StormCenter Communications, Inc.

SBIR-DG-133W-12-CQ-0041 Option 1
Integrate NWS Weather Products into State/Local Emergency Operations Centers

Task 1: Prototype for NWS-MEMA Collaboration, SOO ConOps - Concept of Operations

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TABLE OF CONTENTS

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1. INTRODUCTION

The National Weather Service (NWS) has a requirement to integrate its weather products into state and local Emergency Operations Centers (EOCs). The multi-platform collaborative decision environments being developed under StormCenter's NASA SBIR Phase II contract have been identified as a potential solution for geospatial weather products visualization, sharing and collaboration.

The NWS Roadmap 2.0 is focused on building a Weather-Ready Nation (WRN), which means building community resilience in the face of increasing vulnerability to extreme weather-dependent impacts. To this end, NWS is enhancing decision support services, improving technology to track and forecast storms, and expanding its dissemination efforts to achieve far-reaching national preparedness. To implement the WRN Roadmap, focused Impact-based Decision Support Services (IDSS) activities are occurring as a part of NWS WRN Pilot Projects. In addition, through ongoing prototype activities, many other offices across NWS are exploring new ways of providing decision support services.

In January 2012, the National Weather Service (NWS) Baltimore/Washington Weather Forecast Office (WFO-Sterling) began a Pilot Project as part of the NWS Weather Ready Nation Initiative. The goal of the WFO-Sterling project is to provide Impact-Based Decision Support Services (IDSS) in an Urban Environment. These IDSS services are being developed to provide more tailored and relevant forecast services for emergency managers (EMs) throughout the District of Columbia, Maryland, Virginia and West Virginia. The goal is to provide key information so EMs will be better prepared to respond to the many different types of hazardous weather that affect the Nation's Capital and surrounding areas.

Working together with the Baltimore / Washington NWS WFO in Sterling, VA and Maryland's Emergency Management Agency – MEMA at Reisterstown, MD, the goal of this project is to provide the WFO forecasters solutions to improve the provision of IDSS to Emergency Management through the creation and enhancement of existing geospatial interactive maps, or Common Operating Pictures (COPs) and adding StormCenter's collaborative capabilities to them.

The solutions presented address an issue of significant importance to the WFOs, and will help seek new solutions to the need of delivering IDSS to Emergency Management.

2. CURRENT STATE OF OPERATIONS

2.1 DESCRIPTION OF THE CURRENT ENVIRONMENT

Currently the NWS Sterling WFO delivers IDSS to MEMA in three ways: scheduled conference calls with screensharing support, response to unscheduled calls from emergency management and on-site deployment of personnel to MEMA's Emergency Operations Center (EOC). The most common weather collaboration scenarios between the Sterling WFO and MEMA are state level conference calls that occur during 6 events on average per year. Onsite deployment is are required from the state if a significant threat is established and/or there is high public awareness to an event. This occurs one or two times per year.

The following events have been identified as the most frequent for NWS-MEMA collaboration:

Winter Storm

Collaborations begin from the NWS WFO several days in advance of the weather system. NWS begins decision support services via "heads up" email blast messages (once per day). NWS then proceeds to highlight the potential for a weather system to impact the region. Uncertainty factors are discussed.

If confidence increases to at least 50% and a Watch is issued the NWS WFO will usually perform state level conference calls at the request of MEMA. At this point the NWS transitions to developing impact graphics and focuses on communicating uncertainty through a range of

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possible outcomes. Conference calls in the past have occurred at the frequency of a morning and afternoon call. Occasionally an evening call is requested for an update.
MEMA can request NWS onsite presence at the MEMA EOC if the threat is widespread or major. At that point an ERS Meteorologist follows along with the briefing schedule outlined by the incident commander and or the section chief assigned. In addition, there are usually a multitude of high level conference calls and briefings the ERS Met will perform sometimes including the Governor and his cabinet, MEMA executive staff, Red Cross, MJOC, Search and Rescue crews and the media.

Tropical System

Similar to a winter storm except MEMA spins up their EOC to level 1 or 2 once the 5 day error cone reaches anywhere within the state of MD.
Emails, briefings and conference calls take place at WFO Sterling and then onsite deployment can be requested by MEMA if the threat comes more certain. Briefing schedules and high level briefings much the same as above under winter storm will occur.

Moderate Risk Severe/Tornado Event

Support briefings and graphics are emailed once a slight risk is determined by the SPC. Moderate risk area usually prompts MEMA to call a state level briefing at least twice per day. Occasionally an ERS Met is called for onsite support.

Large event with high public awareness which requires SEOC staffing at Level 1 or 2: Example: War of 1812 Sailabration

Usually handled by a conference call schedule developed by MEMA. Occasionally onsite support is requested.

Trainings / tabletop exercises

NWS also participates in tabletop training exercises. In these exercises simulated hour by hour weather conditions and forecasts are provided multiple times in an time-accelerated emergency management scenario. Many times the NWS has pre-assembled presentations using graphics from previous weather events. Exercises range from immediate response situations (overturned truck, radioactive material) to slow onset events such as hurricanes, winter storm exercises and heat related exercises

Additionally county emergency managers in Maryland are continuously provided with support on-demand from WFO forecasters. This is initiated typically by a call from the county emergency management to the WFO, and the response from the NWS is normally verbal (no graphics, or screensharing is provided).

2.2 USER/CUSTOMER IDENTIFICATION & ORGANIZATION

Primary users of the proposed solutions are the NWS Sterling, VA WFO forecasters and Maryland's Emergency Management Agency (MEMA) staff and stakeholders, including county and municipality emergency management, MD Governor, MD office of homeland security, MD National Guard, MD ESF staff (Emergency Support Functions), State agencies (DOT, ..).
ESF staff (Emergency Support Functions) are responsible for coordination between different agencies and organizations in the following areas: Transportation (Department of Transportation); Communications (Department of Budget and Management); Public Works and Engineering (: Department of General Services); Firefighting (Department of Natural Resources); Information and Planning; Mass Care and Sheltering (Department of Human Resources); Resource Support; Health and Medical Services (Department of Health and Mental Hygiene); Search and Rescue (Department of Maryland State Police); Hazardous Materials (Department of the Environment); Food (Department of Agriculture); Utilities and Energy (Maryland Energy Administration, Public Service Commission); Law Enforcement (Department of Maryland State Police); Debris Management (Department of the Environment); Donations Management; Animal Protection (Maryland Department of Agriculture).

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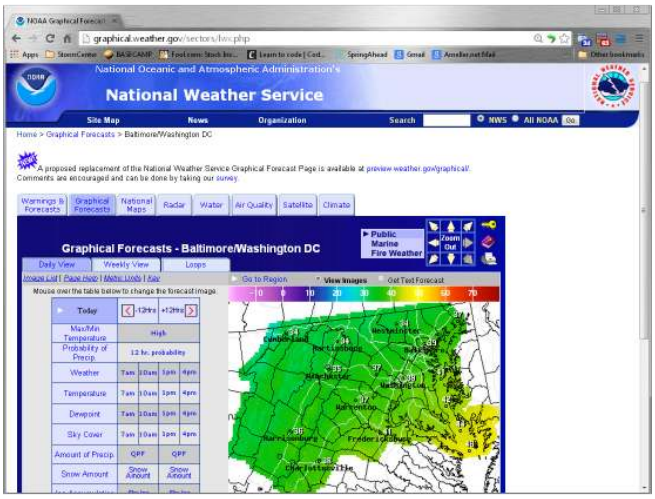
2.3 CURRENT SUPPORT ENVIRONMENT/ARCHITECTURE

Currently the NWS Sterling WFO delivers IDSS to MEMA in three ways: scheduled conference calls with screensharing support, response to unscheduled calls from emergency management and on-site deployment of personnel to MEMA's Emergency Operations Center (EOC). These are the tools used by the users identified when collaborating:

NWS Sterling WFO Tools

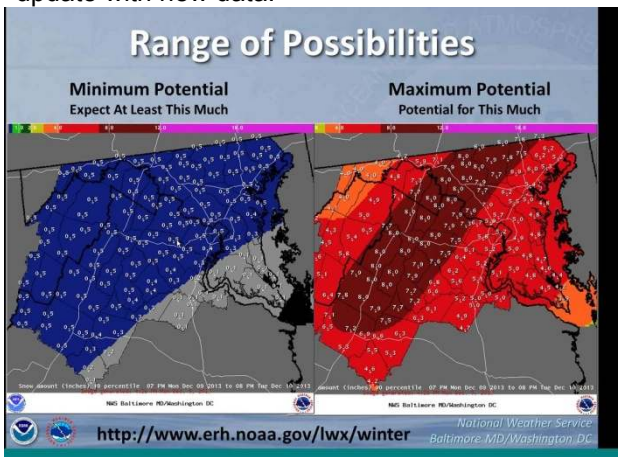
NWS website pages

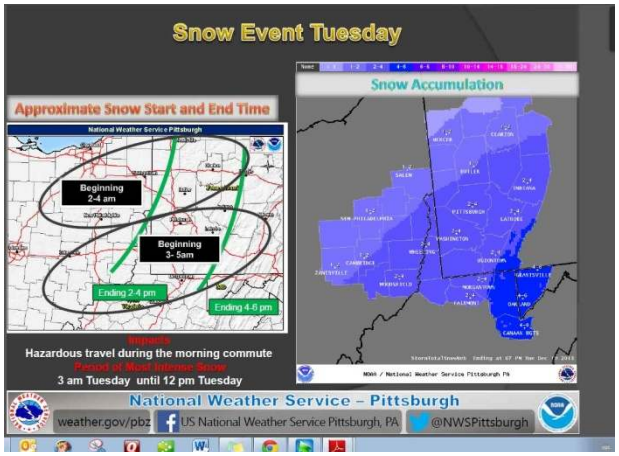
These NWS websites contain relevant weather maps and graphics (NWS products such as watches, warnings, advisories. Hazardous Weather Outlook) which are displayed via screensharing during conference calls.



