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**JPL**

Terrestrial Planet Finder Mission

**TPF**

# TPF Coronagraph Minimum Mission Review

Mary L. White

TPF Coronagraph Design Team Lead

28 April 2004

A NASA  
Origins  
Mission



## Logistics for the Review



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- Parking
  - Parking permits are required for Caltech structures and lots
- Food & Drinks
  - Drinks are hosted by JPL
  - Food is not hosted by JPL, please leave a contribution in the basket
- Thursday we meet at JPL
  - All that do not have JPL badges, please put your name on the list of expected visitors
- Questions?



# Agenda



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April 28, 2004 Morning

8:30	Introduction	M. White
8:55	Requirements	S. Shaklan
9:25	System Description	P. Lisman
9:45	Optical System Design	P. Mouroulis
10:05	Break	
10:15	Mechanical Configuration	T. Ho
10:55	Structural Design	A. Kissil
11:25	Thermal Control System Design	T. Cafferty
11:45	Attitude Control System Design	A. Liu
12:10	Lunch	



# Agenda



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April 28, 2004 Afternoon

1:10	Error Budget	S. Shaklan
1:35	Overview of Analysis	M. Levine
1:55	Optical Analysis	S. Basinger
2:15	Thermal Analysis	E. Kwack
2:45	Break	
3:00	Structural Analysis	A. Kissil
3:40	Attitude Control System Analysis	A. Liu & C. Blaurock
4:10	Analysis Summary and Future Plans	M. Levine
4:25	Summary of Instrument Performance	S. Shaklan
4:35	Summary of Science Performance	P. Lisman



# Agenda



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April 29, 2004 Morning

*(order of events and time allocations are likely to change)*

8:30	Introduction	M. White
8:40	Optical Testing	A. Smith
9:10	Comments and Discussion	
11:00	Wrap-up	V. Ford



## Design Team Charter



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- Two Coronagraph Designs
  - Minimum Mission requirements
    - 35 stars
    - 90% completeness for each star
    - etc.
  - Full Mission requirements
    - 165 stars
    - 90% completeness on average
    - etc.



## Design Team Goals for Pre-Phase A



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- Pre-Phase A period is FY 04 through FY 06
- Present two Coronagraph designs—Minimum and Full
  - Operations scenarios
  - Configurations
    - Launch
    - Deployment
    - Operations
  - Analysis for environmental conditions
    - Integrated Modeling
  - Informed by status of technology development
    - Technology Demonstration Mirror
    - High Contrast Imaging Testbed
    - Masks and Stops



## Design Team History



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- Formed a new design team at JPL
  - About one year ago
- Composition of the team
  - Jet Propulsion Lab
    - Architecture, mechanical configuration, optical design, integrated modeling and analysis (thermal, structural & optical), system engineering, etc.
  - Goddard Space Flight Center
    - Science, Attitude Control System, I&T
  - Industry Partners
    - Ball Aerospace, Northrop Grumman Space Technologies, Lockheed Martin
- Design and Analysis for the Minimum Mission
  - Starting point relied heavily on Ball Architecture Study, 2002
- Preliminary Design for the Full Mission



## Design Team Activities



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- Architecture
- Mechanical Configurations
  - Launch
  - Deployment
  - Operations
- Operations scenario
  - Star survey (frequency of visits for completeness)
- Analysis (thermal, structural and optical)
  - Operational configuration only



# Modeling and Analysis of Minimum Mission Design **JPL**

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- Froze the Minimum Mission design and started a thorough thermal and structural analysis
  - Minimum Mission design continued to need improvements into January
- Due to the different amounts of time required for each analysis, some analysis had to start prior to the design being frozen
  - Care was taken to make sure that these differences do not mislead
  - Mechanical configuration
    - Mv3b-D
  - Thermal
    - Mv3b-D
  - Structural (including optical sensitivities, wavefront error & contrast)
    - Mv3b-D
  - Attitude Control System
    - Mv3b-D (prior to optical bench relocation)
  - Models are archived in the TPF Library

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## Status of Design and Analysis



