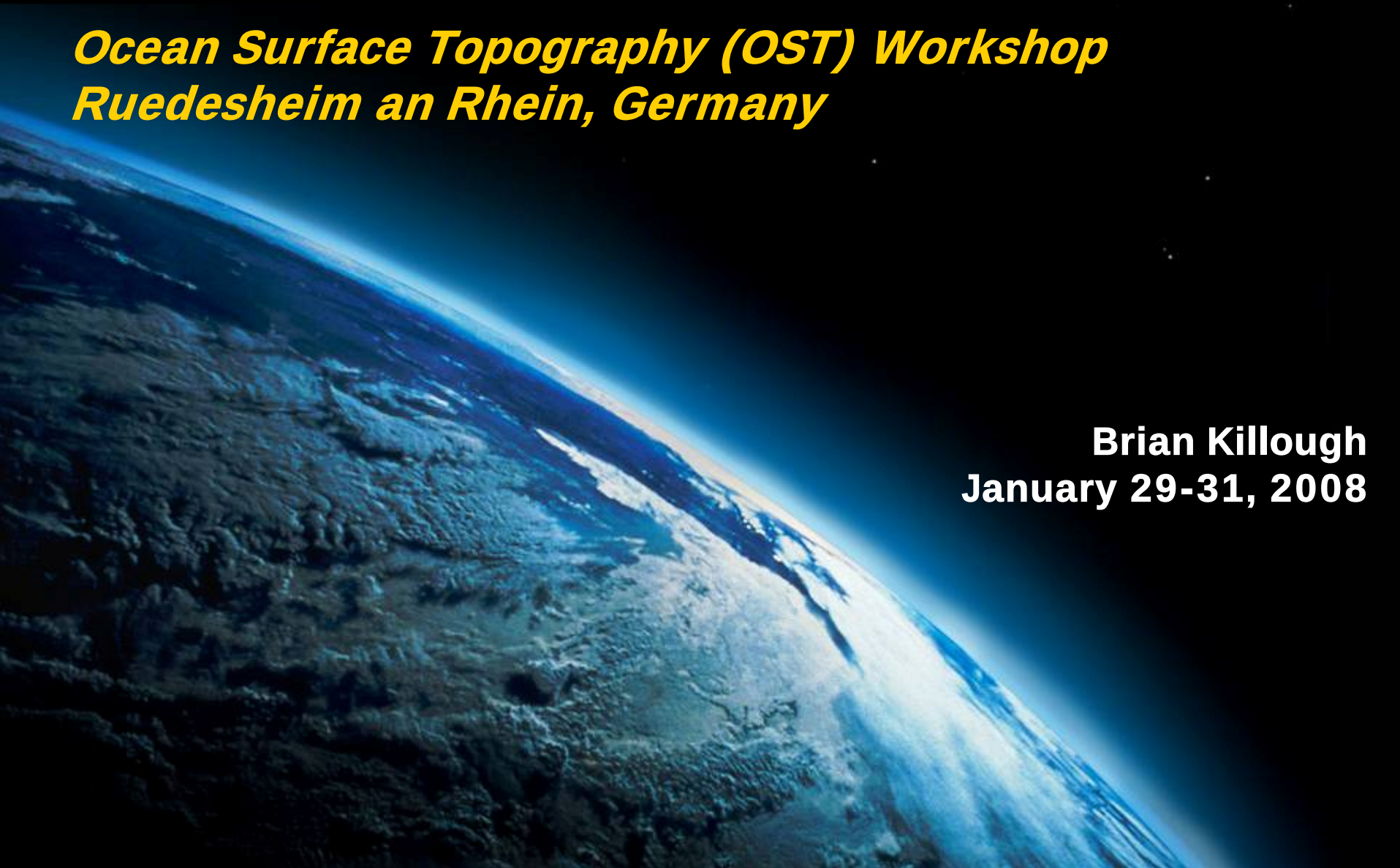
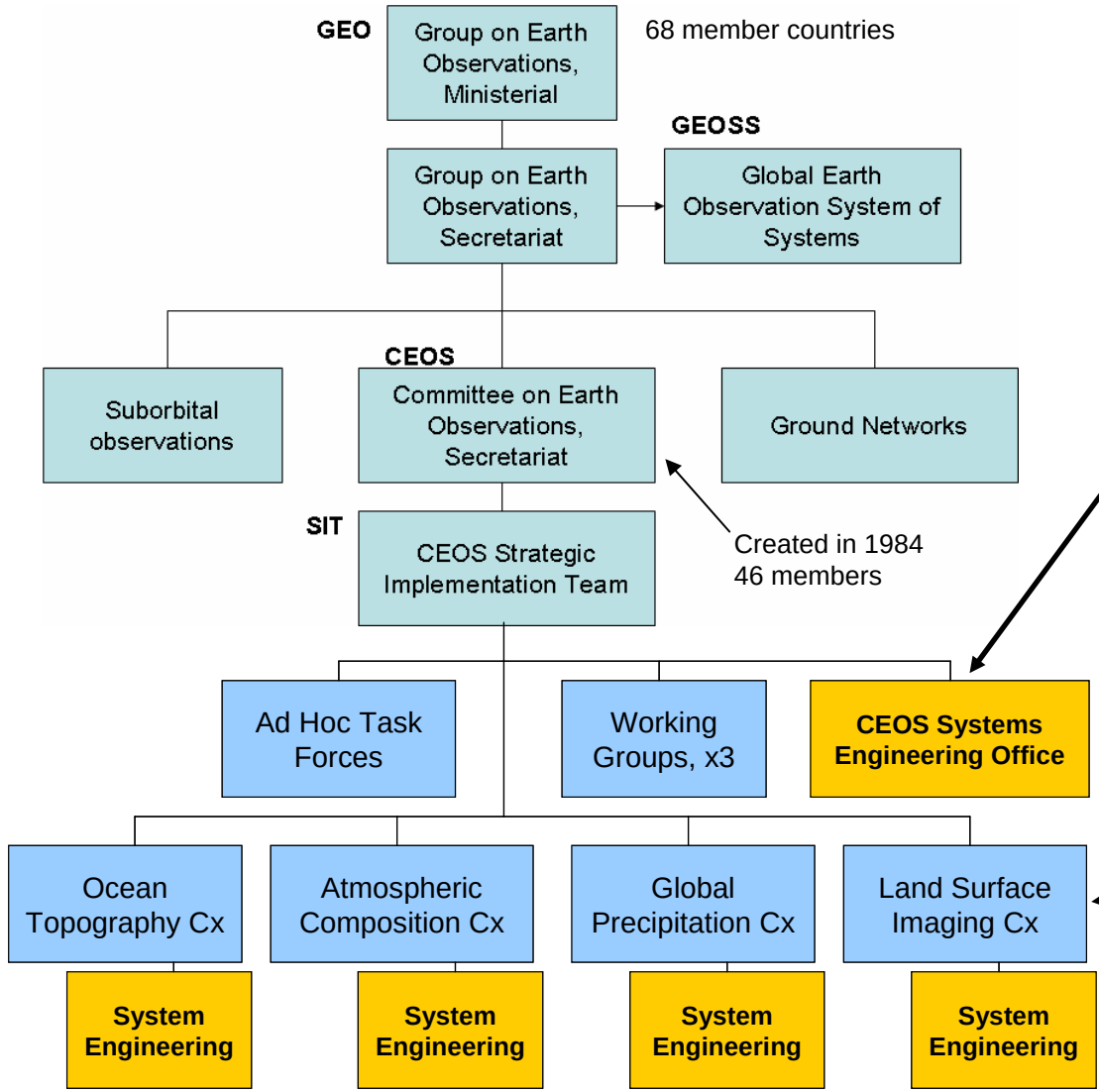
Committee on Earth Observation Satellites (CEOS)
Systems Engineering Office (SEO)

