Helicopter Emergency Medical Services (HEMS) User Assessment

Results and Recommendations

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Federal Aviation Administration

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Introduction

Introduction

- The FAA's Weather Research Branch, ANG-C61, is funding the Aviation Weather Center (AWC) Testbed to find a possible replacement of the National Ceiling and Visibility Analysis (NCVA) in the Helicopter Emergency Medical Services (HEMS) Tool.

- AWC Testbed has implemented two experimental products into the HEMS Tool for Ceiling and Visibility (C&V):

  - Localized Aviation Model Output Statistics (LAMP) product
    - Created by Meteorological Development Laboratory (MDL).
    - Provides analyses and forecasts of C&V every 15 minutes.

  - Real-Time Mesoscale Analysis-Rapid Updates (RTMA-RU) product
    - Created by Global Systems Division (GSD).
    - Provides analyses of C&V every 15 minutes.

- AWDE solicited user input regarding the usability and suitability of the experimental analysis products in the HEMS Tool.

Background

Background

- HEMS operators are highly sensitive to changing and/or adverse weather conditions and need weather information presented for non-weather experts presented quickly and effectively.

- The HEMS Tool shows weather conditions for short-distance and low-altitude flights, as well as historical, current, and forecast information.

- The experimental products in the HEMS Tool are expected to improve safety by providing greater situational awareness of Ceiling and Visibility conditions for HEMS pilots.

Objectives

- Determine the usability of the experimental HEMS Tool;

- Determine how the experimental HEMS Tool will be used to aid in decision making strategies;

- Determine if the tools have the information needed for decision making; and

- Gather feedback to determine tool improvements as related to users' operational environments.

User Assessment Approach

Approach

- Conducted cognitive walkthroughs and interviewed participants at the following locations:
  - ➢ May 9th and 17th, June 4th and 14th at the William J. Hughes Technical Center (WJHTC):
    - ▪ 1 United States Coast Guard (USCG) Helicopter Pilot
    - ▪ 1 General Aviation (GA) Pilot
    - ▪ 5 HEMS Pilots
  - ➢ May 10th, Eastern Regional Helicopter Council Meeting (ERHC), Whippany, NJ:
    - ▪ 50-60 Helicopter Pilots
    - ▪ Experience ranged from HEMS, USCG, Part 91 and 135 Pilots
    - ▪ One participant filled out the demographic form and questionnaire.

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Participant Summary

Total	User Group	Primary Geographic Flying Region	Most Critical Weather information for flight planning	Average Flight Hours	Types of Weather Influence go-no-go decisions.	What weather products do you use for flight planning and how do you access them?		Weather training to support interpretation of weather products
4	HEMS	Mid Atlantic (DC, MD, VA, PA, and NJ) Midwest/Indian Memphis, TN Southern New England	(3) Ceiling and Visibility (1) Flight Category and visibility	5625	Ceiling and visibility at landing site primarily. Seasonal concern with icing levels. Rely heavily on seeing weather trends to determine forecast conditions.	HEMS Tool	Desktop	(1) Self study and Airline Transport Pilot License level of weather knowledge. (2) US Army flight school instructors course. (3) None (4) Training through CIS.
						AWC	Desktop	
						Foreflight	Tablet	
						Intellicast.com	Desktop and phone	
						Flightvector	Tablet	
						Myradar	Tablet	
						Weather channel/Weather Underground	TV, Phone, Tablet	
1	USCG	Southern NJ	Visibility and ceiling	900	Visibility and freezing level	Foreflight	Tablet	
1	GA Pilot	NE and Midwest		400	Low IFR, icing, thunderstorms, high winds,	GFA	Desktop	Training associated with being a commercial pilot and air traffic controller, no additional courses.
						Foreflight	IPAD	
1	ERHC	Northeast	Icing, thunderstorm, ceiling and visibility	6000	Icing, thunderstorms, ceiling and visibility	Foreflight	Tablet	Only what is required for rotary wing pilots.
						1-800 wx briefing	Phone	

*Note: One participant at the ERHC meeting filled out the demographic form and questionnaire and one HEMS Pilot **did not** fill out the form and questionnaire.*

User Assessment Approach

- Three approaches were used for the Assessment due to participant availability and location:

  ➢ Remote, using GoToMeeting.
    - Participants were given access to the HEMS Tool prior to conducting the Assessment.
    - During the meeting, participants were given control and could interact with the tool freely.

