



Fifty Years of Operational Environmental Satellites: The U.S. Experience

Satellite and Information Services
Administration

The United States launched TIROS-1, the first

satellite of the earth

with television cameras

and video recorders

and power and communications systems

TIROS-1 provided weather forecasters

with their first view of cloud formations as they

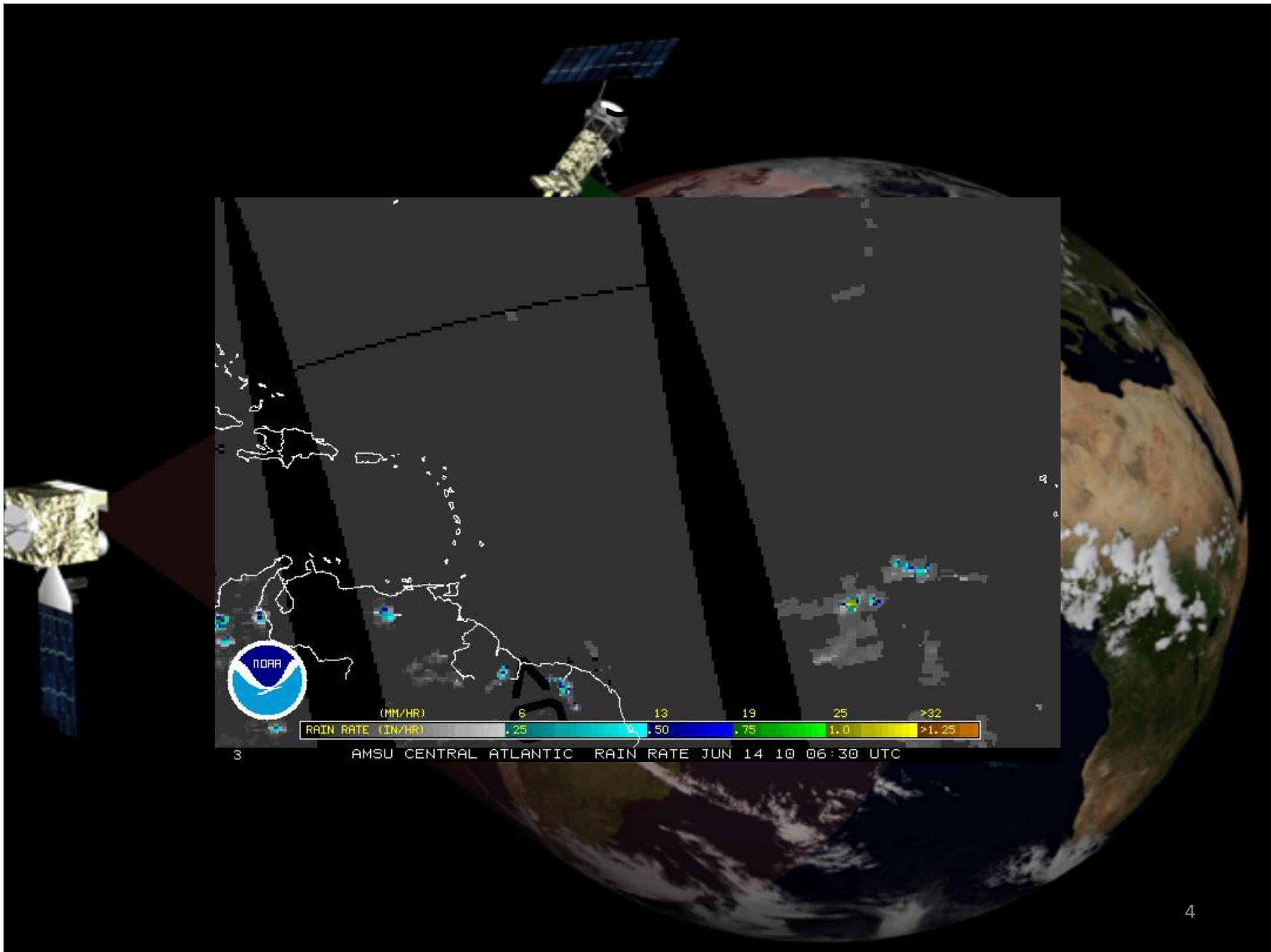
- developed and moved across the earth

TIROS I Satellite Launch.

