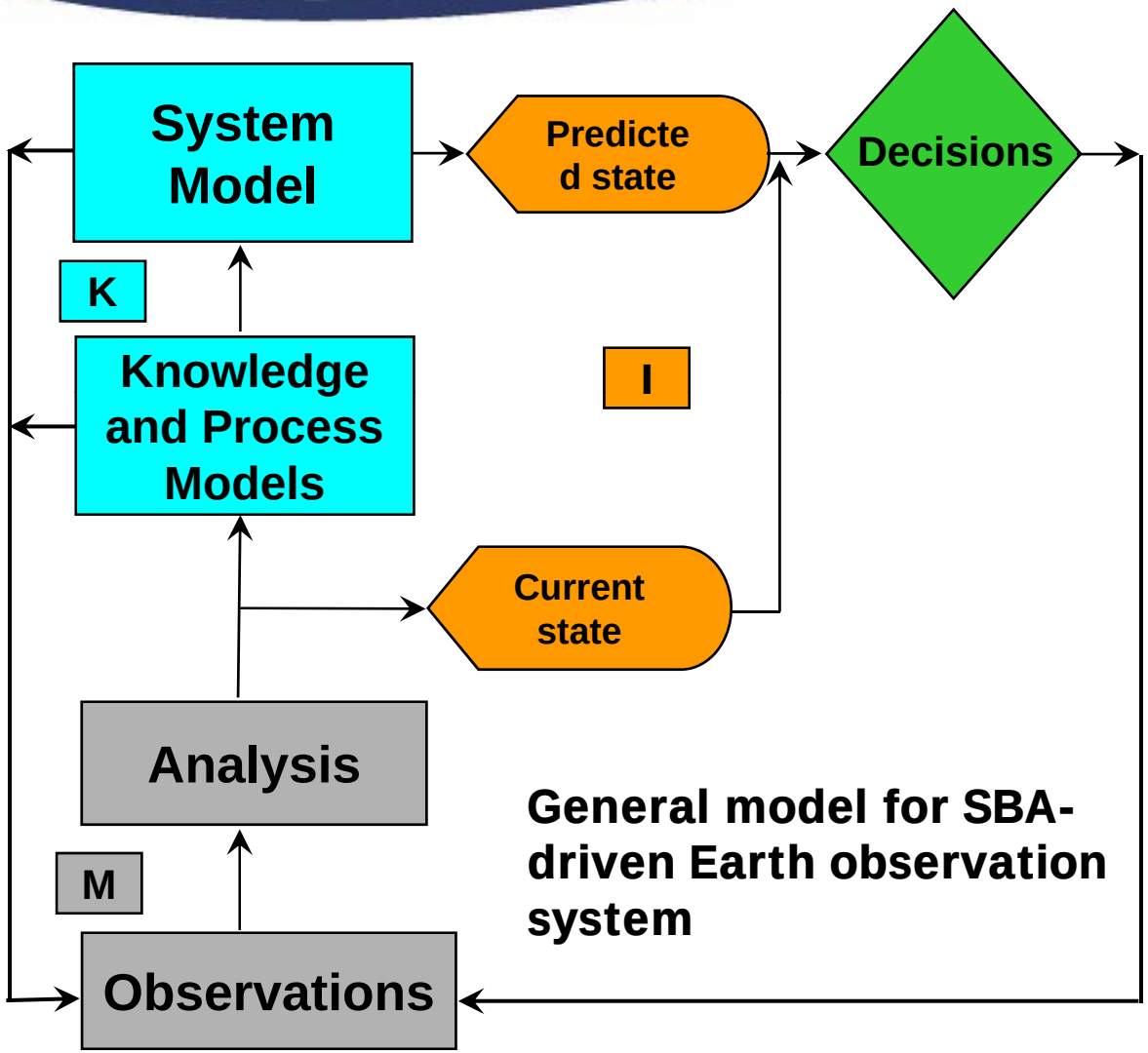
Coordination and cooperation to achieve the GEOSS space segment: A systems approach

Developing a "cooperative blueprint" for the GEOSS space segment

Determining impacts on societal benefits (and gaps remaining) from existing & planned missions

