Federal Aviation Administration

Memorandum

Date: JUN 19 2017

To: AVS Services and Offices

From: John J. Hickey, Acting Associate Administrator for Aviation Safety

Subject: Aviation Safety (AVS) Research Strategic Guidance for Fiscal Year (FY) 2020

Thank you for your support in developing the FY 2019 AVS research portfolio. Balancing competing safety requirements against limited resources is a huge challenge. That is why it is extremely important to ensure the research we do in AVS leads to measurable safety enhancements that truly benefit the flying public. In fact, clear identification of the desired outcome is a key value in the AVS Reasearch and Development (R&D) Prioritization Process. I am excited about the path we are on, the continuous improvement we are making the quality of the requirements, and our use of risk-based prioritization and decision-making in our research program.

Looking forward to 2020, we created the attached AVS Strategic Guidance and Process Supplement for development of the FY 2020 R&D Portfolio. As you know, AVS adopts Safety Management System processes and Risk-Based Decision-Making. This guidance supports these approaches with the inclusion of aviation safety hazard and risk data, emerging risks, and guidance on the consideration of System-level Safety Issues in the development of safety outcomes, implementation plans, and research needs. Sponsors should supplement this guidance with additional data and analysis needed to fully identify and assess desired sponsor outcomes.

Although this guidance emphasizes areas that are important to the AVS mission in FY 2020 and beyond, it is not intended to exclude or restrict proposed research requirements. Rather, this guidance is intended to emphasize areas of aviation safety risk that AVS Services and Offices (S/O) and their Technical Community Representative Groups (TCRGs) should consider when developing safety outcomes, implementation plans, and research requirement proposals. This document is not intended to be a checklist used to evaluate the proposed requirements - requirements are evaluated against the criteria in the AVS Prioritization Process. Each S/O may decide to provide additional direction to their divisions and directorates who can then provide the specifics to their line organizations and TCRGs.

Each S/O should review existing research plans, regulations, standards and policy issues, and cross-coordination of S/O needs. This will allow us to develop the best aviation safety research

portfolio possible that balances short and long term safety needs against our ongoing resource constraints. Once we get funding to conduct a project, we have to see the research all the way through implementation and measure it to make sure it is having the intended impact on safety.

By continuing to communicate, collaborate, work together, and improve the program we have in place, our research efforts will make aviation safer tomorrow than it is today. Thank you for your help.

Attachments

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AVS Research Strategic Guidance

Introduction

This document provides guidance for the development of the FY20 Aviation Safety Organization (AVS) Research & Development (R&D) portfolio. This Strategic Guidance identifies some hazards, risks, and safety issues based on samples of data that drive AVS research needs. While the data cover a variety of operations, it is only a subset of extensive aviation safety data that affect the Federal Aviation Administration (FAA), and specifically AVS. This Strategic Guidance provides notional direction only. It is the responsibility of each AVS Service or Office (S/O) to determine research needs within their areas of responsibility that support the AVS mission.

All Technical Community Representative Groups (TCRG) and Office of Primary Interest (OPI) Representatives should develop and update their research plans. Research plans provide an organized long-range focus on critical research requirements, thus enabling AVS to identify and coordinate long-range resource needs, increasing the likelihood that resources are available.

Communication is critical to the successful development of the annual AVS R&D portfolio. Direct questions and comments on AVS research issues to the OPI representative, the AVS S/O Research, Engineering, and Development (RED) Group Member, and the AVS R&D Manager.

Aviation Safety Hazards and Risks for AVS-Wide Consideration

AVS is responsible for responding to today's hazards and risks, as well as preparing for potential risks associated with changes related to the Next Generation Air Transportation System (NextGen), current FAA Strategic Initiatives, and other foreseeable (and unknown) economic and industry trends. Ensuring that regulations and guidance materials maintain relevancy will require the continued implementation of a comprehensive approach, with reactive, proactive, and predictive components integrated into an agency-wide Safety Management System (SMS) framework. The AVS R&D Program is one of the critical tools supporting development of effective means for continued safety improvement.

The FAA Office of Accident Investigation and Prevention (AVP) analyzed data sources to identify some high priority hazards and risks facing the National Airspace System (NAS). Consideration of these hazards and risks during research requirement development will stimulate multi-disciplinary and coordinated efforts across AVS offices and TCRGs, and the development of research requirements that address these hazards and risks. Thus, AVS will be in a position to meet safety goals and responsibilities spanning the lifecycle of certification and continued operational safety.

