NCEP Status Update

Joint APSDEU-13/NAEDEX-25 Annual Meeting

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Topics

- Migration to NOAA's Weather & Climate Operational Supercomputing System (WCOSS)
- New Data Usage and Acquisition
- Recent Model Upgrades
- Planned Model Upgrades
- NOAA's Integrated Dissemination Program System

NCEP Computing Update

HIGH PERFORMANCE COMPUTING

Weather & Climate Supercomputing System (WCOSS) Transition in July 2013

Location

- Primary
  - Reston, VA (IBM provided facility) - Tide
- Backup
  - Orlando, FL (IBM provided facility) - Gyre

Configuration

- Identical Systems (per site)
  - IBM iDataPlex/Intel Sandy Bridge/Linux
  - 213 trillion calculations/sec
  - 10,048 processing cores
  - 2.59 petabytes of storage
- Performance Requirements
  - Minimum 99.9% Operational Use Time
  - Minimum 99.0% On-time Product Generation
  - Minimum 99.0% Development Use Time
  - Minimum 99.0% System Availability
  - Failover tested regularly

Inputs and Outputs

- Processes 3.5 billion observations/day
- Produces over 15 million products/day

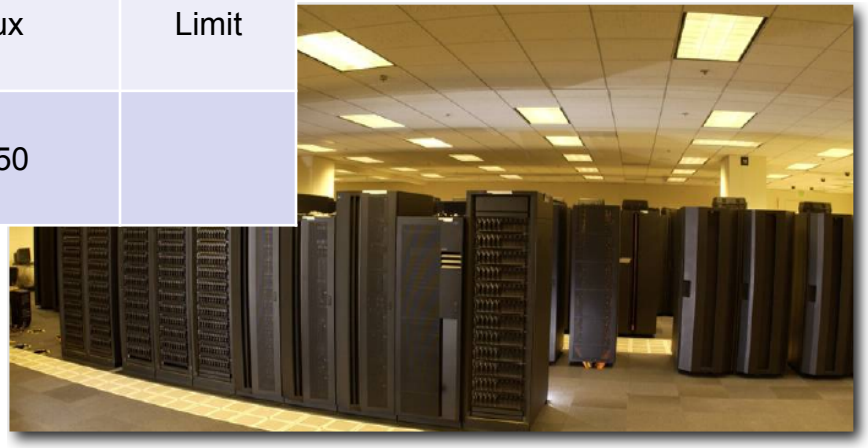
Significance

- Where United States weather forecast process starts for the protection of lives and livelihood
- Produces model guidance at global, national, and regional scales

