Space Avionics to Mission to Policy Implications

Agenda

Broad Reach – what we do
Space Industry Mission balancing act

Small Company Experience
Company Concerns

Space Commercialization & Start Ups
CICERO & Data Purchase
Broad Reach Overview

Founded February 1997
   C-Corporation, Incorporated in Delaware

Current Number of Employees:
   42 +
   Mostly space avionics & embedded software developers
   GPS S/W and Spacecraft Attitude Determination & Control

Locations:
   Tempe AZ, and Golden, CO

High End Avionics, Components and S/ W
Products, Current & in Development

2nd generation IAU
C&DH, uP, SSR, EPS, GPS, …
Battery Charger, Torque Rod I/F…
Ethernet/Spacewire/1553…100’s of I/O

In Development:

Pyxis: GPS/Galileo L1/L2/L5 96 channel Receiver
(3 Frequency ASIC)
GPS Receiver for Geostationary orbits
SB-SAT: Inmarsat / LEO transceiver with GPS
Redundant Integrated Avionics Units
Attitude Determination with GPS

3U cPCI Mirideon Board
1MRad PowerPC 440,
266MFLOPS ,512MByte,
2 ch. 10/100 Ethernet…

48 channel, 4 antenna
dual Frequency GPS receivers

Micro-Steppers &
Servo robotic drivers

LEO/GEO/Interplanetary

4/7/2010
Multi-considerations in systems design

- Payload
- Payload Operational Constraints
- Payload / Customer & Ground Processing
- Payload
- Command & Data Handling
- Software
- Payload
- Solar Arrays
- Batteries
- Propulsion & Fuel Load
- QA, Safety, Regulatory, & Permits
- Launch Vehicle
- Payload

- TT&C
- Aperture
- Datarate
- Desired Science

- Power Consumption
- Thermal
- Structure

- Alleged Saving $ by not testing
- Misguided Schedule Pressures
- "Because I Said So"
- Launch Vehicle
- Politics & Management

- 'Overdesign' Impulses
- Non-Decisions or Late Decisions

- Time & Money
- TALENT
Add Mission ‘Value’ & Business Solvency
Some single missions are an entire career
Parameters to *Maximize* –

Science / dollar (maximize Numerator…minimize denominator…singularities)
Information (need location, time, attitude, ..not ‘GPS, oscillators, star trackers’)
Earliest and persistent Data
Signal/Noise
Maximize Watts collected (not watts/Kg or watts/area, or watt/$)
…
Mass is not a facilitator, it is a constraint
Money is a facilitator, and a constraint
Isp, watts, S/N…Amp-Hr’s, Nms, Nm, Quaternions….are facilitators
Design Approaches & Statements

Designing for Science & Experimental Missions - Art with technical foundation.

Customer is occasionally right, though –
You can’t assume the customer is ‘smarter’ than you are, in the task that you are responsible for (Make sure you have the authority commensurate with your responsibility). Everyone needs to be ‘correct’ and peer ‘reviewable’

Approaches

Copy-cat Design Approach – do what others have done in the past
10% Design Approach –

improve systems or components by ~10% (progression of solar panels)

Order of Magnitude Design Approach –

improve systems or components by 90% (progression of avionics, batteries)

Mission Altering Design Approach and Concepts

Payload Data as a concept to the Scientist’s workstation (COSMIC vs. Weather Balloons), Attitude Determination with GPS
Parting shots

Don’t violate the 2\textsuperscript{nd} Law of Thermodynamics (or the 1\textsuperscript{st})

Don’t violate $E=IR$ or $F=MA$

Please – re-invent the wheel;
our wheels are bald & flat & need new bearings
Policy

Define Instrument to collect Data

Transform data to Information

Transform Information to Knowledge

Define Information needed

Temperatures, Pressures, Water Content, ...

1’s & 0’s

Forecasts, Climate ...

Designing for Science -> Policy
NOAA is privatizing the collection of many types of Environmental Earth Observation Data.

