ROMAN SPACE TELESCOPE

NASA

Nancy Grace Roman Space Telescope

Observatory Reference Information

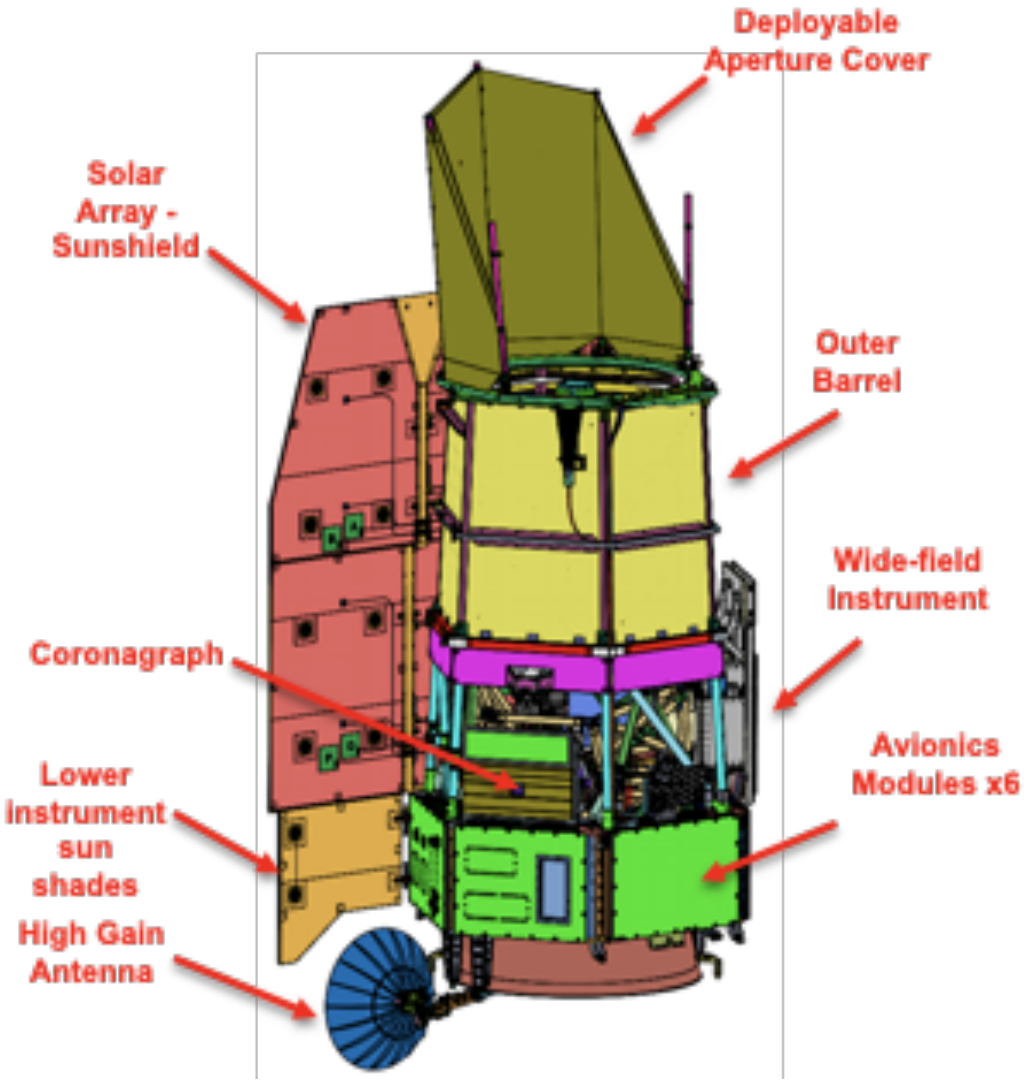
March 1, 2021

• NASA GODDARD SPACE FLIGHT CENTER • JET PROPULSION LABORATORY •
• L3HARRIS TECHNOLOGIES • BALL AEROSPACE • TELEDYNE • NASA KENNEDY SPACE CENTER •
• SPACE TELESCOPE SCIENCE INSTITUTE • IPAC • EUROPEAN SPACE AGENCY •
• JAPAN AEROSPACE EXPLORATION AGENCY • LABORATOIRE D'ASTROPHYSIQUE DE MARSEILLE •
• CENTRE NATIONAL d'ÉTUDES SPATIALES • MAX PLANCK INSTITUTE FOR ASTRONOMY •