  ➢ Co-located at the CPAC Lab at the WJHTC.
    - Participants were not given access to the HEMS Tool prior to the Assessment.
    - Participants interacted with the tool freely during the assessment.

  ➢ Co-located, determined by participant location.
    - Participants were not given access to the HEMS Tool prior to the Assessment.
    - The AWDE Team projected the HEMS Tool onto a screen and presented the capabilities and functionality.

User Assessment Approach

- The Assessment included:
  - ➢ The AWDE Team providing a description of the HEMS Tool, assessment protocols, and participant expectations.
  - ➢ Participants were asked to complete a demographic form to gather data about flight experience, training, and weather products used.
  - ➢ The Assessment lasted between 30-60 minutes.
- Participants were asked to consider planning a flight using the HEMS Tool.
- Participants were asked to use a think-out-loud protocol while using the HEMS Tool:
  - ➢ The think-out-loud protocol allowed the AWDE Team to determine how the tool would be used, participants' information needs, and overall suitability and usability of the tool.
  - ➢ Participants were encouraged to interact with the tool as much as possible to aid in their pre-flight decision making processes.

User Assessment Approach

- AWDE worked with AWC Testbed to develop the Structured Interview Questions, Questionnaires, and Demographic Form.

- During the Assessment, the AWDE Team collected data using Structured Interview Questions.

- Participants provided comments regarding the use of the HEMS Tool.

- Questions focused on information used to support decisions, utility of forecast characteristics, ease of use, and how well the tool supported decision making strategies.

User Assessment Approach

- After interacting with the tool, participants were asked to complete a Questionnaire using three 5-point Likert scales.

  - ➢ *Effectiveness*: 5-Very Effective, 4-Somewhat Effective, 3-Borderline, 2-Somewhat Ineffective, 1-Very Ineffective, and 0-N/A.

  - ➢ *Usability*: 5-Very Easy, 4-Somewhat Easy, 3-Borderline, 2-Somewhat Difficult, 1-Very Difficult, and 0-N/A.

  - ➢ *Agreement Statements:* 5-Strongly Agree, 4-Somewhat Agree, 3-Borderline, 2-Somewhat Disagree, 1-Strongly Disagree, and 0-N/A.

- Each question provided space for additional comments.

User Assessment Results

Effectiveness Questionnaire Results

Effectiveness Questions	Avg.	Med.	Comments
1. In regards to decision making, a forecast that goes out to 3 hours is	4.4	4	The 3 hour forecast is adequate, however, for longer distance flights a 5 hour forecast is needed. ➢Typical EMS flights consist of 20 minutes on the ground, 20 minutes in-flight, 20 minutes on the ground, 20 minutes to hospital, then back to location. ➢Non typical flights have longer in-flight times and ground stays.
2. Using the Ceiling and Visibility forecast to support flight planning is:	4.7	5	
3. The spatial resolution (detail) of the forecast is:	4.6	5	
4. The spatial extent of the forecast is:	4.3	4	
5. To aid in decision making, the forecast was:	4.6	5	
6. The effectiveness of having prior analyses available via the time slider is:	4.5	5	
7. The forecast, with 15 minute updates and validity at the top of the hour is:	4.1	5	When we must make decisions in a compressed timeline that require a margin of safety, a forecast with validity as close to real time as possible would be more helpful
8. The hourly granularity of the forecast product is:	4	4	
9. Moving from Now (current time) to a forecast time, the transition in the forecast display is:	4.4	4	

Usability Questionnaire Results

Usability Questions	Avg	Med	Comments
1. Using the Time Slider to select a specific time for your flight planning needs was:	4.7	5	
2. When moving the Display Timer, knowing what time in relation to the current time was:	4	4	
3. Switching between past analysis, current analysis, and forecast conditions is:	4.6	5	When in full screen mode, the legends at the bottom of the page are no longer visible.
4. It is easy to determine which model is being used for the forecast (RTMA or LAMP)	4	4.5	
5. Distinguishing between the Product Valid time on the time slider, and the File Issuance time indicated at the bottom of the image is:	**3.5**	4	Color code the Time Slider: Now (green), prior conditions (yellow), and forecast (red)

Note: Results in Red indicate "Borderline" results.