Risks to Aviation Safety in the Current NAS

Aviation safety data provides a historical basis from which to indicate possible significant high-priority risks to safety in the current NAS. Mitigating these risks has a direct and predictable effect on the reduction of future accidents, incidents and associated human injuries and fatalities.

In accordance with the mission of AVS, research requirement proposals should contribute to the development and implementation of FAA guidance materials, processes, regulations, policy, and/or standards that serve to reduce, mitigate, or prevent high-priority risks. These research proposals should identify the aviation safety data they are based upon.

When developing research proposals, AVS Sponsors should consider safety risk statistics within various aviation sectors and emerging issues identified by subject-matter experts. For example, the percentage of total accidents attributed to the following events is elevated for Title 14, Code of Federal Regulations (14 CFR) Part 121 Operations, as shown in Figure 1 (See Appendix 1 for acronym key):

- Loss of Control – In Flight
- Structural Component or Aircraft System Failures/Malfunctions (Non-powerplant)
- Runway Excursions – Landing

In comparison, as shown in Figure 2, the percentage of total accidents for General Aviation is elevated for the following events:

- Loss of Control – In Flight
- Controlled Flight Into or Toward Terrain
- Structural Component or Aircraft System Failures/Malfunctions (Powerplant)

The percentage of fatal helicopter accidents is elevated for the following events as shown in Figure 3:

- STRIKE – Obstacle and Wire Strikes
- LOC – Loss of Control
- VIS – Degraded Visibility

Risks involving unmanned aircraft spoken of in UAS community include:

- Lost Link
- Flyaway
- Unseen by manned aircraft

Carefully consider trends within aviation sectors when developing research requirement proposals. Each AVS S/O and TCRG should carefully consider these differences and trends and all other related data and activities that may influence research needs and priorities.

Emerging Risks to Aviation Safety

Historical accident data highlight hazards capable of producing severe and negative outcomes, though it is not comprehensive for forecasting future significant risks to the aviation community.

Moving beyond this reactive historical data to include proactive and forecast approaches involves identifying current or emerging hazards with a high likelihood or potential to result in significant safety risks. Proactive and forecast approaches enable AVS to move forward in the research cycle to prevent accidents and manage safety with the changing composition of hazards.

Currently, the Aviation Safety Information Analysis and Sharing (ASIAS) program serves as a central conduit for the exchange of safety information within the aviation community and is a national resource for the aggregation, analysis, and dissemination of aviation safety products. ASIAS is a central repository for data and analytical tools that enables aviation stakeholders to enhance their safety decision making. ASIAS provides metrics for stakeholders on areas identified as known safety risks, such as:

- Unstable Approach
- Midair Collision
- Controlled Flight Into Terrain
- Loss of Control

In addition, ASIAS conducts directed studies or in-depth assessments of safety topics of particular interest to the aviation community, on subjects such as:

- Runway Safety
- Rejected Takeoffs
- RNAV Departures
- Controller-Pilot Communications
- STAR (RNAV) Ops
- Misconfiguration

The results of systems-level modeling of safety outcomes to forecast risk are being developed and validated. This modeling incorporates planned changes associated with NextGen, as well as unplanned changes associated with market trends and fluctuations. In the interim, by reviewing government and industry reports that rely on historical data, statistical trends, and the input of subject matter experts, a short set of near-term, high-priority safety issues emerge that transcend specific implementation plans, technologies, and operational frameworks (as listed below). Each AVS S/O should refer to this set of safety issues for help in identifying relevant domain-specific future hazards and risks:[1]

- Aircraft Mixed Fleet Equipage
- Assurance of Functional Integrity for Critical Systems
- Certification Methods for Complex Systems (for example, software)
- Changing Roles for Air Traffic and Flight Deck Personnel
- Human-Automation Interaction
- Physiology and Human Performance Vulnerabilities
- Information and Systems Security
- Interoperability and System Incompatibilities

[1] This list is not comprehensive; Issues are organized in alphabetical order – placement does not suggest priority.

