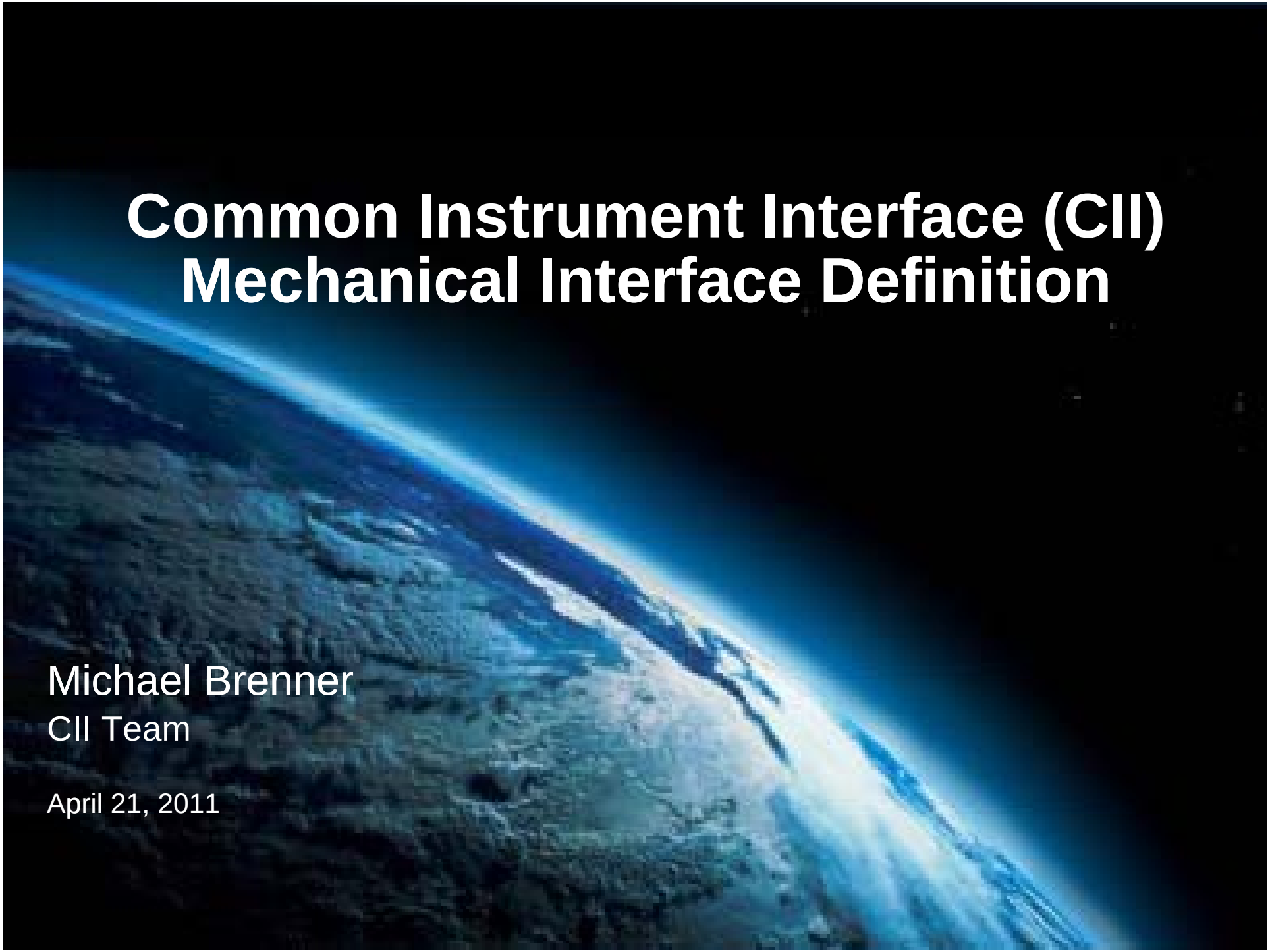
Common Instrument Interface (CII) Mechanical Interface Definition



