

Maximizing Mishap Prevention Through Effective Near-Miss Reporting: Final Report

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Abstract

To reduce safety mishaps, the Department of Defense (DOD) seeks a better understanding of near misses, or events with the potential of causing serious consequences to individuals or property but resulting in few, if any consequences. To support this goal, the Office of the Assistant Secretary of Defense for Readiness/Force Safety and Occupational Health tasked CNA with examining how to optimize near-miss systems, which involves improving near-miss data reporting, collection, and analysis, as well as near-miss-related process improvement strategies, such as modifying training to address near-miss precursors. This report summarizes findings from our comparison of near-miss metrics from DOD, non-DOD, and service near-miss systems, as well as our findings from discussions with DOD and non-DOD subject matter experts on how to optimize near-miss systems.

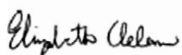
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Executive Summary

The Department of Defense (DOD) is exploring proactive ways to continue inculcating an enduring culture of safety, including more effective near-miss event reporting. Analyzing near misses (i.e., events with the potential to cause serious consequences to individuals or property but resulting in few, if any, consequences) may help DOD to understand any precursors common to both near misses and actual mishaps. In support of the Defense Safety Oversight Council and the Joint Safety Council's ongoing risk reduction efforts, the Office of the Assistant Secretary of Defense for Readiness, Force Safety and Occupational Health (FSOH) tasked CNA with (1) examining how DOD currently manages near-miss data and reporting, (2) researching how commercial and other government entities capture and use near-miss data, and (3) recommending approaches for DOD to optimize near-miss systems; data reporting, collection, and analysis; and near-miss-related process improvement strategies, such as modifying training to address near-miss precursors.

Approach

Our approach to exploring optimal near-miss systems involved the following sources:

1. A qualitative coding and comparison of non-DOD, DOD, and service near-miss data elements.
2. Discussions with 13 non-DOD near-miss subject matter experts (SMEs)¹ from the following industries: health care and social assistance, retail trade, transportation and warehousing, food services, and construction.
3. Discussions with 6 service near-miss SMEs with expertise in the following systems at the following entities:
 - a. Army Safety Management Information System 2.0, operated by the US Army Combat Readiness Center
 - b. Bird Avoidance Strike Hazard and Hazard Reports, operated by Naval Safety Command

¹ We considered non-DOD near-miss SMEs to be safety executives or safety data experts with high visibility on near-miss systems and service near-miss SMEs to be those responsible for operating a near-miss system.

- c. Aerial Delivery Fields Services Malfunction Reporting System and Malfunction Review Board, operated by the Army's Aerial Delivery Manual and Malfunction Office
- d. Navy Weight Handling Database Management Application, operated by the Navy Crane Center
- e. Air Force Safety Automated System, operated by the Air Force Safety Center
- f. Airman Safety Action Program, operated by the Aviation Safety Division at Air Force Safety Center

Findings

The table summarizes our findings related to promising practices² for managing near-miss systems. FSOH may consider reviewing these practices with the services to determine whether the services are already implementing them; if they are not, FSOH could determine whether these practices would be possible to implement. After those discussions, FSOH could determine whether updates to policy would be beneficial or whether other means could be used to communicate and encourage the most viable promising practices.

² We use the term *promising practices* rather than *best practices* throughout this report. Although SMEs may describe certain practices as promising, verifying these claims as true best practices using empirical data with any form of separate analysis was not within the scope of the project, as noted in our limitations section.

Table. Promising practices for near-miss systems

Category	Promising Practice
Encourage near-miss reporting ^a	• Develop a culture that encourages self-criticality, accountability, teamwork, leadership, proactivity, trust, and voluntary participation, while understanding that this culture may take years to develop. • Preserve reporter anonymity. • Foster a blame-free environment. • Ensure a simple reporting process by minimizing the time needed to complete reports and the number of fields to fill out, such as by requiring only what reporters believe were factors that contributed to a near miss. • Frame near misses as healthy data elements—specifically, opportunities to solve a problem before it becomes a mishap. • Ensure senior leader presence by providing direct reporting channels to commanding officers and having senior leaders foster a near-miss safety culture by gaining organizational self-knowledge, assessing their organizational culture to ensure that it engenders trust, and encouraging voluntary participation and proactive reporting. • Share noteworthy near-miss reports with the relevant communities to create a positive feedback loop with potential reporters (although this practice might not be possible with anonymous reporting). • Ensure a collective understanding of definitions of event categories to avoid misinterpretations that may impede accurate reporting.
Collect near-miss data	• Prioritize near-miss data collection based on potential outcome severity. • Explore the use of large language models^b to process and sort near-miss reports. • Explore automated data collection systems, such as sensors, cameras, and other devices for ground vehicles and construction workers.

Category	Promising Practice
Analyze and report results of near-miss data	• Conduct frequency, trend, risk, and root cause analyses. • Hold regularly scheduled executive or leadership meetings to review near-miss data to prioritize significant near misses, provide risk registers, and discuss actions to be taken regarding data, such as changes in standard operating procedures and disciplinary procedures. • Use dashboards to share analysis results with leaders, stakeholders, and decision-makers.
Develop process improvement strategies related to near-miss data	• Ensure that senior leaders reinforce safety messaging, cultivate safety culture, and wield authority to make necessary doctrine or training changes. • Empower local entities to develop solutions to issues stemming from near-miss analysis results.

Source: CNA.

^a DOD requires near-miss reporting. However, during our project, we learned of multiple strategies used by both non-DOD and service entities that service entities can implement more broadly to increase compliance with this requirement, which we refer to as “encouraging” near-miss reporting throughout the report.

^b *Large language models* are “statistical models which assign a probability to a sequence of words,” that are trained on colossal datasets governed by a sizable amount of parameters to develop natural-sounding language and perform various text-based tasks [1].

In addition to promising practices, some of our findings are related to service entities’ perceptions of the DOD data standards. In general, perceptions of the DOD data standards among the service SMEs we spoke with were mixed. Some SMEs stated that the number of data fields required by the standards is necessary, whereas others said that the number of data fields is expansive and burdensome. Furthermore, several service SMEs expressed frustration that DOD has not adequately gathered their input on the DOD data standards.

Recommendations

Adopting the following recommendations may assist DOD in optimizing its near-miss systems and near-miss-related data standards. We based recommendations one and two on gaps that we identified in the DOD data standards for near-miss data elements during our qualitative coding and comparison of non-DOD, DOD, and service near-miss data elements. We based recommendations three through eight on promising practices that we learned about through our discussions with SMEs.

1. **Make variables for systemic factors such as procedural errors, recurrent issues, and unexpected mission occurrences (e.g., flight anomalies) more apparent within the DOD data standards** We found this potential gap when we compared near-

miss DOD data standards to non-DOD near-miss data elements. Although DOD uses the Human Factors Analysis and Classification System (HFACS) to understand some systemic concerns, we found that non-DOD entities also include these factors in their near-miss data reporting systems. Making these variables more apparent may allow DOD to identify and address procedural issues more easily, prioritize solving recurring issues, and better understand unplanned events that lead to near misses. These variables could include the following aviation anomalies: airspace violations; air traffic control issues; flight deck, cabin, or aircraft events; deviations in altitude, speed, or heading; procedural discrepancies; ground excursions or incursions; and ground or in-flight events or encounters. They could also include the following non-aviation anomalies: unplanned events, degraded conditions, and performance deficiencies, including fields that indicate whether the reporter had noticed the problem before, whether the hazard was related to a single event or repeated process, whether a communication breakdown occurred, and whether a system (such as a coolant distribution system or fire suppression system) failed (as opposed to a single piece of equipment failing).³ When these factors are made more apparent, there may be some overlap with HFACS and free text fields for near misses.

2. **Add an estimate of the potential outcomes of near-miss events (e.g., cost, injury, fatality, property damage) to the DOD near-miss data standards so that DOD can perform more in-depth analysis and better inform resourcing decisions, such as which cases trained HFACS personnel should investigate.** We found that the DOD data standards do not currently require these data elements. However, we learned through our discussions that non-DOD SMEs prioritize near-miss data collection based on the potential outcomes of near-miss events. DOD may wish to include these data elements so that it can allocate its resources optimally in near-miss data collection, prioritize which sets of data need to be analyzed in greater depth (based on these potential cost outcomes, injury outcomes, etc.),⁴ and develop near-miss interventions if possible. To do so, DOD may need to develop a systematic potential-of-harm model with clear definitions of certain types of harm. To create this model, service entities could estimate potential negative outcomes (including fatalities, injuries, lost workdays, and property damage) based on what would have occurred if no barriers were in place for the near-miss event (and a mishap occurred).⁵ FSOH may wish to

³ A full list of systemic factors can be found in Appendix D: Systemic Factors Table.

⁴ More in-depth analyses that we found in our literature review included statistical t-test analyses, failure modes and effects analyses, probabilistic risk assessments, fault tree analyses, and event tree analyses. Additional information can be found in Appendix B: Non-DOD Near-Miss Systems.

⁵ A non-DOD SME made this suggestion during our discussions.

leverage the 5x5 risk assessment matrix popularized by the American National Standards Institute (shown in the following figure) to determine which near-miss events to give the most resources to by relying on reporters to estimate the consequences and the probability of the near-miss event turning into a mishap. Service entities should then aggregate the results and note which types of near-miss events the services should prioritize for intervention.

FSOH could use this model to provide potential reporters with clear guidance on which near misses reach a threshold that requires reporting. In addition, during our discussions, one service SME mentioned that differentiating between proactive near misses (i.e., ones in which an action was taken to prevent a mishap from occurring) and reactive near misses (i.e., ones in which a near miss was prevented through chance rather than directed action) was important. Service entities may wish to prioritize proactive near misses for more immediate attention.

Figure. American National Standards Institute 5x5 risk assessment matrix

	Consequence—Could Cause					
	1: First aid, injury, or minor damage	2: Minor injuries (recordable)	3: Moderate damage (lost time)	4: Permanent disability or fatality	5: Multiple fatalities	
Probability	1	2	3	4	5	1–4 Low Risk
1: Rare	1	2	3	4	5	5–8 Moderate Risk
2: Unlikely	2	4	6	8	10	
3: Moderate	3	6	9	12	15	9–12 High Risk
4: Likely	4	8	12	16	20	
5: Almost Certain	5	10	15	20	25	15–25 Critical Risk

Source: [2].

3. **Develop basic training for potential near-miss reporters to identify and classify potential human-related near-miss causes.** One service SME expressed that collecting near-miss data on human factors (such as fatigue or substance use) is challenging because of a lack of trained personnel. The Office of the Secretary of

Defense (OSD) could explore providing training on how to point out significant human factors for reporting. OSD or the services could develop this training by first analyzing near-miss data according to the risk assessment model presented in the figure above. When OSD or the services have determined which near-miss events have both a high probability and high potential for harm, they can conduct one of the in-depth analyses mentioned in our literature review⁶ to determine which HFACS fields contribute to most of these prioritized near-miss events. OSD or the services can then work with HFACS SMEs to adapt the terminal learning objectives or the training requirements for those fields for a non-HFACS audience consisting of those likely to be potential reporters for these prioritized near-miss events. For example, if failure to maintain an adequate following distance results in near collisions that could have resulted in fatalities, drivers of involved ground vehicles may receive training on which factors may have led to the lack of following distance (e.g., fatigue, poor communication).

4. **Make data entry forms easier and less time-intensive to complete by ensuring that service near-miss reporting systems contain as few fields as possible, autopopulating various fields, having investigators complete various fields, and exploring the possibility of using large language models assist in the reporting or analysis process.** Both our discussions with service and non-DOD SMEs and our literature review revealed that ensuring that near-miss reporting is easy is key to ensuring that it occurs. Our suggestions for simplifying the process could reduce front-end work, potentially increasing near-miss reporting. DOD may wish to prioritize collecting variables used by non-DOD entities, variables potential reporters may be aware of, and variables on potential harm from near-miss events that would allow DOD entities to focus on certain near-miss events for further analysis. If DOD seeks to reduce the number of data fields required for near-miss reporting, it may wish to remove these non-contributing factors because they are not represented in the other near-miss systems we reviewed and may not contribute to analysis of near misses. In addition, OSD may benefit from ensuring definitions of event categories are collectively understood to make reporting easier and increase report accuracy.
5. **Explore automated data collection beyond the use of standard near-miss data entry forms, such as the use of cameras or sensors to detect hard braking in vehicles.** This potential change would increase reporting for reasons similar to the ones mentioned in recommendation four. However, OSD and the services must consider data security and other concerns if they decide to capture near-miss data

⁶ More in-depth analyses that we found in our literature review included statistical t-test analyses, failure modes and effects analyses, probabilistic risk assessment, fault tree analyses, and event tree analyses. Additional information can be found in Appendix B: Non-DOD Near-Miss Systems.

elements such as speed and vehicle proximity by installing near-miss sensors on vehicles.

