Helicopter Emergency Medical Services (HEMS) Safety Risk Management Document (SRMD)

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Executive Summary

A safety risk assessment has been conducted on the proposed transition of the Helicopter Emergency Medical Services (HEMS) system from the Experimental Aviation Digital Data Service (ADDS) platform to the operational ADDS platform operated by the National Weather Service Aviation Weather Center in Kansas City, MO. The purpose of this proposed change is to improve the reliability, availability, and maintainability of the HEMS weather tool. After many years of use in an experimental environment, the user community will benefit from a more stable platform. The HEMS weather tool entered operational use by the HEMS community in 2006, and was specially designed to meet the needs of low-altitude Visual Flight Rules (VFR) emergency first responders. The HEMS weather tool is currently referenced in the HEMS Operations Specification (OpSpec), Paragraph A010.

The HEMS weather tool itself is not considered a weather product; it is aggregated data, selected from a wide range of weather products and services to meet the unique needs of a specific aviation user community. The user interface and displays are designed to maximize the speed and efficiency of information retrieval for the HEMS operators, since their unique mission places increased importance on reducing flight preparation time. The HEMS weather tool can overlay multiple fields of interest: ceiling, visibility, flight category, winds, relative humidity, temperature, radar (base and composite reflectivity), Airmen's Meteorological Information (AIRMET) and Significant Meteorological Information (SIGMET), Meteorological Terminal Aviation Routine Weather Report (METAR), Terminal Area Forecast (TAF), and Pilot Reports (PIREP) data. All 3-Dimensional (3D) data are interpolated to above-ground-level (AGL) altitudes and can be sliced horizontally on 500 ft. intervals up to 5,000 ft. The tool has high resolution basemaps, including colored elevation, shaded relief, and elevation contours, streets, hospitals, airports, and heliports for the entire United States.

A HEMS safety risk management (SRM) panel was convened on Tuesday, December 02, 2014. There was strong participation from the HEMS community and related industry associations. In addition, the National Oceanic and Atmospheric Administration (NOAA) and the FAA's NextGen and Flight Standards organizations were well represented. One representative from the National Transportation Safety Board (NTSB) also participated. The panel developed a list of 38 stakeholder issues, and assessed whether the issue was a potential cause, effect, or an actual hazard. Four fundamental causes were identified by the panel, and existing controls were identified for all of the causes. The panel consolidated a number of potential scenarios into a single credible hazard and effect: Hazard HEMS OH-1, "Unfamiliarity with, or misinterpretation of HEMS weather tool."

The SRM panel discussed several risk mitigation strategies throughout the day, and once the single hazard was identified (HEMS OH-1), there was a strong consensus that the focus of the mitigations

should be on awareness and training for the user of the HEMS weather tool. The panel noted that the effectiveness of the mitigations relied on the user's actions and level of understanding of the weather data, and indicated that the predicted residual risk was unchanged from the initial risk assessment. The predicted residual risk remains at a risk level of 3C, a Medium risk.

Table ES-1, Hazard Description and Risk Ratings

Hazard ID	Hazard Description	Current/ Initial Risk	Predicted Residual Risk
HEMS OH-1	Unfamiliarity with, or misinterpretation of HEMS tool	3C - Medium	3C - Medium

The results of the risk assessment, after mitigation has been applied, are summarized in Figure ES-1. The transition of HEMS to Operational ADDS has an acceptable level of risk, in accordance with the FAA Air Traffic Organization (ATO) SMS Manual Version 4.0.

Severity / Likelihood	Minimal 5	Minor 4	Major 3	Hazardous 2	Catastrophic 1
Frequent A	Low	Medium	High	High	High
Probable B	Low	Medium	High	High	High
Remote C	Low	Medium	HEMS Medium OH-1	High	High
Extremely Remote D	Low	Low	Medium	Medium	High
Extremely Improbable E	Low	Low	Low	Medium	High* / Medium

*Risk is high when there is a single point or common cause failure.

Figure ES-1, Predicted Residual Risk, After Mitigation

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1 Current HEMS System Description

The HEMS system entered operational use by the HEMS community in 2006 as a weather tool, specially designed to meet the needs of low-altitude VFR emergency first responders. Since then, the HEMS weather tool has been hosted on the Experimental ADDS platform (http://weather.aero/), a free public service provided by the National Center for Atmospheric Research (NCAR). The purpose of this Safety Risk Assessment is to evaluate the transition of the HEMS weather tool from Experimental ADDS to the operational ADDS platform operated and maintained by the National Weather Service Aviation Weather Center in Kansas City, MO. The operational ADDS platform, unlike Experimental ADDS, has 24 X 7 operational support.

The HEMS Tool can overlay multiple fields of interest: ceiling, visibility, flight category, winds, relative humidity, temperature, radar (base and composite reflectivity), AIRMETs and SIGMETs, METARs, TAFs, and PIREPs. All 3D data are interpolated to AGL altitudes and can be sliced horizontally on 500 ft. intervals up to 5000 ft. All data can be animated in time. The tool has high-resolution basemaps, including colored elevation, shaded relief, and elevation contours, streets, hospitals, airports, and heliports for the entire United States. More detail is revealed as you zoom in and individual layers can be turned on or off independently. The tool can also overlay custom map data from a user's local or remote shape file. Preferred views can be saved for quick recall later, automatically updated with current data. Views include the selected weather grid, overlays, map layers, and zoom. They may be saved locally to the user's computer or remotely on the Experimental ADDS servers for use from other computers in future sessions.

The HEMS weather tool is listed in the HEMS OpSpec, Paragraph A010, as follows:

- HEMS Weather Tool is added as approved weather source
- “The FAA has authorized the certificate holder to use the experimental ADDS HEMS Tool to support VFR flight planning. The ADDS HEMS Tool controls only in the negative (it is applicable only in the “No-Go” decision). The certificate holder may not conduct flight operations based solely on an indication by the ADDS HEMS Tool that safe conditions have been assessed along the proposed route of flight.”

There are no planned future changes to the configuration of the HEMS weather tool, or to the procedures used in conjunction with the tool. The primary purpose of this proposed change is to improve the reliability, availability, and maintainability of the HEMS weather tool. After many years of use in an experimental environment, the user community will benefit from a more stable platform.