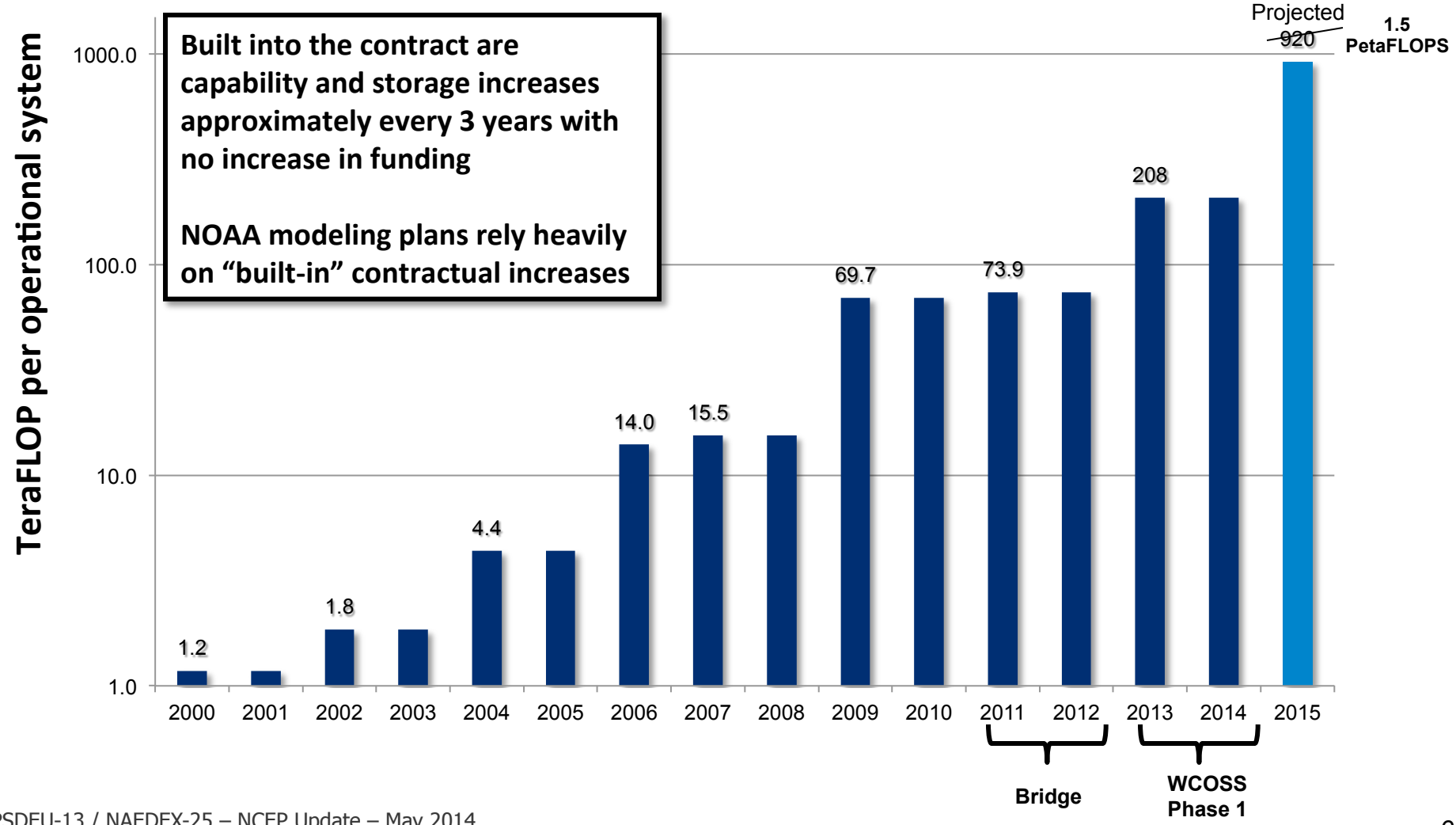
  Examples:
  - Hurricane Forecasts
  - Aviation / Transportation
  - Air Quality
  - Fire Weather

NOAA Research & Development Supercomputing

System	Location	Owner	Vendor	Capability (number and clock speed of cores)	%Avail NCEP
GAEA	Oak Ridge, TN	NOAA OCIO	CRAY	77,800 Cores/ 1.1 PF AMD/Linux	6.2%
ZEUS	Fairmont, WV	NOAA OCIO	SGI	27,648/ 383 TF Intel/Linux	44.8%
S4	Madison, WI	U of Wi		3,072 Cores AMD Opteron 2.2 GHz Linux	No Set Limit
JIBB	Greenbelt, MD (GSFC)	JCSDA	IBM	3,456 Cores/37.8 TF iDataPlex/Intel/Linux	No Set Limit
Jet	Boulder, CO	NOAA OCIO		T-Jet 10,000, U-jet 16,648, S-Jet 23,050 Cores/182 TF	



