International Cooperation at NASA

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Agenda

- **International Cooperation**
  - Overview
  - Guidelines
  - Challenges
- **International Cooperation by Mission Directorate**
- **NASA Engagement with Non-traditional Partners**
  - Several examples
- **Looking Forward**
  - Some International Issues
- **Summary**

International Cooperation: Overview

- International cooperation at NASA:
  - Is directed by the National Aeronautics and Space Act that created NASA in 1958 and continues to be part of national space policy
  - Has been a cornerstone of NASA's activities throughout its history
  - Includes over 3,000 agreements with over 100 nations
  - Brings multiple benefits to NASA and its partners
  - Is pursued for a variety of reasons, through a combination of choice and necessity
- Current international cooperation:
  - Nearly 500 active international agreements
  - 8 partners account for 50% of the agreements (France, Germany, ESA, Japan, UK, Italy, Canada, Russia)
  - By mission area: 2/3 are in science missions
  - By region: 1/2 are with partners in Europe

NASA has clear guidelines for international cooperation

- NASA international partners are generally government agencies due to the significant level of investment and legal requirements
- Each Partner funds its respective contributions, but contributions need not be equivalent
- Cooperation must be consistent with U.S. foreign policy objectives
- Projects/Partnerships:
  - Must have scientific and technical merit
  - Must demonstrate a specific benefit to NASA, support Mission Directorate activities
  - Are structured to protect against unwarranted technology transfer
  - Are structured to establish clearly defined managerial and technical interfaces to minimize complexity
  - Are documented in a written, binding agreement, closely coordinated with the U.S. Department of State and other U.S. government agencies