Roman Mission Key Characteristics

- Mission Life: 5 years (+ ~3 month checkout)
- Mission Orbit: Sun-Earth L2
- Baseline Launch Vehicle: Falcon Heavy, New Glenn, Vulcan possible
- Observatory:
  - 2.4 m primary mirror Telescope
  - Wide Field Instrument (WFI)
  - Coronagraph (CGI)
  - S/C Bus
    - Downlink Rate & Volume – 250-500 Mbps, 11 Tbits/day
    - Pointing stability: 8 mas drift, 12 mas jitter, RMS per axis
  - Refuelable in flight
- Ground System:
  - Ground Stations: NEN-White Sands, NM; ESA-New Norcia, Australia; JAXA – GREAT, Japan; DSN
  - Operations: GSFC, STScI, IPAC

Observatory Overview



Key Features

Telescope: 2.4m aperture

Instruments:

- Wide Field Imager / Slitless Spectrometer
- Internal Coronagraph

Data Downlink: 250-500 Mbps

Data Volume: 11 Tb/day

Orbit: Sun-Earth L2

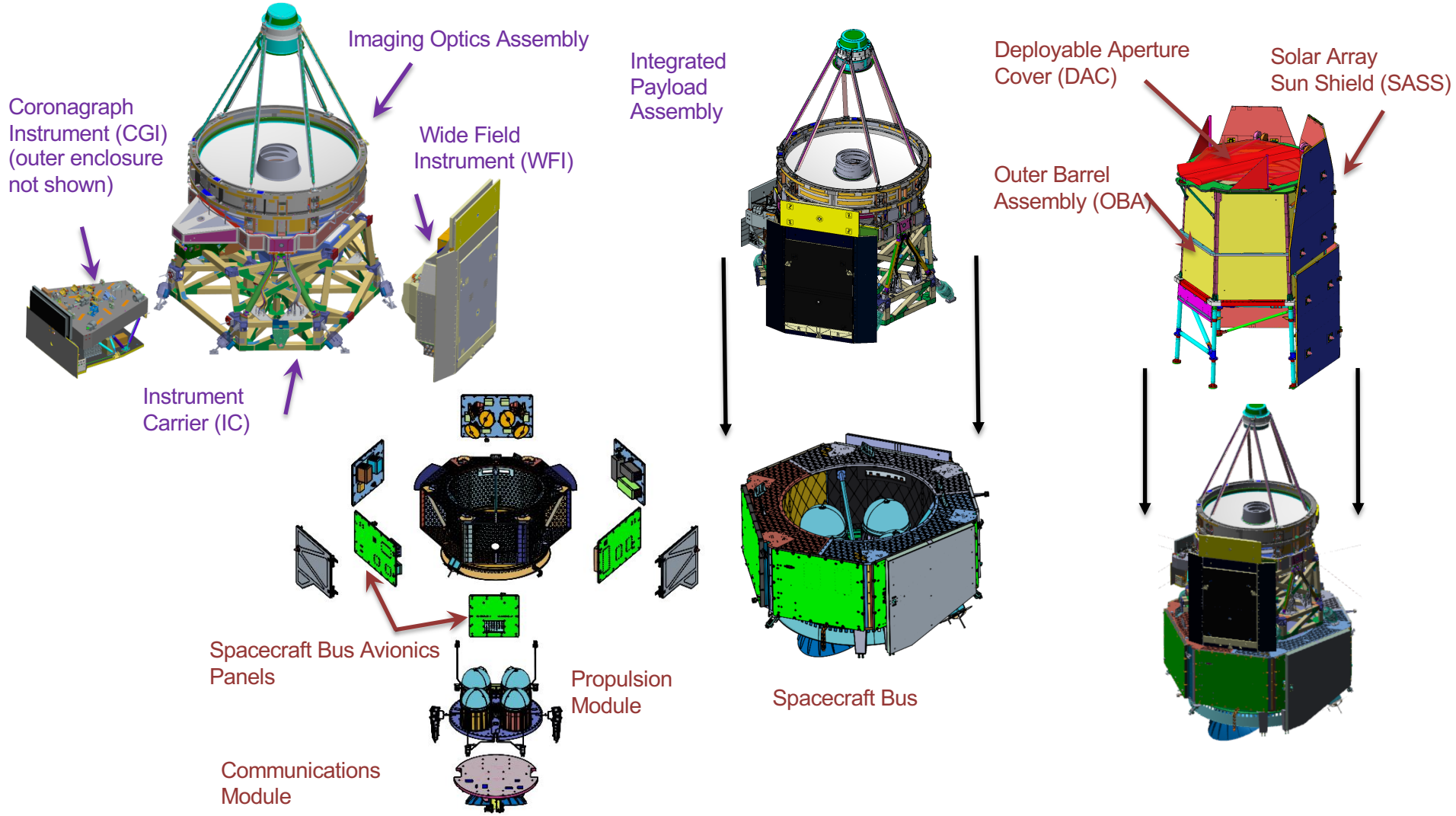
Launch Vehicle: 3 options

Mission Duration: 5 yr, 10yr goal

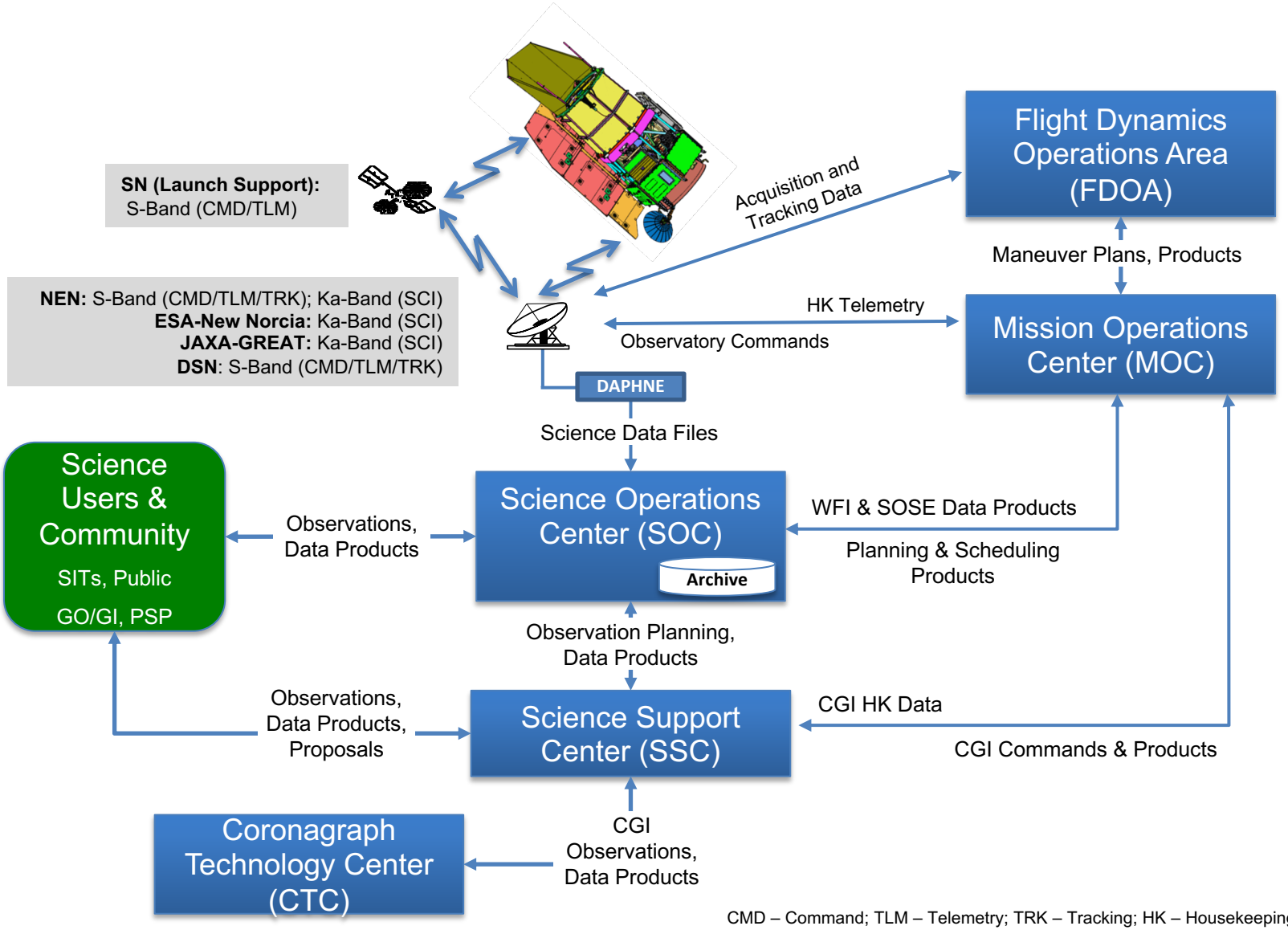
Serviceability: Observatory designed to be robotically refuelable