- System Safety Assessment Methods and Tools
- New types of user technologies, such as unmanned aircraft systems (UAS) and commercial space vehicles

The System Safety Management Transformation (SSMT) program consists of tools to collect data, identify risk, and support risk mitigation evaluation in the NAS, including surface / runway anomalies, terminal / en route anomalies, wake encounters, and NextGen Operational Improvements. Baseline risk metrics are established from multiple data sources, including ASIAS, and future risk assessments can be determined. SSMT's core product, the Integrated Safety Assessment Model (ISAM), supports NextGen and other mission deployment decisions as well as risk-informed rulemaking. In the past, SSMT has supported risk assessments of safety topics including:

- UAS (unmanned aircraft systems) operations
- Airport surface events
- Wake Vortex encounters
- Loss of control – in-flight for general aviation

Each safety issue encompasses multiple hazards and potential risks. For example, research in the area of System Safety Assessment Methods and Tools that addresses increased component and system complexity may also include methods to identify common-cause failures and the introduction of new failure modes. Multiple approaches across AVS S/Os and TCRGs that will mitigate anticipated risks are encouraged for developing responses to these issues.

AVS S/Os should consider additional sources for emerging issues and opportunities for future research, and identify those sources in their requirement write-ups. For example, in fall 2014 the Research, Engineering, and Development Advisory Committee's (REDAC) Subcommittee on Aircraft Safety (SAS) developed a set of Emerging Issues and Future Opportunities to provide input on strategic aspects of the AVS research portfolio. Each year the REDAC SAS carefully reviews proposed AVS research portfolios, provides research recommendations to the FAA, and determines whether the Emerging Issues and Future Opportunities should be changed or adjusted. The SAS has identified this current set of Emerging Issues and Future Opportunities that AVS S/Os may consider as they determine their needs for safety-related research and anticipate future research needs:

https://redacdb.faa.gov/uploadedFiles/REDAC/Full%20Committee%20Meeting%20-%20October%209,%202014/Full%20REDAC%20Report%202014.pdf

- Real-Time System-Wide Safety Assurance
    - Connect and support the joint FAA and NASA Research Transition Team activities
- Dependability of Increasingly Complex Systems
    - Software, Automation, and Autonomy
    - Data Integrity

    - Updated Federal Aviation Regulations (FAR) and Means of Compliance
- Certification of Advanced Materials and Structural Technologies
    - Examples include research into emerging engine issues of hot corrosion, dwell fatigue and inspection techniques
- High-Energy Density Storage, Management, and Use
- Commercial Space Integration with the NAS
- General Aviation's Role in Safety Systems Development
    - Relates to the technologies converging around distributed electrical propulsion and autonomy driving drastic market changes
- Effects of Breakthrough Medical Technologies on FAA Medical Certification Standards

System-level Safety Issues

Under the Administrator's Risk-Based Decision Making Strategic Initiative[2], the FAA established an annual process for identifying, prioritizing, and tracking safety issues that cross FAA lines of business (LOB). The purpose of the process is to proactively identify emerging threats that are most effectively addressed through cross-organizational collaboration to achieve meaningful system-level outcomes. The process is not designed to identify areas of the greatest safety risk, as that would duplicate the issues identified above in the "Risks to Aviation Safety in the Current NAS" section. Rather, the resulting prioritized list is intended as a tool to help FAA decision makers allocate resources. The process recognizes that organizations may already be working to resolve safety issues identified via incidents in the system, yet there may be duplication of efforts due to low visibility, or that the safety issue would be more effectively address through cross-organizational involvement.

In support of the cross-LOB activity, AVS developed an internal process for identifying and managing safety issues that meet the same intent, with particular focus on those most relevant to AVS. The prioritized AVS list of safety issues identified through this process included those derived from AVS safety related analyses and reports. Each AVS S/O had input during the process, and each AVS S/O sent at least one subject matter expert to participate in safety data evaluation and prioritization. Issues and associated mitigations that only affect AVS remained on the internal AVS-only list, while cross-LOB issues were raised to the FAA level.

Examples of previously identified FAA-level (cross-LOB) safety issues include:

- Light Emitting Diode (LED) Lighting in Aircraft Operations
- Runway Incursions
- Inflight Pilot Report (PIREP) Collection and Dissemination
- Potential of Carry-on/Checked Passenger Devices to Cause Fire/Heat/Smoke Incident

[2] FAA Strategic Initiatives: Risk-Based Decision Making: https://my.faa.gov/content/myfaa/en/org/staffoffices/AOA1/Strategic_Initiatives_Group/SIGRisk.html

Examples of previously identified AVS-only safety issues include:

- Pilot Relapse After Substance Dependency/Abuse Rehabilitation
- Laser Illumination – Pilot Incapacitation/ Disorientation
- Sport Pilot Medical Incapacitation Risk

AVS S/Os are encouraged to consider both cross-LOB and AVS-only safety issues, as well as proposed controls and mitigation strategies in determining their research needs. AVS S/Os should identify these safety issues in their research requirement proposals. AVS S/Os are also encouraged to work within their respective S/Os for further information regarding these safety issues and their proposed controls or mitigation strategies. Furthermore, AVS is in the process of maturing that process; therefore, AVS S/Os are encouraged to work within their respective S/Os to identify additional candidates that have been proposed through the new process after publication of this guidance.

