Satellite Proving Ground Demonstration Plan:
Aviation Weather Center Proving Ground – 2014 Demonstrations

1. **Project Title:** 2014 Satellite Proving Ground – Aviation Weather Testbed

2. **Organization:**
   - **a.** Aviation Weather Center Proving Ground, Kansas City, MO
   - **b.** Air Traffic Control Systems Command Center, Warrenton, VA
   - **c.** Center Weather Service Units
   - **d.** Alaska Aviation Weather Unit

3. **Products to be Demonstrated as a GOES-R Proving Ground activity at the AWT**
   - **a.** GOES/POES hybrid imagery
   - **b.** VIIRS Day/Night band
   - **c.** VIIRS/MODIS Dust RGB
   - **d.** VIIRS/MODIS Nighttime Microphysics
   - **e.** GOES GeoColor imagery
   - **f.** NSSL-WRF/NAM Nest Simulated Satellite Forecasts
   - **g.** Flight Icing Threat
   - **h.** Fog and Low Stratus
   - **i.** ACHA Cloud Height Algorithms
     - **i.** Cloud Top Height
     - **ii.** Cloud Top Temperature
   - **j.** NearCasting Model Theta-E
   - **k.** Convective Toolkit
     - **i.** GOES-R Convective Initiation
     - **ii.** Cloud-Top Cooling
     - **iii.** Overshooting Top Detection
     - **iv.** Pseudo Geostationary Lightning Mapper
     - **v.** HRRR Lightning Threat Forecast
   - **i.** GOES-14 SRSOR 1-minute imagery

4. **Demonstration Project Summary**

   a. **Overview**: The Satellite PG has provided aviation-related products to the Aviation Weather Center (AWC) and Aviation Weather Testbed (AWT). Pre-operational demonstrations of these products, which will provide aviation forecasters the opportunity to critique and improve the products relatively early in their development, will occur throughout the coming year. Amanda Terborg, the GOES-R liaison at the AWC, will be handling all logistics and coordination of the new satellite datasets within the demonstration period.

   b. Plan, Purpose, and Scope: The AWC 2014 demonstrations will provide the Satellite Proving Ground (PG) with a pre-operational environment in which to deploy and demonstrate algorithms associated with weather-related aviation hazards while in addition familiarizing end users with its next generation geostationary and polar satellite systems. The demonstration will consist of several long term evaluations (several months each), as well as one week-long, intensive experiment period in the latter half of the year focused on ceiling and visibilty. Products will be evaluated based on the operational desk structure of the AWC.

c. **Goals:** The activities within the Satellite Proving Ground at the AWT will focus on demonstrating and evaluating the baseline and future capabilities products as identified below, and more extensively on integrating them within AWC operations. The 2014 demonstrations will include forecasters from each desk within AWC operations, and this will not only provide a wide variety of feedback, but will also aid in building relationships within a very diverse aviation user community. Both of these things will be vital part in furthering the GOES-R/JPSS PG Research to Operations effort within the AWT.

5. **Participants Involved:**
   a. **Providers:**
      i. GOES/POES hybrid imagery (Smith/McGrath – SPoRT)
      ii. VIIRS Day/Night band (Fuell/Strabala/Miller – SPoRT/CIMSS/CIRA)
      iii. MODIS/VIIRS Dust RGB (Fuell/Knaff – SPoRT/NESDIS STAR)
      iv. MODIS/VIIRS Nighttime Microphysics (Fuell/Knaff – SpoRT/NESDIS STAR)
      v. GOES GeoColor imagery (Szoke/Lindsey – CIRA/NRL)
      vi. NSSL-WRF/NAM Nest Simulated Satellite Forecasts (Sieglaff/Lindesy/Bikos – CIMSS/CIRA)
      vii. Flight Icing Threat (Smith Jr./Heidinger – NASA LaRC/CIMSS)
      viii. Fog and Low Stratus (Pavolonis – CIMSS)
      ix. ACHA Cloud Height Algorithms (Heidinger/Wanzong – CIMSS)
      x. NearCasting Model (Petersen/Line – CIMSS/CIMMS)
      xi. HRRR Lightning Threat Forecast (McCaul, Chronis, Alexander – USRA, UAH, ESRL-GSD)
      xii. Pseudo Geostationary Lightning Mapper gridded version (Stano – SPoRT)
      xiii. GOES-R Convective Initiation (Mecikalski – UAH/SPoRT)
      xiv. Cloud-Top Cooling (Feltz/Sieglaff – CIMSS)
      xv. Overshooting Top Detection (Feltz/Bedka/Monette – CIMSS)
      xvi. GOES-14 SRSOR 1-minute imagery (Schmit/Knaff - CIMSS)
   b. **Consumers:**
      i. Aviation Weather Center forecast operations
      ii. AWC Air Traffic Control Systems Command Center forecast operations

