

# The Role of the Commercial Sector in the Nation's Space Weather Program

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Space Weather Workshop

April 23, 2016

**ASTRA**

**Atmospheric & Space Technology  
Research Associates, LLC**

# Agenda

- **Evolution – things have changed**
- **The Enterprise**
- **Commercial capabilities**
- **Purpose of ACSWA**
- **Funding Challenges**

# Evolution – Things Have Changed

100 yrs



# Evolution (30 yrs)

**1986**

**Government**



**Space  
Weather  
Products**



**Users**

*Commercial  
Academia  
Government*

*Models, Instruments, Space*



# Evolution (30 yrs)

**1986**

**Government**



**Space  
Weather  
Products**



**Users**

*Commercial  
Academia  
Government*

*Models, Instruments, Space*

**2016**

**Commercial**



**Academia**



**Government**



**Space  
Weather  
Products**



**Users**

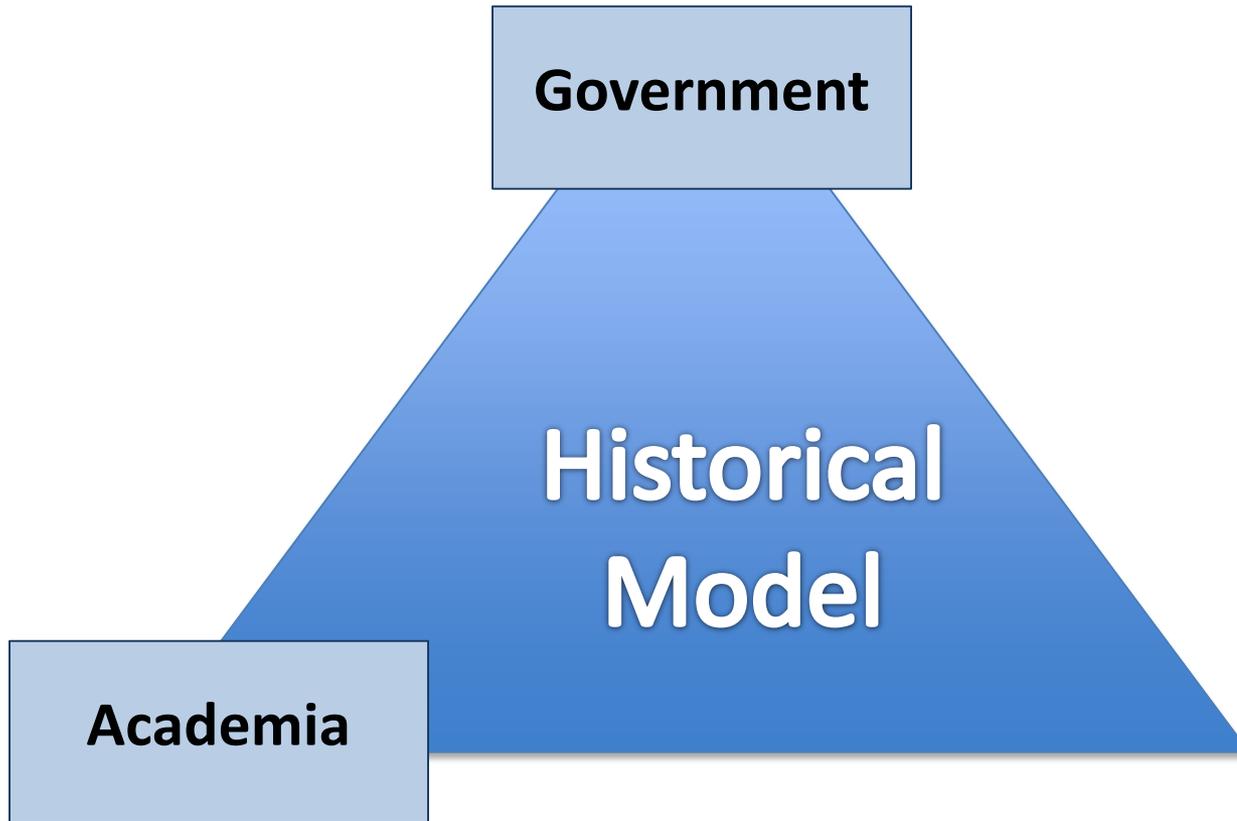
*Commercial  
Academia  
Government  
International*