Ocean Surface Topography (OST) Workshop
Ruedesheim an Rhein, Germany



Brian Killough
January 29-31, 2008

CEOS SEO Background



CEOS Vision: With effective collaboration and less money we could produce more !!!

CEOS Systems Engineering Office (SEO)

NASA LaRC was asked to lead the systems engineering effort in early 2007. The SEO was established in **April 2007** to support the CEOS SIT and the CEOS Constellation Teams.

SEO Charter

- develop a systems engineering framework
- requirements definition
- mission assessment and studies
- constellation architecture planning
- provide decision support tools
- foster communication within CEOS

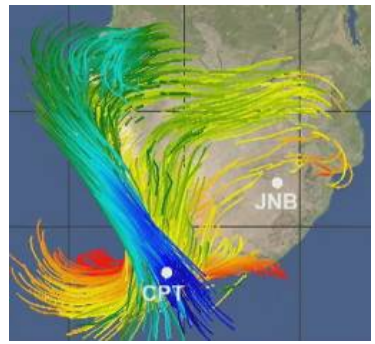
CEOS Constellations

Four constellation groups were created in 2006 to bring about technical and scientific cooperation and collaboration among space agencies.

CEOS SEO 2007 Accomplishments

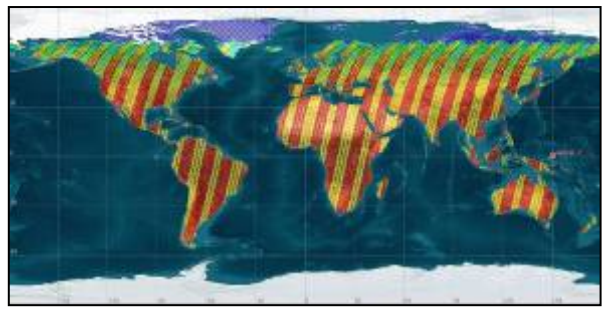
CEOS General Support

- Introduced a new systems engineering framework to facilitate requirements definition and validation.
- Conducted an assessment of the GEO Societal Benefit Area (SBA) observational requirements.
- Produced a CEOS video to support the November CEOS Plenary and the December GEO Summit meetings. Distributed over 300 DVD's globally. The movie was an outstanding success for CEOS !!!
- Initiated and now maintain a CEOS file server to support CEOS management and the Cx teams (over 50 users).



CEOS Constellation (Cx) Team Support

- Managed and funded several constellation projects including a Fire/Smoke Aerosol Project (Jack Fishman, LaRC) and an Atmospheric Composition assessment and gap analysis (Jolyon Reburn, Rutherford Appleton Lab).
- Participated and supported planning of several Cx Workshops, developed draft system requirements and work plans, performed assessments and gap analyses, and facilitated communication with CEOS leaders and CEOS Cx teams.
- Performed concept studies for Atmospheric Composition and Land Surface Imaging.



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CEOS Plenary and GEO Plenary Summary

CEOS Plenary (Hawaii, November 2007)

- CEOS SIT leadership will transition from Barbara Ryan (USGS) to Mary Kicza (NOAA) for 2008. The NOAA team conducted several meetings to become informed about the CEOS issues and to formulate a plan for the future.
- CEOS is focused on short-term progress and accomplishing the action and targets defined by the GEO Work Plan, the GEOSS Implementation Plan and the CEOS Implementation Plan. There is not a consistent plan on how these actions should be addressed in the future and the relationship to SBA's and the Constellation Teams.
- CEOS plans to conduct 2 SIT meetings in 2008. They will be held in April at Woods Hole, Mass (USA) and in September in Japan.
- CEOS will consider new constellations for 2008 and develop a plan for how constellations will be organized and their objectives.

GEO Plenary and Summit Meeting (Cape Town, South Africa, November 2007)

