



Augmented Reality Intelligent Crew Assistant

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Software Robotics & Simulation Division

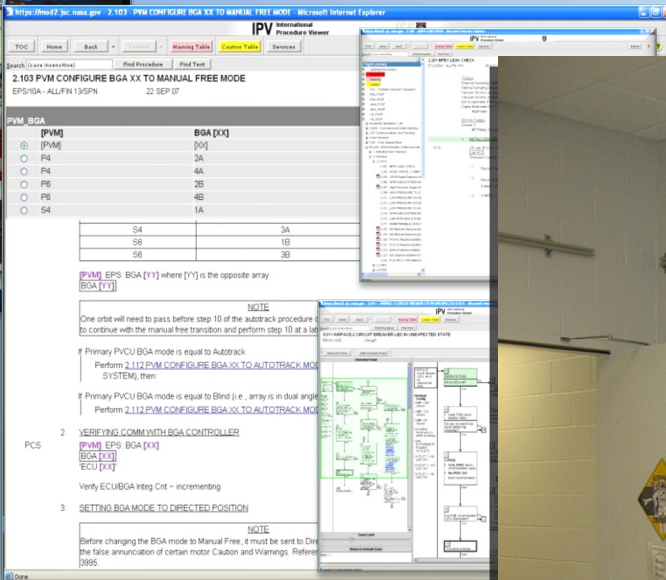
NASA JSC



Vision



Old



Now



The Next Step





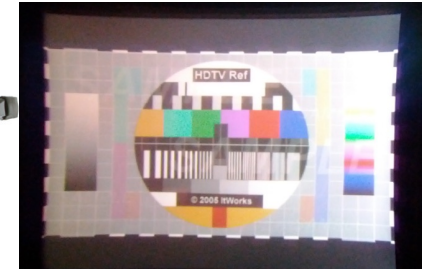
System Evaluations



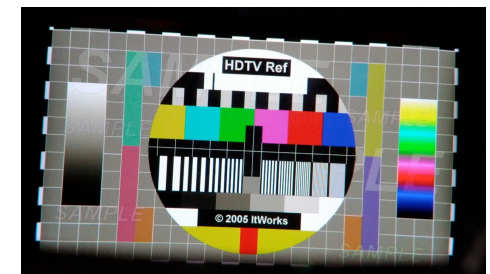
- COTS Systems Hardware
 - Sony HMD
 - Galaxy Pad
 - Google Tablet
- Software Assessment
 - Qualcomm AR SDK v1.5
 - Kinect Fusion



Vuzix 9200 Wrap



Vuzix 1200 Wrap

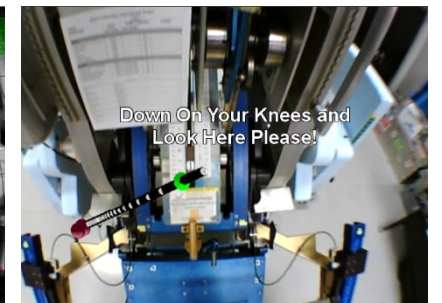
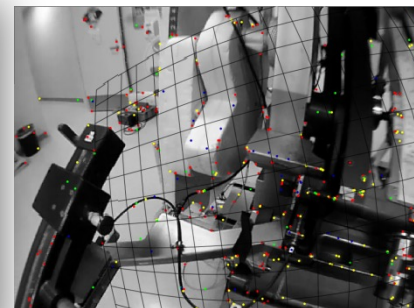
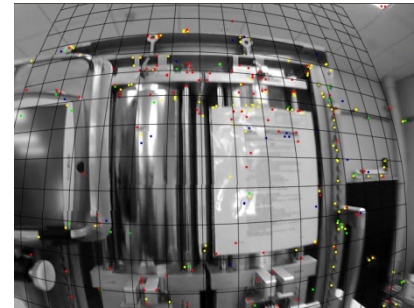
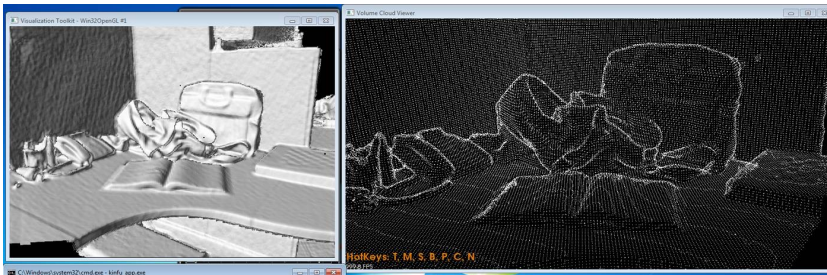