Michael Brenner
CII Team

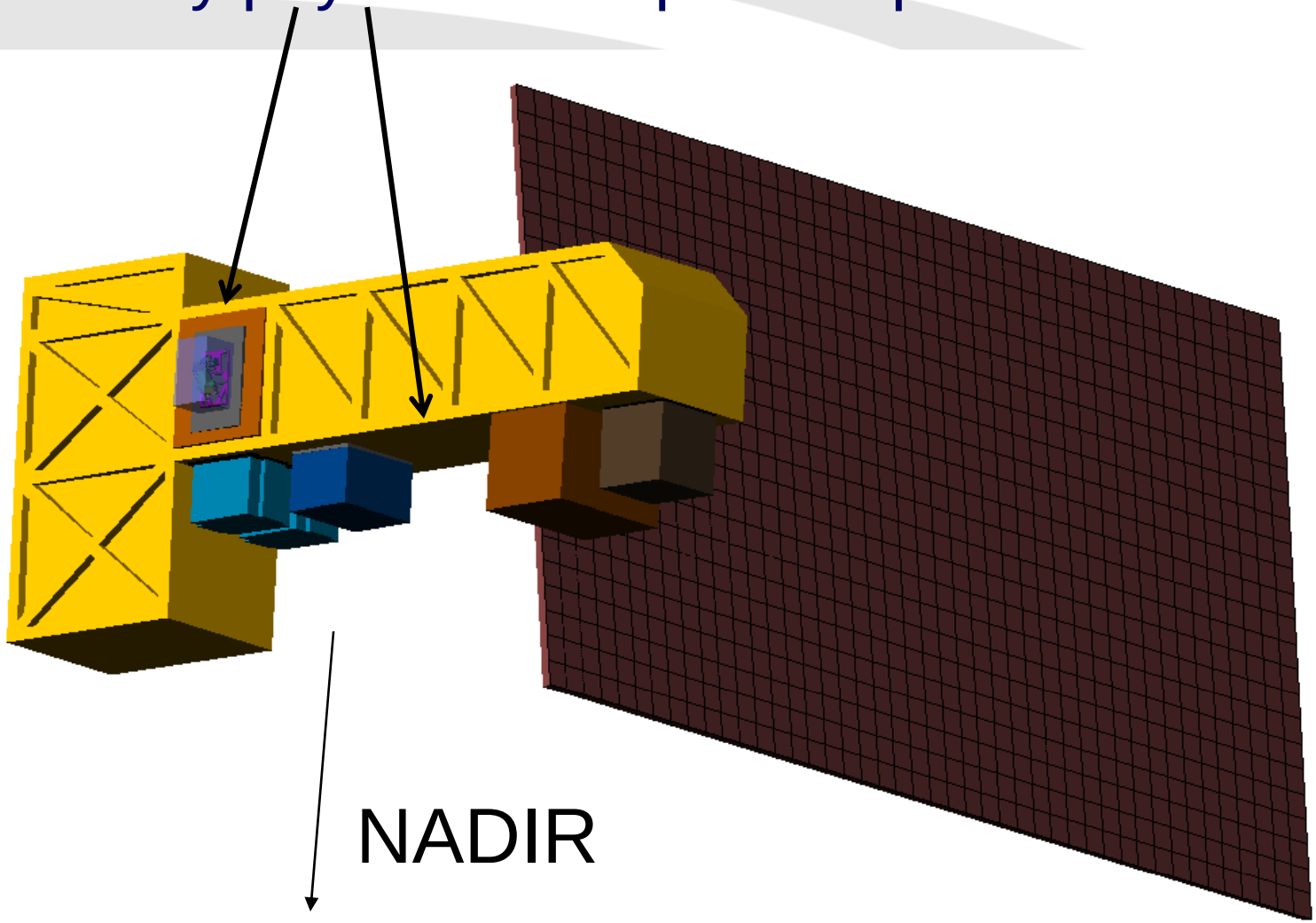
April 21, 2011

Design Goals

- Minimally intrusive to spacecraft provider.
- The interface should allow the spacecraft provider to move out on the design process independent of the Instrument provider.
- The interface should allow the instrument provider to move out on the design process independent of the spacecraft provider.
- Implementation details should be worked out between Spacecraft and instrument once paired in an ICD.

LEO EOS Example

- Secondary payload example and possible locations.