Observatory Expanded View

Observatory = Spacecraft + Integrated Payload Assembly



System Architecture Diagram

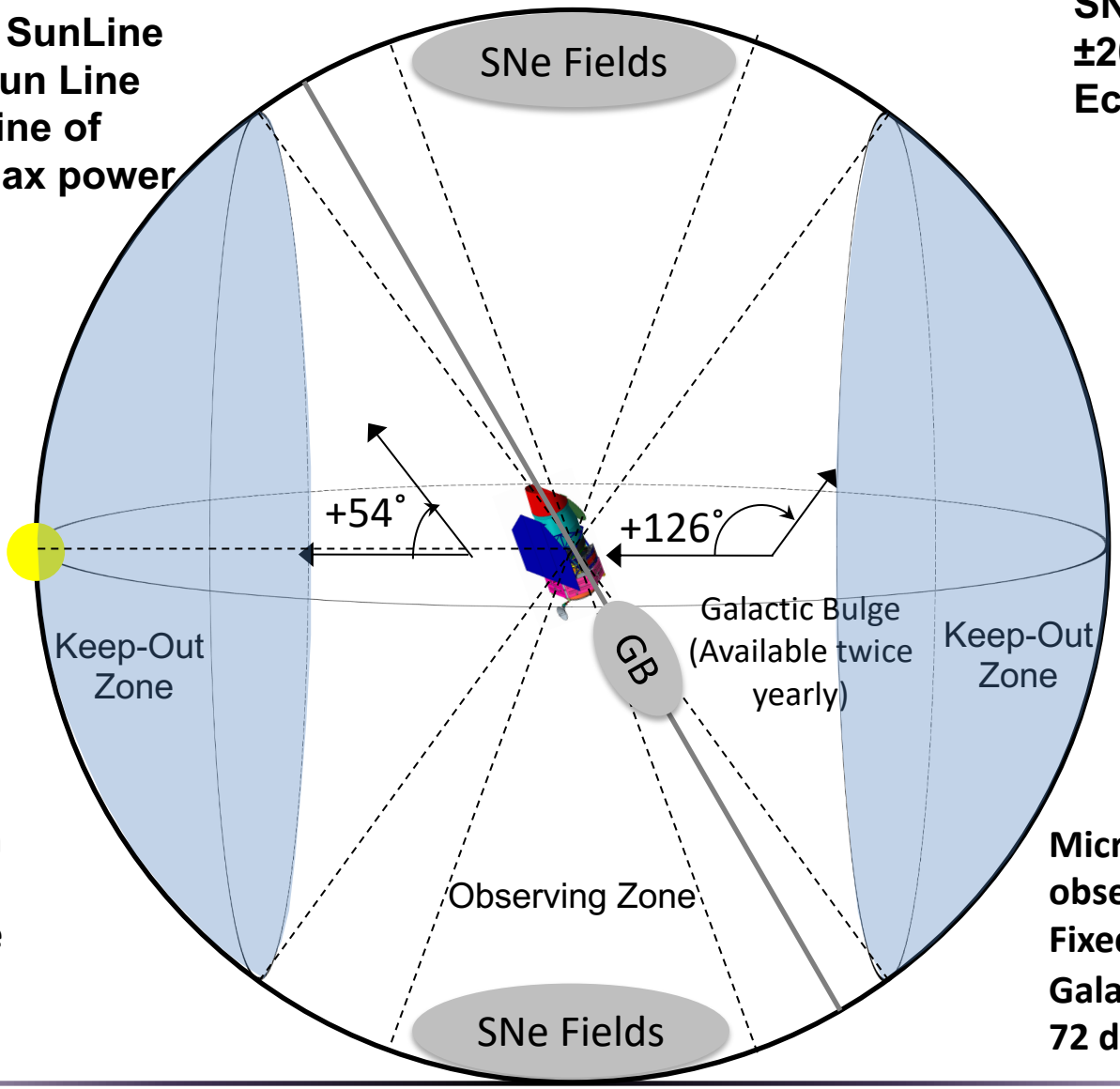


CMD – Command; TLM – Telemetry; TRK – Tracking; HK – Housekeeping; SCI – Science

Field of Regard

Observing Zone:
- **54˚-126˚ Pitch off SunLine**
- **360˚ Yaw about Sun Line**
- **±15˚ Roll about Line of Sight (LOS) off max power roll angle**