6. **Project Schedule/Duration (timeline):**
   a. AWC Testbed Schedule:
      i. Evaluation period I: 1 March – 16 May 2014
         1. GOES/POES hybrid imagery
         2. GeoColor imagery
         3. Flight Icing Threat
         4. ACHA Cloud Height Algorithms
         5. VIIRS Day/Night Band
      ii. Evaluation period II: 19 May – 19 September 2014
         1. NearCasting Theta-E
         2. GOES-R Convective Toolkit
         3. NSSL-WRF/NAM Nest Simulated Satellite Forecasts
         4. VIIRS/MODIS Dust RGB
      iii. 2014 AWT Experiment: 11 – 15 August 2014, fog and low ceiling focus
         1. Fog and Low Stratus
         2. GOES/POES hybrid imagery
         3. GeoColor Imagery
         4. VIIRS/MODIS Nighttime Microphysics

5. NSSL-WRF/NAM Nest Simulated Satellite Forecasts
6. VIIRS Day/Night band

b. First Products in AWC Testbed: May 2012

c. Deadline for all product availability: 1 March 2014

d. Training Period: 1 March – 19 September 2014

e. Center Responsibilities: AWC Operations is responsible for delivering accurate, consistent, and timely weather information for safe and efficient flight across the world airspace system. The main met-watch responsibilities range from small areas of the CONUS (West, Central, East) out to large portions of both the Pacific and Atlantic Oceans. In addition, they are also responsible for a smaller number of global aviation products. Satellite is used within operations to determine areal extent and intensity trends of in-flight weather hazards along aviator's routes of flight. The products demonstrated within the AWC will be evaluated on their usefulness in forecasting the various aviation hazards.

f. Mid-term Evaluation Report: 16 May 2014

g. Final Evaluation Report: 19 September 2014

GOES-R/JPSS Proving Ground Product	Category	Acquisition into Testbed	Training	Formal Evaluation
ACHA Cloud Height Algorithms	Baseline	Already Acquired	Spring 2014	1 March – 16 May 2014
Aircraft Flight Icing Threat	Future Capability/ NOAT Priority (3)	Already Acquired	Spring 2014	1 March – 16 May 2014
GOES/POES Hybrid Imagery	Future Capability	Winter 2014	Spring 2014	1 March – 16 May 2014
GeoColor Imagery	Future Capability	Winter 2014	Spring 2014	1 March – 16 May 2014
VIIRS Day/Night Band	Baseline	Already Acquired	Spring 2014	1 March – 16 May 2014, August 2014
Fog and Low Stratus	Future Capability/NOAT priority (2)	Already Acquired	July 2012	1 March – 16 May 2014, August 2014
VIIRS/MODIS Nighttime Microphysics	Future Capability	Spring 2014	Summer 2014	1 March – 16 May 2014, August 2014
VIIRS/MODIS Dust RGB	Future Capability	Spring 2014	Summer 2014	19 May – 19 September 2014
NSSL – WRF/NAM Nest Simulated Forecasts	Baseline	Already Acquired	May 2013	19 May – 19 September 2014, August 2014
Pseudo Geostationary Lightning Mapper	Baseline	Already Acquired	October 2013	19 May – 19 September 2014
Convective Initiation	Future Capability/ NOAT Priority (1)	Already Acquired	October 2013	19 May – 19 September 2014
Cloud Top Cooling/OTD	Future Capability	Already Acquired	October 2012	19 May – 19 September 2014
NearCasting Model Theta-E	GOES-R Risk Reduction	Already Acquired	Summer 2014	19 May – 19 September 2014

GOES SRSOR 1-minute Imagery	Baseline	Already Acquired	Winter 2013	When available in operations

7. **Project Deliverables**
   - **a.** Proving Ground Operations Plan – First Draft: 24 January 2014
   - **b.** Proving Ground Operations Plan – Final Draft: 24 February 2014
   - **c.** Proving Ground 2014 Demonstration Final Report: 19 September 2014

8. **Responsibilities and Coordination:**
   - **a.** Amanda Terborg, UW-CIMSS/AWC – Satellite Liaison
   - **b.** David Bright, NOAA/NCEP AWC – ASB Chief
   - **c.** Bruce Entwistle, NOAA/NCEP AWC - SOO
   - **d.** Kathryn Miretzky, AS&D for GOES-R Program Office – PG Coordinator

9. **Budget and Resources Estimate:** Funded through the GOES-R Science Office as part of the Omnibus Proving Ground funding to CIRA, CIMSS, UAH, and NASA/SPoRT

Product Name: GOES-R Fog and Low Stratus

Primary Investigator: Mike Pavolonis (NOAA/NESDIS/STAR)

NWS Center/Office Relevance:

- Provides decision support and tactical decision aids for AWC forecasters when identifying the presence and location of fog and low stratus, particularly around major airport hubs
- Products can be used during the day and night, and when high cirrus or ice clouds are present.
- Comparisons to surface observations indicate the IFR probability product outperforms (almost twice as much skill) the traditional 3.9–11 μm brightness temperature difference.
- Fused product that incorporates GOES satellite observations and Rapid Refresh model output.
- Addresses one of the top future-capability priorities of the NOAT.

