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U.S. NAVY AND MARINE CORPS TACAIR AND ROTARY WING CLASS A MISHAPS 1990-1996: A COMPREHENSIVE REVIEW OF CRM ACCIDENTS

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ABSTRACT

A review of all tactical jet (TACAIR) and rotary wing Class A flight mishaps between fiscal years 1990-1996 was performed to examine the role of human error and crew-resource management (CRM) failures in U.S. Naval aviation mishaps. Results of the analysis revealed that over 75% of the mishaps within these communities were attributable, at least in part, to some form of human error. Approximately 70% of these human error mishaps were associated with aircrew human factors, of which 56% involved at least one CRM failure. These percentages are very similar to those observed prior to the implementation of aircrew coordination training (ACT) in the fleet. Apparently, the initial benefits of the ACT program originally documented by other researchers in this area have not persisted. CRM failures continue to be a safety problem in naval aviation.

INTRODUCTION

Safe flight operations require effective crew resource management (CRM) - efficient use of all resources by the cockpit crew, including human resources, hardware, and information (FAA, 1995). It is no surprise then that aviation accidents occur when CRM breaks down. Of greater concern however, is that failures in CRM occur quite frequently and have been linked to the majority of both commercial and military aviation accidents (Kayton, 1993; Yacavone, 1992). In deed, a great deal of effort has been put forth to design training programs and improve standard operating procedures to reduce the number of CRM failures in the cockpit. Unfortunately, many of these attempts have met with only limited or short-lived success and CRM problems continue to contribute to many aviation accidents.

In a study of U.S. naval aviation accidents, Yacavone (1993) analyzed the types of human causal factors associated with all Class A mishaps between 1986 and 1990. The results of the analysis revealed that 59% (181) of the 308 Class A mishaps that occurred during this time period were attributed, at least in part, to aircrew factors. Furthermore, the most common of all aircrew causal factors was the lack of aircrew coordination or crew resource management (CRM). Yacavone found that CRM failures were involved in 45% of all aircrew-related mishaps. In general, these findings paralleled those in other branches of the military (Prince & Salas, 1993) and the commercial aviation industry at the time.

To remedy this problem, the U.S. Navy created a CRM training program known as aircrew coordination training (ACT). The program was based largely on the leadership and assertiveness training that the airlines had developed in the civilian sector. During the late 1980's, the ACT program was first introduced to a limited number of helicopter and tactical aircraft communities. By the early 1990's, the program had become fully integrated into the fleet.

Initial evaluations of the Navy's ACT program were encouraging. Reductions in the rate of human-error related mishaps appeared almost immediately within the communities in which the training was first introduced. To date, however, analyses have yet to be performed to determine whether ACT has continued to impact CRM problems in the fleet. Related research on CRM training within the commercial aviation environment suggests that the benefits of such training may be very short-lived (Helmreich & Taggart, 1995). Therefore, the purpose of the present study was to reexamine the involvement of CRM failures in naval aviation mishaps.

METHODS

Mishap records maintained at the U.S. Naval Safety Center, Norfolk, VA. were reviewed as part of this study. The database contained information concerning U.S. Navy/Marine Corps TACAIR and rotary wing Class A flight mishaps[1] for fiscal years[2] 1990 through

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[1] Class A mishaps are mishaps in which either the aircraft is destroyed, a fatality occurs, there is an injury that results in permanent total disability, or the total cost of damage is $1,000,000 or greater.

[2] The fiscal year for the U.S. government spans from 1 October to 30 September of the following calendar year. Data were parsed by fiscal year vice calendar year in order to facilitate comparisons with previous

1996. The variables analyzed were the types of causal factors associated with each mishap (e.g., human vs. mechanical) and the proportion of human-error related mishaps that involved aircrew CRM failures. No recoding of the mishap causal factors was performed as part of this study. The analysis focused solely on causal-factors identified by the Navy's mishap investigation board during the original accident investigation.

RESULTS

Mishap Frequencies and Rates

A total of 290 TACAIR and rotary wing mishaps that occurred over the 7 year period (1990 – 96) were examined. These mishaps included 204 TACAIR and 86 rotary wing mishaps. The number of mishaps per year ranged from a high of 39 mishaps (FY90) to a low of 18 mishaps (FY94) for the TACAIR community. For rotary wing aircraft, frequencies ranged from a high of 19 mishaps (FY91) to a low of 7 mishaps during each of the last three years examined (FY94-FY96). The overall mishap rate was approximately 3.91 mishaps per 100,000 flight hours, with an average yearly rate of 5.10 for TACAIR and 3.54 for rotary wing aircraft. Mishap rates ranged from a high of 6.0 (FY90) to a low of 3.40 (FY94) for TACAIR. The highest rotary wing mishap rate was 3.73 (FY93) and the lowest rate was 1.56 (FY94).

Human-Error Mishaps

Over 77% (226) of the 290 TACAIR and rotary wing mishaps were attributed, at least in part, to some form of human error (i.e., aircrew, supervisory, maintenance, or facilities personnel). Percentages were relatively equal across TACAIR (78.92%) and rotary wing (75.58%) communities. The frequency of human-error mishaps ranged from a low of 66.67% (FY94) to a high of 88.89% (FY96) for TACAIR. Percentages for rotary wing aircraft ranged from a low of 57.14% (FY94) to a high of 85.71% (FY95).