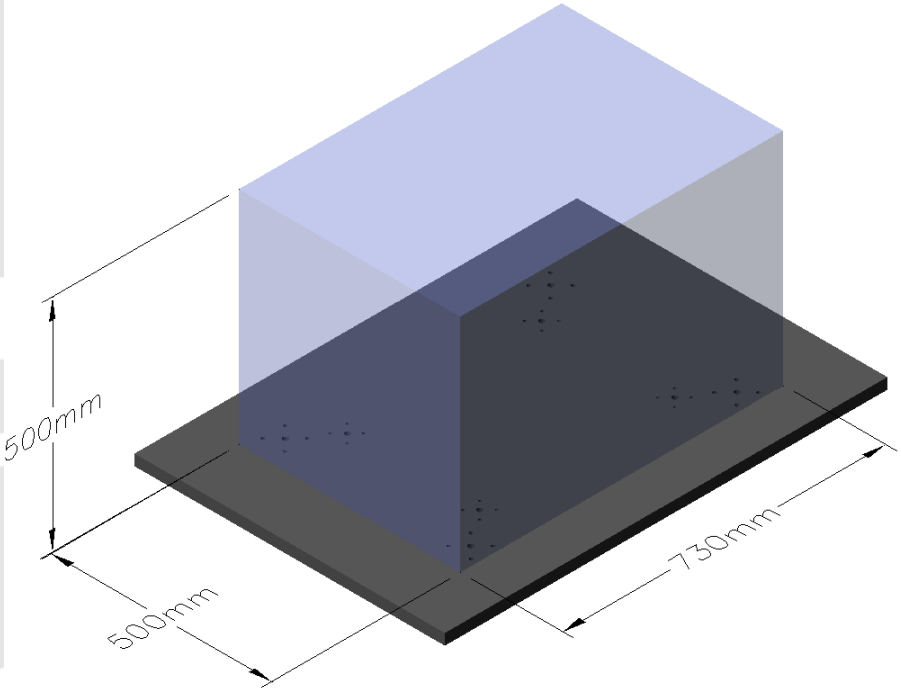


S/C and Instrument Configuration Assumptions

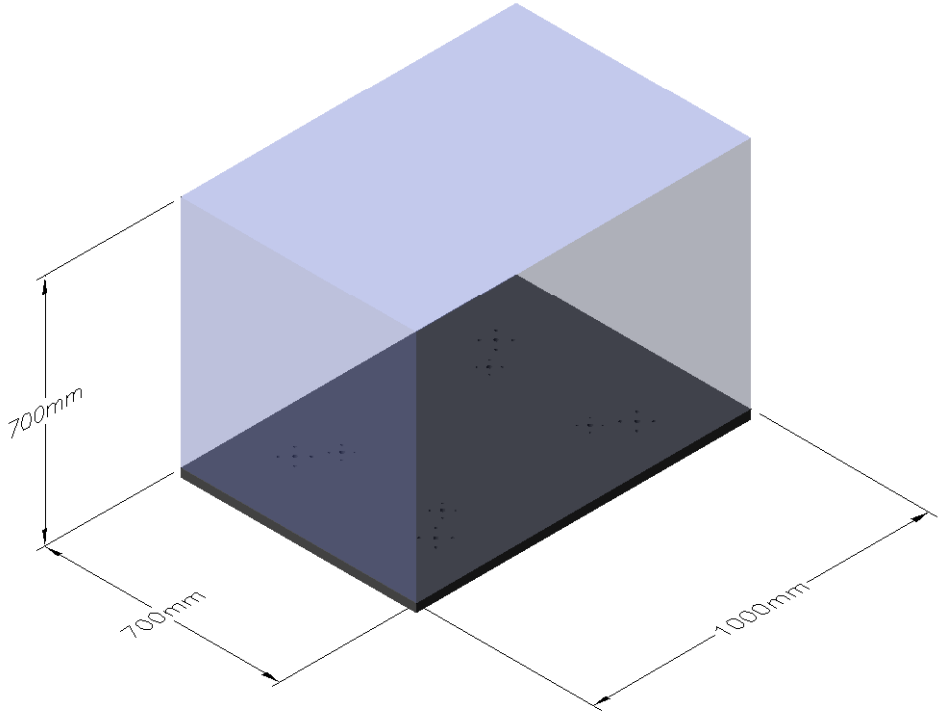
- Instruments are Nadir Pointing
- Location on S/C would accommodate a typical rectangular volume.
- The mass and envelope as identified in the Guidelines were based upon an Instrument survey for similar class missions.
- The instrument should be designed as a self contained assembly with on board electronics and thermal control.
- The Spacecraft Provider is responsible for the mounting interface.
- The Instrument provider is responsible for the kinematic mounting and degrees of freedom.

Guideline Envelope

- The mass and envelope as identified in the Guidelines were based upon an Instrument survey for similar class missions.