Product Overview:

- GOES-R Fog and Low Stratus detection products are designed to quantitatively (expressed as a probability) identify clouds that produce MVFR, IFR, and LIFR conditions.
- Physical thickness of water cloud layers is estimated in the Water Cloud Thickness product.
- Primary limitation is that some discontinuity will be associated with the transition from sunlit to non-sunlit conditions and vice-versa.

Product Methodology:

- Satellite and NWP model data are used as predictors and ceilometer based surface observations of cloud ceiling are used to train the algorithm.
- During the day, the 0.65, 3.9, and 11 μm channels (in various ways) along with boundary layer relative humidity information from the NWP model are used as predictors (similar approach is utilized at night without the 0.65 μm channel).

GOES-R Fog and Low Stratus Products:

- MVFR, IFR, and LIFR Probabilities
- Water Cloud Thickness (Fog Depth)
- The products are available using GOES-13, GOES-15, and MODIS data.

Concept for Pre-Operational Demonstration:

- The Fog and Low Stratus products were delivered to the Aviation Weather Testbed in May 2012 via the University of Wisconsin LDM and converted to a format suitable for display in N-AWIPS.

Concept for Operations:

- The Fog and Low Stratus Products are currently scheduled to be operationalized on OSPO ESPC systems and will be delivered to NWS users via SBN, NCO backbone, Direct Broadcast, and possibly AWIPS DDS as alternative.

Product Name: GOES-R Flight Icing Threat

Primary Investigator: Bill Smith Jr. (NASA LaRC), Andy Heidinger (CIMSS)

National Center/WFO Relevance:

- The GOES-R Flight Icing Threat integrates various cloud properties from the GOES-R baseline DCOMP algorithm to generate a probability and intensity of icing and provides a forecasting tool for aviation operations.
- This product attempts to address one of the future-capabilities of the NOAT and will aid in further guidance regarding a more integrated, NWP-like approach in the future.
- Provides situational awareness for the issuance of icing AIRMETs at the AWC

Product Overview:

- Utilizes various satellite-derived cloud properties and provides information on icing conditions.
- Composed of three components including (1) an icing mask available day and night, which discriminates regions of possible icing, (2) an icing probability, estimated during the daytime only, and (3) a two-category intensity index which is also derived during the daytime only.
- The skill of the algorithm in detecting icing conditions (POD) reported by pilots (via PIREPs) is better than 90%

Product Methodology:

- The icing mask is developed using GOES-R derived cloud thermodynamic phase, cloud top temperature, and cloud optical thickness products to identify which cloudy pixels are most likely to contain significant super-cooled liquid water.
- During the daytime, the probability (low, medium, or high) of encountering icing and the intensity category [light (LGT), or moderate or greater (MOG)] are determined using the liquid water path and effective droplet size products.
- The GOES-R Flight Icing Threat product will assist in resolving small-scale areas of intense icing often missed in other products.

GOES-R Flight Icing Threat Products:

- Flight Icing Threat

Concept for Pre-Operational Demonstration:

- The Flight Icing Threat product was delivered to the Aviation Weather Testbed in February 2013 via the University of Wisconsin LDM and converted to a format suitable for display in N-AWIPS.

Concept for Operations:

- The hope is that the FIT will be centrally produced at OSPO and delivered via SBN or PDA.

Product Name: Hybrid Imagery (JPSS)

Primary Investigators: Matt Smith and Kevin McGrath (SPoRT)

National Center/WFO Relevance and Product Overview:

- Products allow forecasters to utilize polar-orbiting imagery, while keeping the consistency of geostationary imagery in space and time.
- Geostationary imagery is available in 15 minute increments and polar-orbiting imagery from MODIS and VIIRS replaces a portion of the geostationary image at the time that most closely matches the geostationary time stamp.
- Provides a simple means of utilizing high resolution polar data at the national center scale.

Product Methodology:

- The product is created in 15-minute increments using geostationary imagery from GOES-13 and GOES-15. MODIS and VIIRS swaths are then inserted with the geostationary imagery when available and a file is resent to replace the first GOES-only image.
- There may be seams due to the different scan times.
- The products are made available in AREA format to be displayed in N-AWIPS.

