

# Threats to GOES Frequencies

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<http://1stop.usgs.gov/uo/equipmenthelp/support/telemetry/>

***GOES***

***(Geosynchronous Operational Environmental Satellite)***

***DCS***

***(Data Collection Systems)***

# Satellite Data Distribution System

## Overview

### GOES

Geosynchronous Operational Environmental Satellite

### DCP

Data Collection Platform

### DADDS

DCS Administration and Data Distribution System

### DCS

Data Collection System

### LRGS

Local Readout Ground Station

### DRGS

Direct Readout Ground Station

### NESDIS

National Environmental Satellite, Data, and Information Service

### LDR

Low Data Rate

### HDR

High Data Rate

What are all the acronyms?

The primary purpose of the  
GOES DCS  
is to transfer data that is acquired  
and transmitted by a  
Data Collection Platform (DCP)

# Purpose of GOES

GOES orbit 35,800 km (22,300 miles) above Earth's equator at speeds equal to Earth's rotation, which means they maintain their positions.

GOES provide constant monitoring of various areas of the planet and provide the same geographic images over time. To fully cover Alaska, Hawaii, the entire continental United States and the Pacific and Atlantic Oceans (for tropical storms), NOAA operates two GOES satellites simultaneously: GOES-East and GOES-West

The satellites provide constant coverage of the western hemisphere by taking photographic images every 15 minutes. These "constant eyes" are critical for identifying severe weather, snow storms, tropical storms and hurricanes.

In addition to basic imagery, on-board sensors detect cloud formation, land and ocean temperatures, as well as monitor activities of the sun like solar flares that can disturb Earth's magnetic field. NOAA also uses GOES to identify when satellite emergency locator beacons have been activated to help with search and rescue activities.

- See more at: [http://www.nesdis.noaa.gov/about\\_satellites.html#sthash.7174J2NK.dpuf](http://www.nesdis.noaa.gov/about_satellites.html#sthash.7174J2NK.dpuf)

# GOES-R Baseline Products

## Advanced Baseline Imager (ABI)

Aerosol Detection (Including Smoke and Dust)  
Aerosol Optical Depth (AOD)  
Clear Sky Masks  
Cloud and Moisture Imagery  
Cloud Optical Depth  
Cloud Particle Size Distribution  
Cloud Top Height  
Cloud Top Phase  
Cloud Top Pressure  
Cloud Top Temperature  
Derived Motion Winds  
Derived Stability Indices  
Downward Shortwave Radiation: Surface  
Fire/Hot Spot Characterization  
Hurricane Intensity Estimation  
Land Surface Temperature (Skin)  
Legacy Vertical Moisture Profile  
Legacy Vertical Temperature Profile  
Radiances  
Rainfall Rate / QPE  
Reflected Shortwave Radiation: TOA  
Sea Surface Temperature (Skin)  
Snow Cover  
Total Precipitable Water  
Volcanic Ash: Detection and Height

## Geostationary Lightning Mapper (GLM)

Lightning Detection: Events, Groups & Flashes

## Space Environment In-Situ Suite (SEISS)

Energetic Heavy Ions  
Magnetospheric Electrons & Protons: Low Energy  
Magnetospheric Electrons & Protons: Med & High Energy  
Solar & Galactic Protons

