NOAA’s National Weather Service
Office of Science and Technology

Damage Assessment Toolkit

Status Report

Dario Leonardo/OSIP IWT Lead
Ira Graffman/GIS Lead
Storm Damage Assessment
OST/SEC/Support Branch
May, 2012
Project Team

Paul Kirkwood – SRH – Prototype IT Administration

Parks Camp – SR (TLH) – DAT Developer

Keith Stellman – SR DAT Developer

Kris Lander – CR Developer

Jay Laseman – CR developer

Ira Graffman – NWSHQ GIS specialist

John Ferree – OCWWS – OSIP / Field Liaison

Dario Leonardo – NWSHQ OSIP IWT
Background Information

Project Origin

- 2005 Storm Damage Survey on GPS device
- 2009 Project enters OSIP (SON – PP)
- 2011 IWT formed to transition project

Goals

- Reduce preparation time for site deployment
- Reduce perishable damage data collection time
- Improve damage survey data collection consistency
- Improve delivery of geospatially-accurate data to core partners and the public
Role in NOAA Enterprise

DAT GIS Server

DAT Data

USGS

GeoCloud

TPC Shapefiles

Ridge

HPC Data

OGC Services for

External Partners/ Customers

Storm Damage

Hurricane Tracks

Radar

Watch Warning Polygons

AHPS Gauges

Interest from NHC Storm Surge Inundation
DAT contributes to a Weather Ready Nation

Enhancing IDSS: Partners want to know what we know

- Combining DAT collected and quality controlled data with other NWS storm data results in comprehensive situational awareness
- Help to better prepare our communities for extraordinary events
- Provides a time saving collaborative tool for pilot project Emergency Response Specialists

Next Generation Dissemination Requirements

- Deploying DAT via the Cloud as an NWS wide IT tool is the realization of NWS delivering knowledge “anytime anywhere via a scalable, agile, and cost-effective infrastructure”
- Technologically relevant customer/partner support to deliver cutting-edge science
Field Testing

Over the course of the last 2 years, the following focal points have led the Beta testing of DAT at their WFOs:

GLD: David Floyd
LSX: Ron Przybylinski
OAX: Jay Laseman
JKL: Buddy Whorral
LOT: Stephen Rodriguez
FGF: Rick Hozak
GID: Michael Moritz
LBF: Teresa Keck
ILX: Darrin Hansing
ABR: David Hintz
TOP: Chad Omitt
FWD: Mark Fox
SHV: Keith Stellman
TLH: Parks Camp
AMA: Krissy Scotten
LUB: Jody James
LZK: John Robinson
OUN: Richard Smith
TSA: Ed Calianese
LCH: Roger Erickson
LIX: Frank Revitte
BHM: John Deblock
MOB: Jeff Garmon
ALY: Steve DiRienzo
CAE: Steve Naglic
CAR: Noelle Runyan
CLE: Gary Garnet
ILM: Steve Pfaff
ILN: Mary Jo Parker
RLX: Jamie Bielinski
Damage Collection Comparison

Shreveport CWA
October 29, 2009 22 Tornados
April 27, 2011 27 Tornados
Time Savings

1551 = Average Annual Number of Tornadoes (2007-2010)

Approximately ½ of tornado events require overtime to complete storm reports = 775 annual average

Data Collection Team

- 2 people per team, avg 1 team per event
- Annual savings ~ $58,162 (Low estimate...)