6. **Educate the services that hazards that contribute to a sequence of events that could have resulted in injury, illness, or damage had they not been thwarted are also near misses and therefore must be reported.**
7. **Ensure that service senior leadership plays an active role in improving near-miss reporting, analyzing near-miss data, and administering change based on near-miss results.** The role of leadership could include providing direct channels to commanding officers, reinforcing safety messaging, and developing a proactive safety culture (e.g., framing near-miss data elements as healthy data elements or as opportunities to solve a problem before it becomes a mishap). Strong senior leadership and the resulting proactive safety culture are especially necessary for near-miss reporting because near misses result in few to no consequences; therefore, in the absence of leadership and a strong culture, near misses may be swept under the rug. In addition, senior leaders may wish to meet to discuss which near misses should be prioritized, monitor trends, provide risk registers, and discuss actions to take based on the data, such as developing standard operating procedures and disciplinary procedures. It may be necessary to have leaders either wield the appropriate authority to make changes or escalate the issue to an officer with the authority to make those changes. To summarize, near-miss data are best consumed at an enterprise or service level, where systemic issues can be identified and communicated to the lowest level command that can reasonably develop a solution. If implementing that solution requires a higher authority level than the commanding officer possesses, then an officer with an appropriate level of authority may need to assist.
8. **Review the promising practices in the key findings section with the services to determine whether the services are already implementing them; if they are not, determine whether these practices would be possible to implement.** After those discussions, FSOH could determine whether updates to policy would be beneficial or whether other means could be used to communicate and encourage the most viable promising practices.

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Introduction

Background

In support of the Defense Safety Oversight Council and the Joint Safety Council's ongoing efforts, the Office of the Assistant Secretary of Defense for Readiness (OASD-R), Force Safety, and Occupational Health (FSOH) is exploring proactive ways to continue improving the Department of Defense's (DOD's) culture of safety, including more effective near-miss event reporting. Near-miss work supports the Secretary of Defense's goal of "taking care of our people"⁷ by improving the process of identifying operational errors that can be mitigated before a mishap.

OASD-R FSOH recently updated the DOD-wide safety business processes and data standards, which now require collection of near-miss event data for all mishap categories: aviation, afloat, ground, motor vehicle, weapons, and space. We refer to these standards as the near-miss portion of the DOD data standards, which were developed by the Safety Information Management Working Group.

Building on CNA's previous safety culture report,⁸ OASD-R FSOH tasked CNA with providing recommendations for improving DOD's practices and methods for collecting near-miss data by learning from the commercial sector and existing federal programs to ensure that a robust structure for near-miss data management, analysis, and sharing is in place.

The study also supports DOD's goal of integrating near-miss reporting processes and analyses into DOD's safety program and enhancing an enterprise-wide culture of safety that uses leading indicators, which may be identified through near-miss reporting. This work also aligns with the vice chairperson of the Joint Chief of Staff's emphasis on the value of collecting and reviewing near-miss data.

We developed the following questions to guide this project:

⁷ For additional information, see "Taking Care of Our People," US Department of Defense, <https://www.defense.gov/Spotlights/Taking-Care-of-Our-People/>.

⁸ The final report, *Lessons on Safety Culture from Private-Sector Safety Executives*, found that leaders at all levels should reinforce safety messaging, safety executives should operate at high levels within the organization, and safety culture should empower employees, partially by incentivizing reporting [3].

1. How do near-miss data elements collected by service and non-DOD entities⁹ compare to DOD's data standards?
2. How do service and non-DOD entities encourage near-miss reporting?¹⁰
3. How do service and non-DOD entities collect near-miss data?
4. How do service and non-DOD entities analyze and report near-miss data?
5. What promising practices¹¹ exist for using technology to collect, analyze, and report near-miss data for service and non-DOD entities?¹²
6. How do service and non-DOD entities use near-miss data to improve safety processes?
7. How do service entities reflect on the DOD data standards?

Before answering these project questions, we must first establish a clear definition of the term *near miss*.

What is a near miss?

Definitions of *near miss* vary across industries and workplaces. However, definitions that we reviewed commonly noted that a near miss is an event that had the *potential* to cause serious consequences to individuals or property but that *resulted* in minor or no consequences.¹³ Articles that we reviewed defined or described *near misses* as the following:

- A hazardous situation, event, or unsafe act in which the sequence of events could have caused an accident if it had not been interrupted [6].
- An unplanned event that did not result in injury, illness, or damage but had the potential to do so [7].

⁹ We define *service entities* as service suborganizations operating a near-miss system, and we define *non-DOD entities* as businesses operating a near-miss system.

¹⁰ DOD requires near-miss reporting. However, during our project, we learned of multiple strategies used by both non-DOD and service entities that service entities could implement more broadly to increase compliance with this requirement, which we refer to as “encouraging” near-miss reporting throughout the report.

¹¹ We use the term *promising practices* rather than *best practices* throughout this report. Although SMEs may describe certain practices as promising, verifying these claims as true best practices using empirical data with any form of separate analysis was not within the scope of the project, as noted in our limitations section.

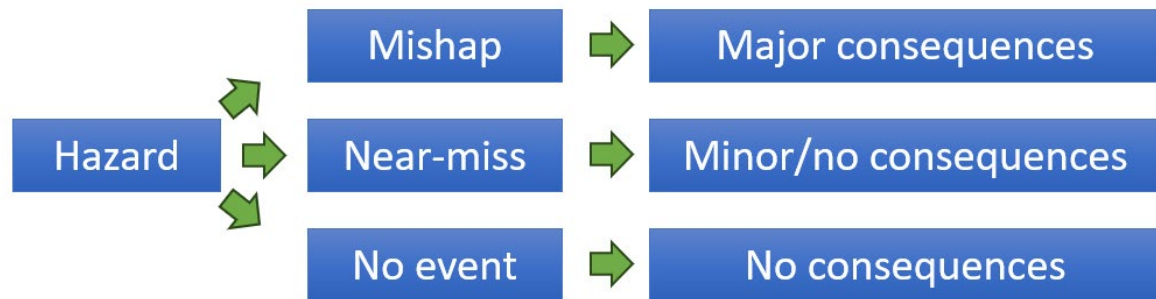
¹² Information on promising technologies was found to tie into the collect and analysis sections, so this information is integrated throughout those sections with subheadings labeled “Promising technology.” For example, use of dashboards is included in the near-miss data analysis section.

¹³ According to FSOH, this definition contrasts with the DOD definition of a *near miss*: “An unplanned event that did not result in an injury, illness, or property damage, but had the potential for doing so.” The Army defines Class E mishaps as those for which the resulting total cost of property damage is \$5,000 or more but less than \$25,000 [4]. The Air Force defines Class E mishaps as “an event cost totaling <\$25k” [5].

- Leading and lagging indicators of safety [8].¹⁴
- Symptoms of undiscovered safety concerns [9].

A *hazard* is something dangerous that could occur, whereas a *near miss* is something that did occur but caused little or no harm. Hazards are often root causes of events. See Figure 1 for a delineation of hazards, mishaps, and near misses.

Figure 1. Hazards, mishaps, and near misses



Source: CNA.

Factors that determine whether a hazard is a mishap or a near miss differ with industry and workplace. However, many industries and companies refer to guidelines offered by the Occupational Safety and Health Administration (OSHA) [10]. OSHA’s guidelines identify the following factors as hazards or near misses with the potential for more serious consequences (quoted, unless text is in brackets) [10]:

- Unsafe conditions [such as a slippery floor or a foreign road object] (hazard)
- Unsafe behavior, such as a worker modifying personal protection equipment for comfort (hazard)
- Events where a safety barrier was challenged, such as a worker bypassing a machine guard (hazard)
- Minor mishaps and injuries that had potential to be more serious (near-miss)
- Events where injury could have occurred but did not (near-miss)
- Events where property damage could have resulted but did not (near-miss)

¹⁴ We defined *leading indicators* in our previous report as “proactive, preventive, and predictive measures that provide information about the effective performance of safety and health activities,” and we defined *lagging indicators* as the “occurrence and frequency of events that occurred in the past, such as the number or rate of injuries, illnesses, and fatalities” [3].

- Events where potential environmental damage could have resulted but did not (near-miss)

Report organization

We organize the remainder of this report as follows. First, we discuss our approach of comparing non-DOD, DOD, and service near-miss safety data elements; reviewing near-miss literature; and holding subject matter expert (SME) discussions with representatives from service and non-DOD entities who administer near-miss reporting systems to answer our project questions. Second, we present the results from our comparison of non-DOD, DOD, and service near-miss safety data elements (corresponding to project question one). Third, we present our findings from our discussions with service and non-DOD SMEs who operate near-miss systems (corresponding to project questions two through seven). We conclude by summarizing our key findings and providing recommendations to aid DOD in optimizing a near-miss system.

Methodology

Near-miss safety data elements (project question one)

To answer project question one (“How do near-miss data elements collected by service and non-DOD entities compare to DOD’s data standards?”), we collected near-miss data elements from three sources:

1. Near-miss data elements from non-DOD entities identified through a Google search for near-miss reporting systems¹⁵
2. Near-miss data elements incorporated into the DOD data standards that we received directly from the sponsor
3. Near-miss data elements from service entities provided either through the FSOH tasking system or through service SMEs identified by the process described in the following “Identifying service entities” section

Our goal for analyzing near-miss data elements was to identify the following types of gaps: (1) categories of non-DOD near-miss data elements not currently in the DOD data standards near-miss data elements and (2) categories of near-miss data elements recommended by the DOD data standards but not yet collected by service entities. For additional information on how we identified these gaps in data elements, please refer to Appendix C: Additional Methodology Information.

Literature review (project questions two and four)

We examined literature databases from several other federally funded research and development centers to identify relevant literature regarding near misses. We identified literature related to project questions two and four on how entities can encourage near-miss reporting and analyze near-miss data. We include information on the former in the body of this report because of its universal applicability and information on the latter in Appendix B: Non-DOD Near-Miss Systems because these analysis techniques may be more situation dependent.

¹⁵ Unfortunately, our requests for non-DOD data elements from the non-DOD SMEs faced business proprietary concerns during our discussions.

Analysis of SME discussion data (project questions two through seven)

We analyzed SME discussion data to answer the following project questions:

2. How do service and non-DOD entities encourage near-miss reporting?
3. How do service and non-DOD entities collect near-miss data?
4. How do service and non-DOD entities analyze and report near-miss data?
5. What promising practices exist for using technology to collect, analyze, and report near-miss data for service and non-DOD entities?
6. How do service and non-DOD entities use near-miss data to improve safety processes?
7. How do service entities reflect on the DOD data standards?

Our process for analyzing SME¹⁶ discussion data included identifying service and non-DOD SMEs, developing a list of discussion topics, holding discussions with the SMEs, and conducting qualitative analysis on the transcripts from those discussions.

Identifying service entities

We sought to hold discussions with service SMEs who had experience operating near-miss reporting systems so that we could learn about their experiences improving near-miss data reporting; the collection, analysis, and process improvement strategies related to near-miss data; and their experiences with the DOD data standards for near-miss reporting. To aid in the accomplishment of this goal, FSOH tasked each of the military departments to provide us with descriptions of service-operated data systems related to near misses along with data elements for these systems. The project team reviewed the list to confirm that the data systems matched the near-miss definitions identified in the literature review.

Through this process, we identified the service-operated data systems collecting and using near-miss data, which are listed in Table 1. Some of the near-miss systems we identified had service-wide coverage, whereas others were used at a smaller scale within a community; one example is the Aerial Delivery Fields Services Malfunction Reporting System, which is used in the Malfunction Review Board airdrop community.

¹⁶ We define *service near-miss SMEs* as those responsible for operating a near-miss system and *non-DOD near-miss SMEs* as safety executives or safety data experts with high visibility on near-miss systems.

Table 1. Service near-miss systems

Service	Near-Miss System	Service-wide/Community
Army	Army Safety Management Information System 2.0, operated by the US Army Combat Readiness Center	Service-wide
	Maintenance and Incident Reports, operated by Tank and Automotive Command	Community
	Aerial Delivery Fields Services Malfunction Reporting System and Malfunction Review Board, operated by the Aerial Delivery Manual and Malfunction Office	Community
Navy	Bird Avoidance Strike Hazard and Hazard Reports, operated by Naval Safety Command	Community/Service-wide
	Navy Weight Handling Database Management Application, operated by Navy Crane Center	Community
	Naval Aviation Maintenance Program, operated by Commander, Naval Air Forces and Commander, Naval Air Systems Command	Community
	Naval Sea Systems Command Trouble Reports, operated by Naval Sea Systems Command	Community
Air Force	Air Force Safety Automated System, operated by Air Force Safety Center	Service-wide
	Airman Safety Action Program, operated by the Aviation Safety Division at Air Force Safety Center	Service-wide
	Joint Patient Safety Reporting, operated by Defense Health Agency	Community

Source: CNA.

We were able to speak with service SMEs with expertise in the following systems at the following entities:

- Army Safety Management Information System 2.0, operated by the US Army Combat Readiness Center
- Bird Avoidance Strike Hazard (BASH) and Hazard Reports (HAZREPs), operated by the Naval Safety Command
- Aerial Delivery Fields Services Malfunction Reporting System and Malfunction Review Board, operated by the Aerial Delivery Manual and Malfunction Office
- Navy Weight Handling Database Management Application, operated by the Navy Crane Center
- Air Force Safety Automated System (AFSAS), operated by the Air Force Safety Center
- Airman Safety Action Program (ASAP), operated by the Aviation Safety Division at Air Force Safety Center

Through our SME discussions about the community-oriented data systems, we learned that the Aerial Delivery Fields Services Malfunction Reporting System feeds into an Army incident report database (governed by DD 1748-2), the Navy Crane Center data do not feed into any service-wide database, and the BASH/HAZREP data currently feed into ASAP and will feed into AFSAS in the future.