## Magnetometer (MAG)

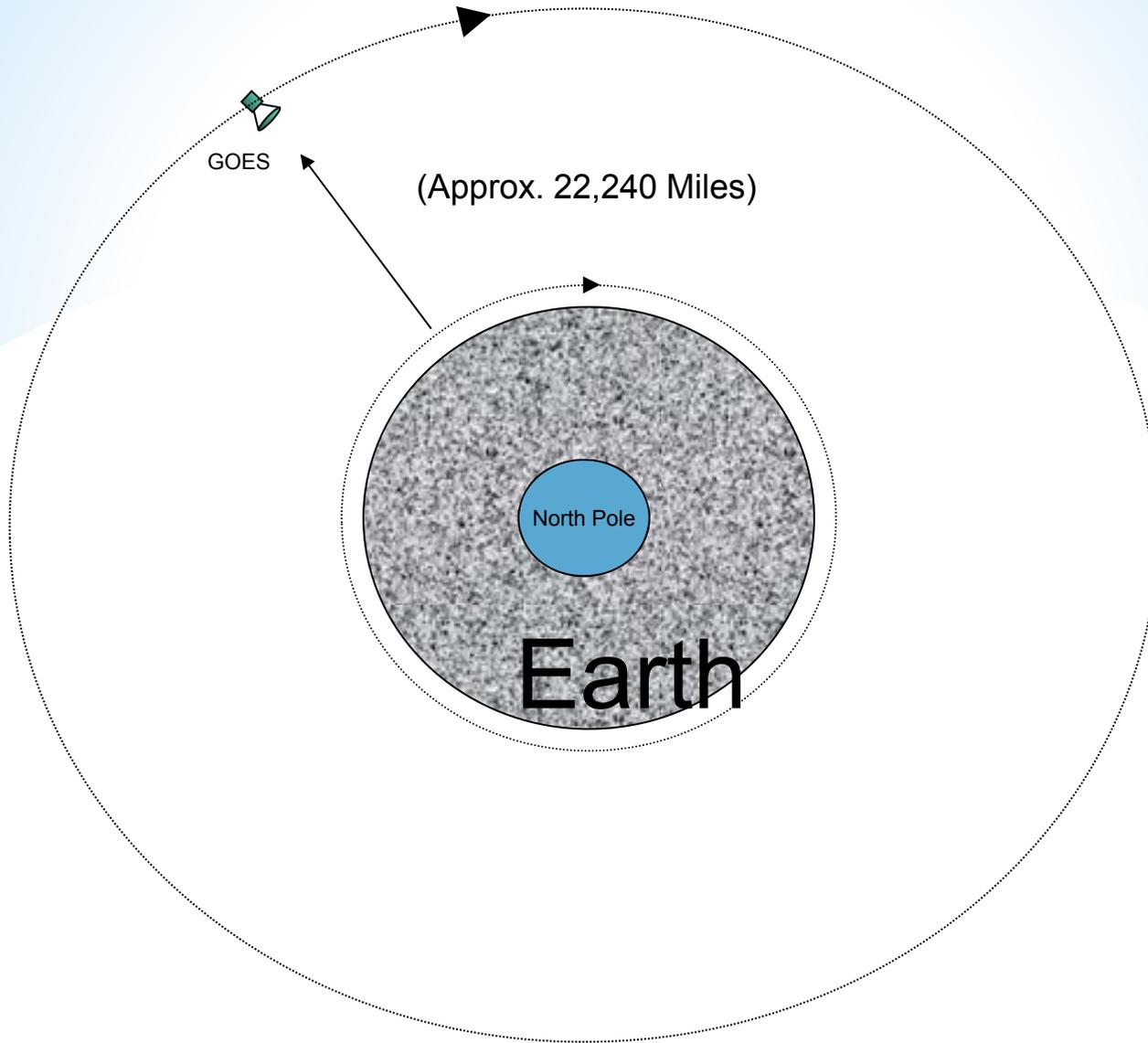
Geomagnetic Field

## Extreme Ultraviolet and X-ray Irradiance Suite (EXIS)

Solar Flux: EUV  
Solar Flux: X-ray Irradiance

## Solar Ultraviolet Imager (SUVI)

Solar EUV Imagery



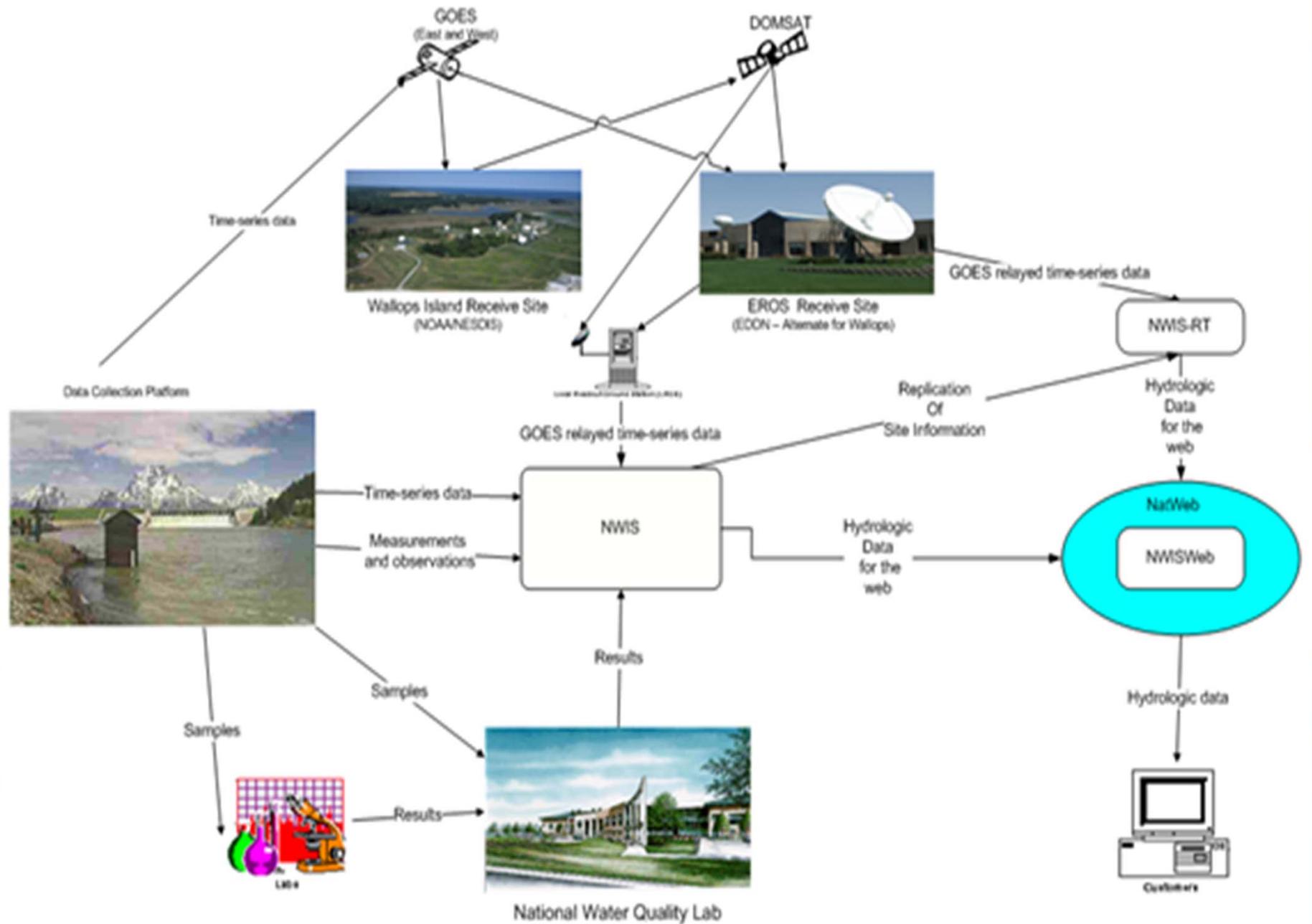
Geosynchronous – A satellite that moves synchronous with the earth's rotation.



