NHC Current and Future Infrastructure

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Outline

• Update on NHC’s current infrastructure and product generation capabilities
• Migration to AWIPS2
• Longer-range plans for NHC and the NWS Tropical Program
• Development and Infrastructure Needs
Operations in 2020

- NHC supported remote work in 2020 due to COVID-19
- 2020: A record breaking year
  - Largest percentage of US coast line ever warned in a single season
  - Largest number of named storms on record in the Atlantic (and counting)
  - Largest number of US landfalls (named storms… hopefully no more)
- TSB spent significant resources supporting operations this year
  - Deployed laptops, documentation on procedures, and troubleshooting for remote work
  - Storm Surge Unit, Science Operations Officer, Lead Developer worked many operational shifts (TSB had issued 73 advisories, 168 TWOs, countless Storm Surge products as of Nov. 17)
NHC On-Site Forecast Desk

- Windows (2 monitors)
- ATCF
- N-AWIPS (2 monitors)
- AWIPS2 (2 monitors)
NHC Remote Forecast Desk

Personal Devices:
Internet products, development

Government Laptop:
N-AWIPS or AWIPS2 (VPN)

(Co-worker)
Forecast Desk Input Data

• **Satellite data**
  - Local GOES-E/W antennas and local data processing
  - NESDIS products from Product Distribution and Access (PDA) system and GEODist servers
  - Satellite Broadcast Network (SBN feed)
  - Experimental products from LDM and web pages

• **Model forecasts**
  - TC initial conditions come from ATCF, go to NHC ftp and NCEP Supercomputer (WCOSS)
  - Model fields come from NCEP data distribution software (dbnet) and SBN
  - Statistical models and tracker output come from WCOSS or local processing

• **Radar and conventional data**
  - SBN
  - Other NWS data feeds

• **Aircraft data, including TDR from P3s**
  - CARCAH ground station
  - SBN
  - Local processing for TDR data
Product Dissemination

- HSU and TAFB text products sent via AWIPS
  - HSU products formatted in ATCF, but transmitted through AWIPS
  - HSU products also sent directly to NHC website via internal processing
- Graphical and GIS Products
  - NHC website (local production and dataflow)
  - Marine RadioFax
  - National Digital Forecast Database (NDFD)
  - NOAA Coast display system
- Other data
  - NHC ftp
  - Restricted distribution via rzdm and WCOSS
    - Opah
NHC Backup

- NHC has 2 primary backup sites for tropical cyclone operations
  - WPC, CPHC
- TAFB also has backup responsibility for HFO, OPC, AWC
- All sites must be able to communicate seamlessly with each other and with central computing locations
- Data also shared with JTWC
NAWIPS to AWIPS2 Transition

- N-AWIPS is a mature system for model display and product generation for NWS National Centers
- Underlying design limits future N-AWIPS use
- NHC and NCEP lack long-term resources to support both N-AWIPS and AWIPS-2
- Several previous migration attempts unsuccessful
  - 1998 when AWIPS1 first deployed
  - NCO effort 2015-2016
- Current effort involves AWIPS Program Office working with NHC staff
# NHC N-AWIPS to AWIPS2 Transition Timeline

<table>
<thead>
<tr>
<th>Unit/Desk</th>
<th>Testing Starts</th>
<th>Scheduled Completion</th>
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<tbody>
<tr>
<td>TAFB Atlantic/Pacific Desks</td>
<td>Underway</td>
<td>May - July 2021*</td>
</tr>
<tr>
<td>TAFB Surface Desk</td>
<td>TBD</td>
<td>TBD</td>
</tr>
<tr>
<td>Hurricane Specialist Unit</td>
<td>February 2021</td>
<td>May 2022</td>
</tr>
</tbody>
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*Completion dates based on when products will be issued through AWIPS2. N-AWIPS will continue to be used for data display until sufficient performance testing is completed.
Developing Tropical Cyclone Forecast capabilities in AWIPS2

- NHC hopes to issue all forecast products directly from AWIPS2 in the future
- Basic capabilities have been developed in AWIPS2
  - Displaying and editing tracks
  - Displaying guidance
  - Formatting text products
- A demonstration version of AWIPS2 with this capability may be available to NHC forecasters in 2021.
N-AWIPS to AWIPS2 transition challenges

- COVID-19 and remote work
  - Extra support required to support operations
  - Difficult to train forecasters
  - Difficult to do sufficient testing of on-site systems to replicate regular operations.
- TSB staffing
- AWIPS2 hardware performance
- Not enough AWIPS2 workstations
- Single point of failure after transition
New Opportunities for Operations-Research Interactions

- Research versions of AWIPS2 can be implemented with limited resources
  - “AWIPS in a box”
  - Unidata-supported version
- Research labs, universities can develop experimental AWIPS displays and products
- Expanded testbed
More on R2O

- NHC Operating Systems
  - Linux (RH7), Windows
- NHC computation environment
  - Python, perl, FORTRAN, shell scripting, GEMPAK
- Operational Graphics
  - NCL, FORTRAN, Python, ArcGIS Server
- Projects/tools that do not use proprietary or unique software have a higher likelihood of success
FY-21 STI Milestones

• Statistical post-processing
  • Compare real-time machine learning-based statistical intensity model forecasts with the operational linear-regression version
• AWIPS Products for Forecasters
  • Real-time tests of AWIPS2 by Hurricane Specialists
  • Test the production of coastal tropical cyclone wind watches and warnings in the AWIPS2 wind hazard recommender tool
• Graphical products for external users
  • Real time in-house testing of new TC maximum wind probability distribution graphical product
• Storm surge
  • Test feasibility of Hazard Services and Polygon-based approach to storm surge watch/warning
• Testbed and R2O
  • Evaluate real-time performance of new 7-day TC genesis probability guidance tool
Upcoming Infrastructure Projects

- Migrate off NAWIPS (2022)
- OS/software migrations (1-2 years)
  - RH8, Python 2.X to 3.X, NCEP supercomputer infrastructure
- Continue migration to vm-based computing (1-2 years)
- Tropical Cyclone forecasts issued from AWIPS2 (2-4 years)
  - AWIPS2 becomes the only forecasting software at the operations desk
- Transition to AWIPS Hazard Services (3-5 years)
- Unknown changes due to IT security requirements
Upcoming Development Projects

- New graphical products
  - Landfall intensity probabilities
  - Time of Departure of winds
  - Media graphics
  - HFIP Social Science recommendations (website and products)
- 6/7 day public forecasts
- Reformatted Tropical Cyclone Marine (TCM) forecast product
- Improved wind speed probabilities and statistical guidance
- WTCM (inclusion of NHC forecasts in NWS gridded forecasts)
- Probabilistic marine products
- Inclusion of new hurricane models in operations
  - HAFS, ensemble systems, upcoming GFS
Long-term goals

- Model improvements lead to better TCM
- Ensembles statistical post-processing refine WSPs
- Improved WSPs, wind hazard recommender lead to better Watches/Warnings