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**

- Imaging Optics Assembly
- Wide Field Instrument (WFI)
- Corogrph Instrument (CGI) (outer enclosure not shown)
- Instrument Carrier (IC)
- Spacecraft Bus Avionics Panels
- Communications Module
- Propulsion Module
- Spacecraft Bus
- Deployable Aperture Cover (DAC)
- Outer Barrel Assembly (OBA)
- Solar Array Sun Shield (SASS)
System Architecture Diagram

Flight Dynamics Operations Area (FDOA)
- Maneuver Plans, Products

Mission Operations Center (MOC)
- HK Telemetry
- Observatory Commands
- Acquisition and Tracking Data

Science Operations Center (SOC)
- Observation Planning, Data Products
- WFI & SOSE Data Products
- Planning & Scheduling Products
- CGI HK Data

Science Support Center (SSC)
- CGI Commands & Products
- CGI Observations, Data Products
- Observation Planning, Data Products

Coronagraph Technology Center (CTC)
- DAPHNE
- Science Data Files
- Observations, Data Products, Proposals
- Observations, Data Products

Science Users & Community
- SN (Launch Support): S-Band (CMD/TLM)
- NEN: S-Band (CMD/TLM/TRK); Ka-Band (SCI)
- ESA-New Norcia: Ka-Band (SCI)
- JAXA-GREAT: Ka-Band (SCI)
- DSN: S-Band (CMD/TLM/TRK)
- SN (Launch Support): S-Band (CMD/TLM)

Observatory Commands
- CGI HK Data
- CGI Commands & Products

Planning & Scheduling Products
- DSN: S-Band (CMD/TLM/TRK)
- HK Telemetry

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

SNe Fields

Galactic Bulge (Available twice yearly)

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

**LEGEND**
- Optic
- Flight Compensator
- Focal Plane Mechanism
- Optical Path
- Optical Pupil

**NOTE:**
Thermal and stray light control provided by Spacecraft Outer Barrel Assembly

### OTA Imaging Optics Assembly (IOA)

- FOA
- PMA @265K
  - SMA @265K (Tip/Tilt/Decenter/Focus)
- WFI AOM
  - F1 (Tip/Tilt/Focus) @218K
  - F2 @218K
  - TM @218K
- WFI CSM
  - EWA @180K
  - ACM @95K (6 DOF)
  - MPA

### CGI Optical Bench Assembly

- CGI TCA
- Pick-off Mirror 265K
  - Mirror 1 293K
  - Mirror 2 293K
  - Mirror 3 293K
- FPAM
  - Masks
    - HLC
    - SPC
- EXCAM @168K
- LOCAM @168K
- DM2
- DM1
- FCM (Focus)
- FSM (Tip/Tilt)

### WFI AOM

- EWA @180K
- ACM @95K (6 DOF)

### WFI CSM

- EWA @180K
- ACM @95K (6 DOF)

### 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
- 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

**Acronym Explanations**
- IWA = 3λ/D
- OWA = 20λ/D
- 1k x 1k detectors
- λ = 546 to 980 nm
- Field Offset: 0.4°
Optical Field Layout

Sky Projection
Baseline Design (v.8.5.5)

(Sunshade)
Observatory FOV +Z

Coronagraph Field
(0.40°)

WFC Field
(Center: 0.496°)

bap - Mar 20, 2019
Representative Slew Times

<table>
<thead>
<tr>
<th>Slew type</th>
<th>Slew angle (deg)</th>
<th>Slew time (s) 6 wheels</th>
<th>Slew time (s) 5 wheels</th>
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<tr>
<td>Gap Fill</td>
<td>0.025</td>
<td>21.4</td>
<td>23.4</td>
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<tr>
<td>Short FoV</td>
<td>0.4</td>
<td>49.3</td>
<td>54.8</td>
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<tr>
<td>Long FoV</td>
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<td>267</td>
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<td>30-deg</td>
<td>30.0</td>
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<td>684</td>
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<tr>
<td>90-deg</td>
<td>90.0</td>
<td>1865</td>
<td>1882</td>
</tr>
</tbody>
</table>

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

Roman Slew & Settle times

- Max expected inertia, no wheels failed
  - Long FoV dir
  - Short FoV dir
  - Diagonal

Slew + Settle time (seconds)

Slew Angle (degrees)

Roman Slew & Settle times

- Max expected inertia, no wheels failed
  - Long FoV dir
  - Short FoV dir
  - Diagonal

Slew + Settle time (seconds)

Slew Angle (degrees)