GeoOptics is poised to be the inaugural supplier – to NOAA and to government and industry around the world.
**Problem**: Commercialization & privatization is being considered as a fix to severe issues with government programs related to space & operational data acquisitions
- Specifically: NPOESS, GOES-R, T-SAT, … you name it.
- Over budget + behind schedule = loss of data / data-gap

**Precedent**: This has happened before → Now we have a private comm-sat industry and mostly private EO industry
- DigitalGlobe, GeoEye, Intelsat, Inmarsat, O3b…

**Opportunity**: This time it will be in the area of “Environmental Earth Data”
- Climate, Weather, Oceans, Snow, Ice, Pollution, Carbon, …

**Solution**: GeoOptics will solve the problem by providing urgently needed data starting with highest priority data set called “Radio Occultation Data (RO)”.
Background: What is RO?

- RO = Radio Occultation is a method by which one can measure properties of a planetary atmosphere

![Diagram of RO](Image)

- Signal is ‘bent’ / refracted as it passes through the medium (like a lens)
History: First Radio Occultation

Entry
Exit
(open loop)

Fjeldbo et al., *Planet. Space Sci.* 1968

Mariner IV at Mars
July 1965
Pioneer Venus Orbiter 1979-1982

First recovery of zonal winds from pressure contours

Newman et al., 1984
Earth Atmospheric Limb Sounding

The Instrument: A modified GPS Receiver
GPS RO Provides the following data:

- High resolution profiles of:
  - Bending angle
  - Refractivity
  - Density
  - Pressure
  - Temperature / Moisture
  - Geopotential heights

- Temporal and spatial averages, 2D maps
- Global pressure contours, gradients, and geostrophic wind fields
The GPS-MET Experiment on MicroLab-I

1995 - ?

Temperature profiles near England

Occultation at 52.6N. 355 E.

- Radiosonde at 54.5 N. 353.9 E.
- Radiosonde at 53.5 N. 357 E.

At about 95-4-25:00:00 UTC
Unique Attractions of Radio Occultation

1. High accuracy: Averaged profiles to < 0.1 K
2. All-weather operation
3. Global 3D coverage: surface to stratosphere
4. Unrivaled vertical resolution
5. Independent height & pressure/temp data
6. Compact, low-power, low-cost sensor

What is it good for?
Four Major Areas:

- Short and Medium Range Weather Forecasting
- Severe Weather Forecasting
- Climate Monitoring
- Space Weather Monitoring and Forecasting

+ to calibrate other products.

Some examples to follow…
Weather Forecasting

• All forecasting is model based
• Model is initialized using a variety of data products
  – Radiosondes
  – Space based Sensors (IR, Radar, Reflections, Sounders…)
  – Typically every 3 hours

The problem:
• Traditional (non RO) data not consistent, even across instruments by the same mfg.
• Calibration difficult – not traceable to a common standard
• Data collection not global
• Data latency anywhere from minutes to days
Confidential

GPS-RO vs. Wx Balloon Distribution

Note: Very few measurements over the ocean.

- About 1000 measurements per day worldwide
- With 20 Satellites and looking at GPS and Galileo about 1500 measurements worldwide every 3 hours!

Message:

GPS-RO can provide a finer grid and lower latency with much more globally distributed coverage. It is also nearly BIAS FREE!
Space Weather affects

- GEO Comms (Military! Commercial!)
- Long range/Short Wave Comms (Military!)
- GNSS Accuracies (Aviation!)

→ Blackouts / Disruptions can have high cost of $$$ and possibly human life
“It’s almost as if we’re forecasting blind”
--Forecaster, Nat’l Hurricane Ctr.
October 2005
RO Offers Visibility Deep Into the Storm
Lili Track Forecast Result from UCAR

Zhang et al. (UCAR), 2005
Confidential

Hurricane Ernesto Forecast

Satellite Photo | Forecast with RO data | Forecast w/o RO data

6 hrs

42 hrs

66 hrs

90 hrs
Multiple University / Science led RO missions since ‘86
First ever dedicated RO constellation – built as “experiment”, now used as “operational data source” worldwide.
IGOR Receiver History

- BRE has licensed BlackJack design from JPL as of 2004
- Evolution has been ongoing
- Technology improvements have been ‘flown back’ (with restrictions) to JPL
Summary: The Constellation

- Phase 1: 9 Orbital planes, 2 SC Each (18 Total SC)
- Phase 2: 12 Orbital planes, 2 SC Each (24 Total SC)
- Phase n: Missions of opportunity and ‘other’ orbits

