

Path Forward for WFIRST CGI Performance Modeling

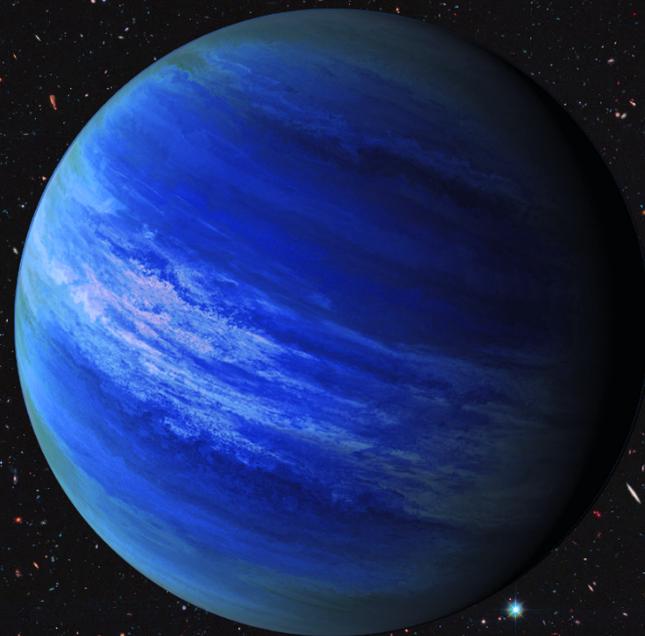
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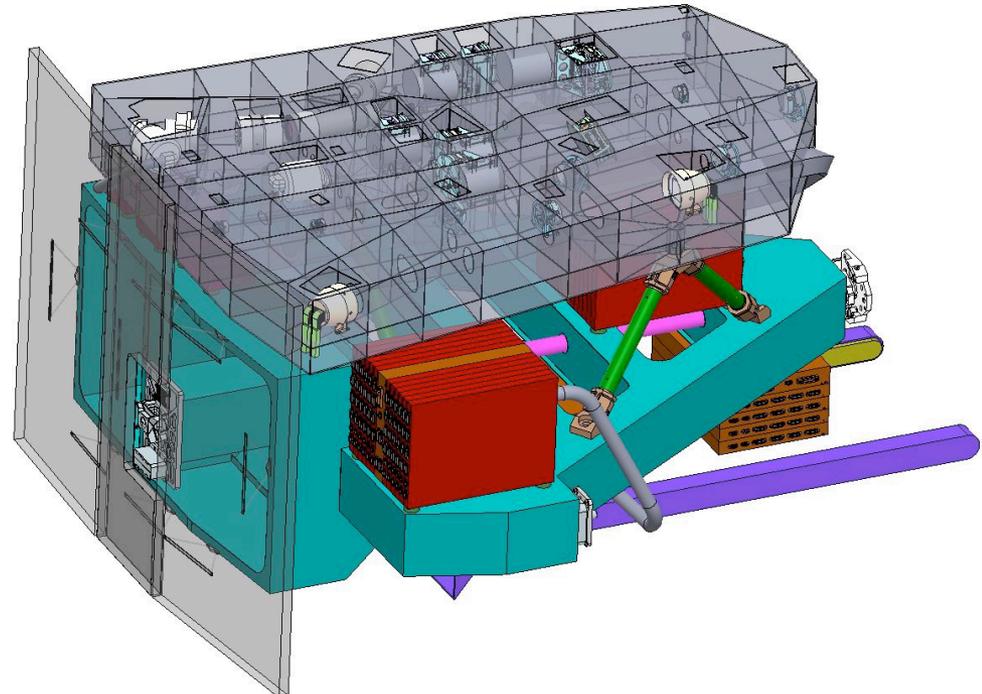
NASA Jet Propulsion Laboratory/Caltech

Virtual Stanford Meeting

2018-10-25



- Integrated Modeling - Planning activities
 - List of concrete deliverables, with approximate need dates
- Current activities and objectives
- Future work





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Project Planning and IM

- CGI is in the midst of a project reorganization, and replanning is part of it
 - <Yawn><Yawn> but it's vitally important
- Updating “Receivables & Deliverables” aka “Giver-Receiver” lists
 - Can't expect a product from someone unless you have a documented agreement with a date
- Taking a fresh look at IM plans and rec-dels, reexamining the rationales
 - Blue-sky or blank-paper starting point, later tempered by fiscal reality
- You might be involved, even if you don't know it yet

A Vision of 2022-25

- In the final year Observatory and CGI build and test, how do we persuade a review board that we'll meet our Level 1, 2, and 3 requirements?
 - Testing, measurements, calibration
 - Integrated modeling (CGI → Observatory → Mission)
 - Mission modeling with a schedule of observations
- So if you're responsible for one of the items at right, what do you need to complete your part? When?