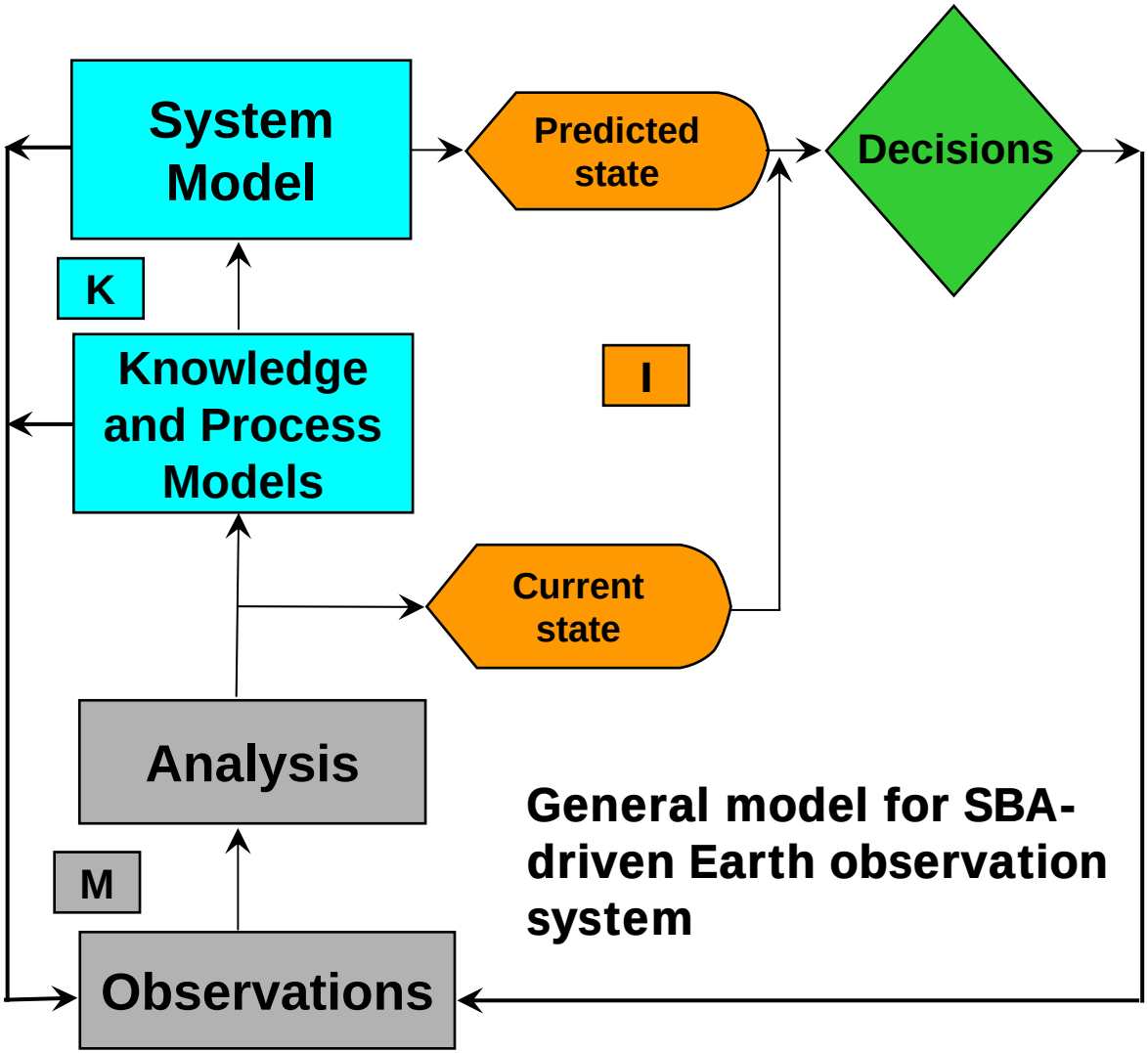
- Large and well attended meeting was focused on education. Countries and space agencies expressed their status and future needs.
- Global climate change was the most discussed topic including the upcoming Climate meeting in Bali. GEO and CEOS expect to play major roles in studying climate.
- CEOS hosted a well-attended reception on Tuesday evening. The GEO community is well aware of CEOS and its potential impact.