Report Generation

- 8 hours per event for Warning Coordination Meteorologist
- Annual saving ~ $654,646
Two Alternatives Analyses were completed for OSIP

- Analysis # 1 for the overall Damage Assessment Process (OSIP Stage 3)
  - DAT was selected as best option
- Analysis # 2 Most Recent for transitioning the field prototype to national operations (OSIP Stage 4)
  - Government Systems
    - Alternative A = NWS Internet Dissemination System (NIDS)
    - Alternative B = NOAA Web Operations Center (WOC)
  - Commercial Cloud Options
    - Alternative C = Esri Cloud
    - Alternative D = USGS facilitated GeoCloud
Alternatives Analysis

Government Systems

Alternative A = NWS Internet Dissemination System

- Implementation Costs = $142K - $197K
- O&M Costs = $135K - $189K/yr + 3% annual increase
- Operating Systems = Linux or Windows
- Could not guarantee implementation schedule requested by DAT

Alternative B = NOAA Web Operations Center (WOC)

- Implementation Costs = $300K (estimated)
- O&M Costs = $190K (estimated)
- Operating Systems = Linux or Windows
- Could not guarantee implementation schedule requested by DAT
Alternatives Analysis
Commercial Cloud Solutions

Esri Cloud

- Implementation Costs = $325K or more
- O&M Costs = $130K/yr + additional development services
- Operating Systems = Windows on Amazon Cloud
- Assured compatibility with other Esri software in DAT solution

USGS facilitated GeoCloud

- Implementation Costs = $119K
  - 14K year 1 and 30K year 2 for USGS
  - 75K for C&A
- O&M Costs = $54K + 3% annual increase
- Operating Systems = Windows on Amazon Cloud
- Requires NWS AA signing an Memorandum of Understanding with USGS
Cost Comparison

Analysis: (more details available in backup slides)

- **Total costs for FY12-13** are as follows:

<table>
<thead>
<tr>
<th>NIDS / Linux</th>
<th>NIDS Windows</th>
<th>USGS GeoCloud</th>
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<tbody>
<tr>
<td>$247,447</td>
<td>$355,127</td>
<td>$119,609</td>
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</table>

- **Total estimated costs for FY14-18**:

<table>
<thead>
<tr>
<th>NIDS / Linux</th>
<th>NIDS Windows</th>
<th>USGS GeoCloud</th>
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<tbody>
<tr>
<td>$735,886</td>
<td>$1,025,931</td>
<td>$307,428</td>
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- **Initial 2 yr cost saving over NIDS** of $127,838
Benefits of DAT

- Complies with NWS’ implementation of an enterprise approach to information technology (IT) solutions as a method for identifying and implementing efficiencies directed by the President.

- The US Chief Information Officer has directed a shift to a “Cloud First” policy, shift to consolidated IT frameworks and develop a strategy of shared services.
  
  - Leveraging the USGS GeoCloud enables the NWS to comply with this direction.

- Promotes sharing of resources and costs between agencies maximizing tax payer investment.
Project Timeline

- **June 2005**: Initial Development with handheld GPS
- **April 2007**: Application for laptops added to toolkit
- **August 2008**: Application for Blackberry Mobile Phones Developed
- **June 2009**: OSIP Gate 1 Approval
- **July 2009**: Field Testing for Laptop Prototype
- **October 2009**: Field Testing for Mobile Phone Prototype
- **June 2011**: Business Case, Project Plan Updated, OSIP Gate 2 Approval
Project Timeline continued

August 2011
- NSTEP Requirements Document
- Technical Requirements Document
- TOC/NiDS/DAT MOU

September 2011
- Operational Transition Plan
- TRD and ODP Posted
- Project Plan Update
- OSIP Gate 3 Review