*Models, Instruments, Space*

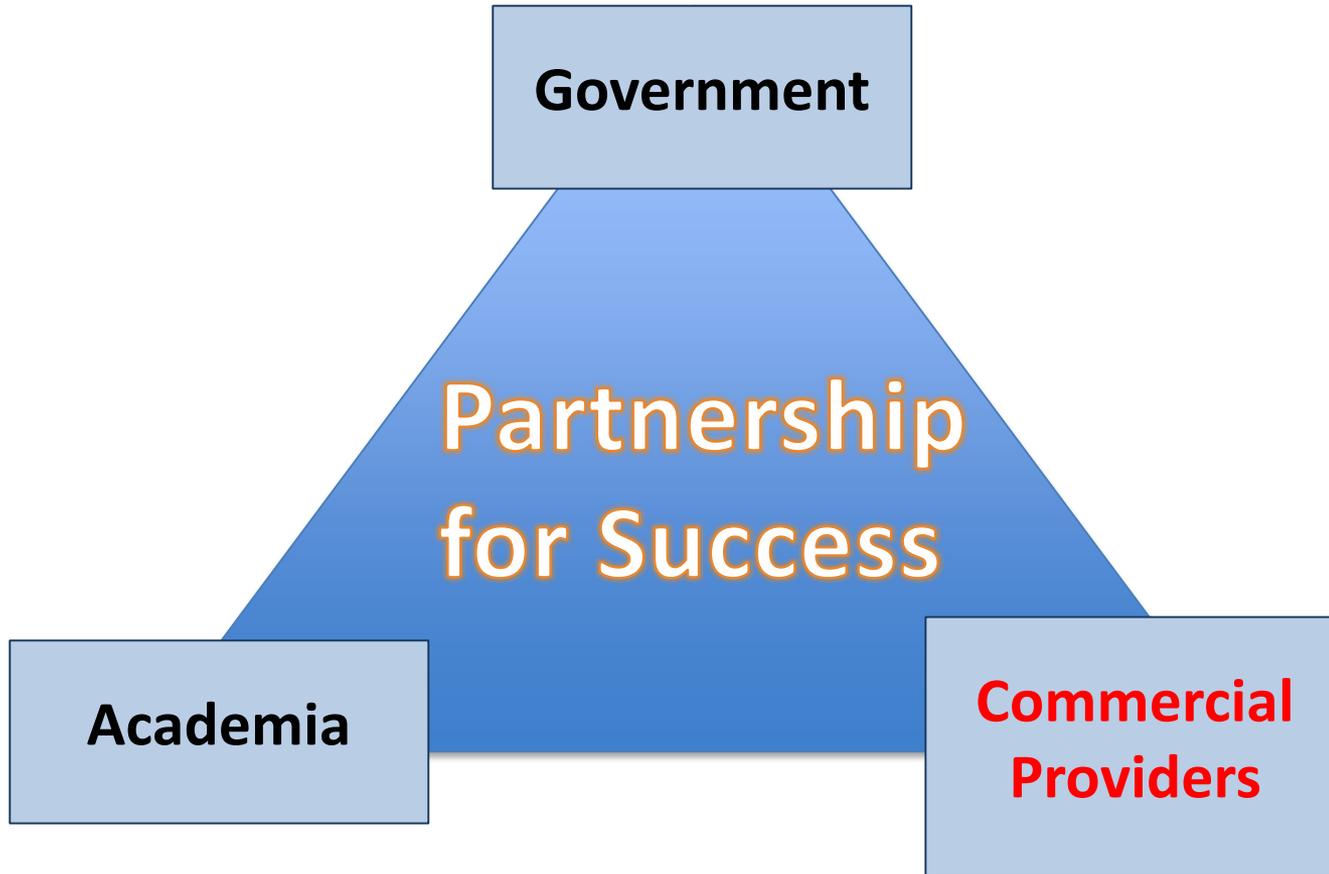


**\$ 1,000**

# Historical SpWx Enterprise

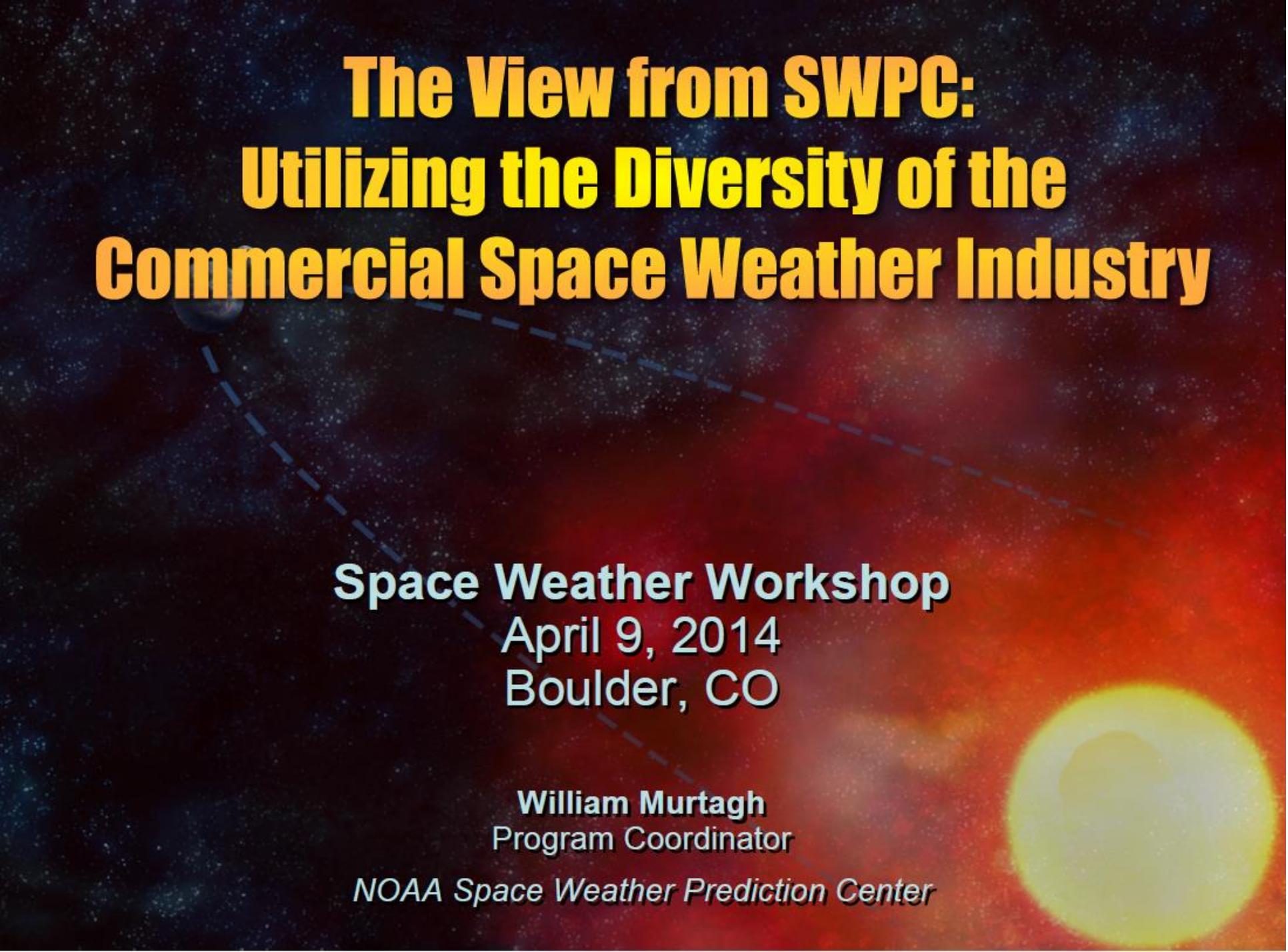


# Modern SpWx Enterprise





# Examples of Commercial Capabilities



# **The View from SWPC: Utilizing the Diversity of the Commercial Space Weather