Power point presentation slides

Also displayed via screensharing during conference calls, these slides include maps, tables, and other graphics. The data shown is only as recent as the snapshot taken in these powerpoints, and will not update with new data.





Interactive map viewers

There are several interactive map viewers available to the NWS to show via screensharing during conference calls. The NWS Enhanced Data Display (EDD), for example, has access to a variety of updated weather data layers that are useful when briefing. These tools are frequently used during briefings to emergency managers, and their usage is on the rise.

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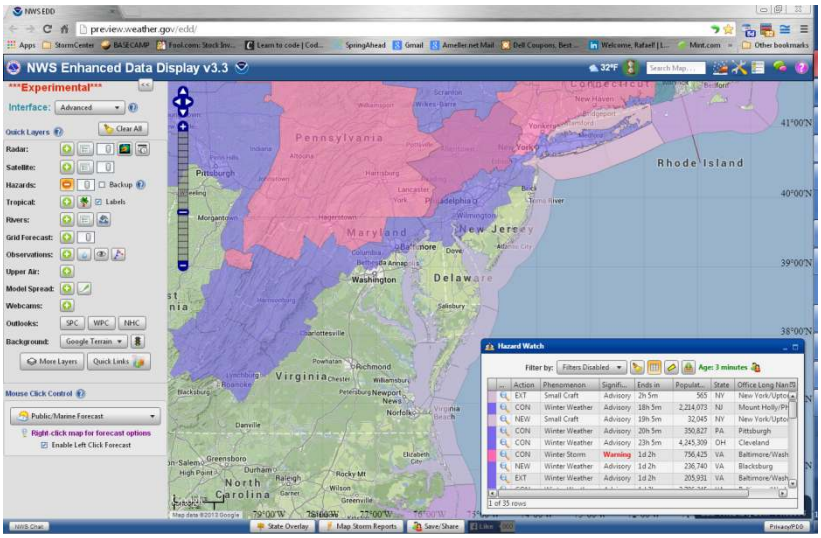

Webcam / HD video teleconference in Decision Support Services office
To connect to remote users via a Polycom video teleconference device. During these calls the products mentioned above are shown in a large flat panel TV behind the presenter.

AWIPS
Forecasters can access the NWS digital database which has all the information that enables forecasters to prepare and issue forecasts and warnings.
AWIPS is only accessible from within the NWS network and does not provide geospatial data export functions on the fly (only static screenshots).

AWIPS Thin Client
The AWIPS thin client gives access to NWS forecasters to the CAVE environment (The AWIPS II visualization tool) from outside of the NWS network. Even though it has some limited functions, such as the lack of the ability to issue Warnings and Watches, it is a valuable tool to access and export into KML all AWIPS data visualized. It is primarily used by deployed personnel and forecasters at the CWSUs (at the FAA facilities) to access and visualize AWIPS data. It handles limited bandwidth situations by compressing the data transmitted (it is a lossless compression).
It works on Linux and Windows, although it is not as robust on Windows.

MEMA Tools

OSPREY Flex Viewer
For situational awareness MEMA currently uses OSPREY (Operational Situational Picture for Response to an Emergency) as a Common Operating Picture (COP). Osprey is a Web mapping application that provides useful geographic data to Emergency Management stakeholders and decision makers (Private, secure version), and to the public in the event of an emergency (Public version). The system compiles data from many sources to give a composite picture of Maryland map data: vulnerabilities, emergency management assets and hazard-related information. The secure version of OSPREY was developed by the Center for GIS at Towson University. OSPREY was built using ESRI's ArcGIS Viewer for Flex 3.0. This works on most platforms except for iOS devices.
The private OSPREY mapping system is accessed after logging in through the WebEOC credentialing system at MEMA. OSPREY users include MEMA staff, county and municipality emergency management, government officials and state and federal agencies that interact with MEMA.
OSPREY can display updated Maryland data layers that are of importance to emergency management in the state, such as vulnerable populations, hospitals, nursing homes, shelters and their status,...
It is used by all stakeholders and personnel on the field as well as in State and County Emergency Operation Centers (EOCs).

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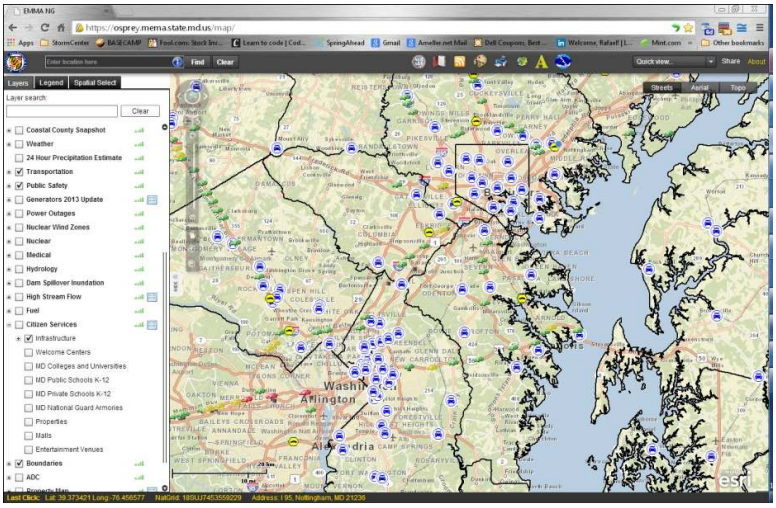
OSPREY has some NWS weather products integrated into the map viewer, such as radar, warnings and storm reports. OSPREY does no archiving of data (only live data shown, even during exercises).



WebEOC

WebEOC is the virtual incident management system that integrates MEMA's Emergency Management data. WebEOC can be accessed online and provides information such as Activity Log & Significant Events, After Action Review (AAR), Contacts, Damage Assessment, Shelters, etc..

MEMA's WebEOC generates map layers with some of the information contained in its database (such as Shelter status) and this information is displayed in the OSPREY interactive map. Sometimes the changes made in WebEOC take some time to refresh on the map.

The private OSPREY mapping system is accessed after logging in through the WebEOC credentialing system at MEMA.

WebEx

MEMA uses WebEx to handle voice conferencing and desktop sharing via the web. When alerted of upcoming weather situations the Maryland Joint Operations Center (MJOC) staff schedules calls. These calls bring in all the state stakeholders (MEMA staff, county and municipality emergency management, government officials and state agencies) and are normally scheduled 24 hours in advance. It is very rare for these conference calls to be done on the fly.

MEMA calls that include weather briefings are the most attended, although many times stakeholders only listen in without using the screensharing capabilities. There are several reasons for this, including how busy they are at that time of the call and their habits, but emergency managers tend to be very visual.

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Another reason the screensharing portion of WebEx calls might not be followed is because the application requires some technical ability and administrative privileges to install on computers. Stakeholders that are not MEMA staff might have a hard time installing the WebEx application and keeping it updated.

The display of graphics and maps with relevant weather information is proven to be very valuable to the decision making process in emergency management.

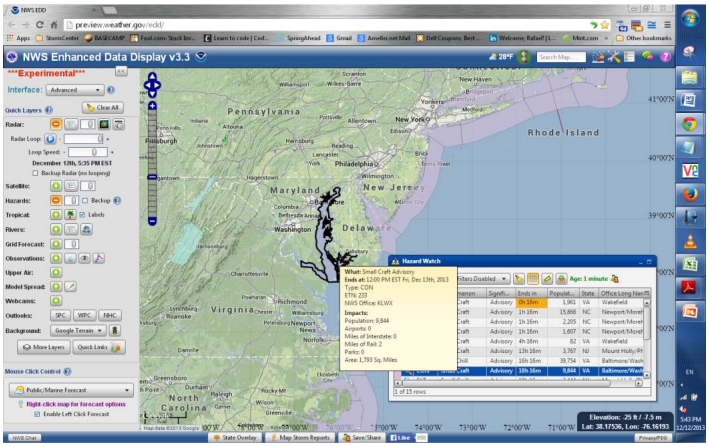
WebEx is used by stakeholders on the field and in State and County Emergency Operation Centers (EOCs). It is a proven, easy way to schedule meetings.

On WebEx the mouse movements of the presenter are seen on the screen by all participants. This has value when briefing to draw people's attention to things.

