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Operations and Services

Performance, NWSPD 10-16

POST-STORM DATA ACQUISITION

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SUMMARY OF REVISIONS: This directive supersedes NWS Instruction 10-1604, *Post-Storm Data Acquisition*, dated July 29, 2011. Changes made to reflect NWS Headquarters reorganization effective April 1, 2015.

The following changes were made to this directive:

1. Added sections on the Damage Assessment Toolkit, (Post-Storm Data Acquisition) PSDA Public Information Statement Creation Software, Unmanned Aircraft Systems, and High Resolution Satellite Imagery.
2. Added the Office of the Chief Operating Officer, National Ocean Service, and the NOAA Homeland Security Program Office under Organizational Roles.
3. Updated training resources.
4. Referenced new PSDA Google Site for all supporting documentation and detailed procedures. Previous appendices on now located on this site for reference.
5. Corrected reporting requirements section.
6. Language and web link updates throughout.

Signed 4/6/2018
Andrew D. Stern Date
Director
Analyze, Forecast and Support Office

Post-Storm Data Acquisition

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1 Introduction

The Post-Storm Data Acquisition (PSDA) activity includes the acquisition and assembly of highly perishable data necessary for accurate post-event analysis. PSDA is an extension of National Weather Service (NWS) Impact-based Decision Support Services (IDSS) that typically takes place during the recovery phase. Properly performed PSDA requires the rapid deployment of trained teams following a significant event to gather damage evidence, e.g., storm debris damage patterns, that can be used to accurately identify and describe the event. In cases of prolonged events, it may be appropriate to collect data during the operational response.

Information gained from PSDA enables the NWS to describe details concerning extreme events, learn how to better use existing equipment, improve warning programs, and provide accurate storm damage information and Enhanced Fujita (EF) Scale tornado ratings to core partners such as emergency management, the news media and academia. During long-duration events, such as flooding, data acquisition and overflights may be valuable and necessary to document the impacts and enhance ongoing forecast services.

Specific NWS goals for PSDA activities include:

1. Support recovery operations by emergency managers and their assigned teams in the assessment of disaster impacts and development of mitigation strategies*
2. Advance the physical and social sciences by providing the research community with critical perishable data from extreme events
3. Increase situational awareness on the socioeconomic impacts of weather and flood events

*****PSDA methods and tools can sometimes be leveraged to monitor the onset or extent of flood events (e.g., glacial dammed lakes, tsunami inundation, river flooding).

Note: all supporting documentation and guidance for this Directive is located on NOAA-internal PSDA Google Site

2 Scope

The procedures outlined here apply only to NWS participation in the PSDA process, as described in the *National Plan for Disaster Impact Assessments: Weather and Water Data*. This national plan and Federal Interagency PSDA efforts are coordinated by the Office of the Federal Coordinator for Meteorological Services and Supporting Research (OFCM). These NWS procedures apply in all 50 states, the Commonwealth of Puerto Rico, U.S. Virgin Islands, Guam, American Samoa, Republic of Marshall Islands, Federated States of Micronesia, Republic of Palau, and the Commonwealth of the Northern Mariana Islands. This section defines the role of the NWS and coordination procedures between the NWS and Federal agencies participating in the acquisition of post-storm environmental data. This activity is one of many Federal missions undertaken in the response and recovery phases that follow a significant hydrometeorological event. For example, the U.S. Geological Survey has primary responsibility for collecting post-storm hydrologic data (high water marks, discharge amounts, etc.)

3 Organizational Roles

3.1 Weather Forecast Offices

NWS Weather Forecast Offices (WFO) initiate "first reviews" of extreme hydrometeorological events. In a "first review," the local Meteorologist in Charge (MIC), their designated representative, or the local Official in Charge (OIC) at OCONUS (outside the contiguous United States) Weather Service Offices (WSO), goes to the incident site, surveys the damage, and if necessary, obtains aerial reconnaissance support. It is the MIC's responsibility to ensure WFO staff members are trained appropriately on PSDA methods and tools. PSDA protocols should be maintained in the WFO's Station Duty Manual (SDM).