Key Technology Areas

There are key technology areas where the FAA has provided research leadership. There are certain areas where FAA is performing research that cannot be duplicated anywhere else in the world. FAA must maintain critical research in areas that make up the backbone of its long-term FAA R&D program. In such cases, FAA has a strategic need to maintain in-house capability and competency to perform research.

Commercial Aviation Safety Team Data

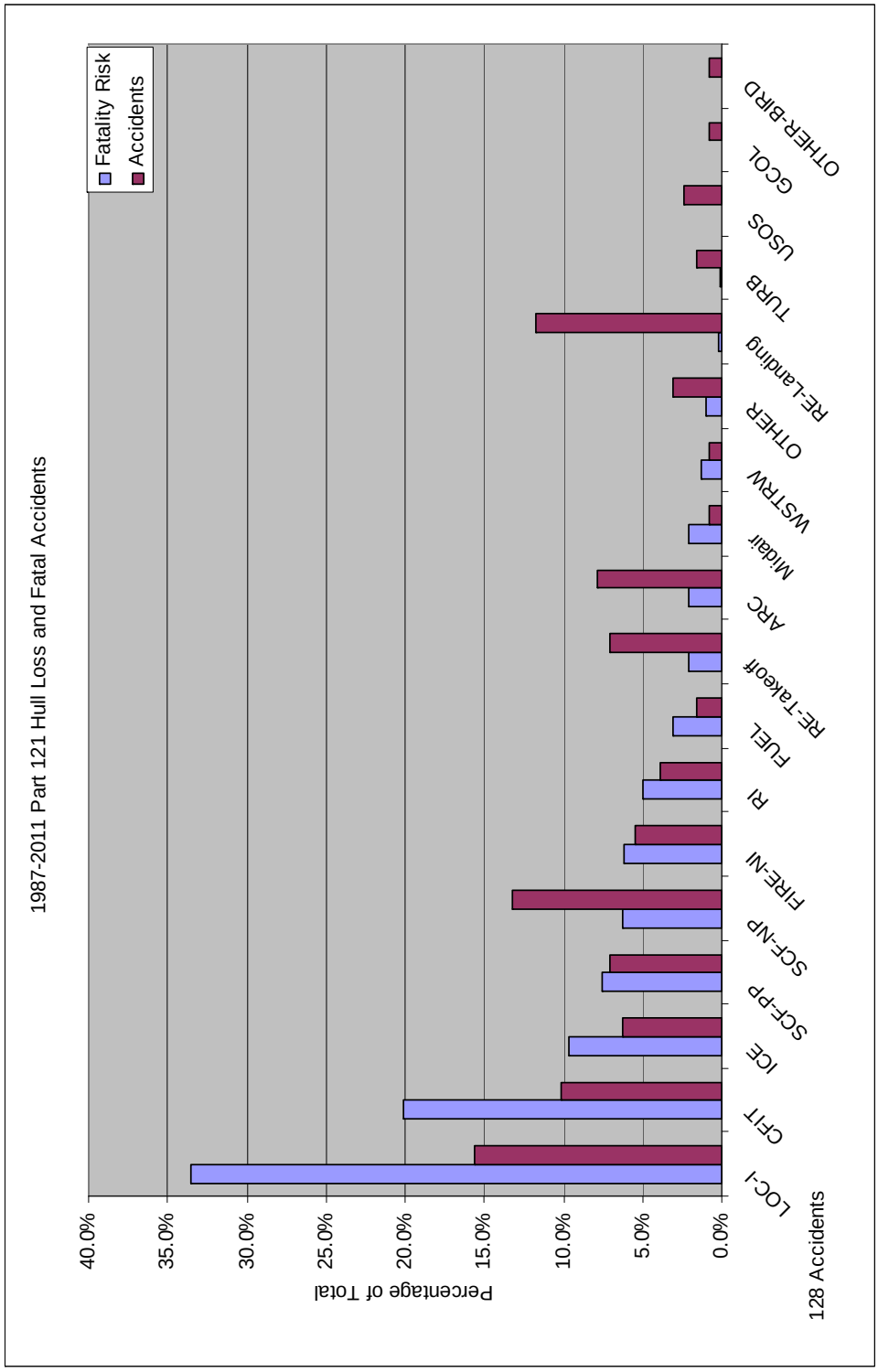

Figure 1

Source: Commercial Aviation Safety Team (CAST) – Domestic U.S. Part 121 Operations