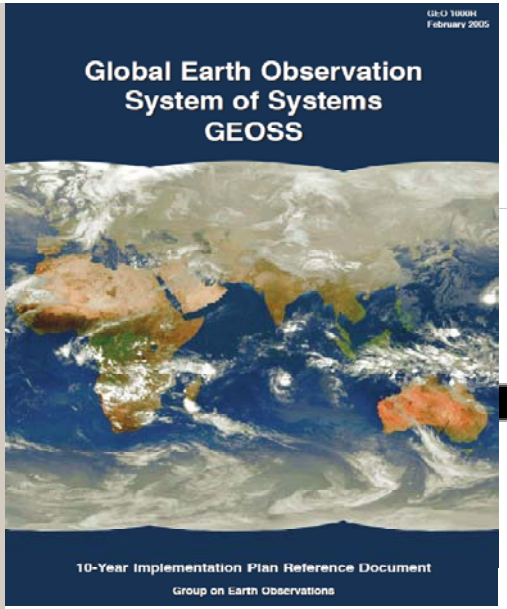
Supporting Constellation teams

Agenda 9.5: Requirements Analysis and Systems Engineering
Presented by: Stephen Sandford
CEOS Systems Engineering Office
November 13, 2007



Requirements Taxonomy

- Decision Makers
- Information products & services — I
- Knowledge & Models — K
- Measurements — M
- Instruments & Missions



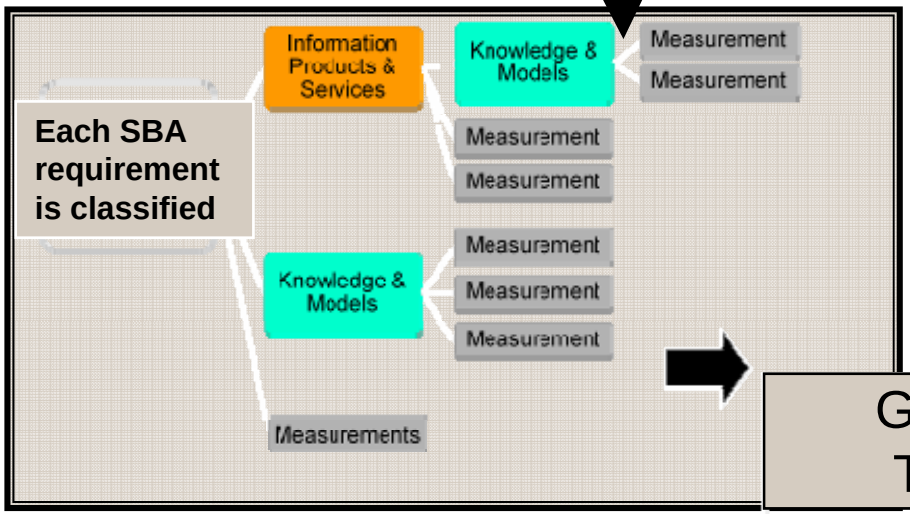
GEO Societal Benefit Area	Societal Benefit Area Requirements*
Disasters	32
Health	19
Energy	31
Climate	44
Weather	41
Water	64
Ecosystems	29
Agriculture	32
Biodiversity	12
Total	294