3.1.1 Extreme Hydrometeorological Events

If the MIC or designee has determined that an extreme hydrometeorological event has occurred in their office's area of responsibility, and believes it will be of national importance (e.g., a service assessment team may be fielded or the survey of the damage will have significant scientific interest), they may request activation of a PSDA Quick Response Team (QRT) through their Regional Headquarters. If NWS first review, emergency management personnel, or media coverage indicate an extreme event (see criteria in list below), the MIC should notify their Regional Headquarters about possible activation of a QRT prior to completing the site survey.

Consideration for fielding a QRT includes:

1. tornado or wind damage possibly greater than EF3;
2. large number of casualties;
3. catastrophic damage;
4. profound coastal or inland flooding;
5. significant scientific interest

3.1.2 Determining Tornado EF Scale Rating Using Quick Response Teams

After a tornado, there is considerable public and core partner (e.g., news media) interest in an assessment of the tornado's intensity, including maximum wind speeds and other considerations of the damage, and the area impacted. WFOs and QRTs should exercise caution in assigning intensity ratings until the survey team has completed the on-site damage assessment and has been able to fully analyze the results. This is especially true when damage is extreme or a high number of casualties have occurred. To ensure the highest level of accuracy in the final EF Scale rating, the following process should be followed:

1. If a WFO observes tornado damage potentially greater than EF3, or is notified of extreme damage, the WFO may request a QRT from their Regional Headquarters, typically through their Regional Operations Center (ROC);
2. Until a final EF Scale rating is determined for the tornado damage, all references to the event will be characterized as "potentially greater than EF3;"
3. Regional Headquarters should maintain an active list of recognized wind damage experts willing to support a QRT;
4. WFOs and QRTs may remotely consult wind damage experts (e.g., ask damage questions by sharing images or video) during their evaluation process. Similarly WFOs and QRTs

are encouraged to collaborate with volunteer wind engineers (e.g., American Society of Civil Engineers (ASCE)) as appropriate;

5. Other NWS personnel not on the Regional QRT list can be considered as wind damage experts and serve on a QRT, if they demonstrate extensive PSDA experience, and are recommended as a national authority by their Regional Headquarters;
6. Regional Headquarters personnel will contact one or more of the listed wind damage experts and provide them with logistical information about the affected WFO. If necessary, Regions should enlist the support of wind damage experts from other NWS Regions;
7. The Analyze, Forecast and Support Office (AFS) at NWS Headquarters helps coordinate this effort and travel funding can be provided through the Office of the Chief Operating Officer (OCOO)/Performance Evaluation Branch (PEB) (i.e., an accounting code) to the Regional Headquarters for QRTs. QRT deployment requests should originate from the Regional Headquarters to the NWS Operations Center (NWSOC) and the National Warning Coordination Meteorologist (WCM). In some cases, the Regional Director (RD)/Deputy RD will directly request QRT support from the COO.

3.1.3 EF Scale Rating Assessment and Notification

1. Where no QRT is deployed, the WFO serving the affected area determines the EF Scale rating for the tornado damage.
2. When a QRT is deployed, the MIC or designee, with expert input from the QRT, will determine that final rating for all suspected EF4 and EF5 tornadoes.
3. The local MIC or designee of the affected area will publish the official EF Scale rating through a Public Information Statement (PNS) posted to the WFO's web site as described in section 3.1.5, and should utilize the Damage Assessment Toolkit (DAT) as described in section 3.1.6.
4. Once a final EF Scale rating is determined, all NWS personnel will adhere to the rating.

[Note: The Department of Commerce has regulations (15 C.F.R. Part 15, subpart B) governing testimony by employees at legal proceedings. These regulations generally prohibit NWS employees from appearing as witnesses in litigation not involving the United States, and require attorneys or their representatives to submit a written request for testimony in connection with potential or pending legal proceedings.]

