NWS and Navy Plans for the ATCF and AWIPS2

Mark DeMaria, Craig A. Mattocks, Christopher Mello, Michael Brennan and Monica Bozeman
NOAA/NWS National Hurricane Center, Miami, FL

Charles R. Sampson and Michael Frost
Naval Research Laboratory, Monterey, CA

HFIP Annual Review Meeting
8-9 November 2017, Miami, FL
Outline

- ATCF
  - Brief history
  - 2017 improvements
  - Future outlook
- N-AWIPS and AWIPS2
  - NHC current usage and future plans
  - Navy plans
- ATCF in AWIPS2
  - Current transition efforts
  - Future plans
Brief History of the Automated Tropical Cyclone Forecasting (ATCF) System

- **Prior to 1988:** Motivated by cumbersome, manually intensive process to generate TC forecast products
- **1986:** ATCF software development began at NRLMRY
- **1988:** Delivered to JTWC in Guam. Ran on IBM-AT class personal computer under MS-DOS operating system
- **Early 1990s:** NHC adopted and modified ATCF for its operational needs
- **1996:** Transitioned from MS-DOS to Unix
  - C, FORTRAN, XVT toolkit, Unix/Python/Perl scripts
  - NRL manages C & GUI code, NHC manages site-specific “standalone” code
- **Many iterative upgrades since 1996:** Annual meeting of developers - make decisions whether to implement new features requested by TC forecasters (requirements lists).
  - Partial support from HFIP
NHC/NRL ATCF Improvements for 2017

- 8 slots for running HWRF/HMON models (5 for NHC)
- Changes to NHC consensus aids (GFDL removed)
- Ability to write advisories on Potential TCs
- New NHC Public Information Statement (PNS) generator available under "Messages" menu
- Headers for NHC mixed-case text products in proper format
- Advisory Composition now remembers when user selected "Last Advisory"
NRL ATCF® Development

Charles R. Sampson and Michael Frost
Naval Research Laboratory, Monterey, CA

Mark DeMaria, Craig A. Mattocks, Christopher Mello,
Michael Brennan and Monica Bozeman
NOAA/NWS National Hurricane Center, Miami, FL
ATCF® DEVELOPMENT

Ticketing - Trac
CM - Subversion

HFIP Funding to NRL

FY14 - 100K
FY15 - 0K
FY16 - 25K
FY17 - 75K

ATCF 5.8.3
~25 NHC specific tasks
Few examples follow
TC Watch/Warning Breakpoints

Coastal watch/warning breakpoints can now be displayed on the ATCF: Graphic -> Breakpoints
Shortcuts in Forecast Dialog Boxes
Wind Radii Consensus Buttons
~13 New NHC-specific requirements

Improve performance of ATCF forecast dialog and display GUIs for systems with large a-decks - specifically wind radii forecast dialog GUI, polar wind radii forecast dialogs, and graph aid intensity vs. time for multiple DTGs.

Add “Storm State” selections for “Tropical Cyclone” and “Potential Tropical Cyclone” to “Forecast Type” menu in Advisory Composition GUI and display them when selected in the TCM and TCD.

Make any necessary changes to the f-deck format and the vortex fix entry GUI to account for new vortex message format.
Track and Intensity GPCE (Not updated since 2015)
Climatology (HURISK-like) and SHIPS Wind Radii

ATCF Climatology (NRL)

SHIPS Wind Radii (CIRA)
Wind Radii Guidance

Objective R34 Performance

R34, R50, R64 estimates
(NRL and CIRA)

R34 GPCE for RVCN (NRL)

34-kt wind radii fix mean errors (brown) and biases (blue) relative to JTWC 2014-2016 best tracks coincident with ASCT. Objective best track (OBTK) gives reasonable estimates. Standard error is shown as black bars on means.
NHC NAWIPS and AWIPS2 usage

- NAWIPS and AWIPS2 jointly used to view all gridded model, satellite, surface observations and radar data
- NAWIPS PGEN used to create TAFB surface analysis maps, and Graphical TWO
- NHC uses NAWIPS to view legacy GOES13 and GOES15 imagery
- AWIPS2/GFE creates all storm surge watches and warnings and gridded forecasts to blend with WFO’s forecasts
- NAWIPS used for creation of coastal tropical cyclone wind based watches and warnings for graphics
- AWIPS2 preferred for viewing radar and GOES-16 data
NHC NAWIPS to AWIPS2 Transition

