

Treadmill 2 Augmented Reality (T2 AR) ISS Flight Demonstration

Presentation for the System Problem Resolution Team Meeting

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Overview of Today's Discussion

- ASO ISS TEA Project Background
- Human Systems Integration (HSI) Approach
- T2 AR Maintenance Scenarios
- AR Application Description
- Demonstration Video Examples
- LIVE DEMONSTRATION

T2 AR is part of ASO ISS TEA

- Autonomous Systems Operations (ASO) is the next iteration of the studies accomplished as part of the previous Autonomous Mission Operations (AMO) project.
- Project Objective: develop and demonstrate advanced software technologies which enable crew/vehicle autonomy to perform aspects of Plan, Train, Fly normally allocated to the ground to enable future missions beyond low earth orbit.
- ASO ISS TEA includes T2 AR, EXPRESS 2.5, and AFTS



ASO T2 AR Multi-Disciplinary Team from Ames and JSC NASA Centers

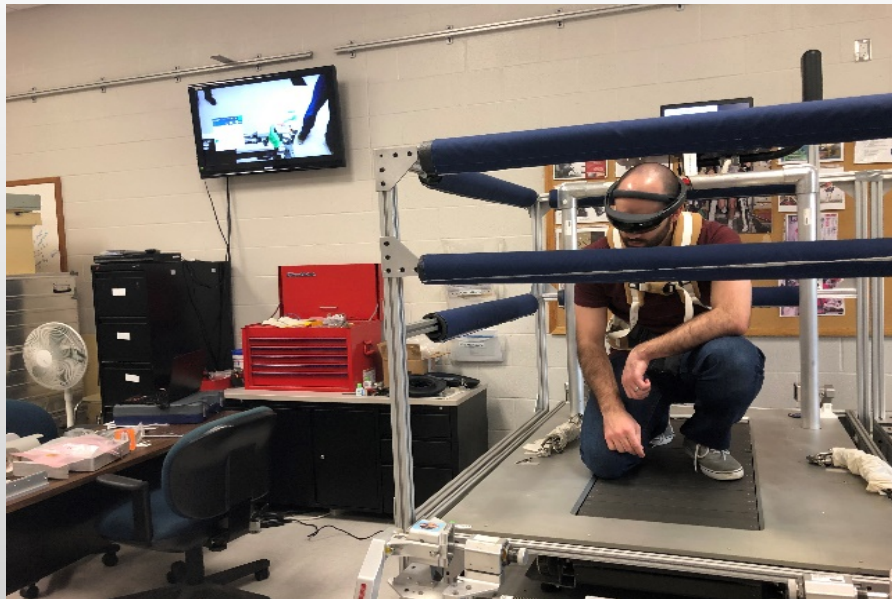
- Jeremy Frank (ARC TI) Principal Investigator
- Jeff Mauldin (JSC CM 53, deputy) T2 Operations Lead
- Christopher Knight (ARC TI) Software
- Lui Wang (JSC-ER611) - Engineering
- Vicky Byrne (JSC SF3) Human Factors Lead
- Brandin Munson (JSC SF3) Human Factors Support
- Kerry McGuire (JSC SF2) Human Factors (Current HF consultant)
- Michael Scott (ARC) Software
- Truyen Van Le (JSC) – Engineer/Software
- Victoria Rosenthal (JSC) – Engineer/Software
- Iona Gipson (JSC SD) ISS Ops/Procedures
- Danielle Conly (JSC SD) ISS Ops/Procedures