When using WebEx MEMA experiences some issues with noise leaking into the call, but they have improved the ways calls are handled. There are still challenges, such as handover issues , too many participants in a call and getting everybody to mute.

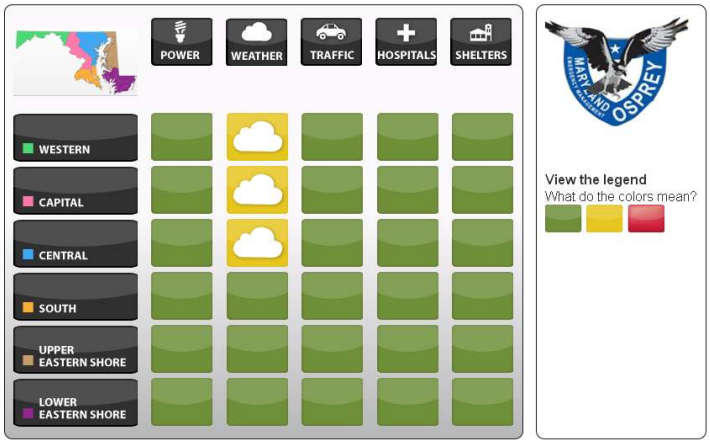
External sites that MEMA accesses:

For weather situational awareness MEMA and the MJOC access NWS weather viewers and private weather vendor viewers. The NWS Enhanced Data Display (EDD) provides easy access to weather data layers that MEMA uses for situational awareness. Additionally, the maps are clickable and provide point forecasts that will bring up additional information and hourly graphs that emergency management can use.



MEMA Osprey Dashboard

The Dashboard acts as a "thermometer of the big picture". Automated alerts for power, weather, traffic, hospitals and shelters are summarized by MEMA Regions in a table and are indicated by the colors green, yellow and red. Where there are multiple indicators in a group, the icon for the region will show the most severe condition present.



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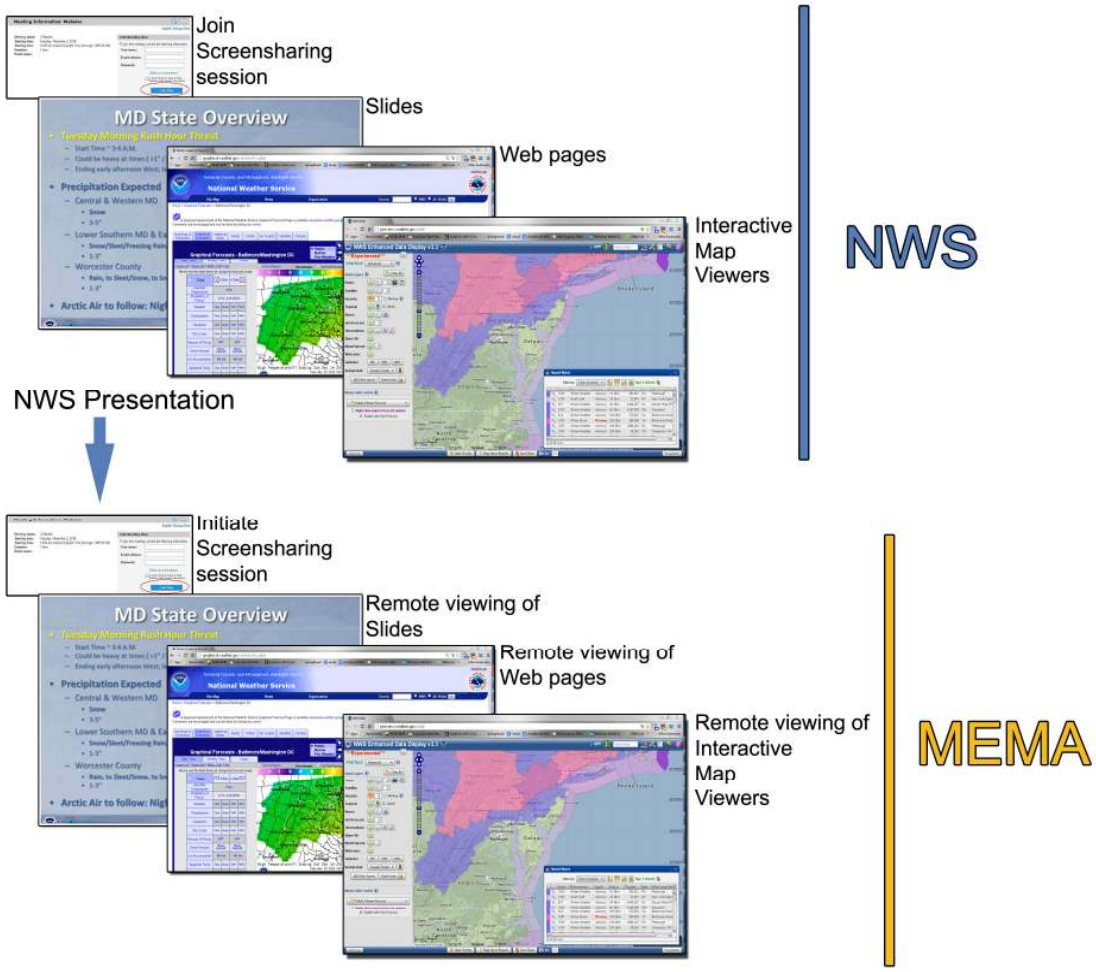
NWS - MEMA current collaboration workflow

During a MEMA scheduled conference call/ screensharing presentation the NWS delivers the weather briefing and presents supporting products while other users watch the screen of the presenter. The weather briefing presentation by the NWS to MEMA staff and stakeholders is typically led by the Sterling WFO and then the 3 other WFOs that cover the state of Maryland add any additional information and present additional slides to MEMA.

Delivering IDSS is more than data layers on a map, it is a series of briefing slides that deliver the core of the story with data products supporting it. The use of local data, local experts with their value-added knowledge and the building of local relationships is vital in the delivery of IDSS.

Products typically used in these presentations include powerpoint slides, NWS web pages displayed in a browser and NWS interactive maps (described above).



In the graphic above the products presented by the NWS (top) during a briefing are viewed via screensharing technology by MEMA staff and stakeholders (below).

Once the call and screensharing session has ended, the graphics and data presented by the NWS are no longer available to MEMA staff and stakeholders. These end users would have to search and display these products on their own, and the chances of these data products appearing fused with the layers and data products that emergency management uses to maintain situational awareness are small. This is

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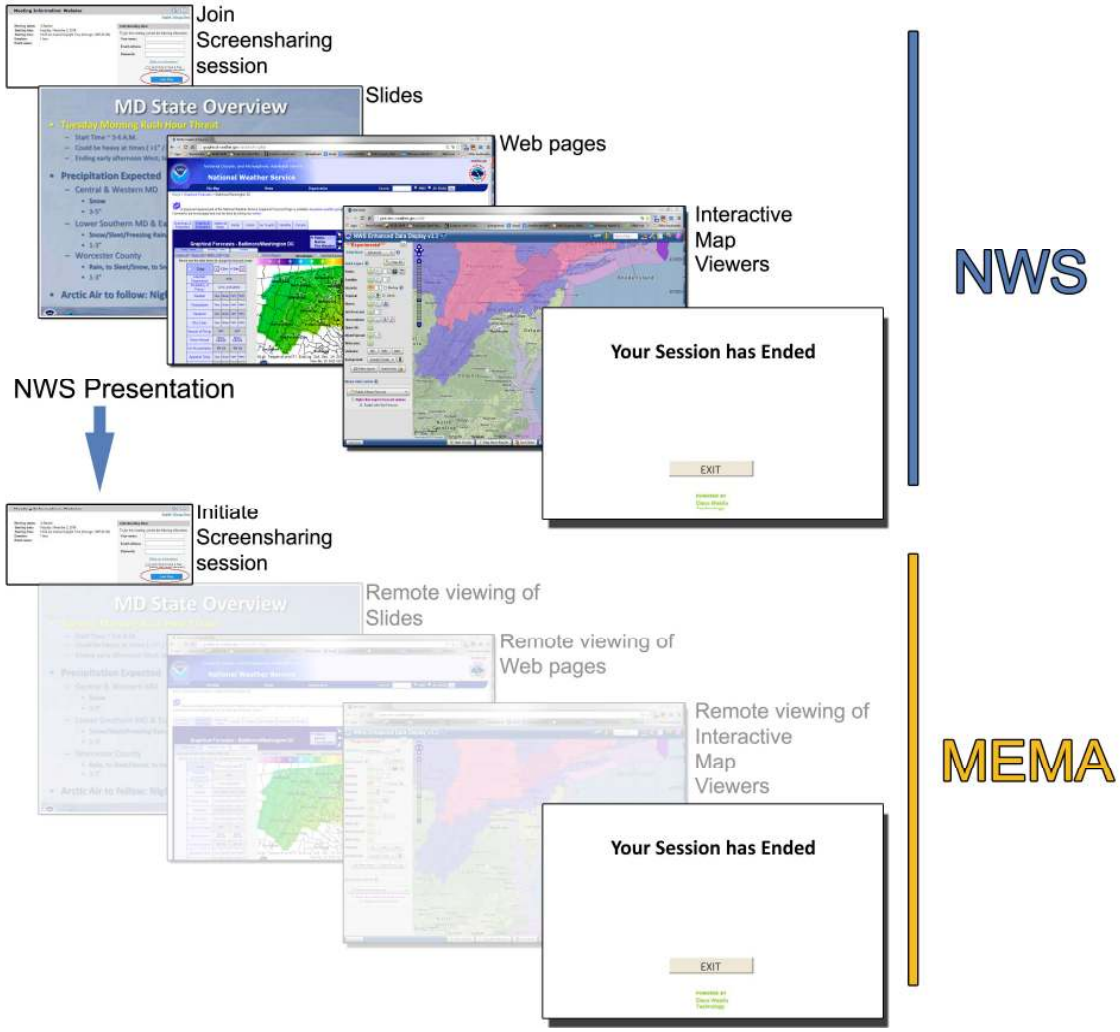
mostly due to lack of expertise fusing geospatial datasets, being too busy when responding to emergency situations and lack of resources (not enough staff and/or software to perform these functions).