AR Algorithms Development



- AR Machine Vision Object Recognition and Tracking
 - 2D & 3D point cloud parallel algorithms from U of Oxford
 - Sparse 3D Points Cloud: PTAMM, SurfGPU, GPU-based KLT-Tracking
 - Dense 3D Points Cloud: DTAM, Kinect Fusion
 - Initial Results:
 - Kinect Fusion provides the best opportunity for performance improvements through GPU
 - Occlusion of objects possible within the 3D scene
- AR Toolkit from Washington University
- AR ARED Prototype with Vuzix WRAP 920AR+ & Sony HMZ-T1 & Custom software including AR Machine Vision, 3D graphic rendering





NEEMO Tastings

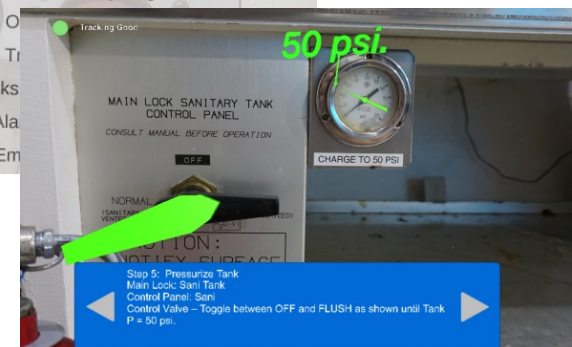
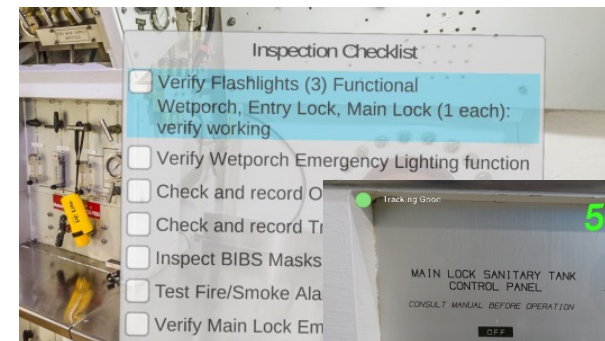


NEEMO 18-19



NEEMO 20

ODG





NASA Use of HoleLens



HoloLens 1



Background: In FY15, through HEOMD sponsorship, (Project code Sidekick) for ISS program.



HoloLens 2 -
But, Not Yet onboard!

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Cargo Trans Ops – **NEEMO21**