- ~95 percent metadata transition complete
- AWIPS2/D2D much quicker load times than NAWIPS
- AWIPS2/D2D color curves and contours still need work to match NAWIPS
- PGEN now has ability to create all legacy NAWIPS products in AWIPS2
- Still uncertainty to which AWIPS2 perspective, NCP or D2D, will become the preferred viewing option for NHC moving forward
AWIPS2 at NHC - GFS Harvey
Navy Plans for AWIPS2

- Being implemented at JTWC, FWC-San Diego, FWC-Norfolk
  - FWC-Norfolk leading
-Awaiting authority to operate
  - IT security issues need to be addressed
- Implementation ~1 year away
- NRL has exploratory project to put ship routes and ship-relevant products in AWIPS2
ATCF Transition to AWIPS2

- NRL supported ATCF *remains* the primary tool for tropical cyclone product generation at NHC, CPHC and JTWC

- Factors affecting ATCF usage by NWS
  - Consolidation of product generation systems
  - Consistency between NCEP and WFOs
  - Long-term maintenance and support
  - Ever increasing IT security constraints

- Pilot project to transition some ATCF capabilities initiated in 2014
  - Initial support from HFIP
  - Support transitioning to the AWIPS program office in FY18
ATCF Transition to AWIPS2

- Progress so far: Import/Export of A/B/E/F decks, GUI development, track plots
- Primary computer language: Java
- ATCF will run in CAVE-D2D (Common AWIPS Visualization Environment - Display 2 Dimensions) GUI developed by Raytheon
- NHC requirements: no radical changes in forecaster workflow, ability to make rapid changes to source code and system functionality
- Functional requirements specification document written and approved by NCO (NCEP Computer Operations) on Oct. 30, 2015
ATCF Transition to AWIPS2

– Project managed by David Plummer, National Centers’ AWIPS Team Lead
  – Single contractor effort since 2015
  – NHC Hurricane Specialists and TSB developers provide input and oversight
  – Monthly meetings between NCO and NHC
– Transitioning to APO in 2018
– Future Tech Support provided by AWIPS Network Control Facility (NCF)
– Much more work to be done, 4 to 5 year effort
ATCF Transition to AWIPS2
CAVE-NCP Graphical User Interface

HFIP Annual Review Meeting, 8-9 November 2017, Miami, FL
ATCF Transition to AWIPS2
CAVE-NCP Graphical User Interface

AIDS (TRACKERS)
ATCF Transition to AWIPS2
CAVE-NCP Graphical User Interface
Summary and Conclusions

- ATCF will remain the primary tool for NHC, CPHC and JTWC tropical cyclone product generation for the next several years
- NWS is moving towards common display and product generation system
  - N-AWIPS transition to AWIPS2
- ATCF capabilities in AWIPS2 development will migrate to AWIPS Program Office in 2018
Extras
Implemented at JTWC

R34, R50, R64 estimates (NRL and CIRA)

R34 GPCE for RVCN (NRL)
Track and Intensity GPCE not updated since 2015
## NHC Forecast Cycle

<table>
<thead>
<tr>
<th>Time (HR:MIN)</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>00:00</td>
<td>Issue Tropical Weather Outlook, Issue Intermediate Public Advisory (if necessary)</td>
</tr>
<tr>
<td>00:45</td>
<td>Receive satellite fix data, plot fixes, determine initial location, intensity, size</td>
</tr>
<tr>
<td>01:00</td>
<td>Initialize models, send model guidance job to supercomputer</td>
</tr>
<tr>
<td>01:10</td>
<td>Receive model guidance and <em>prepare forecast</em> (track, intensity, wind radii)</td>
</tr>
<tr>
<td>02:00</td>
<td>NWS / DOD hotline coordination – coordinate US/international watches/warnings, rainfall, surge, other hazards. Prepare products.</td>
</tr>
<tr>
<td>03:00</td>
<td>Advisory deadline</td>
</tr>
<tr>
<td>03:15</td>
<td>FEMA conference call</td>
</tr>
<tr>
<td>06:00</td>
<td>New cycle begins</td>
</tr>
</tbody>
</table>
ATCF Capabilities and Usage