3.1.4 Training for EF Scale Determination

The Office of the Chief Learning Officer (OCLO) Warning Decision Training Division (WDTD) has EF Scale training and resources available on their web site. To receive credit for completing the EF Scale Training, NOAA personnel can complete the two training modules through the Department of Commerce's (DOC) E-learning Learning Management System (LMS). As appropriate, Regions should conduct yearly refresher training on EF Scale wind determination. PSDA methods and tools should be covered in the WCM Development Course at the NWS Training Center.

Training for using the DAT is also available on the DOC E-learning LMS. The training covers use of the DAT along with best practices for conducting PSDA and consists of a series of web-

based modules. DAT users are required to complete the 'DAT Course' curriculum. Additional information is available on the DAT Google Site.

3.1.5 PSDA Public Information Statement (PNS) Creation Software

The PNS for PSDA at WFOs should be created and edited through the Graphical Forecast Editor (GFE) on the Advanced Weather Interactive Processing System (AWIPS) using the PNS formatter approved by that Region. WFOs also may utilize the DAT to PNS GFE formatter code to disseminate a PNS using the quality-controlled information from the DAT.

3.1.6 The Damage Assessment Toolkit (DAT)

The DAT is a GIS-based application designed for efficient collection, analysis and delivery of storm damage data. The DAT fulfills a core partner (e.g., emergency managers) requirement to geospatially share wind damage impacts during the operational response and recovery. The DAT is an NWS data collection, storage, and display application for documenting wind damage surveys, including tornadoes. Although still considered experimental at the time this Directive was published, WFOs should use the DAT to the fullest extent possible when conducting PSDA that involves wind damage. WFOs may use the DAT for documenting damage from other hazards, such as hail and flooding.

For each PSDA, WFOs will enter data for individual damage locations into the DAT. This data may be entered via the DAT mobile app (iOS or Android) or the DAT Web Editor Interface. Pictures of the damage should be included, when available. For tornadoes, the data should be analyzed to generate a center line (line segment), which will include the start point and end point of the damage track. Additional waypoints may be included along the centerline. The centerline will include all of the necessary metadata needed for inclusion in Storm Data, as well as for the creation of the post-event PNS.

For tornado and straight-line wind damage, polygons should be analyzed encompassing the impacted area whenever possible. Polygons will be generated for all tornado wind damage ratings of EF 2 or greater. For tornadoes, when data allows, the polygons should be analyzed to include the damage at each EF Scale level (Figure 1). When data is insufficient, a polygon should be analyzed which encompasses the entire damage area, tagged with the maximum EF-rating assigned to the entire tornado track (Figure 2). Table 1 outline the possible parameters collected for each geometry type (damage point, track centerline, damage path).

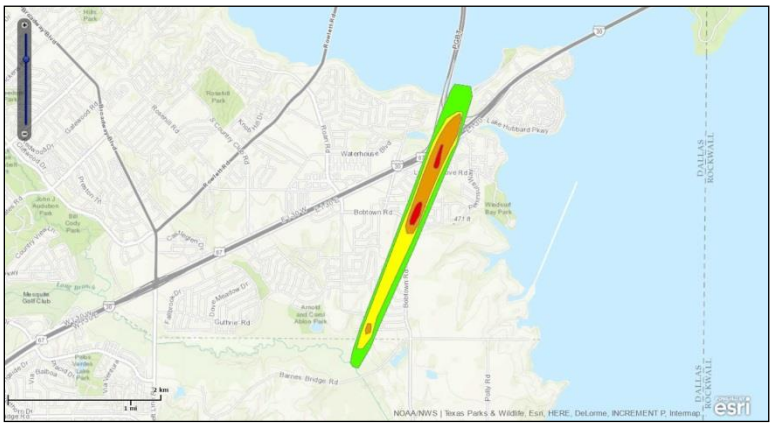

Figure 1. Example of using multiple polygon contours to outline areas of varying EF-scale damage.