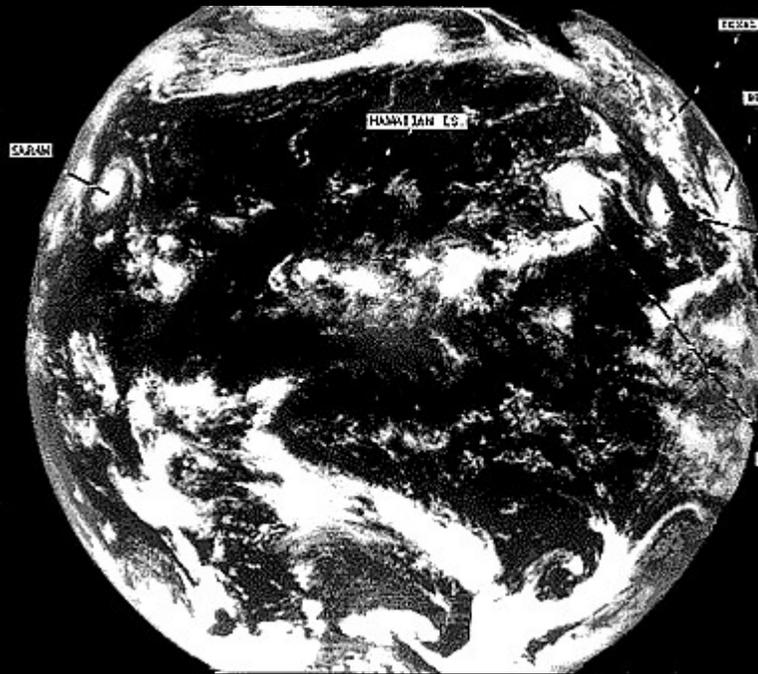


IR

- Since the launch of TIROS-1, the United States has
- Expanded from visible to infrared imagery
- Measured vertical temperature and moisture profiles
- (Soundings) using infrared and microwave instruments
- Added space weather sensors
- Added ozone sensors
- Developed a series of data products used in weather
- Forecasting and climate monitoring
- Moved from high altitude geostationary satellites (1975) to
- Low altitude polar orbit