Hybrid Imagery Products:

- Longwave Infrared
- Shortwave Infrared
- Visible
- Water Vapor

Concept for Pre-Operational Demonstration:

- Products are generated at SPoRT and then provided via LDM to the AWC Proving Ground in AREA format for use in N-AWIPS.

Concept for Operations:

- It is anticipated that this capability will be available within the AWIPS II framework, allowing for forecasters to overlay polar-orbiting imagery on geostationary imagery as part of a routine. This product allows forecasters the opportunity to use high-resolution imagery from JPSS for mesoscale analysis as will occur in the GOES-R era and during AWIPS II transitions.

Product Name: VIIRS Day-Night Band Reflectance

Primary Investigators: Kevin Fuell (SPoRT), Kathy Strabala (CIMSS), Steve Miller (CIRA)

NWS Center/Office Relevance:

- The VIIRS Day-Night Band (DNB) on S-NPP is a new low light sensing capabilities that has numerous NWS applications, including nighttime tropical cyclone center fixing, and cloud, fog and smoke detection.

Product Overview:

- The DNB senses reflected moonlight at night. It can be used in similar ways to the visible channel during the day.

Product Methodology:

- The DNB measures reflected moonlight and emitted light from surface sources such as city lights and fires. To provide a more uniform image as the moon phase changes, a reflectance product is generated using the moonlight algorithm from CIRA.

Pseudo Natural Color Imagery Products:

- The reflectance product is available twice per day from the ascending and descending passes of S-NPP

Recent Product Modifications:

- None

Concept for Pre-Operational Demonstration:

- The DNB is obtained from servers at CIMSS and provided via a SPoRT ftp server. The CIRA moonlight code is applied at SPoRT to create the reflectance product before the data is posted for distribution.

Concept for Operations:

- The DNB and other VIIRS channels will be part of the operational satellite data stream for the NWS.

Product Name: NSSL-WRF and NAM CONUS Nest Simulated Satellite Forecasts

Primary Investigator: Dan Lindsey (STAR/RAMMB), Justin Sieglaff (CIMSS), and Dan Bikos (CIRA)

National Center/WFO Relevance:

- Simulated satellite forecasts allow forecasters to become familiar with the different bands associated with the GOES-R Advanced Baseline Imager (ABI) imager.
- Realistic satellite bands using the model output allow forecasters to easily identify features that may be difficult to determine using standard and derived model output fields.
- Provides an additional forecast tool for the issuance of AIRMETs, particularly for turbulence.

Product Overview:

- Simulated cloud and moisture imagery from the ABI replicates how atmospheric features will appear in the GOES-R ABI bands.

Product Methodology:

- After the NSSL runs their 0000 UTC 4-km WRF-ARW and after the 0000 UTC NAM CONUS Nest run, several variables including temperature, water vapor, and other physical and microphysical parameters are obtained
- When all variables have been received, a radiative transfer model (RTM) is run to generate the synthetic imagery bands.
- Hourly output of NSSL WRF data between 0900 UTC of Day 1 and 1200 UTC of Day 2 (F009-F036) is processed daily; NAM Nest: 0900 UTC of Day 1 to 1200 UTC of Day 3 (F009-F060)
- Resolution of the output is 4-km to match the input resolution of the cloud model; the GOES-R ABI IR bands will have 2-km resolution.

NSSL-WRF Simulated Satellite Forecast Products:

- ABI Bands 7-16, including wavelengths from 3.9 to 13.3 μm
- 10.35-3.9 μm Difference (to identify liquid water clouds)
- 10.35-12.3 μm Longwave Difference (to identify low-level moisture convergence)

NAM Nest Simulated Satellite Forecast Products:

- 6.5 μm Upper Tropospheric Water Vapor
- 10.7 μm Infrared Window

Concept for Operational Demonstration:

- The NSSL-WRF and NAM Nest products are being converted into AWIPS, AWIPS-2, and NAWIPS formats and sent to the National Centers and WFOs

Concept for Operations:

- Cloud and moisture data expected to be centrally produced at OSPO/ESPC and delivered by SBN or PDA. Simulated imagery expected to be generated and displayed via plug-in on AWIPS-2.

Product Name: Pseudo Geostationary Lightning Mapper

Primary Investigator: Geoffrey Stano (SPoRT)

National Center/WFO Relevance:

- Can be used to identify convection that may contain significant lightning, both cloud-to-ground and intra-cloud lightning, that can affect enroute air traffic
- Will prepare forecasters to receive data from the GLM, baseline GOES-R instrumentation designed to measure total lightning.