In the graphic above the products presented by the NWS (top) after a briefing are no longer available to MEMA staff and stakeholders (below).

When the NWS WFO responds to unscheduled calls from MEMA staff and stakeholders, and during on-site deployment of personnel to MEMA's Emergency Operations Center (EOC) it is rare for any visuals to be shared in any way. The tools and datasets available to NWS forecasters cannot be shown because no screensharing is available outside of scheduled conference calls and the NWS forecasters cannot connect to the screens in the EOC.

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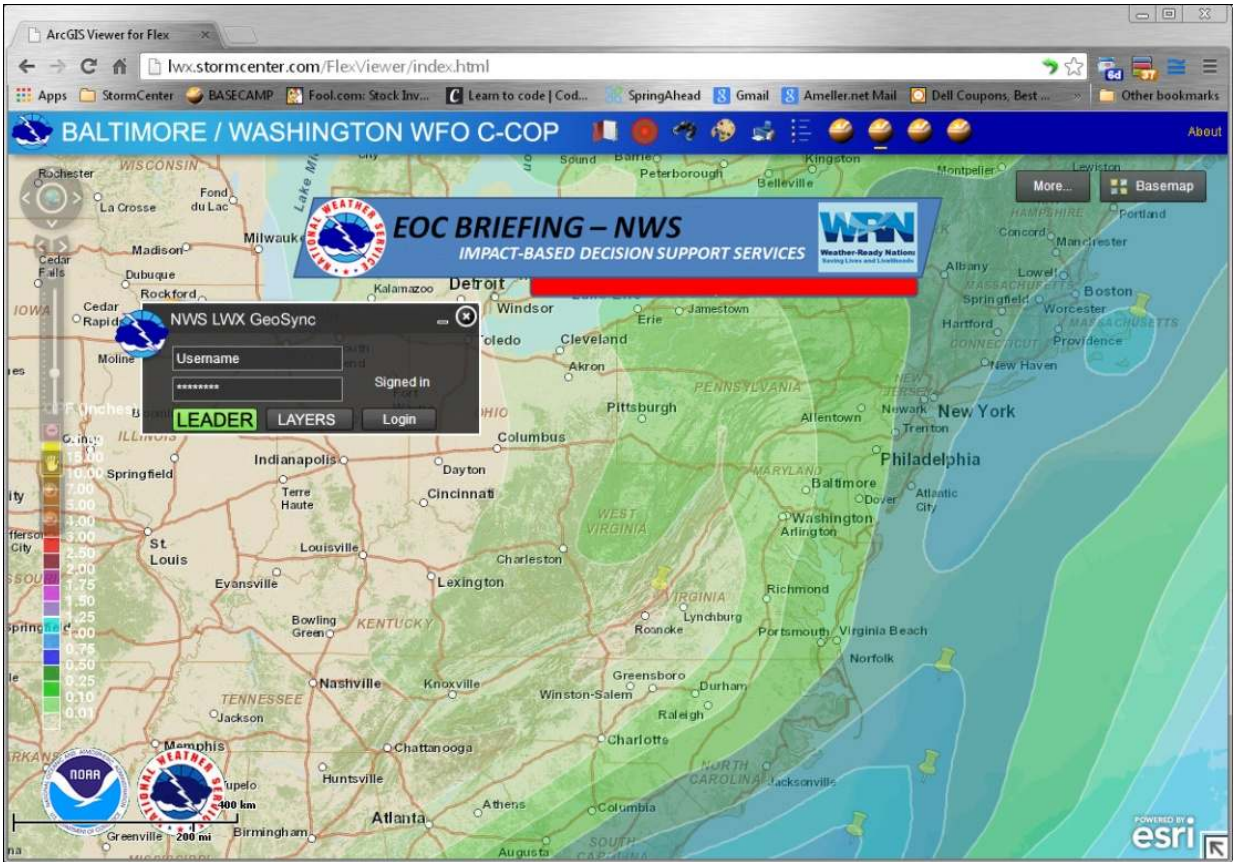
3. PROPOSED SOLUTION CONCEPTS

3.1 NEW CAPABILITIES AND FUNCTIONS

It is important to mention from the start that the current teleconference / screensharing capabilities will continue to be used when applying any new capabilities. These new capabilities will be integrated for use during the screensharing together with other presentation tools, such as presentation slides (we will be building collaborative capabilities into the tools currently available and workflows currently established).

During weather briefings to emergency management (remotely or on-site) one of the tools that has been used with more frequency are Interactive Map Viewers. There are several interactive map viewers available to the NWS to show via screensharing during conference calls. Many of these interactive map viewers have been built recently and are still experimental. The NWS Enhanced Data Display (EDD), for example, is an interactive map viewer that has access to a variety of updated weather data layers. Because the EDD is not mission specific, it loads many national layers and tools, making it necessary to learn how to use it correctly , and the application can take several minutes just to load during low bandwidth connections.

The NWS will be provided with a Collaborative Common Operating Picture (C-COP) in the form of a collaborative interactive map viewer using ESRI's ArcGIS Viewer for Flex technology. The NWS C-COP viewer will have a **GeoSync** widget installed that provides the tools necessary to take the LEAD during real-time geospatial collaboration with the Emergency Management Agency's COP.



Starting with a world base map and a wide variety of basemap layers (roads, political boundaries, cities, etc.), layers of geospatial data can be added collaboratively with the LAYERS menu on the widget. The NWS C-COP will contain multiple sources of weather data in a repository that can be displayed on demand (more on this below).

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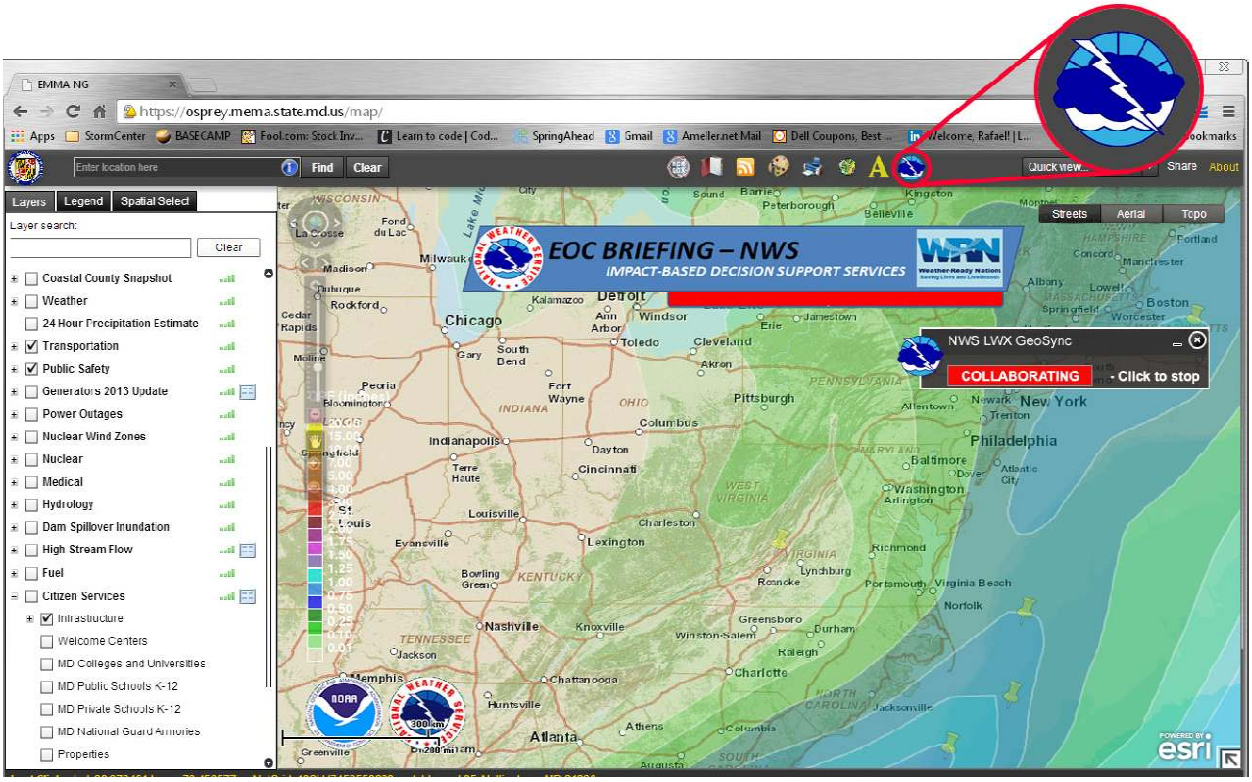
The NWS C-COP will have a NWS Baltimore/Washington (LWX) WFO C-COP banner displayed across the top. Other banners can be developed together with the WFO.
The interactive map viewer functions are the same industry standard functions found in other interactive map viewers. Because it is build using ESRI's technology, a leader in geospatial solutions, the tool has been proven robust enough for use by emergency management and stakeholders.
The NWS C-COP can run simultaneously alongside the other tools currently used by forecasters (described above) and it can also displayed during screensharing briefings.
For NWS forecasters who are logged into the system this provides a one-click solution, where one mouse click will allow users to start collaborating with MEMA.
The viewer and selection of layers will be optimized for network speed. This will be accomplished by reducing the amount of information downloaded when connecting to the NWS C-COP.