For future reference, please note that the FAA has adopted the acronym HAA or Helicopter Air Ambulance, rather than HEMS during FY2014. For this discussion, the term HEMS will continue to be used to describe the system.

1.1 Current HEMS Operation

The basic format of the HEMS user interface is a graphical, map-based screen that can overlay multiple fields of interest. Figure 1-1 shows a representative screen, displaying a flight category analysis indicated by the color coding of the mapped area, overlaid with METAR reports and other weather data callouts indicated by interactive markers placed on the map. The HEMS weather tool itself is not considered a weather product; it is aggregated data, selected from a wide range of weather products and services to meet the unique needs of a specific aviation user community. The user interface and displays are designed to maximize the speed and efficiency of information retrieval for the HEMS user community. Their unique mission places increased importance on reducing flight preparation time.

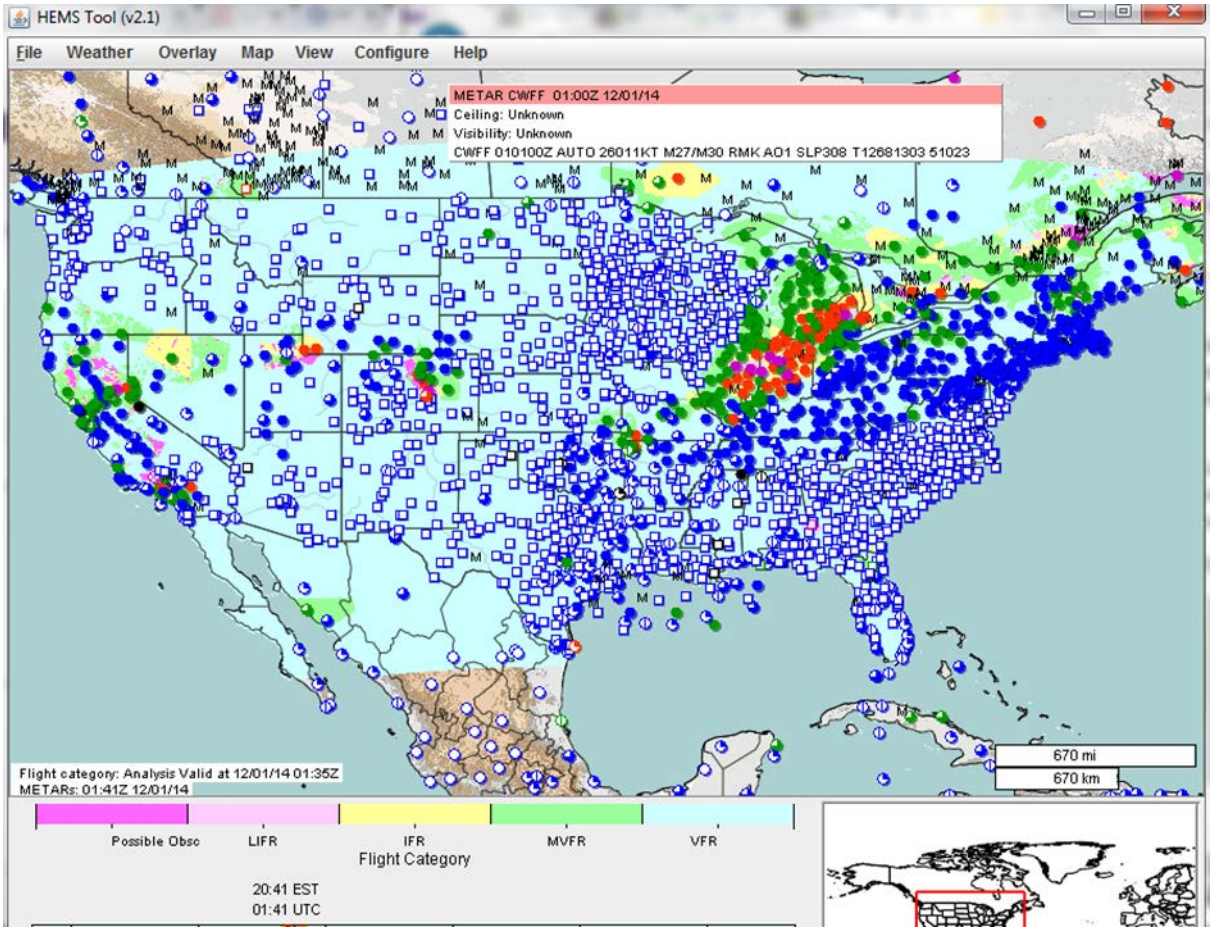

Figure 1-1, HEMS User Interface Example

The HEMS weather tool is currently hosted on the Experimental ADDS site, which is operated by the ADDS development team at NCAR in Boulder, CO. The site is designed with load balancing and redundant hardware to be extremely reliable, but it is not guaranteed to be available 24 hours a

day, 7 days a week. NCAR advises users that: "Experimental ADDS is only monitored by staff during normal business hours and is only installed in a single geographic location. In the event of the loss of our data feed, a massive equipment failure, or damage to the building infrastructure, the site could be unavailable for an extended period. For these reasons, please use Experimental ADDS for our innovative services, but do not rely on us as your sole source of aviation weather."

2 Proposed Change

2.1 Impacts to National Airspace System (NAS)

The HEMS weather tool has very limited connections to the NAS. Most of the data that is ingested into HEMS is provided by weather service organizations. A portion of the data is delivered by the Weather Message Switching Center Replacement (WMSCR) NAS subsystem, and is transmitted by the National Airspace Data Interchange Network (NADIN) NAS subsystem. These interfaces are described by the following NAS Interface Requirements documents:

- NAS–IR–25070001, Weather Message Switching Center Replacement (WMSCR) to File Transfer Protocol (FTP)-Based User Subsystems
- NAS–IR–25070002, Weather Message Switching Center Replacement (WMSCR) to Transmission Control Protocol (TCP)/Internet Protocol (IP)-based User Subsystems
- NAS–IR–25070004, Weather Message Switching Center Replacement (WMSCR) to Transmission Control Protocol (TCP)/Internet Protocol (IP)-based User Subsystems for Binary Data

The proposed change addressed by this safety document introduces no changes to the interfaces that provide weather data to the HEMS weather tool. Since there are no changes to the NAS hardware or software interfaces, the scope of this safety analysis is limited to the potential impact on NAS users.