500km Circular Initial Orbit
750km Circular Final Orbit
@ 72 Degrees Inclination

Altitudes and Orbits are optimized to maximize global distribution of occultation events.
Modified CICERO SC Design
(not baselined but shows versatility)

- Developed in response to AF RFI – added sensors beyond RO
- Slightly larger & heavier (~45kg)
For comparison – COSMIC Satellite

IGOR Instrument

65kg, 50W OAP, 1990 Technology
Summary: The Ground System

- Inmarsat I4 BGAN Constellation At GEO
- Nominal Science and TTC Link
- CICERO Constellation At 750km Circular
- Backup Science and TTC Link
- S-Band Primary UND
- Data Center North America - ND
- Inmarsat - Primary London
- S-Band Maintenance Backup SSC - Kiruna Sweden
- Inmarsat - Secondary USA
- Constellation Control Backup
- VPN via Internet or leased
- Data Center Europe
• **Real-time data link, 24/7, world-wide**
• **Similar total cost to ground network, less initial cost**

![Diagram of Inmarsat IV at GEO with satellite connections to gateways and data centers.](image)

- Up to 492kbps duplex link
- Inmarsat IV connectivity to gateways
- Inmarsat SB-SAT service provider data center support

**Mission Control & Data Center**

**Internet**

**Billing & Support**

**Inmarsat MOC / NOC**

**Inmarsat SAS Gateways**

**CICERO Spacecraft**
Integration and Test – The big picture

• **Phase 1: Parallel development of all spacecraft elements**
  (traditional system development w/focus on design for manufacture)
  – Structure, Mechanisms, Solar Arrays
  – Propulsion System
  – Avionics, Comms, Payload
  – Reaction Wheels
  – Harness(es)
  – Assembly line development
  – Ground system development
  – Launch adapter development
  – Procurement of off-the-shelf items (torque rods, antennas, TAM, etc…)

• **Phase 2: Build a single pathfinder spacecraft**
  (pathfinder I&T and assembly line checkout)
  – Integrate systems above
  – Develop assembly line using the pathfinder
  – In parallel, build and test launch adapter using dummy loads
Integration and Test – The big picture

• **Phase 3: Build 18 flight spacecraft using the assembly line from Phase 2 (manufacturing)**
  – Pipeline manufacturing approach using 4 stations per line
  – Minimum 1 line, possibly 2
  – Avg 4 weeks to assemble and test one vehicle
  – Loaded pipeline puts out one spacecraft per week

• **Phase 4: Stack Integration & Test**
  – 18 Spacecraft delivered to stack I&T
  – S/C fuelled
  – S/C bolted onto stack
  – Minimal stack level testing (only random vibe)
  – Stack shipped to launch site

• **Phase 5: Launch Site Operations, Launch, and On-Orbit checkout/ops**
  – Stack placed on LV
  – Functional verification of each S/C on stack/on LV via minimal cmd/tlm test
Spacecraft Integration at CU/LASP

- Spacecraft Manufacturing (Integration) at CU/LASP
- Major subsystems supplied from outside (inc. BRE)
Environmental remote sensing is being privatized. GeoOptics is leading the way.
• Global data about the environment
  • Raw data
  • Information products (i.e. processed & fused data, maps, forecasts)

• Data types provided are closely aligned with currently used or planned NASA / NOAA / Air Force data products:
  – **Atmospheric data** (temperatures, pressures, moisture, winds, weather)
  – Ocean altimetry (wave heights, tsunamis)
  – Ocean scatterometry (ocean surface winds, roughness, radar)
  – Gravity modeling (polar melting, earth activity, exploration)
  – Precise radiometry (climate variables)
  – Radar interferometry (surface deformation, biomass, ice caps)
  – Atmospheric constituents (carbon, ozone, H20, etc…)
  – Soil moisture

• The worldwide market for such products is > $6B/yr

• Our market entry/first product is “**atmospheric data**” using a disruptive measurement technique called GPS Radio Occultation (GPS-RO)
1988  T. Yunck at JPL proposes GPS RO technique; first RO publication

1989  Yunck at JPL is awarded NASA grant to study implementation of GPS-RO Instrument

1996  Yunck, McCormick, Lenz and others submit GPS-Clim Proposal to NASA

1997  JPL under Yunck’s leadership awarded NASA contract to develop GPS-RO instrument for NASA Mission

97-04  Various missions around the globe establish that the new technique works GPS-RO Classified as ‘disruptive’ technique