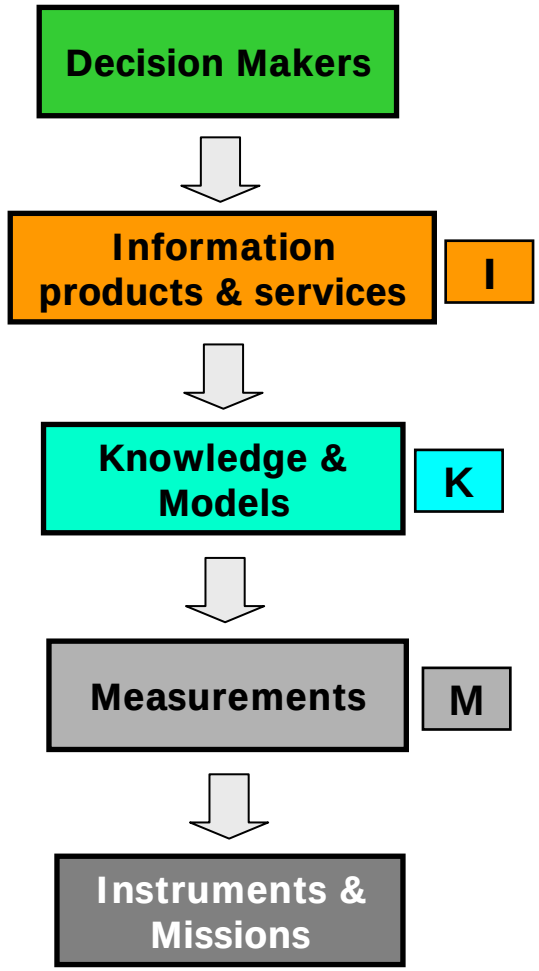
CEOS Plenary Meeting Group

Steve Sandford (SEO) at the CEOS booth with Dirk Kempthorn (Secretary of the Interior), Admiral Laudenbacher (NOAA head), and Mark Myers (USGS head).

CEOS Booth at the GEO Plenary

A new systems engineering framework

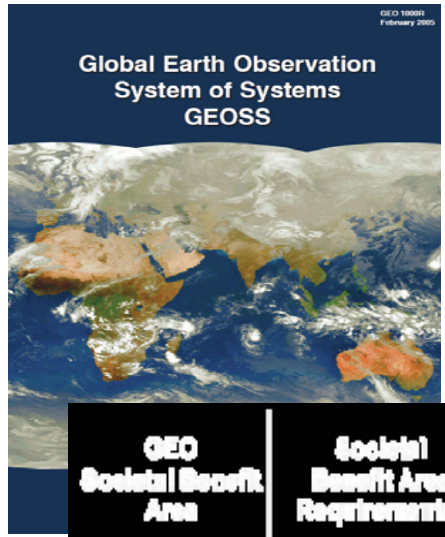




Analysis of GEO SBA's

Objectives

- Analyze the GEO Societal Benefit Areas (SBA) to determine the total, minimum set of GEOSS Space Segment measurements and the shortest path (through the SBA's) to implement the GEOSS using a systems engineering approach.
- Use the new SEO taxonomy and framework for categorizing observational requirements.
- The CEOS Virtual Constellation Teams and the GEO SBA leads will support this effort using an internet-based tool to verify requirements and instrumentation parameters.
- This database and analysis can, ultimately, be used by decision makers to evaluate mission relevance to CEOS objectives and plan future mission architectures.



GEO Societal Benefit Area	Societal Benefit Area Requirements*
Disasters	32
Health	18
Energy	31
Climate	44
Weather	41
Water	54
Ecosystems	29
Agriculture	29
Biodiversity	12
Total	364

Preliminary Results

- GEOSS, GCOS and CEOS have a complex mixture of actions, targets and requirements that are not well integrated and do not produce a clear path to accomplishing GEOSS objectives.
- Weather and Climate requirements account for 55% of the total SBA requirements and there is significant overlap among SBA's.
- A minimum set of requirements is possible, but CEOS and GEO are currently focused on short-term progress of actions.