2.2 Test and Evaluation of Proposed HEMS Change

The new HEMS weather tool has completed a two month test and evaluation period with inputs from 60 HEMS industry users. They provided high-quality feedback during the evaluation period and were very supportive of the product's performance and transition to fully operational status. The current tool has been in continuous operational use since 2006 and has received universal acceptance by the user community it is designed to support.

The National Weather Service (NWS) Aviation Weather Center's standard practice for standing up a service such as HEMS is a 30 day burn-in of the system once it is fully configured and ready for operations. Both site owners have agreed to implement a transition period where the new HEMS tool on Operational ADDS will be operational simultaneously with continued availability of the existing HEMS tool version 2 on the Experimental ADDS site. Parallel operation is a standard practice for Information Technology (IT) application migrations when loss of the operational

capability for even a short period is unacceptable. After the transition and parallel operation periods, the existing HEMS tool version 2 on the Experimental ADDS site will be removed from production.

2.3 Details of Proposed HEMS Change

The HEMS weather tool transition is primarily concerned with rehosting the tool on the Operational ADDS platform (http://aviationweather.gov/adds/) at the NWS Aviation Weather center. The rehost of the HEMS tool will provide measurably higher reliability and availability (99.99% - "four nines") for users of the system. One of the benefits of moving to the Operational ADDS environment is that there are continuing upgrades, focused on reliability, security, and usability. The Operational ADDS website is monitored by NOAA staff 24 hours a day, 7 days a week. It is deployed in 3 separate geographic locations across the United States for load balancing and redundancy. In addition to upgrades at the NOAA Web Operations Centers, the Aviation Weather Service is also migrating their back-end database systems to the Integrated Dissemination Program (IDP) environment. Operational ADDS is currently serving an average of 35 million hits/day, where 75% of those transactions are for raw data. All weather data is archived for a period of two weeks for products running on Operational ADDS. This service is provided by the data center environment and is consistent for all hosted applications; the HEMS tool hosting configuration will follow this practice.

Although the HEMS weather tool requires some re-engineering for the new platform, the change sponsor, Steve Abelman, ANG-C61, requested that all requests or discussions about improvements and enhancements be deferred. The majority of the engineering effort involves a change from the current JAVA based operation to the OpenLayers systems now used for all services on the operational ADDS site. While OpenLayers introduces some changes in the way to navigate around the HEMS application, very little change to the appearance or contents of the HEMS tool is included in this transition.

A few exceptions are worth mentioning. In terms of content, the OpenLayers HEMS tool uses Graphical AIRMET (G-AIRMET) data, which became a “Primary” Operational Weather Product in March 2010. The Java-based HEMS tool uses the older AIRMET data source. The NWS operational Multi-Radar, Multi-Sensor (MRMS) data is the approved radar source for HEMS. The functionality of the tool does not change, and using the best available data sources improves the accuracy and usefulness of the weather information that is presented. In terms of the user experience, the html OpenLayers platform is more amenable to supporting a much wider variety of mobile devices. One third of existing users are already committed to mobile endpoints, and that trend is accelerating. These improvements directly support the mission of the HEMS community, with improved access to higher quality weather data.

2.4 Monitoring the Effects of the Proposed Change

The risks associated with most weather information tools are that a potential user may not have adequate knowledge or experience of how to use the supplied information for safe flight planning

and flight operations. This is a common thread appearing throughout most safety risk assessments involving weather products and services used to support aviation. One commonly used term to describe the cause for this potential hazard is 'Hazardous Misleading Information'. One of the key assumptions supporting this potential hazard is the idea that increasing the ease of access will bring a disproportionate number of users that don't have the required knowledge or experience. Re-hosting the HEMS weather tool on Operational ADDS radically increases the potential user base, compared to the current Experimental ADDS platform. The potential hazard - "Unfamiliarity with or misinterpretation of HEMS tool" exists today; it is the broader level of access that has the potential to increase that risk. Therefore, the safety requirements, safety performance targets, and monitoring plan are all based on reducing the risk associated with the possibility of a new, larger user base.

The HEMS weather tool is a web-based application, and both the application itself and the hosting platform have the capability to implement user access controls and tracking functions. The goal for the safety requirements is to ensure that every aviation professional using the HEMS weather tool understands its intended application and its limitations, and to provide documentation along with the tool, that explains and demonstrates the proper use of the tool. The implementation of these requirements is easily verifiable with mechanisms available within the system, and can be monitored on an ongoing basis.

2.5 Assumptions Related to the Proposed Change

- The HEMS weather tool is an “Advisory” system
- The HEMS weather tool itself is not a weather product; it is a tool that aggregates a number of existing weather products into a single, quick-glance, automated display.
- Operators and pilots need to use primary weather sources for required weather briefings, although it was noted by the panel that the primary versus supplementary designation for weather products is being eliminated.
- Moving the HEMS weather tool from the Experimental ADDS site to the Operational ADDS site will increase the user base for the tool
- The HEMS weather tool is currently being used by others outside the HEMS community, but the exposure is limited by the nature of the Experimental ADDS site
- There are a growing number of aviation operators who predominately use airspace below 5000 feet; examples include: Electronic News Gathering (ENG) vehicles, agricultural operations, Bureau of Land Management (BLM), Department of Homeland Security (DHS), and the growing Unmanned Aerial Vehicle (UAV) community.
- User adoption of the tool within the HEMS community is currently very high, therefore new users will predominately come from outside the HEMS community
- There is a continuing need for an industry-specific weather tool for the HEMS community

- There are no proposed or expected changes in the Ops Specs, Regulations, or intended use of the HEMS weather tool for the HEMS community

2.6 Previous SRM Efforts Related to the Proposed Change

The HEMS weather tool has been in continuous operation since 2006 on the Experimental ADDS site. There is no formal record of any SRM activity related to the development or use of the tool within any operational context. For this reason, several potential hazards that are not directly related to the transition of HEMS to Operational ADDS have been included for analysis in this SRMD.