October 2011
- NWSEO Review

November 2011
- USGS Cloud

March 2012
- NWS/USGS MOU drafted

December 2012
- GeoCloud IOC

January 2014
- GeoCloud FOC
Risk Management

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<th>Trend</th>
<th>Rank</th>
<th>Approach</th>
<th>Risk Title</th>
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<tr>
<td>↑</td>
<td>1</td>
<td>M</td>
<td>GIS Licensing</td>
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<td>↔</td>
<td>2</td>
<td>W</td>
<td>Security Delays</td>
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<tr>
<td>↔</td>
<td>3</td>
<td>M</td>
<td>NWS/USGS GeoCloud Not Approving MOU</td>
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<table>
<thead>
<tr>
<th>Criticality</th>
<th>Trend</th>
<th>Approach</th>
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<tr>
<td>Critical</td>
<td>Improving</td>
<td>M - Mitigate</td>
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<tr>
<td>Moderate</td>
<td>Worsening</td>
<td>W - Watch</td>
</tr>
<tr>
<td>Low</td>
<td>Unchanged</td>
<td>A - Accept</td>
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<tr>
<td></td>
<td>New</td>
<td>R - Research</td>
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<table>
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<th>3</th>
<th>4</th>
<th>5</th>
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<td>3</td>
<td>3</td>
<td>2</td>
<td></td>
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<tr>
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<td>4</td>
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<td>5</td>
<td></td>
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CONSEQUENCES
Milestones in Danger

Milestones

- C&A of DAT application in the Cloud – 6/15
- Transition to operational hosting environment – 12/1

Mitigation Strategy

- Engage management to assist with funding project
- Task security assessment
- Open communication by USGS/NWS with ESRI
Issues

Budget and Policy
- Shrinking budget environment
- Security Policy for Cloud and Mobile Devices is NOT complete

Engineering
- Multiple platforms (problem for personal devices only)

Cultural Challenges
- “My app is best”
- Non-development region buy-in
Future

- DAT application to run on multiple Mobile Operating Systems
- Damage Assessment Teams ability to use their personal devices to conduct surveys
- DAT and AWIPS run from the same Tablet Device
Back-up
Partner Benefits

- **FEMA/DHS**
  - Utilizes storm damage assessment reports to prepare for disaster assistance. Information of damage impact made available the same day shortens the time before FEMA can deploy with assistance (food, clothing, shelter, etc).

- **American Red Cross**
  - Advanced notification of the level of damage and casualties can help to estimate the amount of blood to deploy to Triage locations.

- **EPA**
  - Utilizes storm damage assessment reports to better assess ecological damage and the funding decisions required for environmental cleanup.

- **DOD**
  - Army Corp of Engineers, US Marine Corps use web services for warnings and situational awareness (require OGC web map services).
Societal Benefits

- **Internal NWS**
  - Greater efficiencies - decrease forecaster time / improve quality
    storm damage data
  - Ability to compare Tornado touchdowns to warning areas (via shapefiles) to apply verifications

- **External NWS**
  - Provide public and partner agencies with NWS collected information to use in disaster response and communication.
  - Standardization of the data sets and data collection methodology allow WCMs to train Emergency Managers in advance of how to interpret the data.
References

References


References


FEMA request for NOAA GIS Data

November 19, 2007

NOAA National Weather Service
Central Region Headquarters
Grand Forks, ND Weather Forecast Office
4797 Technology Circle
Grand Forks, ND 58209-0600

Attention: Wendy L. Pearson

Re: Potential FEMA Geographic Information System (GIS) Data Needs in Future Tornado Events

Thank you again for rapidly providing critical GIS data during last summer’s Northwood Tornado Disaster in North Dakota to our office. This information helps determine potential emergency response and recovery needs and is used to assess long term risk and support mitigation strategies. We look forward to working with you on obtaining GIS data for future natural disaster events. Data depicting information such as tornado tracks, flood extent, hurricane damage or any other natural disaster related phenomena are used to support all phases of emergency management.

In the case of tornado track and impact data, we intend to use these data as an additional resource to show our responding emergency management personnel the location and extent of damage. We would prefer GIS data such as shape files or raster data, but line and tabular data would also help in the absence of GIS data. We do not necessarily require finished maps, however GIS data would be extremely beneficial to our efforts when combined with our own map data of FEMA resources.

In addition, our work benefits from automatically obtaining the data rapidly through a notification service, including preliminary data within minutes and updates as they become available. Damage photos, supplemental information, and EF scale ratings included in tornado track data are always helpful when available.

