Instrument Synthesis & Analysis Laboratory

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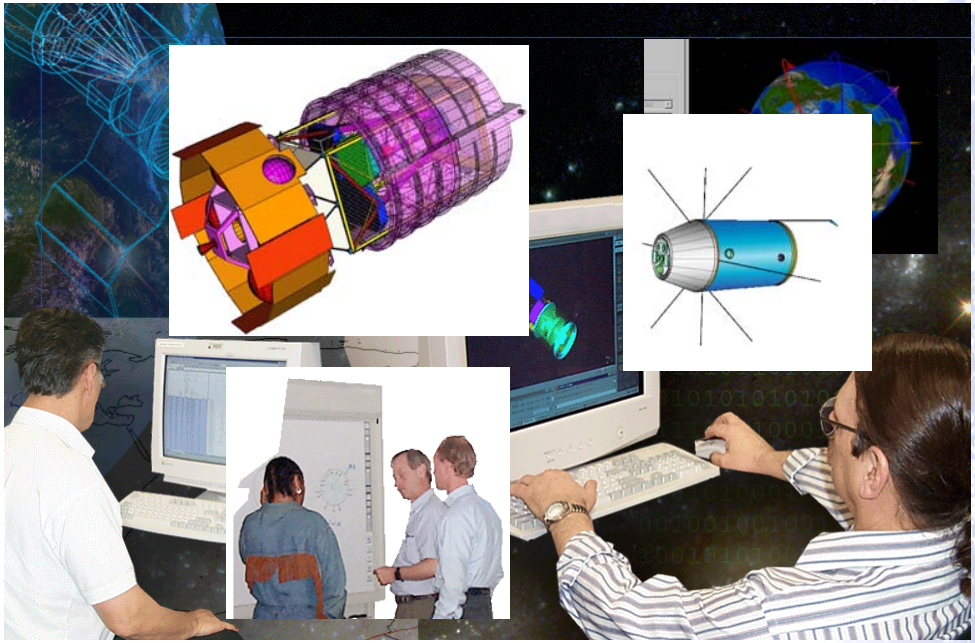
What is the ISAL?

- Instrument Synthesis & Analysis Laboratory (ISAL)
- Part of Goddard's Integrated Design Capability (IDC)
  - IDC comprised of 2 groups
    - ISAL
    - Integrated Mission Design Center (IMDC)
      - Provide overall observatory and mission design
- ISAL Provides rapid multidisciplinary instrument design studies for a variety of earth science, space science, and new technology projects

Why an Integrated Design Capability?

Instrument Synthesis and Analysis Laboratory

- Previous concept design process:
  - Too many meetings
  - Too many people
  - Too low on the priority totem pole
  - Tied up too many resources
  - Took too long to complete
  - Incomplete collaboration between disciplines
  - Inconsistent or non-convergent results
  - Infrequent interaction with the "customer"
  - Did not always meet customer needs or expectations



Proven state-of-the-art engineering…

- Reduced cost and schedule for development of end-to-end space mission and remote sensing conceptual designs
  - Previous engineering process:
    - Study duration: ~ 6 months
    - Level of effort (LOE): 2.5 FTEs
  - IDC engineering process:
    - ISAL study duration: 1 – 2 weeks
    - ISAL approx. LOE: ~0.3 FTE
    - IMDC study duration: 4 – 5 days
    - IMDC approx. LOE: ~0.3 FTE

Proven state-of-the-art engineering con't

- Increased capabilities and improved consistency across studies
- Hands – on involvement of the customer in the design process
  - Customer needs and/or expectations routinely met or exceeded
- Concurrent engineering environment
  - All disciplines working together and all at the same time
  - Consider all aspects of the mission life-cycle at the same time
- Increased and improved collaboration between subsystem disciplines
  - Infuse the end-to-end system perspective into the entire team
  - Improve product consistency, quality and system level convergence
  - Improve technology infusion, especially for cross-discipline items

IDC Competencies – Broad, Diverse, Customer Driven

Instrument Synthesis and Analysis Laboratory

Integrated Mission Design Center

- LEO, HEO, GEO, libration orbits, interplanetary and deep space, balloon
- Single spacecraft missions, formation flying, constellations, distributed systems
- Uncontrolled or controlled deorbit and recoverable payload modules
- Expendable vs. non-expendable launch vehicles
- Custom vs. commercial spacecraft tradeoffs
- Nanosats to large satellites