Industry**

**Space Weather Workshop**

April 9, 2014

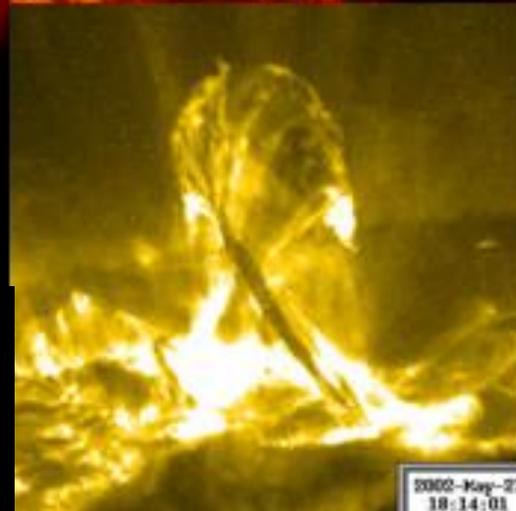
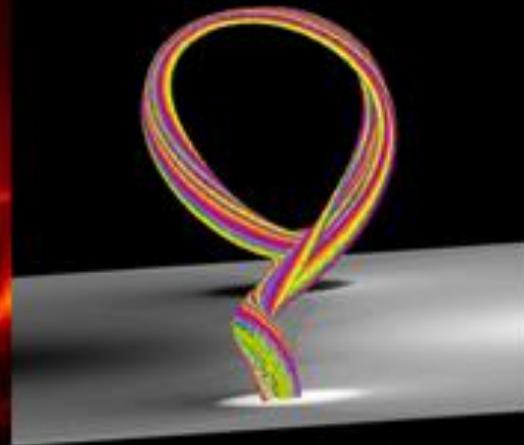
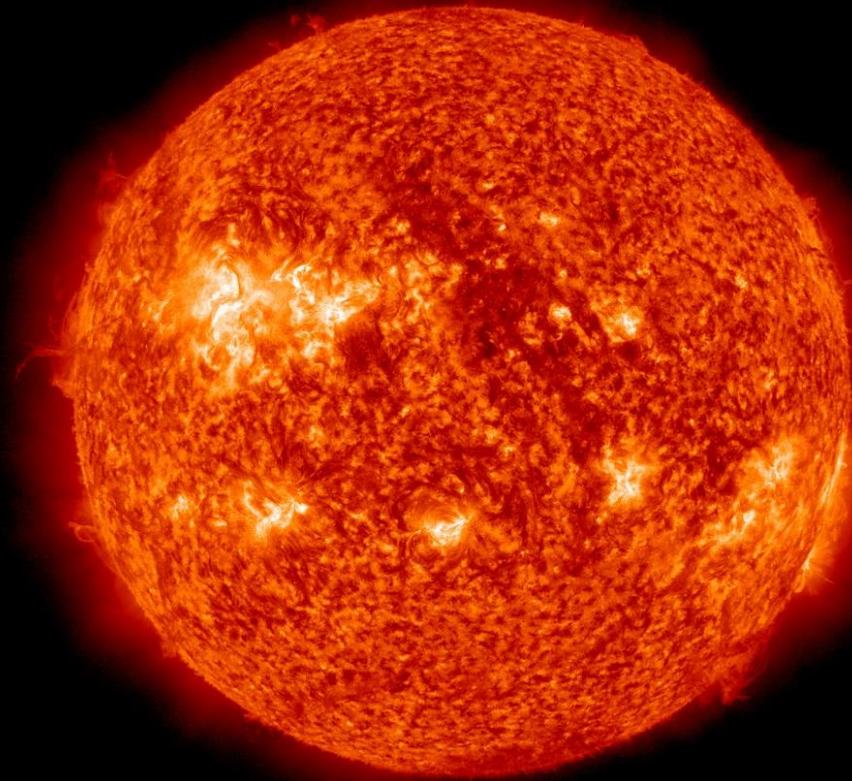
Boulder, CO

**William Murtagh**  
Program Coordinator

*NOAA Space Weather Prediction Center*



Predictive Science, Inc.