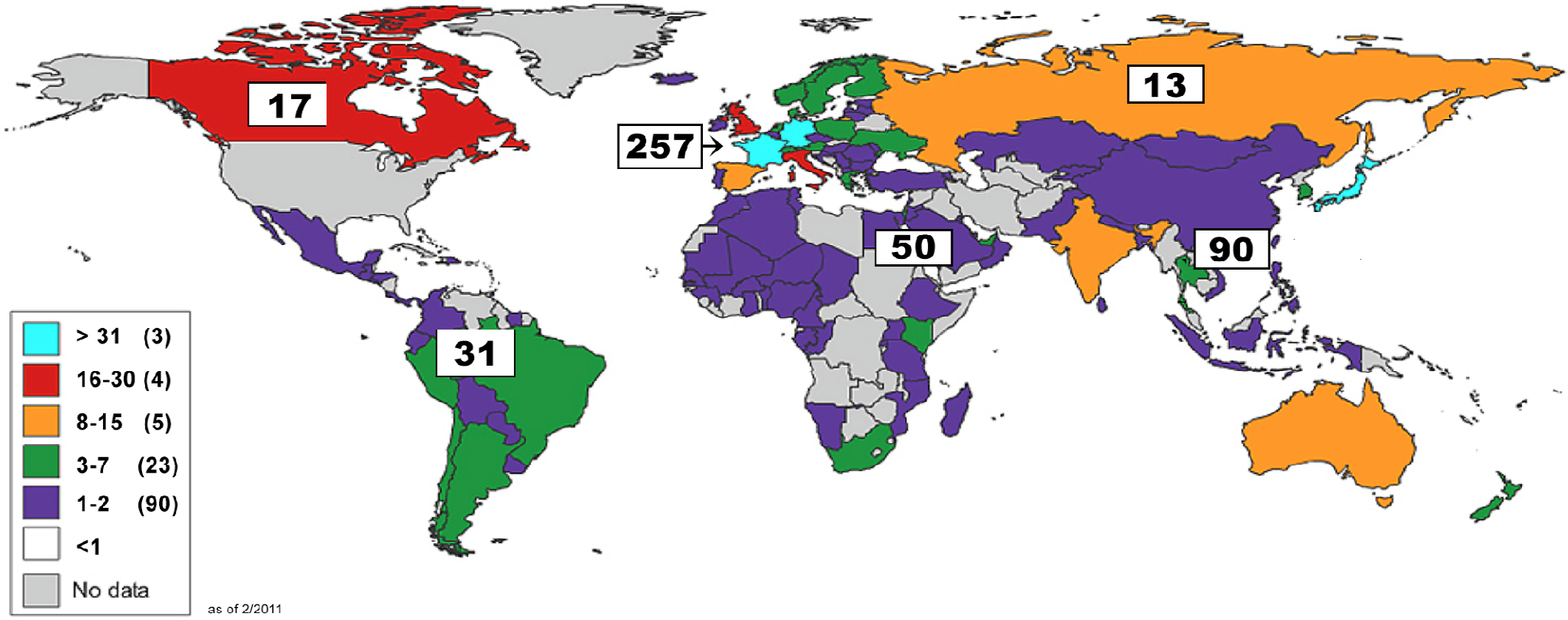
Challenges to Cooperation

- **Management Complexity**
  - Decision-making
    - Complexity grows with number of partners
    - Timing of decisions
    - Who is in charge?
  - Communications difficulties
  - Differing specifications, standards and assumptions
- **Technical and Programmatic Risk**
  - The “critical path” – open for discussion
  - Interfaces difficult to manage at a distance
  - Difficult to monitor progress and get early warning of problems
- **Political Risk**
  - Budgetary and bureaucratic uncertainties
  - Potential linkage to activities unrelated to the cooperation

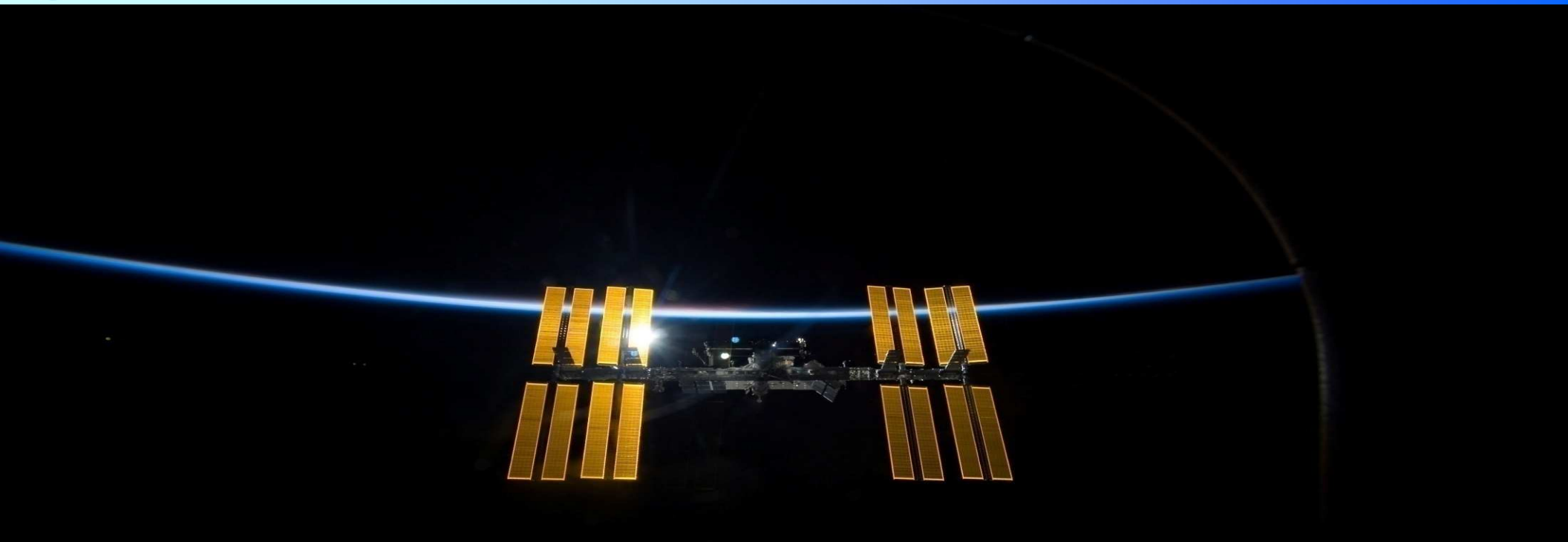
Global Reach: Current International Cooperation