2004  Broad Reach Engineering commercializes JPL RO Instrument

2006  COSMIC Mission launched – First RO Constellation - Government lead 6 Broad Reach Engineering designed Instruments on-board

2005  GeoOptics LLC established to commercialize RO data collection, Proposes NextVIEW like model to NOAA, Congress

2007  Global Weather Centers at NOAA, EUMETSAT, MeteoFrance, UkMet and others start using data operationally

2008  User community starts wondering what to do ‘after COSMIC’

2009  NOAA Solicits commercial data providers for RO Air Force solicits SpaceWx solutions for anticipated DMSP end of life
Killer App? – Example #1: NOAA Forecast Quality

NOAA
Five-Day Anomaly Correlations
Southern Hemisphere
March-April 2008

Instrument Acronyms:
AIRS = Atmospheric Infrared Sounder
AMSU = Advanced Microwave Sounding Unit
MHS = Microwave Humidity Sounder
GPS = GPS Radio Occultation Receiver

**Approx. instrument cost
**Instrument + sats + launch

L. Cucurull, 2009
NOAA/NCEP
In terms of Environmental EO Data, NOAA is the world’s largest and most influential single consumer (NOAA is a lot like NGA in this respect)
Applicable U.S. Law

• Government required to meet space-related needs to the fullest extent feasible using commercially available space goods and services.

• Government may not compete with U.S. commercial providers of space hardware and services.

• Recent precedent: DigitalGlobe/GeoEye v. NGA

Introduction

The National Space Policy includes the following direction to government agencies:

- Use U.S. commercial space capabilities and services to the maximum practical extent;
- Purchase commercial capabilities and services when they are available in the commercial marketplace and meet government requirements;
- Refrain from conducting activities that preclude, deter, or compete with U.S. commercial space activities, unless required by national security or public safety.

The Office of Space Commercialization plays a key role in encouraging NOAA and other government space agencies to pursue commercial alternatives to traditional space procurement processes.

Read more about the National Space Policy...

Timely Delivery: Traditional government space acquisition and procurement processes often experience significant cost overruns and schedule slips, risking the continuity of critical operations. Commercial space companies, on the other hand, are highly motivated to satisfy their...
NASA/NOAA Anchor Tenancy

Section 507 of the FY 1993 NASA Authorization Act (H.R. 6135, Public Law 102-588), codified as 15 USC Sec. 5806, authorizes the Administrators of NASA and NOAA to enter into multiyear anchor tenancy contracts with termination liability.

Read more about H.R. 6135 at LOC.gov...
View 15 USC Sec. 5806 at house.gov...

The following is the complete text of the statute (as of 2009).

Sec. 5806. Anchor tenancy and termination liability

(a) Anchor tenancy contracts

Subject to appropriations, the Administrator or the Administrator of the National Oceanic and Atmospheric Administration may enter into multiyear anchor tenancy contracts for the purchase of a good or service if the appropriate Administrator determines that:

1. the good or service meets the mission requirements of the National Aeronautics and Space Administration or the National Oceanic and Atmospheric Administration, as appropriate;
2. the commercially procured good or service is cost effective;
3. the good or service is procured through a competitive process;
4. existing or potential customers for the good or service other than the United States Government have been specifically identified;
5. the long-term viability of the venture is not dependent upon a continued Government market or other nonreimbursable Government support; and
6. private capital is at risk in the venture.

(b) Termination liability

1. Contracts entered into under subsection (a) of this section may provide for the payment of termination liability in the event that the Government terminates such contracts for its...
NASA Lacks Funds for Earth Science Decadal Survey Projects

NASA does not have the resources to complete all of the projects set forth in the U.S. National Academies' decadal survey for Earth Sciences, NASA Administrator Michael Griffin told the U.S. House of Representatives Science and Technology Committee at a 22 March hearing.

Griffin said that although he respects the advice put forth by the National Academies, "we cannot do every mission in the Earth science decadal [survey] with the money that we have." He noted that the Fiscal Year 2008 budget request for NASA, the subject of the hearing, does provide a modest 3% increase in funding for the agency. However, he admitted that the budget "does not purchase all of the things that all of us would like to purchase."