Instrument Synthesis & Analysis Laboratory

- Imagers, Cameras
- Spectrometers
- Lidars
- Gamma-Ray to IR Telescopes
- Solar Physics Instruments, Spectroheliographs
- Passive or Microwave Radiometers
- Optical Molecular Sensors
- Planetary & Lunar Orbiter Instruments
- Large Weather Satellite Instruments
- Geochemistry experiments

ISAL Objectives

- To provide a rapid and sustainable instrument development environment with clear, efficient processes and skilled engineers.
- To provide a capability for quick and efficient trade studies of instrument architectures and concepts.
  - Supports different maturity levels
    - Direct AO response
    - Trade Studies in advance of AO
    - Instrument Incubator Program projects
    - Space Exploration Studies – new NASA Directives
- To streamline and optimize instrument system design for Phase A, including cost, risk and technology assessment.

ISAL History

- Operational facility since Spring 1999
- Completed more than more than 60 studies since its inception
- Experience with Earth Science, Space Science and Space Exploration instrument projects
  - Aquarius (Sea Salinity Study) selected for Earth Science
  - SDO and GPM have asked for designs
  - EXIST selected as part of the decadal plan by the National Academy of Sciences
  - NGST (now JWST) early studies done in the ISAL

ISAL Resources

- Cadre of highly-skilled discipline engineers
  - Collaboration of clients, discipline engineers, and scientists to discuss concept viability
  - Provide customized level of service
  - Detailed designs with significant analysis
- State of the Art Facility
- Strong Leadership Team
  - Unified ISAL management and operations with the Integrated Mission Design Center (IMDC) to form the Integrated Design Capability (IDC) in Spring 2001

ISAL Engineering Skills

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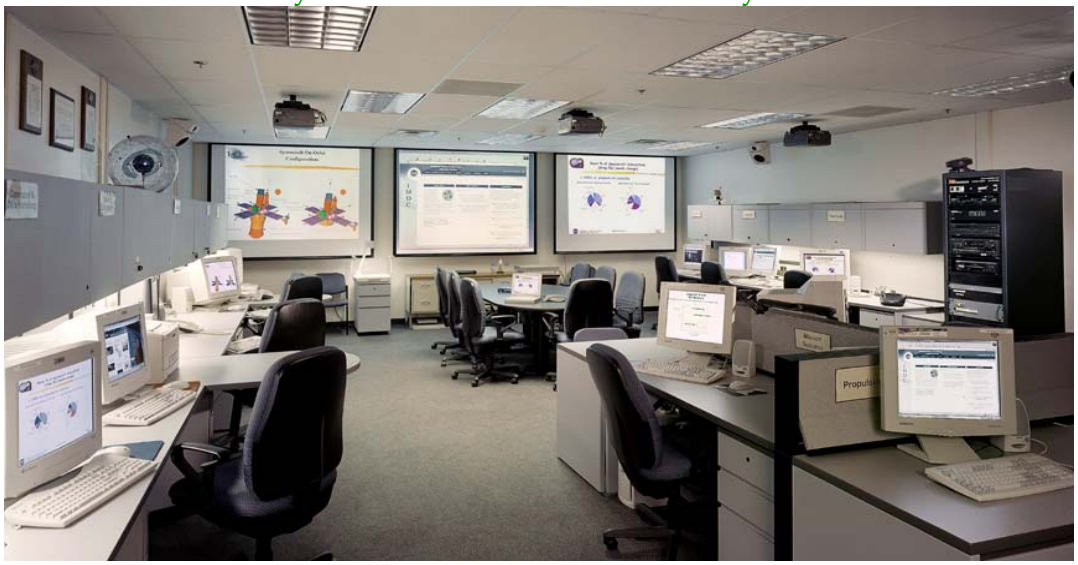
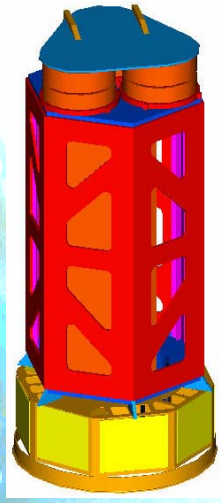