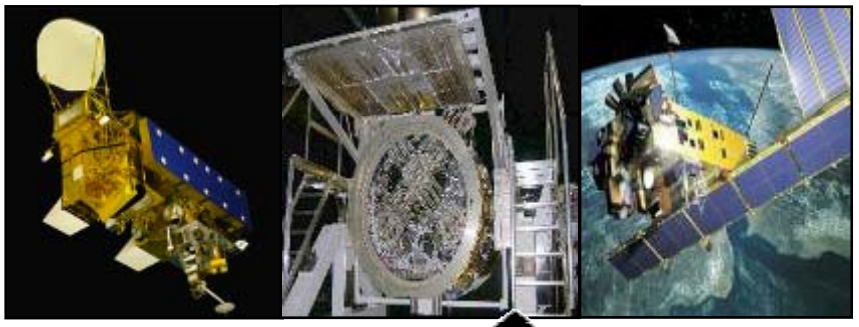
HAWAII 2007
21st CEOS Plenary

Societal Benefit Impacts

Trade Studies

Architecture Planning





GEOSS Space Segment
Total Measurement Set

Requirements, Assessments and Planning

Atmospheric Composition Constellation

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

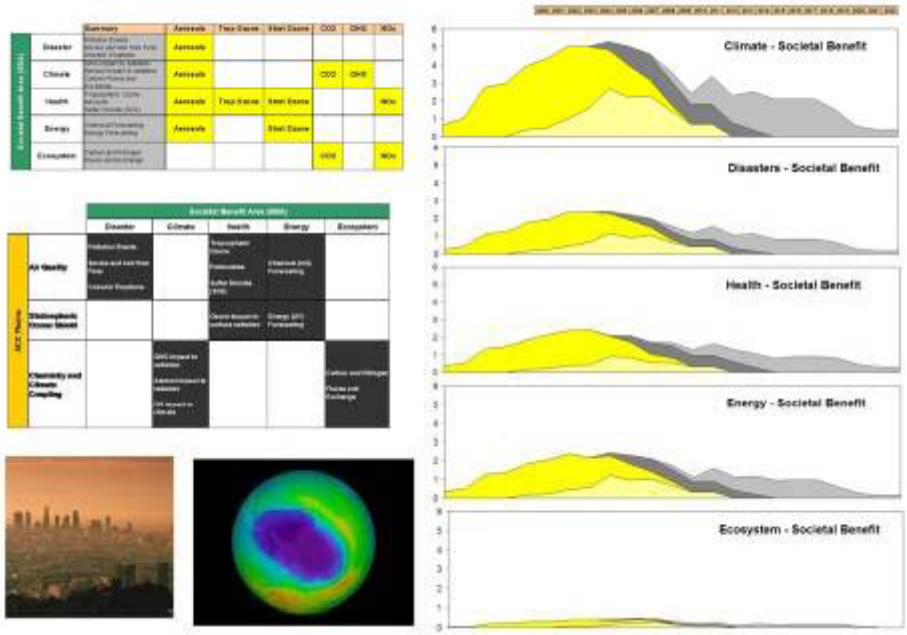
The CEOS Systems Engineering process is based on 3 focus areas: **(1) Requirements** – establish baseline verifiable system requirements, **(2) Assessments** – conduct assessments of current, in-development and planned systems against requirements to identify critical gaps, and **(3) Architectures**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

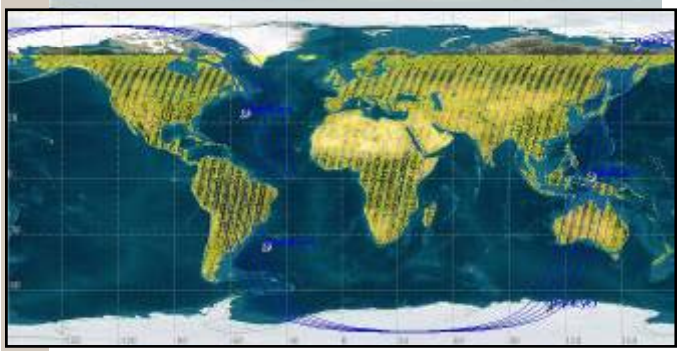
The source of the ACC system requirements is based on existing information from the many CEOS supporting agencies. These resources will be used to formulate a combined set of requirements for the assessment of current, in-development and planned ACC missions, as well as for the development of future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

CEOS Atmospheric Composition Constellation

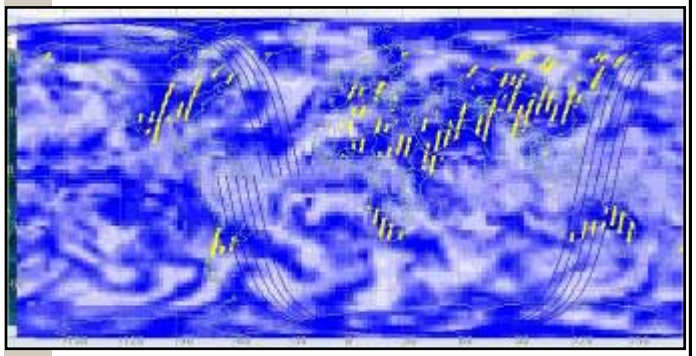
GEO Societal Benefit and Mission Summary