The GeoSync widget in lead mode will have draw (telestrating) capabilities included, so that WFO forecasters can place annotations on the map.

MEMA will be provided with a GeoSync Participant GeoSync Collaborative Flex Widget (FW) that will be installed on the Private OSPREY COP.



The Participant GeoSync Collaborative Flex Widget (FW) will be installed in the widget bar at the top of the Private OSPREY COP

The new capabilities will have no impact on the current OSPREY viewer or the way it is currently used. When using OSPREY MEMA staff and stakeholders will not need to install new software, learn how to access or use a new platform or go to a separate website other than the operating picture that they currently use for situational awareness.
For emergency management GeoSync provides a one-click solution, where one mouse clicking the GeoSync Widget will allow MEMA staff and stakeholders to start collaborating with the NWS WFO over the COP.

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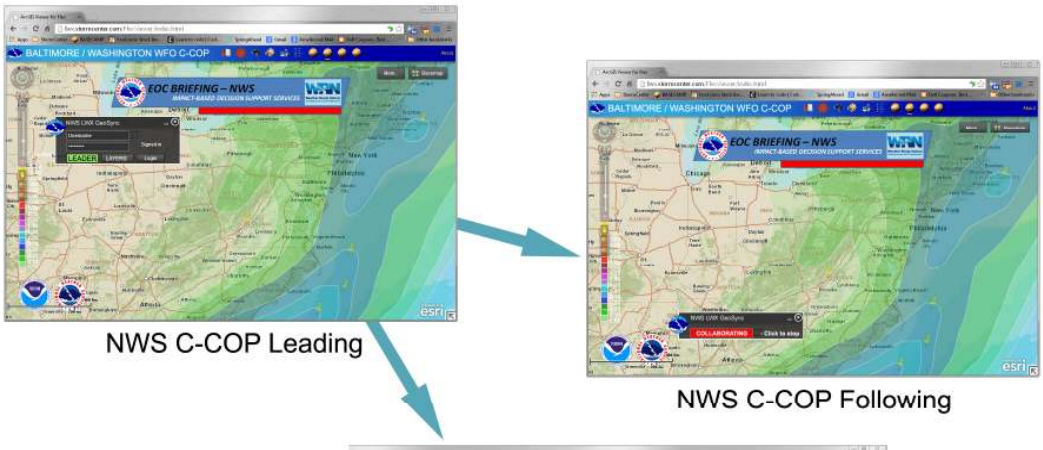

As each user connects to a collaboration using the collaborative interactive map viewers and GeoSync widgets on their own computers all the functions performed on the NWS C-COP (LEAD) map viewer will be executed across all the collaboration participants' map viewers (MEMA COP with GeoSync widget and Participant NWS C-COPs). Functions such as dataset loading and map extent changes will be replicated across all the connected geobrowsers, effectively creating a true geospatial Collaborative Common Operating Picture (C-COP). To prevent misuse, to take the Lead on the NWS C-COP GeoSync widget the forecaster will have to enter a user / password combination. He will then be allowed to take the Lead to start collaborating. When the Lead is released the C-COP will no longer Lead the connected COPs.

Pre-staged NWS geospatial datasets on NOAA and NWS servers (created automatically and available on the web in GIS format) will be presented in the LAYER repository for easy access. The contents of the LAYER repository will align with the collaborative IDSS scenarios and needs of emergency management, as well as any other supplemental layers the NWS might deem necessary.

The Layer repository will be organized by weather event type to quickly find and collaboratively display the layers when necessary. The weather layer repository will evolve and grow as new layers become available to forecasters.

The sharing of KML layers in real time is not limited to layers in the repository. In addition to those available in the GeoSync LAYERS, any compatible geospatial data layer available on any NOAA and NWS web server can be shared using the NWS C-COP at any time. As WFO forecasters discover and test out new geospatial layers that can be valuable for the delivery of IDSS to MEMA, if deemed compatible, these layers can be added to the Layer repository for easy access as well. Compatible layers for the repository must comply with certain

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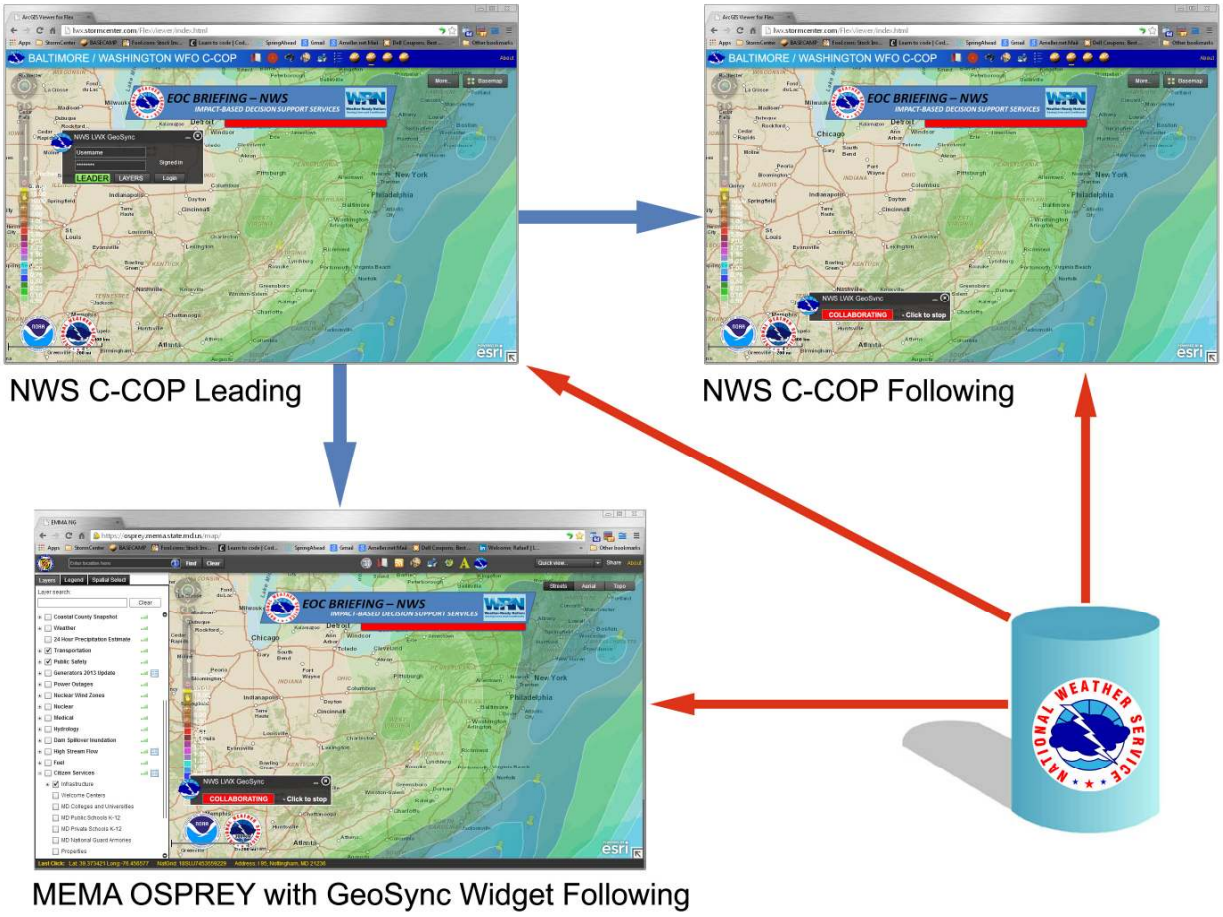
requirements regarding the trustworthiness of the source (authoritative data source providers) and 24/7 availability, to ensure the availability and correct usage of datalayers during presentations. An authoritative data source is a recognized or official data production source with a designated mission statement to publish reliable and accurate data for subsequent use.

