Chapter 15
The Aviation Operational Environment:
Integrating a Decision-Making Paradigm, Flight Simulator Training and an Automated Cockpit Display for Aviation Safety

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ABSTRACT

This chapter will focus on the role of pilot/flightcrew training and performance evaluation in the identification and management of risk, especially while aloft and in changing conditions. The chapter will integrate different- but we posit interrelated, topic areas: First, a decision-making paradigm for flight crew’s use in the operational environment. Second, training and performance evaluation in flight simulators (FS), as well as the design and development of FS scenarios to test decision performance. Third, Relevant Federal Aviation regulations (FAR’s) and approved programs in current pilot/flightcrew training. Fourth, accident investigations; the role and use-value of accident investigation data in flying safety. Finally, the authors will present recommendations for the next steps in the development and use of new and emerging technologies for maximum pilot/flight crew decision performance and safety. This will be done via a collaborative ground-air, automated system and is what we propose to achieve our goal, increasing safety of flight.

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FOREWORD

It should be already clear that this Chapter will be somewhat different, even to format; for example, no other Chapter will have a Foreword. Yet, the authors felt constrained to add this brief Section. We will be presenting original concepts that we have worked on for 20 years, as individuals and as a team. There is little prior or current work done for comparison, argumentation and discussion. But, we have brought enough other works for valid comparison. Next, we are aware that many persons reading this Chapter may not have significant aviation expertise. With that in mind, we have attempted to present enough background and introductory information to make the aviation aspects as clear as possible. For those with aviation expertise, please bear with us. We have included a large Key Terms Section at the end of this Chapter. This Key Terms Section includes definitions of aviation-specific terminology.

Finally, what is presented in is the context of United States civil and military aviation, regulatory agencies and regulations. Today, aviation safety is an international concern with many international, cooperative efforts in that arena. It is our hope that what we present is applicable across other nations’ aviation training and safety efforts and can lead to safety improvements for all of aviation. All we can ask is that you read on and form your opinions at the end of the Chapter.

INTRODUCTION

The perspective in this chapter is identifying seemingly unrelated aviation safety issues, demonstrating that they are interrelated, then describing a set of methodologies whereby these issues can be addressed and resolved. We are at a tipping point in aviation safety where there are many efforts, within the airline community and by governmental agencies, to deal with the same genre of accidents that has plagued civil aviation since its initial development. No attempts seem to be completely sufficient or totally effective. The initial definition and concepts of what was called pilot judgment has been with aviation for many, many years. We now re-define pilot judgment as the capability to make an optimum decision; a decision that is based on the identification, analysis and evaluation of the risk factors in play, with resultant action. We have called this operational decision-making (ODM; Lofaro, Smith or Smith, Lofaro: 2009, 2008, 2003, 2001, 2000, 1999, 1998, 1993) and define it as a cognitive process that is not solely, or in the main, the result of experience, as was previously thought. What will be presented is our effort to met the challenge of this last frontier in aviation training and evaluation: how to accurately identify and manage risk before and while in flight. We now go past ODM to what we call decision performance; the processes for making such decisions and implementing them to manage risk and ensure safety.

We will present two major aircarrier accidents that, literally, boggle the mind as to the decision processes...if any...in play. Some accident investigations have been less than stellar and of minimal help in what accident investigations are purported to do: prevent future accidents. In point of fact, one very recent accident is eerily similar to one only four years prior. Currently, there are tools and techniques for the training and evaluation of flightcrews that address the core problem: decision-making. Further, modern technology has given us new tools and pathways to develop on-board, automated threat displays, increasing flight safety; we need new ways to maximize such technology.

BACKGROUND

After World War II, the aviation industry was faced with major issues: the unreliability of power
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