Aircrew-Related Mishaps

Over 70% (160) of the 226 human-error-related mishaps were associated with some form of aircrew human factors. Approximately 70.80% (114) of the TACAIR and 70.77% (46) of the rotary wing human-error mishaps were associated with aircrew factors. Trends in the aircrew-related mishaps fluctuated across years. The values ranged from high of 83.33% (FY96) to a low of 55.56% (FY92) for TACAIR. For rotary wing aircraft, the frequencies ranged from a high of 100% (FY94 and FY95) to a low of 37.5% (FY92).

Aircrew-error and CRM Mishaps

A total of 90 (56.25%) of the 160 aircrew-related mishaps involved at least one CRM failure that was considered causal to the mishap. For TACAIR, 46.49% (53) of the aircrew-related mishaps involved at least one instance of CRM failure. In contrast, 80.43% (37) of the rotary wing mishaps involved some form of CRM breakdown. Again, however, values fluctuated across years. For TACAIR frequencies ranged from a high of 75% (FY95) to a low of 30% (FY96). For rotary wing aircraft, the frequencies ranged from 100% (FY92, FY94, FY96) to a low of 66.67% (FY95).

DISCUSSION

The overall mishap rate for TACAIR and rotary wing aircraft has remained relatively constant over the past seven years, with the average rate being 3.91 mishaps per 100,000 flight hours. However, differences in mishap rates between the two communities were observed. The TACAIR community had a higher average mishap rate than the rotary wing community. This difference is not surprising given that tactical aircraft are often engaged in more hazardous and dynamic maneuvers in-flight (e.g., dog-fighting, bombing, and close-air support). Nevertheless, over 75% of *both* TACAIR and rotary wing mishaps were attributable, at least in part, to some form of human error. Therefore, regardless of risk levels involved in the missions flown by either community, both face considerable human factors problems.

Additional examination of the human error mishaps revealed that over 70% were associated with some form of aircrew human factors. Of these aircrew-related mishaps, approximately 56% involved at least one instance of CRM failure. However, a much larger percentage (80.43%) of rotary wing aircrew-mishaps was associated with CRM failures than TACAIR (46.49%). This finding could be due to the fact that all rotary wing aircraft have multiple crewmembers, increasing the opportunity for aircrew coordination failures. Whatever the reason, however, the unfortunate news is that these percentages are very similar to those Yacavone (1993) reported when examining mishaps that occurred prior to the implementation of aircrew coordination training (ACT) in the fleet. Apparently, the initial benefits realized early in the implementation phase the ACT program (Alkov & Gaynor, 1991) have not persisted, and CRM failures continue to be problem in the fleet.

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publications and reports produced by other researchers and government agencies on this topic.

One reason why CRM failures continue to plague Naval aviation is that the ACT curriculum often is not tailored to meet the specific needs of the target community (Prince & Salas, 1993). Much of the curriculum has yet to evolve beyond the "classic" examples of civilian aviation accidents involving CRM failures. These examples are often outdated, narrow in scope, and may not capture the factors that contribute to CRM failures in Naval aviation.

Such deficiencies in CRM training are *not* due to a failure to recognize the need for a user-centered approach. Rather, they are due to a lack of appropriate information with which to tailor such training programs. Very few attempts have been made to analyze Navy CRM-related mishaps beyond that performed by Yacavone (1993). As a result, little is known about the types of CRM failures common to Naval aviation in general or specific Naval aviation communities in particular. Ultimately, knowledge of the "root causes" of the CRM failures is required for the development of long lasting, effective intervention programs. Indeed, a much more fine-grained analysis is needed to answer this question, which is not afforded by the data presented here.

In summary, CRM failures continue to be a problem within Naval aviation. Even after the systematic, fleet-wide implementation of ACT, over 50% of TACAIR and rotary wing aircrew-mishaps involved at least one instance of CRM failure. The need to tailor ACT to the specific needs of the fleet is clear. However, the data required for developing such curriculum is lacking. More in depth research is needed to determine the underlying causes of CRM failures and identify possible solutions.

REFERENCES

Alkov, R. A. & Gaynor, J. A. (1991). Attitude changes in Navy/Marine flight instructors following an aircrew coordination course. *International Journal of Aviation Psychology*, 1, 245-53.

Federal Aviation Administration (1995). *Crew resource management* (Advisory Circular 120-51B). Washington, DC: Author.

Helmreich, R.L, & Taggart, W. (1995). Where are we today? *Proceedings of the CRM Industry Update Workshop,* Seattle, WA.

Kayton, P. J. (1993). The accident investigator's perspective. In E. Wiener, B. Kanki,, and R. Helmreich, (Eds.), *Cockpit Resource Management (pp. 99-134).* San Diego: Academic Press.

Prince, C. & Salas, E. (1993). Training and research for teamwork in the military aircrew. In E. Wiener, B. Kanki, and R. Helmreich, (Eds.), *Cockpit Resource Management (pp. 337-366).* San Diego: Academic Press.

Yacavone, D. W. (1993). Mishap trends and cause factors in Naval aviation: A review of Naval Safety Center data, 1986-90. *Aviation, Space and Environmental Medicine*, 64, 392-5.

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