When web hosted geospatial layers are shared while Leading on the NWS C-COP (both layers in the repository or layers from other locations on the internet), these layers are delivered to each one of the participants directly from the source, without interaction or re-serving from any of the collaborating clients (including the Lead) or the COP or collaboration servers. What this means is that the data will be presented and will be updated exactly as the data source providers , authoritative or not, intended it to.



When internet hosted datalayers are displayed by the Lead during a collaboration, all the collaborating COPs retrieve and update the data directly from and as the data source providers intended it to.

Locally saved compatible KML geospatial datasets, including datasets created on demand with the AWIPS thin client via the Export to KML command, can be shared in a collaboration using the NWS C-COP.
These on-the-fly C-COP compatible AWIPS thin client KML exports saved on the presenter's computer, as well as other locally saved KMLs, can be loaded into the collaboration via the GeoSync widget. When a KML is shared, it is uploaded to the collaboration server and hosted for the other collaborating COPs to retrieve. This is an important function of the system because peer-to-peer datasharing is typically restricted in networks and frequently blocked. The end result is that all the collaborating COPs will get the

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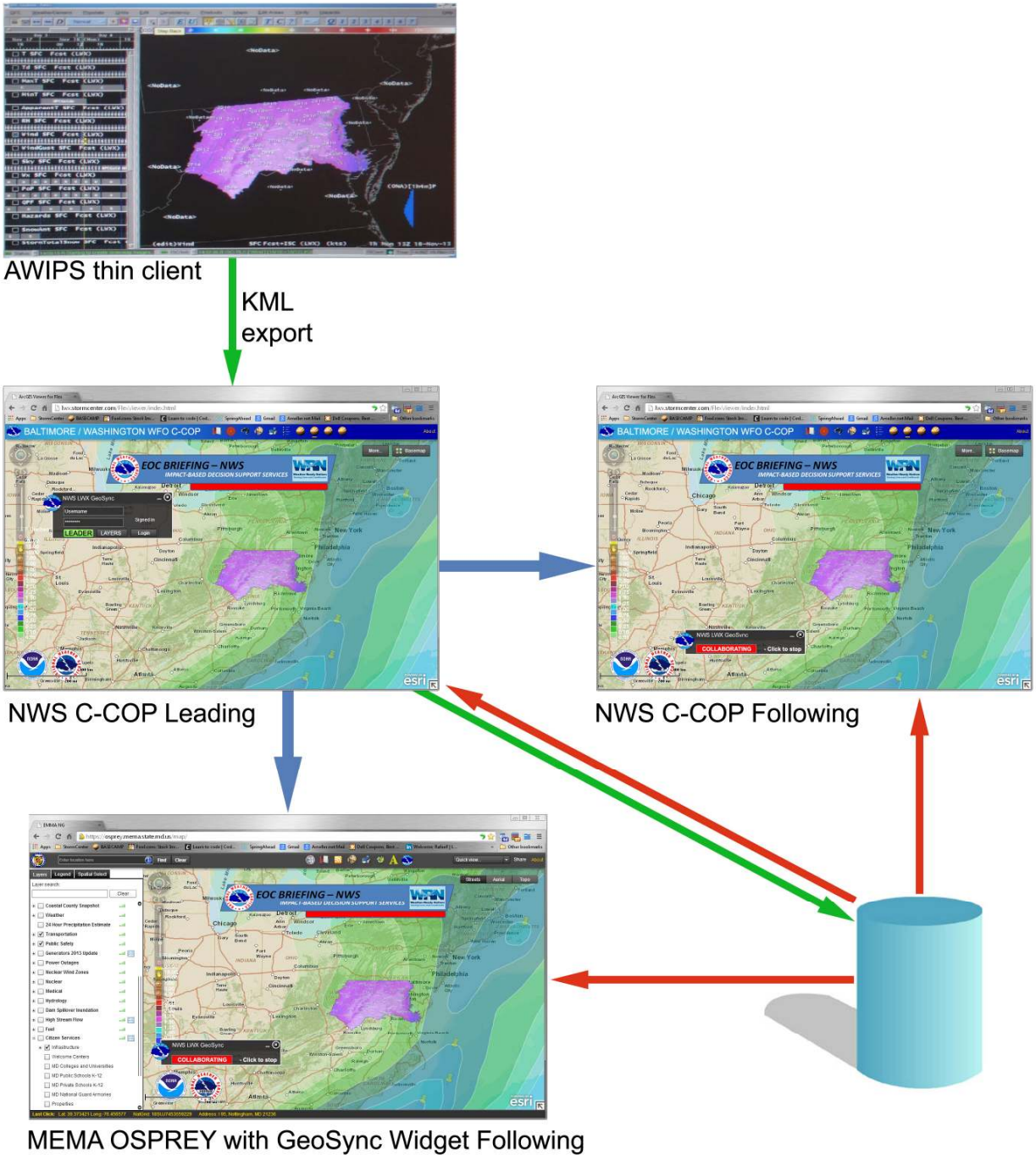
layer loaded locally on their COP, allowing them to further interact with the layer during and after the collaboration, and save it for future display or sharing if desired.



NWS forecasters will have the ability to share on-the-fly C-COP compatible AWIPS thin client KML exports saved locally on their presenting computer. When a KML is shared, it is uploaded to the collaboration server and hosted for the other collaborating COPs to retrieve.

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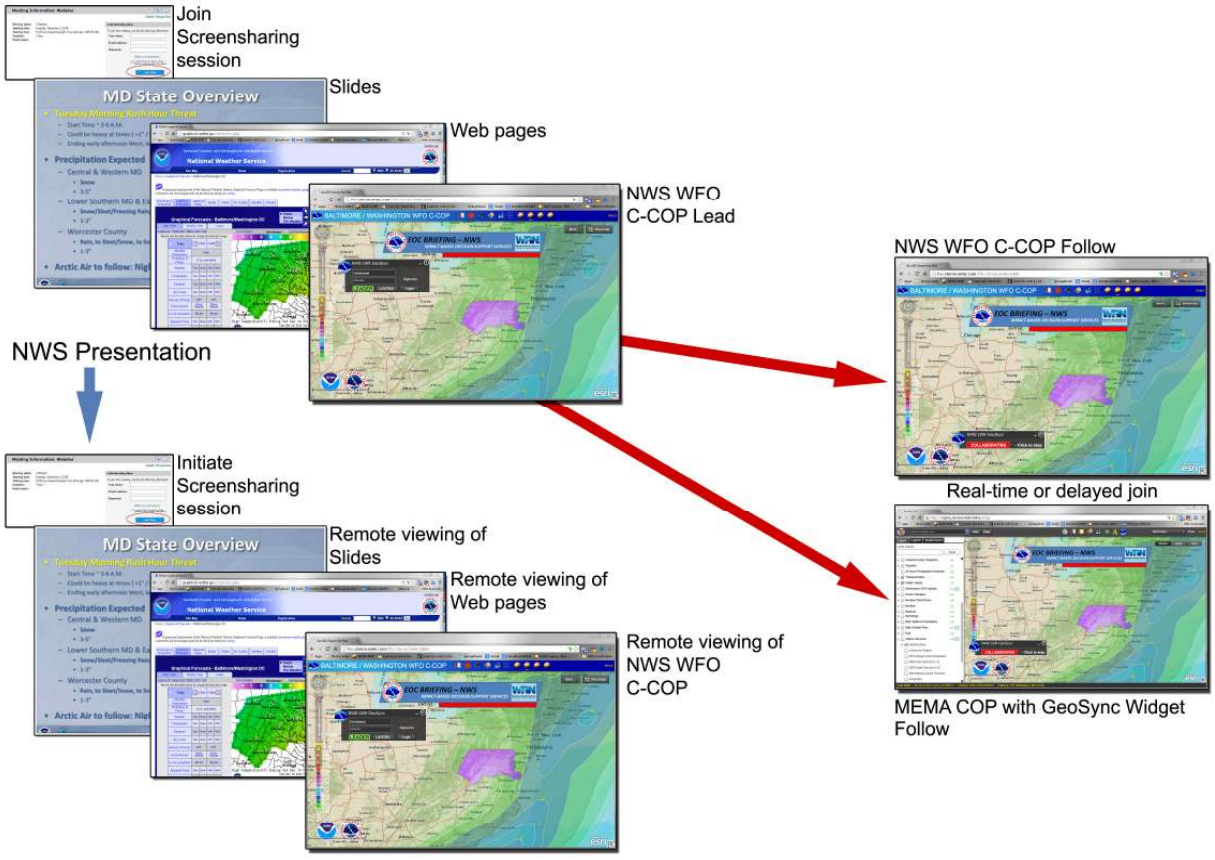
Integration into the current workflow

By building on improving the current delivery of NWS IDSS, the integration of the NWS C-COP into the current workflow will be accomplished by having it replace the current generic interactive map viewer used (which is for national use or from another WFO).

During the WebEx call/screensharing, the workflows will be the same with the addition of the new NWS C-COP as an interactive map viewer that will be used for display of data layers during the call and simultaneously for collaboration with the other COPs.