SNe Fixed Fields ±20˚ off the Ecliptic Poles

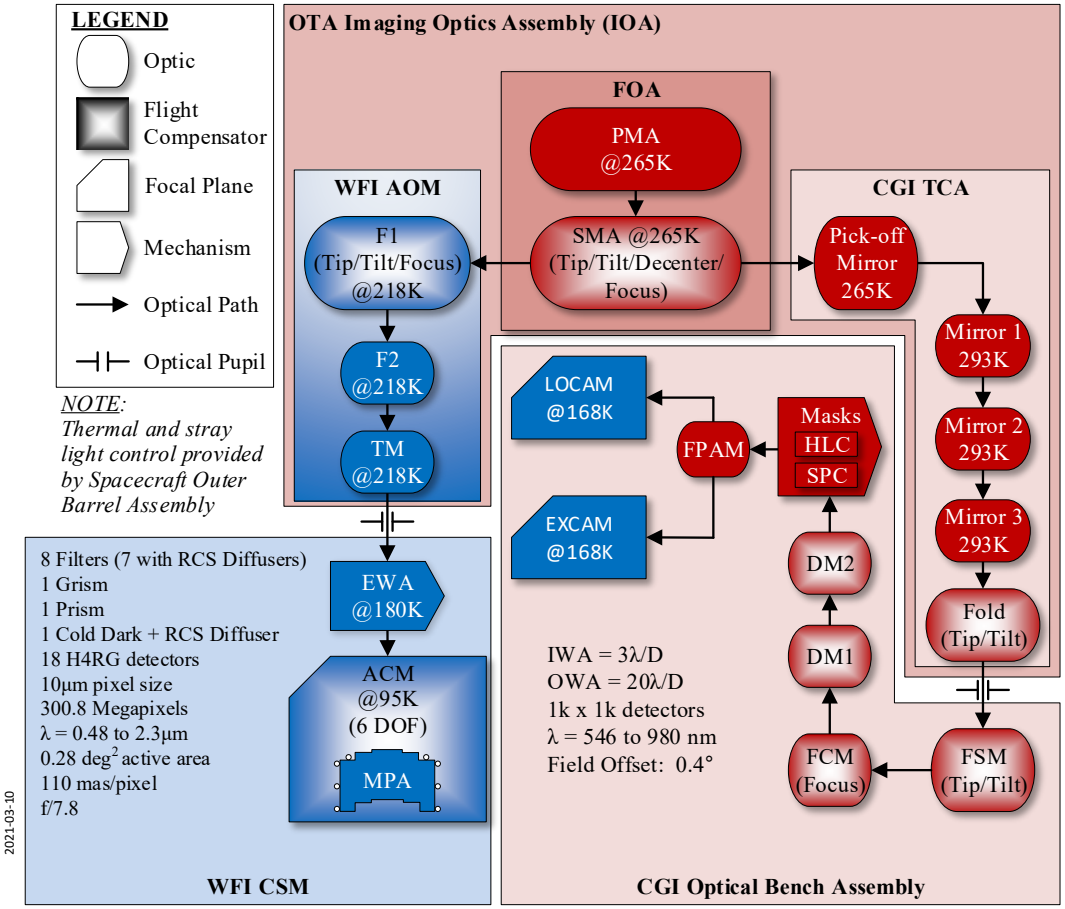


Earth/Moon LOS avoidance angles are a minor sporadic constraint

HL/GO/Coronagraph Surveys can be optimized within the full Observing Zone

Microlensing can observe Inertially Fixed Fields in the Galactic Bulge (GB) for 72 days twice a year