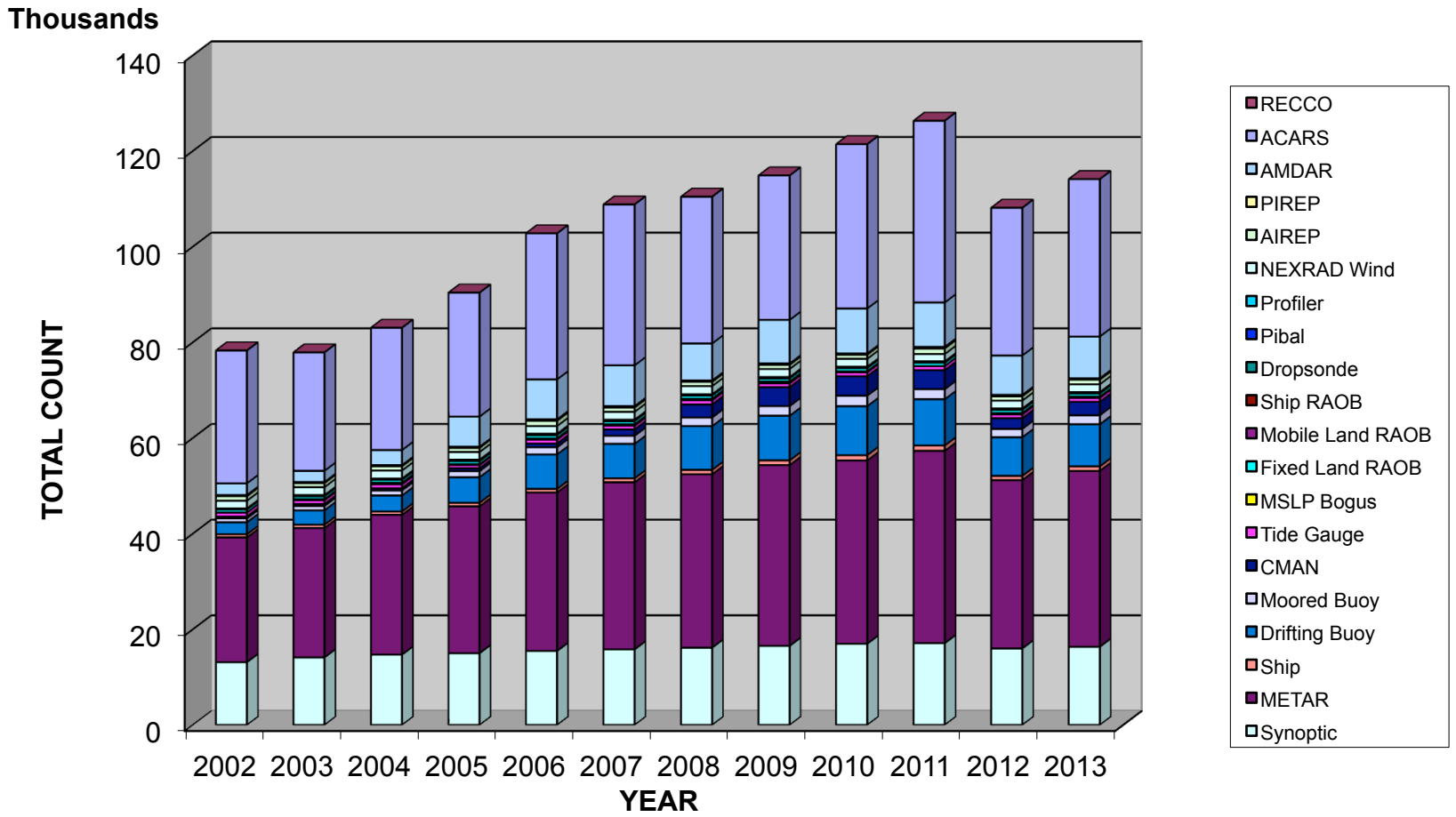
HPC Growth


Built into the contract are capability and storage increases approximately every 3 years with no increase in funding
NOAA modeling plans rely heavily on "built-in" contractual increases
TeraFLOP per operational system
1000.0
100.0
10.0
1.0
1.2
1.8
4.4
14.0
15.5
69.7
73.9
208
Projected
920
1.5
PetaFLOPS
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
Bridge
WCOSS
Phase 1