Identifying non-DOD entities

We also sought to hold discussions with people from non-DOD entities who had experience operating near-miss systems to learn about their experiences improving near-miss reporting and their collection, analysis, and process improvement strategies related to near-miss data. To accomplish this goal, we identified businesses likely to have experience operating near-miss systems, focusing on industries with many safety mishaps. Additional information on how we identified non-DOD entities may be found in Appendix C: Additional Methodology Information.

Discussion procedure

For both service and non-DOD entities, we held 60-minute discussions with SMEs over Microsoft Teams. We assured SMEs that their comments were not for attribution, with the exception of quotes for which we received express written permission to use.

The semi-structured discussions focused on the following topics, matching project questions two through seven listed in the introduction section:

- How does your organization encourage servicemembers and employees to report near misses?

- How does your organization collect near-miss data?
- How does your organization analyze and report near-miss data?
- How are data from your near-miss system used to create change?
- What role does technology play in your near-miss data collection system?
- How do your data systems relate to the DOD data standards? (Service entities only)

One project member facilitated the conversations and took high-level notes on the discussions while up to two notetakers took detailed notes. Project members analyzed each set of two to three note documents and combined all the unique information into a consolidated transcript.

Qualitative analysis of discussion transcripts

As we analyzed the discussion transcripts, we sought to identify common themes and promising practices on improving near-miss data reporting and strategies for improving the collection, analysis, and processing of near-miss data. In addition, we asked SMEs from the service entities about their perceptions of DOD data standards. Additional information on how we identified these themes can be found in Appendix C: Additional Methodology Information.

Limitations

When interpreting this report, readers should note the following three main limitations in our approach:

1. Although SMEs may have noted certain near-miss practices as promising, verifying these claims using empirical data with any form of separate analysis was not within the scope of the project. Future researchers may wish to analyze whether adoption of certain near-miss practices can be reasonably linked to future reductions in safety mishaps.
2. Although SMEs from certain entities did not mention certain near-miss practices, that does not mean that they did not adopt them. For example, one entity may have adopted cameras and telematics to collect data, but an SME may have failed to disclose this practice because they thought that information was irrelevant or proprietary.
3. In this report, we do not present a view that represents the DOD in its entirety because we were limited in our discussions to representatives from the six service entities with near-miss systems mentioned previously; these were the only entities we could schedule discussions with.

How Near-Miss Data Elements Collected by Service and Non-DOD Entities Compare to DOD's Data Standards (Project Question One)

Coding of DOD data standards

As noted in our methodology section, the sponsor provided us with the DOD data standards, which identify the data elements that DOD components must capture when reporting a near-miss event. We coded these data elements similarly to the non-DOD data elements. Typically, the categories of data reported in these near-miss systems¹⁷ fit into the following groups: why the near miss occurred (human, environmental factors, and machinery categories), where and when the near miss occurred (location and time), and in what context the near miss occurred (noncontributing factors or operation).

Table 2 presents the full results of this coding along with definitions and examples.

Table 2. Categories of DOD data standards

Category	Category Definition	Example Data Element
Human	The background and behavior of the staff involved in a near miss	Substance use code
Environmental	External factors out of the staff's control that contribute to a near miss	Wildlife species code
Machinery	Equipment or equipment components that contribute to a near miss	Object unique identifier
Location and time	When and where a near miss occurred	Date

¹⁷ Not all systems we reviewed are specific near-miss systems. Some are more comprehensive systems that support the collection of near-miss data.

Category	Category Definition	Example Data Element
Noncontributing factors	Involvement of individuals who did not directly contribute to a near miss, such as witnesses, event participants, and investigators, as well as general event descriptions	Investigator first name
Operation	The mission, activity, or task underway when a near miss occurred	Object owning organization unit identification code name
Other	Data elements we were unable to determine, reporting and administrative requirements, and data elements not relevant to safety	Event status code
Recommendations and conclusion	Information learned after near-miss event analysis and suggestions for improvement	Recommendation narrative

Source: CNA coding of DOD near-miss data standards.

Coding of non-DOD near-miss data elements

We identified the following near-miss systems through a Google search: the National Aeronautics and Space Administration (NASA) Safety Reporting System, NASA's Aviation Safety Reporting System (ASRS), the Nuclear Regulatory Commission's (NRC's) Accident Sequence Precursor (ASP) Program, the International Association of Fire Chiefs' National Fire Fighter Near-Miss Reporting System (NMRS), and the Federal Aviation Administration's (FAA's) Accident Incident Database System. Appendix B: Non-DOD Near-Miss Systems contains more detailed information.

We coded the data elements found in these near-miss systems qualitatively [11]. Table 3 presents the full results of this coding, along with definitions and examples.

Table 3. Categories of non-DOD near-miss data elements

Category	Category Definition	Example Data Element
Systemic factors ^a	Broad explanations for why a near miss occurred	Communication breakdown

Category	Category Definition	Example Data Element
Human	The background and behavior of the staff involved in a near miss	Number of flight time hours for the pilot in command
Environmental	External factors out of the staff's control that contributed to a near miss	Wind speed
Machinery	Equipment or equipment components that contributed to a near miss	Aircraft engine make and model
Location and time	When and where a near miss occurred	Event local time
Operation	The mission, activity, or task an organization was completing during a near miss	Flight phase
Outcome	The consequences of a near miss	Total injuries involved
Other	Data elements we were unable to determine, reporting and administrative requirements, and data elements not relevant to safety	Report number

Source: CNA coding of non-DOD near-miss systems.

^a *Systemic factors*, a term we developed during our coding process, can refer to procedural errors, recurrent issues, and unexpected mission occurrences (such as flight anomalies). These factors could include the following aviation anomalies: airspace violations; air traffic control issues; flight deck, cabin, or aircraft events; deviations in altitude, speed, or heading; procedural discrepancies; ground excursions or incursions; and ground or in-flight events or encounters. These factors could also include the following non-aviation anomalies: unplanned events, degraded conditions, and performance deficiencies, including fields that indicate whether the reporter had noticed the problem before, whether the hazard related to a single event or repeated process, whether a communication breakdown occurred, and whether a system (such as a coolant distribution system or fire suppression system) failed (as opposed to a single piece of equipment failing). A full list of systemic factors can be found in Appendix D: Systemic Factors Table.

Gaps between DOD data standards and non-DOD near-miss data elements

Table 4 presents gaps we identified between the DOD data standards and non-DOD near-miss data elements.

Table 4. Gaps between DOD data standards and non-DOD near-miss data elements

Near-Miss Data Element Categories	Who Collects These Data
Systemic factors	Non-DOD only
Human	Both
Environmental factors	Both
Machinery	Both
Location and time	Both
Noncontributing factors	DOD only
Operation	Both
Outcome	Non-DOD only
Other	Both
Recommendations and conclusion	DOD only

Source: CNA.

In our coding of the non-DOD near-miss data elements, we identified a few categories of near-miss data elements that we were unable to identify explicitly in the DOD data standards. The “systemic factors” category contained broad explanations for why a near miss occurred. These explanations could involve reasons such as a human or procedural error, a recurrent or previous issue, an equipment system failure, or an unplanned event or anomaly. The “outcome” category directly measured the potential consequences of a near miss, such as injuries, fatalities, and physical damage. Although DOD currently requires outcome data for mishaps, it may wish to explore recommending that service entities include data on *projected* outcomes of near-misses so that DOD or service entities can prioritize analysis of certain near-miss events.

We also identified categories of near-miss data elements in the DOD data standards that we did not find in the non-DOD data elements that we coded. The “noncontributing factors” category from the DOD data standards captured individuals not directly contributing to a near miss and general event descriptions. If DOD seeks to reduce the number of data fields required for near-miss reporting, it may wish to remove these noncontributing factors because they are not represented in the other near-miss systems we reviewed and may not contribute to analysis of

near misses. Specifically, these individuals included participants, witnesses, and investigators. The “recommendations and conclusion” category captured information learned after the analysis.

Gaps between DOD data standards and service near-miss entities

After we coded the DOD data standards, we sought to compare them to the near-miss data elements collected in the four DOD systems we reviewed. However, we received near-miss data elements *and* held conversations with SMEs from only four of these entities. We compared the near-miss data elements of these four entities to the DOD standards and asked them to explain the reasoning for any gaps.

The SMEs provided several explanations for these gaps. One SME noted that collecting human near-miss data is challenging because such data are often inaccurate (partially because those who enter near-miss reports do not receive training on how to code human factors for near misses) and because true human factors coding requires investigator time, which is spread thin and thought to be better utilized for actual mishaps (particularly mishaps with high numbers of injuries or fatalities or high amounts of property damage).

How Service and Non-DOD Entities Encourage Near-Miss Reporting (Project Question Two)

Literature review findings: practices for creating a safety reporting culture for near misses

Previous research defined *safety culture* as “the enduring value and priority placed on worker and public safety by everyone in every group at every level of an organization.” A healthy safety culture must include actions to “preserve, enhance, and communicate safety concerns” [12]. If safety events, including near misses, are not reported, leadership has little opportunity to assess the risk environment of personnel, equipment, and facilities. A strong safety reporting culture is necessary to encourage workers to report events. In this subsection, we note results from our literature review researching what aspects contribute to a successful safety reporting culture.

The most commonly noted aspect of a successful safety reporting culture is the promotion of a blame-free environment [13-16]. Although most articles note this aspect in a general sense, one article notes that a blame-free environment is predicated on both an “atmosphere of trust” and the acceptance that “errors are inherent to human activity” [16]. In addition to promoting a blame-free environment for safety reporting, safety managers can mitigate blame associated with near-miss reporting by developing an anonymous reporting system, in which the reporter is not identified.

During our literature review, we noted several strategies for staff engagement that could encourage a strong safety reporting culture. One article discussed promoting the idea that reporting near-misses is mandatory for all employees is crucial [17]. Several articles note that demonstrating to staff how the organization would use near miss data to develop safety solutions is instrumental in creating employee buy-in on the importance of the reporting system [14, 16].

In contrast, several articles noted barriers to near-miss systems. One journal article identified the following barriers to implementing a near-miss reporting program [18]:

- **The status quo factor.** Organizations grow comfortable with how things are and see near-miss reporting as extra work.
- **Defining *near miss*.** Employees define *near miss* in different ways that do not align.
- **Forms.** Reporting forms are often difficult to understand.
- **Fear of punishment and retaliation.** Employees are concerned that reporting a near miss might make supervisors and employees look bad, leading them to believe that reporting will get a negative response.
- **Lack of recognition and feedback.** Management does not recognize the effort to report a near miss, making personnel feel that doing so is unimportant.
- **Peer pressure.** Coworkers may perceive a near-miss reporter negatively, influencing colleagues in the same way.
- **Concern about record and reputation.** Supervisors and managers perceive near misses as negative events that will be used against them.
- **Desire to avoid work interruption.** Reporting a near miss requires immediate attention from workers on tight deadlines.
- **Desire to avoid red tape.** Employees are concerned that they will be entangled in a long process of questioning and delays after reporting a near miss.
- **Fault-finding mindset.** When looking for a root cause of events, organizations might be required to identify an employee to take the blame.

One article discussed how hospital risk managers commonly note fear of reporting as a barrier to reporting adverse events [14]. Fear of reporting may result from larger organizational incentives. One article noted that focusing solely on capturing “lagging,” “downstream,” or more result-focused measures, as opposed to also including “leading,” “upstream,” or more input-focused measures, may dissuade employees from reporting adverse events because of fear of significant consequences [19]. Such focus also hampers an organization’s ability to prevent mishaps.

Minimizing the technical barriers to reporting is also key to creating a strong safety reporting culture. Two articles noted that creating easy-to-use tools for generating safety reports is critical to developing successful reporting programs [17, 20].

The recommended solution to overcoming several of these barriers is to use an accountability cycle approach [18] that includes the following steps:

1. **Define**—clearly defining factors and expectations (by safety professionals in the workplace).
2. **Train**—conducting an employee orientation in which employees complete actual reports from past events that they witnessed to see how management responds.

3. **Measure**—tracking and displaying the parallels of increased reporting with good safety performance.
4. **Recognize**—acknowledging workers with rewards to increase accountability.

How service entities encourage near-miss reporting

We identified the following themes related to encouraging near-miss reporting during our conversations with service SMEs: (1) a positive near-miss reporting culture, (2) a doctrinal or instructional basis for mandatory reporting, (3) ease of reporting, and (4) anonymity versus transparency.

Culture

The predominant theme coded in our discussions about encouraging servicemembers to report near misses was the development of a positive reporting culture. We broke this larger theme down into four discrete areas: self-criticality and accountability, leadership engagement, the development of a safety culture, and the presence of vocational and occupational subgroups.

Self-criticality, ownership, and accountability

One SME identified the importance of developing a “self-critical” mentality within a near-miss reporting culture. Part of self-criticality is having a robust system for (or culture of) self-evaluation. One data element identified for demonstrating the development of a more proactive self-critical culture was an increase in voluntary reporting (in this case, anonymity was not a condition of near-miss reporting). One way to incentivize this type of initiative is to frame a near miss as a healthy data element—as an opportunity to solve a problem before it becomes a mishap. Indeed, multiple service entities described the idea of self-criticality and proactivity (a local-level problem-solving attitude and approach).

