Appendix: Procedures and Pilot Training

INTRODUCTION

An airliner’s crew, at least two pilots and flight attendants, have to be organized, defined, trained, and checked in order to meet safety standards. These standards are issued by the civil aviation administration and airlines. These regulations are certification rules, operational rules, and operator rules. Certification rules are between the aircraft manufacturer and civil aviation administration. Operational rules are between the civil aviation administration and airlines or operators. The operator rules are issued by the airline and validated by the civil aviation administration.

To handle these various regulations, pilots rely on the Standard Operating Procedure (SOP), a manual that describes each flight segment in detail and defines a pilot’s actions, call out, and responses. Additionally SOP describes multi-pilot coordination, while one Pilot is Flying (PF) the aircraft, even through Auto-Pilot (AP), the other one is Pilot Monitoring (PM) the PF. This organization is standardized in order to define tasks allocation and area of responsibilities. Thanks to these various procedures and company policy, two or more individuals who are perfect strangers to each other before a mission can climb in a cockpit and interact smoothly, coordinating their actions and fly the plane safely (often in adverse conditions) from one point to another. They are sharing the same mental models of how to fly the airplane, which enables flight crews to act in predictable and appropriate ways to meet the safety standards.

Table 1. Color-coding system for failure alerts

<table>
<thead>
<tr>
<th>Failure Level</th>
<th>Priority</th>
<th>Color Coding</th>
<th>Aural Warning</th>
<th>Expected Crew Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Safety</td>
<td>Red</td>
<td>Continuous repetitive chime</td>
<td>Immediate</td>
</tr>
<tr>
<td>2</td>
<td>Abnormal</td>
<td>Amber</td>
<td>Single chime</td>
<td>Awareness then action</td>
</tr>
<tr>
<td>3</td>
<td>Degradation</td>
<td>Amber</td>
<td>None</td>
<td>Awareness then monitoring</td>
</tr>
</tbody>
</table>
Consequently, training is an important factor that affects the flight crew’s performance. Civil aviation administrations transpose their own recommendations and the International Civil Aviation Organization’s (ICAO) into training objectives. Airlines edit their training syllabus accordingly. Training corpus is generally driven by a complete set of mandatory maneuvers. In such organizations, pilots who are rated on a single type of airplane (seldom two on similar airplanes such as Airbus 330/340, which is the maximum authorized), have first to take a Flight Crew Licensing Exam (FCL) to revalidate this type of rating, and then take the Operational Regulations (OPS) exam. In both cases, these exams are taken via Full Flight Simulators (FFS) sessions and pilots are confronted with various failures. Pilots are trained (and evaluated) to react according. Each level is based on the associated operational consequence of the failure. Depending on the aircraft type, these warnings are generated and sorted out by a Flight Warning Computer and displayed on the EICAS to ensure the most important failure is recognized first by the crew. In some types of aircraft, associated procedures are displayed in order to allow the flight crew to perform expected actions, in others a title indicates the Quick Reference Handbook (QRH) entry to find the associated paper procedure. Failures will appear in a specific color (according to a defined color-coding system) and most of the time accompanied by a specific oral warning that advises the flight crew of the urgency of the situation in an instructive, unambiguous manner. Failure levels are defined according to its severity and priority level.

Immediate action refers to emergency maneuvers (to recover from an upset position) and memory items such as an emergency descent (in case of a rapid decompression). In both cases—both abnormal and emergency situations—performance is measured through the pilots’ abilities to meet procedures and safely handle the airplane. In many abnormal situations, an amber LAND ASAP (as soon as possible) message or note in the Quick Reference Handbook (QRH) advises the flight crew to consider landing at the nearest suitable airport. In emergency situations a red LAND ASAP message requires them to land as soon as possible at the nearest suitable airport.

To maximize the amount of simulator training that can be completed in the amount of time (and cost), flight crews are typically presented with one malfunction after another. The crews are often not allowed to see a situation through to its completion before the simulators are reset and the next system malfunction is presented. Time and cost constraints tend to restrict the range and depth of training and too often circumscribe the training in a set of mandatory maneuvers and procedures completion. To provide more “reality” and more consistency in these simulated situations, training is scenario-based; in other words, incidents or accidents that occurred in aviation industry are studied (once the report is released) by a training department in order to simulate real events and train pilots to cope with these situations.
Often, Line Oriented Flight Training (LOFT) is supported by these scenarios. During these sessions pilots are confronted by real-time events and have to handle abnormal or emergency situations. However, there are limitations in these simulated scenarios: crews do not typically encounter simulated events for which the checklists or procedures do not work as expected. Because FFS slots are time limited (generally 3.5 hours to 4 hours), risk analysis, judgment, problem solving, and decision making hardly receive in-depth training. As a result, the degree to which training truly reflects real-life situations is often limited.

**CONCLUSION**

Adverse conditions, time constraint, human performance, capabilities limitations, uncertainty, and training limitations have important implications on safety and have to be supported by a robust and ODM model. Additionally, ODM can help pilots’ cognitive performance in the design of cockpit displays and interfaces.

**KEY TERMS AND DEFINITIONS**

**Abnormal**: In many abnormal situations, an amber LAND ASAP (as soon as possible) message or note in the *Quick Reference Handbook* (QRH) advises the flight crew to consider landing at the nearest suitable airport. Appropriate system abnormality checklist procedures are displayed through the automatic checklist system.

**Emergency**: When an emergency occurs, the crew must understand what the problem is, judge the level of risk and the time pressure, plan for contingencies, and decide and implement a course of action. In emergency situations a red LAND ASAP message requires them to land as soon as possible at the nearest suitable airport.

**Failure Level**: Defined according to severity and priority level.

**Safety**: Denotes vigilant and cautious approaches to various operations. Also includes measures to identify the level of safety of an organization.