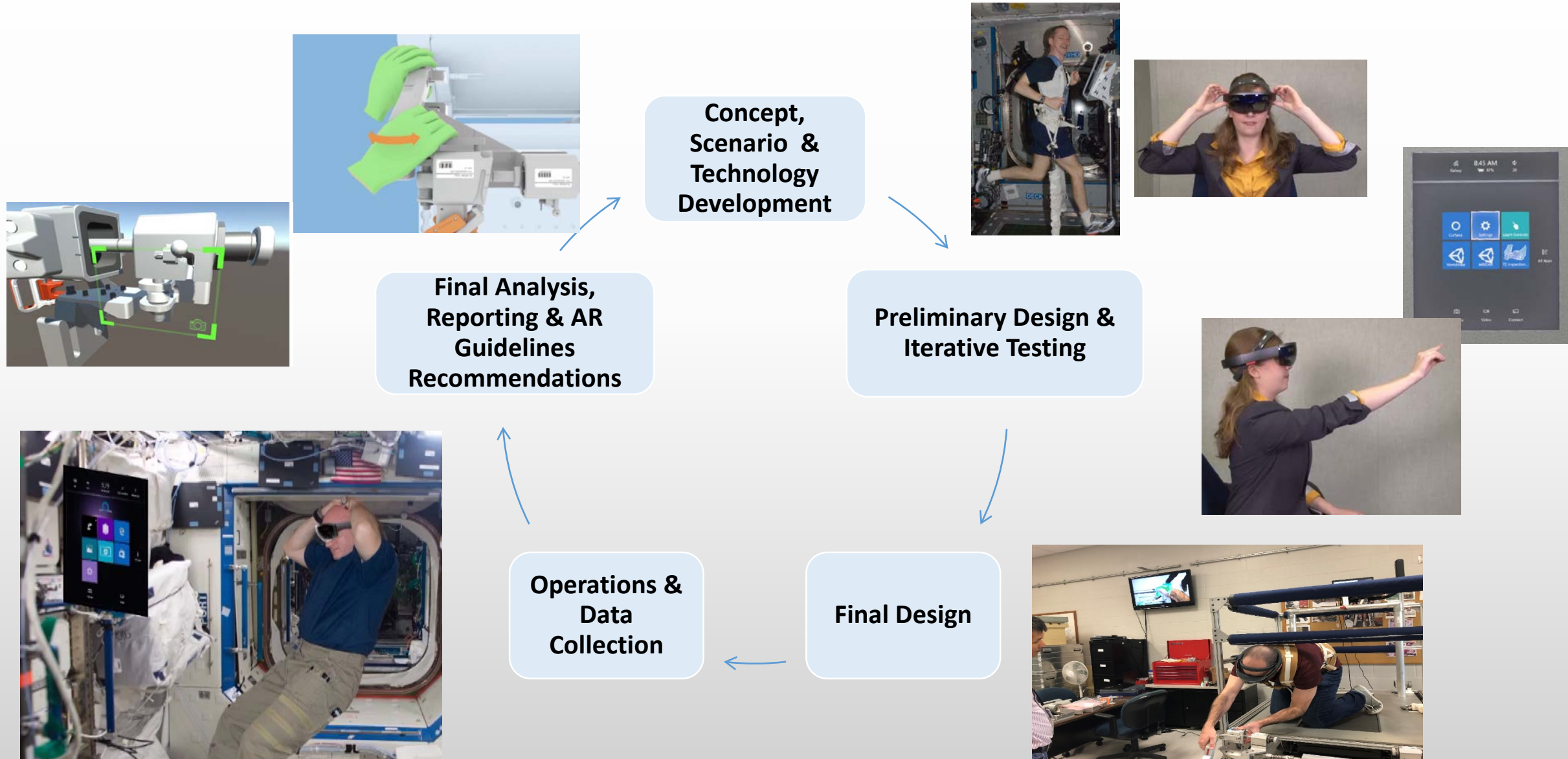
ISS TEA T2 AR Demonstration with Sidekick

Objectives:

- Demonstrate astronaut's ability to perform maintenance activities using augmented reality technology.
- Refine T2 monthly and quarterly inspection procedures for AR system.
- Buy down risk for larger integrated crew autonomy demonstration.