Product Overview:

- Provides an 8km boxed average estimation of total lightning activity within the LMA networks.
- Designed to give forecasters the opportunity to use and critique a demonstration of GLM type data to help improve future visualizations of these data and its trends.
- Serves as reference for comparison with full GLM proxies and derived products.

Product Methodology:

- Takes the raw total lightning observations, or sources, from any of the ground-based LMA available and recombines them into a flash extent gridded field.
- These data are then mapped to a GLM resolution of 8 km and are available at a 1 to 2 minute refresh rate, depending on the ground-based network being used.
- With the flash data, when a flash enters a grid box, the flash count will be increased by one and no flash is counted more than once for a give grid box.

GOES-R PGLM Products:

- Current LMA networks: Oklahoma (OKLMA), Northern Alabama (NALMA), D.C. LMA (DCLMA), Colorado (COLMA), New Mexico (NMLMA), West Texas (WTLMA), and Houston (HGLMA)
- Expected LMA networks by summer 2014: Central Florida and Atlanta?
- GLD360 OCONUS proxy – limited NWS data feed from Vaisala

Concept for Pre-Operational Demonstration:

- The PGLM data, including the NALMA, OKLMA, and DCLMA networks, were delivered to the Aviation Weather Center in May 2012 and the COLMA and HGLMA in April 2013 via the SPoRT LDM. Additionally, the WTLMA, and NMLMA network data are expected in spring 2013. The files have been converted to a format suitable for display in N-AWIPS.

Concept for Operations:

- GLM data are expected to be centrally produced at OSPO/ESPC and delivered by SBN or PDA

Product Name: GOES-R Convective Initiation

Primary Investigator: John Mecikalski (SPoRT)

National Center/WFO Relevance:

- Provides 0-2 h probabilistic forecasts that highlight where convective initiation is likely.
- Attempts to address a difficult short-term forecast challenge with a fused NWP-satellite approach and the top future-capability priority of the NOAT.
- Provides additional situational awareness for the issuance of Convective SIGMETs.

Product Overview:

- NWP-satellite fused probabilistic product that serves as a strategic aid for convective initiation.
- True probabilistic product (unlike previous versions of the convective initiation algorithm) because the algorithm incorporates information about the local atmospheric environment.

Product Methodology:

- Convective initiation probabilistic product is produced using a logistic regression framework.
- Convective cloud properties and 20 fields from the Rapid Refresh model are used to create 0-2 h probabilistic forecasts.
- Early verification statistics have much improved skill scores when the environmental data is included.
- GOES ABI proxies are 10.7µm T 0°C, 10.7µm T time trend, 6.5-10.7µm difference, 13.3-10.7µm difference, 6.5-10.7µm time trend, and 13.3-10.7µm time trend.

GOES-R Convective Initiation Products:

- 0-2 h Probabilistic Forecasts of Convective Initiation

Concept for Operational Demonstration:

- The GOES-R Convective Initiation product was delivered to the AWC testbed via the SPoRT LDM in May 2012 and was formatted for display in N-AWIPS.

Concept for Operations:

- Convective Initiation is expected to be centrally produced at OSPO/ESPC and delivered by SBN or PDA.

Product Name: Cloud-Top Cooling

Primary Investigator: Wayne Feltz and Justin Sieglaff (CIMSS)

National Center/WFO Relevance:

- Product determines which convective clouds are growing vertically particularly those in data sparse regions (radar void areas over the CONUS as well as oceanic areas).
- Stronger cloud-top cooling rate is directly correlated to larger hail when compared to maximum hail size.
- 15-min satellite data is available everywhere over CONUS, including areas where lightning and radar data are either insufficient or unavailable.
- Product assists in addressing a future-capability priority of the NOAT.
- Provides additional situational awareness in the issuance of Convective SIGMETs

Product Overview:

- Product can be used to objectively determine where convective clouds are and are not growing vertically.
- Cloud-top cooling is a satellite indicator used in the GOES-R Convective Initiation product and is considered a compliment and tactical decision aid for convective initiation.

Product Methodology:

- Algorithm uses GOES imager data to determine immature convective clouds that are growing vertically and hence cooling in infrared satellite imagery (i.e., cloud-top cooling rate).
- Cloud phase information is utilized to deduce whether the cooling clouds are immature water clouds, mixed phase clouds, or ice-topped (glaciating) clouds.
- Final result is a prognostic value of a satellite-based measure of vertical cloud growth rate.
- GOES ABI proxies are 0.63μm, 3.9μm, 6.5μm, 10.7μm, 13.3μm, Cloud Mask, Cloud Phase, and Cloud Optical Depth.

