Risk Mitigation Consulting Inc.

Intelligence and Analysis Division

WHITE PAPER SERIES

DoD Aircraft, Maritime, and Train Mishaps

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INTENT

This white paper is designed to provide analysis of relevant, publicly available information on threat and hazard events/trends and their potential impacts to the interests of the United States, both at home and abroad. This product is not intended to be an all-encompassing assessment of the subject.

DoD Aircraft, Maritime, and Train Mishaps

Introduction

This white paper looks at the information on mishaps to find the causal factors involved with nationwide DoD Aircraft, Navy and Marine Maritime, and Train mishaps. The problems can be grouped into three main categories: human error, which includes fatigue, lack of training; material failure/malfunction which involves electrical malfunctions, and supply line issues; and environment factors such as adverse weather, bird strike. This can greatly impact or reduce the ability to effectively carry out missions. Additionally, budget cuts can undermine and exacerbate all of these issues. Knowing these causal factors can help to better understand and maybe overcome the loss of time, equipment, and life by knowing the reasons for the accidents by discovering some of the main factors.

Definitions

Human error as defined by the Army Combat Readiness Safety Center means human performance that deviated from that required by the operational standards or situation. Human error in accidents can be attributed to a system inadequacy/root cause in training, standard, leader, individual, or support failure. Environment is defined as those environmental elements or conditions such as noise, illumination, space and weather conditions (for example, precipitation, temperature, humidity, pressure, wind, and lightning) having an adverse effect on the performance of the individual or equipment so that an accident results or could result. Material failure/malfunction is defined as when equipment, or a part thereof, is considered to have failed or malfunctioned, and when one of the following occurs: (1) becomes completely inoperable, (2) is still operable but no longer able to perform its intended function satisfactorily, or (3) has deteriorated to the point where it is unreliable or unsafe for continued use. [1]

Human Factor

Human factor or human error is far and above the most substantial factor for causes of mishaps across the board. Supervisory causes such as organizational influences, physical and mental awareness, breakdown in teamwork, and budget cuts that lead to a loss of experience. [2]

When looking into human factors, according to the Air Force Safety Center, this is defined by our interaction with tools, tasks, working environments, and other people influence human performance. Human error is the leading cause of DoD mishaps but it's not just the individual that the error can be attributed to; it can also be attributed to a supervisor and/or organization. Mishaps resulting from human error are rarely because of just one error, but a multitude of errors. [3]

Material Factor

Common causes of equipment failure include: budget cuts, supply chain issues, new fleet, design flaws, aging platforms/fleets-material causal factors, failure to follow maintenance procedures, language barrier (operating manuals), and brown out-electrical failure, engine fire, computer failure. [3]

Special Factor

Common causes of special factors include but are not limited to bird impact, foreign object debris (FOD), and adverse weather effects. [3]

Aircraft Mishaps

According to the 2018 Annual Safety Report by the Navy, naval fixed wing aircraft experienced mishaps as a result of human error, material failure/malfunction, and special causes (anything relating to weather or bird impact that didn't fall within the human error or material failure definition). By far human error outweighed the other two in every way. [4]

Navy/Marine Corps Aircraft Percentages from Class A-D Mishaps from 2014-2018:[4]

- E-2 & C-2: The total class A-D mishaps in 2014 had 14, 2015 had 9, 2016/2017 had 19, and in 2018 there was 21, with the cause percentages being Human 68%, Material 25%, and Special 7%.[4]
- C/KC-130 & C-40: The total class A-D mishaps in 2014 had 9, 2015 through 2017 had 11, and in 2018 there was 10, with the cause percentages being Human 81%, Material 14%, and Special 5%.[4]
- Light Transport: The total class A-D mishaps in 2014 had 4, 2015 had 3, 2016 had 5, 2017 had 2, and in 2018 there was 6, with the cause percentages being Human 53%, Material 29%, and Special 18%.[4]
- P-3 & P-8: The total class A-D mishaps in 2014 had 18, 2015 had 19, 2016 had 28, 2017 had 13, and in 2018 there was 22, with the cause percentages being Human 60%, Material 26%, and Special 14%.[4]
- E-6: The total class A-D mishaps in 2014 had 4, 2015 had 15, 2016/2017 had 11, and in 2018 there was 4, with the cause percentages being Human 64%, Material 31%, and Special 5%.[4]
- F/A-18A-F & EA-18G: The total class A-D mishaps in 2014 had 120, 2015 had 170, 2016 had 205, 2017 had 260, and in 2018 there was 230, with the cause percentages being Human 62%, Material, 35%, and Special 3%.[4]
- F-35: The total class A-D mishaps in 2014 had 2, 2015 had 4, 2016 had 5, 2017 had 11, and in 2018 there were 12, with the cause percentages being Human 79%, Material 16%, and Special 5%.[4]
- Training series T-6, T-45, T-34, T-44: The total class A-D mishaps in 2014 had 11, 2015 had 18, 2016 had 24, 2017 had 18, and in 2018 there was 19, with no cause percentages.
- AV-8B: The total class A-D mishaps in 2014 had 11, 2015 had 10, 2016 had 14, 2017 had 11, and in 2018 there was 8, with the cause percentages being Human 77%, Material 16%, and Special 7%.[4]
- F-5 & F-16: The total class A-D mishaps in 2014 had 2, 2015 had 3, 2016 had 5, 2017 had 2, and in 2018 there was 4, with the cause percentages being Human 62%, Material 15%, and Special 23%.[4]