SDO/AIA 304 2012-06-04 11:15:45 UT

[www.predsci.com](http://www.predsci.com)

2000-May-27  
18:14:01

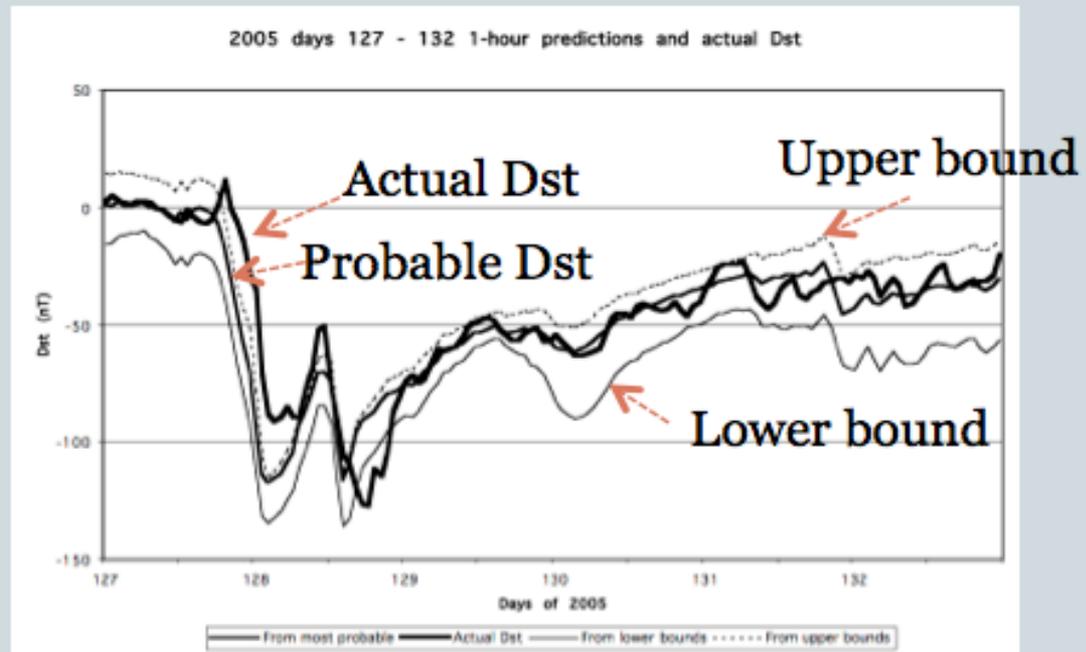


# CARMEL RESEARCH CENTER (CRC)

## CRC SPACE WEATHER FORECASTS



### ○ 1–5 hour forecast of Dst



Courtesy of Devrie Intriligator



## SET's real-time aviation radiation monitoring system for business jets – ARMAS FM5

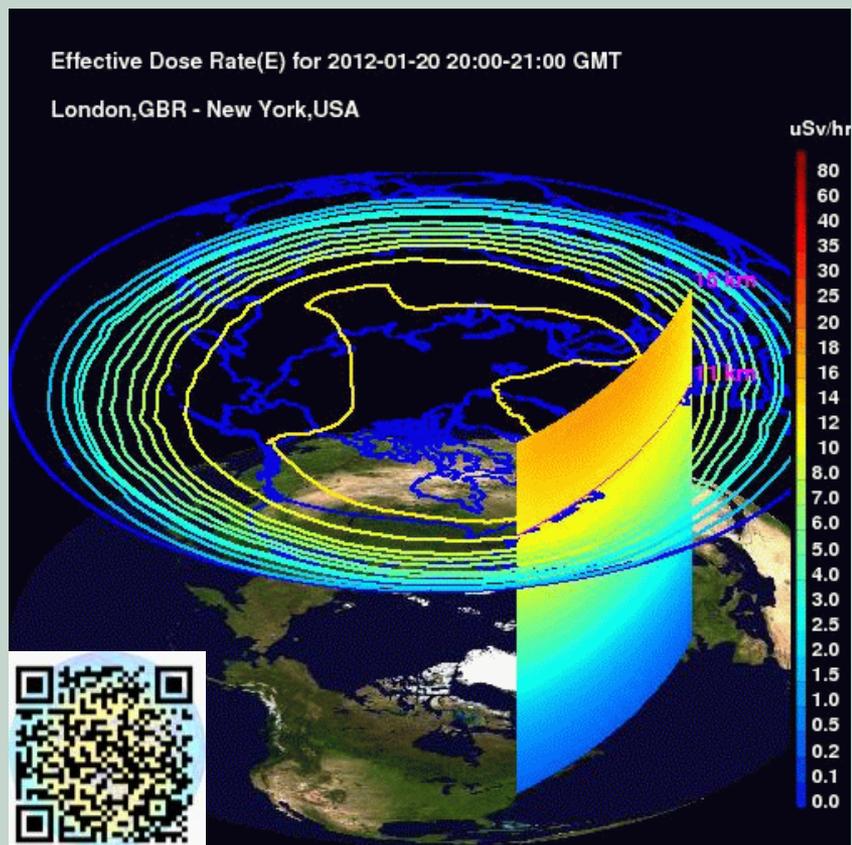
- **FM5 contains a micro dosimeter, data logger, GPS receiver, Iridium transceiver, battery, and Bluetooth in the size of a large smart phone**
- Measures ALL radiation in all altitude ranges with NASA technology
- **Reports personal dose exposure from anywhere in the world** providing REAL-TIME situational awareness onboard or on ground
- **Provides radiation region avoidance during events (like volcanic ash clouds)**
- FM5 is FAA compliant with its own power and no attachment to plane