Leadership engagement in cultivating safety culture

A proactive type of DOD safety reporting culture also involves positive senior enlisted and noncommissioned officer engagement. Part of signaling this engaged type of leadership is indicating sincere appreciation for reports submitted and demonstrating that near-miss reports are taken seriously without adverse reaction or retaliation (and communicating transparently about what is being done to address the underlying issues). Instead of responding with punitive or adverse repercussions for reporters of events, leadership in a proactive culture is described as “leaning in” to support reporters with help in resolving root causes. One service SME considered leaders being present on the deckplates or worksites and

actively engaging in supervising and planning to be key in developing a more proactive safety reporting culture. Direct channels for reporting to commanding officers and senior leaders also signal the importance of near-miss reporting to deckplate personnel.

One service SME considers leading by mandate to be counterproductive and less valuable than building a proactive culture from the ground up. The SME described how a simple mandate to increase the quality of reporting had two effects: the best team leads apologized (without reason) for their “poor-quality reports” (despite them actually already providing high-quality reports) and continued to give high-quality reports, whereas poorly performing team leads did not take a proactive, self-critical approach and attributed problems in reporting to others (and continued to deliver low-quality reports). The net result was even poorer quality reporting data.

Developing a proactive, self-critical safety reporting culture

Overall, SMEs recognized that getting safety reporting culture right is difficult and takes time (one SME suggested a window of 10 years). One service SME noted that assessing this internal culture (i.e., acquiring internal organizational self-knowledge) is also considered a critical leadership skill. A “mature” program was characterized as engendering trust and voluntary participation, which are achieved in part by ensuring deckplate-level understanding among reporting personnel. Service entities described several practices for cultivating this culture, including the following:

- Establishing a blame-free environment in which good-faith reporting does not have an adverse effect on career (see also the section on anonymity).
- Selecting the right leaders (mid-level managers) for near-miss monitoring programs through personal characteristics such as self-criticality.
- Sharing validated and “sanitized” (i.e., anonymized) reports with the broader community to demonstrate the value of reporting as well as disseminating promising practices and lessons learned.
- Involving all deckplate-level personnel in problem-solving discussions (free of blame or negative repercussions)
- Using recognition programs to highlight the value of safety reporting to the organization (e.g., including the phrase “Bravo Zulu” on a naval email correspondence letter or email to indicate a job well done).

Vocational and occupational culture subgroups

At least one service SME pointed to an example of how different internal guilds or subcultures in an enterprise responded differently to mishap and near-miss reporting. The specific example compared differences between air and ground crews for aviation. The two groups use different terminology (supposedly not hampering reporting), and different institutional (and

pecuniary) value is placed on the assets in question (e.g., an airplane versus a piece of ground equipment). Senior leadership wanted to avoid being bombarded with hazard notifications¹⁸ related to more frequent (but considered less critical) ground issues and therefore fostered more junior-level problem-solving (another side of encouraging a command culture of proactivity). Certain occupational groups within a service were identified as being more resistant to admitting mistakes than other occupational groups (perhaps because of perceived negative effects on their careers for admitting these mistakes).

Mandated via doctrine or instruction

The service SMEs we spoke with routinely cited the most relevant doctrine and instructions that require mandatory near-miss-type reporting and—in some cases—compulsory timelines and forms for doing so. Doctrine and instructions can also be key touchpoints for communicating the importance and enterprise value proposition of near-miss reporting. Relevant documents cited included the following:

- Army Regulation 59-4 [21]
- Department of the Air Force Manual 91-223 [22]
- OPNAV Manual 5100.23 [23]
- OPNAVINST 3750.21 [24]
- OPNAVINST 3750.6 [25]
- COMNAVAIRFORINST 4790.2D [26]
- NAVFAC P-307 [27]

Several issues with doctrine and instruction emerged. One SME highlighted that policy cannot preempt every emergent or novel situation. Another pointed out that the existence of a mandatory reporting program in doctrine does not necessarily ensure its enforcement without some mechanism for enforcement or follow-up (the SME suggested increasing the consequences for noncompliance). Doctrine's lack of ability both to preempt novel situations and to enforce non-reporting underscore the importance of developing a mature safety culture—the details of which were mentioned previously in the safety culture section.

¹⁸ Although this service SME mentioned “hazards” in this statement, we interpreted “hazards” inclusive of near misses because earlier in the conversation, the SME noted that most of their attention goes to Class A and B mishaps, especially for Human Factors Analysis and Classification System.

Ease of reporting

Requiring fewer fields

One service SME mentioned trying to limit the number of fields required to those that the reporter believes to be contributing factors, such as environmental conditions.

Technological applications

Facilitating reporting was often linked to technological applications, both hardware and software. Use of mobile hardware, such as tablets and personal and common access card-enabled mobile phones, for reporting at the worksite is only part of the solution for some of the entities. One service SME mentioned that their entity made its near-miss reporting form accessible to more people by requiring *only* a common access card, rather than making the form available to only registered users. Some service entities are beginning to use easily navigable apps for reporting near misses and accidents. Promising standard features of such apps include autofill of commonly used preliminary data and context-specific generation of form fields to reduce repetitive data-entry tasks. Other features include streamlining channels for mandatory and voluntary reporting and contextual linking to remedial tools and relevant policy and regulations.

Anonymity

At least three of the six service SMEs we spoke with mentioned safeguarding anonymity as a means of encouraging near-miss reporting. Notably, anonymity programs often bypass several levels in the chain of command to senior leadership to ensure follow-up. As a program design consideration, anonymity can extend to the reporter (by listing only the safety officer taking the report as the accountability point of contact) and to the personnel involved in the near miss.

Not all reporting is necessarily fully anonymous, and the degree of anonymity and accountability exists on a spectrum. However, the reporter is often protected from the reported information being used as part of an adverse action. Safety reporting can also be anonymized organizationally by siloing—meaning that the reporter’s identity is not disclosed outside the safety entity receiving the report (exceptions are made for intentional damage, deliberate disregard for safety, or other criminal behavior).

One notable downside of the anonymous reporting programs the SMEs mentioned is the lack of a means to recognize (and therefore incentivize) voluntary reporters. One way to provide partial recognition and demonstrate that reports are being heard is to share noteworthy near-miss reports with the relevant community as a positive feedback mechanism (thereby creating a virtuous cycle and feedback loop that encourages reporting and information sharing).

How non-DOD entities encourage near-miss reporting

We identified the following themes regarding encouraging near-miss reporting during our conversations with non-DOD SMEs: (1) a strong reporting culture, (2) ease of reporting, (3) blame-free reporting, (4) anonymous reporting, and (5) incentives.

Reporting culture

Similar to service SMEs, non-DOD SMEs also emphasized building a strong safety culture to drive employees to report mishaps and near misses. In discussions, the non-DOD SMEs described this culture as a mindset that is cultivated from experience in the company and industry. These establishments strive for a culture characterized by teamwork, leadership accountability, proactivity, trust, and self-criticism.

Consider an instance in which a defective ice machine over-dispenses ice. After a glass is filled, an additional ice cube may fall onto the floor. Some employees may notice and pick it up, whereas others may not see it, leaving it to melt on the floor and form a hazard. If this hazard almost causes a fall, then a record on file may designate this situation as a near miss. In a culture that encourages proactivity, an employee would not wait for an accident to happen before reporting the broken ice machine. Similarly, leadership responding to this case, whether displaying a caution sign, taking the machine out of use until it is repaired, or replacing it with a better one, would show their accountability.

Ease of reporting

Also similar to service SMEs, several non-DOD SMEs noted the importance of simplifying the process of reporting. Most of these entities found that if they are going to require more reporting, the reporting process needs to be quick and simple. The more complicated it is to report something, the less likely people are to do it; one non-DOD SME even stated a goal of creating a “want to” report environment. Reporting can be simplified by minimizing the time it takes and the number of fields to fill out, providing clear and concise instructions, and providing user-friendly forms or applications. The use of accessible and intuitive electronic forms and mobile applications has made reporting easier. Depending on the industry, reports might even be automated using various technologies, such as telematics, cameras, sensors, and wearable devices.

Another element of ease of reporting is collectively understood definitions of event categories. Otherwise, misinterpretations may alter the frequency and accuracy of reporting.

Blame-free reporting

Many non-DOD SMEs (similarly to the service SMEs we spoke with) noted the importance of maintaining nonpunitive, or blame-free, reporting, which assures an employee that they will face no consequences, such as a reprimand or retaliation, for reporting. These SMEs noted that these consequences would likely deter individuals from reporting in the future.

Anonymous reporting

Many non-DOD SMEs also noted that anonymous reporting is an important way to mitigate concerns with near-miss reporting. The most obvious advantage of anonymous reporting is confidentiality, which reassures reporters that they will not face negative consequences for reporting. Even so, some SMEs stated that anonymous reporting does not build trust between leadership and employees and hinders the development of safety culture. One SME also linked anonymous reporting to “chronic complainers” and over-reporting of trivial events, possibly skewing data.

Even with all these reporting strategies, one SME noted that it is important to remember that encouraging self-reporting is still difficult because most people are not naturally self-critical.

Incentives

Some non-DOD SMEs reported the use of incentives to encourage near-miss reporting. Positive incentives include not only recognition or rewards but also a positive response from leadership. Employees will report whatever gets a better, stronger, or quicker response from leadership. However, like anonymous reporting, incentives are linked to over-reporting, and the use of positive incentives was described as “transactional” by one of the non-DOD SMEs, suggesting that reports are motivated by the incentive rather than genuine concern.

How Service and Non-DOD Entities Collect Near-Miss Data (Project Question Three)

How service entities collect near-miss data

We identified the following themes regarding the collection of near-miss data during our conversations with service SMEs: (1) ensuring clear definitions of and thresholds for near-miss data, (2) using standardized reporting systems or forms, and (3) facing certain data collection limitations.

Definitions of and thresholds for near-miss data

Facilitating the process of reporting begins with ensuring that the definitions of and thresholds for a near miss (as opposed to a mishap or hazard) are clear and understood by reporting personnel. One community-level service SME who reported they were not specifically told to follow the DOD data standard definitions. Another design consideration is ensuring that data elements in report forms are standardized. One SME (who noted that they were collecting the DOD data standards but found the data produced to be overwhelming), for instance, said that their entity defined a *near-miss data element* as a “low threshold accident” and lowered the reputational or perceived punitive risk of reporting by communicating clearly that reporting such a near-miss data element is part of a healthy and mature system, thereby detaching reporting from an adverse action to the reporter.

When speaking with service SMEs about how they collect near-miss data, we learned that there are slightly different definitions of a *near miss* with corresponding thresholds. Common among the entities is some type of policy document or instruction that requires near-miss reporting.

The service SMEs we spoke with reported having specific requirements for near-miss reporting for the aviation enterprise but not for non-aviation areas, such as maintenance. Some SMEs stated that non-aviation near misses are treated more like hazards. Thus, reporting them consistently would be too disruptive to normal operations. For example, a report would not be generated for an extension cord that created a trip hazard. In this context, a *hazard* is defined as “any type of real or temporary condition that leads to an event.” A recommendation could be to have the services relay to their servicemembers that, concurrent with that definition, hazards that contribute to a sequence of events that could have resulted in injury, illness, or damage had they not been thwarted are near misses and therefore must be reported.

One service SME provided a notable non-aviation exception in which the mishap reporting process is modeled after the process on naval reactors, which have a goal of never having a Class A mishap. The SME said that their entity uses a 1 through 10 scale to define the thresholds for safety events: 1 is a near miss, 2 is lower threshold, 3 is minor damage, and so forth. Near misses are also categorized as proactive¹⁹ and reactive. A *proactive near miss* is an action taken to prevent a mishap from occurring, whereas a *reactive near miss* is found by mere chance with no directed action. An example of a proactive near miss is the supervisor or manager stopping a lift before a strain when the rigging gear is identified as insufficient. An example of a reactive near miss is when a swinging load nearly contacts a structure because of insufficient taglines. This level of detail, combined with a detailed near-miss reporting system, is an example of how to integrate near-miss reporting into a non-aviation operation.

Promising technology: reporting systems and forms

All the service SMEs we spoke with stated that their entities have a formal system for reporting and collecting near-miss data. These systems are often required by service-level policies that dictate what should be reported in such systems. A wide array of systems and forms are used to collect near-miss data. Some entities use proprietary data-collection systems, whereas others use SharePoint or widely available forms. We also heard about the Airman's Safety App, which provides policy and procedures via a desktop computer or tablet at the point of use. At least one service SME reported having an email address and phone number to collect near-miss data on a manual form. Yet, the SME reported that this form is now the least used reporting mechanism and that they collect more data via a mobile app.

Several service SMEs indicated a desire to use technologies such as artificial intelligence or machine learning models, natural language processing, and large language models for near-miss reporting, but at the time of our discussion, they did not believe that they had the ability to make use of these technologies.

Data collection limitations

Several service SMEs reported challenges with collecting near-miss data. The most common challenge was resources (i.e., funding and personnel). The lack of resources for Human Factors Analysis and Classification System (HFACS)-trained investigators was mentioned as a limitation to investigating all near misses. Thus, the focus is primarily on Class A and Class B mishaps. The challenges with personnel resourcing also extend to field teams performing

¹⁹ The term *proactive safety* is often used in the aviation enterprise in association with near-miss reporting systems.

assessments and audits in which evaluations are spread out over longer time periods with shorter engagements.

The resourcing challenges also affect the ability to report near-miss data; some service entities report having to make strategic decisions about what they can report.

How non-DOD entities collect near-miss data

We identified the following themes regarding the collection of near-miss data during our conversations with non-DOD SMEs: (1) ensuring clear definitions of near-miss data, (2) prioritizing data collection, (3) using web-based near-miss data applications, and (4) using automated data collection systems.