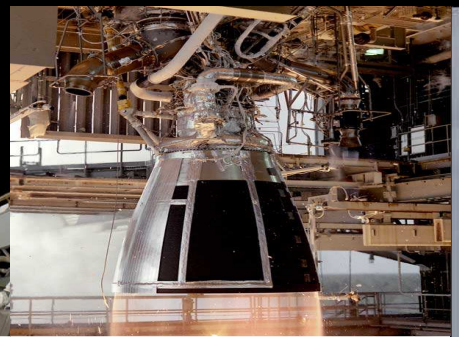
Total International Agreements = 464

Total Countries: 125



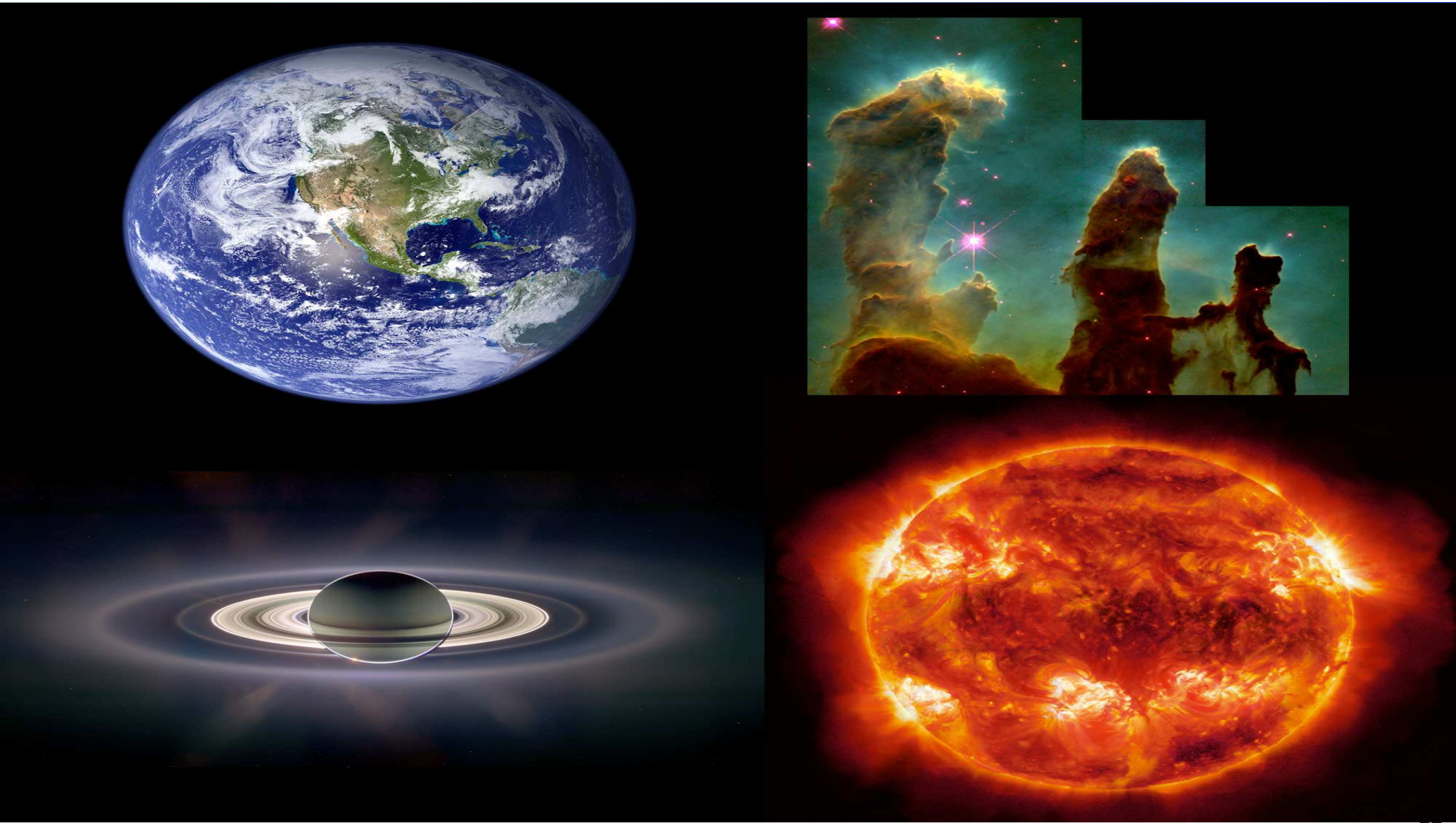
Space Operations





Exploration: Future Systems

NASA Aeronautics Research

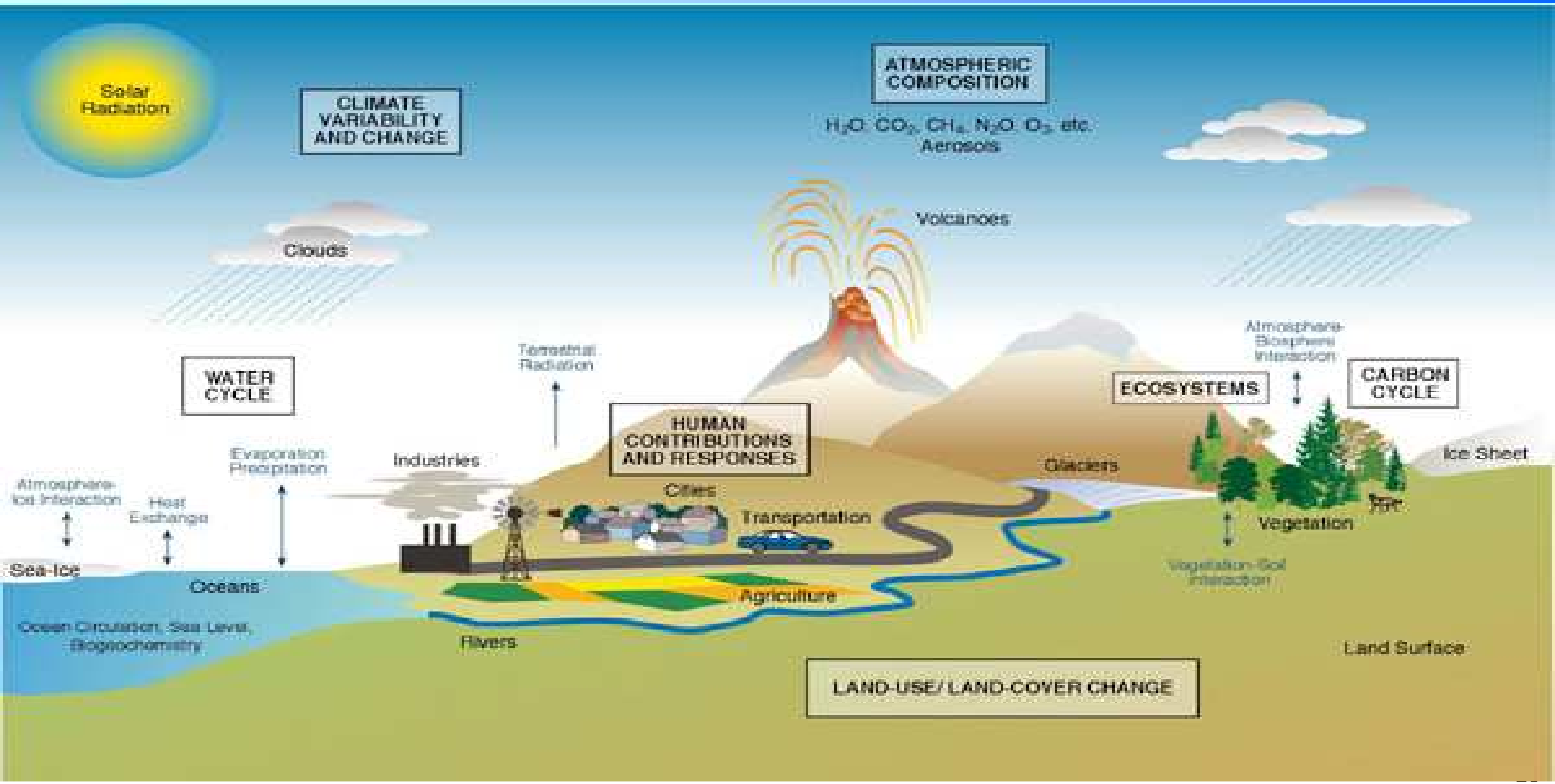



Earth Science
OSTM/Jason 2
Jason
QuikSCAT
ACRIMSAT
Landsat-7
EO-1
Aqua
SORCE
TRMM
Terra
GRACE
ICESat
CALIPSO
CloudSat
Aura
Astrophysics
XMM-Newton (ESA)
Swift
Suzaku (JAXA)
Fermi
INTEGRAL (ESA)
RXTE
GALEX
Herschel (ESA)
Planck (ESA)
WMAP
WISE
Hubble
Kepler
Chandra
Spitzer
Deep Impact (Epoxi)
Hayabusa
Messenger
Stardust-NExT
Mars Express
Cassini
Chandrayaan-1 (M3)
Rosetta
New Horizons
Mars Odyssey
MRO
Mars Rovers
Phoenix
DAWN
Planetary Science
Voyager 1 & 2
TIMED
Geotail
RHESSI
Wind
SOHO
Hinode (Solar B)
FAST
ACE
STEREO
TRACE
Cluster
THEMIS
AIM
TWINS A & B
CINDI/CNOFS
IBEX
Heliophysics