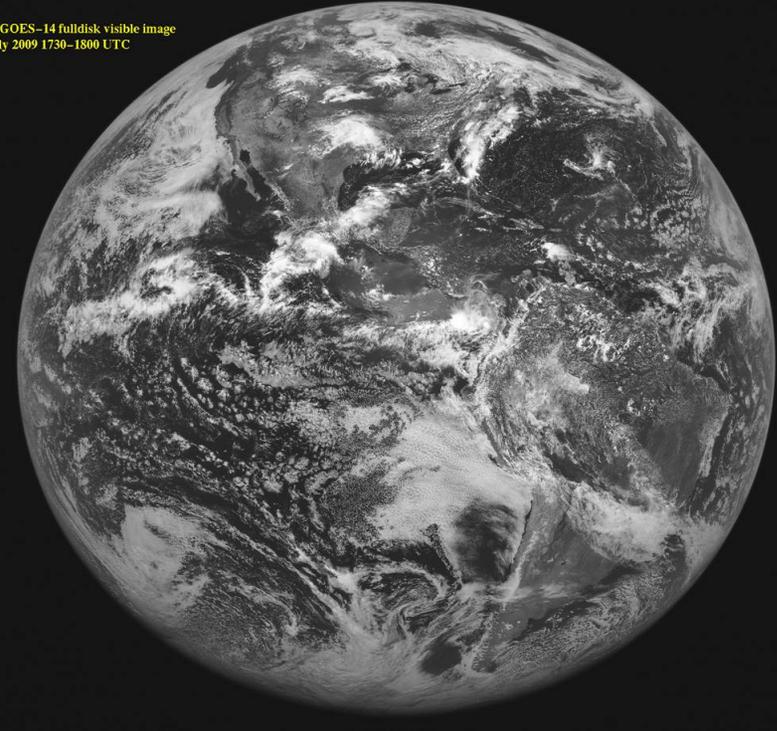


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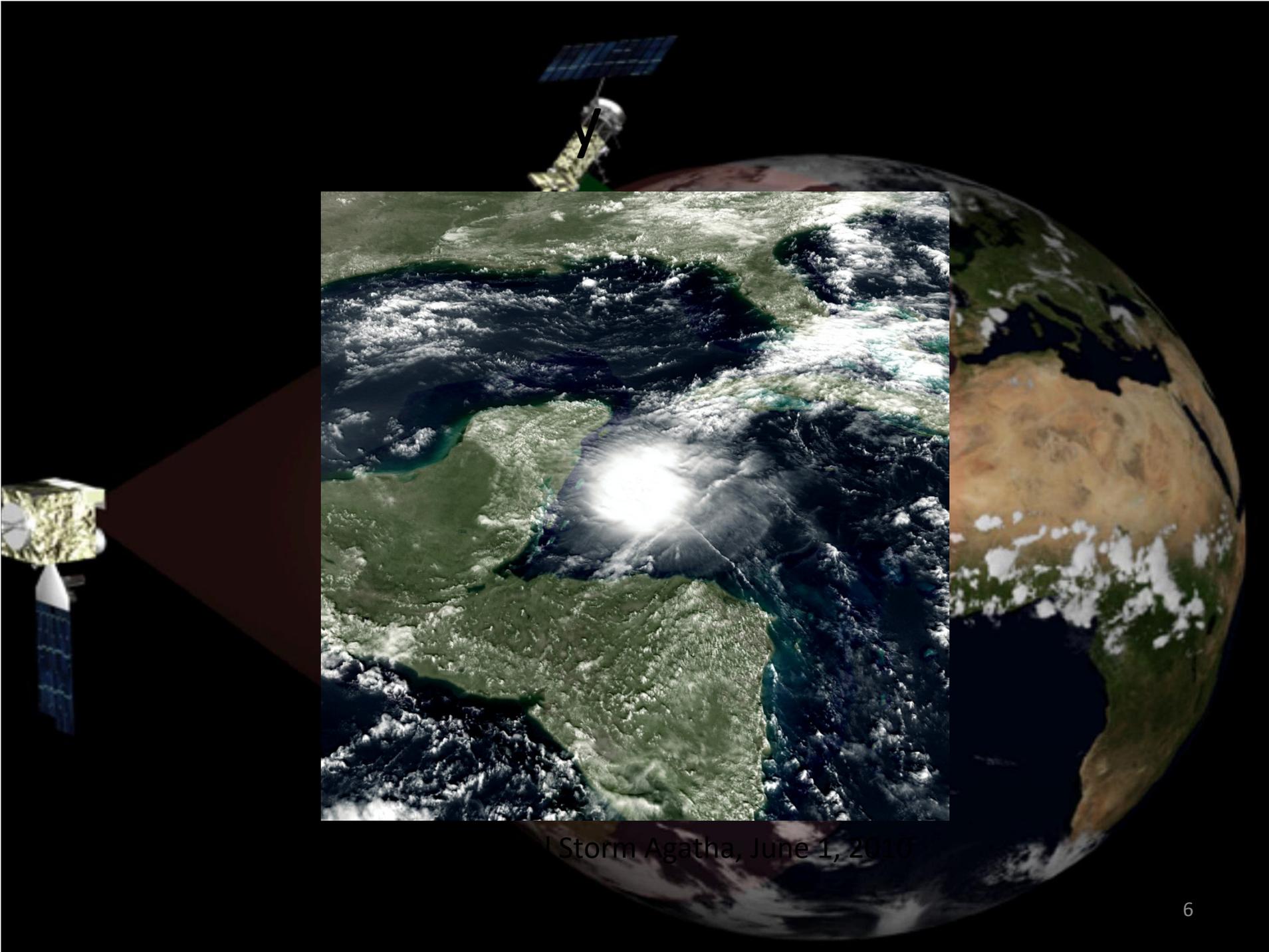