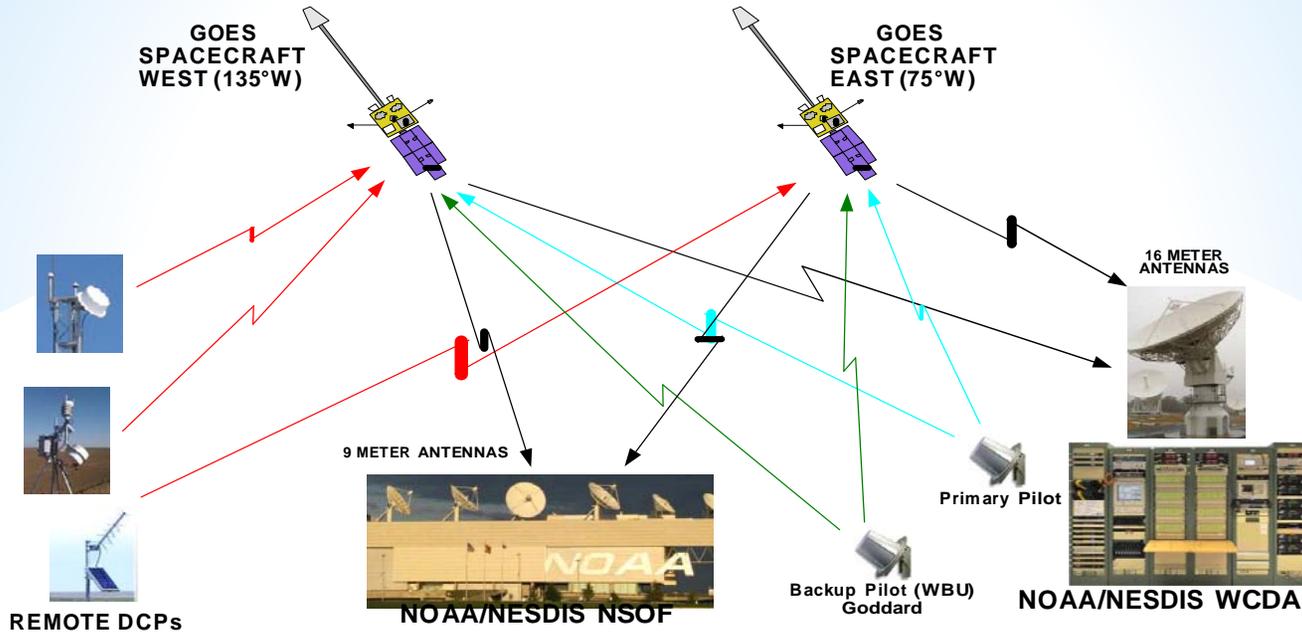
NASA/Cosmos Space Flight Center/Earth Photo II