Engagement with Non-traditional partners

- Efforts to engage non-traditional partners have been ongoing, mostly in support of NASA's science objectives, with a focus on benefits to society through education and Earth science applications
  - Building on existing relationships
  - Establishing new relationships
- These efforts are conducted in close coordination with other USG agencies and are consistent with Administration emphasis on S&T cooperation and STEM initiatives
- Recent initial NASA engagements have resulted in significant interest:
  - NASA presentations in Abu Dhabi, Bangkok, Melbourne
  - In 2010 NASA officials met with counterparts from UAE, Saudi Arabia, Oman, Thailand, Malaysia, Indonesia, Egypt, Qatar, Kenya, Vietnam, Nigeria and Nepal to discuss potential benefits of cooperation
  - Workshop in DC in 2010 wiih participation of representatives from 10 Latin American countries
- Initial NASA focus is on opportunities that are:
  - Mutually beneficial
  - Easy to implement at low cost
  - High impact in terms of results/societal benefits

How is space used to help society?



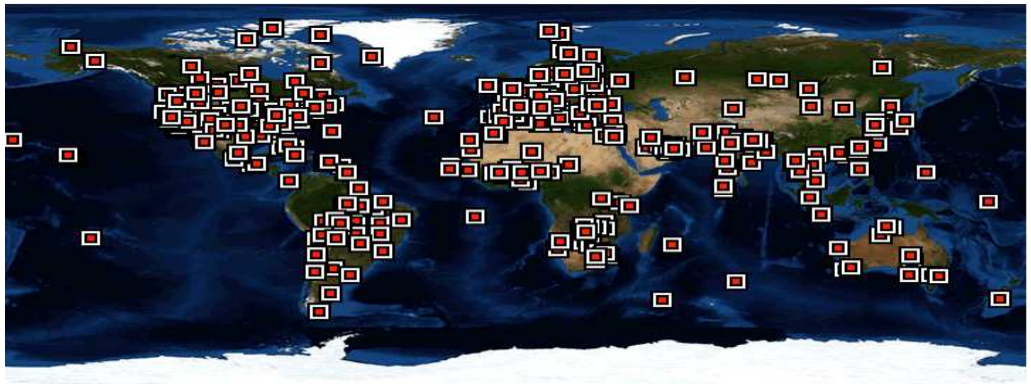
Numerous opportunities exist for substantive collaboration

- Examples include scientific research, Earth science applications and education initiatives, but cooperation in all programmatic areas is welcome

- Examples of ongoing cooperation:
  - Aerosol Robotic Network (AERONET)
  - Global Learning and Observations to Benefit the Environment (111 countries)
  - SERVIR (Central America, East Africa, Himalaya region)
  - Space Geodetic Network
  - Space Communications Network
  - International Space Weather Initiative
  - Digital Learning Network
  - NASA Lunar Science Institute

