GPS-Related Applications, Benefits and Policy Engagement

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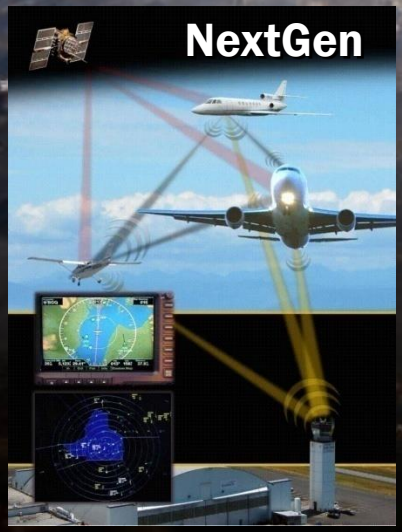
Ray E. Clore
Senior Advisor for GNSS Issues
Office of Space and Advanced Technology
U.S. Department of State

Overview

- GPS Applications
- Some Economic Benefits from GPS
- U.S. Geospatial approach and one program
- U.S. Space-Based PNT Policy and International Implementation Activities
- Summary

GPS enables a diverse array of applications



Personal
Navigation

GPS Offers Enormous Value to Developing Nations

- Obviates need to develop local infrastructure for positioning, navigation, and timing
  - Example: Availability of GPS time eliminates need to build terrestrial time distribution networks
- Supports a wide range of sustainable development activities including:
  - Surveying, mapping, GIS
  - Construction, mining
  - Agriculture
  - Timing for telecom, banking, power grid management
  - Disaster management
  - Environmental stewardship

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Economic Benefits of GPS in U.S.

Excerpted from NDP Consulting report commissioned by the "Save Our GPS Coalition" in 2011

- "We estimate that the value to the U.S. economy of the productivity gains and input cost reductions alone amounts to between $68 billion and $122 billion per year, or 0.5 to 0.9 percent of annual U.S. gross domestic product."
- The report estimates **$67.6 billion in direct economic benefits** due to annual productivity increases and cost savings in precision agriculture ($19.9 billion), engineering construction ($19.9 billion), transportation ($28.2 billion), and other commercial GPS uses ($28.2 billion).
- "In addition, GPS technology creates direct and indirect positive spillover effects, such as emission reductions from fuel savings, health and safety gains in the work place, time savings, job creation, higher tax revenues, and improved public safety and national defense.
- Today, there are **more than 3.3 million jobs that rely on GPS technology**, including approximately 130,000 jobs in GPS manufacturing industries and 3.2 million in the downstream commercial GPS-intensive industries."

Improved U.S. Agricultural Productivity (courtesy of John Deere- 2011)

- **Yield Mapping – used by 80% of grain combine customers in U.S.**
  - Provides insight for precise seed placement, pesticides and fertilizers
- **Auto Guidance – used by 65% of the large agriculture producers in U.S.**
  - Reduced errors in overlap of tillage, seeding and spraying
  - Reduced operator fatigue
  - Opportunity to use local unskilled operators
- **Improved Output**
  - Reduced overlap = fewer passes through the field
  - Less compaction implies higher yield
  - Less tillage required – less fuel, less carbon release and lower food cost
- **Future Gains**
  - Additional advancements needed to feed a growing population

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Conclusions Rio +20

www.uncsd2012.org/rio20

- **Geospatial S &T is part of the Rio +20 outcome document: paragraphs 186 and 274. It is a positive story.**
- **GEOSS and EOE are specifically mentioned.**
- **The language of the outcome text in "The World We Want" Rio +20 is less explicit than in the Johannesburg Implementation Plan of 2002 about geospatial science & technology (GST). The Rio +20 document almost assumes wide adoption of GST.**
- **Today's information economy assumes / requires use of these tools in order to tackle most of the Sustainable Development Goals.**
- **We need to continue and build on innovative public-private partnerships in GST that have proven to be sustainable from WSSD to Rio +20.**