Please feel free to contact me at (303) 235-4859 or Doug.Bauch@fema.gov or Jesse Roselle at Jesse.Roselle@fema.gov should you require additional information or have questions.

Sincerely,

Doug Bauch, Senior Physical Scientist
FEMA Region VIII, Mitigation Division
Field Reports

Comments & Quotes

During a visit to the Birmingham WFO on Saturday, April 30, both NOAA Administrator Jane Dr. Lubchenco and U.S. Representative Bachus were impressed by a demonstration of the DAT prototype.

Experienced SRH damage assessor used application and spent 4-5 hours doing what normally would have taken 3-4 days to accomplish.

Damage area surveyed as the assessor walked through the impact area. The tornado path was updated at the WFO as the assessor walked the impact area.

Quote from the GIS focal point for the City of Lancaster TX: "At the risk of sounding like a total GIS dork, this is awesome!!! Thank you so much for sharing your data & expertise."

Mass media outlets had access to the data within hours rather than days.
Field Reports

- **Comments & Quotes**
  - Quotes from DAT Users include: "With any luck, this tool will become the standard" from Jim LaDue (OCWWS WDTB) and "We need this tool yesterday" from Jim Stefkovich (WFO BHM MIC)
  - Greg Carbin – SPC: Following the March 2, 2012 Kentucky tornado event - “We do not have shapefiles of the tracks. Part of the problem resides with the way the offices are providing survey information”
  - “If anything, this most recent event is more difficult to track because it covers three NWS Regions with somewhat disparate ways of compiling and disseminating the track, damage, and fatality information”
  - “Until the regions and WFOs use a common format in providing the geographic information, we may have to wait for the Storm Data deadline (60 days after the end of the month) to acquire this data and then have it made into a shapefile”
DAT DATA

- March 2nd Tornado report
PDA Interface

1. SMALL BARN AND FARM OUTBUILDINGS (SBO)

Typical Construction
- Less than 2500 sq ft
- Wood or metal post and beam construction
- Wood or metal roof trusses
- Wood or metal panel siding
- Metal or wood roof
- Large doors

<table>
<thead>
<tr>
<th>DOD*</th>
<th>Damage description</th>
<th>EXP</th>
<th>LB</th>
<th>UB</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Threshold of visible damage</td>
<td>62</td>
<td>25</td>
<td>58</td>
</tr>
<tr>
<td>2</td>
<td>Loss of wood or metal roof panels</td>
<td>74</td>
<td>61</td>
<td>90</td>
</tr>
<tr>
<td>3</td>
<td>Collapse of doors</td>
<td>83</td>
<td>68</td>
<td>103</td>
</tr>
<tr>
<td>4</td>
<td>Major loss of roof panels</td>
<td>90</td>
<td>78</td>
<td>110</td>
</tr>
<tr>
<td>5</td>
<td>Uplift or collapse of roof structure</td>
<td>93</td>
<td>77</td>
<td>114</td>
</tr>
<tr>
<td>6</td>
<td>Collapse of walls</td>
<td>97</td>
<td>81</td>
<td>110</td>
</tr>
<tr>
<td>7</td>
<td>Overturning or sliding of entire structure</td>
<td>99</td>
<td>83</td>
<td>115</td>
</tr>
<tr>
<td>8</td>
<td>Total destruction of building</td>
<td>122</td>
<td>94</td>
<td>152</td>
</tr>
</tbody>
</table>

*Degree of Damage

Small Barns and Farm Outbuildings (SBO)

- Expected
- Lower bound
- Upper bound

Wind Speed vs. Degree of Damage

Map of Damage Survey: Distribution of damage across various locations.
Laptop Interface
Quality Control (QC) Interface
Training

Web based training module

- 4 training sessions provided since Jan 2011
- 20 or more WFOs from various regions attend each training session with attendance of approximately 40-60 participants