Cloud-Top Cooling Products:

- Instantaneous box-averaged cloud-top cooling rate (K $(15\ min)^{-1}$)
- 60-min time accumulation of box-averaged cloud-top cooling rate (K $(15\ min)^{-1}$)

Concept for Pre-Operational Demonstration:

- The GOES-R Cloud Top Cooling was delivered to the Aviation Weather Testbed in May 2012 via the CIMSS LDM and has been formatted for display in N-AWIPS.

Concept for Operations:

- Cloud Top Cooling is expected to be centrally produced at OSPO/ESPC and delivered by SBN or PDA.

Product Name: Overshooting Top Detection

Primary Investigator: Kristopher Bedka (NASA LaRC) and Wayne Feltz (UW-CIMSS)

National Center/WFO Relevance:

- Product has been shown to assist in the diagnosis and nowcasting of hazardous convective weather because there are strong overshooting top relationships with hazardous convective weather (i.e., severe weather, total lightning, and heavy rainfall).
- Presence of a persistent overshooting top feature can signify an especially strong and long-lived storm and early recognition of an OT can raise situational awareness of impending hazardous weather.
- 15-min satellite data is available everywhere over CONUS, including areas where lightning and radar data are either insufficient or unavailable.
- Provides additional situational awareness in the issuance of Convective SIGMETs and Aviation Weather Statements.

Product Overview:

- Overshooting convective cloud tops are domelike bulges atop an anvil cloud that indicate a strong updraft within a convective storm system.
- Convection with either overshooting tops or enhanced-V signatures often produce hazardous weather conditions such as frequent lightning, heavy rainfall, and damaging winds.

Product Methodology:

- Overshooting-top product identifies clusters of 11.2 mm IR pixels significantly colder (at least 6.5K) than the surrounding anvil cloud with a diameter consistent with commonly observed overshooting tops.
- Provides a detection accuracy that exceeds that of an existing overshooting top detection technique based on the water vapor minus infrared window brightness temperature difference.
- Enhanced-V features occur when flow diverted around the OT region erodes the updraft summit and carries cloud debris downwind which is reflected in the cold brightness temperatures.
- Brightness temperature difference (at least12K) between the OT and enhanced-V feature.

Enhanced "V" / Overshooting Top Detection Products:

- Overshooting Top detection
- Enhanced-V (thermal couplet) detection

Concept for Pre-Operational Demonstration:

- The Overshooting Top Detection products were delivered to the Aviation Weather Testbed via the CIMSS LDM in May 2012 and were formatted for display in N-AWIPS.

Concept for Operations:

- None at this time. The idea is for it to be centrally produced at OSPO/ESPC, but for the moment the goal is to expose users to the data and collect feedback through organized demonstrations within the GOES-R Proving Ground.

Product Name: NearCasting Model

Primary Investigator: Ralph Petersen (UW-CIMSS)

Aviation Weather Center Relevance:

- Provides AWC forecasters with an additional decision support and situational awareness tool, particularly for the development and intensification of convection that have the potential to affect our National Airspace System and various terminals.

Product Overview:

- Provides 1 – 9 hour forecasts of future atmospheric moisture, equivalent potential temperature, and stability indices, and have shown skill in identifying rapidly developing, convective destabilization up to 6-9 hours in advance.
- The system fills the 1-9 hour information gap that exists between radar nowcasts and longer-range numerical forecasts.

Product Methodology:

- The NearCasting system uses a Lagrangian approach to optimize the impact and retention of information provided by the GOES sounder.
- Its primary data source is hourly, full resolution (10-12 km) multi-layer retrieved parameters from the GOES sounder.
- Results from the NearCasting model increases the areal coverage of single-time GOES data and enhances current operational NWP forecasts by successfully capturing and retaining details (maxima, minima, and extreme gradients) critical to the development of convective instability several hours in advance, even after subsequent infrared satellite observations become cloud contaminated.

NearCasting Model Products:

- Vertical theta-e difference
- 500-mb mean-layer theta-e
- 780-mb mean-layer theta-e

Concept for Operational Demonstration:

- The NearCasting Model products were delivered to the Aviation Weather Testbed via the CIMSS LDM in May 2012 and have been formatted for display in N-AWIPS.

Concept for Operations:

- Expected to be centrally produced at OSPO/ESPC.

Product Name: ACHA Cloud Height Algorithms

Primary Investigator: Andy Heidinger (UW-CIMSS)

National Center/WFO Relevance:

- Provides additional information regarding cloud top properties that can be used for forecasting various aviation hazards, particularly in identifying cloud tops.
- Data is also generated on a global scale, providing additional data over data sparse areas (oceans, etc.) for the AWC's international operations branch.

Product Overview:

- Provides information on cloud top properties (height, temperature, phase) not available via ground-based instruments.
- Provides better spatial and temporal coverage than radiosonde-collected observations.

