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Time Pressure as a Causal Factor in Aviation Safety Incidents
The *Hurry-Up* Syndrome

Jeanne McElhatton
Charles R. Drew

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625 Ellis Street • Suite 305 • Mountain View • California • 94043

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Background and Motivation

Aviation's worst disaster, the catastrophic KLM / Pan-Am accident at Tenerife, was due in great part to a schedule pressure induced inclination on the part of the flight crews to disregard, or fail to recognize potential hazards to safety. The Air Line Pilots Association conducted an eighteen month, three country investigation of the accident, with an emphasis on the human factors of flight crew performance.[1]

They found that the KLM crew had strong concerns related to duty time, specifically that they would be able to return to Amsterdam that evening and remain within their complex duty time regulations. They also expressed concern about the weather and its potential to delay the impending takeoff — the cockpit voice recorder indicates the Captain said "Hurry, or else it [the weather] will close again completely."

Pan Am's crew was equally concerned with potential delays for poor weather. They experienced a delay of more than an hour due to the KLM flight crew's decision to refuel — the KLM aircraft and fuel trucks blocked the taxiway, thus preventing Pan Am's departure. These schedule related problems set the stage for the "Hurry Up" catastrophe.

In this study, the Hurry Up Syndrome is defined as any situation where a pilot's human performance is degraded by a perceived or actual need to "hurry," or "rush" tasks or duties for any reason. These time-related pressures include the need of a company agent or ground personnel to open a gate for another aircraft, pressure from ATC to expedite taxi for takeoff or to meet a restriction in clearance time, the pressure to keep on schedule when delays have occurred due to maintenance or weather, or the inclination to hurry in order to avoid exceeding duty time regulations. Such feelings of pressure can contribute significantly to degradation in human performance and behavior.

Objectives and Scope

The overall objective of this research project was to identify those flight regimes and scenarios that led to time pressure (Hurry Up Syndrome) related pilot errors and deviations, to suggest methods by which pilots may recognize the symptoms and onset of the Hurry Up Syndrome, and to formulate intervention strategies in order to achieve higher levels of operational safety.

Specific Objectives

This study has four specific objectives:

1. Examine and categorize the results of time-related incidents.
2. Determine the operational phase in which the error(s) occurred, and in which the error(s) were manifested.
3. Examine the human behaviors of time related errors.
4. Analyze what specific occurrences precipitated or contributed to time related errors.

Scope

The study was limited to those ASRS records which referenced terms such as "hurry," "rush," "late," or other equivalent language in descriptions of time-related problems or incidents. The scope was further limited to air carrier and commuter operations, which, for the purpose of this examination, were considered to be FAR Part 121 and Part 135 operations utilizing a minimum of two-person flight crews. All aircraft referenced in this study are over 14,501 pounds.

Approach

Data Set

The ASRS data base contains 1142 full form reports containing terms implying the presence of time pressure — roughly 3 percent of all ASRS full-form records. Of these, 125 pertinent air carrier and commuter records were extracted for analysis in this study.

Methodology

A coding form was developed to extract pertinent information from available records. The coding instrument asked the following questions.

1. Does the reporter specifically reference a time-related term such as "hurry," "rush," etc.?
2. What were the results of the incident?
3. In which operational phase did the time-related error(s) take place?
4. In which operational phase did the error(s) manifest themselves, that is, in what operational phase did the incident *result* take place?
5. Which flight crew members made time-related errors?
6. Were these time-related errors those of omission, commission, or motor errors?
7. What specific behaviors took place? (Error categorization.)
8. What contributory factors promoted the time-related error(s)?

Development of the coding instrument required several iterations with trial codings to validate coding instrument questions and structure. Subsequent to adoption of the final coding instrument, a coder-reliability test was conducted to validate single coder accuracy.

Findings

Incident Results

Findings in the Incident Results category indicate that a deviation from Federal Aviation Regulations and/or ATC Clearance occurred in 60 of the 125 incidents. Deviation from Company Policy or Procedure accounted for a further 26 citations[2]. As indicated in Table 1, the remainder of incident results comprise a fairly broad spectrum of problems.