# Context Diagram



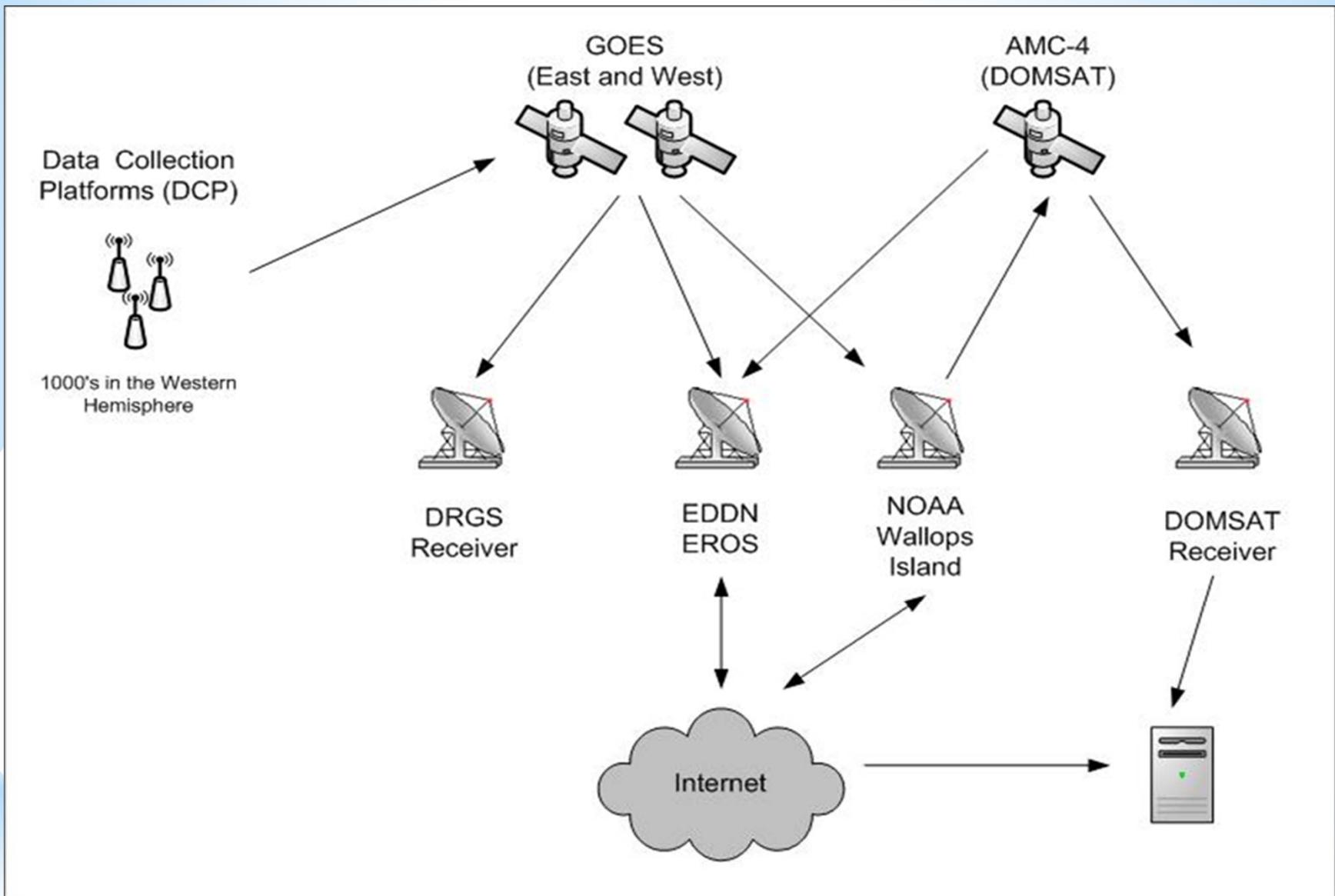
# GOES DCS Overview

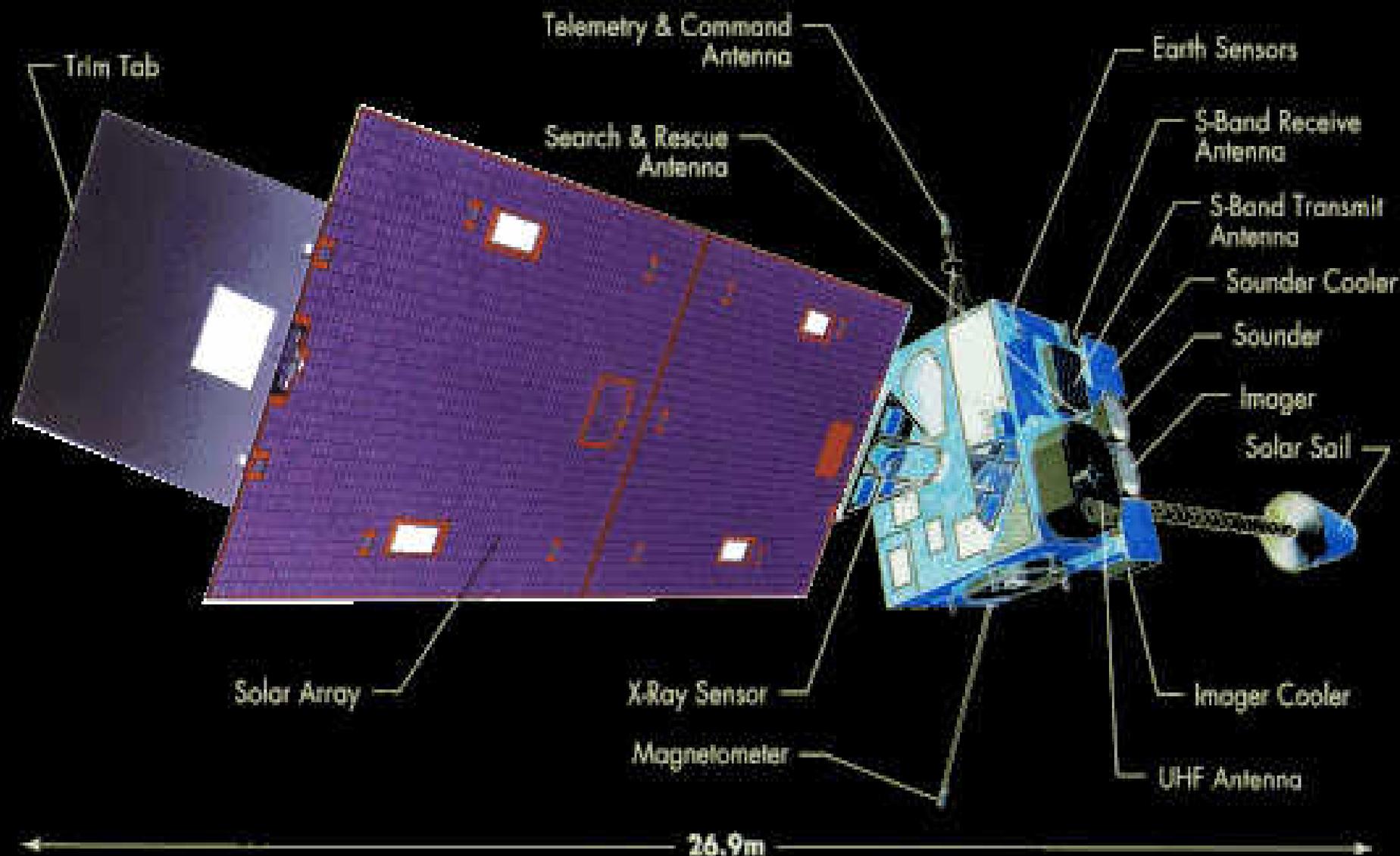


- Y Geostationary Satellites: GOES East @ 75°W and GOES West @ 135°W
- Y WCDA – Primary Receive Site      NSOF – Alternate Receive Site
- Y DCPs Uplink in UHF Band (~402 MHz) & DCS Downlink in L Band (~1694 MHz)
- Y Primary Pilot:    Uplink = 401.850 MHz    Downlink = 1694.450 MHz
- Y Backup Pilot:    Uplink = 401.700 MHz    Downlink = 1694.300 MHz



Microcom Design, Inc.