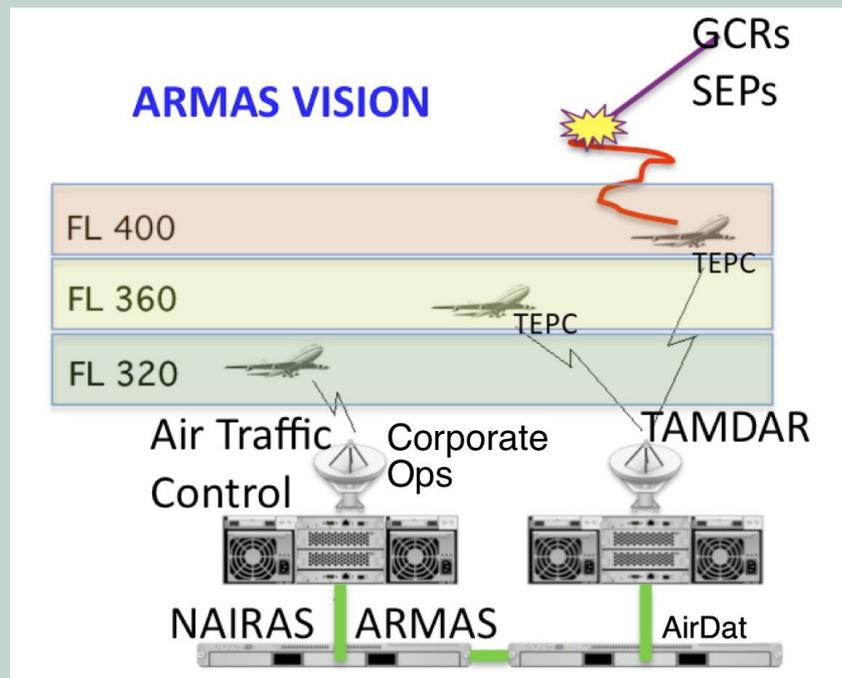


## Characterizing Radiation for Aviation Customers

### NAIRAS

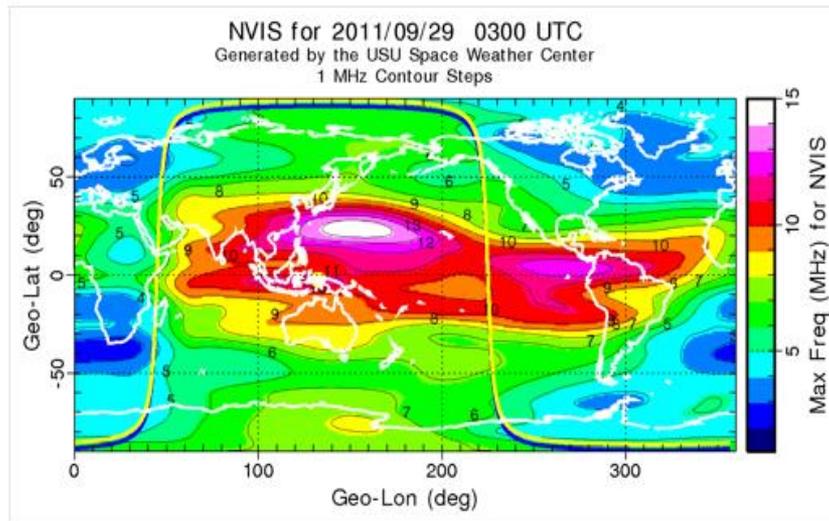


### ARMAS



Courtesy of Kent Tobiska

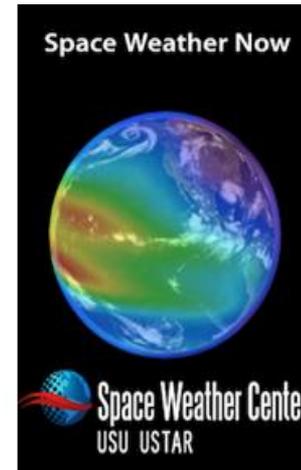
# Corporate and Hams HF propagation



At Q-Up Now we are dedicated to providing the best, most accurate real-time and forecast High Frequency (HF) radio frequencies for propagation.

