General Aviation

Title: A New Approach to Aviation Accident/Incident Prevention/Mitigation

Description of Requirements:
Four the past five years, the Civil Aerospace Medical Institute and the University of Illinois have systematically examined over 20,000 general aviation accidents occurring between 1990-2000 using the Human Factors Analysis and Classification System (HFACS). HFACS is a theoretically based framework used widely throughout aviation and other high-risk industries for investigating and analyzing human error associated with accidents and incidents. The HFACS framework has been reliably used to analyze the underlying human factors causes of both commercial and general aviation accidents and has helped identify general trends in the types of human factors issues and aircrew errors that have contributed to civil aviation accidents. Previous HFACS research performed at both the University of Illinois and the Civil Aerospace Medical Institute (CAMI) has shown that HFACS can be reliably used to analyze the underlying human factors causes of both commercial and GA accidents (Wiegmann & Shappell, 2001, 2003; Shappell & Wiegmann, 2003). Furthermore, these analyses have helped identify general trends in the types of human error that have contributed to civil aviation accidents. For example, when the GA accidents between 1990-2000 were examined using HFACS, several heretofore unknown facts regarding GA aviation safety were revealed (Figure 1). It appears that safety efforts over the last several years have had little impact (flat trend lines) on any specific type of human error associated with GA accidents. If anything, they have had a ubiquitous impact – albeit unlikely. Equally noteworthy, skill-based errors have contributed to GA accidents more than any other error form (roughly 80% of all GA accidents examined). While data such as these are important, the next step in the process is to identify a variety of intervention strategies to either prevent or mitigate general aviation accidents. The purpose of this research is to do just that. However, rather than recycle or continue to employ the same old intervention strategies this requirement will address a new approach to the development of accident/incident prevention/mitigation.

Background:
Historically, accident and incident interventions have been generated by the National Transportation Safety Board in the form of recommendations or have come from experts in the government (FAA, NASA, etc.), military, or other aviation organizations. As a result, they tend to focus on the prevention of specific types of accidents like those related to spatial

disorientation or controlled flight into terrain, rather than specific types of human error per se. What's more, the interventions tend to be rather narrow in scope often emphasizing only changes to the aircraft in the form of automation and displays or simply recommend changes to existing policies or regulations. Even when attempts are made to address specific types of human error, the emphasis has traditionally been placed on pilot decision-making, which accounts for just over 30% of the GA accidents that occur annually.What is needed is a systematic approach to generating intervention/prevention strategies that can tie into the HFACS framework that has proven successful with civilian aviation accident and incident data. Within epidemiology, one such approach, the Haddon matrix was developed to address injuries sustained as the result of automobile accidents. Haddon's argument was that we often overlook potentially useful interventions by not considering all aspects of the accident/incident. Consider the two-dimensional Haddon Matrix in Figure 2. As can be seen when the phases of an accident/incident are compared across different factors such as the person, machine, physical environment, and social environment several different possibilities for interventions are available. Indeed, when one examines the typical interventions recommended by the NTSB and others following an accident they typically focus on only a few of the boxes (e.g., the pre-event x machine) rather than the gamut of intervention possibilities. In fact, when a third level is considered (decision criteria such as feasibility, cost effectiveness) as in Figure 3 the matrix becomes much more sophisticated but potentially more helpful yet.Curiously, when Wiegmann (2003) examined over 75 intervention strategies identified by NASA for use within U.S. civilian aviation using a similar matrix, the vast majority of the interventions fell into only a couple of the boxes, leaving one to believe that a variety of other, potentially useful strategies had been left on the drawing board or not even considered in the first place. Ideally, a similar matrix using phases, HFACS causal categories, factors, and decision criteria could be developed that was both manageable and effective at generating putative intervention strategies and assessing their impact prior to deployment.

Output:

This requirement will address the manner in which intervention strategies are developed and will map them onto current HFACS human error categories (i.e., skill-based errors, decision errors, etc.). The final output will be a tool for use by AFS and other safety organizations for the systematic development of effective intervention/prevention strategies.

Regulatory Link:

1. AOA (FAA) Strategic Plan (1998-2003) Mission Goal:Safety. Key

Strategies "to enable the goal to include identification of root causes of past accidents; and (2) use a more proactive analytical approach, with new data sources, to identify key risk factors and intervene to prevent potential causes of future accidents" (Page 13).2. FY2001 Performance Plan: Focus Area: Accident Prevention. "Aviation Human Factors to coordinate human factors research, development and based on detailed causal analysis" (Page 2)3. AVR Performance Plan:Reduce General Aviation fatal accidents (pg 2). Contribute to aviation safety by developing policies,standards, programs, and systems to reduce the number of aviation accidents and incidents related to human factors (pg 9)