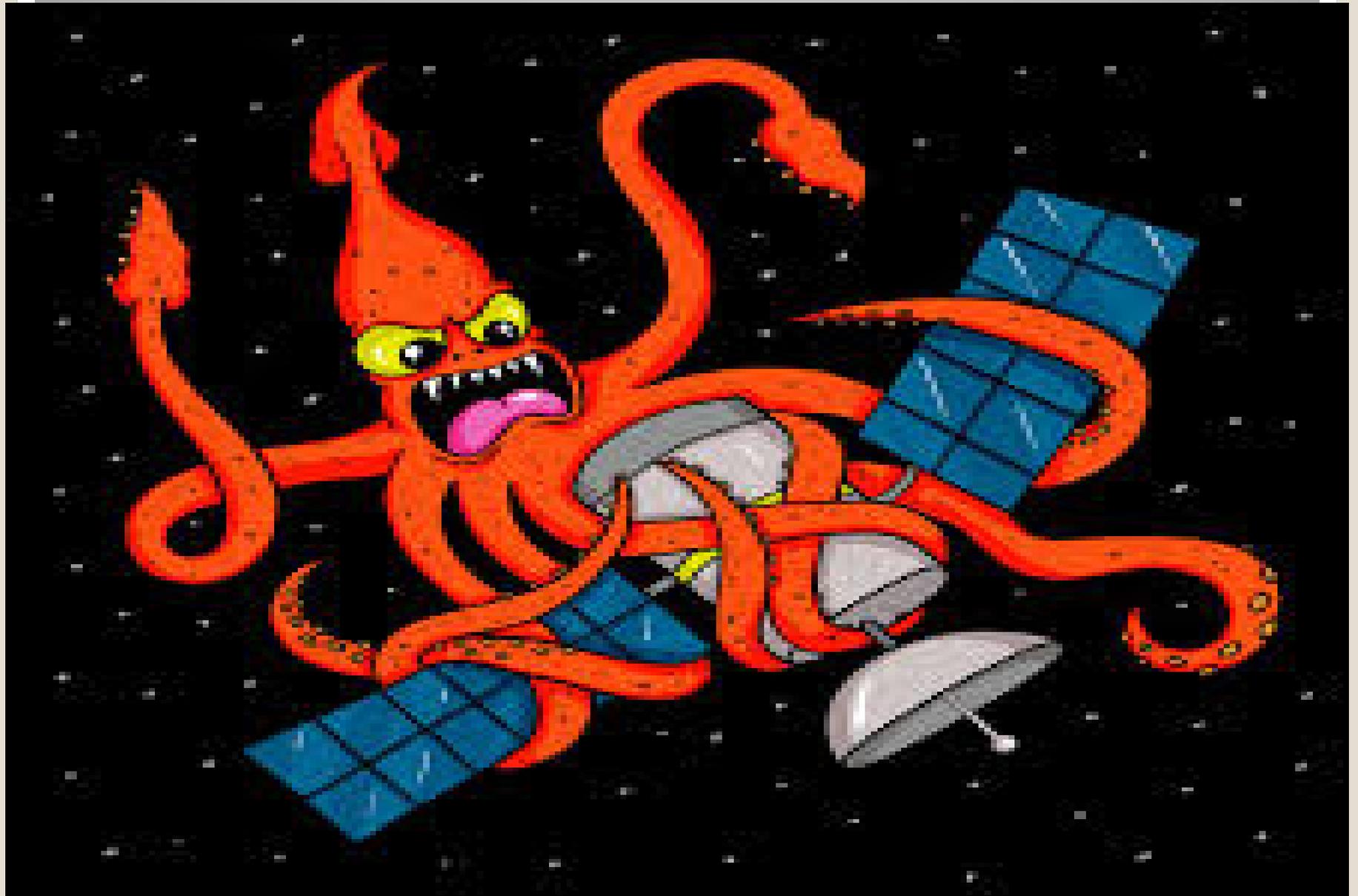


# Global Observation Satellites





# Data Collection System Under Threat



- Spectrum is highly desired by commercial broadband due to its characteristics. Recent AWS-3 auction of 1695-1710 MHz brought in \$44 Billion, so it can be seen as a “cash cow”.
- The band 1675-1695 MHz is occupied by GOES DCS and other operations but is already being looked at for sharing or auction in spite of earlier guarantees that we would be safe.
- Some in NOAA are looking into whether or not DCS should continue to reside on GOES satellites. It started out as experimental and has never been upgraded to a “real” project.
- There are laws in place that are intended to prevent critical operations such as DCS from being “farmed out” to commercial providers

## Two primary threats

## **Recent AWS-3 spectrum auction affects radio frequencies used by USGS**

GOES downlink (DCPR) frequency may suffer from interference from proposed commercial wireless systems near downlink sites.

Low Rate Information Transmission (LRIT) which is our current GOES data backup and High Rate Information Transmission (HRIT) frequencies may also suffer from interference from the AWS-3 spectrum auction.

**1680-1695 MHz frequency band is anticipated to be looked at soon** and includes frequencies that are critical to the operation of the GOES-R system as well as backup systems.

PRW1

# **Federal Radio Spectrum Concerns**

**Slide 19**

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**PRW1**

Changed from "next" to "soon"

Pardee, Richard W., 9/10/2015

# President's FY16 Budget: FCC Legislative Proposal

## Repurpose 1675 -1680 Megahertz using Auction or Fee Authority

**The Administration proposes to direct that the FCC use either auction or fee authority to repurpose spectrum frequencies between 1675-1680 megahertz for wireless broadband use by 2017**, subject to sharing arrangements with Federal weather satellites. Currently, the spectrum is being used for radiosondes (weather balloons). A new weather satellite that is scheduled for launch in 2016 will operate in adjacent frequencies. If this proposal is enacted, the National Oceanic and Atmospheric Administration would move the radiosondes to another frequency, allowing the spectrum to be repurposed for commercial use with limited protection zones for the remaining weather satellite downlinks. Without this proposal, these frequencies are unlikely to be repurposed to commercial use. The proposal is expected to raise \$230 million over the next 10 years.