3 Safety Risk Management Panel

A HEMS SRM panel was convened by Everette C. Whitfield, Branch Manager for ANG-C62, New Weather Concept Development on Tuesday, December 02, 2014. The panel was sponsored by Steve Abelman, Branch Manager for ANG-C61, Weather Research, representing the system owner. There was strong participation from the HEMS community and related industry associations:

- HeliExperts International
- Air Medical Operators Association (AMOA)
- Protean Limited Liability Corporation (LLC)
- Helicopter Association International (HAI)
- The Association of Air Medical Services (AAMS)
- National EMS Pilots Association (NEMSPA)

In addition, NOAA and the FAA's NextGen and Flight Standards organizations were well represented. One representative from the NTSB also participated. The complete list of attendees is shown in table 3-1.

Table 3-1, SRM Panel Participants

Present:		SRM Trained
1. Everette C. Whitfield **	**FAA / ANG-C62**	**Yes**
2. Steve Abelman	**FAA / ANG-C61**	
3. Rex Alexander	**HeliExperts Int'l**	
4. Timothy Beglau	**FAA AFS-250**	
5. Matthew Cauthen	**Flatirons**	**Yes**
6. Chris Eastlee	**AMOA**	
7. Don Eick	**NTSB**	
8. Bruce Entwistle	**NOAA**	
9. Jonathan Godfrey	**Protean LLC**	
10. J. Heffernan	**HAI**	
11. Colin Henry	**AAMS**	
12. Steve Kroening	**FAA / AFS-820**	
13. Thomas MacPhail	**FAA ANG-C61**	
14. Bruce Normann	**CSSI**	
15. Patrick O'Connell	**FAA / AFS-430**	**Yes**
16. Brian Pettigrew	**NOAA**	
17. Andrew Pierce	**FAA / CND-ZMP**	
18. Chris Scott	**FAA / ANG-B3**	**Yes**
19. Deborah A. Smith	**FAA / ANG-C62**	**Yes**
20. Steven Sparks	**FAA / AFS-820**	
21. Michael S. VanBuren	**FAA / ANG-B3**	
22. Dan Vietor	**NOAA**	
23. Kurt Williams	**NEMSPA**	
24. Mark Zettlemoyer	**NOAA**	
25. John Reba	**ANG-B3**	**Yes**
Note: ** Designates Panel Facilitator		

The SRM Panel held one roundtable meeting, and was able to complete the majority of the SRM process during that time. Further discussions and feedback was conducted on an as-needed basis. A full copy of the meeting minutes is available upon request.

3.1 Description of the Safety Management System (SMS) Process

The process utilized for managing the risk associated with the proposed change for the HEMS weather tool, as represented in Figure 3-1 below, includes a systematic identification, assessment, and treatment of risk. This SRMD represents one of the process outputs of the SMS process. Once

the SRMD is approved and Risk-Accepted, the results will be entered into the FAA safety management tracking system.

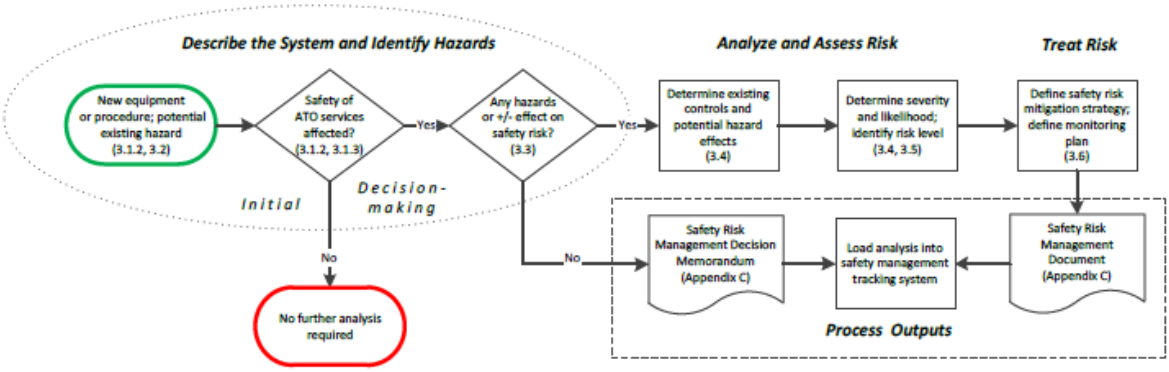

Figure 3-1, FAA SMS Process[1]

[1] Note that section numbers shown in this diagram refer to material in the ATO SMS Manual Version 4.0.

The DIAAT[2] process, as described in Figure 3-2, was used to perform a comprehensive evaluation of all identified potential hazards.