SERVIR: The Regional Visualization and Monitoring Service

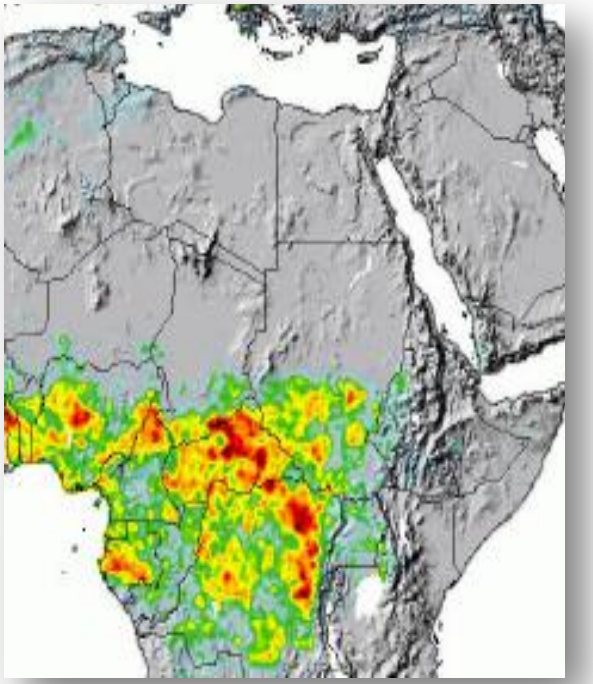
A NASA-USAID project to improve environmental management and resilience to climate change by strengthening the capacity of governments and other key stakeholders to integrate earth observation information and geospatial technologies into development decision-making

www.servirglobal.net; **www.nasa.gov/servir**