Committee Chair Bart Gordon (D-Tenn.) noted that "certainly we would like to do even more" than has been proposed by NASA, but the current budget does not even pay for all of what NASA has been asked to do: exploration, aeronautics, and science.

The January report, "Earth Science and Applications From Space: National Imperatives for the Next Decade and Beyond," was the first ever 'decadal survey' for the Earth sciences, modeled after similar surveys from the other NASA science communities—on Sun-Earth connections, Solar System exploration, and astrophysics (see Eos 88(6), 2007). The report set out a plan for 2010–2020: 17 Earth observing missions to be completed by NASA and the U.S. National Oceanic and Atmospheric Administration.

Griffin said that NASA would use the four decadal surveys, including this new one from the Earth science community, in setting agency science priorities. "Our priorities are strongly influenced by the decadal surveys" but NASA cannot afford to complete every mission proposed in each of them, he said.

However, Richard Anthes, co-chair of the committee that produced the decadal survey, said in a phone interview with Eos that while it may be true that NASA currently lacks the funds for the full list of missions set forth in the Earth science decadal survey, going forth with the full program is "clearly possible." He suggested that NASA could request additional funds starting in FY2009 or shift priorities within the agency. Anthes also noted that NASA was spending a similar amount ($2 billion per year) on Earth science missions just five years ago (compared with about $1.5 billion per year currently).

Griffin said that NASA is still considering how to proceed with the recommendations from the Earth Science decadal survey. The report was released after the agency had put together its FY2008 budget request, though that request was influenced by the National Academies Committee's interim report, Griffin said. NASA plans to incorporate the recommendations from the decadal survey into the agency's planning for FY2009 and beyond, Griffin told the Science and Technology Committee. Further, he said that NASA would be able to provide the committee with an assessment later this summer of how the agency will proceed with the decadal survey recommendations.

—SARAH ZIELINSKI, Staff Writer
Market Risks

• Market won’t buy
  • Government could do it themselves or via partners
  • Government has stated its intents to buy clearly

• Prices / Value will fall
  • Function of competition (see below)

• Competition
  • No credible competition currently
  • Any competitor is 3-5 years behind technologically
  • Team is uniquely positioned in this space – has key relationships
  • GO has secured key IP to implement system

• Regulations / Licensing / Export Issues
  • According to US DOC and NOAA Office of Space Commerce, we do NOT need a license to collect this data
The Situation

• NOAA is the anchor client (NOAA highly motivated due to NPOESS/GOES)
• The challenge is for NOAA & Air Force to accept data-buy approach
• All others must follow once NOAA sets the precedent – this will become the only way to obtain RO data, like buying weather balloons, and that will be that.

The approach

• Convince legislature that NOAA, Govt., and taxpayer benefits from this model
• Convince NOAA leadership that this approach improves its ability to implement NOAA mission [we actually didn’t have to do this]
• Build a system that makes it (nearly) impossible for NOAA to not buy our data
• Get NOAA to commit to RO data (pre) buy via contractual / budget vehicle
GO Progress towards Capturing the Market

- **April 2006** – COSMIC Mission launched. Data a huge success
- **Jan 2007** – NRC Decadal Survey makes RO #1 priority for new NOAA data
- **Feb 2007** – NOAA makes decision to solicit commercial weather/climate data
- **May 2007** – NOAA starts using RO data operationally, others follow
- **Fall 2007** NOAA’s Office of Space Commercialization publicly identifies RO as primary candidate for data buy pathfinder
- **Jan 2008** – NOAA holds Earth Observation Industry Day
- **Aug 2008** – NOAA Issues RFQ for RO Data
- **March 2009** – GO Drives FY09 appropriations bill language instructing NOAA to pursue commercial data purchases – report due May 16
- **April 2009** – NOAA Issues 2nd RFQ for additional data sets
- **April 2009** - Air Force issues space weather data collection RFI w/FY2010 Money
- **FY2010** – “Increment 0’ funding RFP out 2 April 2010
Convergence of Forces

1998 NOAA/NASA Easton Study

2007 NRC Decadal Survey

NOAA Leadership (Dr. Mary Kicza)