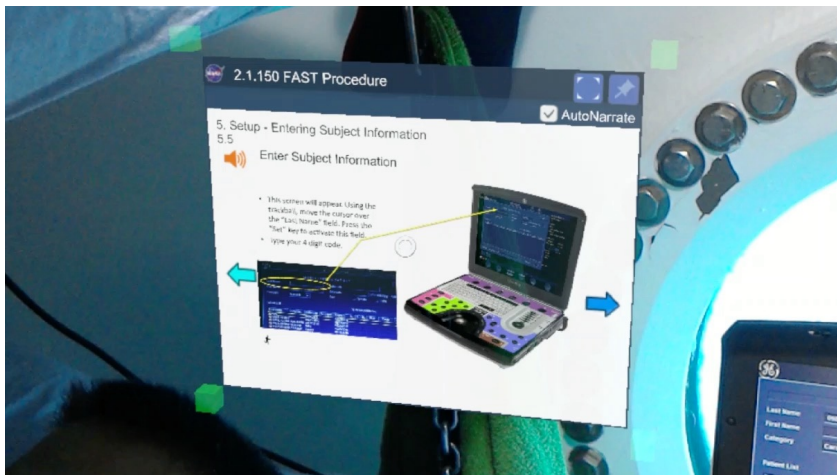
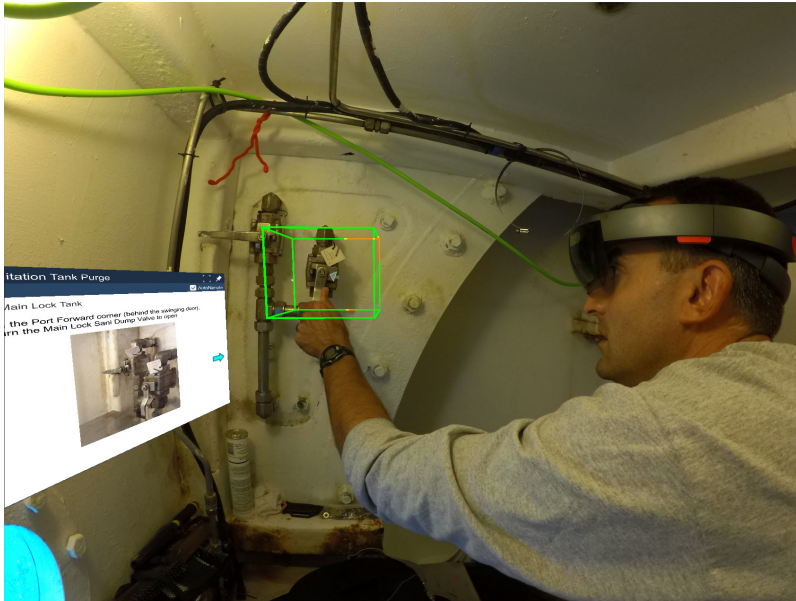




Continue NEEMO Testing



NEEMO 22



NEEMO 23



View & Execution [Available] [Active] [Completed]

6/20/1 MiniDNA Full Procedure (HabDev) test Tietronix

Elapsed: 00h:01m:01s

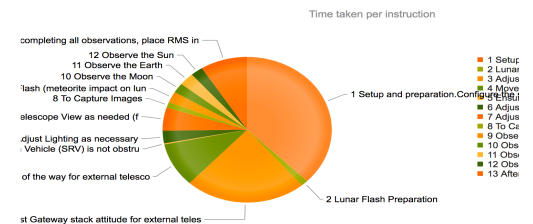
Objective:
To collect environmental samples, extract bacterial DNA with miniPCR, clean up DNA with magnetic beads and sequence using the MiniDNA Sequencer.

1 WORK AREA SET UP AND HARDWARE DEPLOYMENT

- 1.1 Retrieve MiniDNA Dry Supply Bag
- 1.2 Don Nitrile Gloves (to keep extraneous DNA from being introduced).
- 1.3 Retrieve miniPCR and miniPCR POWER - OFF (side of machine)
- 1.4 miniPCR Power Cable -> To habitat power
- 1.5 miniPCR Power Cable -> miniPCR POWER (Side of machine)

