HFIP Goals and Status
Frank Marks (NOAA/AOML/HRD)
HFIP Research Lead
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Develop an updated plan, detailing the specific research, development, & technology transfer activities necessary to sustain HFIP & achieve the 3 focus areas in Section 104 of the 2017 Weather Research and Forecasting Innovation Act:

1. improve prediction of rapid intensification & track of hurricanes
2. improve forecast & communication of storm surges from hurricanes
3. incorporate risk communication research to create more effective watch & warning products

Plan details long-term HFIP goals, priorities, & approaches.
HFIP Strategic Plan – 2019-2024

• **HFIP Strategic Plan** provides details on long-term HFIP goals (Appendix A), priorities, & strategies – June 2019

• High-level plan approved by NOAA for submission to Congress – May 2019

• NOAA SAB EISWG reviewed the plan submitted to Congress - October 2020
1. Reduce numerical forecast guidance errors, including during rapid intensification, by 50% from 2017;
2. Produce 7-day forecast guidance similar to 2017 5-day forecast guidance;
3. Improve guidance on pre-formation disturbances, including genesis timing, track & intensity forecasts, by 20% from 2017; and
4. Improve hazard guidance & risk communication, based on social and behavioral science, to modernize TC product suite for actionable lead times for storm surge & all other threats.
HFIP Goals aligned with Weather Act

**Track**

HFIP Track Mean Absolute Error Baseline and Goal

- **Baseline (2015-2017)**
- **10-Year Goal**

<table>
<thead>
<tr>
<th>Forecast Hour</th>
<th>Baseline</th>
<th>Goal</th>
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<tbody>
<tr>
<td>12</td>
<td>35.6</td>
<td>34.4</td>
</tr>
<tr>
<td>24</td>
<td>47.6</td>
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<td>36</td>
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<td>72</td>
<td>146.4</td>
<td>144.4</td>
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<tr>
<td>96</td>
<td>195.9</td>
<td>194.9</td>
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**Intensity**

RI Cases | RI Goal | All Cases | All Cases Goal

- RI Cases: Red solid line
- RI Goal: Red dotted line
- All Cases: Blue solid line
- All Cases Goal: Blue dotted line

Forecast Hour:

- 0 to 12
- 12 to 24
- 24 to 36
- 36 to 48
- 48 to 60
- 60 to 72
- 72 to 84
- 84 to 96
- 96 to 108
- 108 to 120
Key Strategies:

1. Advance an operational Hurricane Analysis & Forecast System (HAFS)
2. Improve probabilistic guidance
3. Enhance communication of risk & uncertainty
4. Support dedicated high performance computing allocation
5. R2O Enhancement
6. Broaden expertise & expand interaction with external community
Key Strategies: HAFS

1. Advance operational HAFS

- R&D for HAFS to advance deterministic & ensemble prediction capabilities
- R&D for fusion of modeling, data assimilation & observations to produce an Analysis of Record
- R&D for ensemble post-processing to extract guidance & uncertainty information
HAFS Yearly Milestones

✓ HAFS v0.2A: stand-alone regional (SAR) ESG nest configuration over NATL basin, 3 km hor. res, 91L, mod. HWRF physics, VI, DA & ocean coupling (Bin Liu)

✓ HAFS v0.2B: Global-regional nest configuration over NATL basin, 3-km hor. res, 78L, mod. GFS physics & VI (Andy Hazelton)

✓ HAFS v0.2D: SAR nest ESG configuration over NATL & EPAC, 3 km hor. res, 91L, HWRF physics, VI, DA, & ocean coupling (Li Bi)

✓ HAFS v0.2E: 21-member ensemble of HAFS v0.1A, 6-km hor. res, 64L, SKEB, SPPT, SHUM (Zhan Zhang)

● HAFS v0.3: Fully-coupled SAR configuration with moving nest, ocean coupling, VI & DA - 2022
Key Strategies: Guidance & Products

2. Improve probabilistic guidance

- Incorporate dynamically-based uncertainty into hazard models & products
- R&D for hazard-specific products from AFS Tropical Roadmap

TC Wind Hazard Recommender

Hazardous Weather Testbed - Tropical Cyclone Experiment - March 2021

- Tested Tropical Cyclone Wind Hazard Recommender with 14 WFOs (47 participants) for 3 storms (Florence, Hugo, & Michael)
3. Enhance communication of risk and uncertainty

- Evaluate TC products for effective communication of risk using FACETs
- Modernize TC products as informed by social & behavioral science
- Coordinating 9 OAR & Hurricane Supplemental Projects using social & behavioral science research to evaluate TC products
Key Strategies: HPC & R2O

4. Increase HPC Capacity
   - NOAA R&D & operational computing to support HAFS development
   - Hurricane Supplemental will provide R&D HPC ~24M core h/month for HAFS development (Hera & Orion)

5. Research to Operations (R2O) Enhancements
   - Accelerate transition to operations by following NOAA’s best practices for promoting readiness levels (RLs)
   - Develop a process to prioritize research targeted for operational improvements
   - Integrated use & support of Testbeds (JHT, DTC, JCSDA, HWT, HMT, & EPIC)
Key Strategies: Outreach to Community

6. Broaden expertise & expand interaction with external community

- Re-invigorate grants program
- Maintain a visiting scientist program at research and operational centers
- Advisory committees, community workshops
- Collaborate/coordinate with social and behavioral sciences
- Outreach to America’s Weather Industry (AWI)

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<th>HFIP Collaborative Awards Round VI (2020-2022)</th>
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<tr>
<td>PI Name</td>
</tr>
<tr>
<td>Alan Brammer</td>
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<tr>
<td>Enrique Curchitser</td>
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<td>Ryan Torn</td>
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To achieve the increasingly urgent goals of the Weather Act, Section 104 in a reasonable time, NOAA will need to continue to support HFIP, plus:

1) invest in additional physical, social & behavioral science research, motivated & targeted by an expanded set of success metrics;

2) leverage scientific & technological advances enabled by other line offices, testbeds, agencies, organizations & industry;

3) entrain a broader network of expert personnel external to NOAA for convergent research and workforce development.

**Provided 5 Specific Recommendations** - HFIP response prepared
Questions