



Federal Aviation Administration

Memorandum

Date: **MAY 19 2016**

To: AVS Services and Offices

From: Peggy Gilligan, Associate Administrator for Aviation Safety 

Subject: AVS Strategic Guidance for Development of the FY 2019 Research & Development (R&D) Safety Requirements Portfolio

Thank you for your support in developing the FY 2018 Aviation Safety (AVS) research portfolio. Balancing competing safety requirements against limited resources is a huge challenge. That is why it is extremely important that 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 R&D Prioritization Process. I am excited about the path we are on, the continuous improvement we are making in our research program, the quality of the requirements, and our use of risk-based prioritization and decision-making.

Looking forward to 2019, we created the attached AVS Strategic Guidance (SG) for development of the FY 2019 R&D Portfolio. As you know, AVS has adopted Safety Management System processes and Risk-Based Decision-Making. This SG supports these approaches with the inclusion of aviation safety hazard and risk data, emerging risks, and guidance on the consideration of Significant Safety Issues in the development of safety outcomes, implementation plans, and research needs. Sponsors should supplement the SG data with the additional data and analysis needed to fully identify and assess desired sponsor outcomes.

Although the SG emphasizes areas that are important to the AVS mission in FY 2019 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. The SG is not intended to be a checklist used to evaluate the proposed requirements either—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.

Attachment

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AVS Research & Development Strategic Guidance

Introduction

This document provides guidance for the development of the FY19 Aviation Safety Organization (AVS) Research & Development (R&D) portfolio. This Strategic Guidance (SG) identifies some hazards, risks, and safety issues based upon samples of data that may drive AVS research needs. While this data covers a variety of operations, it is only a subset of the extensive aviation safety data that impact the Federal Aviation Administration (FAA), and specifically AVS responsibilities. This SG 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 (TCRGs) Leads and Office of Primary Interest (OPI) Representatives should develop and/or update their research project 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 necessary resources will be available.

Communication is critical to the successful development of the annual AVS R&D portfolio. Direct any questions and comments about the SG or other AVS research-related 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's Office of Accident Investigation and Prevention 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 determine the most significant high-priority risks to safety in the current NAS. Mitigating these risks will have the most 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 high-priority risks. These research proposals should identify the aviation safety data they are based upon.

When developing research requirement proposals, AVS S/O Sponsors should consider accident statistics within various aviation sectors. 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 Attachment (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)

Finally, the percentage of total rotorcraft accidents is elevated for the following events as shown in two data sets in Figure 3:

- Loss of Control
- Autorotation
- System Component Failure

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 highlights 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 predictive approaches involves identifying current or emerging hazards with a high likelihood or potential to result in significant safety risks. Proactive and predictive

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) framework is useful for identifying trends and emerging risks. This source has previously identified risks likely to become more severe in the coming years, such as:

- Loss of Separation
 - Mid-Air Collisions
 - RNAV Arrival and Departure Procedures
- Breakdown in Pilot-Controller Communication
- Airplane State Awareness

The results of systems-level modeling of safety outcomes to predict and 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
- Human Performance Vulnerabilities
- Information and Systems Security
- Interoperability and System Incompatibilities
- System Safety Assessment Methods and Tools
- New types of user technologies, such as unmanned aircraft systems (UAS) and commercial space vehicles

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.

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

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

portfolios, provides research recommendations to the FAA, and determines whether the list of Emerging Issues and Future Opportunities they identified 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:

- Real-Time System-Wide Safety Assurance
- Dependability of Increasingly Complex Systems
- Certification of Advanced Materials and Structural Technologies
- High-Energy Density Storage, Management, and Use
- Commercial Space Integration into the NAS
- General Aviation's Role in Safety Systems Development
- Effects of Breakthrough Medical Technologies on FAA Medical Certification Standards
- Identification and Segregation of Strategic R&D Needs

Significant Safety Issues

Under the Administrator's Risk-Based Decision Making Strategic Initiative², the FAA is currently developing methodologies for identifying, prioritizing, and tracking Significant Safety Issues (SSIs) that cross FAA lines of business (LOB). SSIs may indicate existing or emerging safety risks needing mitigation to an acceptable level, and they can support decision-making processes in implementing system improvements. In support of this effort, AVS is maturing an internal SSI identification process. Issues and associated mitigations that only affect AVS remain on the internal SSI list, while cross-LOB issues are raised to the FAA level.

The prioritized AVS SSI list includes issues derived from AVS safety related analyses and reports. Each AVS S/O has input during the process, and each AVS S/O sends at least one subject matter expert to participate in safety data evaluation and prioritization. AVS S/Os are encouraged to consider SSIs and proposed controls and mitigation strategies in determining their research needs, and should identify these SSIs in their research requirement proposals.