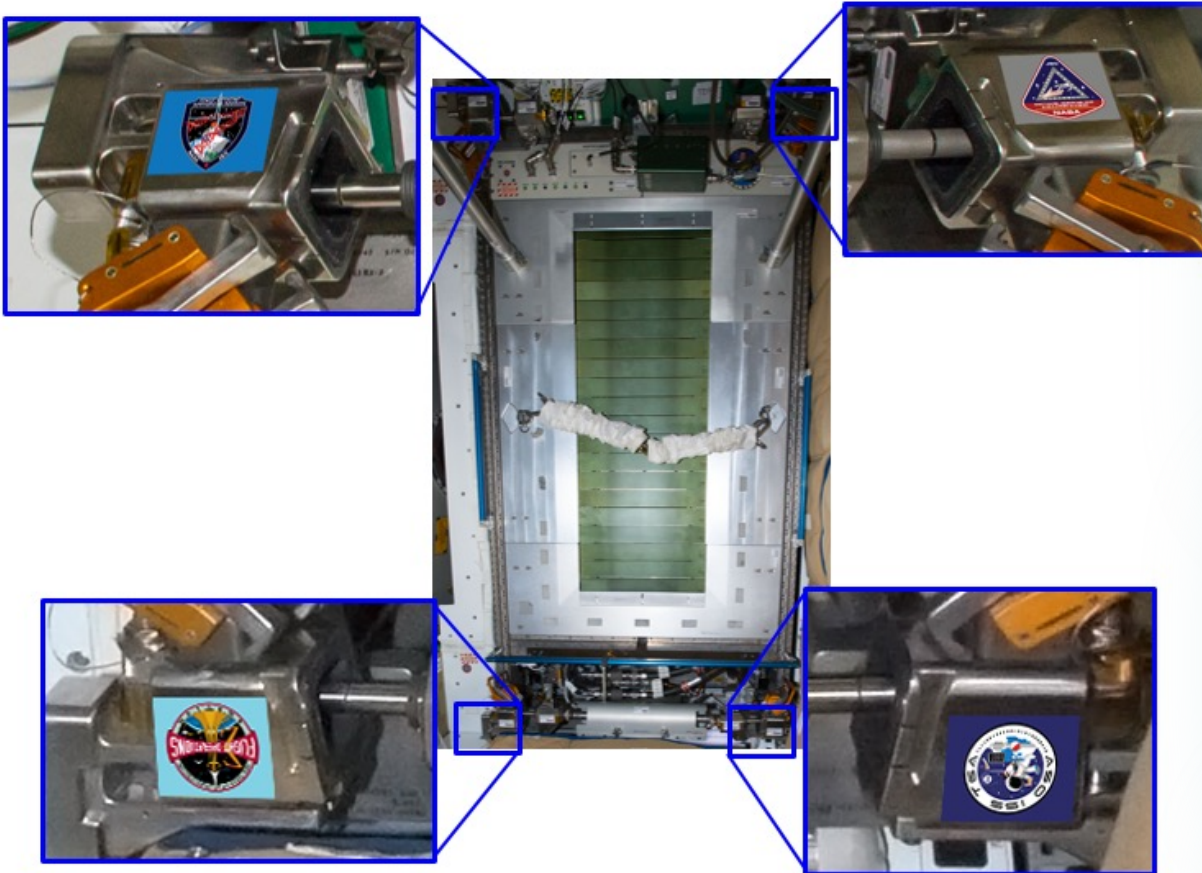
2 SAMPLE COLLECTION

- 2.1 Retrieve timer, miniPCR Test Tube Rack, Test Tube Rack and MiniDNA Consumable Packet from MiniDNA Dry Storage Bag.
- 2.2 Retrieve MiniDNA Sample Collection Kit from "MiniDNA Reagents Kits" bag in cold storage. Return "MiniDNA Reagent Kits" bag to cold storage.
- 2.3 While still in Ziplock Bag(s) inspect sample tubes for leakage.
 - 2.3.1 If leakage present,
 - 2.3.1.1 -> MCC
- 2.4 Temp Store all reagents on test tube rack or miniPCR tube racks.