FY13 – FY14 NCEP Computing Activities

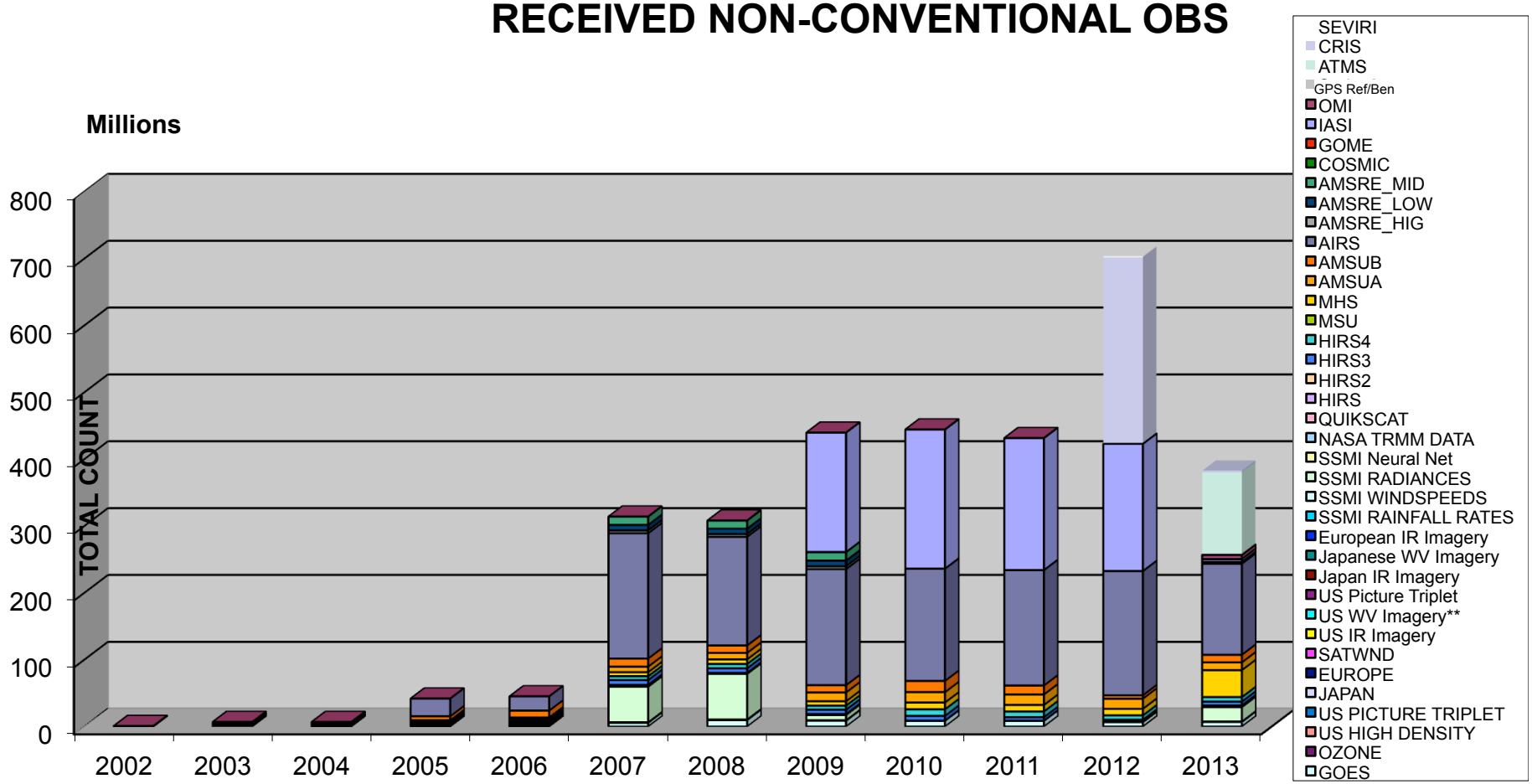
NEW DATA USAGE AND DATA ACQUISITION

Conventional Data Received

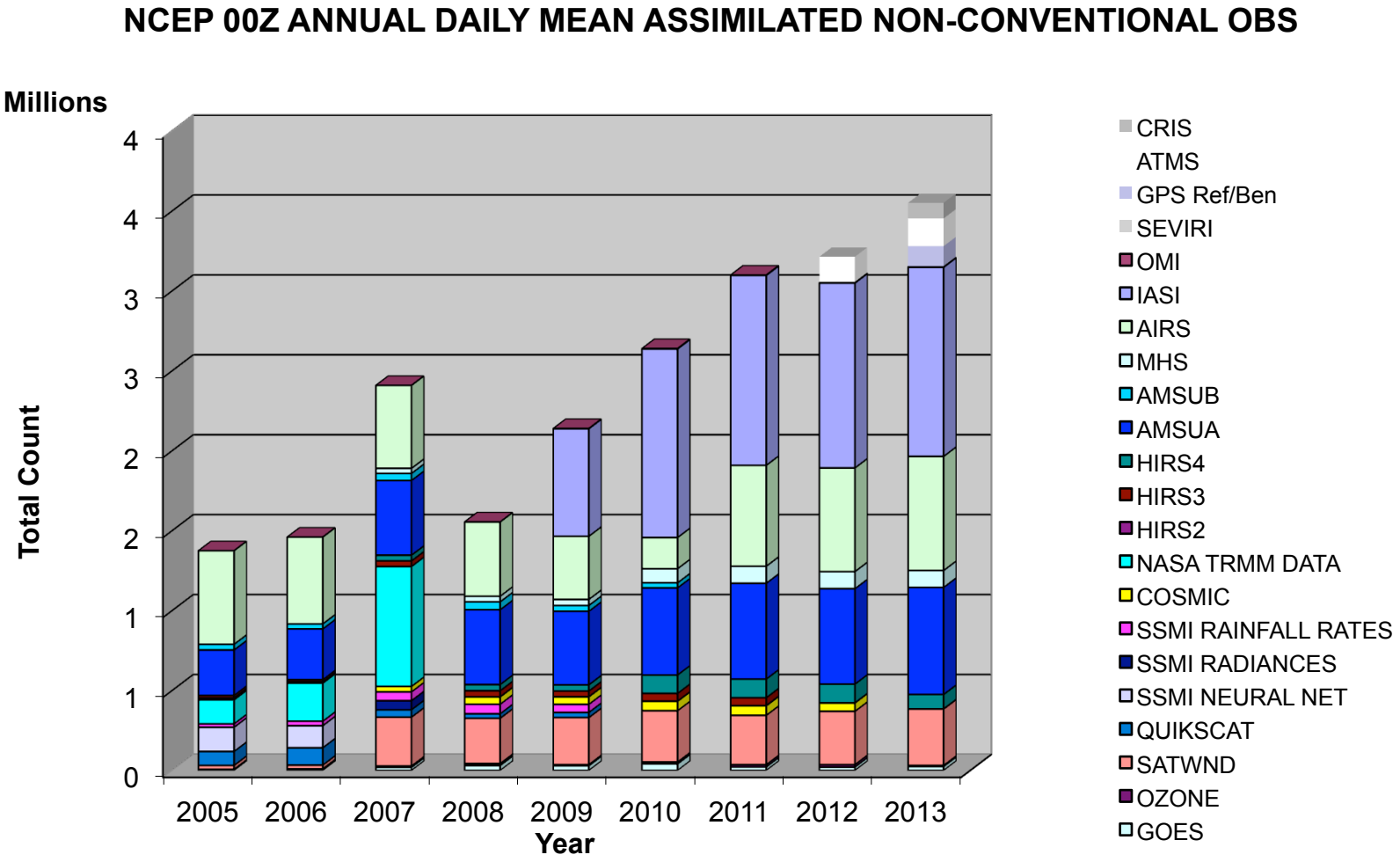


Non-Conventional Data Received

NCEP 00Z ANNUAL DAILY AVERAGE TOTAL OF RECEIVED NON-CONVENTIONAL OBS



Non-Conventional Assimilated Data



New Observations and BUFR/GRIB Packages

October 2012 – September 2013

- Transitioned libraries and decoders to WCOSS (July 2013)
- Dual Pol Radar decoder / NeXRad Level 3 decoder
- SYNOP-R BUFR decoder
- Updates to GRIB & GRIB2 Template Libraries
- Update to NCEP WMO GRIB2 documentation version 11.0

October 2013 – May 2014 (* in process)

- GRIB2 downstream product transition for GFS model upgrade*
- Update WAFS for maximum wind interpolation
- Update Japanese Wind Profiler decoder
- Decode GTS format for NZKL aircraft bulletins
- Glider data BUFR decoder
- Add height assignment methods/pressures to EUMETSAT winds*

FY13 – FY14 NCEP Computing Activities

RECENT MODEL UPGRADES

Model Upgrades
Oct 2012 – Sep 2013

- NARRE (North American Rapid Refresh Ensemble) product updates
- Increased resolution to 2.5km for GMOS and Gridded LAMP
- GDAS V9.0.0 (w/GFS bug fix V9.1.0)