Agreement Statement Results

Agreement Statements	Avg	Med	Comments
1. When viewing the HEMS Tool, it is easy to know a forecast product is available via the Time Slider.	**3.4**	**3**	
2. The information provided on the INFO-Products page was informative:	4	4	Suggest using more laymen terms. For typical users getting into the meteorological terminology is difficult to understand.
3. The information provided on the INFO-Tutorial page was informative:	4.4	4	Reduce the number of acronyms used.

Note: Results in Red indicate "Borderline" results.

Open-ended Questionnaire Results

	Rank Order	Category	Rational
Please rank the products in order from most important to least important to aid in your decision making for flight planning:			
HEMS Pilots (4)	1	Visibility	EMS Pilots are not landing on lighted runways, visibility is primary. If a pilot can land aircraft on a lighted runway with 1 mile visibility doesn't imply the helo can be taken to a remote hospital and safely get there with 1 mile visibility. Visibility (distances) is one of the hardest things for a pilot to judge during flight, ceiling is easier to judge by day, by flying to the base of the clouds and at night by turning on the landing light and aiming up to the base of the clouds. Flight rules, VFR, MVFR, IFR, and LIFR don't do much for HEMS since day ops can be down to 800 ft. ceiling and 2 miles visibility. Ceiling because you need to know when you expect to break out or enter the clouds. Visibility highly uncomfortable when pilot can see ground below but nothing in front FR more of legality big picture trends
	2	Ceiling	
	3	Flight Rule	
HEMS (1)	1	Flight Rule	The graphical depiction of FR is the quickest way to determine the ability to fly. Visibility at low level towers are in play it is very important to have the ability to see and avoid as well as land at an unimproved area should ceiling drop. Ceiling is ranked lowest because they can be seen to decrease and as they decrease a plan can be made to turn around or land.
	2	Visibility	
	3	Ceiling	
USCG	1	Visibility	1. Visibility is go-no-go for the coast guard 2. Flight rule combines both 3. Is already accounted for above.
	2	Flight Rule	
	3	Ceiling	

Open-ended Questionnaire Results

	Rank Order	Category	Rational
Please rank the products in order from most important to least important to aid in your decision making for flight planning:			
GA Pilot	1	Flight Rule	Flight rule is a quick indication and ceiling is generally what is limiting the flight.
GA Pilot	2	Ceiling	
GA Pilot	3	Visibility	
ERHC	1	Ceiling	
ERHC	2	Visibility	
ERHC	3	Flight Rule	

Open-ended Questionnaire Results

	Is there additional information needed for decision making regarding the forecasts? If so, what?	Are there any changes you would suggest to the HEMS Tool Forecast?
HEMS Pilots	Turbulence would be an outstanding addition	Add the ability to play the slider in a loop like the radar info.
	A box similar to a SIGMET box that shows areas of potential thunderstorm activity even when there are no storms currently there are products like that, but there should be a layer on the HEMS tool.	As previously noted, making a forecast and graphical representation as close to real time as possible would be most helpful. Sometimes an observation of IFR will show with an airport having a purple circle but the area around it will not show as LIFR conditions until the update.
	An increase in the data base of reporting points or some way to fill n the gap in the many areas where we have no observation exists.	
USCG		Sectional added, moving map?
ERHC Participants	Icing probability, thunderstorm forecast	

Open-ended Questionnaire Results

	When using the Time Slider were there any issues with the continuity of the forecast display? If so, would it impact your operational decision making?	Are there any other aspects of the HEMS Tool you would like changed?
HEMS Pilots	It could be useful, but again the forecast is making assumptions that often do not pan out. Current conditions are king for HEMS Pilots, combined with TAFs.	Layers, like PIREPS, are hard to find often. Wind barbs should be able to be overlaid on any map at any altitude. As well as freezing level.
		1. Color depiction of the winds, currently are not easy to make out and should use color coding that warns pilot of high winds. 2. Given that most EMS pilots fly around 500 feet so often it would be nice to add Surface and 500 feet to the choices when identifying what altitude you want to look at for weather.

Structured Interview Results

Structured Interview Results: Time Slider

- **The time slider moves in half-hour increments. Does this provide sufficient temporal resolution?**

  ➢ Overall, the 30 minute increments is adequate, however, pilots stated 15-minute increment is better suited for short duration of flights.

  ➢ EMS Pilots may take off, land, and arrive at locations with no weather-reporting capabilities, therefore, a high temporal resolution is needed.

  ➢ Participants interpreted that the time slider is providing updated conditions every 30 minutes.