Outcomes: Categorized according to Common CAST/ICAO Common Taxonomy Team (CICCT) – Occurrence Taxonomy

Fatality Risk: Sum of equivalent full planeloads perished per event

General Aviation Data

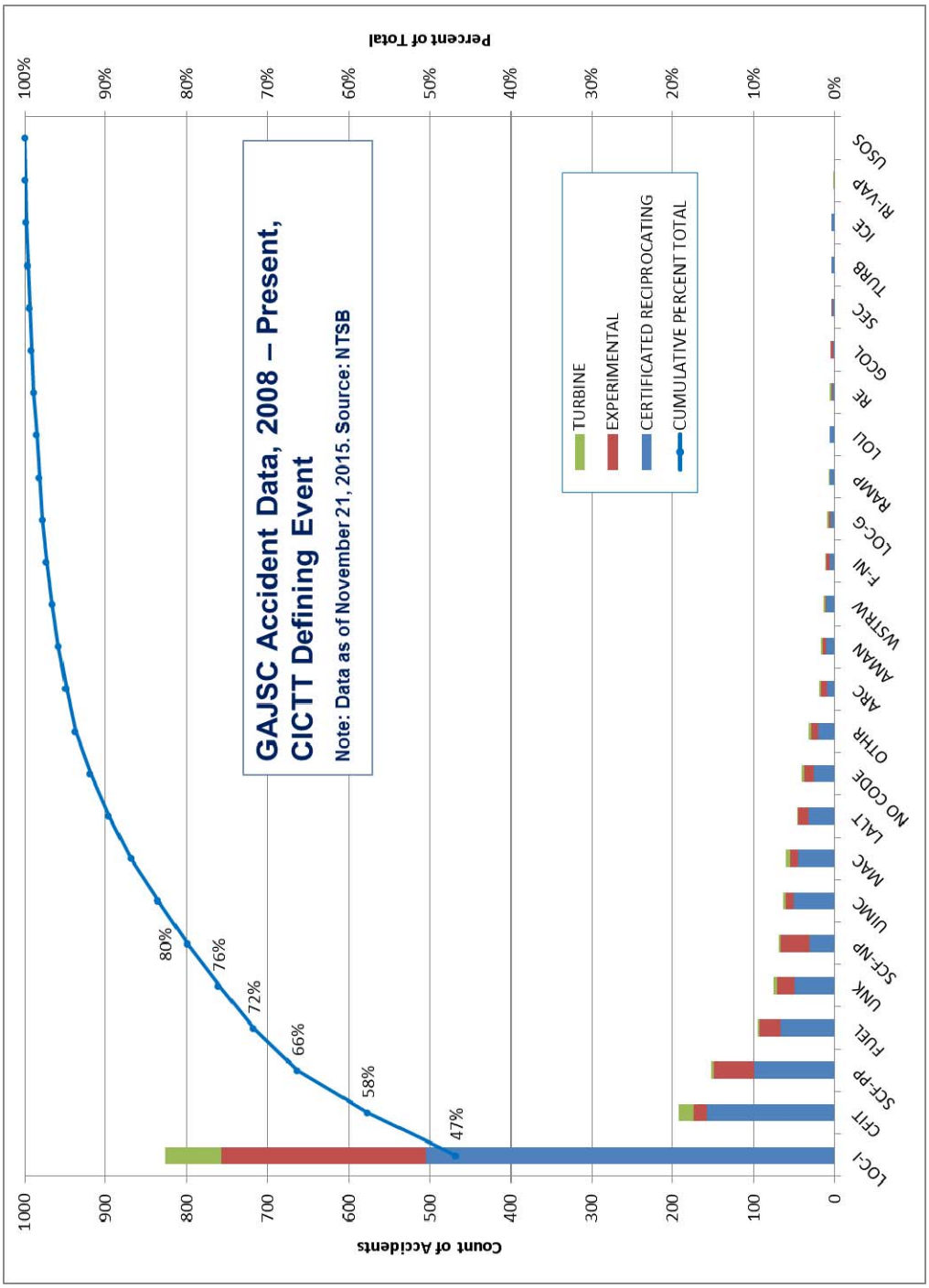

Figure 2

General Aviation Joint Steering Committee (GAJSC) Data Common
CAST/ICAO Common Taxonomy Team (CICCT) Defining Event