The Aerosol Robotic Network

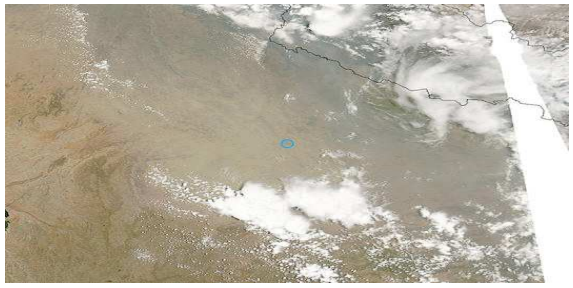
- AERONET is an optical, ground-based, aerosol-monitoring network and data archive, providing vital information about aerosols in the atmosphere.
- NASA has active sensors at over 350 sites in 86 countries and territories.

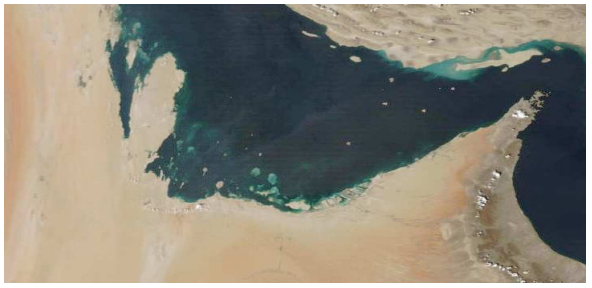


- AERONET provides a long-term, continuous and readily accessible database of various aerosol properties for research and characterization, validation/calibration of satellite retrievals

NASA works with a variety of partners on AERONET

- NASA collaborates with national agencies, institutes, universities, and individual scientists to provide global societal benefits
  - With ISRO to measure monsoons and thunderstorms over India
  - With a Thai University (Chulalongkorn) & Vietnam to measure aerosol distribution and the impacts from weather in SE Asia.
  - With the UAE to measure aerosols in the Middle East, one of the largest concentrations of atmospheric aerosols in the world.
- The AERONET office welcomes new partnerships and is eager to expand the network
- More information at: http://aeronet.gsfc.nasa.gov/





The Global Learning and Observations to Benefit the Environment

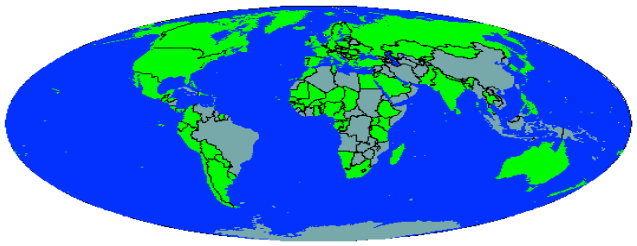
- NASA partners with NOAA and NSF on GLOBE, an internet-based education program for students, teachers and scientists who work together to understand the environment
- Students take measurements that can then be shared with others around the world, using the internet to record the data
- Through classroom activities, fieldwork and international collaboration, students develop a better understanding of the Earth's environment on a local, regional, and global basis

THE GLOBE PROGRAM
CONNECTING THE NEXT GENERATION OF SCIENTISTS

The GLOBE Program

- The network of schools involved in GLOBE continues to grow, providing unique learning opportunities and contributing useful science
  - GLOBE schools are in over 111 countries
  - Over 1.5 million students have participated in GLOBE
  - Over 54,000 teachers have been trained to work with GLOBE
  - Over 23,000 schools are GLOBE members
  - Over 21 million measurements have been taken as part of the GLOBE program

- More information about GLOBE is at: http://globe.gov/



Schools on every continent participate in GLOBE

Africa (22)

- Benin
- Burkina Faso
- Cameroon
- Cape Verde
- Chad
- Congo
- Ethiopia
- Gabon
- Gambia
- Ghana
- Guinea
- Kenya
- Madagascar
- Mali
- Namibia
- Niger
- Nigeria
- Rwanda
- Senegal
- South Africa
- Tanzania
- Uganda

Asia-Pacific (16)