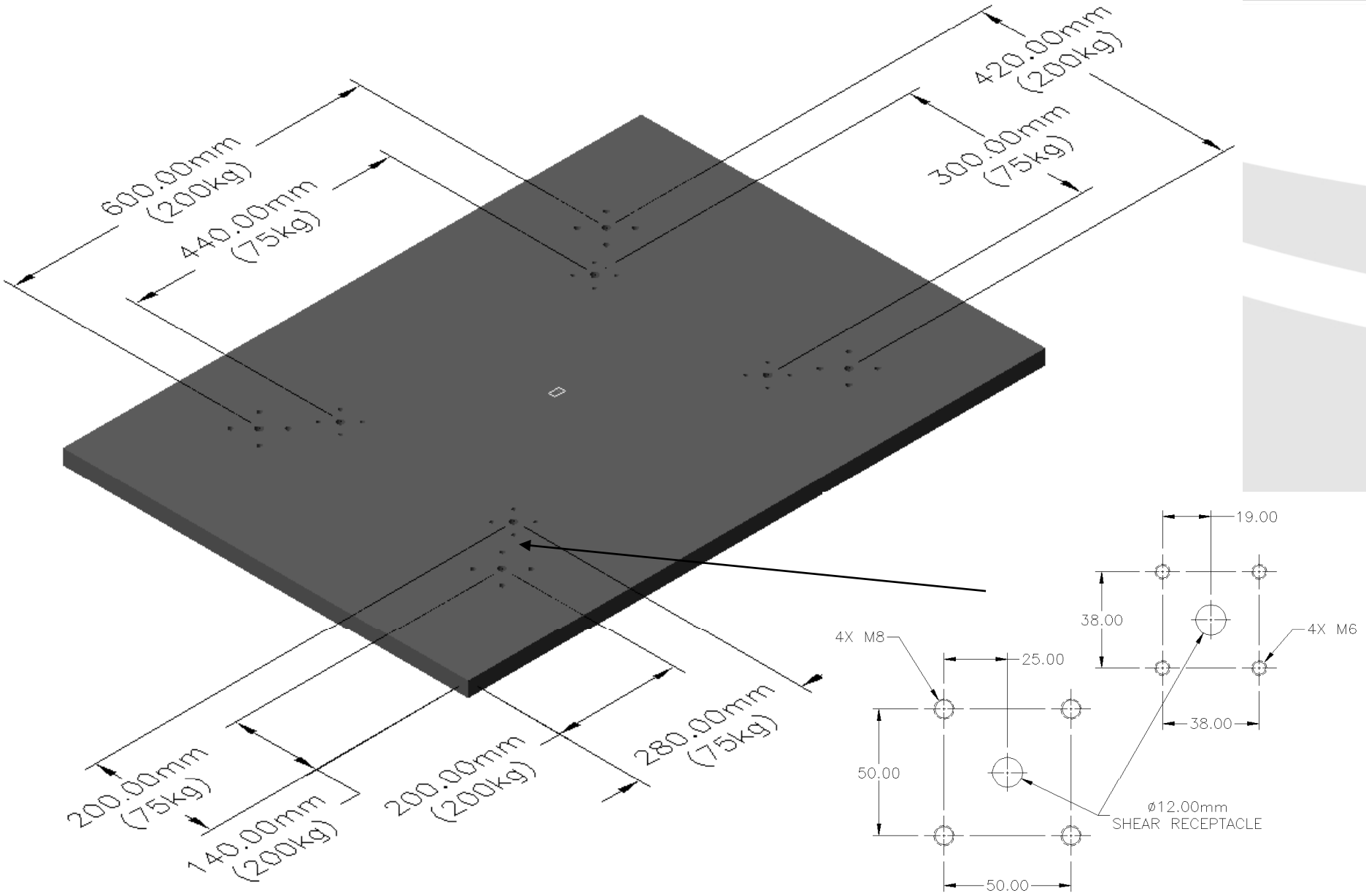


75kg Interface



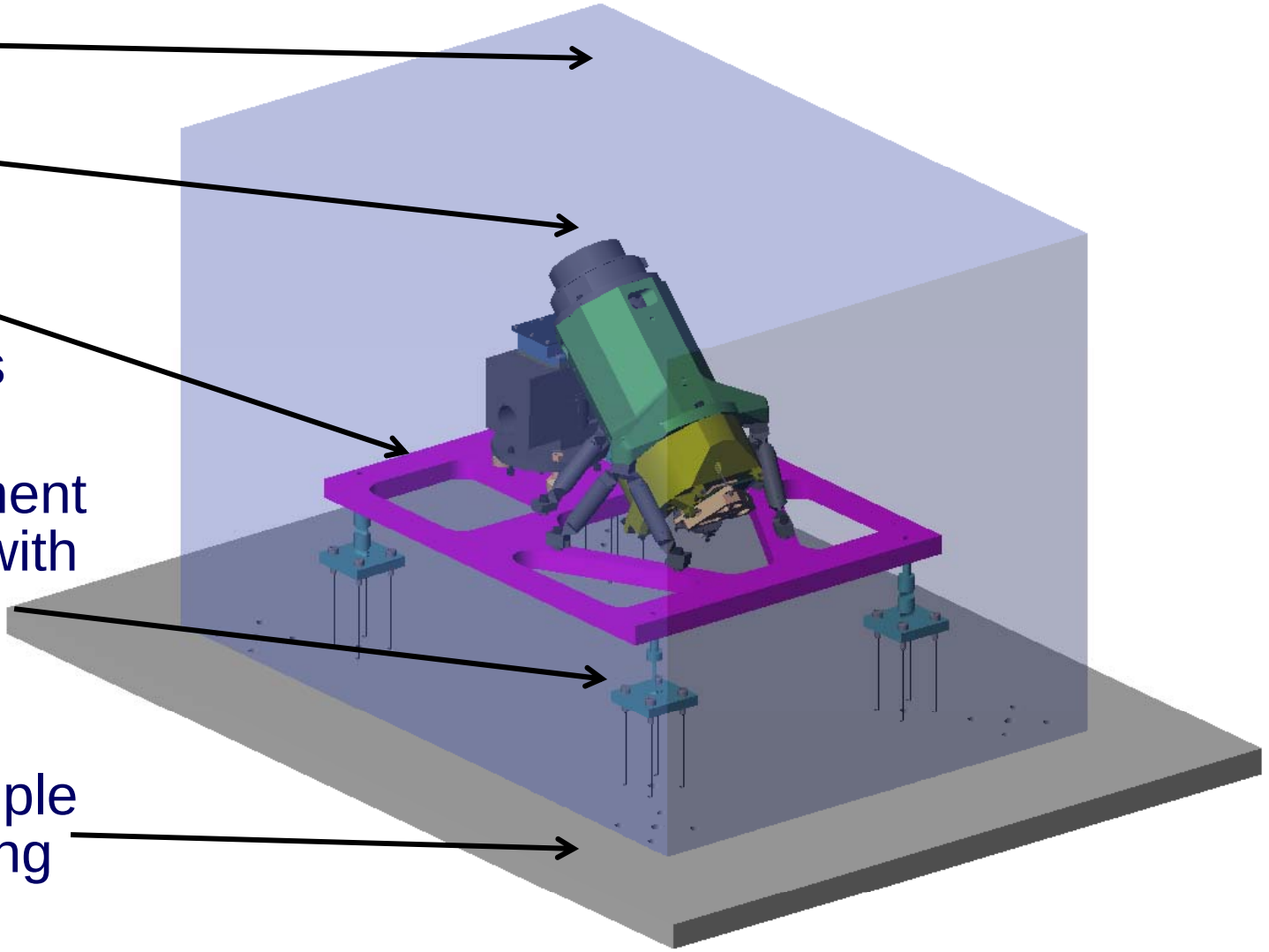
200kg Interface

Mounting Plate (200kg or 75kg Instrument)