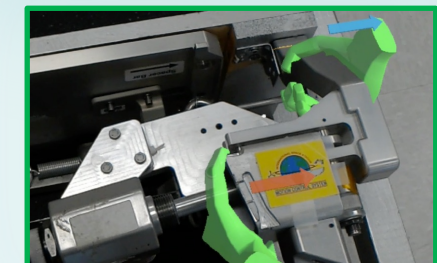
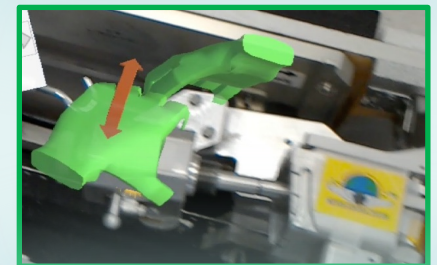




T2 Treadmill “Wiggle Test”



Aerial view of the treadmill

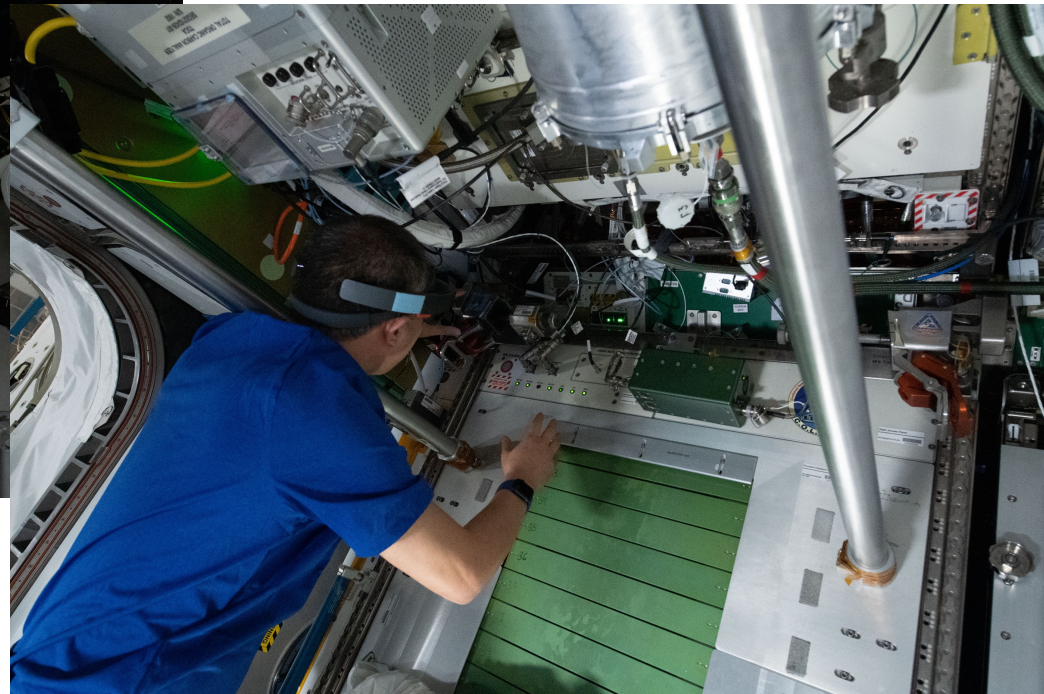




On-Orbit Expedition 64: T2-AR Maintenance



- On April 15, 2021, the T2 Augmented Reality demonstration successfully completed our *first of six* on-orbit activities after many crew schedule constraints and delays.
- Initial feedback from Soichi Noguchi was very positive!
 - He really enjoy the “**overlay graphics of the actual hardware, and suggested motion**”.