[https://apps.fcc.gov/edocs\\_public/attachmatch/DOC-331817A1.pdf](https://apps.fcc.gov/edocs_public/attachmatch/DOC-331817A1.pdf)

- **LightSquared** is a company that sought to develop a wholesale 4G LTE wireless broadband communications network integrated with satellite coverage across the United States using a block of frequencies located near the band used by the Global Positioning System (GPS). However, the issue of interference (using high-powered ground transmitters in spectrum intended for low-powered signals from satellites) has caused problems.

**LightSquared**

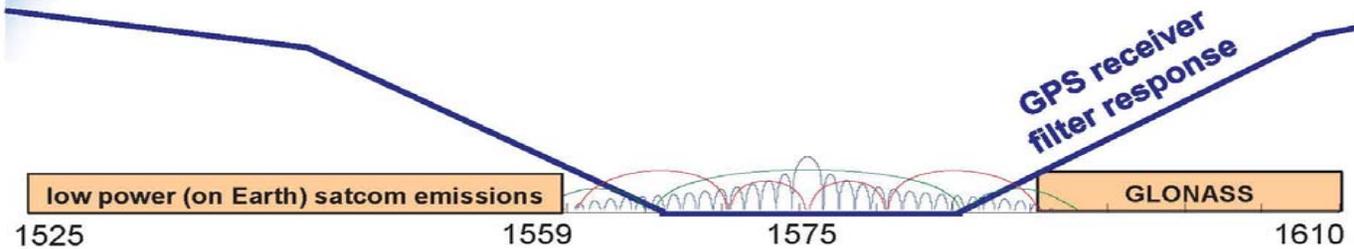
- As a solution to the GPS issues, LightSquared has proposed a “swap” of bands that would give them access to the 1675-1680 MHz frequency range.
- The next generation of GOES uses the upper end of that band for downlink of DCS data.
- Federal downlink sites have “protection” zones intended to prevent broadband interference from affecting data reception.
- It is generally agreed upon by GOES RF engineers that, regardless of those zones, interference will be seen.

