



Title: POIWG 48
Space Acceleration Measurement System (**SAMS**)
Splinter Session

Author: **Ken Hrovat**

Affiliation: **ZIN Technologies, Inc.**

June 30, 2021

Approved for Public Release; Distribution is Unlimited

Space Acceleration Measurement System (SAMS)

Outline

1. Overview
2. Topology
3. Customer Support
4. Two Time Share Scenarios
5. Wireless Deployment (plus contingency)
6. MAMS

SAMS Contacts:

- **Kevin McPherson**, SAMS Program Manager
  kevin.m.mcpherson@nasa.gov
- **Ken Hrovat**, SAMS Operations & Analysis
  hrovatk@zin-tech.com
- **Jennifer Keller**, SAMS Project Manager
  kellerj@zin-tech.com
- **Eric Kelly**, SAMS Software Lead
  kellye@zin-tech.com
- **Helen Brown**, SAMS Integration
  helen.c.brown@nasa.gov
- **Robert McCormick**, SAMS POIS
  robert.j.mccormick@nasa.gov
- **Robert Waymire**, SAMS PARC
  robert.l.waymire@nasa.gov
- **Group Email (*just contacts at GRC*)**
  pimsops@grc.nasa.gov

Approved for Public Release; Distribution is Unlimited

Overview

SAMS Program Goals:

- provide timely and readily-accessible **acceleration measurement data**
- maintain an **archive** of microgravity measurement data from the International Space Station (ISS), including SAMS and Japan Aerospace Exploration Agency (JAXA) data
- provide routine/daily **analysis** plus custom routines, plots & services

SAMS Capabilities and Services:

- instrument & measure the local vibratory regime in **all 3 ISS labs**
- goal is continuous, **24x7** operations
- measurement frequency range: **0.01 < f < 200 Hz**
- primary customers are **scientific payloads & technology developers**
- SAMS also plays a key role in daily ISS **structural dynamics monitoring**

As of 5/7/2021, SAMS has collected over 587,000 sensor hours (15.1 terabytes) of data on the ISS.

For questions, email: hrovatk@zin-tech.com OR pimsops@grc.nasa.gov

Approved for Public Release; Distribution is Unlimited

Overview

If I want to…	then…
download SAMS data	visit https://gipoc.grc.nasa.gov/pims/pub/pad -- *e.g. use the vibration measurements recorded by SAMS in your own models or correlate with your results*
read the binary acceleration data files	visit the link shown just below here to *see how you can start working with acceleration data* https://gipoc.grc.nasa.gov/pims/plots/user/mohan/how2read_pad_binary_files.html
browse daily summary "roadmap" plots	visit https://gipoc.grc.nasa.gov/pims/roadmap -- *these roadmap plots show patterns, structure and boundaries in both time and frequency; these are updated daily*
browse acceleration handbook pages	visit https://gipoc.grc.nasa.gov/wp/pims/handbook -- *these are a collection of PDF files that briefly quantify & qualify various events, activities and various aspects of the microgravity acceleration environment*