  ➢ Participants stated a forecast that goes out 3 hours is sufficient and adequately supports pre-flight planning for short duration flights. However, for longer duration flights a 5 hour forecast is needed.

> All participants associated the time slider increments with an increase in temporal resolution. This is a significant misconception and can result in improper go-no-go decisions, patient transport decisions, and duration-of-stay decisions.

Structured Interview Results: Time Slider

- **When using the time slider, are there noticeable differences between current conditions and forecasts?**

  - ➤ All participants noticed a difference in coverage between current and forecast conditions. This was a concern in terms of trust and reliability of the tool.

  - ➤ Participants did not notice the change in model information at the bottom of the page, participants stated there is no need to know the model information, the concern is with the validity of the forecast.

  - ➤ Participants stated, when viewing the forecast, the tool needs to give clear indication the conditions displayed are forecast conditions.

> A forecast capability is needed for HEMS Pilots because these pilots are often departing/arriving locations (such as pastures or hospitals) with no weather observations.

Structured Interview Results: Display Time

- **When viewing the Display Time (upper-right) and then the product timestamp for current and forecast times (bottom-middle), is it clear what time the forecast is valid for?**

  - ➢ All participants had difficulty identifying the correct valid time of the forecast. There was confusion between the model time stamp, Display Time, and slider.

  - ➢ Participants did not notice the RMTA-RU or the LAMP time stamp at the bottom of the page.

  - ➢ Participants were not able to use the model time stamp and the Display Time to correctly determine the forecast valid time. Participants were unclear what F01, F02, and F03 signified.

  - ➢ The valid time of the forecast is critical information for pilots. The tool should be clearly labeled for each product.

HEMS Pilots make decisions quickly, so the interpretation needed to determine the valid time is unacceptable.

Go-no-go decisions are made within minutes, therefore the accuracy and valid time of a forecast is critical to know, especially when dealing with patients who can't tolerate flying at certain altitudes.

Structured Interview Results: User Customization

- **Is there a need to provide user preference customization for the HEMS Tool and save the preferences? If so, which products and/or overlays should be displayed when starting the tool?**

  - ➢ All participants currently save preferences on local workstations.
  - ➢ All participants stated the need to continue to have the capability of saving preferences.
  - ➢ Specific start-up configurations are not needed due to preference settings and easy to overlay/option access.

Structured Interview Results: Additional Products

- **Are there additional categories needed under the Weather menu (Satellite, Radar, Flight, Category, C&V, Icing Severity, Icing Probability, Temperature, Relative Humidity, and Wind)?**

  ➢ All participants, specifically IFR Pilots, need the freezing level. The freezing level is critical for determining safe altitudes, particularly when patients are on board.

  ➢ Turbulence information is needed, as many patients can not tolerate turbulence.

  ➢ Participants noted the need to have the capability to filter overlays, for example only see winds from MADIS.

> The freezing level is critical to know because pilots may have to fly at restricted altitudes because of patient conditions. Neonatal patients typically can't fly above certain altitudes because it can impact health. Head injuries need to stay at lower altitudes. Knowing the freezing level aids pilots in making critical decisions to determine if certain altitudes can't be maintained to keep patients healthy.

Structured Interview Results: Additional Products

➢ 2 participants stated the need to have surface weather analysis to better inform decision making for duration of stay.

➢ Specifically for winds, the colors are not suitable. Green typically indicates "good" conditions. The colors used for winds are counter-intuitive. Upon a quick glance a user may interpret 60+ winds as suitable conditions and take flight, whereas these conditions are not suitable for helicopter flights.

15   30   45   60   75
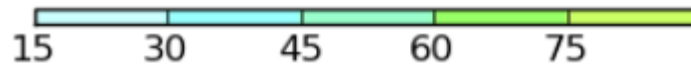
Structured Interview Results: Altitude Range

- **Icing Severity, Icing Probability, Temperature, Relative Humidity, and Wind Speed display altitudes of 1,000-5,000 feet above ground level. Is this adequate?**

  ➢ The 1000-5000 AGL should include lower and higher altitudes. This is needed because:

    ▪ Altitudes up to 9000 feet are becoming more typical during IFR flights.
    ▪ Higher altitudes needed in mountainous locations (i.e., Denver).
    ▪ Higher altitudes needed for longer distances.
    ▪ Lower altitudes needed for duration of stay decisions.