USAID FROM THE AMERICAN PEOPLE

SERVIR Goals

- Improved Access to Data, Models, Online Maps, Visualizations
- Strengthening the Capacity of Regional Institutions, Stakeholders, and Youth
- Decision Support Tools and Services
- Partnerships



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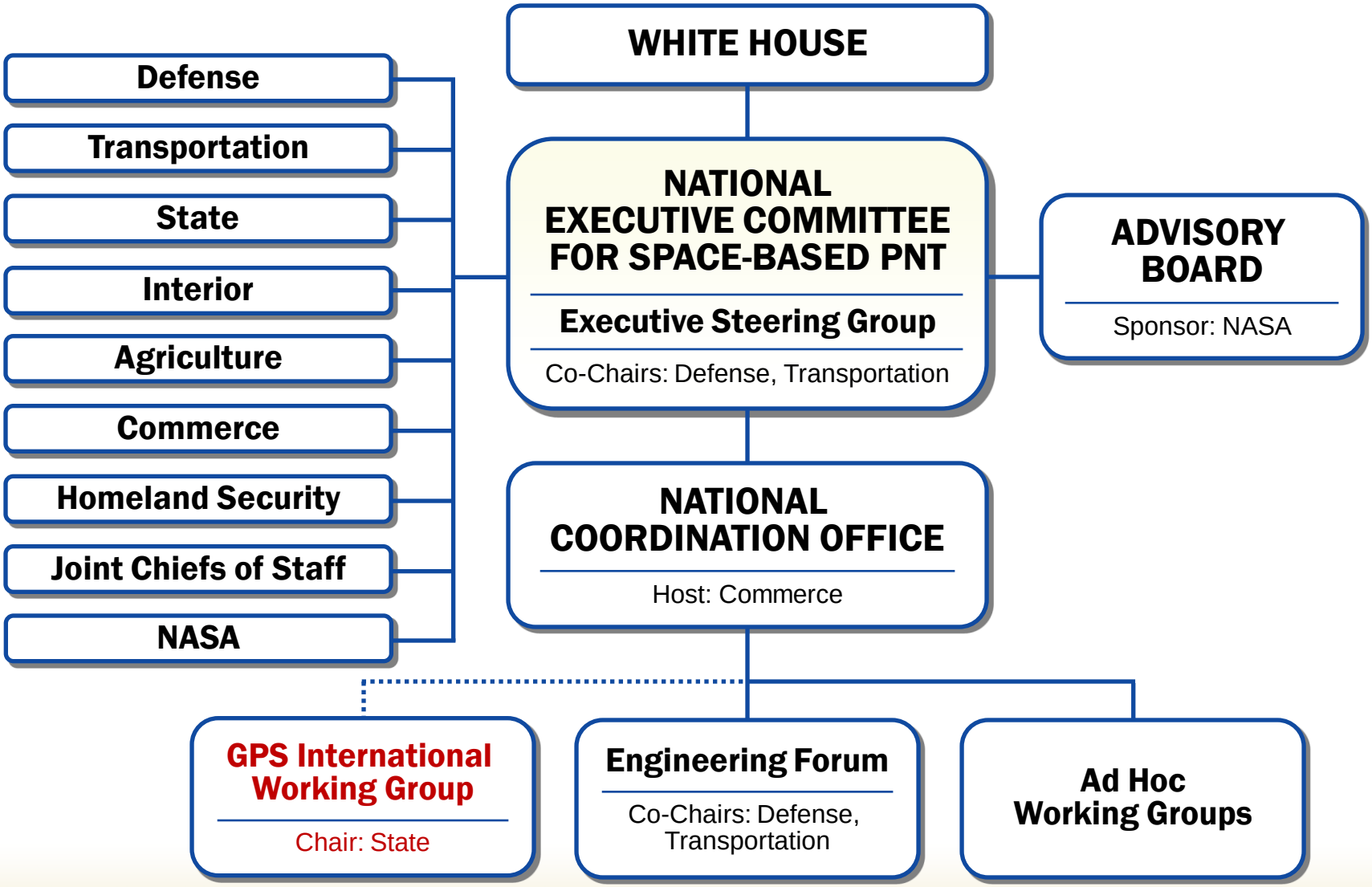
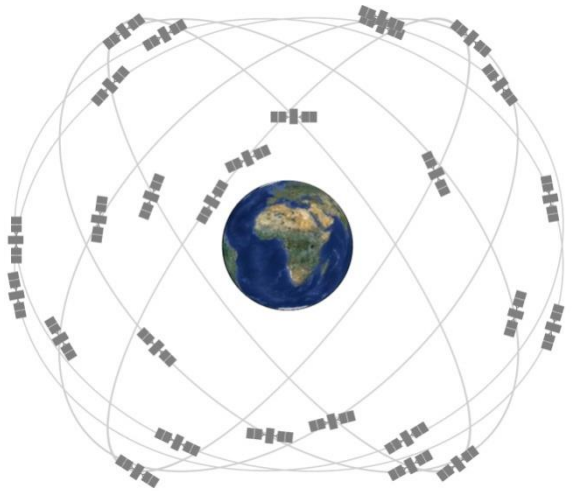
U.S. Space-Based PNT Organization Structure