Approved for Public Release; Distribution is Unlimited

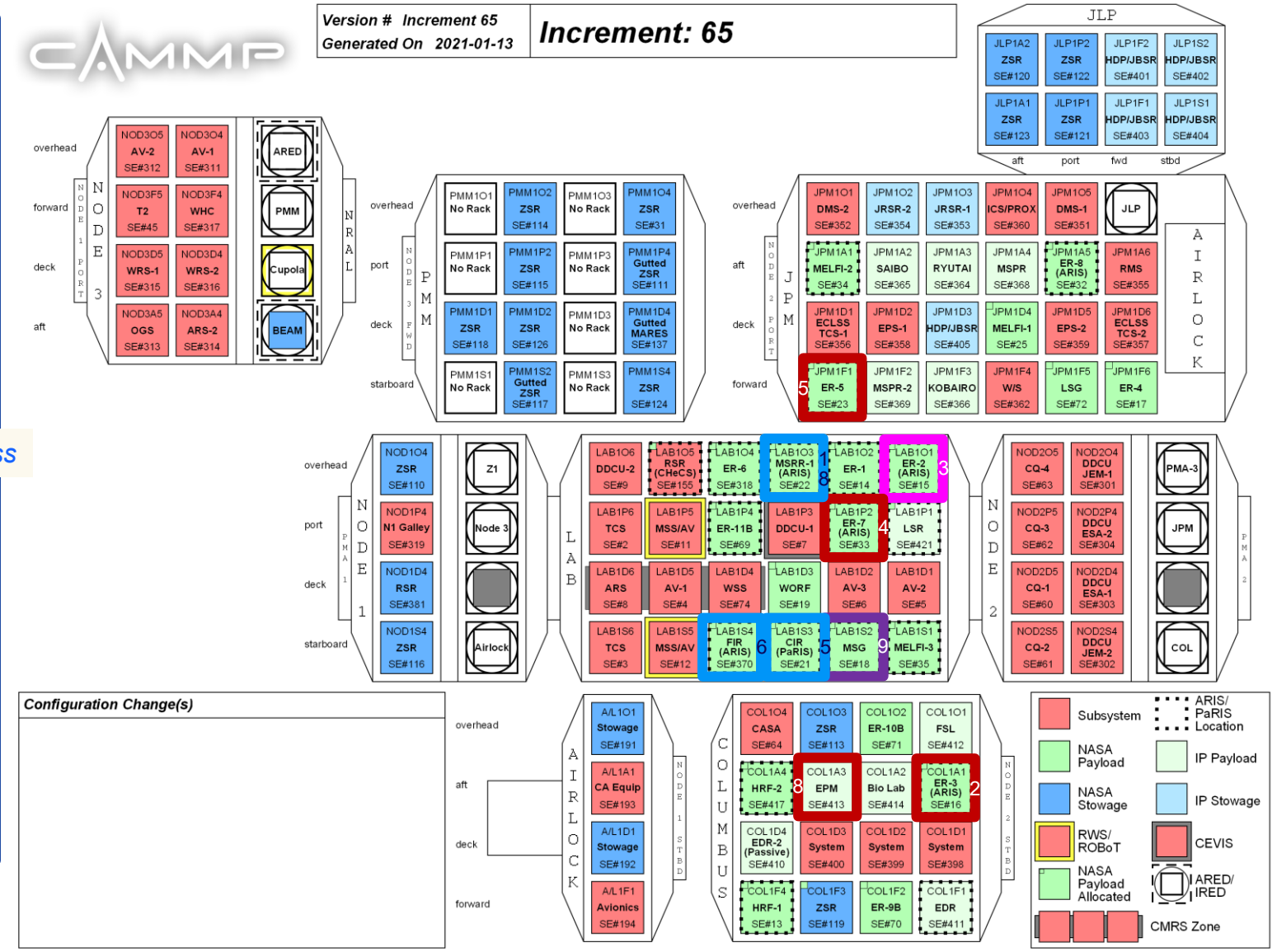
Topology: SAMS **Sensor Locations**, 2021-05-11

SAMS Sensor Head Locations

SE F02, COL1A1, ER3, Seat Track (2)
SE F03, LAB1O1, ER2, Lower Z Panel (3)
SE F04, LAB1P2, ER7, Cold Atom Lab Front (4)
SE F05, JPM1F1, ER5, Inside RTS/D2 (5)
SE F08, COL1A3, EPM, near PK-4 (8)
TSH-ES09, LAB1S2, MSG (9)
TSH-ES05, LAB1S3, CIR (5)
TSH-ES06, LAB1S4, FIR (6)
TSH-ES18, LAB1O3, MSRR, KERMIT (18) *wireless*
TSH-ES03, -ES19, -ES20 stowed spares

LEGEND:

Sensor that does not move
Sensor that has moved or may move
Sensor that has never moved
Stowed or not currently connected
MSG sensor gets installed for some payloads



Topology: SAMS *Electronics Enclosures (EEs) & Cables*, 2021-05-11

Electronics Enclosures (EEs) Locations

EE-F01	LAB1P2	ER7	embedded (4)
EE-F02	**LAB1O2**	**ER1**	**RTS/D1 (3)**
EE-F06	**JPM1F1**	**ER5**	**RTS/D2 (5)**
EE-F04	COL1A1	ER3	embedded (2,8)
EE-F05	LAB1O1	ER2	embedded (18)
EE-F07	JPM1A5	ER8	embedded

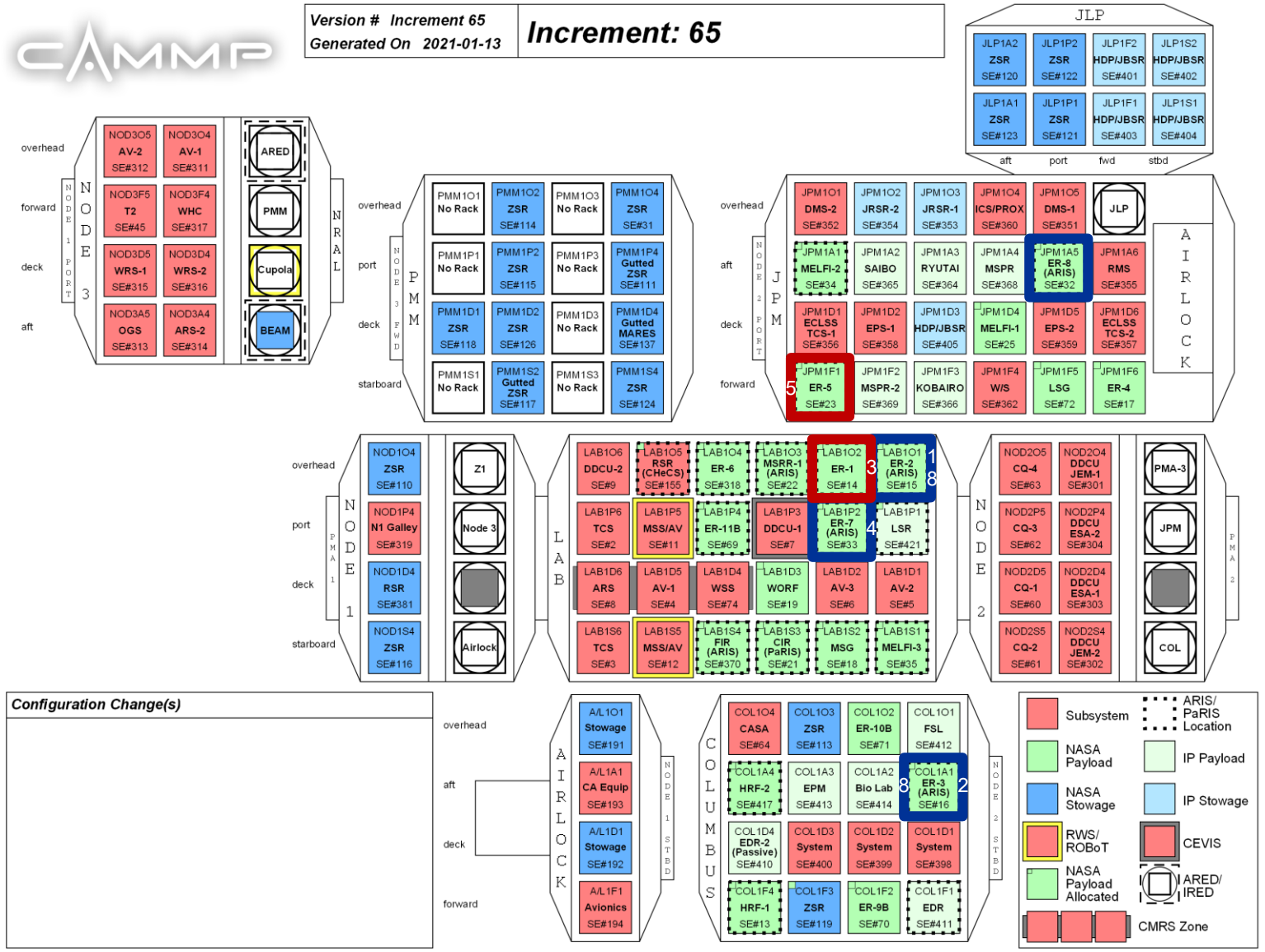
LEGEND:

Embedded EE

EE Inside RTS Drawer

SAMS Cables' Locations

Length	Location	Supporting
42"	LAB	Cold Atom Lab
186"	COL	PK-4
393"	JEM	JAXA PCG



Customer Support: View by Payload

GanttProject [SAMS_Gantt_2021-04-21.gan]

Project Edit View Tasks Resources Help

Gantt Chart

Search <Ctrl+F>

Gantt | Resources Chart

Zoom In | Zoom Out | Today | ← Past | Future → | Show critical path | Baselines...

Name	Begin d...	End date	Launch	Module
SAMS Plan	1/2/17	7/25/22		
PK-4 Cover COL	7/11/18	7/25/22		COL
Rotifer-B2	12/2/20	12/17/20	SpX-21	COL
ICF (Made In Space)	2/1/21	6/1/21		COL
ACES Monitor	8/13/21	7/25/22	SpX-15	COL
Heat Transfer Host	6/1/22	7/13/22		COL (COL1O1)
Colloidal Clusters	7/13/20	1/29/21	SpX-15	JEM
PHAB Char.	1/22/18	7/25/22	OA-7	JEM
LoadsDynamUSL	5/17/01	7/25/22		USL
Cold Atom Lab	5/31/18	7/25/22	OA-9	USL
KERMIT	5/24/21	12/31/21		USL
GTCS	1/3/22	7/25/22		USL
4BCO2	8/13/21	9/24/21		USL (LAB1P4)
4BCO2-2	6/13/22	7/25/22		USL (LAB1P4)
SUBSA	5/5/21	5/31/21		USL
InSPACE-4	6/1/21	7/19/21		USL
RSD	8/2/21	10/4/21		USL
Transp. Alloys	12/2/21	2/18/22		USL
SUBSA	3/14/22	3/31/22		

2020 2021 2022

Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sep Oct

SAMS Plan

F08,Cable 186,EPM Plate — PK-4 Cover COL

Any COL Sensor — Rotifer-B2

F02,Cable 48,bolt holes on ICF — ICF (Made In Space)

TIME SHARE

F02,Cable 393,Bracket Adapter — ACES Monitor

NET April 2023,EDR2 (COL1O1) — Heat Transfer Host

F02,STD-1,Cable 393 — Colloidal Clusters

F05,inside RTS/D2 — PHAB Char.