- Discontinuation of the following products:
  - *GDAS2*
  - *Legacy GFS products*
  - *Legacy radar products*
  - *Legacy Climate Diagnostic Center Products*
- HWRF model upgrade
- **WCOSS went live on July 25, 2013**
- Addition of satellite data to GFS Model – August 20, 2013
  - *METOP-B*
  - *SEVIRI data from Meteosat-10*
  - *S-NPP CrIS data*

http://www.nco.ncep.noaa.gov/pmb/changes/

Model Upgrades
Oct 2013 – July 2014

- Additional fields added to the GFS World Area Forecast System (WAFS) products
  - *Temperature, Geopotential Height, and u & v components of the wind added for FL80, FL210, FL410, FL490*
  - *RH added for FL80 & FL210*
- Upgrade to the SREF Model
- Upgrade to Gridded MOS and LAMP model
- Upgrade to the GEFS and NAEFS (April 8, 2014)
  - *Added variables to bias-corrected products globally and downscaled probabilistic products for CONUS and Alaska from GEFS and NAEFS*
- Removal of legacy GFS products (June 3, 2014)
  - *Old Text Products, FAX and Redbook graphics*
- Upgrade HIRES Window (June 11, 2014)
- Upgrade HWRF v8.0 and GFDL v12.0 model (week of June 10, 2014)
- Observation Processing Suite Upgrade (June 2014)
- Upgrade to Global Wave Ensemble System (July 1, 2014)
- Upgrade to NAM v3.2.0 (July 2014)