**Sharing with GOES**

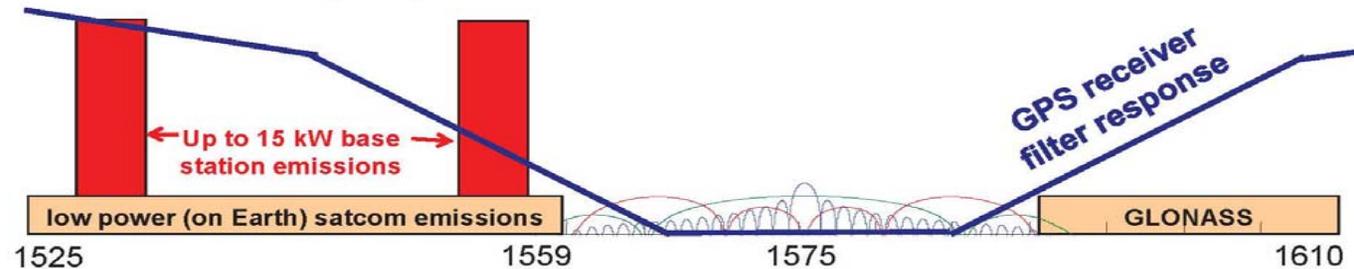


## Illustration of Concerns with LightSquared

Situation before LightSquared



Situation with LightSquared



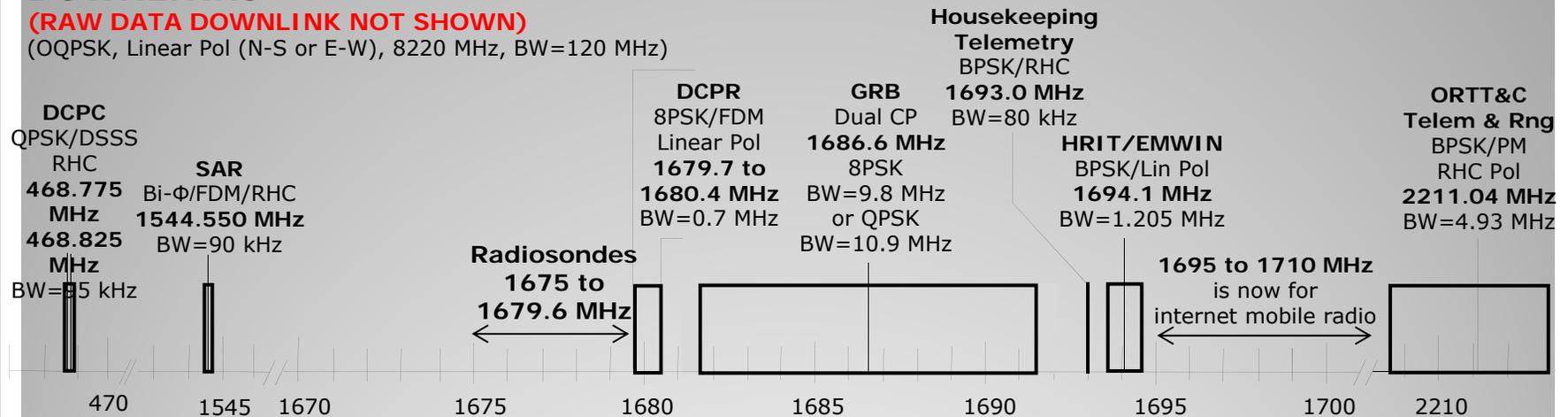
**GPS similar to GOES DCS**

# GOES R Frequency Plan

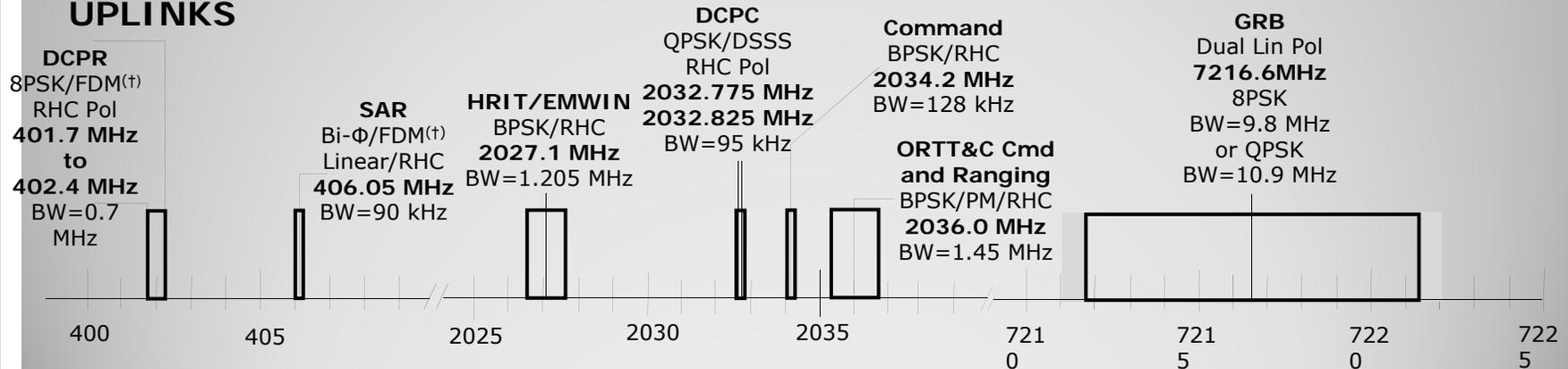
## DOWNLINKS

**(RAW DATA DOWNLINK NOT SHOWN)**

(OQPSK, Linear Pol (N-S or E-W), 8220 MHz, BW=120 MHz)



## UPLINKS



NOTES †: DCPR (8PSK) and SAR (Bi- $\Phi$ ) are individual uplinks FDM'ed in the spacecraft transponder.

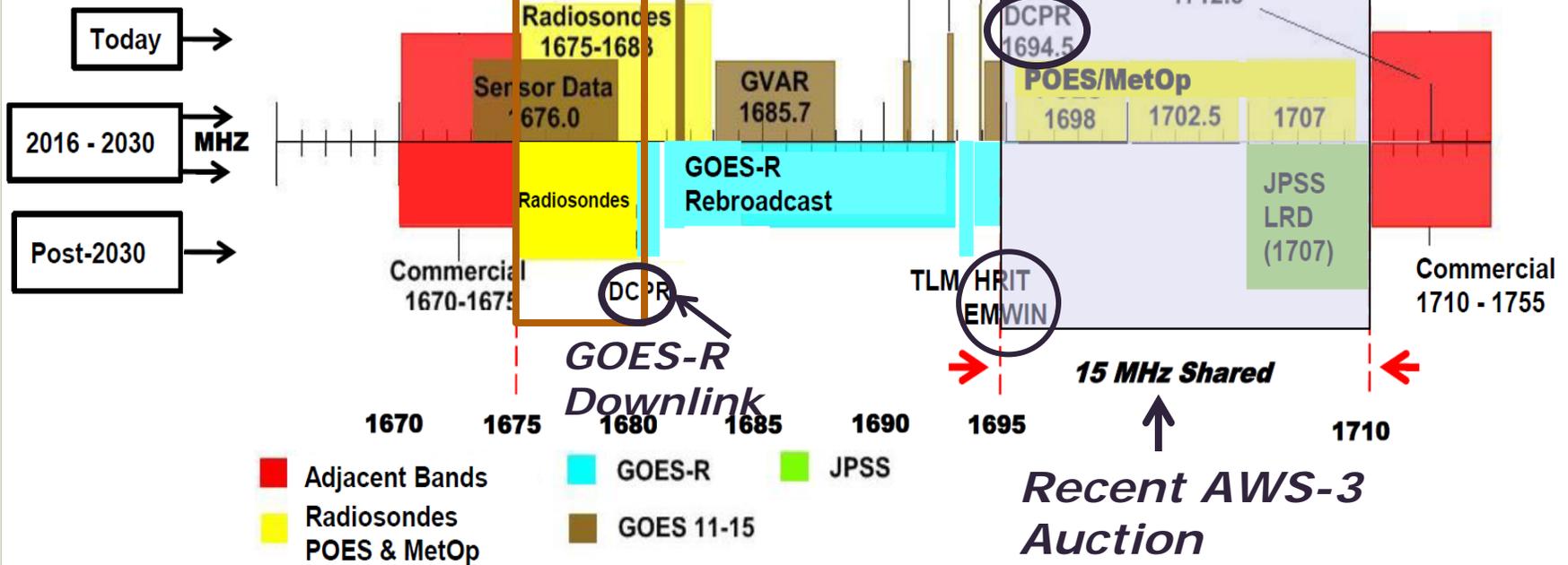
■: Indicates possible extra GRB bandwidth for QPSK modulation

# GOES Frequency Transitions

1675-1680 MHz threat

1680-1695 MHz threat

Band Identified For Fast-Track Sharing



The Federal Communications Commission (FCC) provides an avenue for interested parties (commercial and private) to express their concerns. Federal agencies express concerns through the National Telecommunications and Information Administration (NTIA). The FCC and NTIA coordinate spectrum policy.