F03,Cable 85,Z-panel ER2 — LoadsDynamUSL

F04,Cable 42,bolt holes on CAL — Cold Atom Lab

ES18,STD101,Cable7m201 — KERMIT

ES18,STD101,Cable7m201 — GTCS

STD-102,ES19,Cable7m202 — 4BCO2

STD-102,ES19,Cable7m202 — 4BCO2-2

ES09 — SUBSA

ES09 — InSPACE-4

ES09 — RSD

ES09 — Transp. Alloys

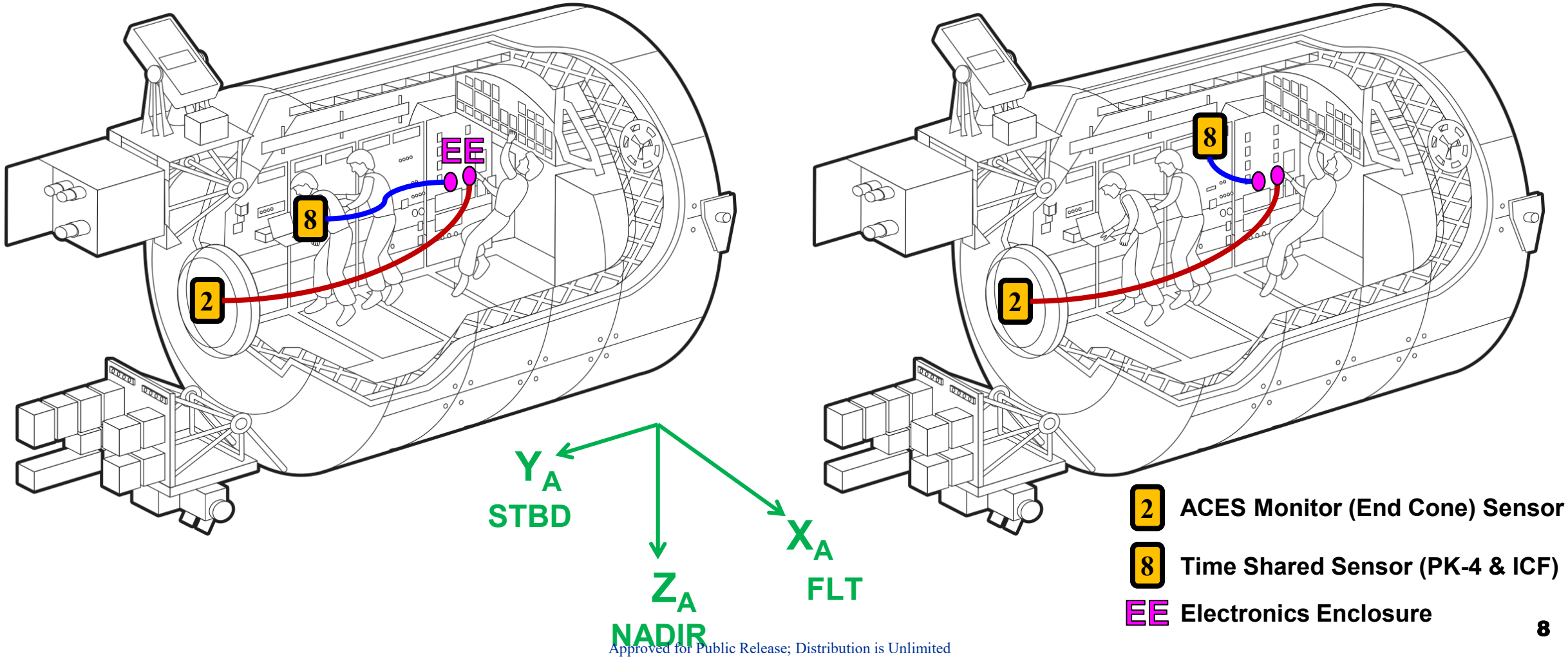
ES09 — SUBSA

Approved for Public Release; Distribution is Unlimited

First Time Share Scenario for Columbus Module

Unbolt SAMS sensor (SE-F08, shown here as just "**8**") from European Physiology Module (**EPM**) and put it on a seat track for easy relocation to time share locations between 2 payloads.