First image from Geostationary (ATS-1, 1967)

First GOES-14 full-disk visible image
27 July 2009 1730-1800 UTC



Today's GOES Visible image

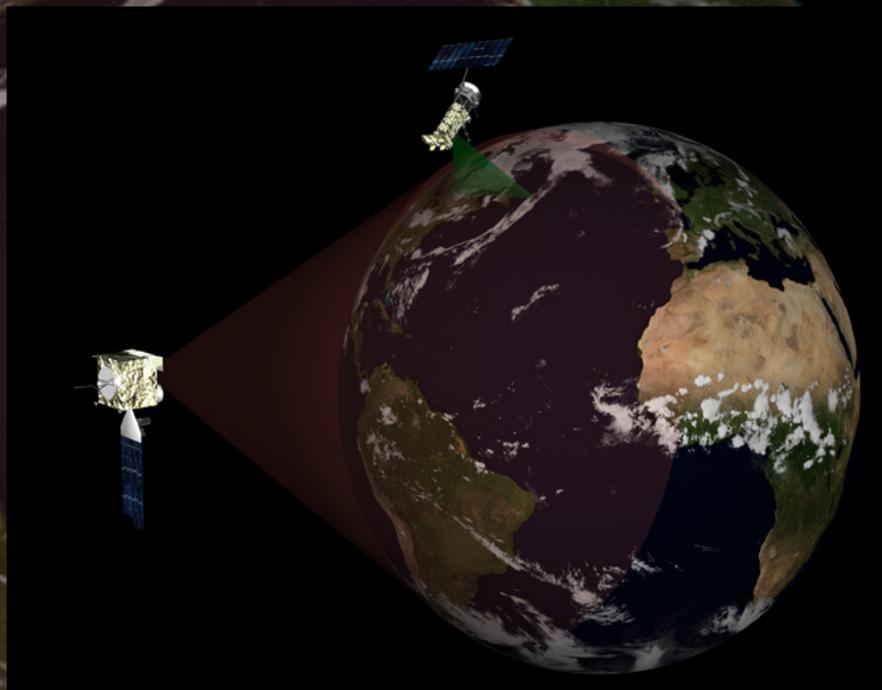


Tropical Storm Agatha, June 1, 2010

Using Satellites for Forecasting

• Two polar-orbiting satellites
• One orbits at mid-morning
• One orbits at equatorial crossing
• One with an early afternoon
• One with a (13:30) equatorial crossing

- Two geostationary satellites
 - One at 75 degrees West (off the west coast of the U.S.)
 - One at 135 degrees West (off the east coast of the U.S.)





Joint Satellite Observations

Continuity of satellite observations is critical
Satellite data is an important input to numerical weather models
Satellite products are used by local weather forecasters
Satellite data supports watches and warnings of severe weather