T2 AR Human System Integration (HSI) Process

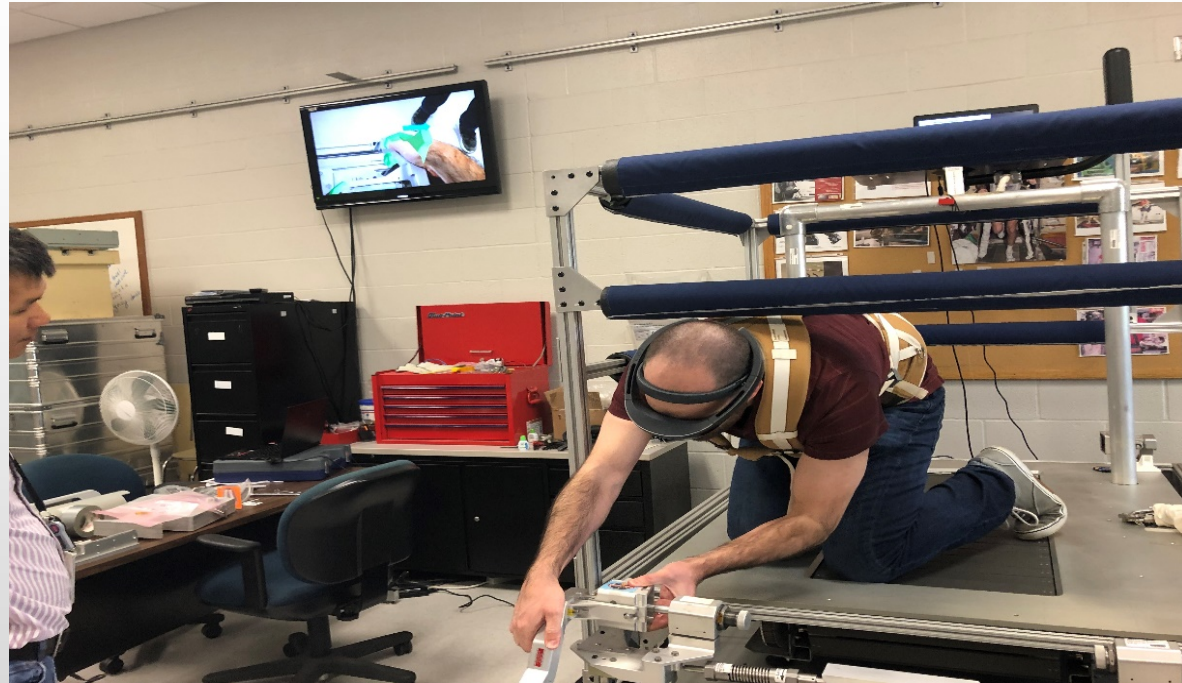


ISS TEA T2 AR Demonstration with Sidekick

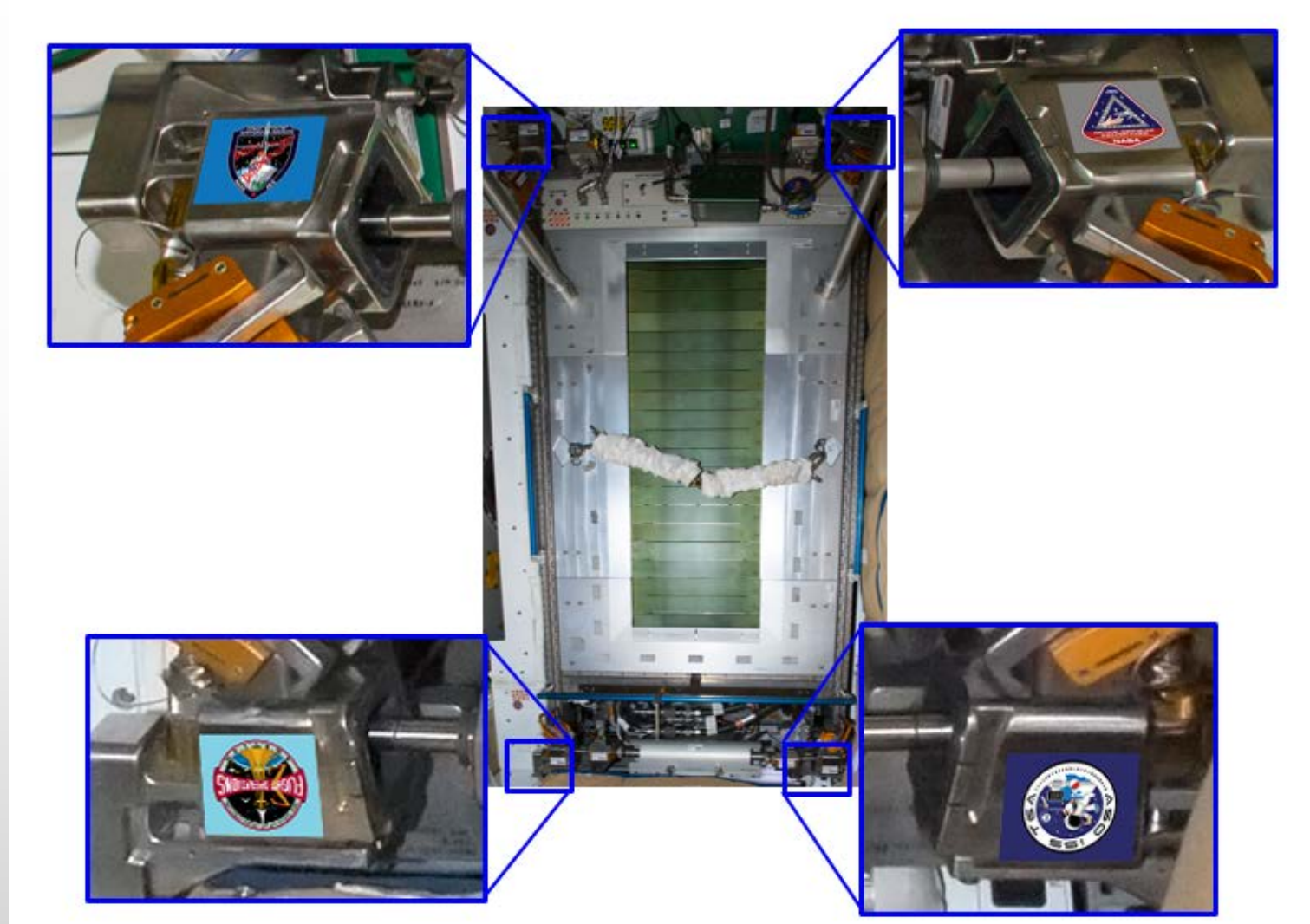
Scenario/Concept of Operations:

Crew will conduct T2 maintenance activities using AR technology, wearing Sidekick (a Microsoft HoloLens).

- Two Scenarios for T2 Inspections
 - Monthly T2 Inspection
 - Quarterly T2 Inspection