Mounting Example

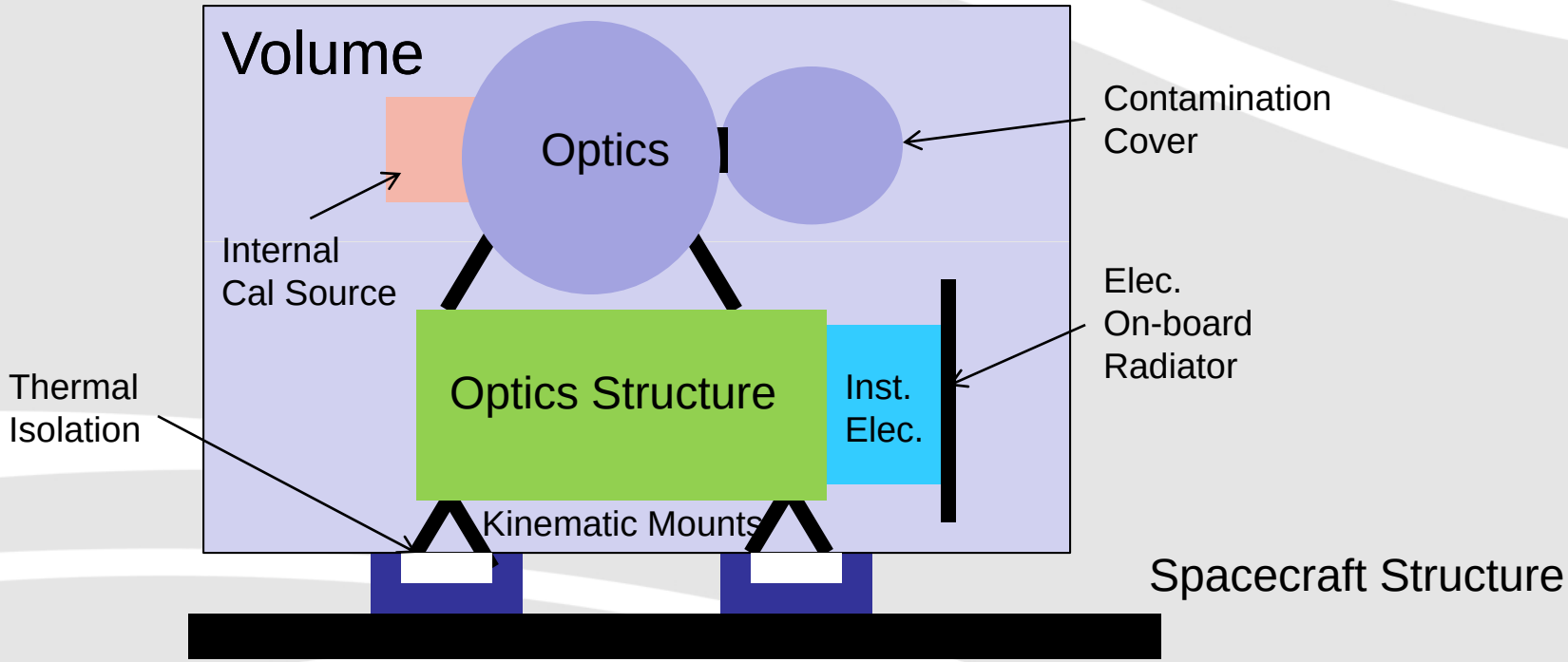
- Volume
- Camera boresight
- Payload secondary structure as required
- The instrument will mount with a kinematic interface.
- Spacecraft panel example and mounting interface.



Guidelines Summary

SUB-ELEMENT
Mechanical Interface Control Document
Physical Envelopes
Fields of View
Mass Properties
Mounting
Alignment
Structural Design Requirements
Finite Element Models
Instrument Mass Models
Instrument Mechanisms
Instrument Disturbance Allocations
Access
Handling Fixtures
Mounting Orientation
Instrument Spacecraft I&T Mounting
Non-Flight Equipment
Launch Site Equipment Installation and Removal

Mechanical Guideline Diagram



Mechanical Interface Guidelines

ID	Function	Guidelines
MECH-1	Instrument Envelopes	Instrument components in the launch and on-orbit configurations should be contained within the detailed instrument envelope of 0.7m x 0.7m x 1.0m (HxWxL) TBD as allocated within the Mechanical Interface Control Drawing (MICD).
MECH-4	Instrument Mass	The Instrument mass should be less than or equal to 200 kg TBR.
MECH-9	Instrument Mounting	The Instrument should be mounted to the Spacecraft via kinematic mount either 3 or 6 point TBR.
MECH-10	Instrument Mounting	The method by which the instrument is mounted to the spacecraft should be as defined in the ICD.
MECH-12	Instrument Mounting	Coordinates and dimensions of the holes for mounting hardware should be specified at the mechanical interface and defined in the ICD.

Mechanical Interface Guidelines Cont.