Helicopter Safety Team Data

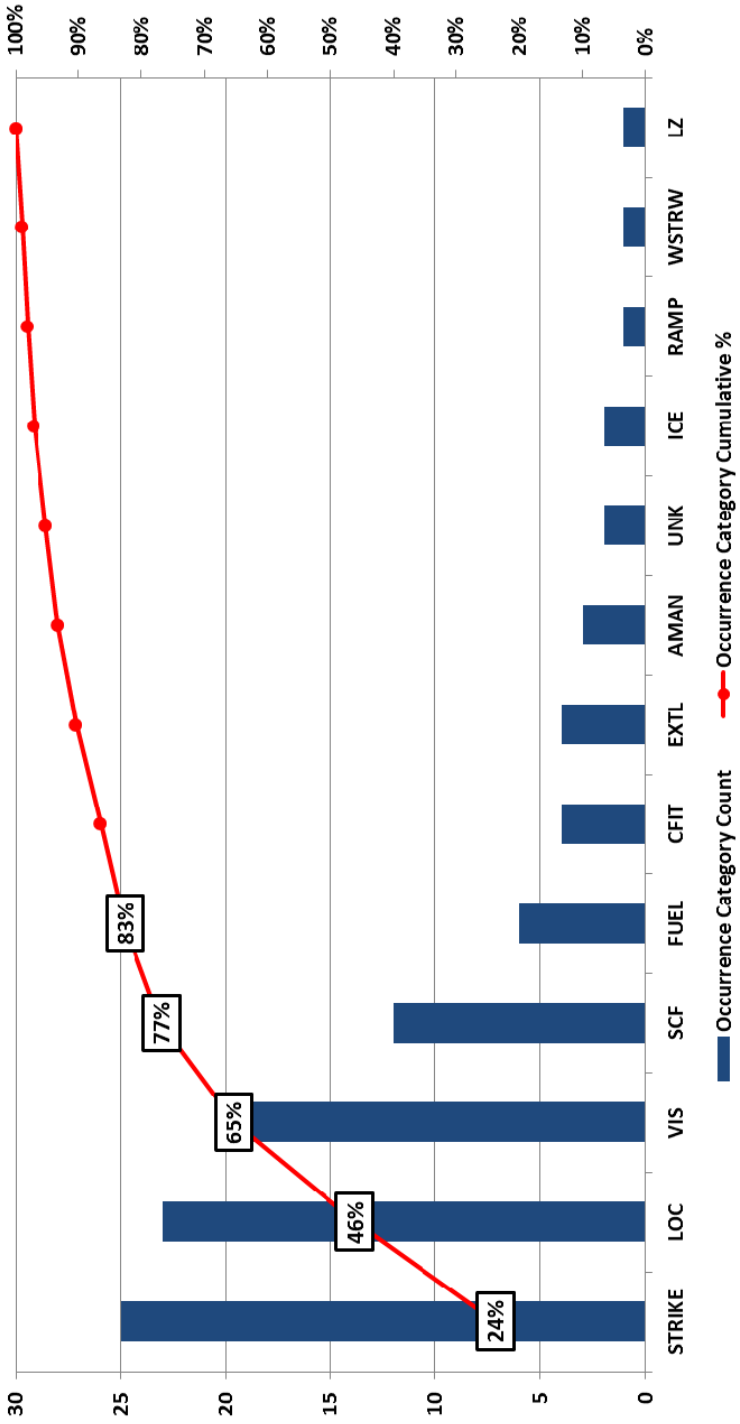

Figure 3
"Priority" Occurrence Category by JHSAT/JHIMDAT Taxonomy
2009 – 2013 (104 fatal accidents)
United States Helicopter Safety Team, March 2014

Appendix 1. Acronyms and Key Terms

ARC: Any landing or takeoff involving abnormal runway or landing surface contact.