schematic depiction, open for discussion, so subject to change

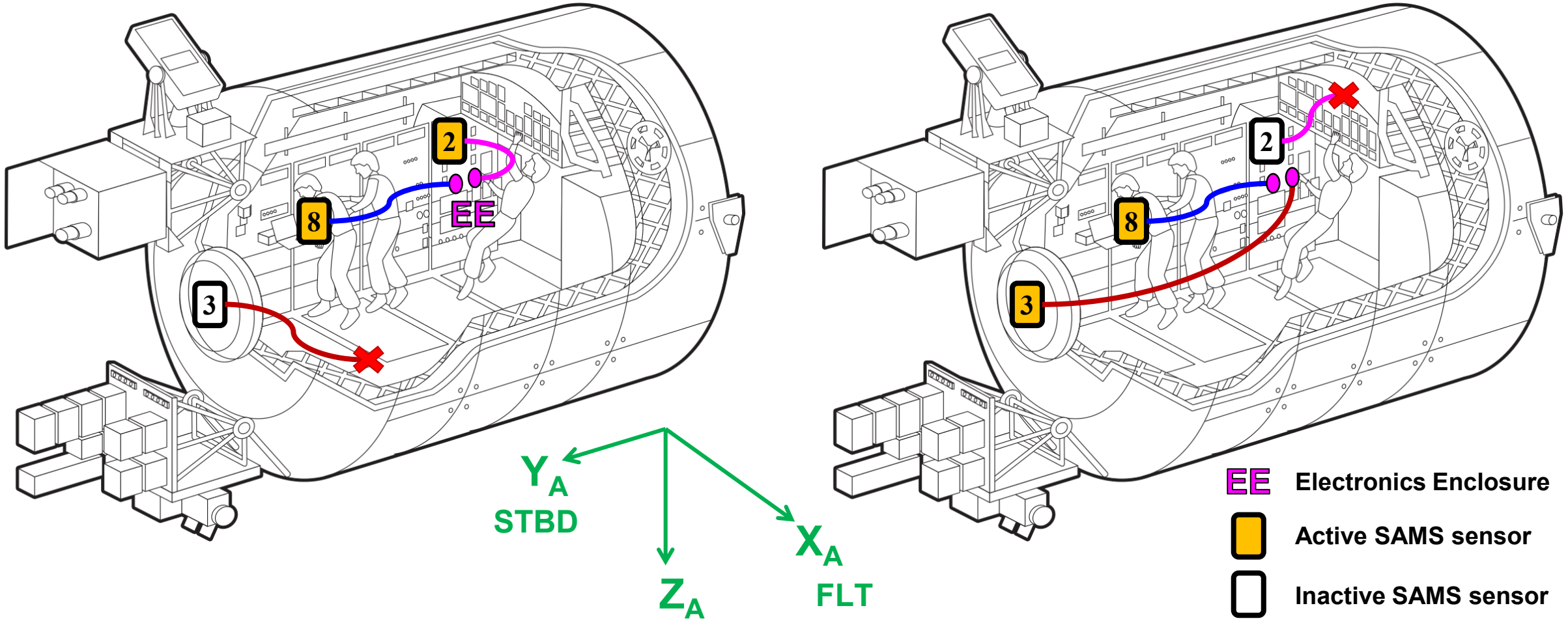


Approved for Public Release; Distribution is Unlimited

Second Time Share Scenario for Columbus Module