The mishap causal factors statistics for rotary-wing craft was very similar to fixed wing in that human factors were the overwhelming majority cause of mishaps.[4]

- MV-22: The total class A-D mishaps in 2014 had 17, 2015 had 22, 2016 had 24, 2017 had 31, and in 2018 there was 24, with the cause percentages being Human 81%, Material 14%, and Special 5%.[4]
- MH/CH-53E: The total class A-D mishaps in 2014 had 15, 2015 had 23, 2016 16, 2017 had 26, and in 2018 there was 28, with the cause percentages being Human 75%, Material 22%, and Special 3%.[4]
- H-60: The total class A-D mishaps in 2014 had 44, 2015 had 45, 2016 had 60, 2017 had 45, and in 2018 there was 58, with the cause percentages being Human 81%, Material 18%, and Special 1%.[4]
- H-1: The total class A-D mishaps in 2014 had 9, 2015 had 15, 2016 had 17, 2017 had 20, and in 2018 there was 19, with the cause percentages being Human 85%, Material 15%, and no Special.[4]
- TH-57: The total class A-D mishaps in 2014 had 2, 2015 had 6, 2016 had 9, 2017 had 5, and in 2018 there was 6, with the cause percentages being Human 85%, Material 15%, and no Special.[4]

The Navy's mishap spike was likely caused when automatic budget cuts known as sequestration took effect. The Navy cut depot work and purchases of spare parts, which meant fewer available aircraft. It also let go of experienced mid-grade maintainers and their supervisors; losses that left fewer chief and senior chief petty officers on the flight line, even as the depth of experience of newer E-4s and E-5s dropped. Navy strike fighters had back-to-back deployments in 2015 and 2016 as the carrier air wings aboard the Roosevelt and Truman set records for the number of munitions dropped and sorties flown in airstrikes against the Islamic State. By 2017, Super Hornets had recorded 18,000 more flight hours than they did in 2013, according to Navy data. This also meant flying hours on fewer ready aircraft, a pace that breaks airplanes. To meet the pace, the Navy took parts from non-deployed aircraft to make deploying units whole, which risked breaking both aircraft in the process. Alternatively, the Navy relocated entire aircraft, which further limited the time non-deployed pilots and maintainers had to train. [5]

Maritime Mishaps

Common causes of equipment failure include lack of proper and constant maintenance to prevent equipment failure, failure to monitor a ship's systems in order to ferret out potential problems before they occur, lack of the necessary equipment and/or protective parts or gear, breakdowns in operating procedures, breakdowns in communications procedures, language barrier (operating manuals). [6]

According to the Naval Safety Center, in 2015 there was 1 Class A afloat mishap, 5 in 2016, 5 in 2017, and 5 in 2018. In 2017 there were 4 U.S. Navy vessel mishaps over a 6-month time frame in Asian waters; all of these were the result of human error. [4]

Train Mishaps

The main factors that cause train accidents are: train operation - human factor; mechanical and electrical failures; track, roadbed, and structure; signal and communication; miscellaneous causes not otherwise listed, environment conditions, loading procedures, highway-rail grade crossing accidents, unusual operational situations, other miscellaneous.[7]

There were 2,189 total train accidents in 2018, and they are broken down as follows: human related - 739, equipment - 283, track - 555, signal - 53, highway-rail - 215, and miscellaneous - 344. Similar to aircraft mishaps, the human factor for mishaps was the highest of all factors.