http://www.nco.ncep.noaa.gov/pmb/changes/

Observation Processing Suite Upgrade

- Observation Processing Suite Upgrade (June 2014) – several satellite-related observations will be assimilated into the following models:
  - *NESDIS GOES cloud (in NAM)*
  - *LaRC GOES cloud (in NAM)*
  - *NPP: CrIS and ATMS radiances in RAP model*
  - *NPP: Ozone (profile, total column)*
  - *METOP-A/B IASI Radiances in RAP model*
  - *METOP-B ASCAT*
  - *Canadian Wind Profilers*
  - *Oceansat scatterometer winds*
  - *GOES Hourly satellite winds*
  - *Include shortwave (3.9 micron) GOES winds for testing*
  - *Include more robust aircraft QC processing*

Update the entire observation processing suite into vertical structure/environment equivalence

http://www.nco.ncep.noaa.gov/pmb/changes/

FY14Q4/FY15Q1 – NCEP Computing Activities

PLANNED MODEL UPGRADES

Planned Model Upgrades August – December 2014

- High-Resolution Rapid Refresh (HRRR) v1.0.0 – September 2014
  - *Initial version of 3 km HRRR – F000-F015 every 15 minutes*
  - *Similar to RAP but allows explicit convection*
  - *Radar assimilated every 15 min / allow a one-hour "spinup" forecast / and final 3km GSI*
- GDAS/GFS v12.0.0 – September / October 2014
  - *0.25 degree resolution (T1534)*
  - *Improved model physics*
  - *Enhanced data assimilation – T574 EnKF*
  - *Extension of high resolution to 10 days*
  - *3 hourly output through F240*
- RTOFS Global Upgrade
- RTG SST High Resolution to include METOP-B
- Sea Ice Drift Model v2.1.0
- SREF Major Upgrade