Federal employees who are interested in expressing their concerns on this site can do so as private, concerned citizens **but are not permitted to indicate affiliation with their federal agency** when doing so via the FCC site.

Two different proceedings and sets of comments dealing with spectrum issues involving GOES can be read on the FCC website. Comments from a variety of sources as well as links through which new comments can be submitted can be found at the following links. Sharing these links with our cooperators would help inform them of the issues.

Proceeding 10-123: <http://apps.fcc.gov/ecfs/proceeding/view?name=10-123>

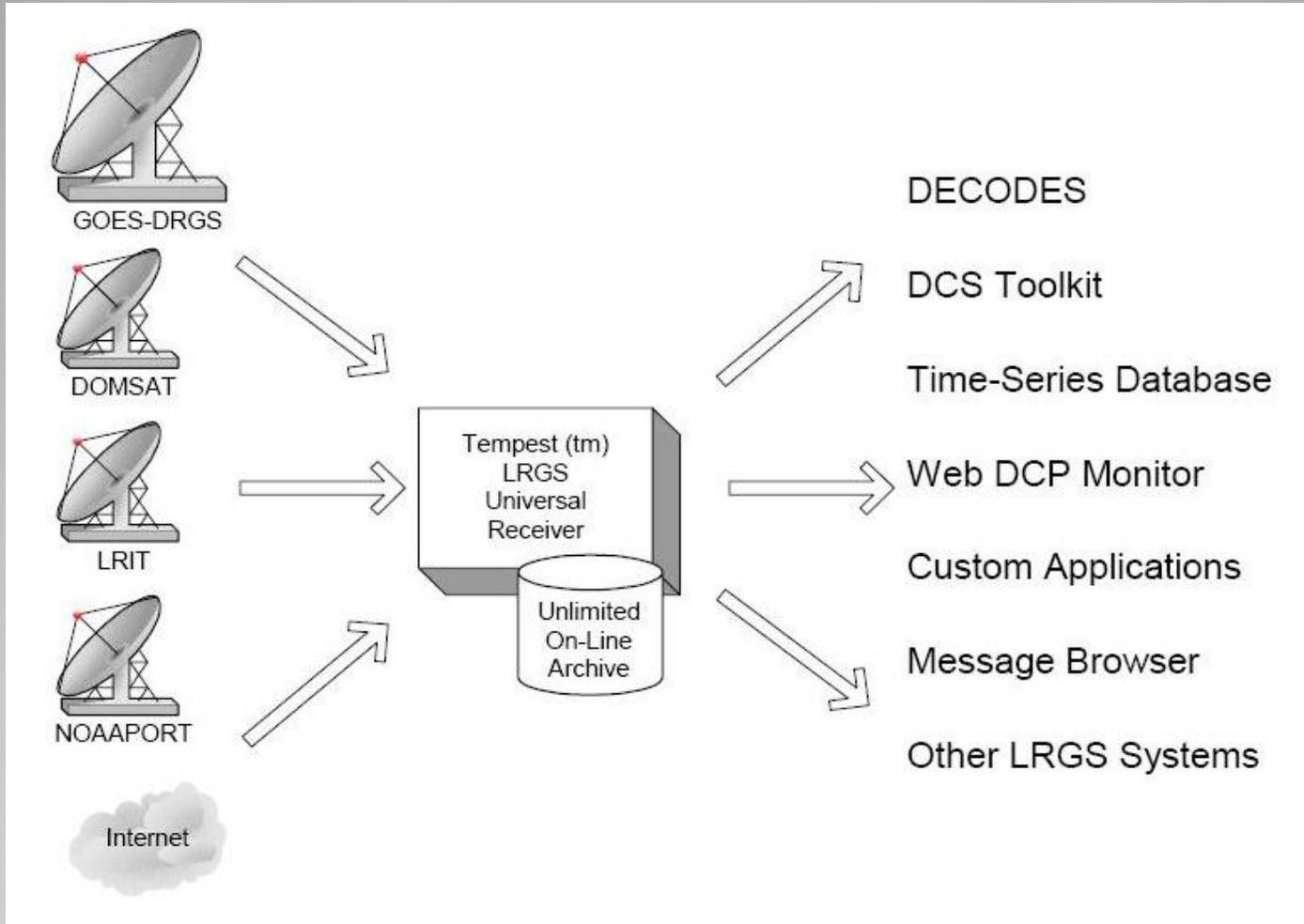
and

Proceeding 12-340: <http://apps.fcc.gov/ecfs/proceeding/view?name=12-340>

## Avenues of Information

# Types Under Discussion

Cellular  
Iridium/other  
Meteorburst/Extended LOS  
VHF/UHF Line Of Site



**Where Will It Go?**

## **Websites to know:**

<http://eddn.usgs.gov/>

<http://eddn.usgs.gov/msgaccess.html>

<https://dcs1.noaa.gov/>

[http://www.ntia.doc.gov/category/spectrum-  
management](http://www.ntia.doc.gov/category/spectrum-management)

<http://acwi.gov/hydrology/stiwig/>

<http://www.goes.noaa.gov/index.html>