Case Studies

June 17, 2017: The USS Fitzgerald collides with a Philippine container ship-US Navy-Maritime

Seven U.S. sailors were killed when the USS Fitzgerald collided with Philippine-flagged container ship in the middle of the night off the coast of Yokosuka, Japan on June 17, 2017. The destroyer was operating about 56 nautical miles southwest of Yokosuka when it collided with the ACX Crystal. Most of the Fitzgerald's 300 crew members on board would have been asleep at the time, the Associated Press reported. The Fitzgerald sustained damage on its starboard side and experienced flooding in some spaces as a result of the collision, according to the Navy. All seven sailors who died were initially missing after the collision and found in the flooded quarters after the destroyer returned to port, a Navy official told ABC News. Those quarters flooded within 90 seconds of the collision. The area is often busy with sea traffic, with as many as 400 ships passing through it every day, according to Japan's coast guard. As a result, the Navy relieved the USS Fitzgerald's commanding officer, executive officer and senior enlisted sailor for alleged mistakes that led to the deadly crash. [8]

Cause: Human Error - no single person was blamed but the commanding officer was court-martialed, and three others faced a mix of charges including dereliction of duty, hazarding a vessel and negligent homicide. A Navy report in late 2017 cited crew exhaustion, skipped certifications, poor watch-standing and training and manning problems among the causes of the collision, which the report concluded was preventable. Blame for the collision fell on the commanding officer and a tactical action officer who were initially charged with negligent dereliction of duty resulting in death and negligent hazarding of a vessel. The charges were dropped 2019 and the two were instead censured by the Navy. Benson retired in December 2019; a Navy panel in January ruled Combs could do the same.

June 21, 2017: The USS John S. McCain collides with a merchant ship-US Navy-Maritime

The USS John S. McCain collided with commercial vessel Alnic MC in waters east of Singapore today, the collision occurred east of the Strait of Malacca around 6:24 a.m. Japan Standard Time. The warship was on its way for a routine port visit in Singapore, the Navy said. As one of the busiest shipping lanes in the world and a third of all maritime shipping goes through the region.

The ship suffered significant damage to the hull, causing flooding in nearby departments, including the crew berthing, machinery and communications rooms, the Navy said. The ship's home port is in Yokosuka, Japan. [9]

Cause: This incident was determined to primarily be caused by human error.

December 6, 2018: F-18 Hornet and KC-130J Crash during re-fueling-US Marine Corps-Aircraft

200 miles off the coast of Japan around 2:00 a.m. on Dec. 6 there was a mishap while the F-18 Hornet and the KC-130J were doing routine training which involved aerial refueling. Both aircraft were stationed at MCAS Iwakuni, Japan. "The Marine Corps conducted an investigation after the fatal crash, which found that pilot error, inadequate oversight of training and operations and an unprofessional command climate contributed to the crash. The investigation repeatedly noted the Hornet pilot's inexperience and suggested that two aviators had sleep aid Ambien and cold medication in their systems, making them "not medically fit for flight duties at the time of the mishap." However, a new investigation was ordered, and in June 2020 they concluded the command investigation was flawed because of inaccuracies. The 2018 investigation wrongly concluded that "medication may have been a causal factor in the mishap, the mishap pilot was not qualified to fly the mission, AN/AVS-11 night vision devices contributed to the mishap, and the previously mentioned mishap in 2016 had not been properly investigated. These conclusions are not supported by the evidence and are addressed in detail in the CDA-RB report." "The initial command investigation placed the onus on the Hornet pilot, saying he was inexperienced, requested to make a non-traditional move away from the KC-130J after refueling, lost situational awareness and collided with the back of the tanker. The CDA, on the other hand, made clear that another Hornet participating in the training event made the first non-traditional move and then turned its bright outer lights on, hindering the pilot's ability to focus on the dimly lit tanker and putting him in a position that few pilots could have successfully managed, regardless of skill and experience." [10]

Cause: This aircraft mishap incident was determined to primarily be caused by human error.

Looking Forward

Aircraft: As of July 2nd, 2020, the Marine Corps found the 2018 crash investigation had flaws and proposed new safety measures. After the F-18 Hornet and KC-130J air refueling crash there were "42 recommendations to address institutional and organizational contributing factors, and ACMC Thomas directed 11 actions to address manpower management, training, operations, and medical policies." For example, "the most talented first-tour aviators would be sent to the most challenging assignments in forward-deployed squadrons, which hadn't been the case before. On training, the F/A-18 training and readiness manuals, standard operating procedures and aerial refueling directives would be updated and standardized." Also, "a Department of Navy Aviation Sleep Management Study, with operations policies being adjusted as needed based on the outcome of the study. And guidance would be updated related to controlled and over-the-counter drugs." [11]