Definitions

The non-DOD SMEs we spoke with defined *near misses* in a way that closely matched our existing understanding. Several SMEs noted that their definition is “an unplanned event that did not result in consequences,” although one SME mentioned that near-misses could include events projected to have future consequences. One SME noted that their entity defines a *hazard* as “a variable with harm-causing potential” and a *near miss* as “an event with harm-causing potential” and gave the example that hazards are like a “shark in the water” and near misses are like “swimming in the water with the shark.” This SME highlighted that there is no difference between a near miss and a mishap until consequences occur.

Prioritizing data collection

The non-DOD SMEs we spoke with had different philosophies about which data to collect. Several SMEs noted that ensuring a simplified data collection process is key to encouraging employees to report data. They noted that requesting too much data might confuse the employee, especially when requesting data that the employee is not aware of or when overburdening the employee with many term definitions. One SME said their entity resolved this issue by prompting employees to insert only information that they knew and having investigators follow up when needed. Another SME noted that their entity trains employees on the “usual suspects” driving near misses.

Several SMEs prioritized collecting certain types of near-miss data. Some collect near-miss data for only near-miss events that could have resulted in a major injury or fatality, a strategy we heard about from only non-DOD SMEs. One SME noted that their entity’s strategy is to collect data on only what their entity could act on, based on interviews, focus groups, and panel discussions with key personnel. Similarly, another SME noted that their entity disseminates near-miss data based on the department that could act on the data.

Promising technology: web-based near-miss data collection applications

More than half of the non-DOD SMEs we spoke with noted that they collect near-miss data through an intranet, internet, or mobile platform. Several non-DOD SMEs mentioned the importance of ensuring that as many types of employees as possible have access to reporting systems and ensuring that obtaining the access is simple. For example, one SME noted that their organization post QR codes that link to the reporting system around the building so that employees can access it easily. This process also involves educating employees on the use of the reporting system and ensuring that they have access to their cell phones to access the reporting system.

Another SME noted that their entity made its app-based reporting system easier for employees to use by prepopulating fields, although the SME mentioned that challenges of this reporting system include miscellaneous, free text, or “other” fields leading to unstructured data, sections irrelevant to the reporter, and mistaken entries. One SME noted that one promising practice is deliberately including nonsensical questions to determine whether reporters are paying attention and inputting information accurately. This SME also mentioned that their entity’s system automatically flags suspicious reports. One SME noted that their entity tries to encourage young people to use a near-miss reporting app by stylizing near-miss reports as social media posts.

Several non-DOD SMEs mentioned large language models (or similar tools, such as artificial intelligence or machine learning) as a promising technology to assist with processing web-based reports. One SME noted that their entity uses artificial intelligence and natural language processing to “read” through report text and categorize it into different issues. One SME noted that their entity uses large language models to correlate reports with injuries and contributing factors such as weather and airport congestion.

Promising technology: automated data collection systems

Unlike the service SMEs we spoke with, most of the non-DOD SMEs we spoke with noted that their organizations have some form of automatic data collection, typically related to their ground and air vehicles. Cameras typically collect data on near-miss events autonomously from ground vehicles, such as hard braking, near collisions, speeding, and stability interventions. Air vehicles enhanced with Internet of Things-enabled sensors collect data on near-miss events, although SMEs did not provide greater detail on what data elements the sensors collected. One SME mentioned non-vehicle-related automated data collection that involves wearable sensors that collect data on construction workers engaging in risky behavior, such as jumping and running, and accidents, such as falls.

Several SMEs noted the benefits of using automated data collection for performance improvement for individual vehicle operators. Some SMEs noted that this automation could take the form of a voluntary self-improvement approach, such as an in-flight system providing pilots with data comparing their performance to that of other pilots so that they could choose to make appropriate adjustments. One SME noted that telematics informs drivers of particular behavior to correct before alerts are sent to leadership. However, some non-DOD entities did note that infractions identified during the automated data collection process could result in mandatory placement in training or discipline, as appropriate. Conversely, some SMEs noted that vehicle operators could see cameras as an “exoneration” tool to prove that they did not commit any infractions during or leading up to an event.

One SME described challenges to automated data collection, including cameras glitching or being damaged and Wi-Fi outages.

How Service and Non-DOD Entities Analyze and Report Near-Miss Data (Project Question Four)

How service entities analyze and report near-miss data

We identified the following themes regarding near-miss data analysis and reporting during our conversations with service SMEs: (1) the importance of multiple avenues for internal and external information sharing to increase understanding of lessons learned and (2) the ubiquity of conducting frequency and trend analysis.

Internal and external information sharing

Once service entities collect near-miss data, they may share it within their own service and across other services via multiple means and methods at various levels. For example, one service SME noted that their entity prioritized analyzing data that had service-wide implications, whereas another service SME noted that their entity may distribute near-miss information through magazine publications and distribute lessons learned at the command level. Similarly, one service SME noted that their entity may promote promising practices at the squadron level in the ready room through “true confessions,” a process of talking through near-misses to avoid reoccurrence.

Our discussions with service SMEs revealed that DOD is paying more attention to breaking down stovepipes among the services over the past few years. To this end, these entities have developed a common reporting system to facilitate sharing of data and information. The services now discuss mishap and near-miss data on a weekly basis. Specifically, a working group meets to discuss near-miss reporting systems, share reports and raw data, look at precursors to events, and see where stovepipes can be broken down.

Dashboards, such as Power BI, allow most commands to access near-miss data and use these data efficiently for decision-making. One of the unique advantages of dashboards is that they allow end users to determine the specific information that they want exported or displayed in their dashboard. One SME cautioned that although dashboards can provide useful default reports, leaders must encourage and oversee training for the required analysis skill sets.

Entities may also share near-miss data externally. For example, we learned of government and corporate partnerships for sharing near-miss data, some of which involve foreign partners. One SME noted that because of the nonprivileged status of near-miss data, they were able to share factual data, investigation analysis, and mitigation strategies from near-miss reports with external partners, such as partner nations and corporate or academic partners. Sharing near-miss data with partner nations can help build relationships and communication, such as risk communication about US aircraft, which partner nations might fly. Sharing near-miss data with corporate or academic partners assists in helping those partners improve aviation platforms or technology used by aviators. Similarly, sharing near-miss data with academic partners broadens service entities' analytic capabilities to develop risk mitigation strategies.

Frequency analysis, trend analysis, and beyond

Frequency analysis and trend analysis are the most common data analysis practices for the service SMEs we spoke with, including both service-wide and community SMEs. They often resort to using near-miss data to count the number of reports or the trend in reporting on a particular topic. When negative trends emerge, decisions must be made to mitigate risks.

Beyond frequency and trend analysis, the service SMEs we spoke with use risk assessment that ties frequency and severity into a matrix of probabilistic analysis. During our discussions, we noted a desire to be able to use advanced analytics (e.g., natural language processing, large language models, predictive analytics), but discussions about their use are currently at the conceptual level in many places. Service entities may wish to explore some of the near-miss analysis types that we identified in our literature review, found in Appendix B: Non-DOD Near-Miss Systems.

How non-DOD entities analyze and report near-miss data

We identified the following themes regarding near-miss data analysis and reporting during our conversations with non-DOD entities: (1) scheduling leadership review of data, (2) organizing dedicated data analysis groups, (3) conducting trend analysis, (4) conducting root cause analysis, (5) conducting risk analysis, and (6) sharing data analysis results through dashboards.

Leadership review of data

Several non-DOD SMEs we spoke with noted the importance of having regularly scheduled executive or leadership meetings to review the data after they are collected. These meetings

consist of executive team members prioritizing looking at significant near misses and injuries, receiving reports from division leads, discussing how data are used, monitoring trends, providing risk registers, and discussing what actions can be taken about the data, such as changes in standard operating procedures and disciplinary procedures.

Dedicated data analysis groups

More than half of the non-DOD SMEs we spoke with explicitly mentioned having a dedicated in-house data analysis or data science team. One noted that a goal of their entity's dedicated data analytics team is to eliminate the "actual hurt level," a data element capturing the level of physical damage that occurs within an organization. For example, according to the SME, safety personnel may report that an event had a hurt level of moderate hurt, severe hurt, or multiple fatalities. This SME also noted that data analysis groups should prioritize reducing the actual hurt level as opposed to the total recordable event rates or the number of reported events. These rates may be decreasing, but this reduction might not correlate with the number of serious injuries and fatalities, which better captures the actual hurt level that the entity is trying to reduce.

Trend analysis

Similarly to the service SMEs we spoke with, most of the non-DOD SMEs we held discussions with noted that they conduct some form of trend analysis.²⁰ Several of them mentioned that their trend analysis involves looking for statistically significant factors or trends, and one SME noted that significance is determined by the trend's p-value. Several SMEs noted that they try to look for "breaks" in the trend line when conducting trend analysis, and one SME noted that they examine trends to determine whether certain safeguards are effective. One non-DOD SME also noted that they conduct a time series analysis to assess multicollinearity, or to determine which variables are correlated with each other. This SME also identifies statistically significant risk factors and ranks them in descending order.

Several non-DOD SMEs cautioned about false interpretation of trends, noting that increased reporting of near misses does not necessarily indicate that more near misses are occurring. Entities analyzing near misses may need to conduct either supplementary analyses or follow-up investigations to determine this answer. Although non-DOD SMEs frequently discussed their experiences with trend analysis, several noted that they do not believe that predictive analytics work. One SME stated that they lack available data for predictive analytics, and another SME noted that they are unable to predict at a high enough threshold.

²⁰ We did not ask SMEs about the quality of their data with regard to this particular type of analysis.

Root cause analysis

OSHA defines *root cause analysis* as a process to identify a “fundamental, underlying, or system-related reason why an incident occurred that identifies one or more correctable system failures” [28]. Most of the non-DOD SMEs we held discussions with noted that they conduct some form of root cause analysis, although this analysis could take different forms. Several non-DOD SMEs mentioned that this process begins by defining an issue or outcome variable, such as a failed inspection or behavior that falls below a predetermined safety threshold. Next, the events leading up to the outcome variable are examined to determine which steps in the process did or did not work, the potential consequences for each step not working, what safety barriers worked or failed, where there was a breakdown in the process, and whether there were single items that “changed everything” [29].

When conducting root cause analysis, one SME noted the importance of attempting to get the complete picture of the event. This SME noted that they evaluate reports from different types of employees and conduct follow-up investigations to learn additional information when needed. One SME also noted that when the root cause analysis is complete, they code the data to determine what type of solution, such as employee training, is needed.

Risk analysis

Almost half of the non-DOD SMEs we held discussions with mentioned that their organizations conduct some form of risk calculation. Several SMEs noted that their calculation of risk includes analysis of both the potential severity and the potential frequency of a near-miss event. One SME noted that they calculate severity estimates by looking at consequences that would have occurred without employee intervention. One SME noted that they do not look at event probability because they believe that events will eventually happen; instead, they focus on building safeguards for harm mitigation.

Promising technology: dashboards

Several non-DOD SMEs mentioned that after they analyze near-miss data, they use dashboard platforms, such as Power BI, to display results. One SME noted that they use these dashboards to share results with managers because dashboards allow users to “dig in” to major contributors to negative outcomes.

How Service and Non-DOD Entities Use Near-Miss Data to Improve Safety Processes (Project Question Six)

How service entities use their near-miss system to improve safety processes

We identified the following themes regarding the use of near-miss systems to improve safety processes during our conversations with service SMEs: (1) information-sharing practices, (2) involvement of higher authority, and (3) empowerment of local remedial action.

Information-sharing practices (feedback loop)

The development of lateral and vertical information-sharing practices is a key outcome of analysis for some service entities. Such practices allow them to give feedback, test remedial activities, and disseminate promising practices more widely. The practice of seeking opportunities for institutional learning from minor or near-miss events is seen as a preventive approach to identifying risks and antecedents of major mishaps. Information sharing can take a variety of forms, but often includes dedicated semiannual (or quarterly or monthly) meetings and briefings to review analysis findings with key stakeholders and leadership and can involve developing material changes and training programs.

Other informal means for information sharing include distributing newsletters or magazines on lessons learned and promising practices to avoid issues reoccurring. One SME also described the sharing of formal reports and even spreadsheets of raw data (for technical audience users). This vertical and lateral communication could also extend to civilian contractors and vendors (original equipment providers) as well as foreign entities (using nonprivileged hazard information or via information-sharing constructs such as the North Atlantic Treaty Organization (NATO) and FVEY ("Five Eyes"))²¹ to institute a continuous ecosystem or enterprise-wide system of learning and improvement. One SME also considers deliberate lateral information sharing an important remedy for overcoming the tendency of intraservice stovepiping. The same SME also reported extending this lateral information sharing to interservice information sharing via a memorandum of understanding. SMEs also

²¹ One SME noted sharing non-privileged near-miss and hazard data with NATO and FVEY.

emphasized the importance of following up to ensure that new information and standards are being used and implemented.

A key component of vertical information sharing is regular analysis by higher level command that aggregates local unit-level analysis to ensure that reporting to higher level commands is consistent with reality. Some SMEs pointed out that they are unsure about or lack visibility into whether the data and reporting that they provide to higher echelons for analysis are used to create tangible changes (perhaps a symptom of lack of reachback and two-way vertical information sharing and communication).