- Australia (GLOBE site)
- Bangladesh
- Fiji
- India (GLOBE site)
- Japan (GLOBE site)
- Korea, South
- Maldives
- Marshall Islands
- Micronesia
- Mongolia
- Nepal (GLOBE site)
- New Zealand (GLOBE site)
- Palau
- Philippines
- Sri Lanka
- Thailand (GLOBE site)

111 GLOBE Partner Countries

Europe-Eurasia (40)

- Austria
- Belgium
- Bulgaria
- Croatia (GLOBE site)
- Cyprus
- Czech Republic (GLOBE site)
- Denmark (GLOBE site)
- Estonia (GLOBE site)
- Finland (GLOBE site)
- France
- Germany (GLOBE site)
- Greece (GLOBE site)
- Hungary (GLOBE site)
- Israel
- Iceland
- Ireland
- Italy (GLOBE site)
- Kazakhstan
- Kyrgyzstan
- Latvia (GLOBE site)
- Liechtenstein
- Lithuania (GLOBE site)
- Luxembourg
- Macedonia (GLOBE site)
- Malta
- Moldova
- Monaco
- Netherlands (GLOBE site)
- Norway (GLOBE site)
- Poland (GLOBE site)
- Portugal
- Romania
- Russia
- Serbia and Montenegro
- Spain
- Sweden
- Switzerland (GLOBE site)
- Turkey
- Ukraine
- United Kingdom (GLOBE site)

Near East-North Africa (13)

- Bahrain
- Egypt
- Jordan
- Kuwait
- Lebanon
- Mauritania
- Morocco
- Oman
- Pakistan
- Qatar
- Saudi Arabia
- Tunisia
- United Arab Emirates

Latin America-Caribbean (18)

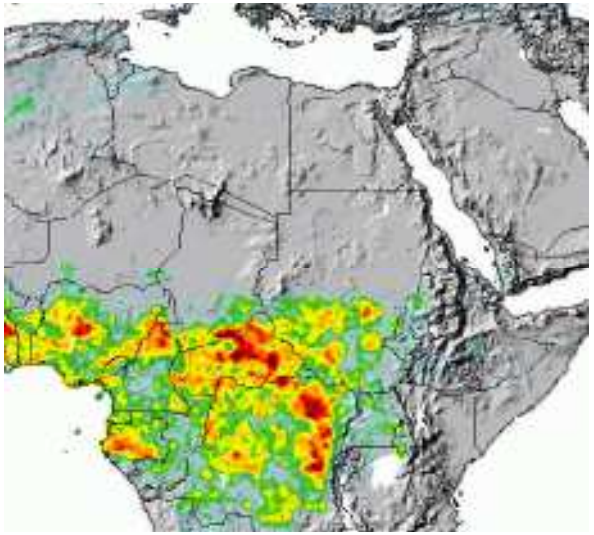
- Argentina (GLOBE site)
- Bahamas
- Bolivia
- Chile
- Colombia
- Costa Rica
- Dominican Republic
- Ecuador
- El Salvador
- Guatemala
- Honduras
- Mexico
- Panama
- Paraguay
- Peru (GLOBE site)
- Suriname
- Trinidad and Tobago
- Uruguay

North America (2)

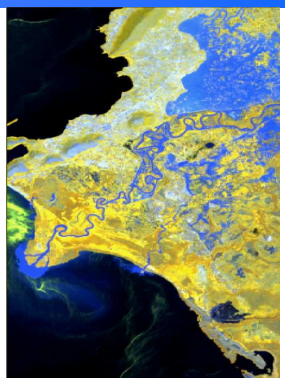
- Canada (GLOBE site)
- United States of America

SERVIR: an inventive way to monitor environmental changes and respond to natural disasters

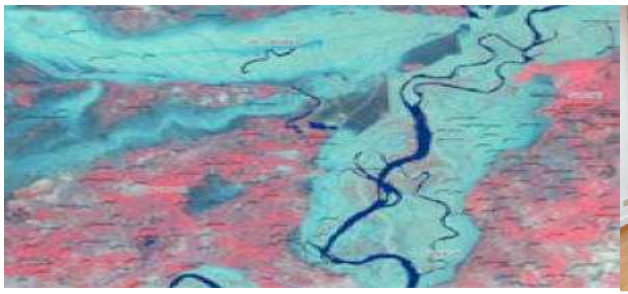
- NASA partners with USAID to use Earth observation/predictive models for the benefit of society
- SERVIR integrates satellite observations, ground-based data and forecast models to monitor environmental changes and to improve response to natural disasters (floods earthquakes, landslides, earthquakes)
- Three facilities currently exist, with plans to expand to other regions:
  - SERVIR Central America (Panama)
  - SERVIR Africa (Kenya)
  - SERVIR Himalaya (Nepal)