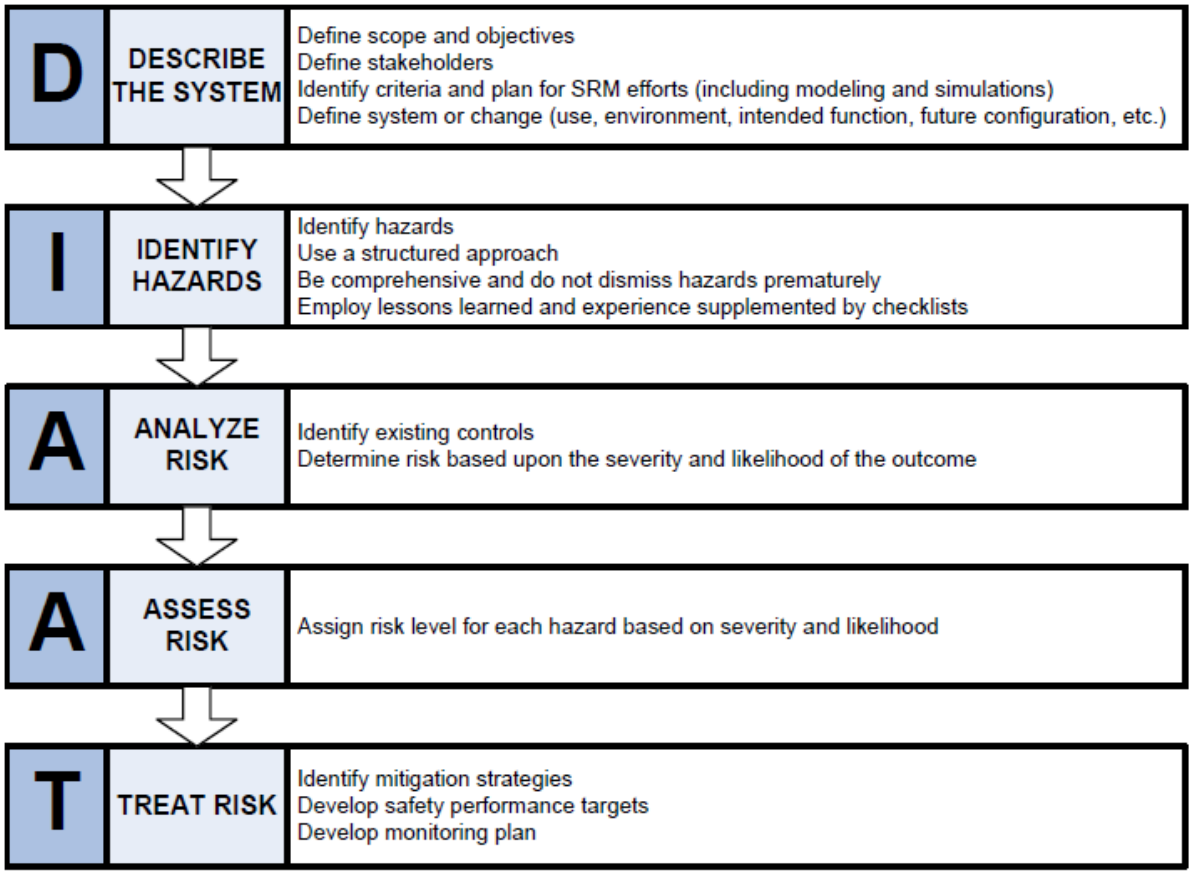

Figure 3-2, SRM "**DIAAT**" Process

[2] DIAAT = Describe system, Identify hazards, Analyze risk, Assess risk, Treat risk - from the ATO SMS Manual Version 4.0.

4 Risk Assessment

4.1 Process Used to Gather Stakeholder/Expert Input

After the presentations by the system owners and general discussions about the HEMS program and weather tool, the panel conducted a brainstorming session to capture potential stakeholder safety concerns. There was no risk analysis performed for the stated concerns during this portion of the discussion, but all potential safety issues were captured so everyone's thoughts were represented, regarding the transition and use of the HEMS weather tool on the Operational ADDS platform. These issues were subsequently used to identify specific hazards, and separate out potential causes and effects from their associated hazards.

Stakeholder issues were documented in a data driven process that incorporated a number of different Hazard Identification and Analysis Tools and Techniques. The safety assessment described in this document was performed by applying a combination of methods, as defined in the FAA ATO SMS Manual Version 4.0. The What-If Analysis methodology was used during brainstorming sessions to identify Stakeholder issues. These issues were then examined in order to identify hazards, hazardous situations, or specific events that could produce an undesirable consequence. The Scenario Analysis method was used to refine the interactions of cause and effect for several of the hazards. The PHA worksheet included in Appendix A, serves to document the findings and recommendations generated during the panel discussion.

4.2 Identified Hazards

The panel reviewed the list of 38 stakeholder issues generated at the meeting, with three aims. First, the panel assessed whether the issue was a potential cause, effect, or an actual hazard as defined in the FAA ATO SMS Manual Version 4.0. Secondly, the panel assessed the credibility of the issue, as only credible hazards need to be analyzed. Thirdly, the panel assessed whether the issue was within the defined scope of this SRM analysis. During the panel discussion, existing issues with the current HEMS tool, which will exist 'as-is' during and after the transition were considered as out of scope for this SRM analysis. Later discussions with ANG-B3 representatives identified a concern that existing hazards which were not subject to SRM in the past should not be carried over with the new system without assessing and treating the associated risk. This document has been updated to include the additional safety issues which were initially considered to be out of scope.

After the discussions of each of the stakeholder issues, a clearer picture emerged of how the items could be broken down into Hazards, their potential Causes and possible Effects. Several fundamental causes were identified by the panel, and existing controls were identified for most of the causes. In some cases an existing control addressed multiple causes. The panel spent a significant amount of time assessing the possible effect of the hazard and was able to consolidate a number of potential scenarios into a single credible hazard and effect. Hazard HEMS OH-1: "Unfamiliarity with, or misinterpretation of HEMS tool", is documented below in Table 4-1.

Table 4-1, Hazard Identification

Hazard Name	Hazard Description	Cause	System State	Existing Controls	Existing Control Justification	Effect
HEMS OH-1	Pilots unfamiliarity with, or misinterpretation of HEMS tool data	C1. New / Users using the tool in isolation C2. Inexperience user using the tool C3. Inadequate training C4. Incorrect Aeronautical Decision Making (ADM) C5. Some Weather information may be invalid or incorrect C6. Navigational Aid database source may have errors C7. Private Heliport location data may have errors C8. HEMS tool does not provide critical synoptic conditions, squall lines, outflows	HEMS Running on Operational ADDS site, and HEMS Running on Experimental ADDS site	(Causes C1,C2,C3,C4,C5, C6,C7,C8) HEMS users shall make use of available tutorials and help pages (Causes C1.C2.C3) HEMS users and operators shall perform operational testing on experimental platforms before releasing the product on operational networks (Causes C1,C2,C3) HEMS users and operators shall perform impact evaluations with a portion of the userbase when changes are introduced (Causes C1,C5,C8) HEMS User shall limit their use of the HEMS tool, in conformance with relevant OPSpecs (Causes C1,C3,C4,C5,C8) HEMS users shall use the required primary weather products in flight planning and operations	The HEMS weather tool has been in operational use since 2006, and the controls have been effective in addressing the hazard causes identified. A two month Test & Evaluation period was conducted for the re-engineered HEMS tool with approx. 60 users.	HEMS users encountering unexpected / unplanned weather conditions

4.3 Risk Analysis

The panel used tables 3.4 and 3.5 from the ATO SMS Manual Version 4.0 to assess the severity of the hazard's effect. The majority of the group felt that the severity should be classified as Minor (4); however at least two members of the panel indicated that the severity should be classified as Major (3). It was noted that the end result of the hazard could be very similar to a malfunction of a weather system which led to a failure to detect adverse weather, as illustrated in Table 3.5 in the ATO SMS Manual v4.0. In that case adverse weather information (adverse weather includes wind shear, thunderstorms, icing, Instrument Meteorological Conditions [IMC], etc.) is not reported to the pilot, and a 'significant reduction in safety margin' occurs. Considering this scenario, the panel agreed to accept the most conservative estimate for severity after discussion.