- Systems
- Science Liaison
- Thermal/Cryogenics
- Optical
- Electro-Optical
- Electronics
- Electro-Mechanical
- Opto-Mechanical
- Mechanical Design and Analysis
- Detectors
- Cost Modeling/grass roots
- Laser Technology
- Microwave Technology
- Flight Software
- Orbital Debris
- Mission Success/Risk

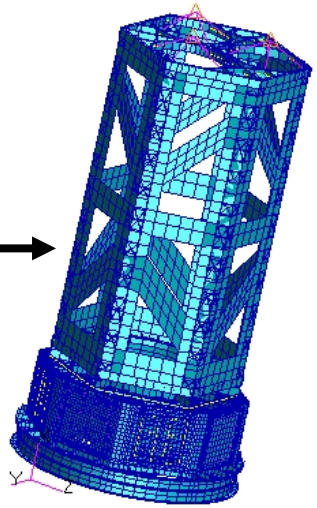
ISAL Sample Product
Structural Analysis

Instrument Synthesis and Analysis Laboratory

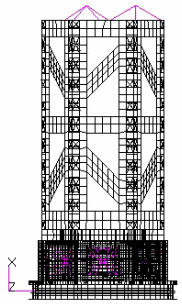
CAD Concept



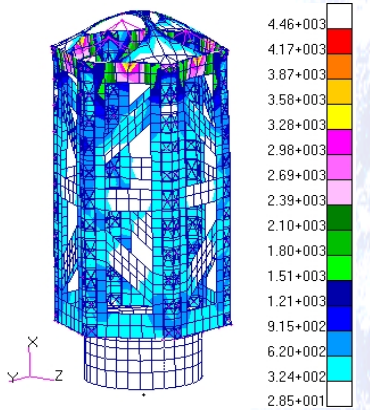
Finite Element Model



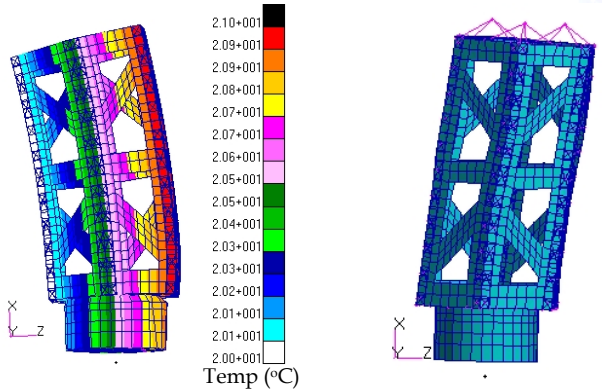
Dynamics



Stresses



Structural Deformation



Analysis Process & Products

State of the Art Facility

Location – Goddard Space Flight Center – Bldg. 23 Room W324

- **Computer Resources**
  - **Workstations for discipline engineers**
  - **COTS programs for engineering disciplines**
- **Conference Area**
  - **'Smart Board'**
  - **Fax Machine**
  - **Speakerphone**
  - **Projection/White Board**
- **Displays**
  - **3 Projectors with switching to display each engineer's workstation**
- **Audio System**
  - **For teleconferencing**
- **Video Conferencing Capability**
  - **To enhance teleconferencing**

Summary: Why ISAL?

- **Laboratory with a proven history**
  - Completed 60+ studies successfully
  - Experience and service for all NASA enterprises
  - Efficient processes and tools
- **State of the Art Facility**
  - Utilizes computers with the latest hardware and software for discipline use
  - Conferencing capability for scientists and engineers who cannot be present
- **Strong Engineering Team**
  - Provides a cadre of skilled engineers from Goddard's engineering branches
  - Unified operations and management with the Integrated Mission Design Center (IMDC) to form the Integrated Design Capability to assess instrument design and mission parameters together

Management Team

- **IDC Operations Manager** **Ellen Herring/ 500** **301-286-7393**
  programmatics & strategic planning for ISAL & IMDC

- **ISAL Team Lead** **Jennifer Bracken/ 531** **301-286-3688**
  daily planning, scheduling & product delivery

- **Science Liaison** **Dr. H. John Wood/ 551** **301-286-6314**
  interface between science team & engineering team