Verify performance of LOWFC and HOWFC algorithms

Models of Observatory integration & alignment measurements

Observatory IM data for PROPER, Ground System, data post-processing, and prototypes of Level 1 & 2 verification

CGI IM results support L3 flight system performance verification

Level 1 & 2 verification relies on Observatory IM results

Observatory IM with many OS*s predicts performance with updated/calibrated observatory data and observation scheduling

Prepare analysis tools and simulated data

- System identification
- Characterizing CGI performance in Phase E



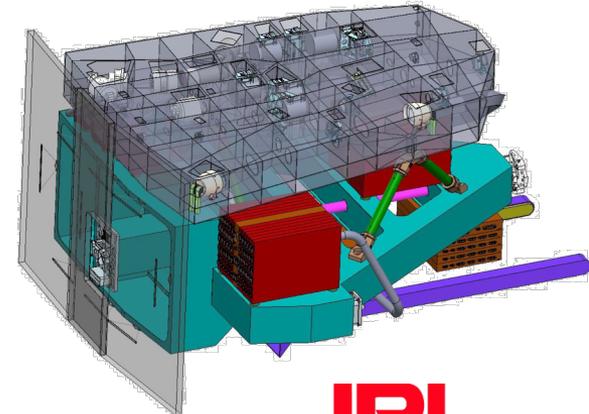
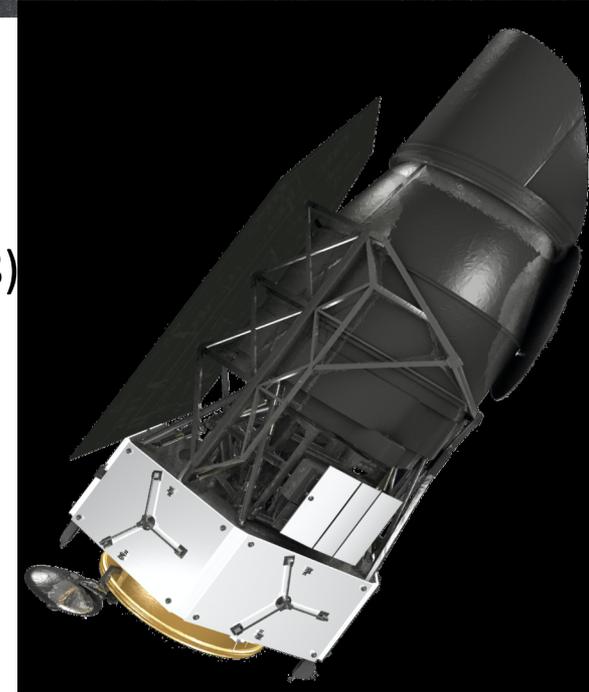
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Questions for the room

- Who is responsible for CGI L1 and L2 verification?
- What support do they need? From whom?
When?
- What resources must the project provide to enable it?

Structural-Thermal-Optical (STOP) Modeling

- Begins with CGI design: structures, thermal, optics
 - We have a Phase A design
 - Developing models of Phase B design
- Combine CGI with Phase A Observatory model (Dec '18) or with reduced Observatory model (“CGI-only”)
- “Pipeline” executes thermal scenario, then structure, then optics, without human intervention; batch runs
- CGI-only model with a Phase A CGI almost complete
- Phase B CGI complete 2/1/19
- Phase B Observatory complete ~April-May
 - Pipeline runs (multiple CGI OS's) begin after that
- Schedule is snug for producing full-Observatory products for PDR; considering backstop options





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Optical Modeling of WFIRST CGI

- PROPER is used for optical propagation of the aberrated wavefront through the entire optical system
 - Static system model includes: realistic errors on all optical surfaces (telescope + CGI), polarization-induced aberrations, current “flight” CGI designs
 - Observing scenario (time-dependent) modeling, using STOP outputs, includes: thermally-induced aberration changes, corrections by LOWFS/C, pupil shear, pointing jitter, wavefront jitter, DM creep & thermal response, finite stellar diameter
 - Currently evaluating impact of BMC MEMS DM surface errors
- Current optical modeling schedule
 - Prior released speckle time series included full CGI optical model but not full CGI STOP model, but will from now on
 - Only full observatory + CGI (not CGI-only) speckle time series will be released to the community for selected observing scenarios (takes 1 week for STOP modeling + 1 week for optical modeling per scenario)
 - Phase A observatory + full Phase A CGI OS6(?) run ~Dec 2018
 - Fallback results for presenting at PDR if Phase B observatory model delivery from GSFC is late
 - Phase B observatory + full Phase B CGI OS run >April 2019
 - Would need immediate (by end of May) post-processing of speckle fields in order to make PDR using these



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Other Modeling Activities

- Coronagraph mask design
- Flux ratio noise budget and exoplanet sensitivity estimation
- Data post-processing and exoplanet/disk signature extraction
- Concept of Operation, observation scheduling, and mission design
- and...?