  ➢ Users noted when selecting a specific wind altitude then selecting Flight Category, Ceiling, or Visibility, the wind altitude changes to 1000 AGL. This is a concern because it is not noticeable the wind altitude changed. Pilots may think the display is showing the specific altitude that was previously selected.

> It was noted, Pilots will fly at a slightly higher altitude and catch a tail wind to make up speed and reduce fuel consumption.

Structured Interview Results: Help Feature

- **Is it clear where to find information about tool capabilities and other helpful information about the HEMS Tool?**

  ➤ All HEMS Pilots are active daily users of the deployed HEMS tool, but were not aware of the INFO button. Assessment Participants did not use the INFO button on the Experimental Tool, either.

  ➤ Participants stated the label INFO was not clear.

    ▪ Using the term "INFO" implies getting information such as version number and/or when the last update of the tool occurred.

    ▪ Using a more accepted term such as "HELP" implies providing information regarding the tool's use and capabilities.

    ▪ Participants also stated, it is important to have consistency throughout each product hosted on the AWC website because other products are used.

> Participants are accustomed to seeing the term "HELP" instead of "INFO." However, the term used, should be consistent throughout the AWC site.

Structured Interview Results: Products Page

- **Was the Products page information useful? Was it presented in a logical, meaningful manner? Was it easy to find information needed using the page? Are there any suggestions on how to improve the Products page?**

  ➢ Several participants stated the use of acronyms was difficult to comprehend and stated the information was too technical and should be written for non-meteorologists. For example, under Base Maps, the term "ESRI terrain view" is used, but most pilots do not know what this means.

  ➢ Participants stated the need for a Search capability to easily find information.

  ➢ To increase the usability of the Product page, the suggestion was made to add hyperlinks to each capability. This will allow users to quickly access the capability through the site.

  > Participants had never used or accessed the Products or Tutorial pages on the operational HEMS Tool, users noted the pages were useful.

Structured Interview Results: Tutorial Page

- **Was the Tutorial page information useful? Was it presented in a logical, meaningful manner? Was it easy to find information needed using the page? Are there any suggestions on how to improve the Tutorial page?**

  ➢ Several participants stated the use of acronyms was difficult to comprehend and stated the information was too technical and should be written in layman's terms.

  ➢ Participants stated the need for a Search capability to easily find information.

  ➢ To increase the usability of the Tutorial page, the suggestion was made to add hyperlinks to each capability. This will allow users to quickly access the capability through the site.

Conclusions/Recommendations

Usability Conclusions

1. **Determine the usability of the experimental HEMS Tool.**

   ➢ Participants could not determine the valid time of the forecast.

      ▪ Participants didn't notice the RTMA-RU or LAMP time stamp at the bottom of the page.

      ▪ The LAMP forecast values (F01, F02, and F03) did not have meaning and could not be interpreted by the participants.

      ▪ The terms RTMA-RU and LAMP do not have value to the participants. The pilots are not interested in knowing which model is being used. The concerns are:

         ▪ Is the forecast valid?

         ▪ Is the forecast accurate?

      ▪ Valid time was not presented in plain language, e.g., "Forecast is valid at 15Z."

   ➢ There was a misconception the Display Time represented the forecast updated interval.

   ➢ The change from the current conditions (RTMA-RU) to the forecast (LAMP) was noticeable and difficult for participants to interpret why the change occurred. Participants noted the need to review other products to verify the forecast because of the change.

Usability Conclusions

CONT: **Determine the usability of the experimental HEMS Tool**

- ➢ An animation capability, where appropriate, would allow pilots to see trends in the weather.

- ➢ The radar time label needs to be included on the looped images similar to the current operational tool.

- ➢ Participants noted the overlays stack on-top of another making it difficult to access or interact with the lower level layers.

- ➢ When selecting a specific altitude for wind then selecting FC, Ceiling, or Visibility, the specific wind altitude changes to 1000 AGL. This impacts the user because the change may not be seen and the user may believe a different altitude is being displayed.

- ➢ The colors for winds are misleading. Green indicates "good," whereas green for winds, on the HEMS tool, means higher winds, which are not good conditions for HEMS Pilots

Usability Conclusions

CONT**: Determine the usability of the experimental HEMS Tool.**

➢ When in full screen mode, the legends at the bottom of the page and the INFO button are no longer visible. The legends are important to see because users need to know quickly what products are being displayed.