The panel used table 3.7 from the ATO SMS Manual Version 4.0 to assess the likelihood of the hazard's effect. Based on eight years of operational use in the HEMS industry and in other flight domains, the industry subject matter experts (SME) on the panel indicated that the likelihood was less than once per three months and more than once per three years, yielding a likelihood classification of Remote (C).

The combination of only one identified hazard and one credible effect, the risk analysis yielded a single risk, named HEMS OH-1 in this document, with an initial risk rating of 3C – Medium. Details of the analysis are consolidated in Table 4-2 below.

Table 4-2, Risk Analysis

Hazard Name	Hazard Description	Effect	Severity	Severity Rationale	Likeli-hood	Likelihood Rationale	Initial Risk
HEMS OH-1	Pilots unfamiliarity with, or misinterpretation of HEMS tool data	HEMS users encountering unexpected / unplanned weather conditions	**3-Major**	SMS Manual Table 3.5: Result of hazard is similar to "Malfunction: Failure to Detect Adverse Weather"	**C-Remote**	Based on 8 years operational use in the HEMS industry, industry SMEs indicated likelihood of less than once per three months and more than once per three years.	**3C - Medium**

Figure 4-1 below shows the initial risk, named HEMS OH-1, plotted in the approved risk matrix obtained from the ATO SMS Manual Version 4.0. As indicated in the text, the risk level is categorized as Medium.

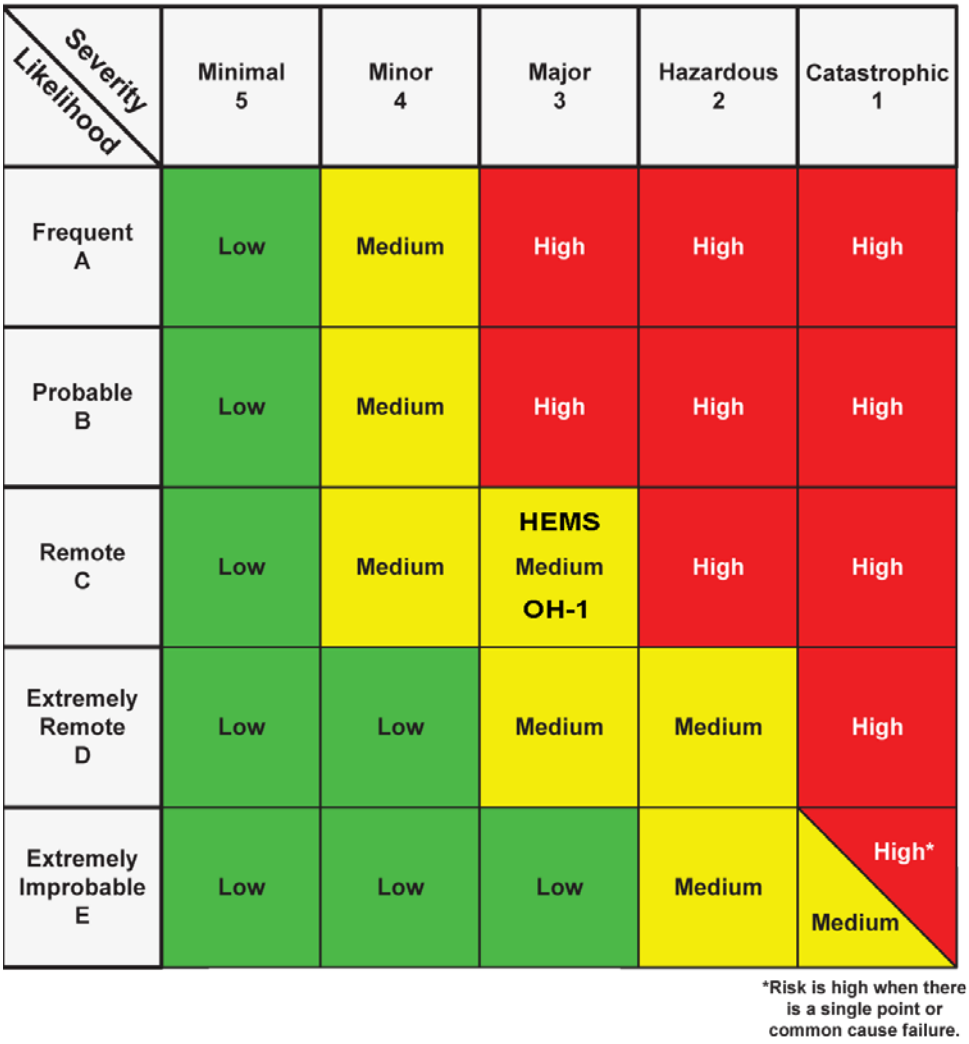

Figure 4-1, Initial Risk Matrix

5 Risk Treatment and Monitoring

The SRM panel discussed several risk mitigation strategies throughout the day, in the context of safety issues, and once the single hazard was identified (HEMS OH-1), there was a strong consensus that the focus of the mitigations should be on awareness and training for the user of the HEMS weather tool. The panel noted that the effectiveness of the mitigations relied on the user's actions and level of understanding of the weather data, and indicated that the residual risk was unchanged from the initial risk assessment, and the predicted residual risk remained a risk level of 3C, a Medium risk.

Likelihood \ Severity	Minimal 5	Minor 4	Major 3	Hazardous 2	Catastrophic 1
Frequent A	Low	Medium	High	High	High
Probable B	Low	Medium	High	High	High
Remote C	Low	Medium	HEMS Medium OH-1	High	High
Extremely Remote D	Low	Low	Medium	Medium	High
Extremely Improbable E	Low	Low	Low	Medium	High* / Medium

*Risk is high when there is a single point or common cause failure.

Figure 5-1, Predicted Residual Risk

5.1 Risk Treatment

The HEMS weather tool, once it is available on the Operational ADDS site, will be available to a wider user audience. Almost all of the stakeholder issues identified in the hazard identification process were related in some way to the potential expansion of the user base beyond the HEMS community that the tool was specifically designed to support. The panel focused their thoughts for new safety requirements on ways to directly target the new users who were unfamiliar with the tool and the data presented in the tool, and those who were most likely to misinterpret the source data, or the presentation of that data.