2012 Solar Max

NOAA & Air Force Scientists

White House OSTP 2007 direction to NOAA

World Science Community

Global Climate Change

Extreme Weather Events

House & Senate 2009 CJS Markups

NPOESS, COSMIC, DMSP Data Gaps & Budget Growth

Colo. Senator Ken Salazar

House Surveys & Investigations Staff

GeoOptics Congressman (Adam Schiff)
The Market – Let’s review an analogy

The Commercial Imagery Market

Confidential

Commercial and Non-US Revenue

US Government Revenue

US Government Operations Of assets procured from private industry

Examples:

Spot
Landsat
Spy-Sats

PDD-23 Allows private imagery companies

Natl. Security Presidential Directive
2003
Directed US Govt. to buy Data from Industry

NGA Issues NextView Contract to DG and GeoEye

Google Earth licenses DG Imagery

~$1B from Commercial and Intl. Sources (DG and GeoEye)

$500M GeoEye

NextView Contract

$500M DG

ClearView Contract

Commercial & Intl.

$72M DG

$120M Space Imaging

1960's

1992

2003

2006

Time

Commercial and Non-US Revenue

US Government Revenue

US Government Operations Of assets procured from private industry

Examples:

Spot
Landsat
Spy-Sats

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ClearView Contract

Commercial & Intl.

$72M DG

$120M Space Imaging

1960's

1992

2003

2006

Time
The Market – Environmental Data Buy Market

NOAA: “We’ll model RO Data Buy on Imagery Market”

US and other Government Operations of assets procured from private industry

Examples:
- CHAMP
- COSMIC
- Grace

Commercial and Non-US Revenue

US Government Revenue

FY2009 Appropriations
Bill directs NOAA towards New MO, meaning Data Buy

NOAA Issues RFP for Data Buy

White House
NOAA Leadership
Congress
Direct NOAA to investigate new MO

NOAA Issues Pre-Buy Contract

Commercial and Non-US Revenue

$100M GeoOptics
US Govt. For 2010 - 2012

$150M GeoOptics

Follow-On Contract

NextView like Contract

Q1/09

1980's

2007

Q3/08

Q1/09

2010

2013

Confidential
Timeline towards a USG Purchase Decision

**Scientific Evidence & Recommendations**
- Initial RFI from NOAA – USG Starts Exploring Options / Fact finding
- NOAA Issues RFQ – first step towards RFP & Funding

**Industry response & lobbying for approach**
- Air Force Starts Fact Finding
- Legislative Action
- NOAA Issues 2nd RFQ
- Air Force issues RFI
- White House Info

Momentum is reaching critical levels

- **April 2006** – COSMIC Mission launched. Data a huge success
- **Jan 2007** – NRC Decadal Survey makes RO #1 priority for new NOAA data
- **May 2007** – NOAA & National Weather Service starts using RO data operationally, others follow (UK, France, Canada, Taiwan, others)
- **Fall 2007** NOAA’s Office of Space Commercialization identifies RO as primary candidate for data buy pathfinder via Reach to Space Conference presentation
- **Jan 2008** – NOAA holds Earth Observation Industry Day, listing 3 Categories of Data (A-C), A being the highest priority. A-List encompasses RO derived data products
- **Feb 2008** – GO Provides RO White Paper to NOAA in response to RFI/Industry Day
- **Aug 2008** – NOAA Issues RFQ for A-List Data Set
- **Sep 2008** – NOAA Makes study award to GO for RO Data
- **Dec 2008** – GO Submits Study report covering RO and other A-List items. Feedback throughout from NOAA is “you’re top of the heap, right what we are looking for”.
- **Jan 2009** – GO w/Gen. Clark makes contact with NSSO Head re. Space Weather & CICERO. Initial skepticism turns into excitement → NSSO, Aerospace Corp, 55th Space Wing evaluate CICERO model. Promise to re-issue a failed RFI from 2008 to include data buy as option.
- **March 2009** – GO Drives FY09 appropriations bill language instructing NOAA to pursue commercial data purchases – report due May 16 (delayed by staffing issues, any day now)
- **April 2009** – NOAA Issues 2nd RFQ for additional data sets (“B-List”)
- **April 2009** - Air Force re-issues space weather data collection RFI w/FY2010 Money
- **May 2009** – Gen. Clark meets with Holdren @ White House – Feedback positive, GO Business model in line with Obama Administration expectations of how to operate acquisitions into the future.
- **May 2009** – Air Force holds industry day to replace aging DMSP Space Weather capability
- **June 2009** – GO has one-on-one meeting with AF/55th to discuss RFI response
- **July 2009** – NOAA Issues 3rd RFQ for additional data sets (“C-List”)
Promoting Space Commerce
Market Growth