In essence, the forecaster at the Sterling WFO (top) while delivering a briefing to MEMA (bottom) will continue to use the current tools available during the screensharing session, but instead of using a generic interactive map viewer for national use or from another WFO, the forecaster will use the provided NWS Baltimore/Washington (LWX) WFO C-COP (NWS C-COP).

WebEx will still handle the audio and powerpoint slides, web page and interactive viewer presentations via screensharing (workflow described above in section 2.3), but there will be an additional product delivered via the NWS C-COP. When Leading on the NWS C-COP and collaborating with the connected COPs , which is accomplished by activating GeoSync in the MEMA COP or by following via GeoSync on the NWS C-COP, MEMA users will be able to receive the data layers and map movements that the presenter is currently displaying. Users can choose to follow the forecaster's presentation on the collaborating COP open in a browser in addition to the screensharing portion of the conference call. Both C-COP and screensharing can be run simultaneously on the same computer, or displayed on separate screens, depending on the user preference.

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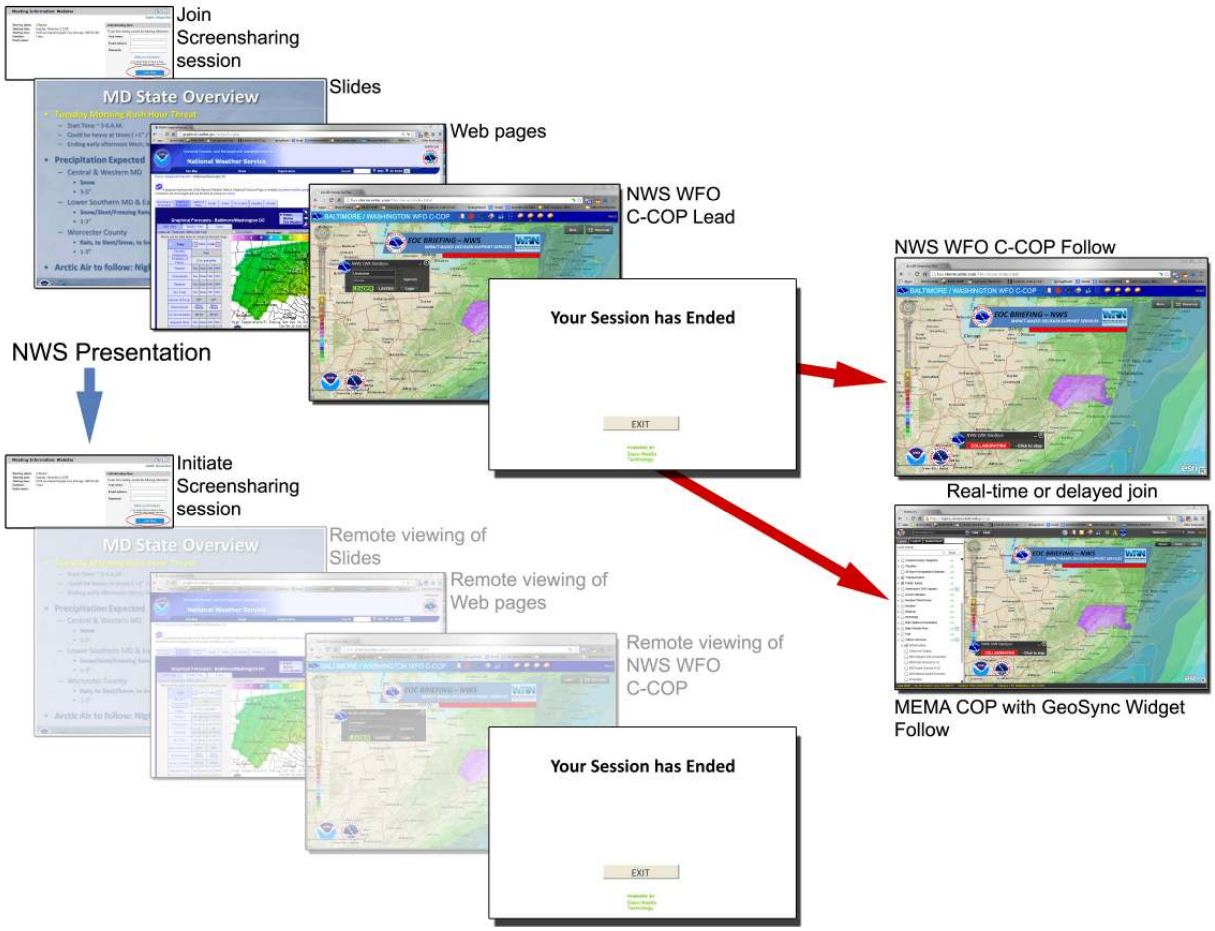
Loading the datasets displayed during the NWS briefing using the NWS C-COP and the MEMA COP can be accomplished in real-time (during the briefing) or by activating GeoSync after the briefing (delayed join), where the user will receive the layers shared, the last displayed layer visibilities, and the last map extent (zoom level and map position) shown. In this case the tool provides a take-away from the NWS presentation, regardless of the attendance of the screensharing portion of the call.



At the end of a screensharing session, MEMA staff and stakeholders will now have a take-away from the NWS briefing in the form of NWS geospatial datalayers delivered and already integrated into their OSPREY COP, used daily by emergency management for situational awareness.

The NWS WFO presenter will make MEMA staff and stakeholders aware of the intent of using the collaborative COP prior to the collaboration when scheduling the calls and remind session attendees that the briefing will include a portion that can be followed on OSPREY as well as on the screensharing portion of the WebEx conference call. Instructions on how to connect can be provided as well in a simple graphic (click on the NWS GeoSync widget to enable collaboration) or by showing it during the screensharing (MEMA or NWS can do these things). MEMA staff and stakeholders should be encouraged to log into the OSPREY system, as well as following briefings during the WebEx call/screensharing. At the end of the NWS briefing participants in the session will be reminded that they can log into OSPREY and use the GeoSync widget to get the latest info displayed on their map.

While collaborating on GeoSync the OSPREY COP will continue to follow the Lead presenter. MEMA staff and stakeholders can regain control of their OSPREY COP at any time during the collaboration by suspending the session collaboration on GeoSync. The geospatial datasets loaded by the NWS WFO, the visibility settings of those layers and the latest map position and zoom level will remain on the

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OSPREY viewer. Once control is regained on the COP users can move their map and change the NWS map layer visibilities through the Layers tool or their own layer visibilities.

The NWS presenter can instruct users to suspend the collaboration and engage with the map at any time, to see if they have any questions after their "hands-on" experience with the data. Collaboration can be re-engaged at any time.

Video recordings of the full briefing (with audio and all materials displayed) can be accomplished by using the record session functionality in WebEx. The solutions proposed are fully compatible with this functionality, in addition to delivering the NWS products in the COPs via GeoSync.

Additional capabilities that can be integrated

In addition to the integration of collaborative capabilities into the current briefing workflow, there are additional, new functions that can help with the delivery of NWS IDSS to MEMA. These functions are designed to reduce workflow impact by delivering the greatest collaborative benefits with the lowest impact.

In addition to harvesting live weather data layers for the LAYERS repository, the tool will have the capability to display archived or historical geospatial datasets on-demand via the NWS C-COP on MEMA's COP. These data layers will become useful when performing tabletop trainings or simulated scenarios where MEMA brings in the NWS WFO for simulated briefings.

The archived datalayers used for these scenarios can be added to a Training Layers repository kept separate from the Live weather repository. If deemed necessary, these archived layers can be kept on a separate NWS Training C-COP to prevent incorrect usage during operations. Another solution would be to overlay EXERCISE banners on all collaborating COPs each time one is displayed.

Archived datalayers can be stored on the collaboration server or any website, but to guarantee availability it is recommended they are not kept on a server outside of the project participants (NWS, MEMA, StormCenter).

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3.2 OPERATIONAL LIMITATIONS & CONSTRAINTS

Workflows

Briefings must be delivered quickly and efficiently by the NWS WFO, and MEMA staff and stakeholders need a solution that will not disrupt their workflows.. The solution proposed accomplishes that in addition to providing more data sharing between NWS and MEMA.

The solution will be designed to hold one collaboration (the latest). Changes made by the Lead on the NWS C-COP will be automatically applied to the collaborating COPs, including starting a new session. If the user desires to keep the same graphics on the browser COP engaging into a new collaboration should be avoided. Before engaging in a new collaboration users can always save the latest data locally.

Interactive map viewer functions

The Sterling WFO C-COP needs to have the same capabilities as the MEMA COP for all functions to be handled collaboratively. Functions that do not exist in the MEMA COP will not be built into the NWS C-COP, since they will not work. The current MEMA OSPREY interactive map viewers cannot handle animated layers, and therefore the NWS C-COP will not have this functionality.

We will work closely with the WFO to find or create layers that will be able to show different time frames of data during presentations as an alternative to animation.

Upgrades to interactive map viewers

Interactive map viewer technology is a moving target. There are other emerging technologies that may have more functionality (multi device compatibility, for example), but are not as robust yet. New ESRI JavaScript versions appear every month as they continue to debug their APIs. We plan to stay on top of the latest technologies, and, while on contract, we will deliver the right technology to the right workflows. All this without minimal workflow impact and keeping the same tools and formats being built in to minimize training.