CFIT: Controlled Flight Into or Toward Terrain. In-flight collision or near collision with terrain, water, or obstacle without indication of loss of control.

Fire-NI: Fire/Smoke (Non-Impact). Fire or smoke in or on the aircraft, in flight or on the ground, which is not the result of impact.

Fuel: One or more powerplants experienced reduced or no power output due to fuel exhaustion, fuel starvation/mismanagement, fuel contamination/wrong fuel, or carburetor and/or induction icing.

GCOL: Ground Collision. Collision while taxiing to or from a runway in use.

ICE: Icing. Accumulation of snow, ice, freezing rain, or frost on aircraft surfaces that adversely affects aircraft control or performance.

LALT: Low Altitude Operations.

LOC: Loss of Control.

LOC-G: Loss of Control – Ground. Loss of aircraft control while the aircraft is on the ground.

LOC-I: Loss of Control – In Flight. Loss of aircraft control while or deviation from intended flight-path in-flight.

MAC: Midair/Near Midair Collision. Airprox, ACAS alerts, loss of separation, as well as near collisions or collisions between aircraft in flight.

Other: Any occurrence not covered under another category.

Other-Bird: Occurrences involving collisions / near collisions with bird(s) / wildlife

Ramp: Ground Handling. Occurrences during (or as a result of) ground handling operations.

RE-Landing: Runway Excursion Landing. A veer off or overrun off the runway surface.

RE-Takeoff: Runway Excursion Takeoff. A veer off or overrun off the runway surface.

RI: Runway Incursion: – vehicle, aircraft or person. Any occurrence at an aerodrome involving the incorrect presence of an aircraft, vehicle or person on the protected area of a surface designated for the landing and take-off of aircraft.

RNAV: Area Navigation. A method of navigation that permits aircraft operation on any desired flight path within the coverage of navigation aids

SCF-NP: System/Component Failure or Malfunction (Non-Powerplant). Failure or malfunction of an aircraft system or component – other than the powerplant.

SCF-PP: System/Component Failure or Malfunction (Powerplant). Failure or malfunction of an aircraft system or component – related to the powerplant.

STRIKE: Obstacle and wire strikes

TURB: Turbulence Encounter. In-flight turbulence encounter.

UNK: Unknown or Undetermined. Insufficient information exists to categorize the occurrence.

USOS: Undershoot/Overshoot. A touchdown off the runway/helipad/helideck surface.
VIS: Degraded Visibility.
WSTRW: Windshear or Thunderstorm. Flight into windshear or thunderstorm.

AVS Research Process Supplement

The Aviation Safety R&D Prioritization Process 2013 document describes the process for prioritizing and funding FAA Aviation Safety (AVS) research requirements. This supplement clarifies, emphasizes, and modifies specific parts of the process and specifies major submission deadlines.

a. **You must complete all REQUIRED fields on the Requirement Input Document on the AVS RE&D Management System KSN site for each requirement, per instructions**. Incomplete information inhibits the AVS RED Group evaluation of requirements and could result in a low technical ranking so that the requirement does not get programmed for funding. If the sponsor believes there are circumstances where the document cannot be completed, the sponsor should contact the Office of Primary Interest representative or RED Group member for guidance and assistance **before your office's deadline or before the AVS research proposal submission deadline of September 22, 2017**. (For questions concerning the Requirement Input Document and office dates, contact your RED Group member.)

b. **Sponsoring Office Manager Approval:** Per Section 4.5 of the Process, the Sponsoring Office Manager, as delegated by the AVS Service or Office (S/O), must endorse and date each requirement.

   Sponsoring Office Manager Approval indicates that the Sponsor Point of Contact (POC) and the Sponsoring Office Manager listed on the requirement are fully accountable for the requirement throughout the requirement life-cycle.

   The Sponsor POC field should identify only ONE sponsor from the office that owns the implementation and outcome. The Sponsoring Office Management Approval field should identify ONE manager in the direct management chain of the individual identified as Sponsor POC. Multiple sponsorships and Sponsoring Office Manager Approvals may create ambiguity regarding ownership and accountability for the requirement and outcome.

   If multiple AVS S/O's need research in a similar area, each S/O should submit its own requirement, specifying the unique sponsor outcome for each requirement. The Sponsor POC and Sponsoring Office Manager identified in each requirement MUST have authority over the respective implementation plans and outcome identified in each requirement (e.g., AIR personnel and organizations should not be identified as sponsors for topics that specify an AFS outcome and implementation plan). Due to the similarity, each requirement should specify a link to the other in comments.

