Flight Operations Briefing Notes

Human Performance

Human Factors Aspects in Incidents / Accidents

I Introduction

This Flight Operations Briefing Note provides a summary of human factors issues identified in incidents and accidents.

This summary may be used either to assess :

- The company exposure and develop corresponding prevention strategies; or,
- The reader's individual exposure and develop corresponding personal lines-of-defense.

Ultimately, human factors are involved in all incidents and accidents.

Whether crew-related, ATC-related, maintenance-related, organization-related or design-related, each link of the safety chain involves human beings and, therefore, human decisions and potential human errors.

Acknowledging that a chain is as strong as its weakest link, human factors need to be addressed in all domains (i.e., design, manufacturing, operations, maintenance, air traffic control, …).

II Background Information - Statistical Data

A study performed by NASA reveals that more than 60 % of incidents (source : NASA ASRS – 1993) have their origin in the pre-flight phase of operations.

These incidents were found to be the result of a perceived time-related pressure resulting in rushed actions and errors (this condition is usually referred to as the hurry-up syndrome).

Overall, high workload is a factor in 80 % of incidents and accidents resulting from crew error (source : NASA ASRS – 1993).

III Human Factors Issues in Operational Events

III.1 Operational and Human Factors Markers :

The operational and human factors analysis of operational events (as performed by Airbus) is based on a set of markers that are used to qualify the contribution of each operational and human factor to a given event.

These markers are grouped into four clusters and nineteen domains, as follows :

- **Situation recognition and crew diagnosis :**
  - Cockpit alerts, other cockpit / cabin effects, crew diagnosis, human-machine-interface aspects.
- **Procedure(s) :**
  - Type of procedure, access to procedure, procedure contents.
- **Human performance :**
  - Procedure execution by flight crew, other crew actions, threat management, crew-error management, aircraft attitude / flight path control, crew coordination.
- **Operating environment and circumstances :**
  - Operational environment, weather conditions, runway conditions, aircraft systems condition / configuration, crew factors, organizational factors.

The observation of individual factors or patterns of factors involved in operational events is used to identify lessons-learned in terms of design procedures and training.

These lessons-learned, along with the lessons-learned stemming from industry studies and incidents or accidents investigation reports, have been used to illustrate the various Flight Operations Briefing Notes.

The following paragraphs provide an excerpt from the Flight Operations Briefing Notes that contain reference to human factors issues.

III.2 Standard Operating Procedures (SOPs) :

To ensure effective compliance with published SOPs (and associated normal checklists and standards calls), it is important to understand why pilots intentionally or inadvertently deviate from rules or standards.

Pilots rarely deviate intentionally from SOPs (i.e., violation of SOPs), in most cases the procedure that was followed in place of the published procedure (i.e., deviation from SOPs) seemed to be more appropriate for the prevailing circumstances, considering the information available at the time.

The following factors and conditions often are cited in discussing deviations from SOPs:

- Task saturation (i.e., task overload);
- Inadequate knowledge of and/or failure to understand the rule, procedure or action; this includes:
  - training;
  - quality of wording or phrasing; and/or,
  - perception of rule or procedure or action as inappropriate;
- Insufficient emphasis on strict adherence to SOPs during transition training and recurrent training;
- Lack of vigilance (e.g., fatigue);
- Distractions (e.g., due to cockpit activities);
- Interruptions (e.g., due to pilot/controller communications);
- Incorrect management of priorities (i.e., absence of decision-making model for time-critical situations);
- Reduced attention (tunnel vision) in abnormal or high-workload conditions;
- Incorrect CRM techniques (i.e., for effective cross-check, crew coordination or backup);
- Company policies (e.g., regarding schedules, costs, go-around and diversion events);
- Other policies (e.g., crew duty time);
- Personal desires or constraints (i.e., personal schedule, focus on mission completion);
- Complacency;
- Overconfidence; and/or,
- High time on aircraft type (i.e., condition possibly conducive to complacency and overconfidence).

III.3 Use of automation :

Errors in using and managing automatic flight systems and/or lack of awareness of operating modes are observed as causal factors in more than 20 % of approach-and-landing accidents and near-accidents.

These factors can result in flying an unintended flight path, which - if not recognized - can cause a less-than-desired terrain separation or a CFIT.