Fiducial markers will be pre-placed on the 4 corners of T2

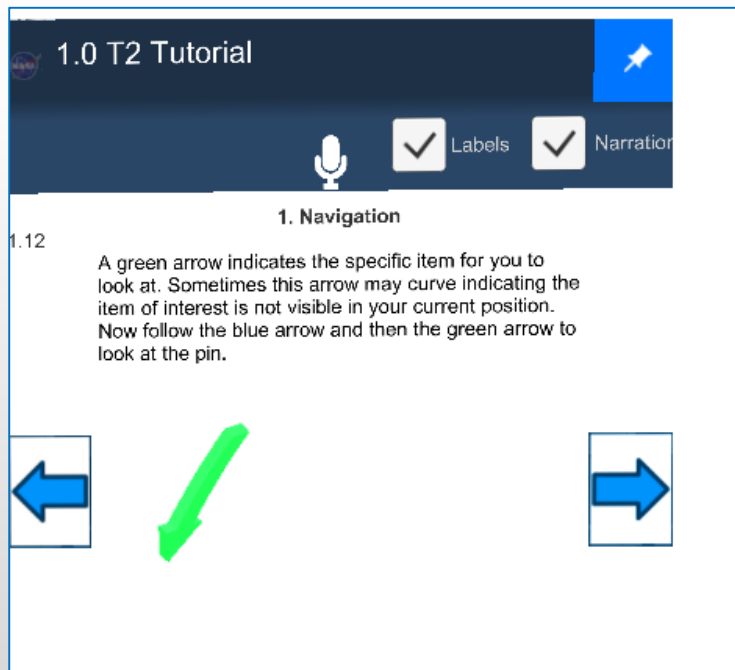


Arial view of the treadmill

T2 Inspection AR App: Monthly and Quarterly Sidekick procedures contain multimedia to support these crew activities

Pictures, Overlays and Graphics

Text



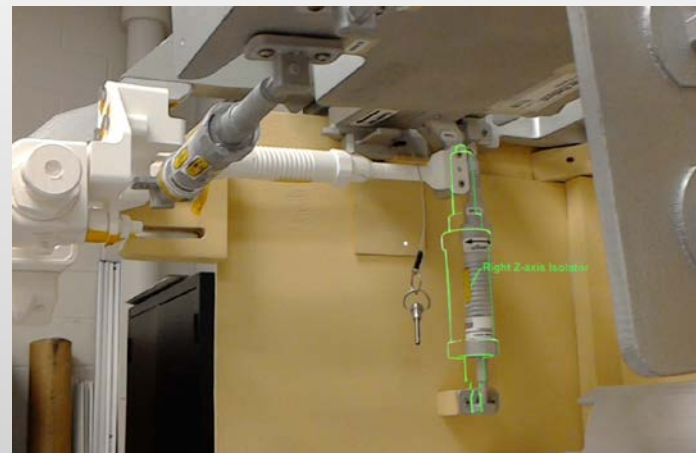
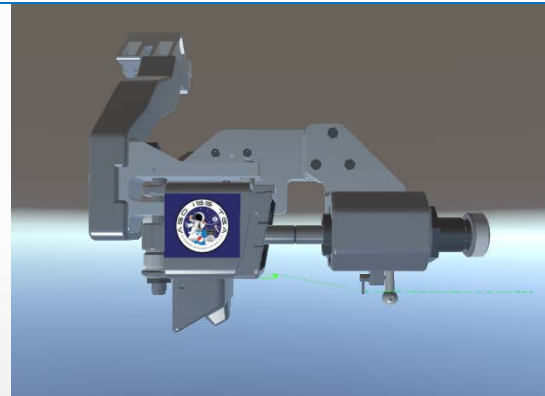

1.0 T2 Tutorial

Labels Narration

1. Navigation

1.12

A green arrow indicates the specific item for you to look at. Sometimes this arrow may curve indicating the item of interest is not visible in your current position. Now follow the blue arrow and then the green arrow to look at the pin.



Animations



Hover over this example animation to bring up the control bar for viewing it

Up next:

- Video Demo Examples
- Live Demo by Brandin Munson



Example 1 - T2 Monthly Maintenance

Hands on crew perspective – T2 AR App with animations for “Alignment Guides” hardware removal (Video Clip)

Example 2: T2 Monthly Maintenance

Hands on crew perspective – T2 App Moving Corner to Corner for a Wiggle Test (Video Clip)

Example 3: T2 Quarterly Maintenance

Tape application animation next to hardware
(Video Clip)

Thank you!

Any questions?



Back up

ASO Relationship to Previous Demos

- AMO EXPRESS
 - Preserving procedure display and procedure automation, adding EXPRESS scheduling
- Sidekick demo (HoloLens)
 - Emphasizing use of AR for crew autonomy
- AMO TOCA SSC
 - Leveraging expertise and some deployment expertise
- ICAST
 - Focused scheduling demonstration on short timescale (hours)
 - Focused on rescheduling in presence of faults and unexpected events; reasoning about hard constraints, flight rules and priorities