Continuity is threatened by

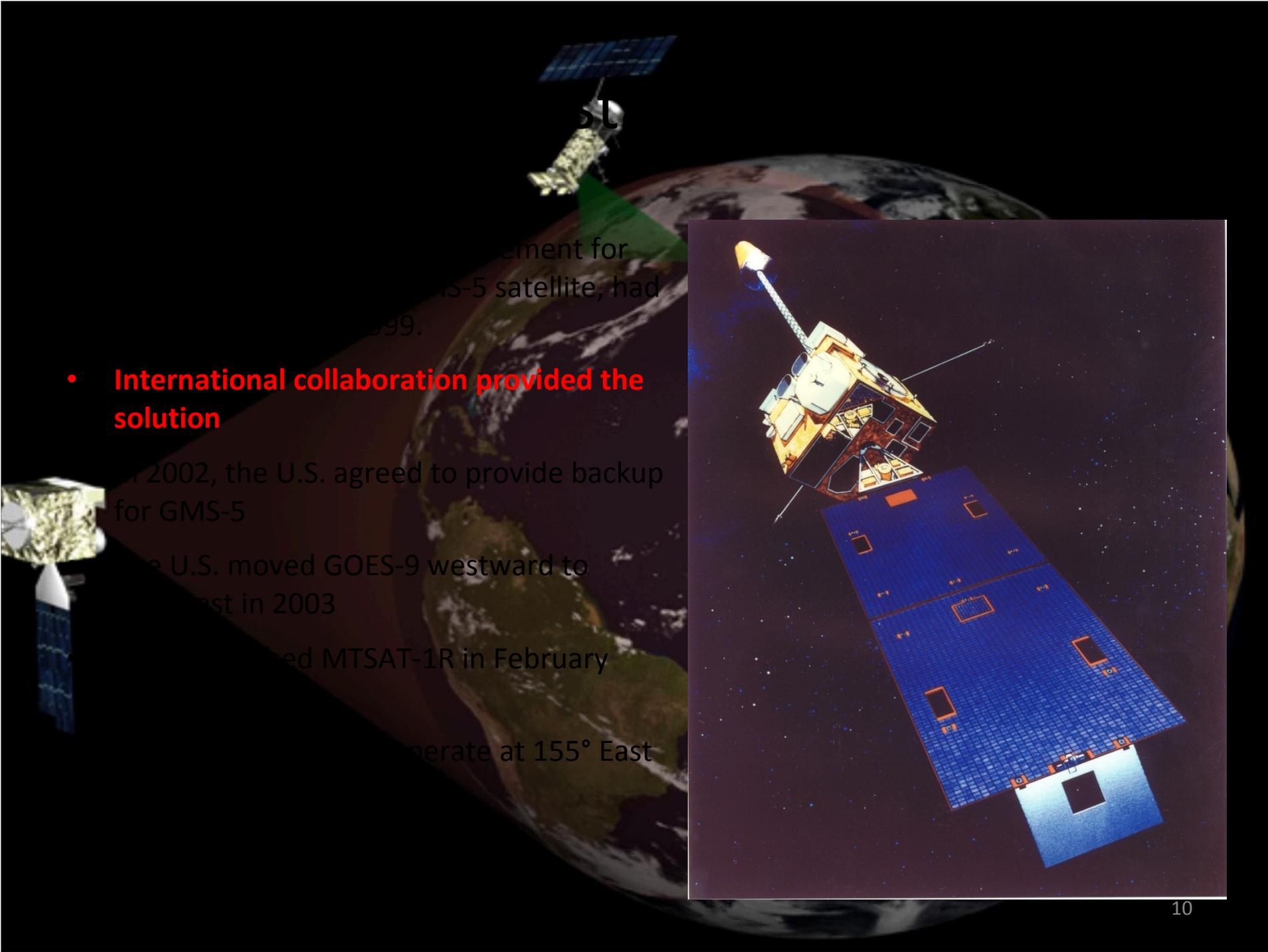
- Launch failures
- On-orbit failures prior to the completion of satellite design life
- Launch delays caused by satellite development problems
- Rapidly increasing cost of satellite development

- **International collaboration has proven to be a means of mitigating the threats to satellite continuity**

GOES operation



- In 1986, lightning struck the GOES-G launch vehicle, destroying the satellite
- GOES-I, the first of a new generation of satellites, had major development problems causing a 5 year schedule slip
- These events caused the GOES constellation to drop to a single satellite on orbit in 1990
- **International collaboration provided the solution**
- From 1991 to 1995, the European Meteosat-3 was operated, first at 50 degrees West, then at 75 degrees West, in support of the U.S.
- Data from Meteosat-3 was especially important in forecasting the landfall and intensity of Hurricane Andrew in 1992



SL

... agreement for
... S-5 satellite, had
... 1999.

