GOES-R Proving Ground Demonstration Proposal:
Aviation Weather Center Proving Ground – 2013 Winter Experiment

1. **Project Title:** 2013 GOES-R Proving Ground – Aviation Weather Testbed Product Demonstrations

2. **Organization:** Aviation Weather Center Proving Ground

3. **Products to be Demonstrated as a GOES-R Proving Ground activity at the AWT**
   - **a.** GOES-R Fog and Low Stratus
   - **b.** NSSL-WRF/NAM Nest Simulated Satellite Forecasts
   - **c.** Aircraft Flight Icing Threat
   - **d.** ACHA Cloud Height Algorithms

4. **Demonstration Project Summary**
   - **a. Purpose:** Demonstrate and evaluate the identified GOES-R Proving Ground products with the 2013 Winter Experiment at the AWT
   - **b. Scope:** The GOES-R Fog and Low Stratus product suite, the NSSL-WRF/NAM Nest Simulated Satellite Forecasts, the Aircraft Flight Icing Threat, and the ACHA Cloud Height Algorithms will be evaluated and explored in the N-AWIPS environment for their usefulness in supporting Aviation Weather Center forecast operations.

5. **Participants Involved:**
   - **a. Providers:**
     - **i.** GOES-R Fog and Low Stratus (Pavolonis – CIMSS)
     - **ii.** NSSL-WRF/NAM Nest Simulated Satellite Forecasts (Sieglaff and Lindesy/Bikos – CIMSS/CIRA)
     - **iii.** Aircraft Flight Icing Threat (Smith Jr. – NASA LaRC)
     - **iv.** ACHA Cloud Height Algorithms (Heidinger – CIMSS)
   - **b. Consumers:**
     - **i.** Aviation Weather Center forecast operations

6. **Project Schedule/Duration (timeline):**
   - **a. Winter Experiment** (FLS, WRF-ABI, FIT)
     - **i.** AWC Testbed Schedule: 11 - 22 February 2013
     - **ii.** First Products into AWC Testbed: 19 December 2012
     - **iii.** Deadline for all product availability: 4 January 2013
     - **iv.** Training Period: 4 – 8 February 2013
     - **v.** Final Evaluation Report: 28 June 2013

GOES-R Proving Ground Product	Category	Acquisition into Testbed	Training	Formal Evaluation
Fog and Low Stratus	Future Capabilites/NOAT priority (2)	Already Acquired	July 2012	11 – 22 February 2013
NSSL – WRF/NAM NEST Simulated Forecasts	Baseline	Already Acquired	April 2013	11 – 22 February 2013 12 – 23 August 2013
Aircraft Flight Icing	Future Capability/	19 December 2012	February	11 – 22

Threat	NOAT Priority (3)		2013	February 2013
ACHA Cloud Height Algorithms	Baseline	Already Acquired	Summer 2013	12 – 23 August 2013

7. **Project Deliverables**
   - **a.** Proving Ground Operations Plan – First Draft: 1 November 2012
   - **b.** Proving Ground Operations Plan – Final Draft: 13 January 2013
   - **c.** Proving Ground Winter Experiment Final Report: 28 June 2013
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 Mozer, AS&D for GOES-R Program Office – PG Coordinator

9. **Budget and Resources Estimate:** N/A

Product Name: GOES-R Fog and Low Stratus

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

• Provides decision support and tactical decision aids for AWC forecasters when identifying the presence and location of fog and low stratus.

• Products can be used during the day 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.

Path to Operations:
• 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.

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

Primary Investigator: Dan Lindsey and Dan Bikos (CIRA)

Aviation Weather Center 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 identify features that may be difficult to determine using standard and derived fields.

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 0000UTC NAM Nest run, several variables including temperature, water vapor, and other physical and microphysical parameters are sent to CIRA.

• When all variables have been received at CIRA, an observational operator is run to generate the synthetic imagery for 5 GOES-R ABI bands (6.95, 7.34, 8.5, 10.35, and 12.0 μm).

• Hourly output between 1200-1200 UTC (F012-F036) is processed daily.

• Resolution of the output is 4-km to match the input resolution of the cloud model; the GOES-R ABI bands will have 2-km resolution.

NSSL-WRF Simulated Satellite Forecast Products:
• 6.95 μm Upper/Mid-level Tropospheric Water Vapor
• 7.34 μm Lower/Mid-level Tropospheric Water Vapor
• 8.5 μm Cloud-top Phase
• 10.35 μm Clean Infrared Longwave
• 12.3 μm Dirty Infrared Longwave
• 10.35-3.9 μm Fog Difference
• 10.35-12.3 μm Longwave Difference (moisture convergence)

NAM Nest Simulated Satellite Forecast Products:
• 6.95 μm Upper/Mid-level Tropospheric Water Vapor
• 10.35 μm Clean Infrared Longwave

Path to Operations:
• The NSSL-WRF products were delivered to the Aviation Weather Testbed in May 2012 via ftp, and the NAM Nest products were delivered to the Aviation Weather Testbed in February 2013. Both were converted to a format suitable for display in N-AWIPS.

Product Name: GOES-R Flight Icing Threat

Primary Investigator: Bill Smith Jr. (NASA LaRC)

Aviation Weather Center Relevance:
• The GOES-R Flight Icing Threat integrates various cloud properties to generate a situational awareness and decision support tool for AWC forecasters.

• 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.

Product Overview: The GOES-R Flight Icing Threat product
• 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
• Cloud Phase

Path to Operations:
• The Flight Icing Threat product were 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.

Product Name: ACHA Cloud Height Algorithms

Primary Investigator: Andy Heidinger (UW-CIMSS)

Aviation Weather Center Relevance:
• Provides AWC forecasters with an additional information regarding cloud top properties which can used for forecasting various aviation hazards.

• It is of particular use in identifying potential icing conditions

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
• Cloud Top Phase

Path to Operations:
• 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.