Table 1 — Incident Results
Based on 203 Citations from 125 Incidents

Incident Result	Cited	Percent
Deviation from ATC Clearance or Federal Aviation Regulations	60	48.0%
Deviation from Company Policy or Procedure	26	20.8%
Runway Transgressions	21	16.8%
Miscellaneous Other	20	16.0%
Aircraft Equipment Problem	15	12.0%
Altitude Deviation	14	11.2%
Fuel Errors, including dispatch with incorrect or inadequate fuel loads	13	10.4%
Dispatch and Paperwork Errors	12	9.6%
Landing or Takeoff below Minimums	11	8.8%
Track or Heading Deviation	11	8.8%
Total Citations and Percent of Data Set	**203**	162.4%[2]

Operational Phase and The Point of Error of Time-Related Human Errors

Each Hurry Up incident has a point where the time related error(s) began. The majority of incidents had their origins in the Pre-Flight phase of operations (79 instances from 125 reports, or 63%). The Taxi-Out phase accounted for 34 instances (27%), while all other operational phases combined amounted to less than 10% of all incidents.

Operational Phase & Incident Occurrence

While time related human errors may have their roots in a given operational phase, those errors may not manifest themselves immediately. For example, while most errors occurred in the Pre-Flight phase, a large number of incident results occurred in the Takeoff phase (41 instances from 125 reports, or 33%). The next most common category for incident occurrence was the Taxi-Out phase with 22% of all reports. Figure 1 compares Point of Error and Incident Occurrences for the Operational phase.

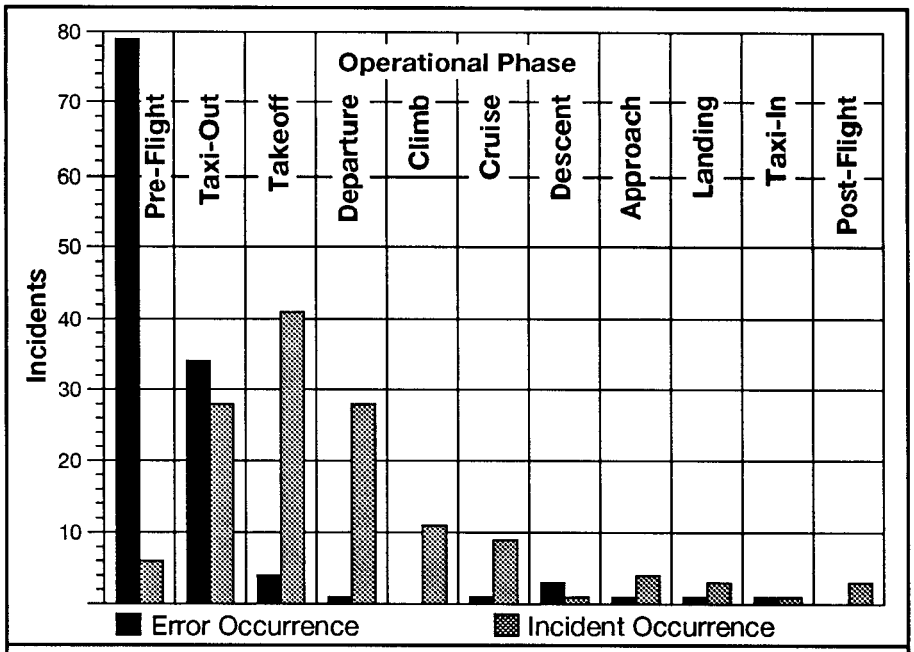

Figure 1 — Operational Phase vs. Error & Incident Occurrence
Based on 125 Incident Reports

Attribution of Time-Related Human Error

The coding form permitted attribution of the Hurry Up error either to a specific flight crewmember, or to the flight crew as a unit (where the flight crew *collectively* made human errors). In 87 of 127 citations (69%), the error was collective. In another 34 citations, the analyst concluded that the Captain (Pilot-in-Command) was primarily responsible for the error, while all other flight crew members totaled only 6 of 127 citations.

Type of Time-Related Human Error

Sixty percent (77 of 128 citations) of human errors were errors of Commission, that is, pilots carried out some element of their required tasks incorrectly, or executed a task that was not required and which produced an unexpected and undesirable result. In 24 of 128 citations (38%), pilots made errors of omission, meaning that they neglected to carry out some element of a required task.

Classification of Human Behaviors

For the purposes of this study, human errors were categorized as cognitive, perceptual, or motor. Cognitive errors were considered to be those where task execution was flawed in some manner, such as neglecting or forgetting a required task, or focusing on a task of lesser importance to the detriment or exclusion of the required task. Motor errors are those in which the intent of some action was correct, but an error or problem occurred with physical input to aircraft controls, systems, equipment, or in some related physical task. Perceptual errors are those where an individual failed to detect, or incorrectly detected (see, hear, or feel) some element of available information. Figure 2 illustrates the Classification of Human Error.