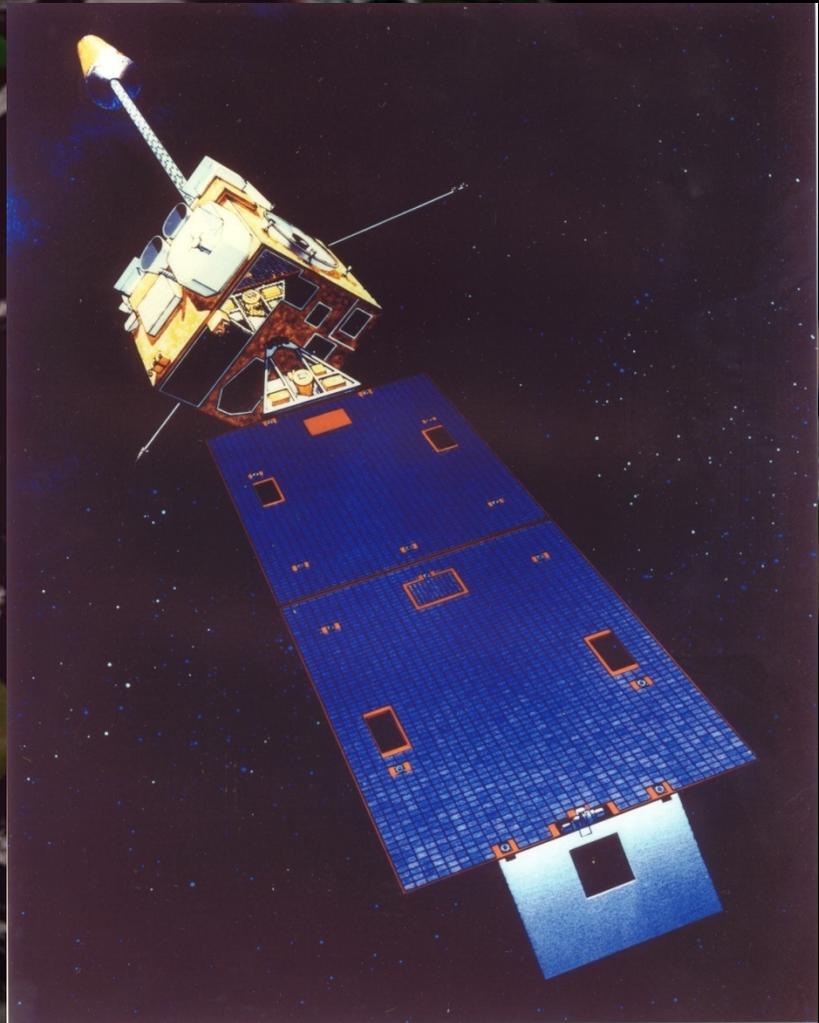
- **International collaboration provided the solution**

... 2002, the U.S. agreed to provide backup
for GMS-5

... the U.S. moved GOES-9 westward to
... east in 2003

... MTSAT-1R in February

... operate at 155° East





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– Despite growing in cost and complexity, and despite performance improvements, satellite costs have actually decreased in recent years

– Demand for higher resolutions and new capabilities

– The U.S. and Europe want data from polar satellites in mid-morning and early afternoon orbits

– Yet the cost of maintaining satellite continuity in two polar orbits is more than either the U.S. or Europe wants to shoulder on its own