SERVIR assists decision makers and scientists



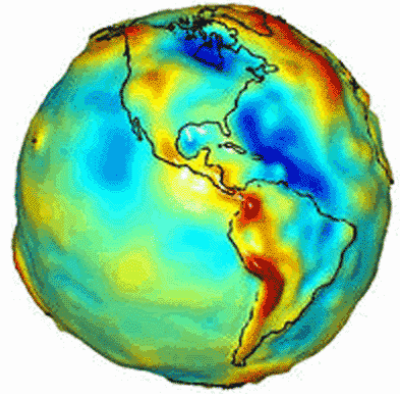
- The central concept is to get critical information into the hands of decision makers for societal benefit, while also using SERVIR data for education and capacity building
- SERVIR provides information to decision makers related to:
  - Disaster Analysis
  - Environmental Monitoring
  - Air Quality Assessment
  - Climate Change and Biodiversity
  - Short Term Weather Prediction
  - Flood forecasting
- SERVIR info is online at: http://www.nasa.gov/mission_pages/servir/index.html



Space Geodesy and Geodynamics Research

- **Cooperation with 16 countries on six continents to answer key questions:**
  - How do tectonics and climate interact to shape the Earth's surface and create natural hazards?
  - What are the interactions among ice masses, oceans and the solid Earth and their implications for sea level change?
  - What are the dynamics of the Earth's gravity and magnetic fields?
  - Are we using water resources in a sustainable fashion?

- **These Space Geodetic Systems techniques allow us to understand the exact position of ground based systems, precise orbits of spacecraft and the location of Earth in the cosmic framework as key enablers of research activities:**
  - Satellite Laser Ranging
  - Very-Long Baseline Interferometers
  - Global Navigation Satellite System
  - Other geodetic imaging techniques



Looking Forward: Some International Issues

- **International Space Station**
  - Confirmation by ISS member agencies of continued funding for ISS operations to 2020
  - Utilization of ISS: presentations in February 2011 to the 62 nation UN Committee on the Peaceful Uses of Outer Space (COPUOS)
  - Future crew transportation and rescue: mix of commercial and government developed vehicles
  - Resupply (future US capability, HTV, ATV, Russian “Progress” vehicles)

- **Space Exploration**
  - Strong international interest in cooperation with NASA -- in some cases, the U.S. program will have direct implications on international partner planning and budgets
  - How will cooperation evolve as NASA’s budget situation is clarified?
  - The Global Exploration Strategy dialogue will continue via the International Space Exploration Coordination Group, with bilateral discussions in parallel

Looking Forward: Some International Issues

- **Meeting existing commitments**
  - Successful implementation of existing international cooperation is important for NASA credibility
  - Open and transparent dialogue as NASA plans evolve is also a critical component of that credibility

- **“Non-traditional” partnerships**
  - Although ½ of our international agreements are already in this category, we continue to reach out to non-traditional partners in Africa, the Middle East, and Asia
  - Working with other USG agencies such as USAID, we must find an appropriate balance between NASA program objectives and expanding collaboration with non-traditional partners that responds to societal needs

Summary

- **International cooperation will remain very important to NASA**
  - ISS: a mature program, a model for future activities of this scale
  - Exploration: many potential partners, ongoing discussions
  - Science: will remain the most active international Mission Directorate, likely focus for non-traditional partners
- **Well structured international cooperation can contribute significantly to national goals of each partner**
- **We anticipate continuing opportunities for international cooperation, particularly with our traditional partners in space exploration and science**
- **NASA also welcomes discussions with potential new partners in areas of mutual interest, particularly in regions of the world in which NASA currently has little cooperation**