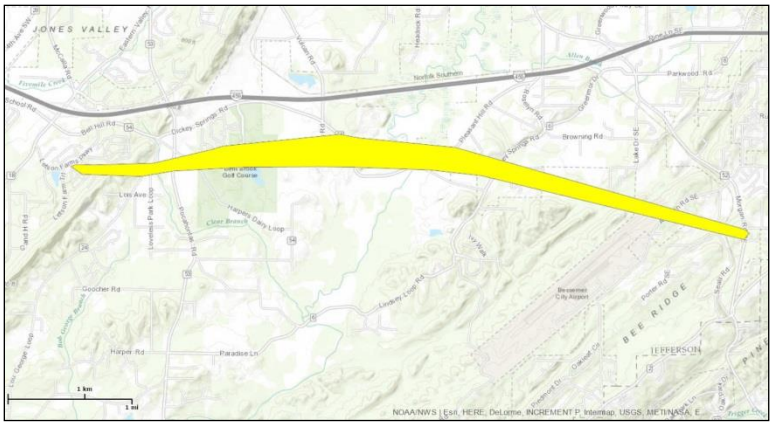

Figure 2. Example of using a single polygon contour to outline damage area. Polygon value is the maximum EF rating assigned to the tornado.

Damage Points	Track Centerline	Damage Path
Storm Date	Storm Date	Storm Date
Survey Date	Survey Date	Event ID
Event ID	Event ID	EF Rating
Damage Indicator	Start/End Time	Length
Degree of Damage	Start/End Latitude	Width
EF Rating	Start/End Longitude	Injuries
Estimated Wind Speed	Path Length	Fatalities
Injuries	Maximum Path Width	Comments
Fatalities	Injuries	Quality Control Flag
Latitude	Fatalities	
Longitude	EF Rating	
Office ID	Property Damage ($)	
Image/Photograph	Crop Damage ($)	
Comments	Comments	
Quality Control Flag	Quality Control Flag	

Table 1. Possible DAT parameters collected for the damage points, track centerline, and damage path.

If damage near the tornado path is analyzed as being caused by intense straight-line/downburst winds, as can commonly occur near damage from squall line tornadoes, the events (and causes) should be documented separately. This allows them to be classified separately, even if there is little spatial difference. This should keep the outer edge of the tornado track line from erroneously extending beyond the analyzed track.

After collection, the data will be reviewed by the WCM or designee, and quality-controlled as best as reasonably possible for delivery via the experimental public facing interface and GIS-based web services.

DAT Interfaces (accessible via the **PSDA Google Site**):

1. Web Editor Interface (Internal) - data collection and editing interface
2. Experimental Public Viewer Interface (External) - display and extraction of quality-controlled data
3. Experimental GIS-based web services (External) - for use in GIS software
4. Mobile apps (iOS and Android) for field data collection:
    a. The DAT mobile apps are typically configured on NOAA government owned devices. DAT usage is permissible on personal mobile devices in accordance with the following minimal protocol:
        i. The MIC should approve the employee to install the DAT on their personal device (verbal approval is fine).
        ii. Once the MIC has approved DAT for the employee, the employee should sign CIO Approval Form and Personal Device Waiver.
        iii. The WFO MIC signs the waiver and keeps it in their office's local files.
    b. All NOAA users should subscribe to the Storm Damage e-mail list available here. Send a request to "join" if you are a new DAT user.
        i. Developers monitor this list and this is your first stop for technical problem solving.
    c. Additional steps for approved installation of the DAT on personal devices are at the discretion of the Regional Headquarters.