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 this 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.

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

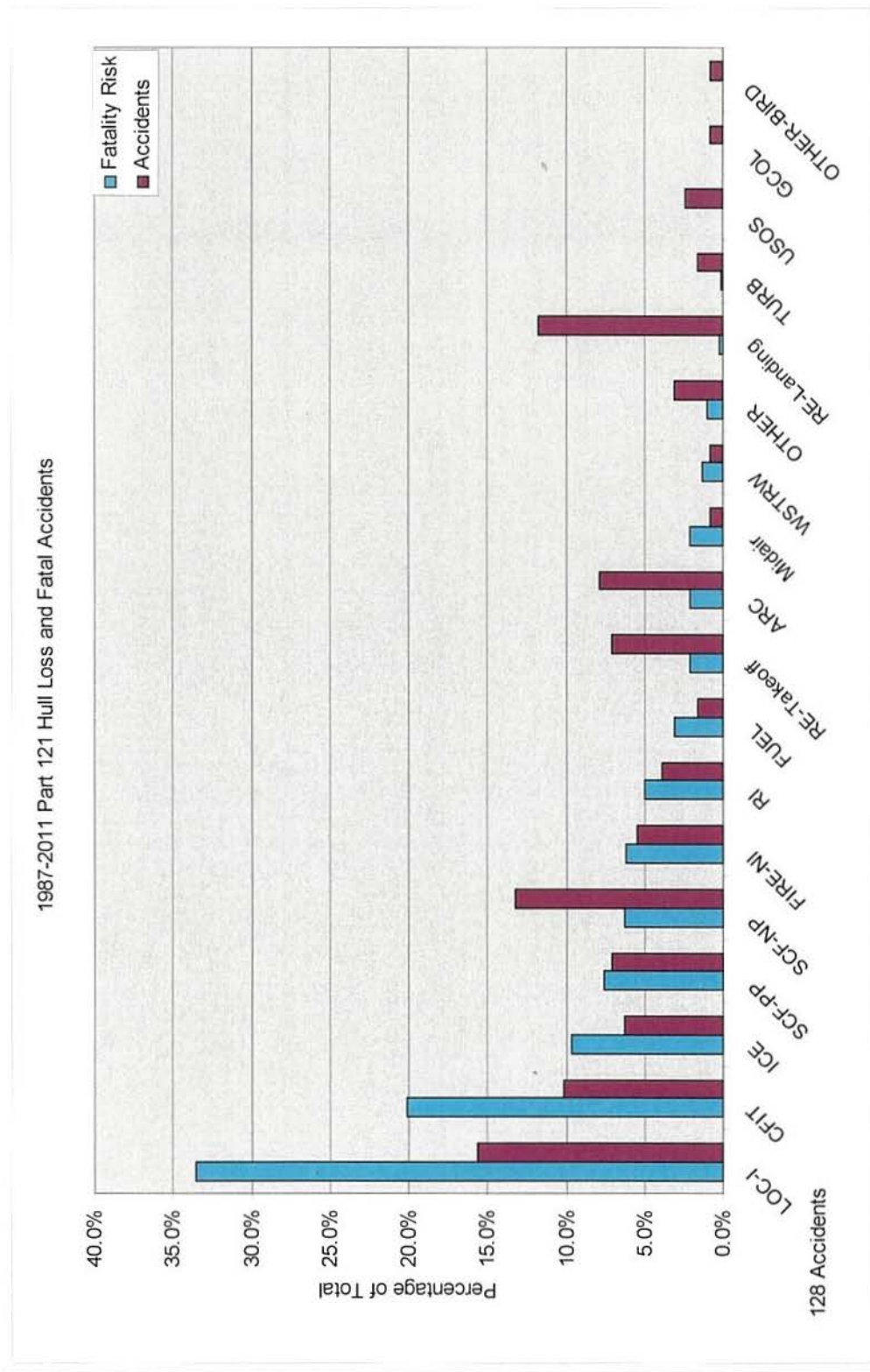


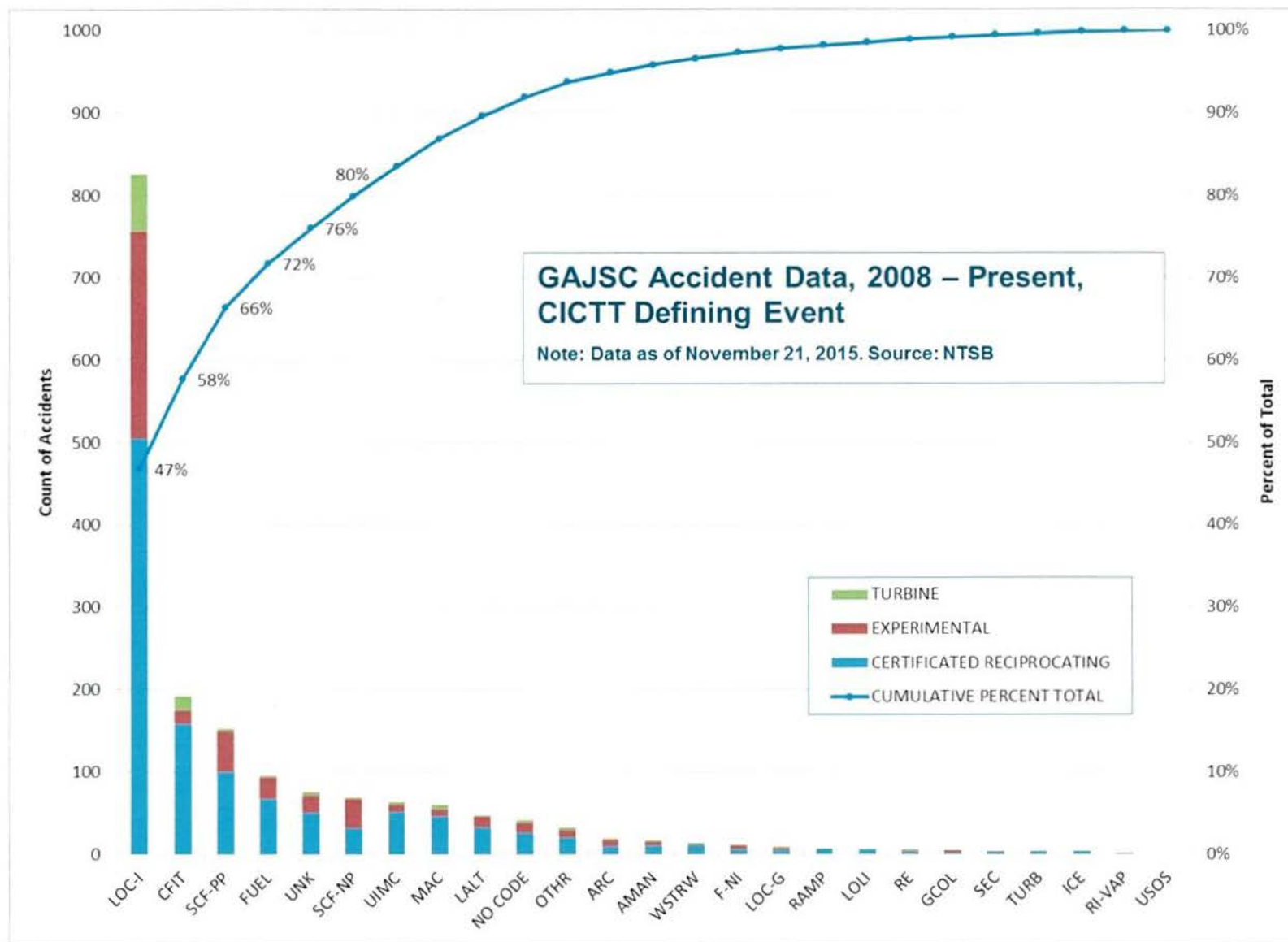
Figure 1

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

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

Fatality Risk: Sum of equivalent full plane loads perished per event

Figure 2



Occurrence Category	JHIMDAT (CY09-11): 415 Accidents	JHSAT (CY00-01,06): 523 Accidents
LOC – Loss of Control	47.5% (197)	41.5% (217)
AUTO – Autorotation	32.8% (136)	31.7% (166)
ARC – Abnormal Runway Contact	24.6% (102)	7.6% (40)
SCF – System Component Failure	21.4% (89)	27.5% (144)
STRIKE	19.8% (82)	16.4% (86)
FUEL	8.2% (34)	7.6% (40)
VIS – Visibility	8.0% (33)	10.7% (56)
FIRE	7.0% (29)	6.1% (32)
CFIT – Controlled Flight into Terrain	6.7% (28)	3.1% (16)

Figure 3

Occurrence Category Comparison

Data from:

Comparative Report, Volume I

U.S. Joint Helicopter Implementation Measurement Data Analysis Team (JHIMDAT) Data to U.S. Joint Helicopter Safety Analysis Team (JHSAT) Data

To The United States Helicopter Safety Team, March 2014

Supplemental Research Requirement Instructions

- a. **You must complete all REQUIRED fields on the requirements submittal form on the AVS RE&D Management System KSN site for each requirement.** The AVS RED Group will not evaluate requirements with incomplete forms. If the sponsor feels there are circumstances where the form cannot be completed, the sponsor shall contact the OPI representative and/or RED Group member for guidance and assistance **before your office's deadline or before the AVS research proposal submission deadline of September 23, 2016.**

- b. **Sponsoring Office Manager's Approval:** Per Section 4.5 of the Process, the Sponsoring Office Manager, as delegated by the AVS S/O, must endorse and date each requirement. This approval confirms the requirement has the review and approval of the sponsoring Directorate or Division manager.