Reach to Space Conference
November 2007

Edward Morris
Director, Office of Space Commercialization
National Oceanic and Atmospheric Administration

Space Transportation (COTS)
Imaging
Comms
Mapping
GPS-RO (!!!)

**Government Markets**

Procurement Methods
- Government Owned and Operated
- International Partnerships
- Government Furnished Equipment
- Public - Private Partnerships
- Commercial Data Buy

**National Space Weather Program**

NSWP – Assessment Committee Report

Critical Findings and Recommendations
- Ensure Continuity of Data Sources – L1 Sensors
- Examine Potential for Micro-Satellite Technology
- Enhance Processes for Transitioning Research to Operations
- Increase Private Sector Role for Services and Products
- Quantify the National Benefit

**How Can Industry Engage?**

Sources Sought / Market Study Announcement
- Released on December 20, 2007
- Identify commercial solutions to meet space-based Earth Observations and Space Weather requirements.

Industry Day
- Held on January 28, 2008
- Objective: Facilitate the preparation of industry responses.

- Identify commercial solutions to meet space-based Earth Observations and Space Weather requirements.
Since 2007, GeoOptics and its D.C. representatives IFS have been informing Congress on the state of Environmental Earth Observation, the need for a new business model, and the value of this data to society and US commercial vitality.

Since 2007 GO has been in contact on a quartely basis with:

Congressman / Senator Udall (CO)
Senator Salazar (CO) / Senator Bennet (CO)
Senator Dorgan (ND)
Congressman Schiff (CA) – also on CJS Appropriations Subcommittee
Congressman Perlmutter (CO)
Senator Boxer (CA)
Senator Feinstein (CA)
Senator McCain (AZ)
According to Senate Staffers:
Report was due May 12, but delayed due to Bush/Obama transition & staffing issues. Expect it any day now.
“For this effort, the IORD-II ionospheric electron density profile characteristics and scintillation measurements are considered Key Performance Parameters (KPP) and must be satisfied.”

“The Air Force is considering alternatives for acquiring space environmental data in support of the KPPs and KSAs. The system may include an orbital hardware follow-on concept, leveraging of planned programmed assets (both ground and space-based), and/or shared/purchased data …”
With “help” from GO, Air Force and NOAA coordinate behind the scenes – mission overlap since RO can address both NOAA and AF needs uniquely.

Notable: NOAA Office of Space Commerce references AF Space Weather RFI!

Info Sought on Commercial Space Weather Data Sources
Posted 4/13/2009

On April 8, the U.S. Air Force issued a Request for Information (RFI) on cost-effective ways to fulfill its requirements for space environmental data. According to the RFI, "The Air Force is evaluating all possible solutions sets, including the employment of commercial systems as a data provider with sensors already on-orbit or hosting sensors on future platforms." Due date for response is May 7, 2009.

The Air Force RFI is similar to the RFQ issued by NOAA on March 23.

Read about NOAA’s interest in commercial data sources... »

NOAA Office of Space Commerce Website
The conference report contains our language on commercial sources:

“Commercial satellites. - The conferees direct NOAA to report to the House and Senate Committees on Appropriations within 60 days of enactment of this Act on how the agency could benefit from acquiring space-based scientific data from commercial sources over the next three years, its plans to obtain such data, and analysis of expected availability.”
Overview

Satellite Transponder Leasing
- Combined GSA-DISA Acquisition

Hosted Payloads

Remote Sensing Data Buys
- ClearView & NextView
- SeaWiFS

Space Transportation Services
- COTS
- Rideshare/Multiple Manifesting

Earth Observations & Space Weather Data
- NOAA Industry Day & Feasibility Studies
- Air Force Space Weather RFI

Advance Funding Commitments
- NASA/NOAA Anchor Tenancy
- DoD/DHS/NASA Multi-Year Contracting Authority