NWS Plans for the ATCF

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ATCF Capabilities and Usage

- **Purpose**: a dedicated, interactive software application to automate and streamline the monitoring, tracking and forecasting of tropical cyclones (TC)
- **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
- 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
Receive Fix from Reconnaissance Aircraft

Final fix with an outbound maximum flight-level wind of 62 kt, which equates to 56 kt (90%) at the surface.
Enter a Recon Aircraft Fix

<table>
<thead>
<tr>
<th>Center/Intensity</th>
<th>Center Fix</th>
<th>Max Wind Speed Fix</th>
</tr>
</thead>
<tbody>
<tr>
<td>DTG (YYYYMMDDHHMM)</td>
<td>201008291721</td>
<td></td>
</tr>
<tr>
<td>Latitude</td>
<td>18.7°</td>
<td>N</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>C. Flight Level</th>
<th>700</th>
<th>1000 feet or millibars</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>C. Flight Level Min Height</td>
<td>266</td>
<td>meters</td>
<td></td>
</tr>
<tr>
<td>Max Stc Wind</td>
<td>D. Intensity</td>
<td>54</td>
<td>kts</td>
</tr>
<tr>
<td>E. Bearing</td>
<td>G. Range</td>
<td>36</td>
<td>deg</td>
</tr>
<tr>
<td>F. Dir</td>
<td>H. Min Sea Level Pressure</td>
<td>984</td>
<td>millibars</td>
</tr>
</tbody>
</table>

| I. Outside Eye Temp | 10° | deg C |                  |
| J. Inside Eye Temp | 13° | deg C |                  |
| K. Dew Point | L. Wall Cloud Thickness |                  |
| K. Sea Surface Temp | M. Eye |                  |
| L. Sea Surface Temp | M. Eye | Eye Shape | CI - Circular |                  |
| N. Wall Cloud Thickness | O. Accuracy | Navigational | Meteorological |                  |
| O. Accuracy | P. Diameter | 13 | nm (Long axis if Elliptical) |                  |
| P. Diameter | Q. Short Axis | 13 | nm (Blank if not Elliptical) |                  |
| Q. Short Axis | R. Orientation | 15 | deg |                  |
| R. Orientation | S. Navigational | 0.02 | nm |                  |
| S. Navigational | T. Meteorological | 15 | nm |                  |
| T. Meteorological | U. Mission Number | 15 | |                  |

Comments: MAX OUTBOUND FL WIND 62 KT SE QUAD 1735Z
Initials: XXXX

* Fields marked with an asterisk (*) are required.
Enter Dvorak Fixes

TAFB fix
Enter Best Track Information

1800 UTC best-track location 18.8N 79.2W

intensity and pressure

wind radii
Initialize Models

After determining the center, intensity, motion, and size of the tropical cyclone, the Hurricane Specialist sends that information to a supercomputer to run the models.
Receive Model Guidance

Then analyze numerical model output and prepare track, intensity, and wind radii forecasts.
Enter your radii prediction (n mi) for each forecast period

Select forecast period. Radii forecasts only out to 72 h

Guidance

Summary of your radii forecasts
Do we need watches or warnings?
Remember to consider forecast uncertainty

12 h forecast - Don’t forget about the Cayman Islands.

24 h forecast - Western Cuba and the Isle of Youth?

36 h forecast - Florida Keys and Dry Tortugas?

48 h forecast - Still time for the Gulf Coast?

12 h forecast - Don’t forget about the Cayman Islands.
ATCF Development Team at NHC

- **Mark DeMaria** - Chief of TSB
  - Management, oversight, funding

- **Craig Mattocks** - Meteorologist, Software Developer
  - Team Lead, ATCF software development
  - Develops/maintains NHC local “standalone” applications in Fortran/C

- **Monica Bozeman** - Meteorologist, Software Developer
  - Dataflow, scripting, documentation

- **Mike Brennan** - Sr. Hurricane Specialist
  - Testing, management of ATCF decks, annual requirements/improvements

- **Dave Zelinski** - Meteorologist, Software Developer
  - Web development, scripting, graphics, GIS
ATCF System Development Life Cycle (SDLC) – Timeline

- **Nov**
  - ATCF Requirements Meeting

- **Dec**
  - NOAA Hurricane Conference

- **Dec - Mar**
  - Rapid Development Period
  - “high priority requirements”

- **Mar - May**
  - Test and Debug Period

- **May - Jul**
  - Additional Upgrades

- **Jul**
  - ATCF System Rollout (Release 2)
  - “if possible/necessary”

- **Aug - Nov**
  - Next fiscal year Development Cycle
  - Routine Maint

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**ATCF System Development Life Cycle (SDLC)**

1) Concept  
2) Requirements  
3) Design / Code
4) Test / Debug
5) Implementation
6) Maintenance