3.2 Regional Headquarters

The Regional Headquarters support the impacted WFOs to ensure NWS personnel are dispatched to the impacted area(s) in order to conduct PSDA. Regional Headquarters will ensure timely notification of significant hydrometeorological events to the NWSOC. They should determine whether damage surveys can be conducted by the local office, or whether this should be elevated to the national QRT process, and notify the National WCM and NWSOC accordingly. The NWSOC and National WCM will ensure communication to the COO. Regional Headquarters can support WFOs conducting PSDA in a variety of ways including aerial reconnaissance, satellite remote sensing imagery, and QRTs. The composition of the QRT will be determined by the Regions in collaboration with the COO, National WCM, and the NWSOC and other Regional Headquarters as necessary.

3.3 Analyze, Forecast and Support Office

AFS maintains an NWS representative to the OFCM's Working Group for Disaster Impact Assessments and Plans: Weather and Water Data (WG/DIAP) and contributes to the *National Plan for Disaster Impact Assessments: Weather and Water Data*. AFS coordinates with the OFCM on Department of Defense (DOD) U.S. Air Force (USAF) Civil Air Patrol (CAP) overflight support. This includes the DOD-DOC Umbrella Agreement, Annual Agreements and

the CAP request forms and protocol. During a significant hydrometeorological event, AFS can provide the affected Regions with logistical support for a CAP support request and/or a QRT. When available, AFS can share OFCM WG/DIAP PSDA resources with the Regions, National Centers and impacted WFOs/RFCs during events. AFS also maintains all of the supporting documentation and protocols on the PSDA Google Site. NWS supports activities according to procedures defined in the *National Plan for Disaster Impact Assessments: Weather and Water Data*.

3.4 Office of the Chief Operating Officer

OCOO supports the Regional Headquarters by relaying reports of significant hydrometeorological events to NOAA leadership and the Federal Interagency. OCOO also assists the Regions with the coordination and funding of QRTs. OCOO may also support the Regions with unique PSDA support requests on a case-by-case basis.

3.5 Storm Prediction Center

The Storm Prediction Center (SPC) may provide a heads-up message to recognized wind damage experts in the days leading up to a severe weather outbreak. SPC Outlooks should be used by NWS offices as indicators to begin preparing for PSDA activities. For example, WFOs in areas delineated by SPC at risk for significant tornadoes or significant thunderstorm winds should be prepared to conduct PSDA. In rare instances, SPC may need to leverage PSDA methods and tools for their own efforts.

3.6 River Forecast Centers

RFCs may utilize PSDA methods and tools for their own efforts. RFCs should work through their Regional Headquarters for support of their PSDA activities. RFC requests typically focus on information about the current status of ongoing flooding, such as areas inundated and locations of levee failures, as well as on the significance of the event to their respective programs. It is the Hydrologist in Charge's (HIC) responsibility to ensure appropriate RFC staff members are trained on PSDA methods and tools. Applicable PSDA protocols should be maintained in the RFC's operational references.

3.7 Office of the Federal Coordinator for Meteorological Services & Supporting Research

The OFCM is responsible for Federal Interagency coordination in the collection of perishable hydrometeorological data during the initial response to an event. The goal is to advance research and the science of these environmental hazards. The OFCM oversees the WG/DIAP that develops the *National Plan for Disaster Impact Assessments: Weather and Water Data*. They coordinate Federal Interagency PSDA efforts leading up to and during major hydrometeorological events. The OFCM maintains the Memorandum of Understanding (MOU) with the DOD USAF CAP. The OFCM processes CAP mission support requests submitted by the NWS or other Federal agencies. In the rare occasion that CAP is not available, Regional Headquarters, with the assistance of AFS, may attempt to secure air support through NOAA's Office of Marine and Aviation Operations (OMAO).

3.8 Civil Air Patrol

Upon request, CAP provides mission support on a reimbursable basis. CAP support will be coordinated through their National Operations Center (NOC) and the OFCM. NWS has been

granted authority to utilize CAP aircraft for aerial assessment flights. The NWS mission will fall under the following event types to be considered covered by this MOU:

1. Pre-storm environment (e.g., coastal assessment);
2. Post-storm damage assessment (e.g., tropical cyclones; severe convective outbreaks, including tornadoes, hail, and high winds; wildfires; tsunamis; river flooding; winter storms; volcanic eruptions);
3. Monitoring of longer-term events (e.g., inland flooding, ice movement)

3.9 Office of Marine and Aviation Operations

OMAO is responsible for NOAA's fleet of aircraft and aviation operations, including the Aviation Safety requirements (e.g., training) for all on-duty NOAA employees. The NWS will conform to OMAO's safety policy and procedures. NWS utilization of CAP was approved by OMAO.