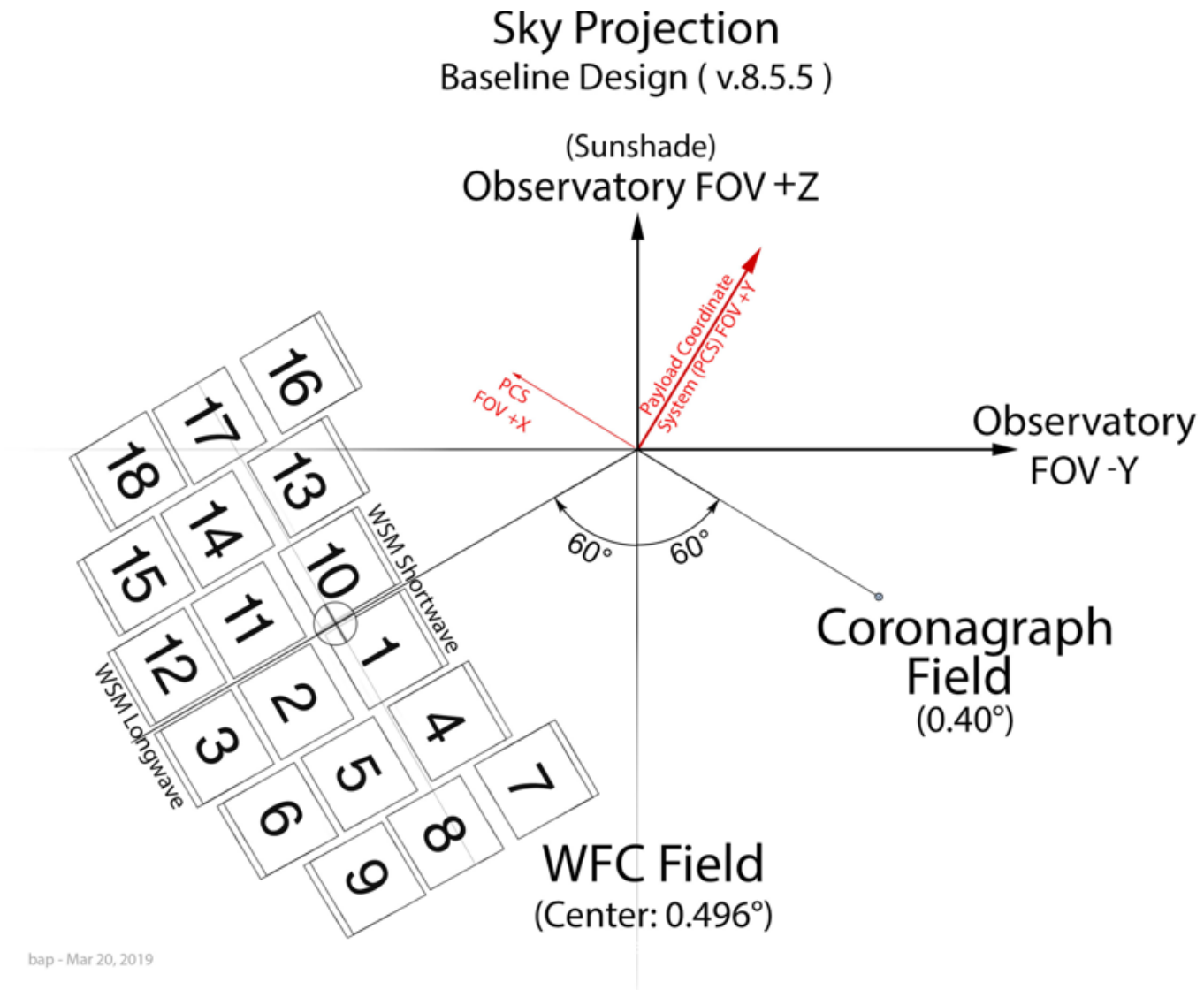
Payload Optical Block Diagram



Acronyms

AOM – Aft Optics Module
ACM – Alignment Compensation Mechanism
CGI = Coronagraph Instrument
CSM = Cold Sensing Module
DM = Deformable Mirror
EWA = Element Wheel Assembly
EXCAM = Exoplanet Camera
FCM = Focus Control Mechanism
FOA = Forward Optics Assembly
FPAM = Focal Plane Alignment Mechanism
FSM = Fast Steering Mirror
HLC = Hybrid Lyot Coronagraph
IFM = Instrument Fold Mirror
LOCAM = Low Order Wavefront Sensing Camera
MPA = Mosaic Plate Assembly
OTA = Optical Telescope Assembly
PMA = Primary Mirror Assembly
SMA = Secondary Mirror Assembly
SPC = Shaped Pupil Coronagraph
TCA = Tertiary Collimator Assembly
TM = Tertiary Mirror
WFI = Wide Field Instrument

Optical Field Layout



Representative Slew Times

Slew type	Slew angle (deg)	Slew time (s) 6 wheels	Slew time (s) 5 wheels
Gap Fill	0.025	21.4	23.4
Short FoV	0.4	49.3	54.8
Long FoV	0.8	67.4	76.0
2-deg	2.0	98.7	116
5-deg	5.0	162	179
10-deg	10.0	267	284
30-deg	30.0	667	684
90-deg	90.0	1865	1882

Times computed assuming maximum expected inertia.

Times shown include the settle time.

Baseline operations: 6 wheels

Must meet mission requirements with 5 wheels

Slew and settle times