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- We're at the beginning
- Goal for this design
  - Launch and deployment to be plausible
  - Operational configuration
    - Targeting requirements of the Minimum Mission
- Goal for this analysis
  - One design to be used for all analysis (thermal, structural & optical)
  - Comparison of performance to requirements
    - Single analysis cycle (we have not unfrozen the design)
  - Indication of improvements that should be implemented in next design cycle



## Goals for This Review



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- Present the current state of the TPF Coronagraph Minimum Mission
  - Design
  - Analysis
- Receive advice that can be used to improve the design of the TPF Coronagraph
  - Telescopes
  - Thermal Control
  - Attitude Control



# Approach to Stability of the Optical System

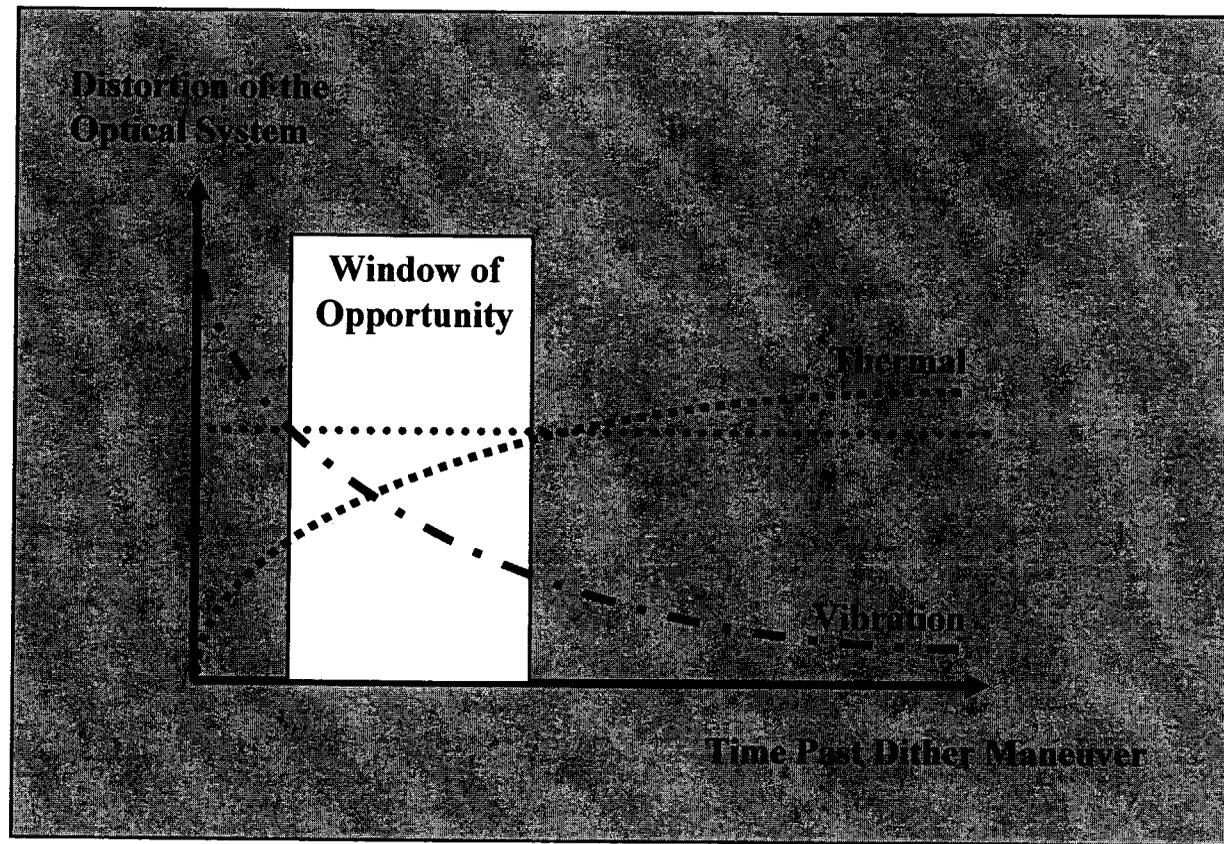


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- Dither Maneuver will be used to enable the subtraction of speckle
  - 20 degree roll of the telescope about the optic axis
  - Optical system must remain stable





## You May Ask



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- What is not modeled?
- What is not analyzed?
- What is assumed to have ideal performance?