➢ Participants had a misconception of what the INFO button page contained. Using the term INFO indicates product information such as last update and version number.

➢ Participants noted the capability to filter overlays is needed. For example, the capability to only see winds from MADIS.

Usability Recommendations

1. **Ensure the valid time of the forecast is easy to understand.**

   ➢ Have one location on the tool displaying a time stamp so users don't have to interpret the valid time.

   ➢ Use plain language when displaying the valid time, for example, the forecast is valid at XXXX.

2. **Modify the design of the Display Time Slider to:**

   ➢ Ensure which conditions (past or forecast) are being viewed is clearly identified, this could be done by using different font colors on the slider and/or changing the slider bar color. In addition, the time stamp font color should correspond to the font color on the slider.

   ➢ Accurately represent the forecast valid time. For example, if the forecast is valid at the top of the hour the slider should move in one hour increments.

3. **If different analysis products are used, suggest blending the transition between products (past to forecast) to minimize the change between products.**

Usability Recommendations

4. Provide the capability to see weather conditions in an animated loop.

5. Include the time labels for the radar loop and any future animated loops.

6. When overlays are used, the tool should not mask the lower layer levels.

7. When selecting specific altitudes for weather overlays, the selected altitude should not be overridden when other products are selected.

8. Suggest changing the colors used for wind speed to red for higher winds and green for lower winds.

9. Ensure the legends are visible when in full screen mode.

10. Suggest changing the INFO label to HELP.

11. When applicable, provide the capability to filter overlays to display specific information.

Decision Making Conclusions

2. **Determine how the experimental HEMS Tool will be used to aid in decision making strategies**

   ➢ For HEMS Pilots the most important weather product is visibility because most pilots are flying VFR, pilots can judge the ceiling by flying at the base of the clouds, and flight category gives an overall big picture, but pilots need more in-depth visibility information.

   ➢ The HEMS Tool is used for pre-flight planning. Participants noted an inflight version would be useful.

   ➢ HEMS Pilots look for historical trends in weather conditions to determine forecasts.

   ➢ The forecast would be used to make go-no-go decisions.

   ➢ For short distance flights (1-3 hours), pilots are looking approximately one hour out. This accounts for a 20 minute flight, 20 minutes on ground, and 20 minutes to location, then 20 minutes back to "home" site. Because of the short duration, a 15-minute update of forecasted weather is ideal.

   ➢ For longer distance flights (greater than 3 hours), 30 minute update of forecasted information is adequate.

Decision Making Conclusions

CONT: **Determine how the experimental HEMS Tool will be used to aid in decision making strategies**

➢ The forecasted information will aid in decision making by helping pilots determine:

- The best time to leave,
- The best transport type for the patient (ground or helicopter),
- Duration of stay at locations, and
- The best altitudes to fly for patient safety.

➢ HEMS Pilots rely heavily on the valid time and accuracy of weather information. Because flights tend to be short and patient safety mandates safe altitudes based on the type of patient and injury, the accuracy and validity of a forecast is critical. Due to this, knowing the valid time is important to know and should be clearly stated.

➢ HEMS Pilots make go-no-go decisions quickly, therefore it is critical to make the information on the tool easy to see and interpret. For example, when displaying a forecast, the Display Time should clearly indicate by using color or other method to clearly show a forecast is being displayed.

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Decision Making Recommendations

1. Increase the temporal resolution of the forecast to have an updated 15 minute forecast.

2. Provide an animated loop, where applicable, of weather products to see trends.

3. Ensure the Display Time slider and time stamp visibly distinguish which weather conditions are being displayed. This can be done by using different font color for past and forecast conditions. The time stamp should have the same font color as the slider font.

4. Ensure the valid time of the forecast is easy to understand.
    ➢ Have one location on the tool displaying a time stamp so users don't have to interpret the valid time.
    ➢ Use plain language when displaying the valid time, for example, the forecast is valid at XXXX.

5. Provide a portable version of the tool that can be accessed while in-flight.

Information Needs Conclusions

3. **Determine if the tools have the information needed for decision making.**

   ➢ The valid time of the forecast at the top of the hour does not sufficiently support operational use. Participants stated a need for high temporal resolution of forecast information due to the short duration of flights and patient safety. The higher temporal resolution would allow pilots to make better informed decisions about safe altitudes to fly and determine if flying is the most appropriate transport for patients.