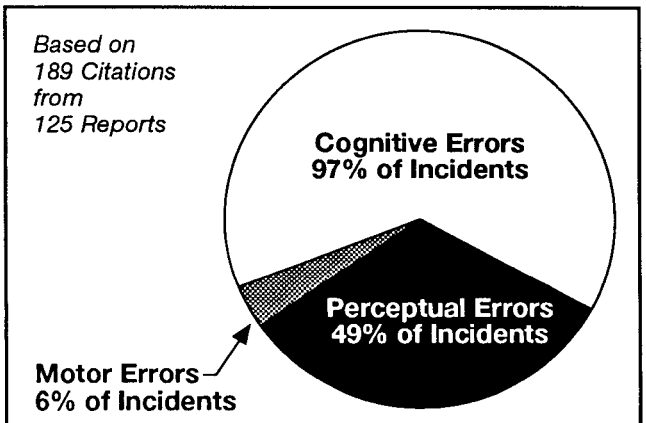

Figure 2 — Classification of Human Error

Where cognitive errors were noted, distraction from a required task appeared to be a significant cause. Distraction accounted for only 26% of this category (59 of 230 citations), but was noted as a factor in 47% of the 125 record data set. In the case of perceptual errors, a lowered level of awareness was noted in 41 of 63 citations (65%) — a significant majority of this category.

Factors Which Promoted the Occurrence of Human Error

In each incident report, one or more contributory or causative events promoted a Hurry Up error on the part of one or more of the flight crew. The coding form provided for four major classifications of contributory situations, and each classification provided for a number of sub-groupings. As noted in Table 2, High Workload was cited in 80 percent of all incidents. Problems involving Physical or Motivational States were next with 74% of incidents. Delay comprised 55% of all records.

Table 2 — Factors Which Promoted the Occurrence of Human Error[2]
Based on 309 Citations from 125 Reports

Factors	Citations	Percent of Data Set	Citations	Percent of Data Set
High Workload, including...			**100**	**80.0%**
Time Compression due to Delays	61	48.8%		
Other Miscellaneous	19	15.2%		
High Workload Flight Phase	18	14.4%		
Use of Checklist	15	12.0%		
Operational Procedure	9	7.2%		
Loss of Positional Awareness	5	4.0%		
Loss of Situational Awareness	4	3.2%		
Physical or Motivational States, including...			**92**	**73.6%**
Mental or Emotional Predisposition to Hurry	80	64.0%		
Physically Induced Predisposition to Hurry	26	20.8%		
Delay, including...			**69**	**55.2%**
Other	31	24.8%		
Maintenance on Aircraft	17	13.6%		
Unspecified	12	9.6%		
ATC Clearance Delays	10	8.0%		
Weather	8	6.4%		
Ground Crew Problems	4	3.2%		
Deicing/Anti-Icing	2	1.6%		
Dispatch Office Related Problems	2	1.6%		
Social Pressures, including...			**48**	**38.4%**
Pressure from Gate Agent/Ground Crew	31	24.8%		
Peer Pressures	17	13.6%		
Supervisory Pressures	1	0.8%		
Total Citations and Percent of data Set			**309**	**247.2%**

NOTE: Each of the primary Factor categories have 2 or more sub-categories, and multiple responses are permitted. Thus, the total number of sub-category citations for any category will equal or exceed the number of citations noted for that primary category.

It is significant that a Mental or Emotional Predisposition to Hurry Tasks was cited in 64% of incidents, and that Time Compression due to Delays was cited in almost half of all incidents. Also noteworthy is Pressures from Gate Agents or Ground Crew personnel were more commonly noted Social Pressures than pressures from company supervisory personnel.

Discussion

Onset of Error

Research data indicate that 90% of all time related human errors occurred in the Pre-Flight or Taxi-Out phase of operation as opposed to all other operational phases. There may be a substantial difference in the nature of duties in these phases, particularly the pre-flight phase, when contrasted to other flight regimes.

Most flight phases of air carrier and commuter operations employ well designed standard procedures that tend to be linear in nature — a given required task follows another required task. For example, in the takeoff phase the application of power is followed by a check of engine performance or power, which in turn may be followed by a performance check at 80 knots, and V_1, V_r, V_2, gear and flap retraction respectively, depending on the particular aircraft and operator. In contrast, duties in the pre-flight phase may not be linear; a pilot may need to deal with flight planning, weather information and changes, fuel loading, dispatch manifests and release, last minute maintenance or MEL items, duty time requirements, or aircraft deicing at pretty much the same time, and often under pressure due to time compression for "late" operations. Further, there may be no typical standard operating procedure (SOP) for assigning sequence or priority to these tasks, neither does one task necessarily or obviously require that another task be previously and correctly completed — thus it may be easier to make an undetected error in one or more duties.