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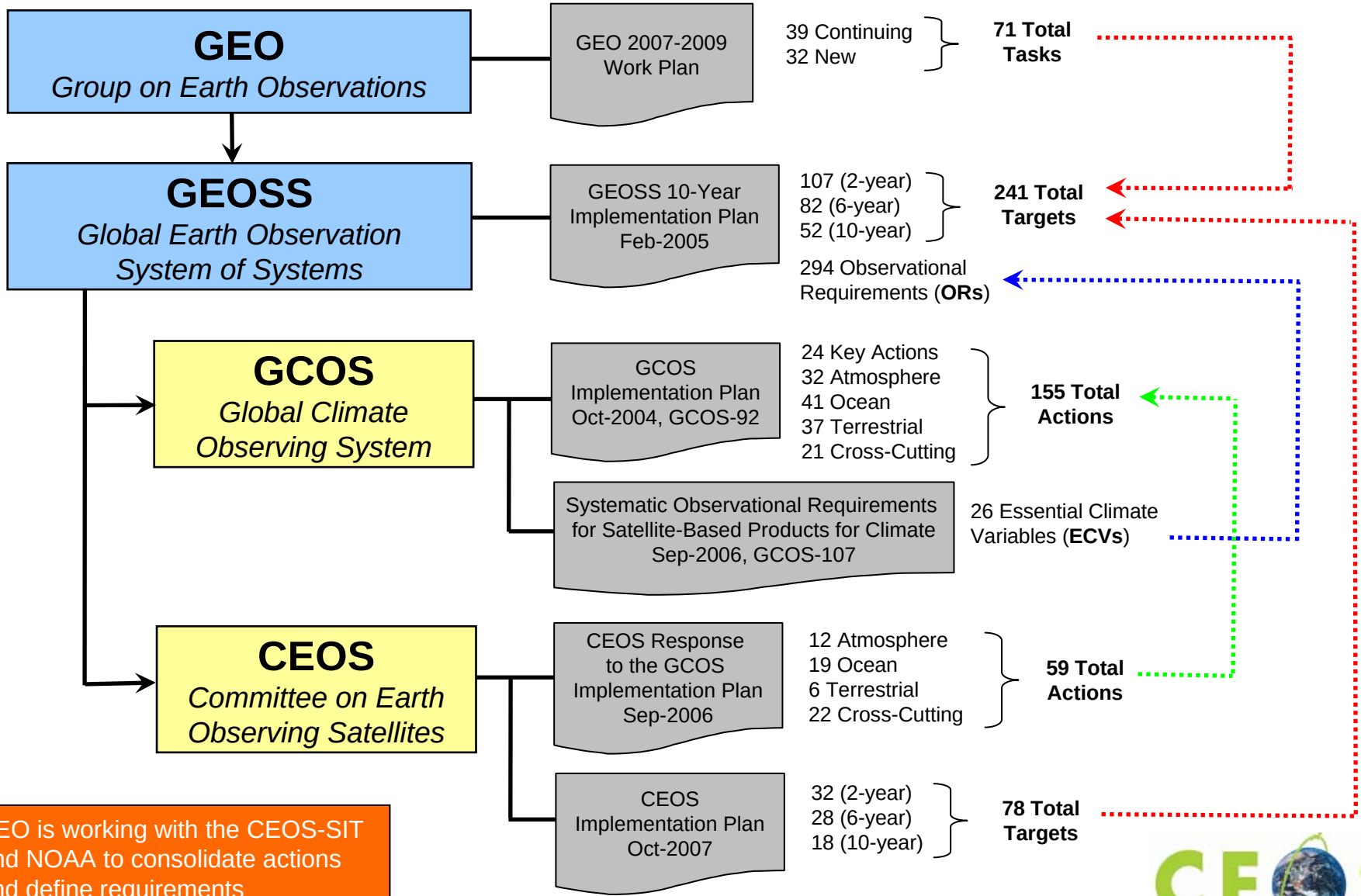
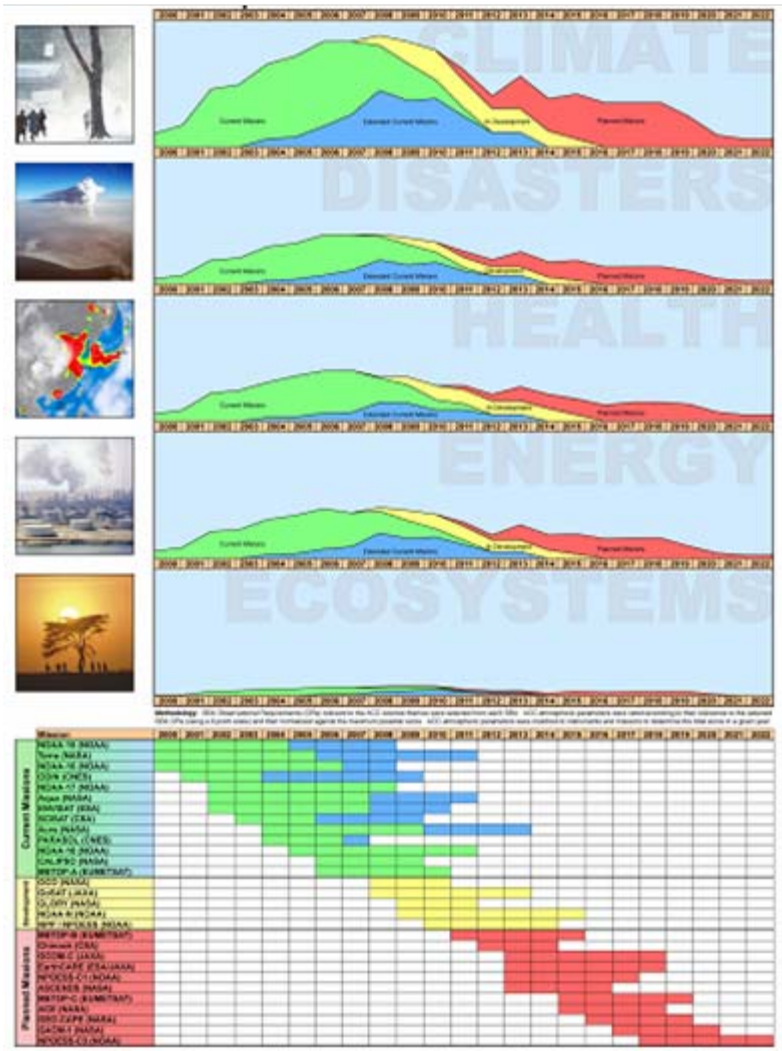
The CEOS and GEO Complexity of Actions, Targets and Requirements