Involving senior leadership

The SMEs we spoke to considered involving senior leadership in appropriate ways as a key force for change at multiple levels. One SME mentioned the importance of having access to advocating flag and general officers with sufficient sway to institute change at the doctrine and training levels. Moreover, transactional-style escalation to authority is an ultimate arbiter of change (if a team is not complying with a policy or reporting standard), but some SMEs noted that the “stick” method often has untoward data outcomes (as with the previously discussed example of poor-quality reporters simply ignoring broad-brush mandates to improve). Other SMEs that had services “upgrade” their authority noted the importance of having adequate institutional sway and seniority with other commands to drive change within their service.

One SME reported that increased oversight increases the number of near misses reported and decreases the severity of accidents. Other SMEs emphasized that senior leader involvement must be appropriately triaged so that only the most severe cases are elevated to their attention (at the one- and two-star level, for instance). A SME suggested that non-flag officers (on their own) could perform the bulk of the risk mitigation process. Senior leadership could also assess assessors or otherwise ensure that mid-level managers and inspectors are leading safety programs properly.

Local corrective action

One theme that emerged during our service discussions is using the near-miss reporting system to encourage proactive local corrective action without necessarily relying on higher level interventions by more senior leadership. One SME noted that local solutions can in fact feed back into the near-miss analysis process to identify promising practices that can then be more widely disseminated in a given work community. Leadership could empower local-level commands to identify and implement solutions independently and encourage them to share that information laterally and vertically for the organization’s benefit.

How non-DOD entities use their near-miss systems to improve safety processes

We identified the following themes regarding the use of near-miss systems to improve safety processes during our conversations with non-DOD entities: (1) involving leadership, (2) modifying policy and operating procedures, (3) assigning training, and (4) administering discipline.

Leadership involvement

Depending on the result of the analysis, sometimes what is not broken does not need to be fixed; however, it needs to be maintained. Our discussions with non-DOD SMEs revealed that leadership often communicate to employees the need to continue vigilant safety practices and reinforce their cultural standards and principles. This message is usually communicated through internal reports, company-wide email, video messages, or some other form of media. When an issue is identified, however, employees rely on leadership to intervene and communicate the progress of their efforts across the company in the same way.

Modifying policy and operating procedures

Several non-DOD SMEs noted that safety data often drive leaders to establish a new company policy. For example, root cause analysis might identify the need for an extra precaution to prevent adverse events. To enforce this effort, it must be a requirement in the company's standard procedure. For example, one non-DOD entity observed a higher frequency of events at a certain location. This entity was able to identify a lack of adherence to guidelines, prompting a decision to publish a list of safeguards that must be in place before starting work.

Training findings

Safety data may reveal an underlying need to modify an employee's or a team's training or how they are managed or coached. Our conversations with non-DOD SMEs revealed that necessary guidance could be as simple as an email nudge to remind workers of safety procedures if the context is minor or as elaborate as an enterprise-wide revision of training policy and requirements if the problem is extensive.

Discipline

A safety trend analysis might also reveal that an employee is deliberately practicing unsafe behavior. In this case, managers may need to take disciplinary actions. Our conversations with non-DOD SMEs revealed that the type of discipline is likely determined by the frequency and

severity of the behavior—a one-time event might result in a critical conversation with a supervisor, whereas repeated reckless conduct may result in poor assessments, demotion, or termination.

How Service Entities Reflect on the DOD Data Standards (Project Question Seven)

We identified the following themes regarding reflections on the DOD data standards during our conversations with service SMEs: (1) data and reporting overload, (2) challenges with HFACS, (3) attitude toward compliance, and (4) a lack of input from services.

Data and reporting overload

Several SMEs raised concerns about the sheer quantity of data that monitoring programs require. This reporting burden presents a large (and perhaps unsustainable) personnel tax on regular operations that requires organizations to prioritize data collection (e.g., toward mishaps with injuries). For example, one SME argued that one ground crew cannot complete 15 near-miss reports a day in addition to their primary duties. Even SMEs that largely agreed with the data collection standards admitted that data requirements are expansive and burdensome for the services. One SME explicitly stated that they believed that the more fields they required, the less reporting they would get. However, one SME did believe that DOD was working with them to reduce the number of fields required.

Challenges with HFACS

HFACS understanding was a barrier to optimal data collection for one SME we spoke with. This SME described at some length the challenges with implementing HFACS. Several SMEs noted that they have to prioritize Class A and B reporting over Class C and D reporting (much less near-miss reporting). HFACS reporting is also considered to be of lower quality as an input because of the degree of subjectivity involved. Again reiterating the personnel reporting issue, these SMEs described that they do not have sufficient personnel trained in HFACS to do reporting of any category beyond Class A and B mishaps.

Attitude toward compliance

In general, SMEs had a positive attitude toward compliance with the data standards and a desire to improve (e.g., “goal is to never have a Class A mishap,” “get real, get better”). Some

SMEs described their compliance at 95 to 100 percent of the data collection standards. One difficulty is the difference in definitions and terminology that impedes compliance or one-to-one mapping of data collection with the standards, such as the Air Force not having unit identification codes. Another SME described their entity's journey from an old system that did not collect all the old standards to one adopting the new standard—demonstrating a successful pathway for change. One of the strategies this entity implemented was determining which data elements in their old system had the same name as the DOD data standards and conducting a “mapping” process for those data elements that did not to determine how the data they are collecting map to the DOD data standards.

Lack of input

Several service SMEs expressed frustration that they are not fully consulted on DOD data collection standards or that their input is not fully considered or “heard” when they are able to provide their concerns or input. Others, including those generally in agreement with the standards adopted, characterized the joint data standards as an overreach, suggesting that service independence would be difficult for DOD to overcome without soliciting buy-in (because the services, although they do not control the standards, have de facto responsibility in executing data collection and management). However, as previously mentioned, one SME did believe that DOD was working with them to reduce the number of fields required.

Key Findings and Recommendations

The high personnel and property cost of safety mishaps necessitates DOD developing, implementing, and maintaining a comprehensive safety strategy. Part of this strategy should involve optimizing near-miss systems. In support of that strategy, the OASD(R)/FSOH tasked CNA with understanding promising practices related to how service and non-DOD entities optimize near-miss systems, which involves improving near-miss data reporting, collection, and analysis, as well as implementing process improvement strategies related to near-miss data.

We developed the following questions to guide this project:

1. How do near-miss data elements collected by service and non-DOD entities compare to DOD's data standards?
2. How do service and non-DOD entities encourage near-miss reporting?
3. How do service and non-DOD entities collect near-miss data?
4. How do service and non-DOD entities analyze and report near-miss data?
5. What promising practices exist for using technology to collect, analyze, and report near-miss data for service and non-DOD entities?
6. How do service and non-DOD entities use near-miss data to improve safety processes?
7. How do service entities reflect on the DOD data standards?

We gathered our project findings related to these questions by comparing near-miss data elements for non-DOD, DOD, and service near-miss entities and holding discussions with service and non-DOD entities. When reviewing our findings, note that we are unable to determine whether certain promising practices are currently in development at the Office of the Secretary of Defense (OSD) or service level or whether these practices have a causal effect on reducing safety mishaps.

Key findings

In this section, we discuss our key findings and promising practices. FSOH may consider reviewing these practices with the services to determine whether the services are already implementing them; if they are not, FSOH could determine whether these practices would be possible to implement. After those discussions, FSOH could determine whether updates to policy would be beneficial or whether other means could be used to communicate and

encourage the most viable promising practices. Both the service SMEs and non-DOD SMEs we spoke with noted that fostering a healthy culture is a key contributing factor in encouraging near-miss reporting, with the understanding that building this culture can take years. Elements of this culture mentioned during our discussions included self-criticality, accountability, teamwork, leadership, proactivity, trust, and voluntary participation. Service SMEs we spoke with suggested that leaders should gain organizational self-knowledge and assess their organizational culture to ensure it engenders trust and encourages voluntary participation. Part of this strategy may include framing near misses as healthy data elements or as opportunities to solve a problem before it becomes a mishap, highlighting noteworthy near-miss reports with the relevant community to create a positive feedback loop with potential reporters (although this practice might not be possible with anonymous reporting), and ensuring senior leader presence in encouraging a near-miss safety culture by having them encourage proactive reporting and by providing direct reporting channels to commanding officers. Service and non-DOD SMEs we spoke with also mentioned the importance of maintaining the anonymity of reporters and cultivating a blame-free environment. They noted that these strategies prevent a fear of reprisal among potential reporters, removing barriers to future reporting. Finally, both the service and non-DOD SMEs we spoke with noted the importance of ensuring that near-miss reporting is an easy process. Strategies such as requiring only a few fields (e.g., only fields that the reporter believes were contributing factors to a near miss) or autopopulating fields would simplify and speed up the experience for near-miss reporters. Also, non-DOD entities stressed the importance of ensuring a collective understanding of definitions of event categories to ensure reporting remains easy and to avoid misinterpretations that may impede accurate reporting.

Both the service and non-DOD SMEs we spoke with prioritized the collection of certain types of near-miss data over others. In our coding of the DOD data standards, we noted that DOD does not collect data on the potential injury level, potential fatality level, or potential property damage level for near misses. However, our coding of non-DOD near-miss data elements and our conversations with SMEs from non-DOD entities revealed that they do collect these data, and for some entities, leaders instructed potential reporters to report only near misses that could have resulted in a major injury or fatality. In our comparison of DOD and non-DOD data elements, we also found that DOD does not explicitly collect data on certain types of systemic factors, such as a human or procedural error, a recurrent or previous issue, an equipment system failure, or an unexpected mission occurrence (such as flight anomalies).²² Finally, one service SME noted that they found collecting HFACS information challenging because few personnel are trained on that system; they also suggested that trained human factors investigators are few in number and better utilized for analyzing safety mishaps. A few non-

²² A detailed list of systemic factors can be found in Appendix D: Systemic Factors Table.

DOD and service SMEs noted that they are considering the potential of large language models to process and categorize near-miss reports automatically. We heard about automated near-miss data collection, typically through the use of cameras and sensors on moving vehicles, from only non-DOD entities.

Both the service and non-DOD SMEs we spoke with tended to conduct frequency or trend analysis on near-miss data and were skeptical of the possibilities of predictive analytics. Both types of SMEs mentioned that after they collected and analyzed near-miss data, the next step was review by key leaders and stakeholders, often facilitated through the use of dashboards, such as Power BI. Non-DOD SMEs in particular highlighted the need for regularly scheduled executive or leadership meetings to review near-miss data, prioritize significant near misses, provide risk registers, and discuss actions to be taken about data, such as changes in standard operating procedures and disciplinary procedures.

Although the service and non-DOD SMEs we spoke with both mentioned leadership as a key factor for developing improvements based on near-miss data, non-DOD SMEs noted that leadership's primary role is to reinforce vigilant safety practices and safeguard the reporting culture, whereas service SMEs viewed leadership as more of a necessity in the appropriate authority to make changes at the doctrine and training levels. However, some service SMEs did note that they are unsure whether data shared with higher echelons are used to create tangible changes. Both service and non-DOD SMEs also stressed the importance of empowering local entities to develop solutions once near-miss analysis identifies recurring issues. The service SMEs we spoke with noted that a key element of creating change is senior leadership involvement. Such involvement consists of tasks such as reinforcing safety messaging, cultivating safety culture, and wielding authority to ensure doctrine or training includes a process for escalating to higher authority levels if near-miss policies are not being adhered to, although some SMEs cautioned that only severe cases should be elevated to the flag-officer level.

Perceptions of the DOD data standards were mixed among the service SMEs we spoke with. Some found the number of data fields required by the standards to be necessary; others found the number of fields required to be expansive and burdensome. Furthermore, several service SMEs expressed frustration that OSD has not adequately gathered their input on the DOD data standards.

Recommendations

Adopting the following recommendations may assist DOD in optimizing its near-miss systems. We based recommendations one and two on gaps that we identified in the DOD data standards for near-miss data elements during our qualitative coding and comparison of non-DOD, DOD,

and service near-miss data elements. We based recommendations three through eight based on promising practices that we learned about through our discussions with SMEs.

1. **Make more apparent within the DOD data standards variables for systemic factors such as procedural errors, recurrent issues, and unexpected mission occurrences (e.g., flight anomalies).** We found this potential gap when we compared near-miss DOD data standards to non-DOD near-miss data elements. Although DOD uses HFACS to understand some systemic concerns, we found that non-DOD entities also include these factors in their near-miss data reporting systems. Making these variables more apparent may allow DOD to identify and address procedural issues more easily, prioritize solving recurring issues, and better understand unplanned events that lead to near misses. These variables could include the following aviation anomalies: airspace violations; air traffic control issues; flight deck, cabin, or aircraft events; deviations in altitude, speed, or heading; procedural discrepancies; ground excursions or incursions; and ground or in-flight events or encounters. They could also include the following non-aviation anomalies: unplanned events, degraded conditions, and performance deficiencies, including fields that indicate whether the reporter had noticed the problem before, whether the hazard was related to a single event or repeated process, whether a communication breakdown occurred, and whether a system (such as a coolant distribution system or fire suppression system) failed (as opposed to a single piece of equipment failing).²³ When these factors are made more apparent, there may be some overlap with HFACS and free text fields for near-misses.
2. **Add an estimate of the potential outcomes of near-miss events (e.g., cost, injury, fatality, property damage) to the DOD near-miss data standards so that DOD can perform more in-depth analysis and better inform resourcing decisions, such as which cases trained HFACS personnel should investigate.** We found that the DOD data standards do not currently require these data elements. However, our discussions with non-DOD SMEs revealed that they prioritize near-miss data collection based on the potential outcomes of near-miss events. DOD may wish to include these data elements so that it can allocate its resources optimally in near-miss data collection, prioritize which sets of data need to be analyzed in greater depth (based on these potential cost outcomes, injury outcomes, etc.),²⁴ and develop near-miss interventions if possible. This process may involve developing a systematic potential-of-harm model with clear definitions of certain types of harm. To develop

²³ A full list of systemic factors can be found in Appendix D: Systemic Factors Table.

