Orion Imagery Working Group (OIWG)

Orion Imagery – What's New for Artemis II

Rev E

December 4, 2023

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Orion Imagery System (OIS) Overview

For Artemis II, the vehicle-mounted OIS comprises:

- 4 Solar Array Wing (SAW) cameras
- 3 in-cabin wireless cameras
- 3 external wired cameras
- 2 human-health monitoring cameras
- 2 camera controllers
- 1 Fwd Bay high speed camera

15 cameras

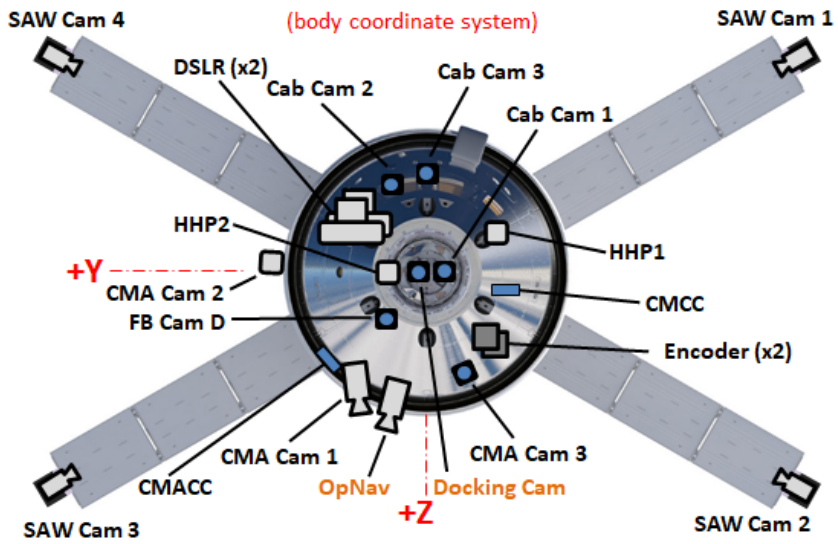
Other optical systems:

- 4 wireless cameras for NatGeo payload (proprietary data)
- 4 Portable computing devices (tablets) with webcams
- 2 Nikon D5 DSLR camera bodies (+ lenses, batteries, etc.)
- 2 ZCube video encoders (prime + spare)
- 1 Docking Camera (DCAM)
- 1 Optical Navigation (OPNAV) camera
- 1 drag-on temp-mount camera to monitor crew ingress (KSC system)

13 cameras

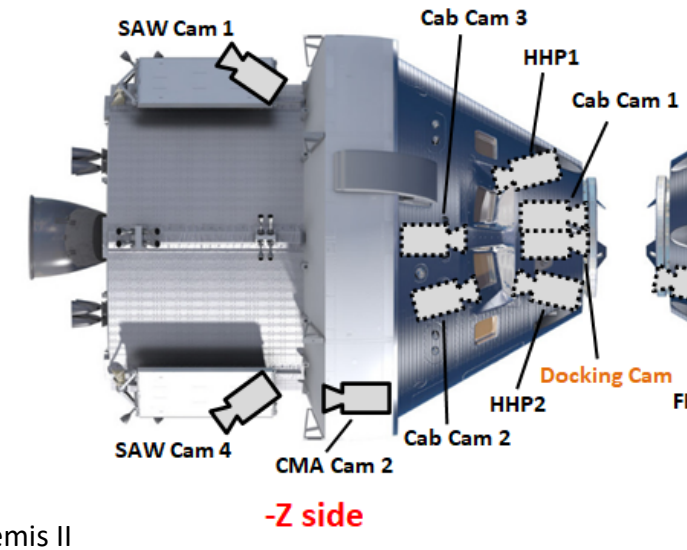
Total: **28** cameras supporting Orion on Artemis II

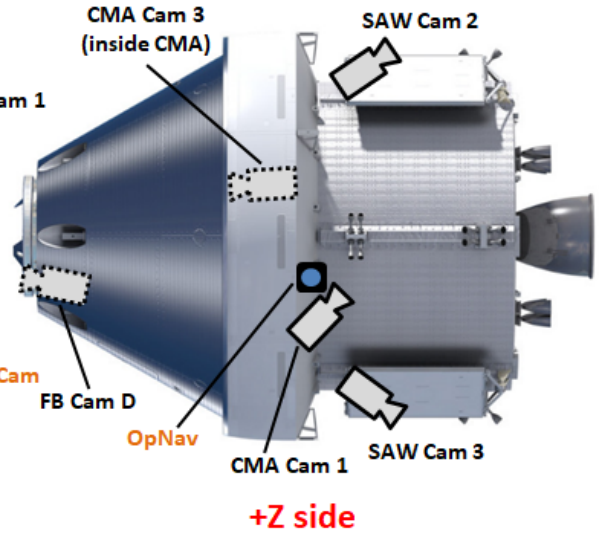
Orion Imagery System for Artemis II

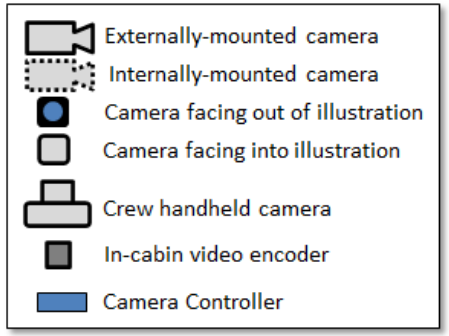


	CAMERA	USE	STREAMING FORMATS
	Cab Cam 1,2	Engineering, Jettison Events, Parachutes	<SD, HD
	Cab Cam 3	Crew Monitoring	
B ☆	HHP1,2	Dynamic Flight Crew Monitoring	
	SAW Cam 1,2,3,4	Engineering, Vehicle Inspections	
	CMA Cam 1	Engineering, Jettison Events	SD, Custom
	CMA Cam 2	Engineering, Vehicle Monitoring	
	CMA Cam 3	Engineering, Spacecraft Separation	
☆ G	Docking Cam	GN&C, Proximity Operations	Custom
B ☆	DSLR (x2)	Crew Photography, Media Events	HD, UHD
	FB Cam D	High Speed FBC Jettison/Parachute Ops	N/A
G	OpNav	GN&C, Optical Navigation	N/A