Product Methodology:

- Multiple IR channels on the ABI are used to estimate cloud temperature, cloud emissivity, and particle size.
- Height and pressure are derived from the temperature and NWP profiles from the GFS
- Products are generated within minutes of receiving satellite data and are consistent through the terminator.

ACHA Cloud Height Products:

- Cloud Top Height
- Cloud Top Temperature

Concept for Pre-Operational Demonstration:

- The ACHA Cloud Height products were delivered to the Aviation Weather Testbed via the CIMSS LDM in May 2012 and have been formatted for display in N-AWIPS.

Concept for Operatios:

- The ACHA cloud height algorithms are expected to be centrally produced at OSPO/ESPC and delivered by SBN or PDA, and will also provide input for other AWIPS decision aids.

Product Name: Super Rapid Scan Imagery

Primary Investigator: T. Schmit (NESDIS/ASPB), J. Knaff, (NESDIS/RAMMB)

National Center/WFO Relevance:

- GOES-R will provide routine 5-min imagery and better capabilities for providing 30 sec and 1 min imagery than the current GOES satellites. 1-min imagery is routinely utilized at AWC when GOES-14 is out of storage.
- Will provide super rapid scan operations (SRSO) data during experimental periods and the summer demonstration to better forecast for high-impact aviation weather hazards and expose forecasters to GOES-R-like temporal resolution.

Product Overview:

- 1-min imagery will be provided from current GOES satellites. This will include Super Rapid Scan Operations (SRSO) data from the operational GOES-east and –west when possible and SRSO-Research (SRSO-R) from GOES-14.

Product Methodology:

- SRSO-R 1-minute data will be collected beginning in the middle of August and continue through the end of the month (Aug 13-28).
- During the, the GOES-14 satellite will be centered at 105 W and utilized for experimental and operational use at the AWC. With SRSO-R, 26 images can be collected every ½ hour.

Super Rapid Scan Imagery Products:

- Full resolution 1 minute visible imagery

Concept for Pre-Operational Demonstration:

- The SRSOR has been previously implement into the N-AWIPS workstations in AWC Operations and the AWT. This data will be available for demonstration during its experimental runs.

Concept for Operations:

- SRSO data will be available via direct readout systems and is also expected to be centrally produced at OSPO/ESPC and delivered via SBN or PDA for AWIPS-IIor NESDIS servers and displaced on AWIPS2 systems at NHC when GOES-R becomes operational.

Product Name: GeoColor Imagery

Primary Investigator: Steve Miller, Ed Szoke and Dan Bikos (CIRA)

National Center/WFO Relevance:

- An alternative overview type of imagery that represents some of the potential for image combination that will be available in the GOES-R era but can be replicated now.
- Provides a seamless transition between day- (visible imagery) and nighttime (IR) imagery with clouds appearing white during both day and night.

Product Overview:

- In addition to the basic characteristics of the imagery noted above, at night low clouds and fog are highlighted in a pinkish hue by utilizing the AWIPS fog product that uses the difference between the 10.7 and 3.9 μm channels. Also, a natural color background is provided during the day while at night city lights are used.

Product Methodology:

- The basic satellite imagery comes from GOES East and West visible and infrared imagery.
- The daytime background true color image comes from the NASA Blue Marble data set that is derived from MODIS imagery. It is currently a static image but could be updated using real-time MODIS and VIIRS imagery.
- The nighttime background is also a static image from the "Nighttime Lights of the World" dataset. Future versions could also use real-time Polar Orbiter satellite data.
- Opacity of the cloud layers (determining how much of the background imagery bleeds through) is determined by various transparency factors.
- Additional cloud discrimination is applied at night using the 10.7-3.9 micron difference.
- More detailed information can be found at http://rammb.cira.colostate.edu/research/goes-r/proving_ground/cira_product_list/geocolor_imagery_detailed.asp

Image Products:

- Images are available over the full Continental United States.
- Time resolution is 30 minutes.
- Spatial resolution is 1 km during the daytime and 4 km at night.

Concept for Operational Demonstration:

- The product is created in netcdf format, converted to McIDAS AREA format, then read in and displayed by NAWIPS.

Concept for Operations:

- The GeoColor imagery is expected to be generated and displayed as an AWIPS-2 plug-in

Product Name: RGB Dust

Primary Investigator: Kevin Fuell (SPoRT) and John Knaff (NESDIS/STAR/RAMMB)

NWS Center/Office Relevance:

- The dust product will allow for the monitoring of dust storms over the CONUS. This will be of value to the Aviation Weather Center as a decision aid for issuing dust SIGMETs, particularly over the western U.S.

Product Overview:

- Product designed to monitor the evolution of dust storms during both day and night.