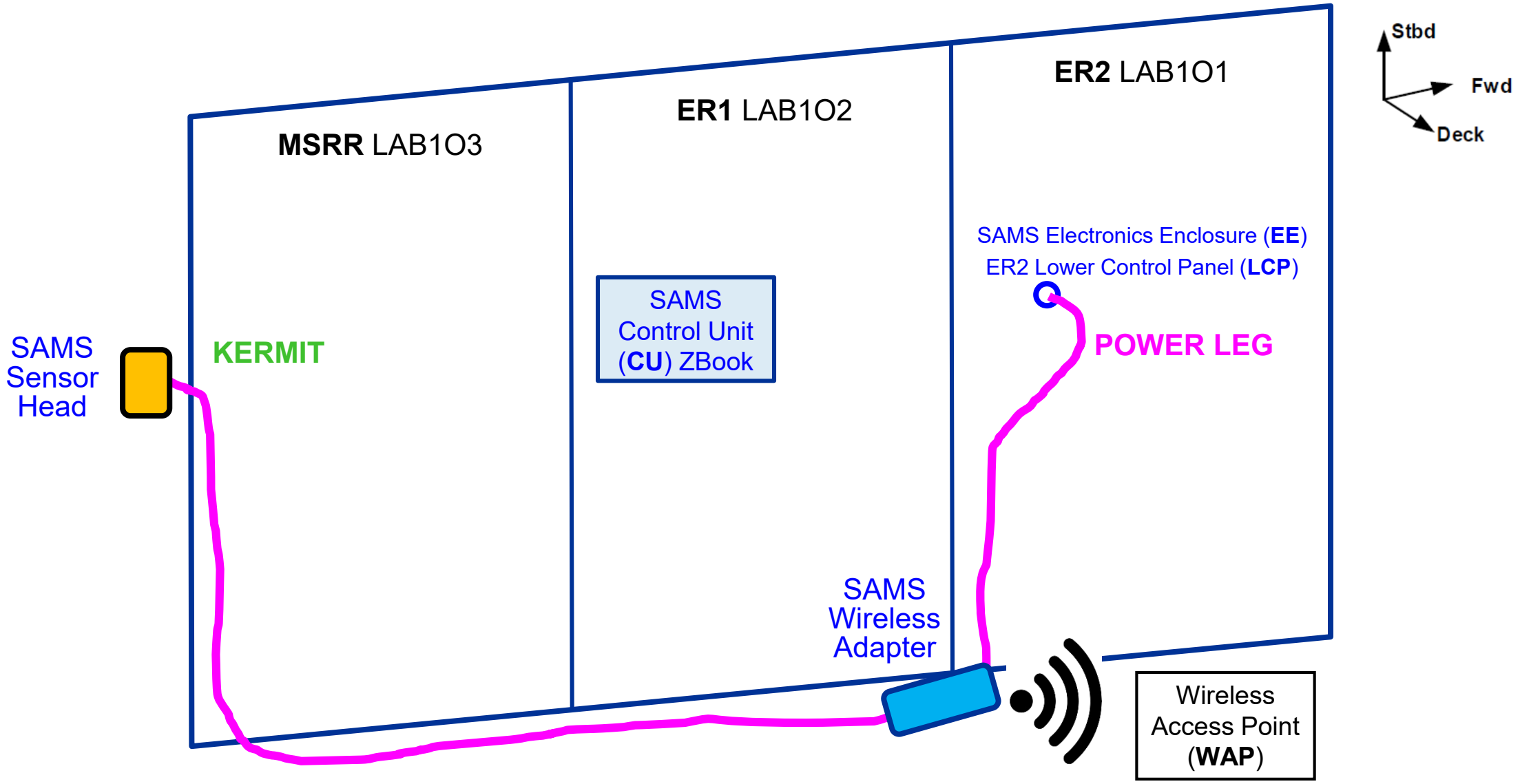
An extra sensor & cable, both pre-mounted, ready to time share one of the two connections on the SAMS Electronice Enclosure (**EE**) embedded in EXPRESS Rack 3.