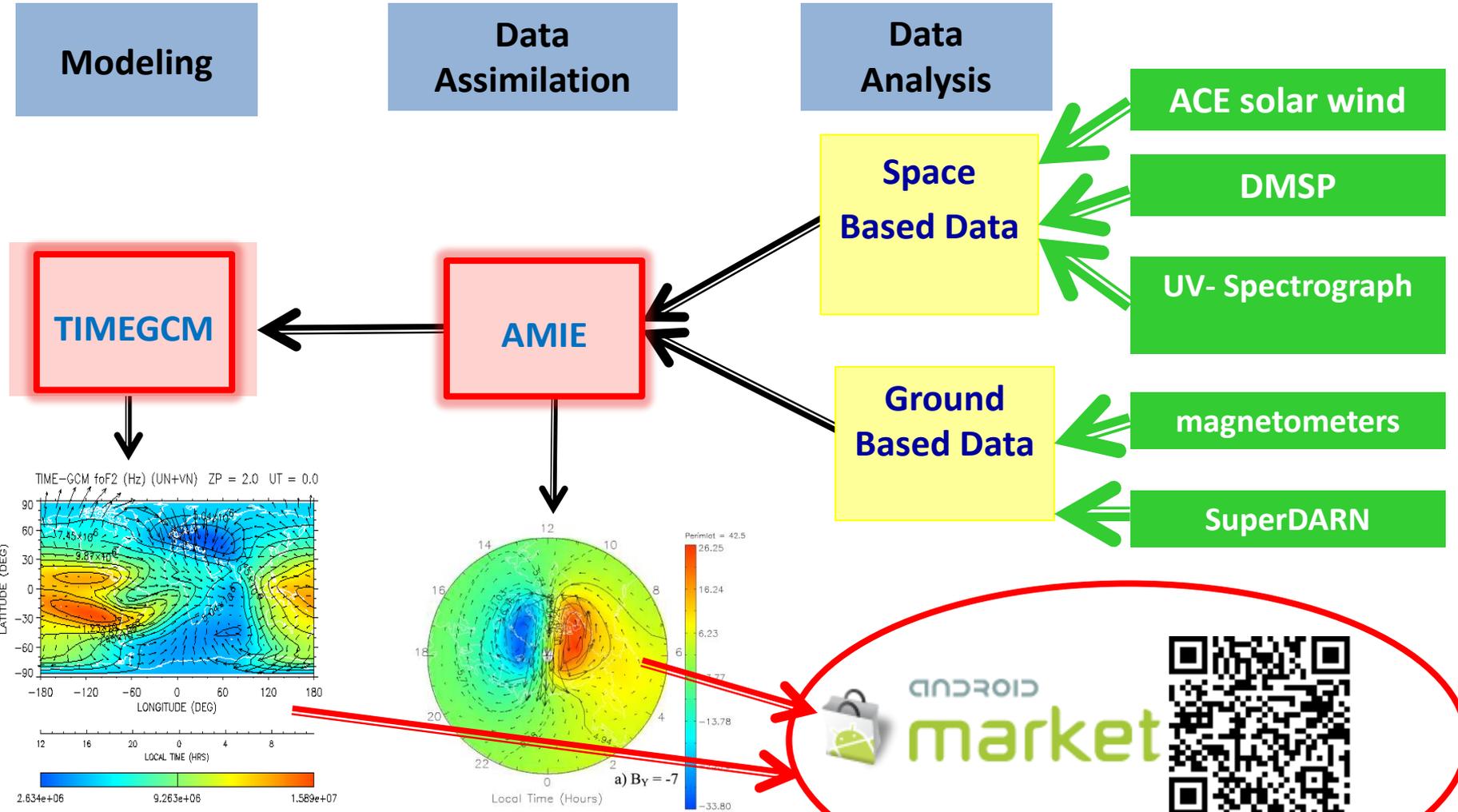
## What is Propagation?

Radio propagation is the transmission, including reflection, of a radio wave in a specific direction through a medium. Radio waves are a form of electromagnetic radiation (EM) and pass through free space, the ionosphere, air, and even solid materials. The reflections of the EM waves are affected by charged particles, such as electrons, in the ionosphere. As such, having a knowledge of how the ionosphere varies can help us understand how radio waves will propagate.



# Transition of AMIE & TIMEGCM Models

Assimilative Mapping of Ionospheric Electrodynamics  
Thermosphere-Ionosphere-Mesosphere-Electrodynamics-GCM



android market



[www.astraspacenet](http://www.astraspacenet)