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Data Dissemination: Future

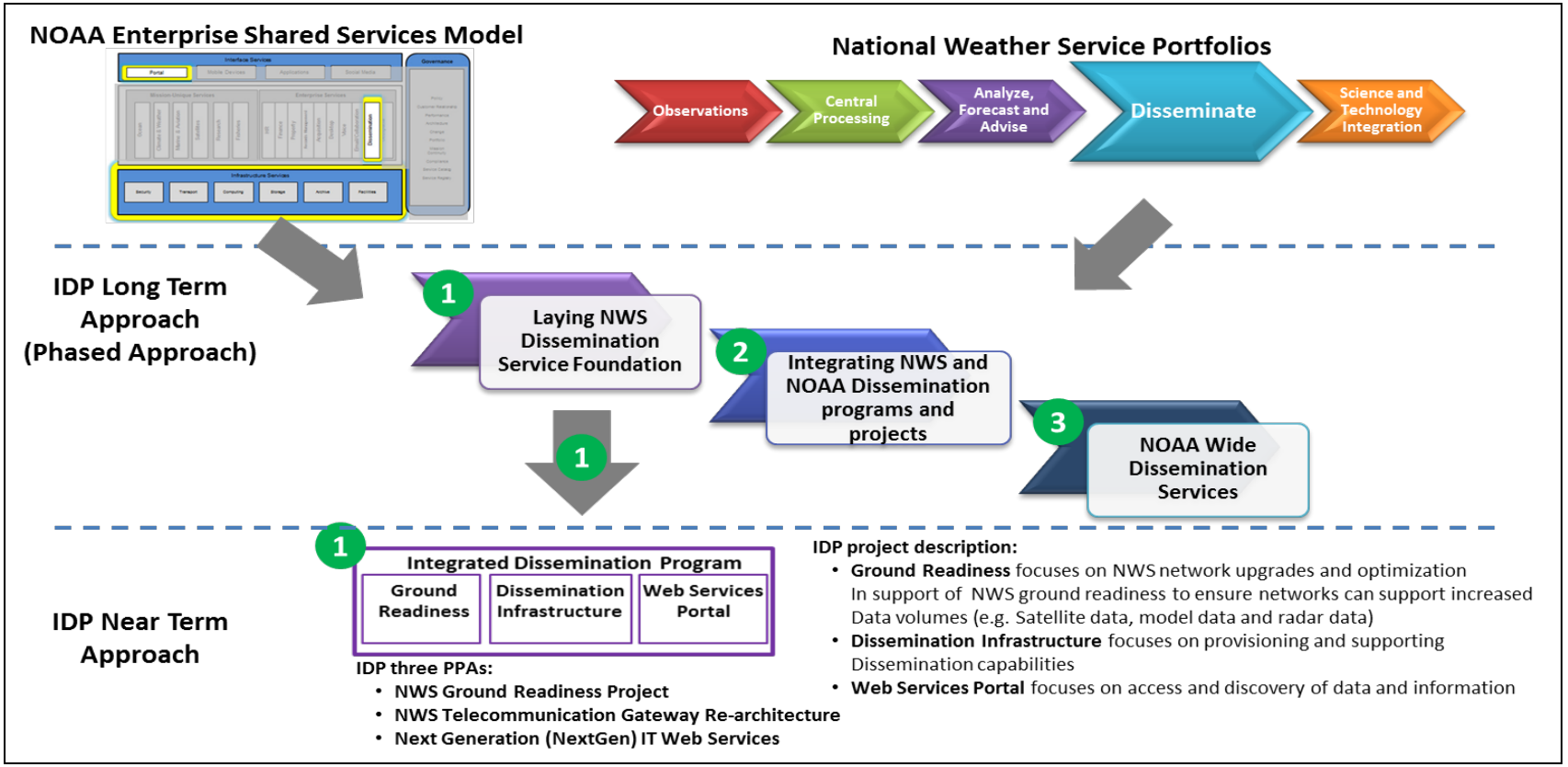
DISSEMINATION PRIORITIES

NOAA Integrated Dissemination Program

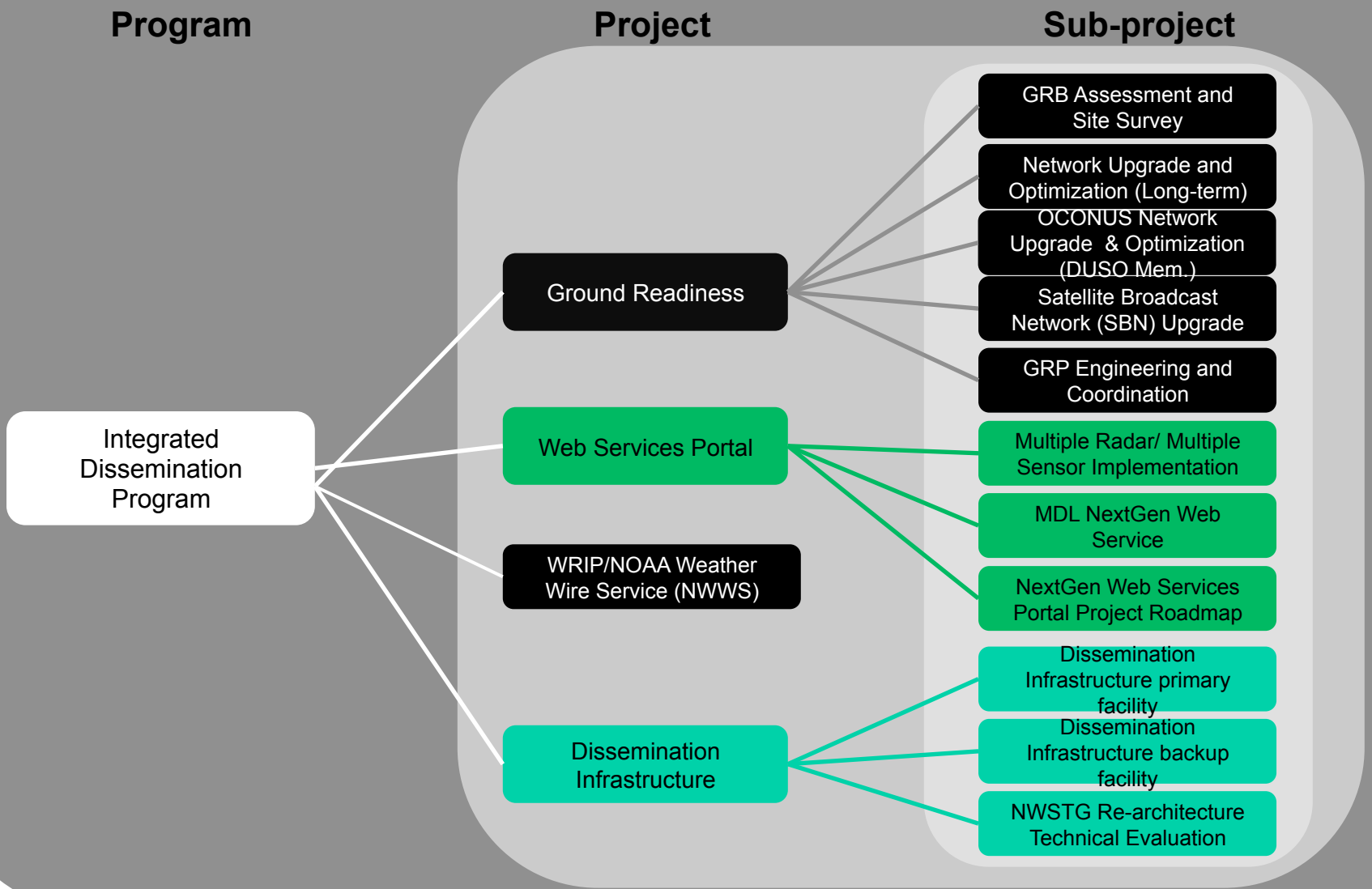
- NOAA's Integrated Dissemination Program (IDP) established to transform organization's dissemination capabilities from a collection of independent stovepipes to an integrated enterprise-wide dissemination service
- IDP funding is derived from three separate funding lines (NWSTG Re-architecture, NextGen, and NWS Ground Readiness Project (GRP))
- IDP includes multiple projects and subprojects
- Primary IDP dissemination facility to be part of NCEP Central Operations in College Park, MD…backup in Boulder, CO
- Projects and applications are to be moved into (e.g. NOAA National Operational Model Archive and Distribution System (NOMADS)) or established in overall dissemination service facilities