ID	Function	Guidelines
MECH-14	Instrument Mounting	The Instrument Provider should provide all kinematic mounts.
MECH-17	Instrument Mounting	The Spacecraft Contractor should provide shims or other mounting hardware as required to attain the required alignment accuracy.
MECH-19	Mounting Location	The Spacecraft Contractor should determine the location of the instrument on the spacecraft.
MECH-20	Mounting Location	The mounting location of the instrument on the spacecraft should be documented in the ICD.
MECH-25	Handling	The instrument should provide mechanical attachment points that will be used by a handling fixture during integration of the instrument and documented in the ICD.

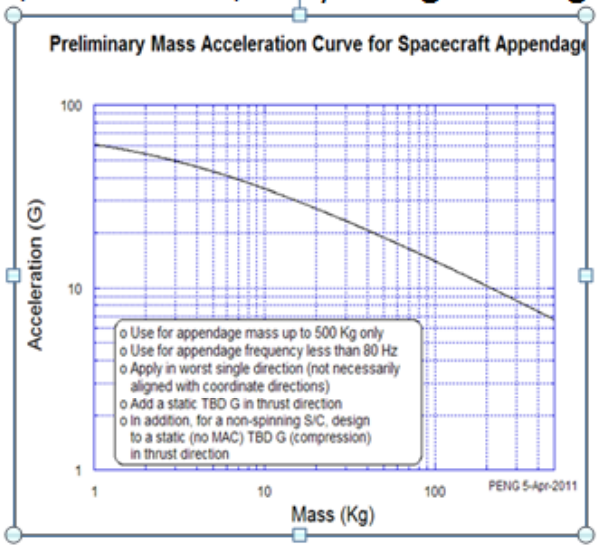
Mechanical Interface Guidelines Cont.

ID	Function	Guidelines
MECH-29	Test guidelines	Instrument mechanisms, thermal control, or any exclusions to testing and operations related to orientations should be documented in ICD.
MECH-31	Temporary Sensors	The Instrument should accommodate temporarily installed sensors (e.g. acceleration sensors, thermal monitors, etc.) and supporting hardware to support environmental testing.
MECH-32	Venting	The number, location, size, vent path, and operation time of Instrument vents should be defined in the ICD.
MECH-34	Fields of View Allocation	The spacecraft bus should provide clear (i.e., no blockage) fields-of-view (FOV) that equal or exceed the Instrument science and radiators, as defined in the ICD.
MECH-36	Stray Light	The spacecraft should provide a model and optical properties of hardware in close proximity for instrument stray light analysis.

Mechanical Interface Guidelines Cont.

ID	Function	Guidelines
MECH-37	Mechanisms	Instrument mechanisms that require restraint during launch should be caged during launch without requiring power to maintain the caged condition.
MECH-40	Minimum Fixed-Base Frequency - mass of less than 200 Kg	The instrument component with a mass of less than 200 Kg, configured for launch, should have a fixed-base frequency of > 50 Hz TBR. Fixed-based is defined as follows: Each mounting point should be constrained in those degrees of freedom which are rigidly attached to the Spacecraft, and should be free in those degrees of freedom for which kinematic mounts or flexures provide flexibility.

Mechanical Interface Guidelines Cont.

ID	Function	Guidelines
MECH-42	Interface Limit Loads	Preliminary design should be analyzed to MAC loads as derived from Figure below. The acceleration is applied in the worst single direction, which may not be aligned with coordinate directions, to produce the greatest load component (axial load, bending moment, reaction component, stress level, etc.) being investigated. 
MECH-43	Design Limit Loads	The design limit loads should be multiplied by a factor of 1.4 to obtain the ultimate design loads, and by 1.25 to obtain the yield design loads for a tested interface.

Mechanical Interface Guidelines Cont.

ID	Function	Guidelines
MECH-46	Combined Structural Dynamics Analysis Results	The Spacecraft Contractor should provide the combined structural dynamics analysis results to the respective Instrument Provider.
MECH-47	Coupled Loads Analysis Results	The Spacecraft Contractor should be responsible for providing the results of launch vehicle/spacecraft coupled loads analysis in easy to use format to the instrument provider.
MECH-49	Instrument Mass Model	The Instrument providers should develop all instrument physical mass models (dummy models) required for Spacecraft mechanical testing.
MECH-54	Handling Fixtures	Handling and lifting fixtures should be designed to 5 times limit load for ultimate and 3 times limit load for yield. Handling fixtures should be tested to 2 times working load.
MECH-57	Alignment Parameters	The Instrument Provider should specify, in the ICD, the pointing accuracy, knowledge and stability guidelines.