²⁴ More in-depth analyses that we found in our literature review included statistical t-test analyses, failure modes and effects analyses, probabilistic risk assessment, fault tree analyses, and event tree analyses. Additional information can be found in Appendix B.

this model, service entities could estimate potential negative outcomes (including fatalities, injuries, lost workdays, and property damage) based on what would have occurred if no barriers were in place for the near-miss event (and a mishap occurred). FSOH may wish to leverage the 5x5 risk assessment matrix popularized by the American National Standards Institute to determine which near-miss events to give the most resources to by relying on reporters to conduct an estimate of the consequences and the probability of the near miss turning into a mishap.²⁵ Service entities should then aggregate the results and note which types of near-miss events the services should prioritize for intervention.

FSOH could use this model to provide potential reporters with clear guidance on which near misses reach a threshold that requires reporting. In addition, during our discussions, one service SME mentioned that differentiating between proactive near misses (i.e., one in which an action was taken to prevent a mishap from occurring) and reactive near misses (i.e., one in which a near miss was prevented through chance rather than directed action) is important. Service entities may wish to prioritize proactive near misses for more immediate attention.

3. **Develop basic training for potential near-miss reporters to identify and classify potential human-related near-miss causes.** One service SME expressed that collecting near-miss data on human factors (such as fatigue or substance use) is challenging because of a lack of trained personnel. OSD could explore providing training on how to point out significant human factors for reporting. OSD or the services could develop this training by first analyzing near-miss data according to the risk assessment model presented in Figure 3 in Appendix A: Near-Miss Analysis Techniques. When OSD or the services have determined which near-miss events have both a high probability and high potential for harm, they can conduct one of the in-depth analyses mentioned in our literature review²⁶ to determine which HFACS fields contribute to most of these prioritized near-miss events. OSD or the services can then work with HFACS SMEs to adapt the terminal learning objectives or the training requirements for those fields for a non-HFACS audience consisting of those likely to be potential reporters for these prioritized near-miss events. For example, if failure to maintain an adequate following distance results in near collisions that could have resulted in fatalities, drivers of involved ground vehicles may receive training on which

²⁵ A graphic of the matrix can be found in Figure 3 in Appendix A: Near-Miss Analysis Techniques.

²⁶ More in-depth analyses that we found in our literature review included statistical t-test analyses, failure modes and effects analyses, probabilistic risk assessment, fault tree analyses, and event tree analyses. Additional information can be found in Appendix B: Non-DOD Near-Miss Systems.

factors may have led to the lack of following distance (e.g., fatigue, poor communication).

4. **Make data entry forms easier and less time-intensive to complete by ensuring that service near-miss reporting systems contain as few fields as possible, autopopulating various fields, having investigators complete various fields, and exploring the possibility of using large language models to assist in the reporting or analysis process.** Both our discussions with service and non-DOD SMEs and our literature review revealed that ensuring that near-miss reporting is easy is key to ensuring that it occurs. Our suggestions for simplifying the process could reduce front-end work, potentially increasing near-miss reporting. DOD may wish to prioritize collecting variables used by non-DOD entities, variables potential reporters may be aware of, and variables on potential harm from near-miss events that would allow DOD entities to focus on certain near-miss events for further analysis. If DOD seeks to reduce the number of data fields required for near-miss reporting, it may wish to remove these non-contributing factors because they are not represented in the other near-miss systems we reviewed and may not contribute to analysis of near misses. In addition, OSD may benefit from ensuring definitions of event categories are collectively understood to make reporting easier and increase report accuracy.
5. **Explore automated data collection beyond the use of standard near-miss data entry forms, such as the use of cameras or sensors to detect hard braking in vehicles.** This potential change would increase reporting for reasons similar to the ones mentioned in recommendation four. However, OSD and the services must consider data security and other concerns if they decide to capture near-miss data elements, such as speed and vehicle proximity, by installing near-miss sensors on vehicles.
6. **Educate the services that hazards that contribute to a sequence of events that could have resulted in injury, illness, or damage if they had not been thwarted are near misses and therefore must be reported.**
7. **Ensure that senior service leadership plays an active role in improving near-miss reporting, analyzing near-miss data, and administering change based on near-miss results.** The role of leadership could include providing direct channels to commanding officers, reinforcing safety messaging, and developing a proactive safety culture (e.g., framing near-miss data elements as healthy data elements or as opportunities to solve a problem before it becomes a mishap). Strong senior leadership and the resulting proactive safety culture are especially necessary for near-miss reporting because near misses result in few to no consequences; therefore, in the absence of leadership and a strong culture, near misses may be swept under the rug. In addition, senior leaders may wish to meet to discuss which near misses should be

prioritized, monitor trends, provide risk registers, and discuss actions to take based on the data, such as developing standard operating procedures and disciplinary procedures. It may be necessary to have leaders either wield the appropriate authority to make changes or escalate the issue to an officer with the authority to make those changes. To summarize, near-miss data are best consumed at an enterprise or service level, where systemic issues can be identified and communicated to the lowest level command that can reasonably develop a solution. If implementing that solution requires a higher authority level than the commanding officer possesses, then an officer with an appropriate level of authority may need to assist.

8. **Review promising practices in the key findings section with the services to determine whether the services are already implementing them; if they are not, determine whether these practices would be possible to implement.** After those discussions, FSOH could determine whether updates to policy would be beneficial or whether other means could be used to communicate and encourage the most viable promising practices.

Appendix A: Near-Miss Analysis Techniques

Similar to most areas of safety data, near-miss safety data analyses use a mix of methods. The following section from our literature review provides a sampling of these techniques and a case study example.²⁷

Incident or risk analysis

Incident analysis often uses a 5x5 risk assessment matrix (see Figure 2), which was popularized by the American National Standards Institute. Safety incidents and near misses are classified and ranked by safety experts according to the severity of the incident's potential consequences and the likelihood of the incident occurring [2]. Figure 2 provides an example that classifies consequences with injuries and fatalities; however, another example could involve organizations classifying consequences in terms of property damage or financial losses.

Figure 2. American National Standards Institute 5x5 risk assessment matrix

	Consequence—Could Cause					
	1: First aid, injury, or minor damage	2: Minor injuries (recordable)	3: Moderate damage (lost time)	4: Permanent disability or fatality	5: Multiple fatalities	
Probability	1	2	3	4	5	1–4 Low Risk
1: Rare						
2: Unlikely	2	4	6	8	10	5–8 Moderate Risk
3: Moderate	3	6	9	12	15	9–12 High Risk
4: Likely	4	8	12	16	20	
5: Almost Certain	5	10	15	20	25	15–25 Critical Risk

Source: [2].

²⁷ We break with the DOD definition and refer to safety events as “incidents” in this section to match the terminology found in the literature.

Frequency and trend analyses

Frequency and trend analyses are the most basic forms of near-miss data analysis that we uncovered. Frequency analysis involves simply determining which portions of an operation report the most incidents (e.g., a nuclear power plant in a series of nuclear power plants). However, one article points out that this method relies on evidence that is “correlational” rather than indicative of a true increase in causal factors. One portion of an operation could simply have more tasks and thus would have a higher propensity for near misses or have more vigilance about near-miss incident reporting and thus capture more data [20].

Trend analysis considers fluctuations within a portion of an operation over time, which may partially account for the issues associated with frequency analysis. However, one article cautions that data that appear to indicate trends may in fact be reflecting highly variable data. As a solution, the article recommends looking at month-to-month or at least quarter-to-quarter changes, rather than year-to-year changes, before determining which portions of an organization warrant further investigations or safety interventions [20].

Statistical t-test analysis

Statistical t-test analysis involves collecting data on near-miss incident frequency and potential contributors to a near-miss incident and determining which potential contributors had statistically significant relationships with near-miss incident frequency [20]. For example, one article discusses a study on an oil rig that determined that the number of hours on duty at the time of an accident and the number of hours worked in the previous 24, 48, or 72 hours before an accident were significantly related to accident propensity [20].

Failure modes and effects analysis

The purpose of failure modes and effects analysis (FMEA) is to identify root causes of near misses and develop improvement hypotheses [13]. Analysts conduct a FMEA by first determining a broad range of failure modes and then narrowing them down to address increasingly specific modes [13].

Probabilistic risk assessment, fault tree analysis, and event tree analysis

A fault tree analysis (FTA) is used to analyze the multiple paths of combined events that contribute to an “undesired event” (such as a near-miss event), whereas an event tree analysis (ETA) is used to analyze multiple paths of combined events that *follow* an “undesired event” and were either successful or unsuccessful in mitigating it [30]. FTAs often make use of diagrams that notate whether certain inputs or events were sufficient to cause an output (which in turn may cause an undesired event) or jointly sufficient to cause an output. The International Civil Aviation Organization uses fire as an example. Fuel, oxygen, and ignition are all jointly sufficient to cause a fire; however, ignition may be caused by a lit cigarette *or* an electrical spark [30]. If data are present, FTAs can employ a quantitative analysis to determine probabilities of each possible input.

ETAs often make use of diagrams that begin with an undesired event and are followed by a series of steps designed to mitigate the event that result in either success or failure. Each path of subsequent successes or failures is labeled as a specific outcome. Similar to the FTA, ETAs can employ quantitative analysis to determine probabilities of each outcome occurring [30]. Probabilistic risk assessments (PRAs) can make use of both FTAs and ETAs. The NRC notes that the goals of its PRAs are to determine “(1) what can go wrong, (2) how likely it is, and (3) what its consequences might be” [18, 31].

Case study from the construction industry

One article presents a case study examining an eight-stage framework for near-miss management in the construction industry [32]. If a near miss is made explicit by the first three stages—*discovery*, *report*, and *identification*—the next step is to prioritize the near miss for analysis. The values of near-miss *prioritization* (V_{nmp}) are calculated from four variables:

- Consequences of a potential accident (C)
- Near-miss possibility (PO)
- Near-miss proximity (PR)
- Near-miss learning value (LV)

where,

$$V_{nmp} = C \times (PO + PR + LV) \quad (1)$$

The weights of V_{nmp} are detailed in the above equation. Those with higher prioritization values reach the next stage, *causal analysis*, to determine a *solution*, either corrective or preventive

measures. The result of the near miss is then *disseminated* and continually *evaluated* for its effectiveness over time.

Appendix B: Non-DOD Near-Miss Systems

NASA Safety Reporting System

NASA developed the NASA Safety Reporting System in 1987 in response to the *Challenger* space shuttle accident. The purpose of this system is to provide an “anonymous, voluntary and responsive” mechanism for NASA employees to report safety issues directly to NASA senior management [33].

NASA’s Aviation Safety Reporting System

NASA also manages the ASRS. The ASRS was developed in 1976 through a memorandum of agreement between the FAA and NASA. The agreement requested that NASA operate the ASRS. ASRS developers feared that having the FAA operate the ASRS would dissuade potential reporting of safety violations, as potential reporters may fear safety reports would lead to sanctions from the FAA due to the FAA’s regulatory nature. The purpose of the ASRS is to provide a “confidential, voluntary, non-punitive” reporting mechanism for aviation events that can produce event data for NASA to analyze and communicate anonymously to FAA decision-makers [34].

NRC’s Accident Sequence Precursor program

The NRC established the ASP program in response to recommendations from the Lewis Committee’s independent review of the Reactor Safety Study and the NRC’s inquiry into the causes of the Three Mile Island event in the late 1970s and early 1980s. The main purpose of the ASP program is to prevent significant accident precursors, which would in turn lead to radiation-based accident prevention. After receiving event reports, ASP program staff conduct qualitative and quantitative analysis to determine whether the event report lists a legitimate precursor and whether it is significant. After the analyses and appropriate reviews, the results are “sent to licensees for consideration as part of its operating experience program” [35].

The International Association of Fire Chiefs' National Fire Fighter Near-Miss Reporting System

The National Fire Fighter NMRS is operated by a program advisory board and funded by a grant from the US Department of Homeland Security. Its purpose is to provide a “voluntary, confidential, non-punitive and secure reporting system” to provide learning opportunities for firefighters, develop risk-mitigation strategies, and advance a safety culture. The program’s advisory board uses data generated from the NMRS to identify near-miss trends and develop risk mitigation strategies and presents the entirety of this information to the firefighter community through reports, press releases, and other online communication [36].

FAA’s Accident Incident Database System

The FAA operates the Accident Incident Database System, which is the FAA’s “official system of record for all accidents and incidents.” The purpose of this system is to share accident and incident data with stakeholders [37].

Appendix C: Additional Methodology Information

How we compared data elements collected by service and non-DOD entities to the DOD data standards

To answer project question one (“How do near-miss data elements collected by service and non-DOD entities compare to DOD’s data standards?”), we collected near-miss data elements from three different sources:

1. Near-miss data elements from non-DOD entities identified through a Google search for near-miss reporting systems²⁸
2. Near-miss data elements incorporated into the DOD data standards we received from the sponsor
3. Near-miss data elements from service entities provided either through the FSOH tasking system or through service SMEs identified by the process below

Our goal for analyzing near-miss data elements was to determine whether there were gaps in terms of (1) categories of non-DOD near-miss data elements not currently in the DOD data standards near-miss data elements and (2) categories of near-miss data elements recommended by the DOD data standards not yet collected by service entities.