3.10 National Ocean Service

NOAA's National Ocean Service (NOS) provide a broad range of scientific, technical, and policy experts to support the response to significant hydrometeorological events and inform recovery operations. This includes the capability to rapidly collect, process, and deliver high-resolution imagery and/or Light Detection and Ranging (LIDAR) data. These data and images can support evacuations, facilitate search and rescue efforts, identify hazards and HAZMAT spills, locate errant vessels, and damage assessments through the comparison of before-and-after imagery. NOS maintains a representative to the OFCM's Working Group for Disaster Impact Assessments and Plans: Weather and Water Data (WG/DIAP) and contributes to the *National Plan for Disaster Impact Assessments: Weather and Water Data*.

3.11 NOAA Homeland Security Program Office

The Homeland Security Program Office (HSPO) is responsible for maintaining the NOAA CONOPS for All Hazards Incident Management which ensures compliance with the National Response Framework. All NOAA line offices work in support of the HSPO during incidents as directed. The HSPO Director acts as NOAA's liaison with the Department of Homeland Security and other Federal agencies and serves as the Under Secretary's principal advisor on issues relating to intelligence matters, terrorism, and other emergencies.

4 PSDA Support and Tools

4.1 Deployment

The local MIC/HIC or designee should initiate post-storm data collection within 12 hours (or less) following notification of a significant hydrometeorological event. WFO/RFC personnel deployed for PSDA activities should take a completed DOC Form CD-29 Blanket Travel Order with them in the field. If needed, the MIC/HIC or designee should identify a source for overflight support to PSDA activities as soon as possible.

4.2 Civil Air Patrol Overflight Support

Once the need for an overflight is determined, request CAP support as soon as possible. The current *NWS Procedures for Utilizing Civil Air Patrol (CAP)*, and templates for the *NWS Form for Requesting Civil Air Patrol (CAP) Overflight Support* and the *NWS Mission Report Form*

After Utilizing Civil Air Patrol (CAP) are maintained on the PSDA Google Site. These procedures are maintained here to protect the confidentiality of the contacts. If CAP is not utilized for overflight support, the only other option is to coordinate an approved flight through the OMAO.

4.3 Other Options for Overflight Support

If the MIC/HIC or designee determines that CAP is not a viable option for overflight support, the only flight options available are determined by OMAO's Aviation Safety Program policy.

1. Use of non-NOAA aircraft, follow OMAO's procedures, including application forms and contact information, on the OMAO Intranet.
2. Use of NOAA aircraft in support of NWS operations will follow OMAO's procedures, including the application form and contact information, also available on the OMAO Intranet.

4.4 Unmanned Aircraft Systems

All NOAA unmanned aircraft system operations must follow the policies contained in NAO 216-104A (Management and Utilization of Aircraft), which requires, among other things, that the NOAA Aircraft Operations Center of OMAO evaluate all NOAA owned or operated unmanned aircraft systems prior to use in operations. At the time this Directive was published, there remained a moratorium on the purchase and use of Unmanned Aircraft Systems (UAS) in NWS. This moratorium was conveyed in a policy memo issued by COO, John Murphy, on 3/4/2016 titled "UAS Purchase and Use Moratorium." Follow guidance contained in this section for utilizing other NOAA, government, commercial, and privately gathered UAS information.