# Real-time GPS Data Product

❖ Science

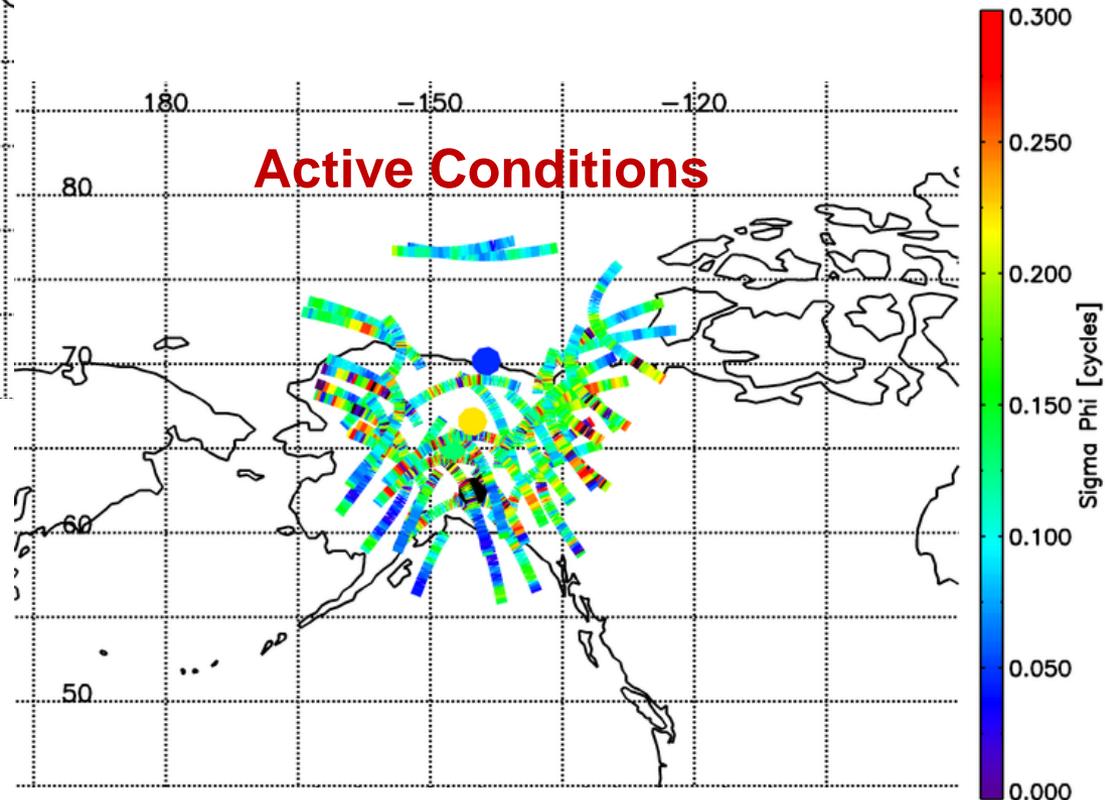
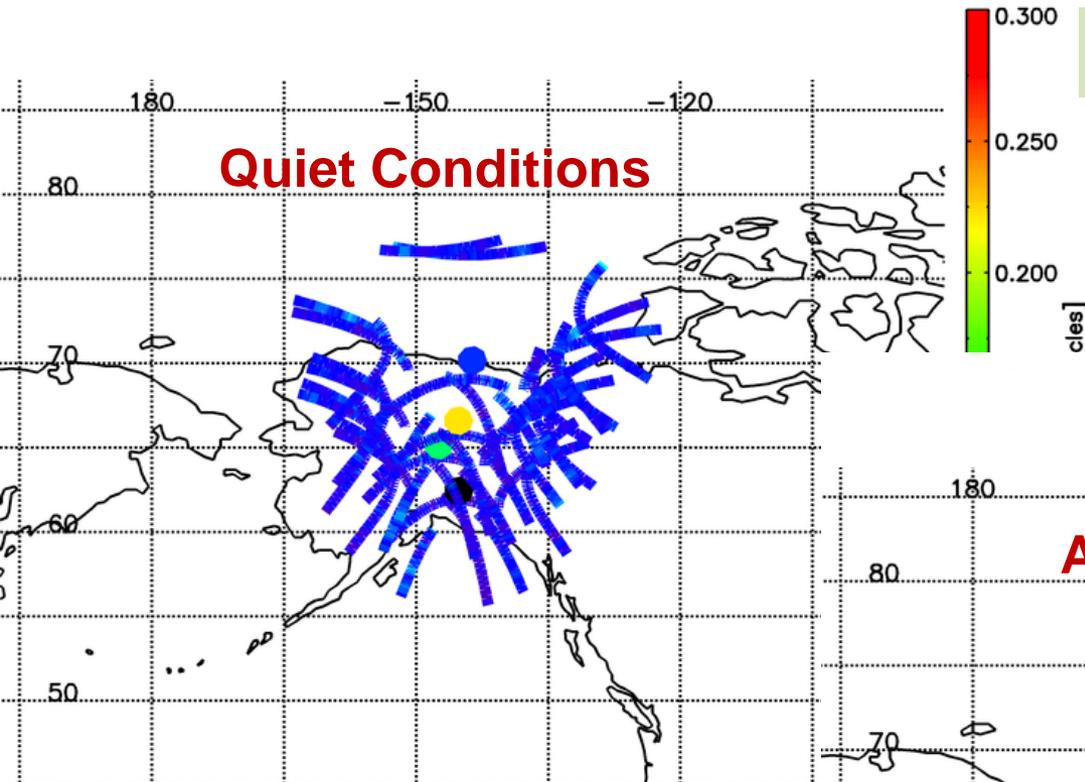
❖ Technology