schematic depiction, open for discussion, so subject to change



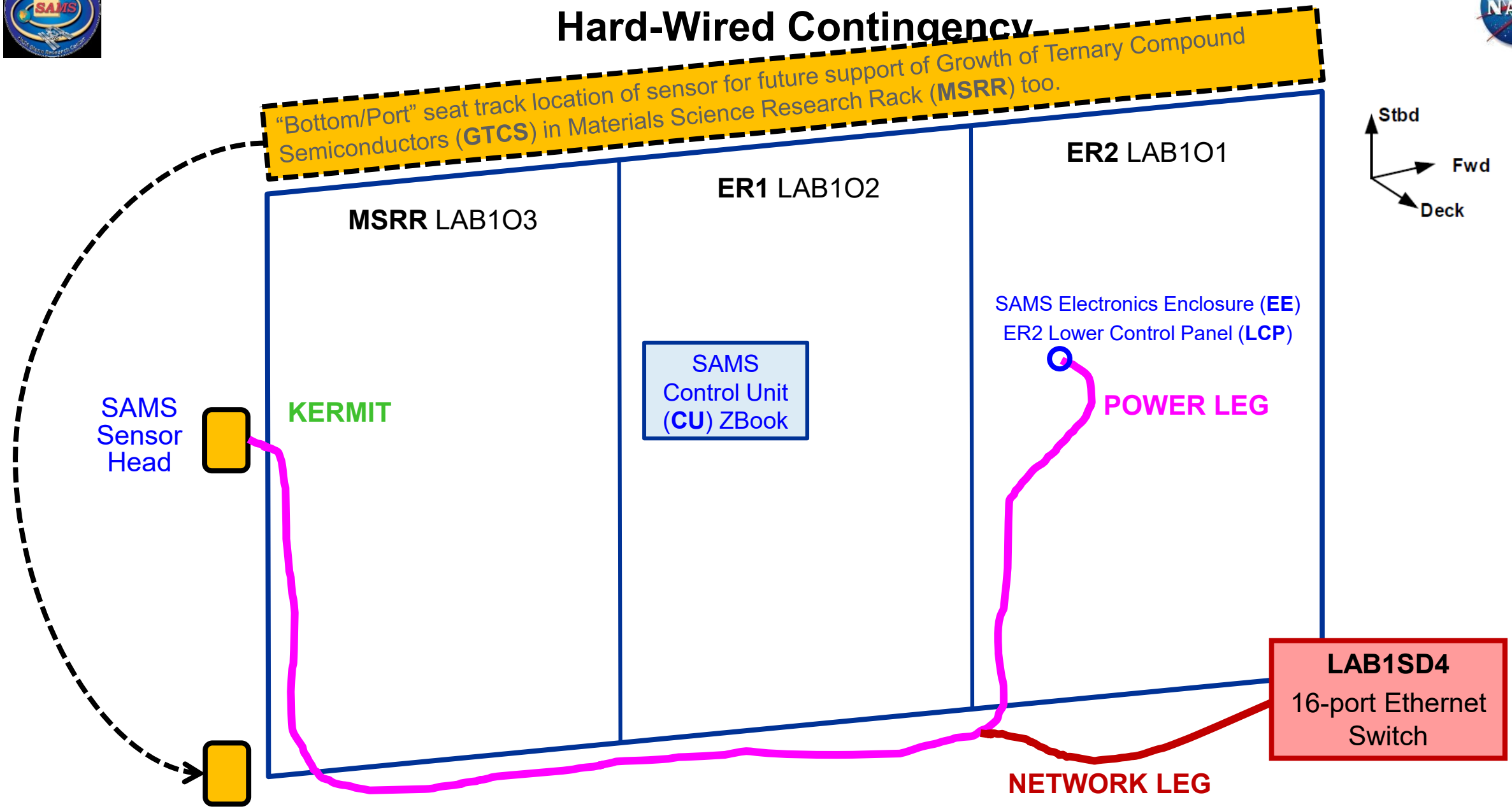
Approved for Public Release; Distribution is Unlimited

Wireless Deployment of Triaxial Sensor Head - Ethernet Standalone



Approved for Public Release; Distribution is Unlimited

Hard-Wired Contingency



Approved for Public Release; Distribution is Unlimited

Microgravity Acceleration Measurement System (MAMS)

- MAMS reflight might be coming soon (no later than the flight that manifests ZBOT-NC)
- **centralized** measurement in US LAB
- **quasi-steady regime (f ≤ 0.01 Hz)**
- use rigid-body assumption to **mathematically map data** to arbitrary ISS locations
- nominally operates continuously, **24x7**
- support Zero-Boil-Off Tank (**ZBOT**) Experiments on the ISS along with any other payloads or technology developers who can give us their location of interest in Space Station Analysis (**SSA**) coordinate system



Acronym	Description
OARE	Orbital Acceleration Research Experiment
OIS	OARE Interface Subsystem
OSS	OARE Sensor Subsystem

Approved for Public Release; Distribution is Unlimited