Product Methodology:

- The dust product is an RGB composite based upon infrared channel data from the Meteosat Second Generation satellite. The resulting product depicts dust in magenta and purple colors over land during day and night, respectively. Over the ocean the dust also shows up as magenta, although with a little less contrast than over the land.
- Product is generated from Meteosat Second Generation SEVIRI channels 7 (IR8.7), 9 (IR10.8), and 10 (IR12.0).
- Highlights dusty regions, which is accomplished by:
    - Differencing two IR channels related to optical thickness (i.e., at 12.0 µm and 10.8µm) (Red)
    - Differencing two IR channels related to particle phase (i.e., 9.71 µm and 11.03 µm).
    - (Green)
    - Uses the IR window channel (10.8 µm) to indicate surface temperature. (Blue)

MSG Dust Products:

- MSG-based RGB Dust imagery will be generated every 15 minutes.

Recent Product Modifications:

- None

Concept for Pre-Operational Demonstration:

- Product is generated at SPoRT, converted to a format suitable for N-AWIPS and provided via an ftp server or the LDM.

Concept for Operations:

- It is anticipated that by the time GOES-R is operational, the AWIPS2 deployment will be completed, so that this RGB product can be locally generated from the individual ABI bands and used a decision aid.

Document Last Updated: 31 July 2013

Product Name: Lightning Threat Forecast

Primary Investigator: McCaul, Chronis, Alexander (USRA, UAH, ESRL-GSD)

National Center/WFO Relevance:

- May have utility in the generation of the Collaborative Convective Forecast Product or in the issuance of Aviation Weather Statements at the ATCSCC
- May have utility at the AWC tropical forecasting desk

Product Overview:

- Differentiates areas of convection in the modeled environment that are predicted to produce lightning from those that are not.
- Output displayed as lightning flash-rate density, or flashes $(5\ \text{min})^{-1}\ \text{km}^{-2}$

Product Methodology:

- A calibrated graupel flux at -15°C term, or Lightning Threat 1, captures the temporal variability of the lightning threat well.
- A calibrated vertically integrated ice content term, or Lightning Threat 2, captures the spatial coverage of the lightning threat well.
- Lightning Threat's 1 and 2 are blended together in a weighted average to produce the Flash Rate Density product, or Lightning Threat 3.

GOES-R Lightning Threat Forecast Products:

- Lightning Threat's 1, 2 and 3 from the WRF-NSSL model.
- Lightning Threats 3 from the HRRR model.

Concept for Operational Demonstration:

- The Lightning Threat Forecast products have been formatted for display in N-AWIPS.

Concept for Operations:

- This topic is still to be discussed.

Document Last Updated: 17 March 2014

Product Name: RGB Night-Time Microphysics

Primary Investigator: Kevin Fuell, Andrew Molthan and Kevin McGrath (NASA SPoRT)

National Center/WFO Relevance:

- May have utility in the generation of the Area Forecasts and issuance of graphical AIRMETs for low ceilings.
- May have utility in the issuance of the Aviation Weather Statement for low ceilings at the ATCSCC
- May have utility in issuing FA forecasts over the tropics and Caribbean

Product Overview:

- Takes advantage of multiple IR channels with the RGB concept to distinguish between various types of cloud physical, microphysical, and thermal characteristics. It was specifically designed to more efficiently highlight cloud types and the additional channels allow one to better distinguish between fog and low clouds at night compared to the standard "fog" imagery product.

Product Methodology:

- The Night-Time Microphysics is an RGB composite based on infrared data from the VIIRS and Terra/Aqua MODIS imagers. The resulting product depicts fog and low clouds as light blue areas in warm climates and light green in colder climates. The shades of the blues and greens will vary depending on the thickness of the fog and low clouds, and associated green and red contributions
- The product is generated using the 12.0, 10.8, and 3.9 micron IR channels
- Highlights fog and low clouds by the following:
  - Differencing two IR channels related to optical thickness (i.e., at 12.0 µm and 10.8µm) (Red)
  - Differencing two IR channels related to particle phase (i.e., 10.8 µm and 3.9 µm).
  - (Green)
  - Uses the IR window channel (10.8 µm) to indicate surface temperature. (Blue)

RGB Night-Time Microphysics Products:

- VIIRS Night-Time Microphysics
- Aqua and Terra MODIS Night-Time Microphysics

Concept for Operational Demonstration:

- The Night-Time Microphysics products have been formatted for display in N-AWIPS and pulled into the Aviation Weather Testbed via LDM from NASA SPoRT

Concept for Operations:

- It is anticipated that by the time GOES-R is operational, the AWIPS2 deployment will be completed, so that this RGB product can be locally generated from the individual ABI bands and used a decision aid