   ➢ All participants, specifically IFR pilots need to see the freezing level.

   ➢ All participants need an animation capability to determine trends.

   ➢ Turbulence forecasts are needed to aid in decision making about the type of transport needed for patients.

   ➢ IFR and some VFR pilots fly up to 9000 AGL, therefore, the weather products need to provide data above 5000 AGL. Particularly mountainous regions may need higher altitudes.

Information Needs Recommendations

1. Increase the temporal resolution of the forecast to have an updated 15 minute forecast.

2. Include the capability to see the freezing level.

3. Include turbulence forecasts.

4. Provide an animated loop, where applicable, of weather products to see trends.

5. Increase the weather products to provide information up to 9000 AGL.

Tool Improvement Conclusions/Recommendations

4. **Gather feedback to determine tool improvements as related to users' operational environments.**

   ➢ Make the valid time of the forecast easy to interpret.

   ➢ Increase the temporal resolution of the forecast to every 15 minutes.

   ➢ Increase the AGL for weather options up to 9000 feet.

   ➢ Include the freezing level.

   ➢ Include turbulence forecasts.

   ➢ Change the colors for wind speed.

   ➢ Add the time label for the radar loop.

   ➢ When specific products/altitudes are selected to display, those selections should *NOT* change when other products are selected to be displayed.

   ➢ Increase the usability of the overlays so lower level information can easily be accessed.

   ➢ Make the HEMS tool available as a mobile application so it can be used on a phone or tablet.

Tool Improvement Conclusions/Recommendations

***CONT*: Gather feedback to determine tool improvements as related to users' operational environments**

➢ Change the name of the tool.

▪ Not only used by HEMS Pilots but also general aviation, crop duster, and forest service pilots, to name a few.

▪ May get more use if the name is more generic.

▪ Some name suggestions are: Low Altitude Aviation Weather Reporting System, Graphical Aviation Weather Reporting Platform, Low Altitude Graphical Weather Reporting Platform.