Table 5-1, Risk Treatment

Hazard ID	Hazard Description	Initial Risk	Safety Requirements	Organization Responsible for Safety Requirements	Predicted Residual Risk
HEMS OH-1	Pilots unfamiliarity with, or misinterpretation of HEMS tool data	3C-Medium	Service provider shall require users to acknowledge a disclaimer similar to the 'Precautionary Use Statement' utilized on the CVA[3] weather tool. Service provider shall improve & enhance tutorial materials & help pages, and include specific references to potential hazards identified here.	Aviation Weather Center	3C-Medium

[3] CVA (Ceiling and Visibility Analysis) is a real-time analysis of current C&V (ceiling and visibility) conditions across the continental U.S., provided by the Aviation Weather Center. The product is primarily intended to help the general aviation pilot (particularly the VFR-only pilot) avoid IFR conditions. https://www.aviationweather.gov/cva

Monitoring Activities	Frequency	Duration	Safety Performance Targets
Maintain a log detailing all user accounts, and include verification that all users have acknowledged the Precautionary Use Statement before being granted access to the HEMS tool	Review the user account log, once every month	For a minimum of one year, or until the performance targets are met and the predicted residual risk is verified	HEMS users encounter unexpected/unplanned weather conditions less than once per three months of operation

5.2 Monitoring of Safety Performance Targets

NWS Aviation Weather Center shall maintain a log detailing all user accounts, and include verification that all users have acknowledged the Precautionary Use Statement before being granted access to the HEMS tool. The user logs shall be reviewed by the NWS Aviation Weather Center once a month, for a minimum of one year, or until the performance targets are met and the predicted residual risk is verified.

5.3 Specific Concerns Highlighted By SRM Panel

The panel discussed the possibility of restricting or obscuring user access to the HEMS weather tool on the Operational ADDS site. The initial plan was to not publish any links on the Operational ADDS site and to publicize the direct Uniform Resource Locator (URL) to the intended user community (HEMS Operators) through industry channels. Ultimately this mitigation strategy was rejected, because the existing controls and proposed safety requirements that are identified in Table 5-1 were considered by the group to be more effective at targeting root causes than restricting or obscuring user access. Specific comments and discussion by the panel regarding this issue are captured in more detail in Appendix B – Comments and Concerns from Dissenting Panel Members.

The panel discussed the fact that some data sets currently available in the existing tool contained inaccurate and out-of-date information. Specifically, the graphical display of known

navigational aids and public heliports is derived from the FAA Airport Master Record, Form 5010, which is known to have errors and omissions in its data set. The panel discussion acknowledged that this issue had not caused any major problems for the relatively small HEMS operator community, but also expressed concern that general aviation pilots using the tool might not be aware of the data issues. Ultimately, the panel agreed that providing clear disclaimers and warnings about the potential for errors or omissions in the source data was the best approach for mitigating this hazard. Training materials referencing the source data and potential opportunities for misinterpretation of the data will also be developed and released with the tool. Specific comments and discussion by the panel regarding this issue are captured in more detail in Appendix B – Comments and Concerns from Dissenting Panel Members.

5.4 SRM Conclusion for Proposed HEMS Change

The results of the risk assessment for the one risk identified, after mitigation has been applied, are summarized in Figure 5-1, and detailed information is presented in the PHA contained in Appendix A. The completed risk analysis for the combination of one identified hazard and one credible effect, yielded a single risk, named HEMS OH-1 in this document, with an initial risk rating of 3C–Medium. The predicted residual risk remained at a level of 3C–Medium, due to the difficulty in predicting human behaviors for users of the tool. Details of the analysis are consolidated in Table 4-2, Risk Analysis.

The SRM process followed in the development of this SRMD provides clear evidence to indicate that the transition of the HEMS weather tool to the Operational ADDS platform has an acceptable level of risk.

Appendix A - HEMS Preliminary Hazard Analysis

The following draft Preliminary Hazard Analysis table shows the final list of hazards, along with their potential causes and effects:

Table A-1 HEMS Preliminary Hazard Analysis

Hazard Name	Hazard Description	Cause	System State	Existing Controls	Existing Control Justification	Effect	Severity
HEMS OH-1	Pilots unfamiliarity with, or misinterpretation of HEMS tool data	C1. New / Users using the tool in isolation C2. Inexperience user using the tool C3. Inadequate training C4. Incorrect Aeronautical Decision Making (ADM) C5. Some Weather information may be invalid or incorrect C6. NAV aid database source may have errors C7. Private Heliport location data may have errors C8. HEMS tool does not provide	HEMS Running on Operational ADDS site, and HEMS Running on Experimental ADDS site	(Causes C1,C2,C3,C4,C5, C6,C7,C8) HEMS users shall make use of available tutorials and help pages (Causes C1.C2.C3) HEMS users and operators shall perform operational testing on experimental platforms before releasing the product on operational networks (Causes C1,C2,C3) HEMS users and operators shall perform impact evaluations with a portion of the userbase when changes are introduced (Causes C1,C5,C8) HEMS User shall limit their use of the HEMS tool, in conformance with relevant OPSpecs	The HEMS weather tool has been in operational use since 2006, and the controls have been effective in addressing the hazard causes identified. A two month Test & Evaluation period was conducted for the re-engineered HEMS tool with approx. 60 users.	HEMS users encountering unexpected / unplanned weather conditions	**3 - Major**

		critical synoptic conditions, squall lines, outflows		(Causes C1,C3,C4,C5,C8) HEMS users shall continue to use the required primary weather products in flight planning and flight operations			
Severity Rationale	**Likelihood**	**Likelihood Rationale**	**Initial Risk**	**Safety Requirements**	**Organization Responsible to Implement Safety Requirements**	**Predicted Residual Risk**	**Safety Performance Targets**
SMS Manual Table 3.5: Result of hazard is similar to "Malfunction: Failure to Detect Adverse Weather "	**C - Remote**	Based on 8 years operational use in the HEMS industry, industry SMEs indicated likelihood of less than once per three months and more than once per three years.	**3C - Medium**	Service provider shall require users to acknowledge a disclaimer similar to the 'Precautionary Use Statement' utilized on the CVA weather tool. Service provider shall improve & enhance tutorial materials & help pages, and include specific references to potential hazards identified here.	Aviation Weather Center	**3C - Medium**	HEMS users encounter unexpected /unplanned weather conditions less than once per three months of operation

Appendix B -
Comments and Concerns from Dissenting Panel Members

1. During the panel meeting, following the general discussion, Dan Vietor presented a live demonstration of the Open Layers HEMS weather tool. Several use cases and features of the tool were shown. This led to additional discussion topics, one of which was:

   The group noted that the Navigational Aids (NavAids) display and the Heliport display were based on data that is known to be inaccurate. The HEMS community (intended users) is well aware of the heliport data quality issue. General Aviation (GA) users (unintended users) may not be aware of the NavAids data quality issue.