☆ = New for Artemis II
G = Owned and operated by GN&C
B = Battery-powered device







What's New for Artemis II

Human Health & Performance (HH&P)
- 2 cameras on CM fwd bulkhead to monitor crew during dynamic flight
- Primary job is high speed internal recording during ascent, entry, aborts
- One (H1) will simo live stream from ingress through ascent H/O to TDRS

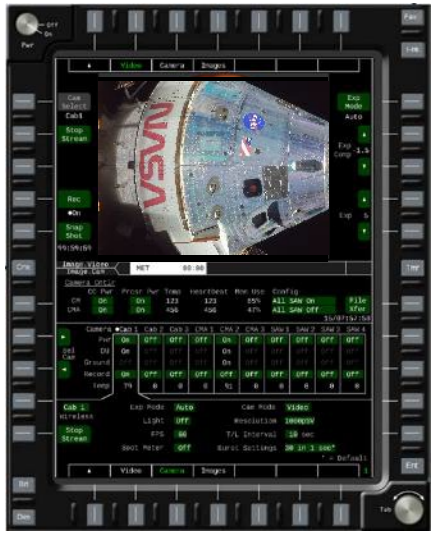
Crew Handheld Camera
- 2 Nikon D5 DSLRs for PAO and crew preference photography
- 14-24mm lens, 80-400mm lens

Video Encoder
- ZCube encoder will efficiently compress video from CAB H1 and Nikon DSLR for live stream downlinks
- Can handle both HD (1920x1080) and UHD[1] (3840x2160) video formats

Crew Displays
- DU interfaces added for crew interaction with vehicle cameras[2]

Docking Camera (DCAM)
- Optical navigation sensor, managed as part of the GN&C subsystem[2]
- Centerline mounted behind forward docking hatch window, used for Rndz and Prox. Ops (RPO) Demo

NOTES
[1] Requires Optical Comm downlink and ground system configuration upgrades
[2] DCAM (only) can simo live stream to crew and ground. CAB, SAW, and CMA cameras stream to ground or crew, not both.



Pre-Launch Crew Ingress (KSC)
- Temp-installed ground camera to monitor crew ingress and strap-in, removed prior to launch

Personal Computing Device (PCD)
- MS Surface Pro
- Used for PFCs, PMCs, office apps, DSLR imagery storage, viewing recorded stills/videos on camera controllers

NatGeo Payload
- Handheld GoPros for crew to record the mission, proprietary use by Disney/NatGeo for documentary
- No in-flight downlink

Artemis II Challenges

Comm

- RF bandwidth limitations make s-band downlink pipe a limited and shared resource
- Optical Comm DTO may allow up to ~20-30 Mbps burst downlink mode for short times, depending on vehicle attitude

Onboard Storage

- Vehicle camera imagery storage is very limited – camera controllers are already nearing max capacity
- For Nikon D5, 10 256 GB compact flash cards should (hopefully) provide ample storage but timeline downlink remains a challenge
- If in-flight downlink of Nikon video files is desired, strongly recommend limiting to HD (1080 or 720) format; large 4K/UHD video will most likely need to remain onboard for post-flight retrieval

Windows

- Orion requirements officially call for Cat B window optical quality (suitable for “Large Lens Photography” with focal lengths $\geq$ 400 mm)
- Officially verified to at least “Cat D” (suitable for “Piloting Tasks and Small Lens Photography”) – basically point-and shoot type cameras with lens focal lengths <100mm
- Orion imagery team is pressing for full-frame DSLR characterization photography of windows in full flight-like (triple-pane) stack – at a minimum, in-flight crew photography on FD1,2 should help inform options for camera configuration and window choice for lunar flyby later in the mission

Artemis II Major Imagery Ops per Flight Day

Flight Day	Major Imagery-Related (or supporting) Events
1	Pre-launch vehicle inspections, Crew ingress, Liftoff/ascent (LAS & SAJ jettison, SAW deploy, ICPS sep), RPO demo, Optical Comm activation
2	TLI burn, PAO event(s), NatGeo payload activation, CSM external inspection
3	NatGeo payload opportunity, PAO event(s)
4	NatGeo payload opportunity, PAO event(s)
5	Lunar approach, NatGeo payload opportunity, PAO event(s)
6	Lunar flyby, NatGeo payload opportunity, PAO event(s), CSM external inspection
7	PAO event(s)
8	NatGeo payload opportunity, PAO event(s)
9	NatGeo payload opportunity, PAO event(s)
10	CM/SM Sep, Entry, Descent, Landing, Recovery

Transfer of CMA camera controller files to CM camera controller

TBDs:

- Availability of OpCom
- Video for in-flight evaluation of exercise equipment (probably use Nikon D5, but camera config, procedures, and days TBD)
- Use of video (PCD) vs A/G (voice only) for PMCs and PFCs
- CSM umbilical ice detection (TBD hrs prior to entry)
- Wastewater (urine) vent port monitoring DFTO (days TBD)
- Imagery ops for lunar science (Science imagery plan TBD)
- Ad hoc (currently unplanned) imagery requests

Questions?