MEMA is testing the latest generation of JavaScript interactive map viewers and will be eventually replacing the OSPREY Flex technology with JavaScript technology. There are no set dates for when this might occur. If MEMA transitions OSPREY from its current Flex viewer technology to JavaScript technologies during the performance of this contract we will work on the tools necessary for cross-browser technology collaboration. StormCenter's project team will remain in contact with the IT and GIS teams at MEMA in order to stay informed on new developments.

Compatibility of KMLs

Correctly constructed KML code (following KML standards) and limiting the number of children layers (too many children layers can overload systems resulting in failure to display) are important when handling cross-COP collaboration. In the repository files will already be "pre-screened" and other files outside of the repository can be checked on the fly on the separate training C-COP or. preferably, prior to the collaboration with emergency management. Separate viewer for training and testing layers on the fly.

As upgrades have been introduced to the different viewers used, they have become less "picky" of the KML coding, and this is expected to continue. Additionally, KML export functions and automated KML generators are continuously becoming better at performing the task without coding errors.

NWS personnel will be trained on how to identify issues with KML layers and how to solve them

Under contract StormCenter can provide these services to the NWS (either on-demand or by creating automated scripts).

Layer updating

The refresh timing of weather layers is set by the maker of the layer dataset. In cases where end-users might have their COP up and running continuously during an event it is important that the layers or the viewer updates periodically to show the latest data. StormCenter can put measures in place to have the COPs refresh on demand or automatically after pre-set intervals. This can also be done with certain layers by accessing them trough a kml that summons the data based on refresh intervals. We will determine what the best solutions are based on the selection of layers made during development.

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3.3 OPERATIONAL SCENARIOS

The solutions proposed can be used in all the identified collaboration events between MEMA and the NWS WFO. The tools will be in all stages of an event: before, during and after, in the same way that the scheduled conference calls are used now. Below is a list of the key information needed by MEMA for each identified collaboration scenario and the products currently delivered.

Winter Storm

- Key factors/impacts needed: When to deploy resources, what type of resources, temperatures, timing of onset of wintry precipitation and type, duration of the event, type of weather to follow the event.
- Products or services delivered: Watches, warnings, advisories if applicable. Hazardous Weather Outlook, New Winter Probabilistic Products for planning purposes and decision support services.

Tropical System

- Key factors/impacts needed :Timing of tropical storm force winds (at 50 mph the Chesapeake Bay Bridge has to be shut down). Timing of storm surge, locations and at what time of the tide (high or low tide). Duration of winds, peak gusts, heavy rainfall and potential for flooding.
- Products or services delivered: Track and intensity forecasts from the NHC. Local products from NWS Sterling. Decision Support briefings from ERS Meteorologists.

Moderate Risk Severe/Tornado Event

- Key factors/impacts needed: Event timing, type of event (IE…damaging winds, tornadoes, heavy rainfall, threat for flooding, flash vs. river flooding). Event duration. Preparedness information.
- Products or services delivered: SPC outlook forecasts, Hazardous Weather Outlook, local forecasts, Watches, Warnings (within the event itself). Decision Support graphics and impacts from ERS Mets.

Large event with high public awareness which requires SEOC staffing at Level 1 or 2: Example: War of 1812 Sailabration

- Key factors/impacts needed: Dependant on the season of the year. If summer, how hot will the temperature and heat index rise, deployment of resources, cooling tents, shelters to be available for evacuation if lightning is possible.
- Products or services delivered: Local forecasts, point or event specific point and click forecasts, briefing services.

Trainings / tabletop exercises

NWS also participates in tabletop training exercises. In these exercises simulated hour by hour weather conditions and a forecast are provided multiple times in an time-accelerated emergency management scenario.

3.4 SUMMARY OF IMPACTS

3.4.1 Operational Impacts

Upon delivery of the NWS C-COP and the MEMA OSPREY GeoSync widget, forecasters will gain new capabilities that are integrated with other applications currently used during briefings.. We will leverage the use of the Interactive Map Viewers in briefings, a tool that is being used increasingly during presentations, and the impacts are expected to be low.

The WFO will require either practice and training on how to use the new and enhanced features. These tools should facilitate better provision of IDSS to MEMA. On-line and formal training, on-line workshops, and dissemination of training materials to the WFO will be conducted.

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MEMA's impact is also expected to be low, since the current delivery of IDSS will not be altered. Additionally, the widget will be integrated in the OSPREY tool that they are currently using. MEMA staff and stakeholders can choose to enable the COP collaboration or not during or after the briefing. For emergency management this provides a one-click solution, where one mouse click will allow users to start collaborating with the NWS WFO.

3.4.2 Organizational Impacts

There are no organizational impacts identified at this time.

3.4.3 Impacts during Development

Development of the new tools will require interaction with the WFO forecasters in order to derive requirements and gain approval for the GUI designs and other verification functionalities.
MEMA is testing the latest generation of JavaScript interactive map viewers and will be eventually replacing the OSPREY Flex technology with JavaScript technology. There are no set dates for when this might occur. If MEMA transitions OSPREY from its current Flex viewer technology to JavaScript technologies during the performance of this contract we will work on the tools necessary for cross-browser technology collaboration. StormCenter's project team will remain in contact with the IT and GIS teams at MEMA in order to stay informed on new developments.
The NWS C-COP and collaborative capabilities with MEMA's COP will be hosted during development on StormCenter's clouds (Rackspace and Amazon EC2), causing little impact during development.

3.4.4 Impacts during Transition

When transitioning the code to MEMA's Osprey system there is little impact expected. The code for the GeoSync widget developed will eventually be hosted on the MEMA server, together with the OSPREY map viewer, and the activation of the widget in the OSPREY map viewer can be enabled by modifying the configuration file of the viewer on the server.

3.5 BENEFITS

Without removing current functionality we are addressing the needs of both the NWS, by improving the delivery of IDSS to emergency management, and MEMA, who wants to increase the usage of their OSPREY system. The tools proposed will encourage greater usage without disrupting workflows.
By facilitating access to the NWS data by introducing products though the system that MEMA currently uses for situational awareness (OSPREY) it is expected we increase the usefulness of the weather products, as well as the number of users viewing the visual part of NWS presentations (either live during presentations or when logging in after a call).

By using MEMA's OSPREY to display NWS data it is expected that MEMA staff and stakeholders will be able to:

- Receive new functions that are compatible with current collaborative webinar-based solutions (WebEx).
- Provide the ability for emergency management to keep an eye on only one platform, or operating picture.
- Use NWS data more efficiently for decision making and situational awareness because it will be fused on the OSPREY map with the OSPREY data on delivery.
- Provide better feedback to the NWS about what is useful and what isn't.
- Have better questions (thanks to the hands-on experience with the data).
- Practice during training on the mapping tools that are used during an actual event by showing historical or archived weather data layers in OSPREY on-demand for training or exercises.
- Receive a take-away from the NWS briefing that is already integrated in their COP, and with the layers important to MEMA staff and stakeholders.
- Have access to products they might not have known about at the right time, without overwhelming them by sending them a list of products.

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By providing the right tools in the NWS COP, including access to on-the-fly exported data from the AWIPS thin client and pre-staged geo-products, we are expecting:

- WFO forecasters to find it easier to show more NWS mapped products to emergency management
- The data in the Layer repository products will be updated more frequently than a static image in a Power Point
- During presentations there will be greater interaction with the data presented (clicking on map for info, zooming around, etc)
- WFO forecasters will be able to deliver visuals to emergency management during the response to unscheduled calls from emergency management (outside of pre-planned scheduled conference call and without screensharing support). This can be accomplished by activating the layers necessary in the NWS C-COP and any OSPREY user at any time can click to collaborate and get the latest NWS update.
- Even without a call or screensharing presentation, the WFO can keep up the most significant map information loaded on the viewer so that OSPREY users can access it even without the need of a call and/or screensharing. We will work with the WFO to develop banners as static overlays that can be displayed on top of the OSPREY map to extend the collaboration to non-real time briefing functions.
- WFO forecasters can show historical or archived weather data layers in OSPREY on-demand for training or exercises, allowing practice during training on the mapping tools that are used during an actual event
- Discovery of the most useful information to emergency mangers for them to take better decisions, by combining these layers with the layers they use for situational awareness.
- WFO forecasters will be able to present and test new GIS layers from the NWS to EMs outside of scheduled calls, which normally happen during event activations and are a bad time to present new products. This will provide the ability to display new weather generated products and see if they are useful in Emergency Manager's decision making process as well as improve the refinement of products the WFO is currently experimenting with.
- Provides functionality that could be used every day, facilitating the "ramp-up" to full operations

4. REQUIREMENTS DEVELOPMENT METHODOLOGY

The requirements were discovered over the course of two months with 2 meetings (one at MEMA, one at the NWS WFO), several screensharing and collaborative conference calls and interviews conducted with the identified users, as well as participation in and reviews of current operational procedures.

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