Display Time Solutions

Current Time
1729

22 May 2018

12:00 13:00 14:00 15:00 16:00 17:00 18:00 19:00 20:00

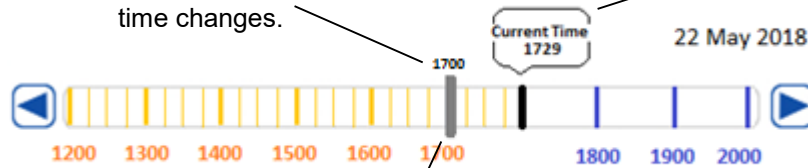Display Time
1700
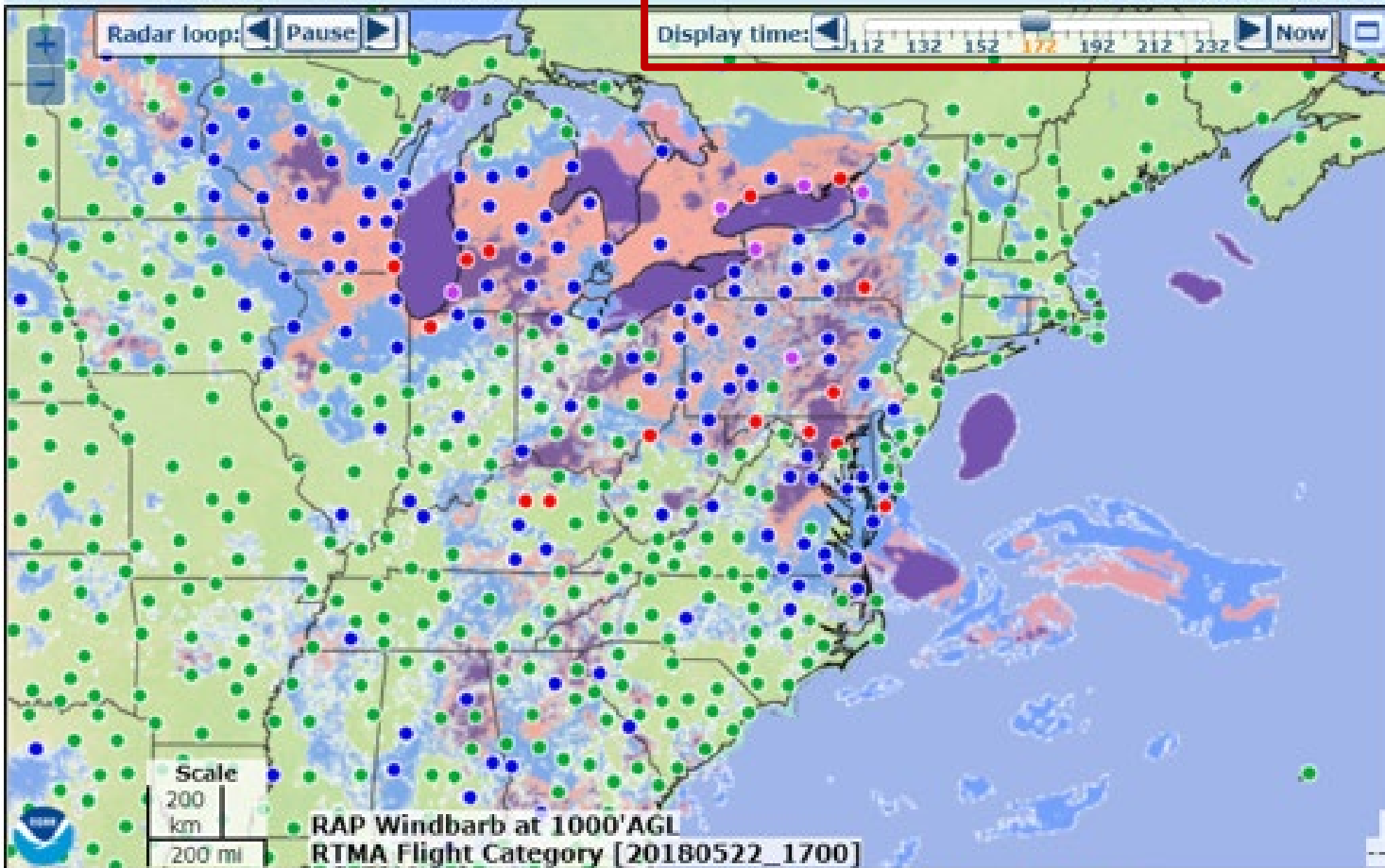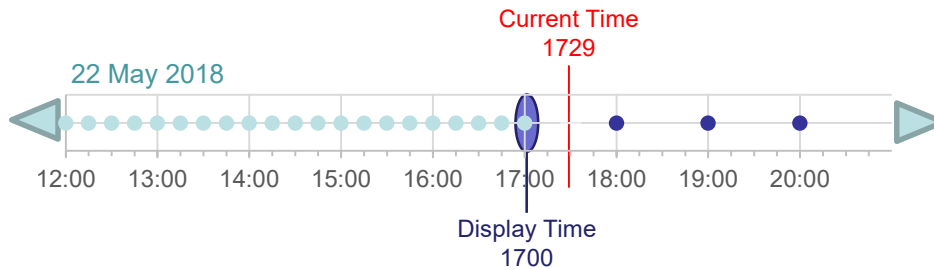
Current time is also a Button, providing the capability to easily view the "Current Time"

As the slider moves, the time changes.

Current Time
1729

22 May 2018

1700

1200 1300 1400 1500 1600 1700 1800 1900 2000

Different font color for past and forecast conditions.

Slider bar to slide through the different times.

Only three options for forecast conditions since the forecast is only valid at the top of the hour out to 3 hours.

Controls are at the bottom. However, the slider can still be moved with the mouse.

22 May 2018

1200 1300 1400 1500 1600 1700 1800 1900 2000
1700
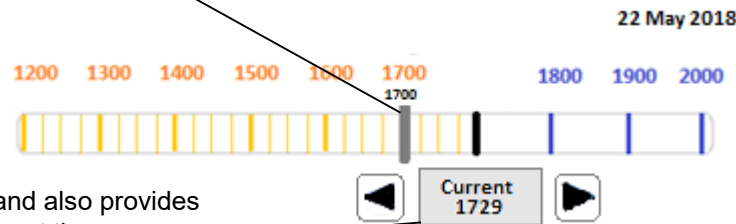
Current
1729

Button displaying Current Time and also provides quick access see the current time.

Federal Aviation Administration

Deliverables

Deliverables

Task	Date
User Assessment Plan and Data Collection Tools	May 29, 2018
Recruit Participants	February – May, 2018
Conduct Evaluation	May – June 2017
Final Report/Briefing	July 20, 2018

Questions?