❖ Applications

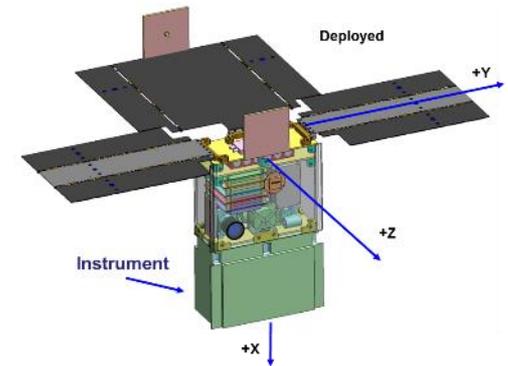
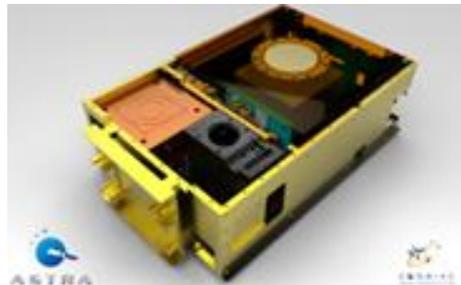
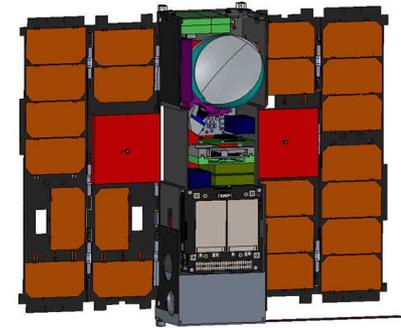
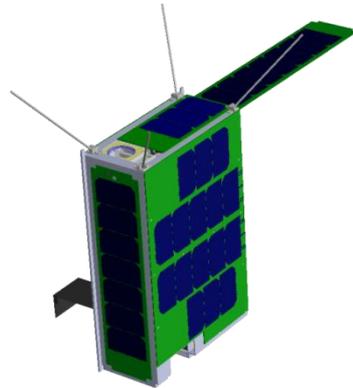
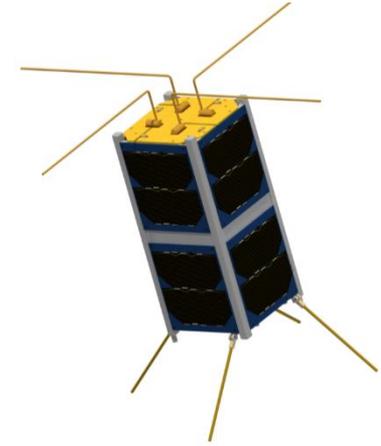
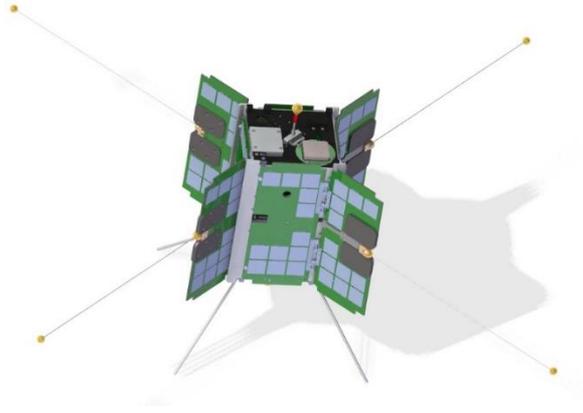
*Bringing It All Together*



<http://cases.astraspace.net>



# Small Satellites and Cubesats



# Radio Occultation Constellations





# What Can Commercial Sector Do?

## NASA Technology Model

Program Manager reports to NASA Office of Chief Technologist  
(6 yr contract)

Assembled an Advisory committee including many industry people

What can Commercial sector provide already?

What technologies will be available soon from commercial sector?

What should NASA focus on, and what should they fund through SBIRs?

## Vision for SWARM/SWAP Tech Development

Establish a similar Advisory Committee for Space Weather Technologies

Should include many commercial people

Same questions....



# The Purpose of ACSWA

## American Commercial Space Weather Association

- **Founded in 2010**
- **19 commercial organizations**
  - ✓ **Represents interests of commercial SpWx providers**
  - ✓ **Represents commercial SpWx in nat'l & int'l arenas**
  - ✓ **Supports advisory services to government agencies**

## **ACSWA is helping to organize commercial SpWx**

- ✓ **Providers of quality space weather data and services**
- ✓ **Developing operational space weather best-practices**

# Funding Challenges

## How can we fund private sector?

- **BAA / RFP (Open or restricted access)**
- **GSA (Pricing schedules)**
- **Seaport-E, etc (IDIQ Contracts)**
- **SBIRs**

# **Small Business Innovative Research**

**Government encouraging small business to develop technology for operational capabilities**

**Phase-I Feasibility Study (TRL = 0 to 1)**

**Phase-II Proof of Concept, Prototype (TRL = 2 to 4)**

**Phase-III Commercialization (TRL = 5 to 9)**

**Standard rule: Government has to compete everything (*takes time*)**

**SBIR rule: Government can sole-source to SBIR companies (*much quicker*)**

**Why?**

**.... Government wants to see technology evolved to operational status**

**.... Return on Investment**

# Conclusions

- Postulated a modern infrastructure for Space Weather Enterprise
- Differs from historical model



- Our nation can no longer afford to ignore commercial capabilities
- Commercial providers are among the best scientists in the field
- Skills and insights to share; sophisticated tools available (> Govt and Academia)
- **Space Weather infrastructure should be modeled on the successful meteorological community: highly collaborative Govt-Academia-Commercial relationship**

**Ideas:**

- 1) Technology Advisory Committee
- 2) SBIR Sole-source