GPS Constellation Status

30 Satellites Operational
As of May 2013

- "Expandable 24" configuration (27 slots)
- 8 Block IIA
- 12 Block IIR
- 7 Block IIR-M
- 3 Block IIF
- 4 residuals on orbit



- Continuously assessing constellation health to determine launch need
- Best ever User Range Error at 51 cm

New Civil GPS Signals

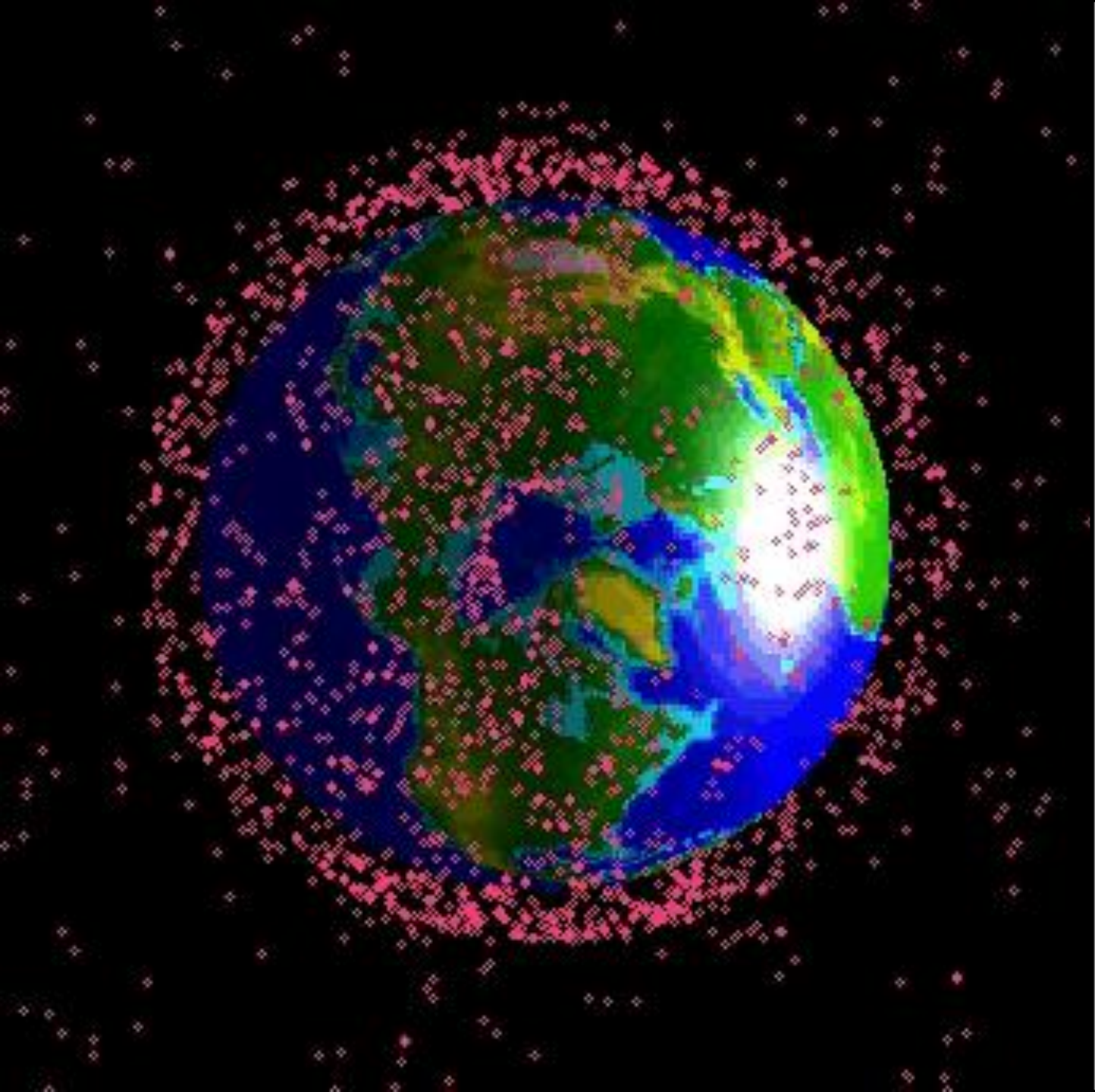
Signal	Benefits	# of Satellites Broadcasting Now	Availability on 24 Satellites
L2C	Meets commercial needs for ionospheric correction, higher effective power, etc.	10	~2018
L5	Meets requirements for safety-of-life transportation; enables triple-frequency positioning techniques	3	~2021
L1C	GNSS interoperability; performance improvements in challenged environments	Will start with GPS III in 2015	~2026

Planned Global and Regional Space-Based Navigation Systems

- Global Constellations
  - **GPS (24+)**
  - GLONASS (30)
  - Galileo (27+3)
  - Compass (27+3 IGSO + 5 GEO)
- Regional Constellations
  - QZSS (4+3)
  - IRNSS (11)
- Satellite-Based Augmentations
  - **WAAS (3)**
  - MSAS (2)
  - EGNOS (3)
  - GAGAN (2)
  - SDCM (3)

International Cooperation

- U.S. goals for GNSS cooperation:
  - Compatibility and interoperability
  - Transparency in civil service provision
  - Fair market access
  - Detecting, mitigating, and increasing resiliency to harmful interference
- Bilateral relationships
  - Russia, Europe, Japan, India, Australia, China
- Multilateral engagement
  - ICG, APEC, ICAO, IMO, ITU, NATO



Space debris, operations, and Space Situational Awareness (SSA) are global challenges