The following common errors in handling auto-flight systems can increase the risk of accident during any flight phase, but particularly during approach-and-landing:

- Inadvertent selection of an incorrect mode;
- Failure to verify the selected mode by reference to the flight mode annunciator (FMA);
- Failure to arm a mode when required (e.g., failure to arm the localizer or approach mode, when cleared for LOC or ILS interception);
- Failure to select a required guidance target (e.g., failure to set the ILS final approach course);
- Inadvertent change of a guidance target (i.e., changing the speed target instead of changing the selected heading);
- Selection of an incorrect altitude and failure to confirm the selection on the primary flight display (PFD);
- Selection of the altitude target to any altitude below the final approach intercept altitude during approach;
- Preoccupation with FMS programming during a critical flight phase, with consequent loss of situational awareness; and/or,
- Failure to monitor the automation, using raw data.

The Flight Operations Briefing Note **Operations Golden Rules** addresses aspects that are considered frequent causal factors in incidents and accidents, such as:

- Lack of situational / positional awareness;
- Interaction with automation;
- Overreliance on automation; and/or,
- Lack of crew crosscheck.

III.4 Briefings :

The importance of briefings and briefing techniques often is underestimated, although effective briefings contribute to enhance crew standardization and communication.

The routine and formal repetition of the same points on each sector may become counterproductive; adapting and expanding the briefing by highlighting the special aspects of the approach or the actual weather conditions and circumstances of the day result in more lively and effective briefings.

In a nutshell, briefings should attract the attention of the PNF.

Briefings should help both the PF (giving the briefing) and the PNF (receiving and acknowledging the briefing) to understand the sequence of events and actions, the safety key points, specific threats / hazards and circumstances of the takeoff, departure, cruise segment, approach and landing.

An interactive briefing fulfills two important goals of the briefing: provide the PF and the PNF with an opportunity to:

- Share a common action plan; and,
- Set priorities and task sharing.

III.5 Pilot / Controller Communications :

Effective communication is achieved when our mental process for interpreting the information contained in a message accommodates the message being received.

This mental process can be summarized as follows:

- How do we perceive the message ?
- How do we reconstruct the information contained in the message ?
- How do we link the information to an objective or an expectation ? and,
- What bias or error is introduced in this process?

Crew Resource Management (CRM) researches highlight the importance of the context and expectations in this mental process.

The following factors may affect the correct understanding of communications:

- High workload;
- Fatigue;
- Non-adherence to “sterile cockpit” rule;
- Distractions;
- Interruptions; and/or,
- Conflicts and pressures.

This may result in :

- Incomplete communications;
- Omission of call sign or use of an incorrect call sign;
- Use of nonstandard phraseology; and/or,
- Failure to listen or respond.

III.6 PF / PNF Communications :

Interruptions and distractions in the cockpit break the flow pattern of ongoing cockpit activities (i.e., actions or communications), such as:

- SOPs;
- Normal checklists;
- Communications (i.e., listening, processing, responding);
- Monitoring tasks; and/or,
- Problem solving activities.

The diverted attention resulting from the interruption or distraction usually leaves the flight crew with the feeling of being rushed and being faced with competing or preempting tasks.

Unless mitigated by adequate techniques in order to set priorities, this disruption and lapse of attention may result in:

- Not monitoring the flight path (possibly resulting in an altitude or course deviation or a controlled flight into terrain);
- Missing or misinterpreting an ATC instruction (i.e., possibly resulting in a traffic conflict or runway incursion);
- Omitting an action and failing to detect and correct the resulting abnormal condition or configuration, if interrupted during a normal checklist (e.g., altimeter setting); and/or,
- Leaving uncertainties unresolved (e.g., regarding an ATC instruction or an abnormal condition).

III.7 Altimeter Setting and Altitude Deviation Issues :

The incorrect setting of the altimeter reference often is the result of one or more of the following factors:

- High workload;
- Inadequate pilot/system interface;
- Incorrect pilot/controller communication;
- Deviation from normal task sharing;
- Interruptions and distractions; and/or,
- Absence of effective backup between crewmembers.

Strict adherence to the defined task sharing (for normal or abnormal/emergency conditions) and correct use of normal checklists are the most effective lines-of-defense against altimeter setting errors.