- **Purpose:** a dedicated, interactive software application to automate and streamline the monitoring, tracking and forecasting of tropical cyclones (TC).
- Performs multiple analyses of TC state (center position, intensity, wind radii structure, forward motion, ocean wave height).
- Ingests “fix” data - TC data from Dvorak satellite estimation techniques, microwave satellite imagery interpretation methods, reconnaissance aircraft, NWP models, vortex trackers/aids (343 forecast aids in this year’s ATCF techlist), etc.
- Prepares data for initializing a wide range of models (NWP, statistical, climatological), submits this data to supercomputing clusters, retrieves the results, and merges them together - on the screen, as weighted blends, or as consensus forecast products.
- Data stored in a ASCII character CSV (comma-separated value) flat-file database known as the “decks”:
  - **a-deck:** all available forecast aid projections for the entire storm history
  - **b-deck:** Best Track, the best operational estimate of TC parameters at 6-hr synoptic times
  - **e-deck:** probability records (track, intensity, RI, genesis)
  - **f-deck:** records of track/intensity fixes from multiple platforms
Up to 8 HWRF Slots

You can now submit up to 8 HWRF runs from the ATCF, but NHC/CPHC can only use 5 slots unless we pre-coordinate with JTWC.

Note that HMON will only run for the first 5 slots.

Option under the Aids menu labeled “NWP Model Priority”.

HFIP Annual Review Meeting, 8-9 November 2017, Miami, FL
NCEP/NHC ATCF Migration to AWIPS II
Project Status as of 11 July 2017

**Project Information and Highlights**

**Points of Contact:** Carmen Jenkins, David Plummer

**Scope**
- Migration of Automated Tropical Cyclone Forecast (ATCF) System application functionality to AWIPS II
  - Document functionality in legacy ATCF System
  - Implement same (or equivalent) functionality in AWIPS II
  - Center Specific Training
  - Migrating NHC/CPHC product production and dissemination to AWIPS II

**Success Criteria**
- Operational production and dissemination of all NHC and CPHC products currently done in legacy ATCF migrated to AWIPS II.

**Not Included**
- Migration of functionality currently in scripts and standalone programs external to the legacy ATCF application itself.

**Issues and Risks**

**Issues and Risks / Mitigations**
- None.

---

**Scheduling**

<table>
<thead>
<tr>
<th>Milestone</th>
<th>Completion Date</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Investigate ATCF legacy &quot;File&quot; Menu Entries</td>
<td>May 12, 2017</td>
<td>Completed</td>
</tr>
<tr>
<td>Investigate Print and Graphics-related entries</td>
<td>Apr 21, 2017</td>
<td>Completed</td>
</tr>
<tr>
<td>Investigate Inter-site Data Exchange entries</td>
<td>May 5, 2017</td>
<td>Completed</td>
</tr>
<tr>
<td>Develop &quot;Fixes&quot; Menu Entries</td>
<td>Aug 18, 2017</td>
<td>On Track</td>
</tr>
<tr>
<td>Develop &quot;Display Fixes...&quot; entry and dialog</td>
<td>Jun 9, 2017</td>
<td>Completed</td>
</tr>
<tr>
<td>Develop &quot;Display Fixes...&quot; display resource</td>
<td>Jul 14, 2017</td>
<td>Delayed</td>
</tr>
<tr>
<td>Develop &quot;Enter Fix Data...&quot; entry and 8 type dialogs</td>
<td>Aug 14, 2017</td>
<td>Not Started</td>
</tr>
<tr>
<td>Develop &quot;View Fix Data...&quot; entry and dialog</td>
<td>Sep 18, 2017</td>
<td>Not Started</td>
</tr>
<tr>
<td>Develop &quot;Track Management&quot; Menu Entries</td>
<td>Nov 30, 2017</td>
<td>Not Started</td>
</tr>
<tr>
<td>Develop &quot;Objective Aids Management&quot; Menu Entries</td>
<td>Apr 6, 2018</td>
<td>Not Started</td>
</tr>
<tr>
<td>All ATCF coding delivered to the AWIPS baseline</td>
<td>Jun 30, 2019</td>
<td>On track</td>
</tr>
</tbody>
</table>

**Resources**

NCO/SDBBruce Hebbard (contractor): 0.9-1.0 FTE. (See Issues and Risks)
NHC/TSG: Monica Bozeman, Mark DeMaria, Craig Matlock

External Resources: NCO/RODO/APO resources assisting with certain issues (e.g., AWIPS networking and comms for data exchange with external ATCF partners such as JTWC)
Thank you!

References:


• NRL users manual for the ATCF:


• NRL documentation on the ATCF:

  http://www.nrlmry.navy.mil/atcf_web/docs/