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**System Requirement Categories**

1) Tropical Cyclone Center Requirements
2) Inter-agency Requirements
3) WMO / International Partner Requirements
4) Product / Service Improvements
5) Research to Operations
6) System Maintenance / Upgrades
<table>
<thead>
<tr>
<th>Item</th>
<th>Category</th>
<th>Assigned to</th>
<th>Description/Notes</th>
<th>Complexity</th>
<th>Risk</th>
<th>Priority</th>
<th>Percent Complete</th>
<th>Estimated Completion</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Miscellaneous</td>
<td>Craig</td>
<td>Low priority, can be easily corrected by hand.</td>
<td>Medium</td>
<td>Medium</td>
<td>Low</td>
<td></td>
<td>Defers</td>
</tr>
<tr>
<td>3</td>
<td>Miscellaneous</td>
<td>All</td>
<td>Longer term item (2017)</td>
<td>Medium</td>
<td>Medium</td>
<td>Low</td>
<td></td>
<td>Defers</td>
</tr>
<tr>
<td>4</td>
<td>Advisory Code</td>
<td>Craig</td>
<td>Current advisory code already returns intensity trend. Might be difficult to properly code up motion</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>0%</td>
<td>Defers</td>
</tr>
<tr>
<td>5</td>
<td>Advisory Code</td>
<td>Craig, Monica</td>
<td>Waiting to be implemented for CPHC</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td></td>
<td>Defers</td>
</tr>
<tr>
<td>6</td>
<td>Guidance</td>
<td>Monica, Mike</td>
<td>1/20/2016: Script updated, Monica will implement this week</td>
<td>Low</td>
<td>Low</td>
<td>Medium</td>
<td>100%</td>
<td>Done</td>
</tr>
<tr>
<td>7</td>
<td>Advisory Code</td>
<td>Mike</td>
<td>1/20/2016: Already fixed in current version of NHC advisory code</td>
<td>Low</td>
<td>Low</td>
<td>Medium</td>
<td>100%</td>
<td>Done</td>
</tr>
<tr>
<td>8</td>
<td>Dataflow</td>
<td>Monica</td>
<td>1/20/2016: Request from user to add WSP products to FTP server like other advisory test products. Mike provided details. Monica will include in RFC. Implemented week of 1/26.</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>100%</td>
<td>Done</td>
</tr>
<tr>
<td>9</td>
<td>Products</td>
<td>Mike</td>
<td>1/20/2016: Already modified file offline and tested on after build account. avr2-sent to Craig for repo</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>100%</td>
<td>Done</td>
</tr>
<tr>
<td>10</td>
<td>Guidance</td>
<td>Mike</td>
<td>1/20/2016: Modify files in SATCHIND</td>
<td>Low</td>
<td>Low</td>
<td>High</td>
<td>100%</td>
<td>Done</td>
</tr>
<tr>
<td>11</td>
<td>Guidance</td>
<td>Mike</td>
<td>1/20/2016: Modify files in SATCHIND</td>
<td>Low</td>
<td>Low</td>
<td>High</td>
<td>100%</td>
<td>Done</td>
</tr>
<tr>
<td>12</td>
<td>Guidance</td>
<td>Mike</td>
<td>Code was already set up to do this. Matt fixed typo in script, so it should now work</td>
<td>Low</td>
<td>Low</td>
<td>Medium</td>
<td>100%</td>
<td>Done</td>
</tr>
<tr>
<td>13</td>
<td>Miscellaneous</td>
<td>Mike, Matt</td>
<td>1/20/2016: Will truncate b-deck - need to fix so that truncated decks don't get posted to openftp. Do truncation in a temp directory and don't touch actual b-deck 2/17. GIS applications go to source for b-deck (SATCFSTRMS) - Craig increased buffer to 500 characters - manatee FORTRAN dace files</td>
<td>Medium</td>
<td>Medium</td>
<td>Medium</td>
<td>100%</td>
<td>Done</td>
</tr>
<tr>
<td>14</td>
<td>Guidance</td>
<td>Mike</td>
<td>1/20/2016: Make nqc_make.sh send input files to both tide and gcy. Written and tested.</td>
<td>Low</td>
<td>Low</td>
<td>Medium</td>
<td>100%</td>
<td>Done</td>
</tr>
<tr>
<td>15</td>
<td>Advisory Code</td>
<td>Craig</td>
<td>1/22/2016: Test on add outlook test - seems to work on TCP, but not in all cases. 2/26: Mike tested - works properly.</td>
<td>Low</td>
<td>Low</td>
<td>High</td>
<td>100%</td>
<td>Done</td>
</tr>
<tr>
<td>16</td>
<td>Advisory Code</td>
<td>Craig</td>
<td>1/22/2016: Comment out call to nqc_postproc.sh in do_storm_prob script on shelf and test to see if that works</td>
<td>Medium</td>
<td>Medium</td>
<td>Medium</td>
<td>100%</td>
<td>Done</td>
</tr>
<tr>
<td>17</td>
<td>Miscellaneous</td>
<td>Monica, Davis,</td>
<td>1/27/2016: Met Office will compute ensemble mean for track for us to ingest</td>
<td>Medium</td>
<td>Medium</td>
<td>Medium</td>
<td>100%</td>
<td>Done</td>
</tr>
<tr>
<td>18</td>
<td>Guidance</td>
<td>Monica</td>
<td>Miscellaneous: On-going</td>
<td>Medium</td>
<td>Medium</td>
<td>Medium</td>
<td>100%</td>
<td>Withdrawn</td>
</tr>
<tr>
<td>19</td>
<td>Guidance</td>
<td>Monica</td>
<td>Miscellaneous: On-going</td>
<td>Medium</td>
<td>Medium</td>
<td>Medium</td>
<td>100%</td>
<td>Withdrawn</td>
</tr>
<tr>
<td>20</td>
<td>Advisory Code</td>
<td>Craig, Mike</td>
<td>2/10/2016: Some progress - word wrapping works OK on warning, but not rest of TCM - work with TCM warning file only and then paste in?</td>
<td>Low</td>
<td>Low</td>
<td>Medium</td>
<td>100%</td>
<td>Done</td>
</tr>
</tbody>
</table>
New Features and Bug Fixes for 2016