To answer these questions, we organized near-miss data elements from the first two sources into categories. Project members examined the set of near-miss data elements for each source and developed a draft list of categories. Project members then convened to agree on a final set of categories. Then, each project member assigned each data element to a category. Project members convened again to resolve any differences in the coding collectively. This process resulted in a final set of categories for sources one and two.

After we established the list of categories, we compared categories between sources one and two to determine whether there were gaps, or near-miss categories found in the non-DOD entity data elements that are not currently included in the DOD data standards. We also compared categories between sources two and three to determine whether there were gaps,

²⁸ Unfortunately, our requests for non-DOD data elements from the non-DOD SMEs faced business proprietary concerns during our discussions.

or categories included in the DOD standards that do not appear to be collected yet by the service entities. We then contacted the service entities to determine potential reasons why they are not collecting the required DOD near-miss data elements to identify potential issues with these data standards for the sponsor.

How we identified non-DOD entities

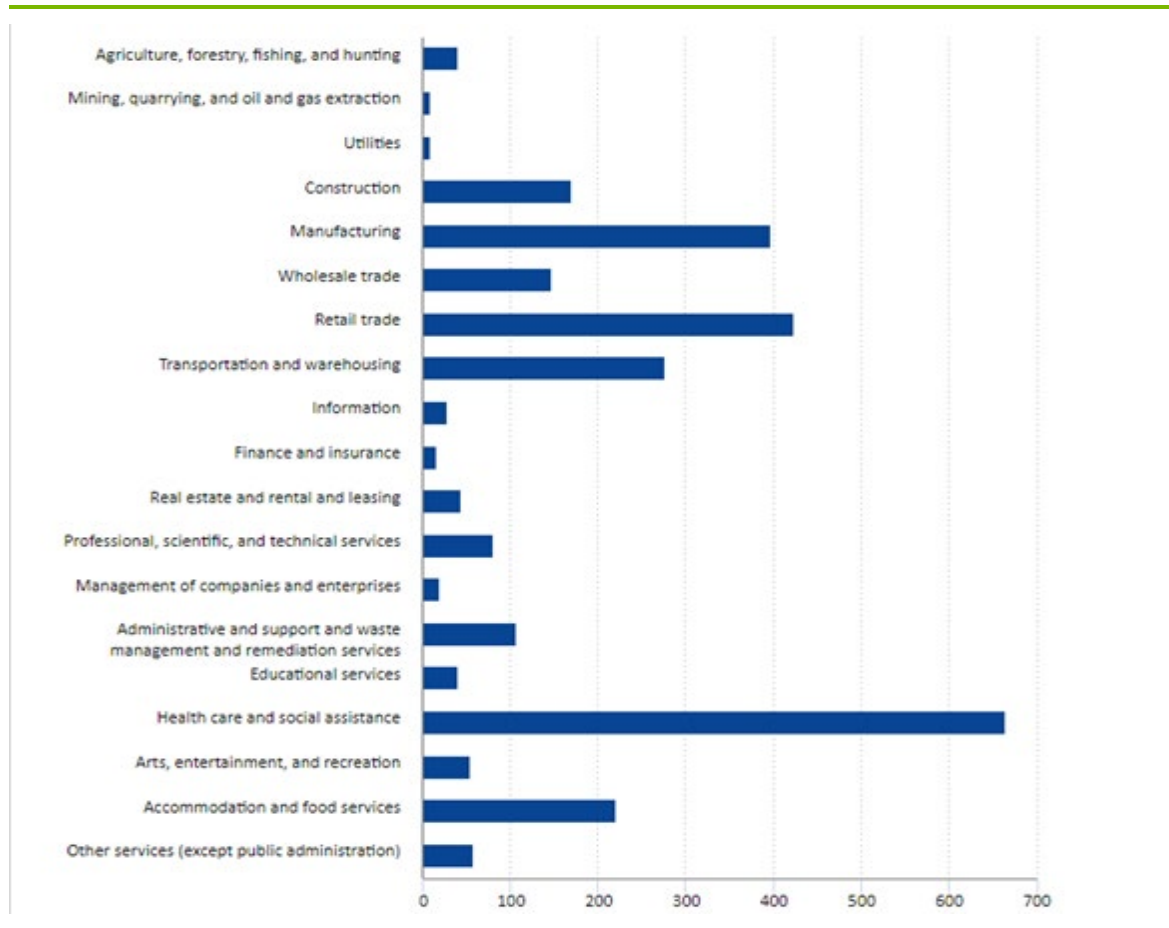
We sought to hold discussions with SMEs from non-DOD entities who had experience operating near-miss systems to learn about their experiences with improving near-miss reporting and their collection, analysis, and process improvement strategies related to near-miss data. To accomplish this goal, we identified businesses likely to have experience operating near-miss systems, focusing on industries with many safety mishaps.

As Figure 3 shows, the industries with the most nonfatal work injuries and illnesses included health care and social assistance, retail trade, manufacturing, transportation and warehousing, accommodation and food services, and construction [38].²⁹ We developed a list of companies for outreach using several websites to determine the largest companies in each of those industries by market capitalization or revenue [39-45].³⁰

²⁹ Nonfatal injuries and illnesses were used instead of fatal injuries because data on fatal injuries did not have the same detailed industry grouping on the US Bureau of Labor Statistics website.

³⁰ We also considered the largest trucking companies and those labeled directly as transportation companies.

Figure 3. Number and rate of nonfatal work injuries and illnesses in private industries, 2022 (in thousands)



Source: US Bureau of Labor Statistics [38].

We contacted approximately 60 companies on our list. We also supplemented our list with the companies that we spoke with in CNA’s previous study on safety culture [3]. We noted in our initial outreach email that we sought to speak with senior safety executives because we believed that they would have visibility on safety data systems at their company, including near-miss systems. We spoke with 12 companies from the fields of health care and social assistance, retail trade, transportation and warehousing, food services, and construction. We also spoke with one non-DOD entity from a government organization that we identified during the data element coding process, which is described in the previous section, for a total of 13 non-DOD entities.

How we conducted a qualitative analysis of discussion transcripts

As we analyzed the discussion transcripts, we sought to identify common themes and promising practices for improving near-miss data reporting, collection, and analysis, and process improvement strategies related to near-miss data (as well as reflections about the DOD data standards from the service entities).

After we developed consolidated transcripts for each of our 18 discussions, we implemented a two-phase qualitative analysis procedure involving the NVivo software tool. During the first phase, project members coded a subset of transcripts to correspond with the themes listed in the previous paragraph. This process involved assigning references from the transcript to particular codes. For example, if a transcript referenced that an entity uses cameras and telematics to collect data, the project member may have included this reference under the “collection of near-miss data” code.

After the initial coding, a separate project member reviewed each subset of coded transcripts, noted any differences, and resolved differences with the original project member’s coding via email. Once project members coded all the transcripts using this method, each project member reviewed the entire set of codes and transcript snippets assigned to the codes and drafted ideas for common themes within each code. Project members then convened to discuss and agree on a common set of themes, or subcodes within each code. Each project member then volunteered to take on a set of the codes (e.g., the collect code and the analyze code) for the second phase.

During the second phase, project members coded their subset of codes according to the themes agreed to in the previous meeting. Returning to the previous example, the project member may have coded “uses cameras and telematics to collect data” within the agreed-upon theme of “automated data collection.” We present these themes and the information contained in them in the Findings section. When discussing the information presented in the themes, we note rough counts of how many entities spoke to a theme. Although we wished to mention which practices came up multiple times during our discussions because this information may be of interest to the sponsor, we do not include hard counts. Including hard counts may have led to misinterpretation of actual practices, as just because certain entities did not mention certain near-miss practices does not mean that they did not adopt them. For example, one entity may have adopted cameras and telematics to collect data but failed to disclose this practice because it did not believe that it was relevant or it believed that information to be proprietary.

Finally, after examining the findings in their entirety, we developed a set of recommendations found in the Key Findings and Recommendations section of this report.

Appendix D: Systemic Factors Table

Table 5 lists the data elements we coded as systemic factors during our coding of non-DOD near-miss data elements and the system in which we located them.

Table 5. Data elements coded as systemic factors

Metric	System
Whether or not you have reported the hazard elsewhere	NASA NSRS
Whether the hazard relates to a single event or a recurring process	NASA NSRS
What you believe caused the hazard	NASA NSRS
What you think can be done to correct the hazard and prevent a recurrence	NASA NSRS
Problem	NASA ASRS
Communication Breakdown (Entity 1)	NASA ASRS
Communication Breakdown (Entity 2)	NASA ASRS
UAS Communication Breakdown (Entity 1)	NASA ASRS
UAS Communication Breakdown (Entity 2)	NASA ASRS
Anomaly.Aircraft Equipment	NASA ASRS
Anomaly.Airspace Violation	NASA ASRS
Anomaly.ATC Issues	NASA ASRS
Anomaly.Flight Deck/Cabin/Aircraft Event	NASA ASRS
Anomaly.Conflict	NASA ASRS
Anomaly.Deviation - Altitude	NASA ASRS
Anomaly.Deviation - Speed	NASA ASRS
Anomaly.Deviation - Track/Heading	NASA ASRS
Anomaly.Deviation / Discrepancy - Procedural	NASA ASRS
Anomaly.Ground Excursion	NASA ASRS
Anomaly.Ground Incursion	NASA ASRS
Anomaly.Ground Event/Encounter	NASA ASRS
Anomaly.Inflight Event/Encounter	NASA ASRS
Anomaly.No Specific Anomaly Occurred	NASA ASRS
Anomaly.Other	NASA ASRS
Contributing Factors / Situations	NASA ASRS
Primary Problem	NASA ASRS
Analysis Type (Initiating Event or Degraded Condition)	NRC ASP
Initiating Event Type	NRC ASP
LOOP Duration	NRC ASP
Hazard Group	NRC ASP
Performance Deficiency	NRC ASP

Metric	System
Precursors by Risk Bin	NRC ASP
Inadvertent SI (safety injections)	NRC ASP
LOCA (Loss of coolant accident)	NRC ASP
LOOP (Loss of offsite power)	NRC ASP
LOOP and SBO (Loss of offsite power and station blackout)	NRC ASP
Loss of CHS	NRC ASP
Loss of Electric Bus	NRC ASP
Loss of Feedwater	NRC ASP
Loss of SDC (shutdown cooling)	NRC ASP
Loss of SW (Service water)	NRC ASP
MSLB (Main Steam Line Break)	NRC ASP
Other	NRC ASP
SGTR (steam generator tube rupture)	NRC ASP
Transient	NRC ASP
EDG (emergency diesel generator)	NRC ASP
AFW (Auxiliary Feedwater)	NRC ASP
SRV (Safety relief valve)	NRC ASP
HPCI (High Pressure Coolant Injection)	NRC ASP
Switchyard	NRC ASP
Safety Injection	NRC ASP
RCIC (Reactor Core Isolation Cooling System)	NRC ASP
RHR (Residual heat removal)	NRC ASP
Recirculation	NRC ASP
SWS (service water system)	NRC ASP
Electrical Bus	NRC ASP
Other	NRC ASP
Flood Protection	NRC ASP
Fire Protection	NRC ASP
CCW (component cooling water)	NRC ASP
MSIV (Main Steam Isolation Valve)	NRC ASP
HELB (high energy line break) Protection	NRC ASP
RPS (Reactor Program System)	NRC ASP
SSF (specified safety function)	NRC ASP
TBV (turbine block valve)	NRC ASP
ABT (automatic bus transfer)	NRC ASP
Isolation Condenser	NRC ASP
CRD (control rod drive)	NRC ASP
LPCS (low-pressure core spray)	NRC ASP
CSS (containment spray system)	NRC ASP

Metric	System
RCP (reactor coolant pumps)	NRC ASP
Instrument Air	NRC ASP
Seismic Protection	NRC ASP
Suppression Pool	NRC ASP
SLC (standby liquid control)	NRC ASP
Tornado Protection	NRC ASP
Do you think this will happen again? (Select only one)	NMRS
Event cause	NMRS
Describe the event (RN Note: Asked to consider following fields)	NMRS
Describe the lessons learned as a result of the incident	NMRS

Source: CNA.

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Abbreviations

AFSAS	Air Force Safety Automated System
ASAP	Airman Safety Action Program
ASP	Accident Sequence Precursor
ASRS	Aviation Safety Reporting System
BASH	Bird Avoidance Strike Hazard
DoD	Department of Defense
ETA	event tree analysis
FAA	Federal Aviation Administration
FMEA	failure modes and effects analysis
FSOH	Force Safety and Occupational Health
FTA	fault tree analysis
FVEY	“Five Eyes”
HAZREP	Hazard Report
HFACS	Human Factors Analysis and Classification System
NASA	National Aeronautics and Space Administration
NATO	North Atlantic Treaty Organization
NMRS	National Fire Fighter Near-Miss Reporting System
NRC	Nuclear Regulatory Commission
OASD-R	Office of the Assistant Secretary of Defense for Readiness
OSD	Office of the Secretary of Defense
OSHA	Occupational Safety and Health Administration
PRA	probabilistic risk assessment
SME	subject matter expert

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