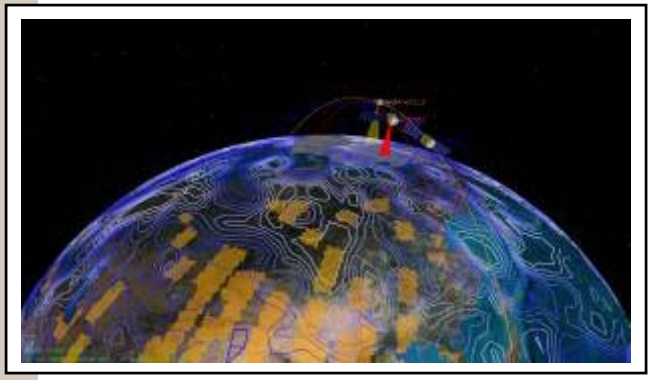
Land Surface Imaging Constellation



RapidEye – 5-day Repeat Coverage Interval



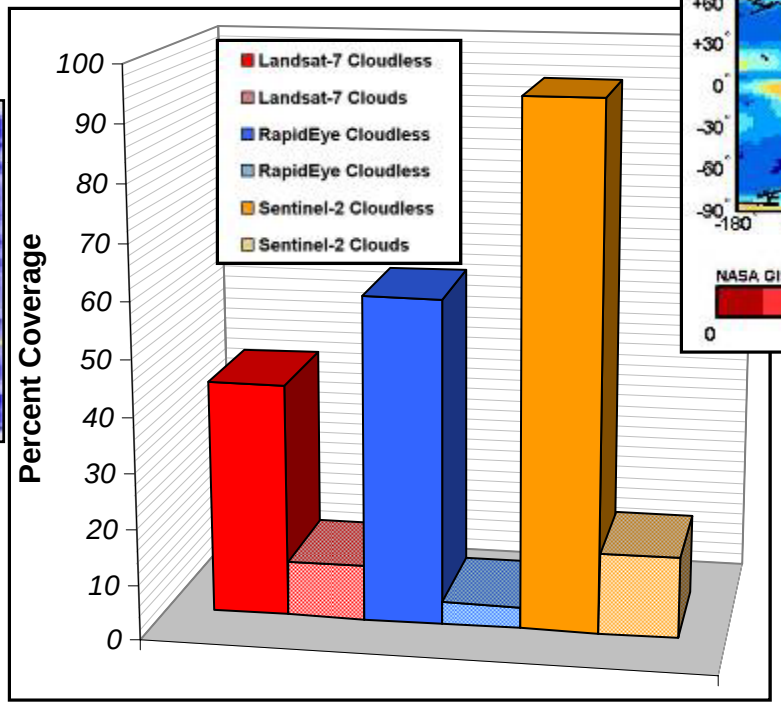
RapidEye – 5-day Cloud Constrained Coverage Interval

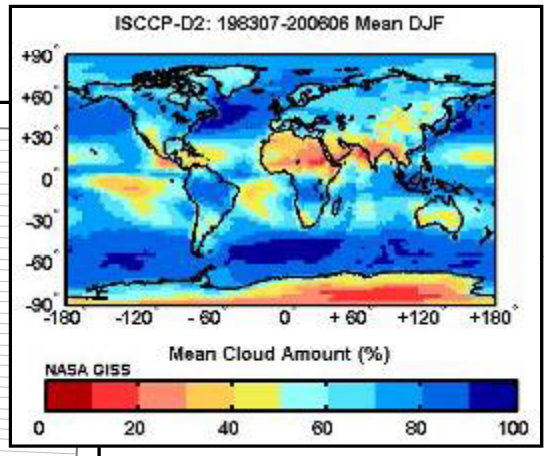


Land Imaging Opportunities in Cloud Contour Map

Global cloud-constrained analysis: Investigate trends of surface access reduction due to realistic cloud interference based on historical cloud cover datasets. Accesses were only computed when cloud coverage was **less than 20%** (modeled after on-orbit Landsat 7 performance)**.**

Mission Period: 12/21/05 – 12/26/05





	Cloudless	Clouds	Loss
Landsat 7	42%	10%	32%
RapidEye	59%	4%	55%
Sentinel 2	94%	15%	79%

Result: Analysis coincides with winter mean cloud **variations** obtained from the International Satellite Cloud Climatology Project (ISCCP).

Preliminary results suggest larger reductions in coverage are proportional to an increase in cloud variability.

Longer simulations (underway at NASA LaRC) of seasonal variations can further increase the fidelity of assessing cloud interference.