- Mixed-case advisory products for CPHC
- Preliminary/climatological predictions of wind radii (PRERCL) and track/intensity (PRETCM) for CPHC
- Add storm development type at end of TC Vitals files (used to initialize HWRF/GFS) to prevent re-bogus of a storm already spun up
- Ingest new forecast trackers/aids from ECMWF, UK Met Office, NRL, JMA (now 343 forecast aids in techlist)
- Fix bug that posts preliminary WSP graphics to NHC web page prior to transmission of forecast advisory (TCM)
- Create Best Track GIS products even when there are no wind radii or forecasts - prevents “blank spots” in the NHC web site, which implies to users that an error has occurred
- Fix bug caused by empty warning files
- Improve automatic word wrapping of watch/warning section in forecast advisory (TCM)
- Implement capability to run WSPs early on WCOSS supercomputing cluster
- Began work to enable the creation and issuance of “genesis” advisory products for potential tropical cyclones (PTCs) in 2017
- Many additional enhancements delayed one year because of 64-bit upgrade of XVT toolkit for GUI (NRL)
ATCF Transition to AWIPS II

- ATCF has grown “organically” over the past 30 years:
  - More and more TC forecasting capabilities from different centers (NHC, CPHC, JTWC) incorporated into application
  - ATCF now employs 6 different scripting languages (csh, sh, ksh, bash, perl, python),
  - Minimal coding standards (Fortran 66, 77, 90/95, 2003/2008/2013), lack of modularity
  - Different compilers used (PGI 2008-2014 pgcc/pgf77/pgf90, GNU gcc/gfortran, Intel 2016 icc/ifort)
  - No version control system or back-ups until recently
  - Huge increase in data flow, from plethora of sources (recently centralized on “opah” server at NCEP)
  - Security restrictions at NCEP/DoD complicate access to servers and supercomputers

- **Result:** ATCF has become a monster “mash-up” project, almost impossible to manage, even for teams of dedicated developers
ATCF Transition to AWIPS II

- **Solution:** Merge ATCF into AWIPS II
  - Functional requirements specification document written and approved by NCO (NCEP Computer Operations) on Oct. 30, 2015
  - NHC requirements: no radical changes in forecaster workflow, retain ability to make rapid changes to source code and system functionality
  - Project will be managed by David Plummer, National Centers AWIPS Team Lead
  - Initial funding allocated, contractors (software developers) hired
  - High-level scoping/development plan due at the end of this fiscal year (Sept. 2016)
  - At least a 5-year project
  - NHC Hurricane Specialists and TSB developers will provide input and oversight
  - Monthly meetings between NCO and NHC now underway
  - Primary computer language: Java
  - Initial software development efforts will focus on ATCF decks database
  - ATCF will run in CAVE-D2D (Common AWIPS Visualization Environment - Display 2 Dimensions) GUI developed by Raytheon
  - Tech Support will be provided by Network Control Facility (NCF), just like AWIPS II
ATCF Transition to AWIPS II
CAVE-D2D Graphical User Interface
Thank you!

- NHC Senior Hurricane Specialist Dan Brown provided the forecaster workflow scenarios from his ATCF instructional course entitled “Forecast Scenario: Filling the Role of NHC Forecasters”

References:


- NRL users manual for the ATCF:
  

- NRL documentation on the ATCF:

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