

# HAFS Development Priorities After Initial Operational Implementation

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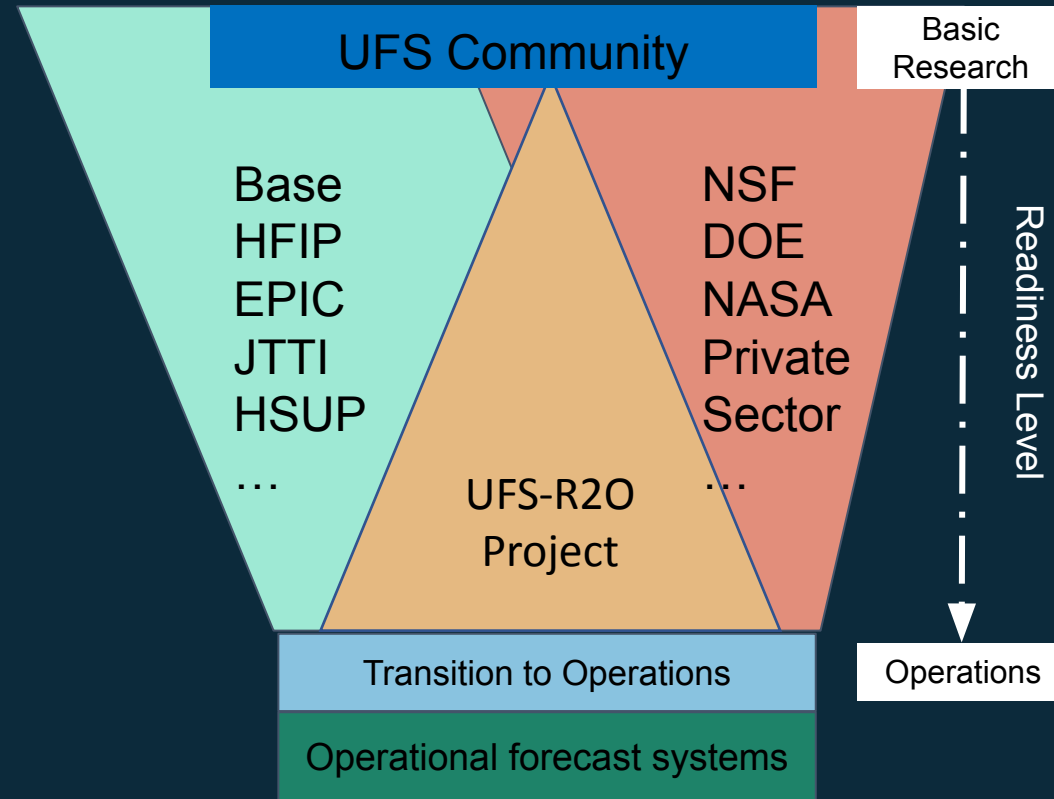
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# UFS Development Approach

UFS-R2O Project and its application follows the same approach:

- Develop innovations into operations
- Ensure lower Readiness Level (RL) research in the R2O pipeline
- Leverage other research and development programs and projects
- Transfer high RL research into operations



# HAFS Development Priorities: Year 4

- **Moving nest**
  - Multiple storms
  - Flexible nesting refinement
  - Mass adjustment for fine topography consistency in blending zones
  - Code optimization
- **Data assimilation**
  - New data ingestion
  - Weakly Atmosphere/Ocean coupled DA
  - JEDI transition
- **Physics**
  - PBL for TC application
  - NOAA-MP transition and evaluation
  - CP upgrade, transition, & evaluation
  - Microphysics parameterization upgrade
- **Ocean and wave model transition**
  - HYCOM to MOM6 transition
- **Ensemble capabilities**
  - Stochastic physics ensemble capability
  - Ensemble on Cloud
- **Products**
  - Ensemble products
  - Product fidelities
  - 7-day forecast products

# Main Activities in Year 4

Task #	Activity (main organizations)	Priority addressed	Times
1	Multiple moving nests/grid refinement (AOML/EMC)	Nest capability	02/28/24
2	Various DA configurations for implementing self-cycled 4DEnVar (EMC/AOML)	DA	06/30/24
3	Multi-scale DA with high-temporal and spatial resolutions (OU/EMC/AOML)	DA	06/30/24
4	VI for storms with/without inner-core observations (EMC)	DA	06/30/24
5	Physics schemes: MP, PBL, sa-CP, NOAA-MP, and uGWP (EMC/AOML)	Physics	06/30/24
6	MOM6 Ocean model coupling capability (EMC/AOML)	Ocean	06/30/24
7	Yearly upgrade and implement HAFSv2 (EMC/AOML)	System	06/30/24
8	Test and evaluation of HAFSv2+ upgrades	System	06/30/24
9	Transition HAFS v2 to NCEP operations (EMC/NHC)	System	06/30/24
10	Code and workflow, developer support, and documentation (EMC/AOML/DTC)	System	06/30/24

# HAFS Release Activities in Year 4

Task #	Activity	Times
1	Multi-platform support (Cloud, RDHPCS, and External HPCS)	FY24
2	Scientific documentation	FY24
3	User's guide	FY24
4	Tutorial and workshop	FY24
5	Code repository management	FY24
6	Special issue in Frontiers in Earth Science	FY24
7	Help desk	FY24

# HAFS Development Priorities: future innovation

- **Moving nest**
  - Global moving nest
  - Telescopic moving nest for LES capability
- **Data assimilation**
  - AI/ML technology for DA
  - Atmosphere/Ocean coupled DA: strongly vs. weakly
  - All-sky radiance: CRTM vs. RRTMG
  - New DA methodology: scale-aware, particle filter, etc.
  - DA and physics parameterizations interaction
- **Observations**
  - New observations
  - Observation strategy
- **Ensemble**
  - Initial condition perturbation
  - Ensemble for DA
  - Ensemble on Cloud
- **Physics**
  - AI/ML for physics parameterizations
  - Sub-kilometer physics
  - Physics interactions
- **Ocean-Wave-Atmosphere coupling**
  - Three-way coupling
  - Coupling strategy
  - Ocean and wave model physics
  - Ocean and wave model initialization

# Main Activities in the Future

Task #	Activity	Priority addressed	Times
1	Weakly coupled ocean and atmospheric initialization/DA capability	DA	FY25
2	Coupled ocean and atmosphere initialization/DA	DA	FY26
3	Coupled ocean and atmosphere DA for new observation	DA	FY26
4	Transition to JEDI based DA	DA	TBD
5	DA system upgrade and implementation	DA	TBD
6	PBL and GFDL MP development	Physics	FY25
7	Physics schemes T&E: PBL, sa-CP, NOAH-MP, and uGWP (EMC/AOML)	Physics	FY25
8	Ocean model transition from HYCOM to MOM6 T&E (EMC/AOML)	Ocean	FY25
9	Ensemble development, T&E	System	FY25
10	Code release and community support	System	FY25