Sponsoring Office Management Approval indicates the Sponsor Point of Contact (POC) and the Sponsoring Office's 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 and the Sponsoring Office Management Approval field should identify ONE directorate or division manager in the direct management chain for the individual identified as the Sponsor POC. Multiple sponsorships and Sponsoring Office Management 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 (identifying the linkage between the AVS requirements), specifying the unique sponsor outcome for each requirement. The Sponsor POC and Sponsoring Office's Manager identified in each requirement **MUST** have authority over the respective implementation plans identified in each requirement (i.e., 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 the Linked AVS Requirements field provided on the AVS RE&D Research Requirement Input Form.

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 organizations in the Other Related Office(s) field in the AVS RE&D Research Requirement Input Form.

In the unlikely event there is a requirement that cannot conform to these instructions; the sponsors should contact the associated AVS RED Group Members and the AVS R&D Manager for consultation and guidance.

- c. **Linked AVS Requirements:** As applicable, requirements with linkages to other AVS RE&D requirements, shall list the specific linking requirement control account numbers and titles, along with a short description of the linking relationship and how the requirements are being coordinated. For assistance with the linkage field, the

sponsor should contact the OPI representative. The linked requirements should cross reference each other.

- d. **Research Connection to Strategic Guidance:** During the April 28, 2014 AVSMT, AVS-1 asked that the research requirements show connection to the Strategic Guidance. To meet this request, a “Strategic Guidance Connection” field has been added to the requirement template. The requirement write-up must indicate whether there is a connection to the SG, and if so must clearly identify the connection. The requirement write-up should refer to data provided in this document, and/or reference additional data sources. Completing these fields will meet the AVS-1 request and will not affect requirement ranking, as these fields are not explicitly part of the ranking criteria. However, you should use **data on safety hazards and mitigations from the sources referenced in these fields in the justifications for the evidence and impact for each of the ranking criteria.** This strengthens the justifications used to determine the ranking. As stated in part (a) above, all required fields must be completed for evaluation by the AVS RED Group.
- e. **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

AVS R&D Prioritization Process Supplement

- a. **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 2, 2016** in accordance with Section 5.2 of the Process. The performing organization responsible for executing the research will develop the cost estimate(s) in coordination with their sponsor(s). 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 FY19 cost estimates is available on the [AVS RE&D Management System KSN](#).³ Each AVS RED Group member must ensure that the tasking identified in the cost estimate aligns with the sponsors' research objectives within the requirement. Incomplete or incorrect cost estimates affect programming decisions.
- b. **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 Requirement Execution Plans (REPs) and Provider Research Execution Plans (PREPs) *in parallel* with the submission of the requirement write-up. Furthermore, you must submit an unbudgeted research within the appropriate fiscal year's research portfolio so that it aligns with the fiscal year funding requested. For example, if you request FY15 carryover funding for a particular unbudgeted research requirement, then you must submit that requirement to the FY15 research portfolio.
- c. **AVS RED Group Member Concurrence:** 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 in order 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 form, 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 in order to resolve comments. A sample concurrence sheet signature box is below (Figure 4), capturing concurrence and comments. The total document may also provide impact statements.

³ Link to RE&D Cost Estimate:

<https://avssp.faa.gov/avs/aviationsafetyresearch/AVS%20RD%20Process/Forms/AllItems.aspx>

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
Name 1/AVS					
Name 2/AAM					
Name 3/AFS					
Name 4/AIR					
Name 5/AOV					
Name 6/AVP					
Name 7/AUS					
Comments:					

Figure 4

Sample signature box from AVS RED Group Member Concurrence Sheet

- d. **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, from this time forward all research proposals for Aviation Safety RE&D funding related to the safe integration of UAS in the NAS must be made through the UAS TCRG. This includes all new research proposals for FY19 and beyond as well as unbudgeted requests from now forward. This will ensure proper coordination between all of the UAS subject matter experts, in keeping with the function of the TCRG.

Attachment (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: Fuel related. 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-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.

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.

WSTRW: Windshear or Thunderstorm. Flight into windshear or thunderstorm.