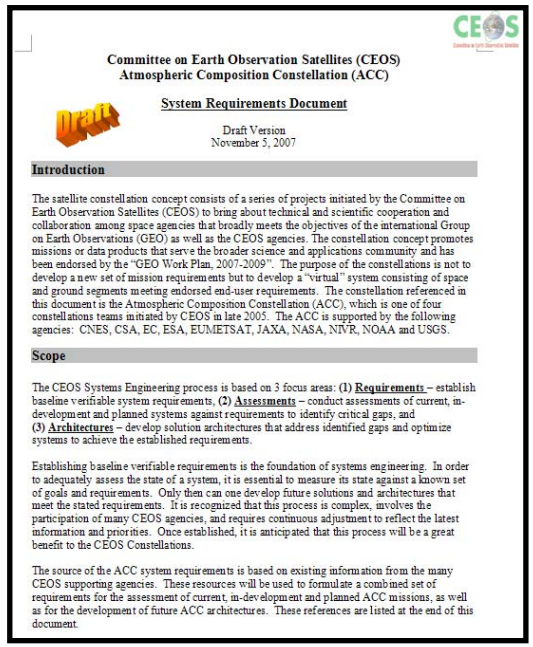


SEO is working with the CEOS-SIT and NOAA to consolidate actions and define requirements

Ocean Surface Topography

SBA Impact Assessment and Mission Architecture Assessment





Committee on Earth Observation Satellites (CEOS)
Atmospheric Composition Constellation (ACC)

System Requirements Document

Draft Version
November 5, 2007

Introduction

The satellite constellation concept consists of a series of projects initiated by the Committee on Earth Observation Satellites (CEOS) to bring about technical and scientific cooperation and collaboration among space agencies that broadly meets the objectives of the international Group on Earth Observations (GEO) as well as the CEOS agencies. The constellation concept promotes missions or data products that serve the broader science and applications community and has been endorsed by the "GEO Work Plan, 2007-2009". The purpose of the constellations is not to develop a new set of mission requirements but to develop a "virtual" system consisting of space and ground segments meeting endorsed end-user requirements. The constellation referenced in this document is the Atmospheric Composition Constellation (ACC), which is one of four constellations teams initiated by CEOS in late 2005. The ACC is supported by the following agencies: CNES, CSA, EC, ESA, EUMETSAT, JAXA, NASA, NIVR, NOAA and USGS.

Scope

The CEOS Systems Engineering process is based on 3 focus areas: **(1) Requirements** – establish baseline verifiable system requirements, **(2) Assessments** – conduct assessments of current, in-development and planned systems against requirements to identify critical gaps, and **(3) Architectures** – develop solution architectures that address identified gaps and optimize systems to achieve the established requirements.