Big sky paradigm no longer assures safety of flight

SSA improvement helps

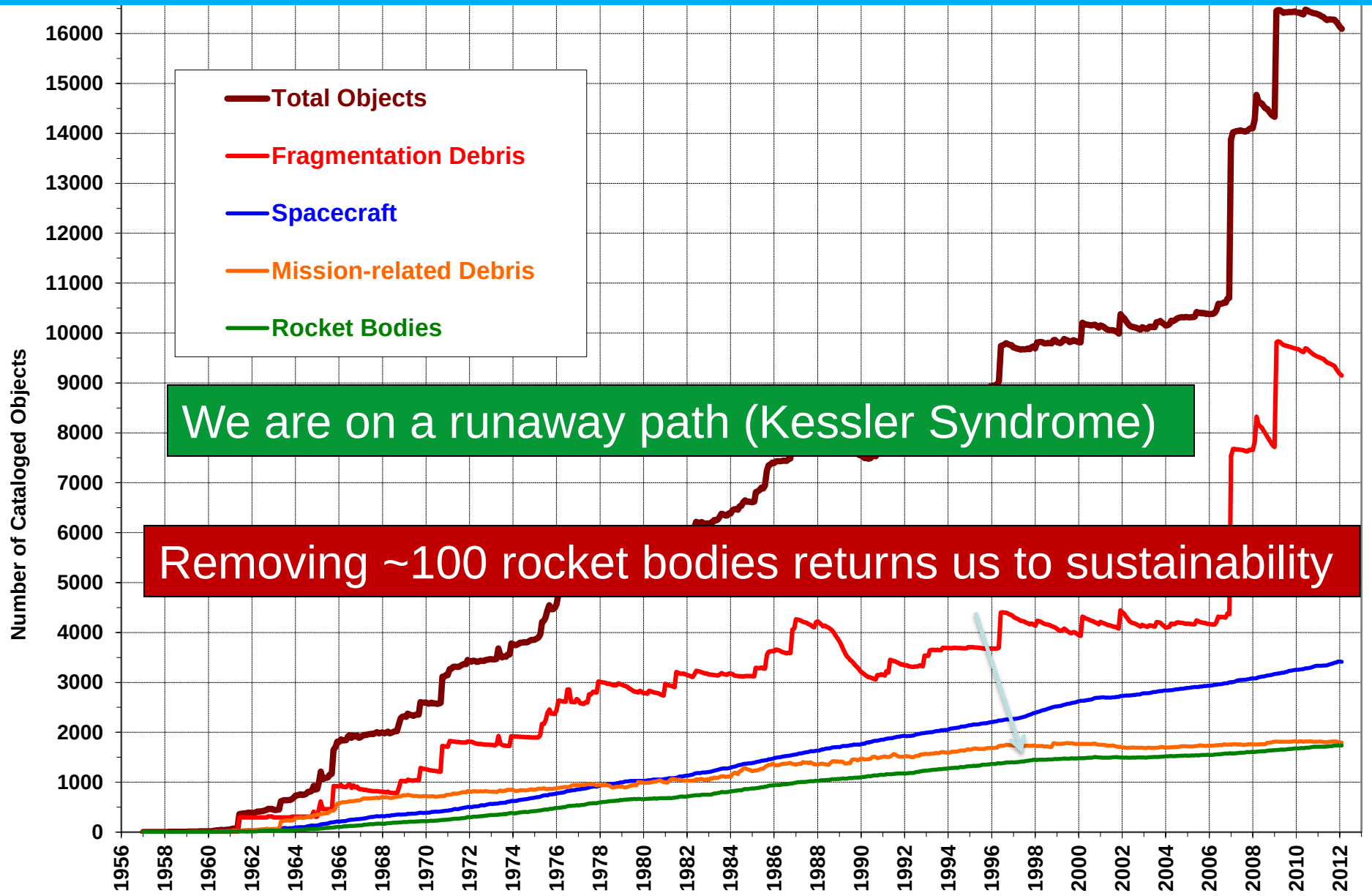
Many active satellites have no maneuver capability

Vigorous U.S. lead and international participation in UN space group

Space Debris: Why is it a problem?

- NASA Don Kessler predicted in 1978 that objects in earth orbit would collide and create more debris – chain reaction (Kessler Syndrome)
- Different views on when syndrome starts: soon…
- When it really starts, satellite lifetimes could be measured in years or months
- Many satellite-based or enabled applications could become impaired
- Threat to manned missions in LEO may be too great to continue

Monthly Number of Catalogued Objects in Earth Orbit by Object Type



International Committee on GNSS (ICG)

- Emerged from 3rd UN Conference on the Exploration and Peaceful Uses of Outer Space July 1999
  - **Promote the use of GNSS** and its integration into infrastructures, particularly in developing countries
  - Encourage **compatibility and interoperability** among global and regional systems
- Members include:
  - **GNSS Providers** (U.S., EU, Russia, China, India, Japan)
  - Other Member States of the United Nations
  - International organizations/associations
- First meeting held November 2006 and then annually
- **ICG-7** was held in Beijing in November 2012, and **ICG-8** will take place in November 2013 in Dubai

Summary

- GPS /GNSS supports many applications including geo-spatial information systems
- **SERVIR** - a NASA-USAID partnership supports geo-spatial information training and use in developing countries – www.servirglobal.net
- GPS constellation robust, with best ever accuracy and availability
- **Space debris** is an increasing threat to space-based applications – international cooperation needed to ensure sustainable use of space