of airplanes. Without a standardized language for communication, there would be misunderstanding between the controllers and the pilots. Consequences of lack of proper communication can be detrimental.

### Consequence

Communication error has been cited as the biggest causal factor in both level bursts and runway incursions in Europe. This replicated in other parts of the world where aviation accident statistics have been documented. In a bid to standardize communication and between pilots and controllers, Commercial Aircraft Transport pilots and other pilots flying IFR within controlled airspace are required to abide by a commonly used reference radiotelephony guide to attain language uniformity and more understanding.

Noting that communication error is a leading cause of accidents apart from technical components, ICAO has come up with guidelines that help commercial aircraft pilots and other pilots flying within controlled airspace to communicate effectively. The need for clear and unambiguous communication between ATC controllers and pilots is essential for safety reasons. It is crucial that the use of standard words and phrases have been employed to ensure that pilots and ATC maintain highest professional standards while using RTF. This is important when operating in busy and congested frequencies where a fraction of a second wasted with verbosity and non-standard, ambiguous phrases could result in flight safety incidents.

ICAO has developed standard phraseology over time that provides maximum clarity and brevity in communication and ensures that the phrases are



unambiguous. While standard phraseology is not applicable in all situations, knowledge of Standard English will aid communication when plain language is essential. The terms are applicable to clearance and taxi, take-off and departure, read-back, climb, cruise and descent, approach and landing, and emergency communications.

Air navigation system

Define

Air navigation systems are information systems used for flight planning, recording, and movement control from one place to another. Efficient navigation systems have been the focus of the aviation industry for decades motivated by safety. Thus, air navigation systems are aimed at piloting an aircraft from point A to B without getting lost, breaking aviation rules, or endangering the safety of those onboard.

Aeronautical ground light and radio facilities

Aeronautical ground light systems are controlled by the control tower. They are used by pilots to control runway lights on or off. Runway edge lights, in-pavement lights and approach lights have intensity control systems varied to meet the requirements of the pilot.

Advanced control systems

Advanced control systems are automation software and systems utilized in aviation industry to drive growth through efficient management and safety. An example of an advanced control system is NextGen. According to NextGen is a next-generation air transportation system that improves safety and diminishes negative environmental impacts. Goglia (2012) states “ A key initiative within the project involves development of advanced software to

anticipate potential safety issues and identify their resolution. Part of this approach entails “ data mining””. It is a product from CAASD developed in collaboration with FAA with advanced capabilities in system engineering, mathematics and computer science. Through application of in-depth domain knowledge on air traffic management and airspace user operations, ACS have been found to enhance air traffic management worldwide and provide a competitive edge while harmonizing operations to meet future global aviation concerns.

#### Air Traffic Management (ATM) system

Air traffic management systems have been designed to accommodate future demands necessitated by increased traffic. Currently, a concept known as Future Air Navigation Systems (FANS) presenting a space-based method for handling increased traffic and safe passenger scenarios has been developed. FANS concept employ significant changes to airplanes, infrastructure, and ground systems. Thus, it is an attractive system for increased traffic levels anticipated in the future.

#### Benefits

Operator benefits offered by FANS involve increased fuel burn and flight time via direct routing and increase payload capability for takeoff-weight-limited flights. FANS provide improvements in the in the following scenarios;

- Reduced separation between planes
- More efficient route changes
- Satellite communication
- More direct routings
- Lack of altitude loss when crossing tracks

## Consequence

The concept of FANS is based on satellite technology to manage air traffic. Spaced-based FANS is less expensive and independent of ground infrastructure than current air traffic management system. This system accords flight crews, air traffic controllers and other staff seamless communication via satellite-based networks and GPS. For it to be implemented it needs operational changes, airspace operational procedures are used to control traffic controllers and flight crew. Ground and airplane equipment should also be altered to suit the current system.

## Conclusion

In order for airlines to perform effectively in a competitive environment that only provides marginal profits, it needs efficient decision making and management practices that optimize technology and reduce costs. Airlines use tactics based on scientific and mathematical methods to arrive at conclusions favorable for cost minimization and profit maximization.

It is evident that safety in airplane control is paramount to the industry as a whole. Relevant measures need to be put in place to safeguard it against possible environmental, structural and operational disruption.

Through the use of turbulence detection systems, more resources could be saved in addition to averting disasters and crisis. Air control systems and Air Traffic Management work on the same line by simplifying traffic operations while at the same time enhancing safety.

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