Maritime: As of June 16, 2020 the Navy has implemented a series of changes to surface fleet training; there is no longer just a focus on ship-handling and navigation, but also the manning and assignments of ships' crews and even policies and practices tackling issues such as crew rest and fatigue. USS McCain "is one of the first ships to benefit from these changes, including revised individual and unit training, updated career paths and practices, and a renewed focus on professional seamanship and navigation." [12]

Trains: After the Rail Safety Improvement Act of 2008 "the U.S. freight rail industry has been working on the Positive Train Control (PTC) technology on over 60,000 miles of rail network that "consists of a bundle of state-of-the-art technologies meant to avoid accidents caused by human error, track or equipment malfunction, faulty movement of trains through a grade crossing, breaches on railroad tracks and other types of train operator errors." Mainly, "PTC aims to prevent train-on-train collisions, deflections caused by excessive speed or other derailments on tracks where maintenance operations are underway. The technology uses a number of factors like weight and length of the train, track composition, train speed and train authorization in order to calculate the adequate stopping distance for a train. The PTC system includes an onboard locomotive system that monitors the position and speed of the train and triggers braking in case of speeding or unapproved train movement; a wayside system to check track signals, switches and track circuits for movement authorization; and a back office server that stores all relevant rail traffic information." The Positive Train Control Enforcement and Implementation Act of 2015 requires all railroads subject to the statutory deadline to fully implement PTC by December 31, 2018 or December 31, 2020 if they applied for an extension. [13]

In conclusion, whether it was aircraft, maritime, or train mishaps the most common cause of the accidents were humans.

By knowing the main causes and reasons that they happen, this allows for better understanding in how best to deal with the problems from within so that fewer accidents happen in the future across all lines of transportation.

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1 https://safety.army.mil/Portals/0/Documents/STATISTICS/Standard/Accident_Terms_Aviation_Cause_Factor.pdf

2 https://www.safety.af.mil/Divisions/Human-Factors-Division/HFACS/

3 https://www.safety.af.mil/Portals/71/documents/Human%20Factors/DoD%20HFACS%207.0%20(AFSAS)%20Final.pdf?ver=2019-06-06-110309-983

4 https://navalsafetycenter.navy.mil/Portals/29/Documents/2018%20Annual%20Report.pdf?ver=2020-05-06-110313-660

5 By:Tara CoppSuper Hornet Class Cs have spiked while the older Hornets Class Cs have dropped as the military has sharply cut their flying hours., & By:. (2018, April 09). Navy's spike in aviation mishaps is the military's worst, up 82 percent. Retrieved August, 2020, from http://hrana.org/articles/2018/04/navys-spike-in-aviation-mishaps-is-the-militarys-worst-up-82-percent/

6 Top Reasons for Maritime Accidents. (2014, July 18). Retrieved August, 2020, from https://www.maritimeinjuryguide.org/blog/top-reasons-maritime-accidents/

7 FRA. (n.d.). Retrieved August, 2020, from https://safetydata.fra.dot.gov/officeofsafety/publicsite/downloads/appendixC-TrainaccidentCauseCodes.aspx?State=0

[8] LaGrone, B. (2017, June 18). 7 Sailors Missing, CO Injured After Destroyer USS Fitzgerald Collided with Philippine Merchant Ship. Retrieved August, 2020, from https://news.usni.org/2017/06/16/destroyer-uss-fitzgerald-collides-japanese-merchant-ship

[9] 10 Missing, 5 Injured After USS John S. McCain Collides With Merchant Ship. (n.d.). Retrieved August, 2020, from https://www.defense.gov/Explore/News/Article/Article/1283969/10-missing-5-injured-after-uss-john-s-mccain-collides-with-merchant-ship/

[10] LaGrone, B.(2018, December 06). UPDATED: 5 Marines Still Missing Following F-18 Hornet, KC-130J Crash; Second Recovered Marine Dies in Hospital. Retrieved August, 2020, from https://news.usni.org/2018/12/06/second-marine-recovered-5-missing-following-f-18-hornet-kc-130j-crash-search-continues

[11] Eckstein, B. (2020, July 02). Marine Corps Finds 2018 Crash Investigation Had Flaws, Proposes New Safety Measures. Retrieved August, 2020, from https://news.usni.org/2020/07/02/marine-corps-finds-2018-crash-investigation-had-flaws-proposes-new-safety-measures

[12] Fuentes, G. (2020, June 16). USS John McCain Back to Operations Almost 3 Years After Fatal Collision. Retrieved August, 2020, from https://news.usni.org/2020/06/16/uss-john-mccain-back-to-operations-almost-3-years-after-fatal-collision

[13] Statement on Positive Train Control Implementation. (n.d.). Retrieved August, 2020, from https://www.transportation.gov/briefing-room/statement-positive-train-control-implementation