   When an S/O has an interest in a requirement of another S/O, but no responsibility for an outcome or implementation, the sponsor of the requirement should specify the interested organization in the Other Related Office field in the Requirement Input Document.

   In the unlikely event a requirement cannot conform to these instructions, contact your associated AVS RED Group Members and the AVS R&D Manager for consultation and guidance.

c. **Use plain language.** Please keep in mind that the AVS RED Group reviewing the requirement does not have intimate knowledge of the activity. Please reference the link below for additional guidance on the use of plain language.

   https://my.faa.gov/tools_resources/branding_writing/plain_language.html

d. **Development of Cost Estimates:** In accordance with Section 5.1 of the 2013 Aviation Safety R&D Prioritization Process, the AVS RED Group will distribute an abbreviated list of prioritized requirements that have a reasonable likelihood of funding within the Aircraft Safety budget target. Performing organizations will submit cost estimates for these requirements **not later than December 1, 2017** in accordance with Section 5.2 of the Process. Incomplete information inhibits the AVS RED Group evaluation of requirements and the result could be that the requirement does not get programmed for funding. The performing organization responsible for executing the research will develop the cost estimates in coordination with their sponsors. Only tasks outlined in the requirement write-up should be programmed for funding. In accordance with Section 5.2 of the Process, cost estimates will include fiscal year costs for the duration of the research project. A template for developing cost estimates will be available on the AVS RE&D Management System KSN. Each AVS RED Group member must ensure that the tasking identified in the cost estimates received aligns with the sponsors' research objectives within the requirement. Incomplete or incorrect cost estimates affect programming decisions.

e. **Unbudgeted Research Requirements:** AVS sponsors are reminded that when submitting an unbudgeted research requirement per Section 8 of the AVS R&D Prioritization Process, they may also work with their respective performers as necessary to submit execution plans *in parallel* with the submission of the requirement proposal. Furthermore, you must submit an unbudgeted research requirement in the appropriate fiscal year research portfolio so that it aligns with the fiscal year funding requested. For example, if you request FY16 carryover funding for an unbudgeted research requirement, then you must submit that requirement to the FY16 research portfolio. Unbudgeted research requirements that request multi-year funding support shall submit the "unbudgeted requirement write up" in the current year.

f. **AVS RED Group Member Concurrence:** The AVS RED Group Member represents their Director in the AVS RE&D process, and is responsible for coordinating within their Service or Office, and obtaining concurrence from their Director. The AVS R&D portfolio requires concurrence by each AVS RED Group Member before it receives final approval by AVS-1. Furthermore, each time there are major changes to an approved portfolio, for example, in the events of Continuing Resolution or Sequestration, AVS RED Group Member concurrence is needed to formally accept portfolio changes. A concurrence sheet will be used to document AVS RED Group Member concurrence, as well as to state the impact of the proposed portfolio changes. When signing this sheet, each AVS RED Group Member is representing the position of their respective S/O director, and may provide comments (including proposed alternatives or recommendations) as a condition of their

concurrence; however, additional meetings or discussions among RED Group Members may be required to resolve comments. A sample concurrence sheet signature box is below (Figure 1), capturing concurrence and comments. The total document may also provide impact statements, proposed alternatives, as well as a deadline when concurrence is due to the AVS R&D Manager.

NAME/ORG	CONCUR	CONCUR W/ COMMENTS	NON-CONCUR	NON-CONCUR W/ COMMENTS	INITIALS & DATE
Name 1/AVS					
Name 2/AAM					
Name 3/AFS					
Name 4/AIR					
Name 5/AOV					
Name 6/AVP					
Name 7/AUS					
Comments:					

Figure 1

Sample signature box from AVS RED Group Member Concurrence Sheet

g. **Development of UAS Research Proposals:** In accordance with Section 4.3 of the 2013 Aviation Safety R&D Prioritization Process and in alignment with the mission of the UAS Integration Office (AUS), from this time forward all research proposals for Aviation Safety RE&D funding **related to UAS integration in the NAS** will be considered for funding under the A11L budget line, and coordinated between the sponsoring office and the AUS R&D Division (AUS-300) before submission into the AVS R&D Process. This includes all new research proposals for FY20 and beyond as well as unbudgeted requests from now forward. This will ensure proper coordination between UAS subject matter experts.