III.8 Rushed and Unstabilized Approaches :

The following circumstances, factors and errors often are cited when discussing rushed and unstabilized approaches:

- Fatigue, regardless of short/medium-haul or long-haul operation;

  This highlights the need for developing countermeasures to restore the level of vigilance and alertness for the descent, approach and landing;

- Pressure of flight schedule (e.g., making up for takeoff delay);
- Any crew-induced or controller-induced circumstance resulting in insufficient time to plan, prepare and execute a safe approach;

  This includes accepting requests from ATC for:

  – flying higher and/or faster than desired; and/or,

  – flying shorter routings than desired;

- Insufficient ATC awareness of crew or aircraft capability to accommodate a last-minute-change;
- Late takeover from automation (e.g., in case of AP failing to capture the GS, usually due to crew failing to arm the approach mode);
- Lack of awareness of tail wind component;
- Incorrect anticipation of aircraft deceleration characteristics in level-flight or on a 3-degree glideslope;
- Failure to recognize excessive parameter-deviations or to remember the excessive-parameter-deviation criteria;
- Belief that the aircraft will be stabilized at the stabilization height or shortly thereafter;
- PNF excessive confidence in the PF in achieving a timely stabilization;
- PF/PNF excessive reliance on each other in calling excessive deviations or in calling go-around; and/or,
- Visual illusions during the acquisition of visual references or during the visual segment.

III.9 Runway Excursions and Overruns :

The following factors are recurrent in runway excursions and overruns (i.e., highlighting human factors involving controllers, flightcrew and maintenance personnel alike):

- No go-around decision, when warranted;
- Inaccurate weather information on:

  – surface wind and/or windshear; and/or,

  – runway condition.

- Incorrect assessment of crosswind limit for prevailing runway conditions;
- Incorrect assessment of landing distance:
  - for prevailing wind and runway conditions; or,
  - following a malfunction affecting the configuration or braking capability;
- Captain (when PNF) taking over control and landing following the call or initiation of a go-around by the First Officer (as PF);
- Late takeover from automation, when required (e.g., late take over from autobrake in case of system malfunction);
- Inoperative equipment not accounted for per MEL (e.g., one or more brake being inoperative); and/or,
- Undetected thrust asymmetry (i.e., forward / reverse asymmetric thrust condition).

III.10 Adverse Wind / Crosswind Landing :

The following human factors often are cited in discussing events involving adverse wind and / or crosswind conditions:

- Reluctance to recognize changes in landing data over time (e.g., wind direction shift, wind velocity change or wind gustiness increase);
- Seeking any evidence to confirm the initial information and initial options (i.e., reluctance to change pre-established plans);
- Reluctance to divert to an airport with less crosswind conditions; and/or,
- Lack of time to observe, evaluate and control the aircraft attitude and flight path in a highly dynamic situation.

IV Summary of Key Points

Addressing Human Factors issues in incidents and incidents and accidents is an effort that must include :

- Defined company safety culture and policies;
- Related prevention strategies;
- Robust standard operating procedures;
- Effective CRM practices; and,
- Personal lines-of-defense.

V Associated Briefing Notes

The following Briefing Notes can be referred to as a complement to the above information, to amplify or expend a specific aspect, as desired:

- **Operating Philosophy - SOPs**
- **Operations Golden Rules**
- **Standard Calls**
- **Normal Checklists**
- **Conducting Effective Briefings**
- **CRM Issues in Incidents / Accidents**
- **Effective Pilot / Controller Communications**
- **Managing Interruptions and Distractions**
- **Altimeter Setting - Use of Radio Altimeter**
- **Altitude Deviations**
- **Flying Stabilized Approaches**
- **Preventing Runway Excursions and Overruns**

VI Regulatory References

- ICAO – Annex 6 – Operation of Aircraft, Part I – International Commercial Air Transport – Aeroplanes, Appendix 2, 15.
- ICAO – Procedures for Air navigation Services – Aircraft operations (PANS-OPS, Doc 8168), Volume I – Flight Procedures (Post Amendment No 11, applicable Nov.1/2001).
- ICAO – Accident Prevention Manual (Doc 9422).
- ICAO – Human Factors Training Manual (Doc 9683).
- ICAO – Human Factors Digest No 8 – Human Factors in Air Traffic Control (Circular 241).
- FAR 121.406, 121.419, 121.421 or 121.422 - CRM Training for pilots, flight attendants and aircraft dispatchers.
- JAR-OPS 1.945, 1.955 or 1.965 - CRM Training.

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FOBN Reference : FLT_OPS – HUM_PER - SEQ01 - REV02 – MAY 2004