IDP Overview

- IDP plans to deliver NOAA Wide Dissemination Services in a phased approach.
- In Phase 1, IDP's focus is on executing against NWS requirements.



IDP's Projects and Subprojects



IDP Project: Dissemination Infrastructure

- Project Scope:
  - *Build a service-oriented dissemination infrastructure at a primary facility (College Park, MD) and a backup facility (Boulder, CO).*
- Goals:
  - *Implement a scalable, robust, secure, and commonly shared dissemination infrastructure*
  - *Ensure NWS GOES-R and JPSS ground readiness (particularly increase in satellite, model, and radar data).*
  - *Standardize scalable architecture.*
  - *Provide Infrastructure services.*
  - *Provide cloud computing where appropriate.*
  - *Support NOAA OCIO Principles:*
    - Build Enterprise Shared Services
    - Modernize IT Infrastructure
    - Consolidate Data Centers

Phase 1: IDP Primary Site Current Compute Farm augmented at NCWCP - COMPLETED

Phase 2: Build out IDP Primary Site at NCWCP, College Park - Summer 2014

IDP Project: Ground Readiness

Network Upgrade & Optimization - FY16

Provide telecommunication upgrades to ensure the NWS network is able to accommodate the increased volume of data due to increases in model, radar and satellite (e.g., GOES-R, GOES-S, and JPSS) data.

Satellite Broadcast Network (SBN) Expansion - Q1 FY15

The NWS's Advanced Weather Interactive Processing System (AWIPS) SBN is the primary data-supplier network for over 95% of the NWS field offices.

- The SBN Upgrade will increase the SBN bandwidth to meet Ground Readiness and will ensure that NWS field offices can receive critical weather data using the SBN.

GRB Assessment and Site Survey – Q4 FY15

The purpose of the GOES-R Rebroadcast (GRB) Site Survey Project is to ensure that NWS Centers & Regions can receive GOES-R data and products, thus extending their current operational capabilities to exploit this next generation of satellite data.

NWS Sites to be upgraded with GRB Capabilities

NCWCP in College Park, MD
NHC in Miami, FL
SPC in Norman, Oklahoma
SWPC in Boulder, CO
Pacific Region in Honolulu, HI
Guam
Alaska Region in Anchorage, AK
AWC in Kansas City, MO

Questions ???

"From the Sun to the Sea…
Where America's Climate, Weather, Ocean and Space Weather Services Begin"