   During stakeholder review of the draft meeting minutes, Andrew Pierce of the FAA made this comment: This hazard "…data known to be inaccurate…" is not accounted for in the hazards table. Transferring the Tool from the experimental server to the operational server without addressing this hazard would be unacceptable to AFS-250 as it stands, without mitigation. It is not likely that all of the "…HEMS community is well aware of the heliport data quality issue." It doesn't matter how well acquainted the typical user may be with inaccuracies depicted. The HEMS user base is dynamic. From time to time, new users or transferred users (floater pilots, short term substitute pilots) may access a new or different area of the site and may not have historical / tribal knowledge of the inaccuracies within the databases affecting their area of interest.

   Ideally, the data should be corrected. If it cannot be corrected or if the data is dynamic, it should not be presented on the Tool. If it must be presented or referenced for the tool to be operational, at the very least, the group responsible for allowing the inaccurate data to be used or displayed should require some type of Warning regarding these inaccuracies and their effects. The warning should be acknowledged prior to a user gaining access to the HEMS Tool.

   The proposed resolution for this comment is: This issue is included in the general description of the Hazard HEMS OH-1, and is mitigated by both the Existing Controls and the proposed Safety Requirements. The panel expressed full agreement with the mitigations described by Mr. Pierce, during the panel discussions. In addition to incorporating acknowledgement of the Warning statement in the user access controls, the panel also suggested that information addressing data quality issues must be included in the tutorials and help screens. It was also noted during the discussions that the HEMS display was configurable, and the Navigational Aids and Heliport data could be omitted from the default configuration.

2. During the panel meeting, following the general discussion, Dan Vietor presented a live demonstration of the Open Layers HEMS weather tool. Several use cases and features of the tool were shown. This led to additional discussion topics, one of which was:

   The group discussed the possibility of restricting or obscuring user access to the HEMS tool on the Operational ADDS site. The current plan is to not publish any links on the ADDS site and to publicize the URL to the intended user community (HEMS Operators) through industry channels. There are configurable login preferences on Operational ADDS that will allow a user to add HEMS to their personalized desktop.

   During stakeholder review of the draft meeting minutes, Andrew Pierce of the FAA made this comment: What purpose would this restriction to access serve? To permit only those users (HAA operator personnel) who know about the unpublished problems and their "work-arounds" to use the tool. How do you know the individual actually gaining access to the site is knowledgeable about defects in critical databases, or how to overcome the shortcomings of the Tool?

   The proposed resolution for this comment is: This discussion topic is essentially a proposed mitigation. The issues that Mr. Pierce raises here were raised during the panel discussion, and ultimately this mitigation strategy was rejected, for those same reasons. The Existing Controls and proposed Safety Requirements that were identified by the panel were considered by the group to be more effective at targeting root causes than restricting or obscuring user access. In addition, leveraging the user access control capabilities, as described above in section 1 of this Appendix, provides a more robust mechanism for addressing potential data quality issues that the new user may not be aware of.

Appendix C - Glossary

3-D	Three Dimensional
AAMS	The Association of Air Medical Services
ADDS	Aviation Digital Data Service
ADM	Aeronautical Decision Making
AFS	Flight Standards division (FAA Routing Symbol)
AGL	Above Ground Level
AIRMET	Airmen's Meteorological Information
AMOA	Air Medical Operators Association
ANG	NextGen Organization (FAA Routing Symbol)
ATO	FAA Air Traffic Organization
AWC	Aviation Weather Center (part of NWS)
BLM	Bureau of Land Management (USA)
CVA	Ceiling and Visibility Analysis (weather tool at AWC)
DHS	Department of Homeland Security (USA)
DIAAT	Describe System, Identify Hazards, Analyze, Assess and Treat Risk
ENG	Electronic News Gathering
FAA	Federal Aviation Administration
FTP	File Transfer Protocol
FYxxxx	Fiscal Year xxxx
G-AIRMET	Graphical Airmen's Meteorological Information
GA	General Aviation

HAA	Helicopter Air Ambulance
HAI	Helicopter Association International
HEMS	Helicopter Emergency Medical Services
IDP	Integrated Dissemination Program (AWC IT program)
IMC	Instrument Meteorological Conditions
IP	Internet Protocol
IT	Information Technology
JAVA	Programming language and computing platform
LLC	Limited Liability Corporation
METAR	Meteorological Terminal Aviation Routine Weather Report
METAR	Meteorological Aerodrome Report
MRMS	Multi-Radar, Multi-Sensor
NADIN	National Airspace Data Interchange Network
NAS	National Airspace System
NCAR	National Center for Atmospheric Research
NEMSPA	National EMS Pilots Association
NextGen	FAA/Industry Next Generation Air Traffic Control System
NOAA	National Oceanic and Atmospheric Administration
NTSB	National Transportation Safety Board
NWS	National Weather Service (USA)
OpSpec	Operations Specifications
PHA	Preliminary Hazard Analysis
PIREP	Pilot Reports
SIGMET	Significant Meteorological Information
SIGWX	Significant Weather (Forecast)
SME	Subject Matter Expert
SMS	Safety Management System
SRM	Safety Risk Management
SRMD	Safety Risk Management Document
TAF	Terminal Aerodrome Forecast or Terminal Area Forecast
TCP	Transfer Control Protocol

UAV Unmanned Aerial Vehicle
URL Uniform Resource Locator

VFR Visual Flight Rules

WMSCR Weather Message Switching Center Replacement