Finally there is the issue of cockpit or crew coordination. In an in-flight phase where the flight crew is seated together with unrestricted capability for interpersonal communication, the practice of Cockpit Resource Management (CRM) is facilitated by physical proximity and access. In the pre-flight phase of operation, however, interpersonal communication may be degraded by physical separation of flight crew members, and by distraction from numerous and varying external sources.

External Pressures

Data indicates that events and personnel outside the cockpit are often factors in time pressure errors. Findings indicate that flight crew often allow themselves to be rushed or pressured by company dispatchers, ground or maintenance personnel, or passenger agents who, of course, are themselves experiencing various pressures to achieve "on-time" operations. In fact, official publication of on-time performance figures for various carrier operators may lead directly or indirectly to "keep-to-the-schedule" pressures for flight crews and other company personnel.

ATC may contribute to the "hurry-up" mindset by requesting an expedited taxi, an intersection departure, by issuing a "clearance invalid if not off by...," or other time-sensitive requirement. Of course, ATC personnel are similarly under pressure to adhere to schedule or operational requirements.

Faced with a complex and sometimes bewildering array of external "pressures," pilots in turn hasten to accommodate demands directly and indirectly related to their own operation. Thus, checklists are delayed or ignored, flight planning is abbreviated or flawed, essential tasks are left uncompleted or incorrectly executed.

Point of Incident Occurrence

While it had not been anticipated that the vast majority of time pressure errors would have their beginnings in the first two operational phases, it should not be considered unusual for the results of such errors to manifest themselves either in the phase where the human error occurred, or in the phase immediately following. There are several reasons for this. First, many of the errors detected in this study are of a type where the error result would logically be expected to occur in quick succession. For example, if a flight crew misunderstands an ATC taxi restriction while leaving the gate, that error is going to be manifested in the taxi-out phase, not in some other down-line phase. Secondly, errors are less likely to be detected in a high workload, time compressed flight phase than in a low workload flight phase encountered some time after departure.

Finally, error detection on the part of the flight crew is probably exponential in nature — there may be, by way of example, a 50% chance that a pilot may discover an error in the first minute after the error, 50% of the remainder in the second minute, 50% the third, and so-on. Graphing this concept reveals that a high percentage of errors should be detected in the first few minutes of operation.

Conclusions and Recommendations

Predicting and Avoiding Hurry Up Errors

Hurry Up errors appear most likely to occur in high workload operational phases, specifically in pre-flight and taxi-out. Additionally, external distraction and schedule pressure are significant predisposing conditions. Pilots should note that such errors are more likely to occur when distraction and schedule pressure are combined with a high workload operational phase.

It is suggested that companies and flight personnel consider providing greater structure to pre-flight activities in order to reduce the frequency of time related errors. Similarly, when distraction and schedule pressure are seen to occur in this flight phase, a reasonable response is to slow down and carry out tasks in as linear a fashion as practical. Where time related pressure is encountered from external sources, pilots may find it a good strategy to calmly explain the nature, probability, and typical results of hurry up errors to those who "apply the pressure."

No single human behavior is significantly more likely to result in a hurry up deviation than another. Application of CRM technique is likely to yield positive results in a high number of cases. One reporter noted that he "had some CRM training and should have told the Captain to stop taxi until they could clarify runway assignment and taxi clearance."

Specific Recommendations to Flight Crew:

- Maintain an awareness of the potential for the Hurry Up Syndrome in Pre-Flight and Taxi-Out operational phases — pilots are advised to be particularly cautious if distraction and schedule pressure are encountered in these phases,
- When pressures to "hurry up" occur, particularly in the pre-flight operational phase, it is a useful strategy for pilots to take the time to re-evaluate various tasks and their priority,
- If a procedure is interrupted for any reason, returning to the beginning of that task and starting again will significantly reduce the opportunity for error,
- Positive CRM techniques will eliminate many errors — effective crew coordination in "rushed" situations will catch many potential errors,
- Strict adherence to checklist discipline is a key element of pre-flight and pre-takeoff (taxi-out) phases,
- Deferring paperwork and non-essential tasks to low workload operational phases will serve to reduce the problems of distraction and time compression due to high workload.

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1 Airline Accident Report, Pan American Boeing 747, KLM Boeing 747, Canary Islands, 03/27/77, Airline Pilots Association.

2 The coding form may allow multiple responses for a given question thus the number of citations for a given question may be greater than the 125 reports that comprise the data set.. Similarly, percentages for these multiple response categories may be expressed as a percentage of the data set , and thus can total more than 100%.