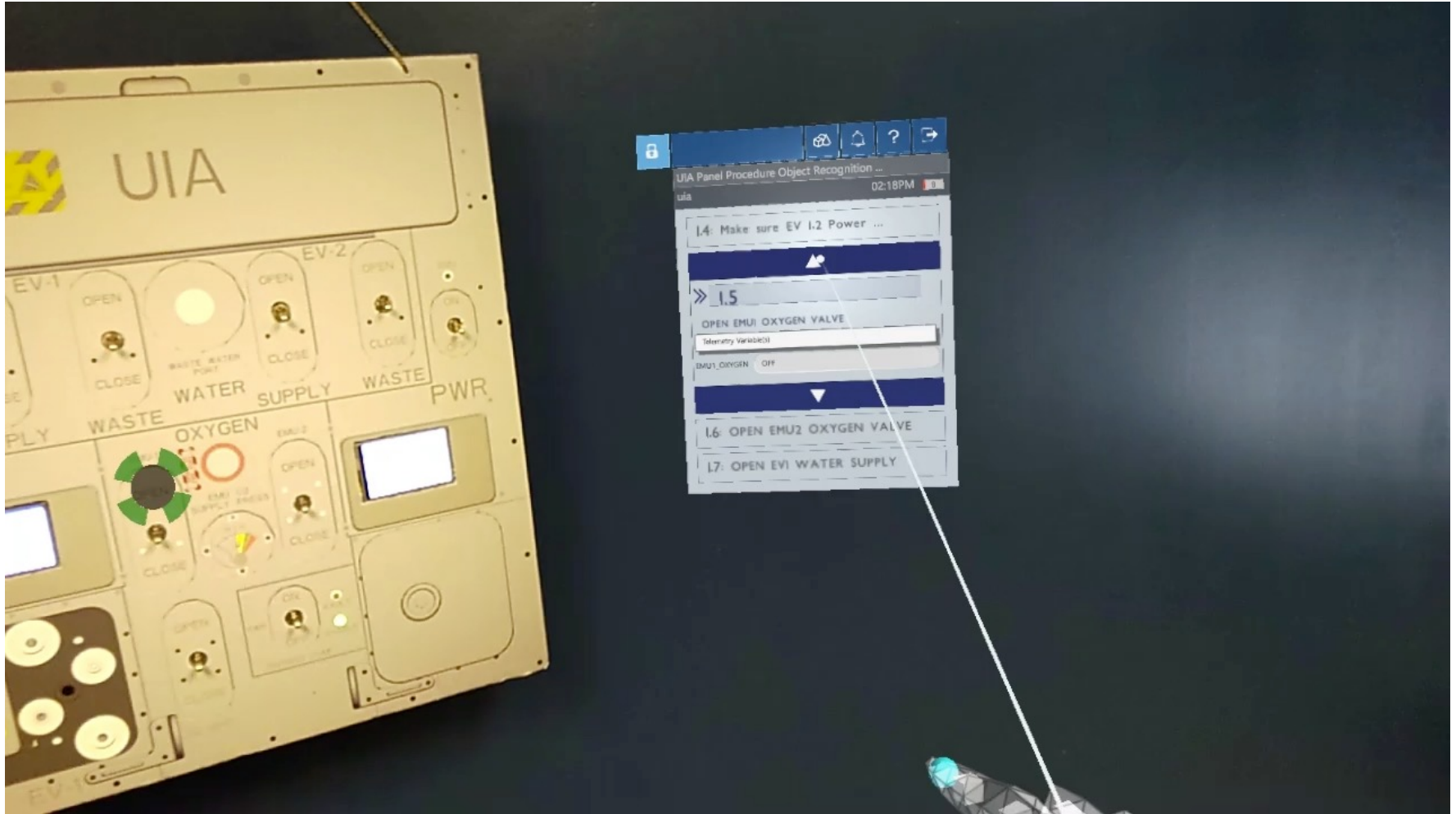
T2 AR On-Orbit Features & "First"



- T2-AR Application Features:
 - AR Procedural display panel with multimedia content (text, images, and video) that can hide, docked or follow user
 - AR procedures with 3D directional cues to guide user to the work site
 - AR procedures with 3D animation sequences overlays registered directly on top of the system to be inspected
 - AR procedures with voice commanding to navigate procedure sequences
 - AR procedures to voice readout the instruction
 - AR procedures that record execution status
- For this activity, we made several **"First"**
 - **Operational First:**
 - First autonomous crew use of AR technology ('untethered' from MCC)
 - First use of AR to perform maintenance and inspection of ISS systems in space
 - **Technical First:**
 - First use of commodity Microsoft HoloLens on orbit Tasks
 - First use of NASA built HL application for maintenance and inspection of ISS systems



AR EVA Prep Procedure





AR IRIS (Dialogue Voice Interaction)





What's Next?