Establishing baseline verifiable requirements is the foundation of systems engineering. In order to adequately assess the state of a system, it is essential to measure its state against a known set of goals and requirements. Only then can one develop future solutions and architectures that meet the stated requirements. It is recognized that this process is complex, involves the participation of many CEOS agencies, and requires continuous adjustment to reflect the latest information and priorities. Once established, it is anticipated that this process will be a great benefit to the CEOS Constellations.

The source of the ACC system requirements is based on existing information from the many CEOS supporting agencies. These resources will be used to formulate a combined set of requirements for the assessment of current, in-development and planned ACC missions, as well as for the development of future ACC architectures. These references are listed at the end of this document.

System Requirements Document using the SEO framework

Add more here

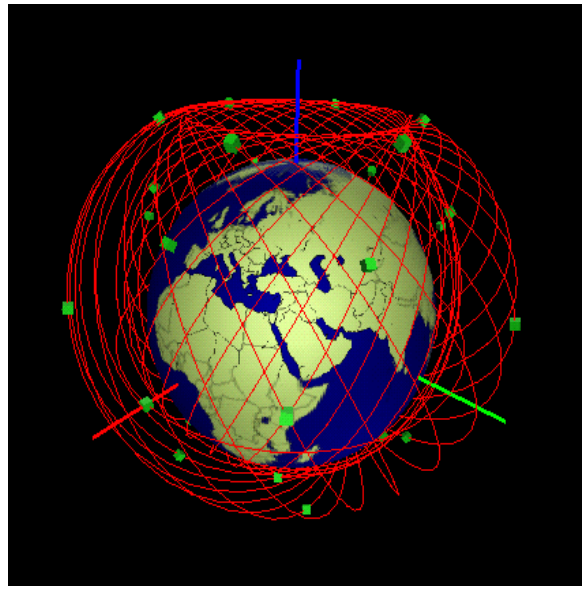
CEOS and OST Videos

TBD summary of CEOS and OST movies

Include demo of ocean video

CEOS SEO … The Future

- Continue to utilize the SEO's expertise in Systems Engineering, Science and Systems Analysis to support CEOS.
- Support existing and new CEOS Constellation teams by conducting assessments, defining requirements and developing candidate architectures that promote collaboration among CEOS partners.
- Conduct future campaign analyses to assess the impact of cost, technology readiness, launch delays, loss of missions, or other variables on the CEOS architecture options.



SEO's Goals for 2008

- Establish the SEO framework for the future of CEOS/GEO/GEOSS
- Establish a consistent approach to analyzing the constellations (impacts, missions, etc)
- Complete CEOS requirements database (web-based, SBA ORs, SBA Targets, gaps)

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CEOS File Server Summary

https://ceos.larc.nasa.gov (notice this is a secure website … https)

- 4 Folder of content that support the AC Constellation Team: (1) CEOS Background, (2) AC Constellation General, (3) March 2007 Workshop, and (4) September 2007 Workshop. Your username and password are below.
- **Changing Password**: Click "My-Info" on the top-right. Select "change password" on the top-right. Select "submit" when complete. Select "files" on the top-left to return to the file-folder screen.
- **Download File**: Click directly on the filename to download a file. DO NOT click on the disk icon on the left. The file can be opened directly or saved to your computer.
- **Upload NEW File:** To add a NEW file to the server, click on the "New File" link in the upper-right of the screen. On the folder menu select the appropriate folder for the file. Add a short description of the file. Finally, click "Browse" to locate the file on your computer. Select "submit" on the far right to upload the file. If you desire to edit a file or delete a file, click the "notepad" icon in the far-left column. You can edit the title and description or delete the file using the "delete file" selection on the top-right.
- **Upload an UPDATED File (new version):** This server allows users to upload new versions of files. It will not delete the old versions. This process uses the "Disk Icon" on the 2nd-to-left column labeled "co". Click on the "Disk Icon" to "check out" the file temporarily. Enter a check-out reason, for example, "update". Click submit. You will notice a change to the icons on the left. Now click on the "Disk Icon" again to add an updated file to this line. Browse your computer to select the location of the updated file. Click "submit" to upload the new file. You will notice a number in parentheses under the "version" column. If you click on that number you will have access to the old file versions. The most recent file is always listed at the top.