Modern technology has made it feasible to acquire aerial data/imagery using UAS for rapid deployment after small scale severe storm events. In accordance with NAO 216-104A, there are three basic ways that the NWS can obtain UAS data to assist with PSDA (listed below). NWS will refrain from specifically asking UAS operators to fly over a storm damage region. Generic calls for both ground and aerial based data, similar to how WFOs currently request reports from trained SKYWARN Weather Spotters, are permissible. As the NWS continuously communicates the need for aerial data, the UAS community will be more likely to voluntarily respond. As with any external data sources, the NWS should follow the standard guidelines to properly credit the entity providing the information/data/imagery. Data agreements for use of aerial data/imagery will conform to NWSPD 1-12 and for those that impose redistribution restrictions to NWSI 1-1201.

1. **Government/Public Partners:** Local government partners, such as emergency managers, law enforcement, fire, etc., may own a UAS or have contracts with commercial UAS operators (see option 2 below). Given the NWS already has close partnerships with local government agencies, those partnerships could be leveraged to obtain any available aerial imagery of storm damage.
2. **Commercial/Section 333/Part 107 UAS Operators:** There are many Federal Aviation Administration (FAA) licensed, trained and insured UAS operators that can function as a commercial entity. These operators can fly over most areas while following strict rules for safe operation. NWS is not authorized to provide monetary compensation or sign a contract for any services or data provided by commercial UAS operators. NWS will not

explicitly ask commercial UAS operator(s) to fly a particular mission/storm damage area. Their usage can only be coordinated through government partners. NWS will not show favoritism of or endorse any one company/operator.

3. **Hobbyist/Recreational UAS operators:** These UAS operators cannot be specifically tasked by the NWS to provide aerial imagery. However, they may provide aerial imagery in response to a public request similar to the way NWS traditionally receives damage information and pictures from the general public and/or trained weather spotters. Although it is not the responsibility of the NWS to enforce, hobbyist operators can be encouraged to follow FAA model aircraft safe operating guidelines.

4.5 High Resolution Satellite Imagery

High resolution satellite imagery is available as a resource for NWS when conducting PSDA. There are at least four ways for WFOs/RFCs to acquire high resolution satellite imagery for PSDA in their County Warning Area (CWA):

1. If available, the DAT has the ability access to high resolution satellite imagery through NASA's Short-term Prediction Research and Transition Center (SPoRT). OCLO developed training for using the DAT and NASA SPoRT imagery is available on the DOC E-learning LMS. For information on this capability you can also visit the NASA SPoRT web site.
2. The U.S. Geological Survey (USGS) provides the Collection Management Tool (CMT) through their Emergency Operations Portal that allows users to view Areas-of-Interest (AOIs) submitted for a given event, and to monitor the collection progress for the previously submitted AOIs. The NWS Central Region Headquarters has established a protocol that can assist any WFO/RFC with accessing event imagery through the USGS CMT, otherwise, contact your servicing Regional Headquarters for assistance.
3. NOAA's National Geodetic Survey's Remote Sensing Division acquires and rapidly shares a variety of spatially-referenced datasets. This high resolution imagery for major events is available on their website.
4. The Federal Emergency Management Agency (FEMA) posts remote sensing imagery and other data collected during disasters via their FEMA Web Portal

5 Reporting and Documentation Process

All relevant PSDA data and information for significant hydrometeorological events will be entered into the Storm Data publication as per NWSI 10-1605. Wind damage and EF Scale ratings will be documented via PNS posted to the WFO's web site, and should be entered in the DAT, as soon as reasonably possible. When a QRT is deployed they should be contributing their expert analysis and any key survey data into these products.

WFOs/RFCs that utilize CAP for aerial reconnaissance will prepare a one-page report no later than 14-days after the flight(s) as per the protocol and reporting form on the PSDA Google Site.

All relevant PSDA data and information will be archived to meet the minimum 5-year service records retention requirement as per NWSI 10-2003. This practice also supports the efforts of potential NWS Service Assessment Teams. Information and data uploaded to the DAT, published via PNS, or Storm Data do not need to be archived at the local WFO/RFC level.