- **International collaboration provides the solution**

– Europe has taken responsibility for the mid-morning orbit

– The U.S. has taken responsibility for the early afternoon orbit

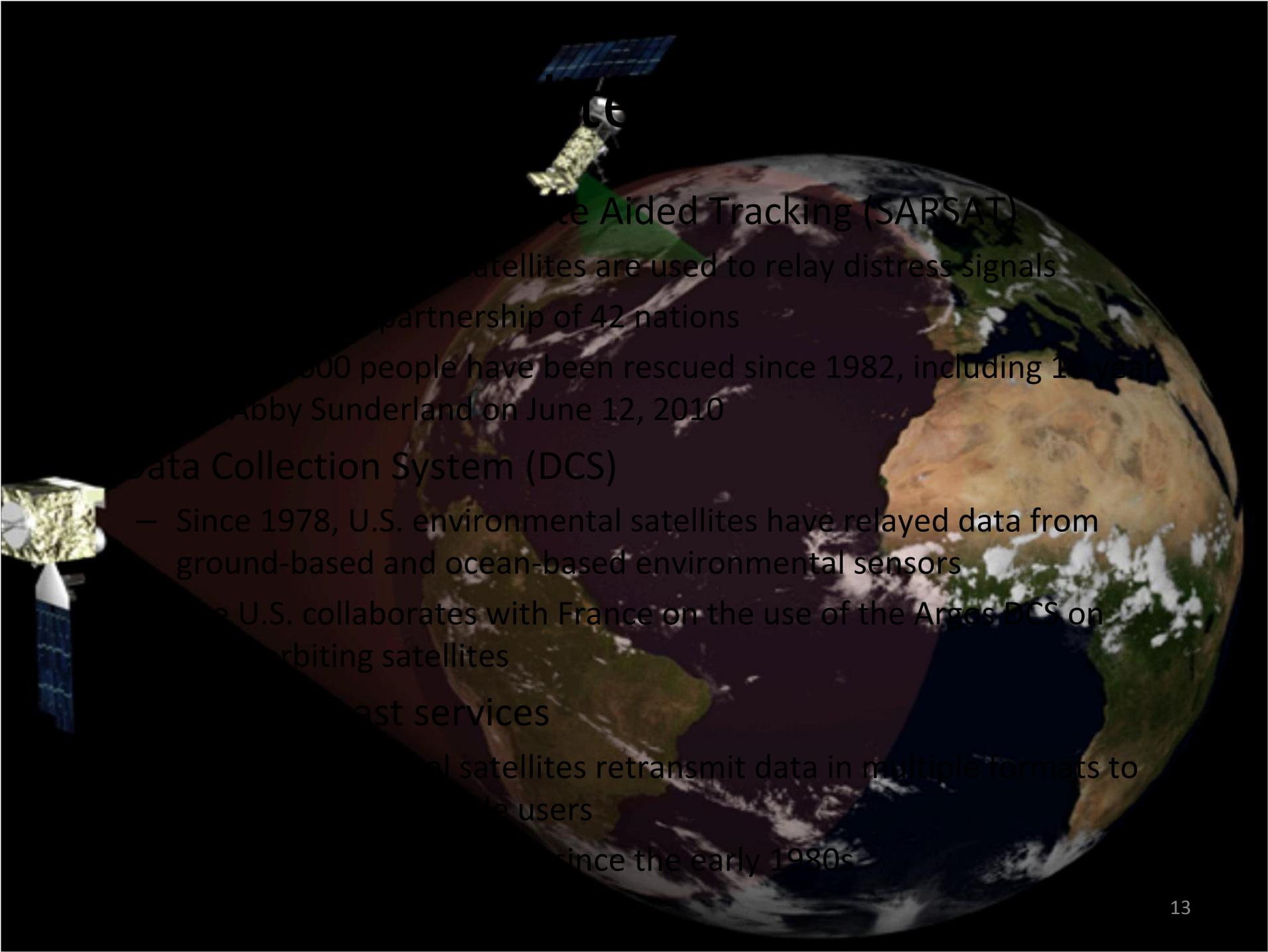
– Each has provided some of the other's instruments on its satellites

– They have had a data exchange since 2007

– The current cooperation to include other nations

Research to Operations





Search and Rescue Satellite

Search and Rescue Satellite Aided Tracking (SARSAT)

Search and Rescue Satellites are used to relay distress signals

– A partnership of 42 nations

– Over 10,000 people have been rescued since 1982, including 18 year old

– Abby Sunderland on June 12, 2010

Environmental Data Collection System (DCS)

– Since 1978, U.S. environmental satellites have relayed data from ground-based and ocean-based environmental sensors

– The U.S. collaborates with France on the use of the Argos DCS on orbiting satellites

– Provides coast services

– Environmental satellites retransmit data in multiple formats to multiple users

– Data is available since the early 1980s



Group on Earth Observations

• Collecting Earth observations

• No one satellite can afford to collect all the observations it needs

- **Multilateral international collaboration is vital to divide up this massive task amongst space-faring nations**

• International environmental satellite organizations are working to achieve “virtual constellations” and environmental data sharing

• Group on Earth Observations (GEO)

• Committee on Earth Observation Satellites (CEOS)

• World Meteorological Organization (WMO) Space Program

• Global Meteorological Group for Meteorological Satellites (CGMS)

- **The U.S. is committed to full, open, and timely sharing of environmental data across international boundaries**