Working Group Meeting 1

Focusing on Power and Introducing Post-Meeting Work for Communications / Positioning, Navigation, and Timing (PNT)

LOGIC Core Team
March 12, 2024
LOGIC Website: https://logic.jhuapl.edu

Agenda

- Introduction

- Logistics and Announcements

- Working Group Process Overview

- Working Session – MIRO Board

- Homework Assignment / Post-Meeting Tasks

Introduction

- LOGIC's Goals and Objectives:
  - Collaborate with commercial space industry to find gaps in lunar technical interoperability and create an international, inclusive, US-led consortium to deliver standards recommendations.
  - Standards recommendations will focus on interfaces between systems of systems. Recommendations could expand to cross-cutting standards depending on community / industry feedback.
  - Approach: Adopt, Adapt, Author
  - Other Deliverables – Standard Lexicon and Operating Guidelines

Introduction

LOGIC

- Working Group Team (overall LOGIC team list with contact information, including DARPA team, in backup slides)
  - Power
    - Technical Lead: To be Determined. See the call on next slide.
    - APL Core Team Lead: Anna Shin
  - Communications:
    - Technical Lead: To be Determined. See the call on next slide.
    - APL Core Team Lead: Jason Arcido
  - PNT
    - Technical Lead: To be Determined. See the call on next slide.
    - APL Core Team Lead: Danielle Mortensen
  - Cross Cutting:
    - Standards SME: Katherine L. Morse, JHU/APL
    - Consortium Lead: Kristin Jaburek, JHU/APL

Call for Technical Leads

LOGIC

- LOGIC Needs YOU!
  - Looking for this to be industry/community led
  - Looking for volunteer leads from the community for three topic areas: Power, Communications & PNT to start
  - Will be the face of the community and help guide the discussions to build consensus and set priorities
  - Need to be honest brokers of standards, guidelines and best practices
  - Need working knowledge of the State of the Art for the topic area

- Looking for several folks to step up for broad community representation, engagement and topic coverage

- If you want to volunteer, please provide the following information via E-mail at LOGIC@jhuapl.edu
  - Name
  - Company
  - Short Summary of Experience (one paragraph)
  - CV / Resume

> We are seeking Technical Leads for Power and Communications / PNT Working Groups.
> Please e-mail LOGIC@jhuapl.edu if you are interested in filling this role.

Logistics and Announcements

LOGIC

- Zoom Etiquette
  - While in the main session please remain on mute and raise your hand or use the chat for questions

- Content Reminder:
  - This is an international, diverse community
  - Please be respectful of others as you participate!
  - The meeting will be recorded for team notes/records but will not be posted. Slides will be posted on the LOGIC website

    Please Do NOT:

  - Post CUI, Export Controlled, Intellectual Property or other Sponsor Sensitive Information.
  - Post Protected Health Information (PHI).

- Become a member of LOGIC!
  - https://logic.jhuapl.edu/Sign-Up/

- Next Meeting: April 9, 2024 from 1 to 2:30 PM EDT
  - Advanced registration specific to this individual meeting is required and will open shortly.
  - Registration will close on March 28.
  - Registration closure date is firm

- LOGIC Email: LOGIC@jhuapl.edu   (Brenda Clyde, Kristin Jaburek, Anna Shin)

Logistics and Announcements


Registration Closes by **April 7 (In Person and Foreign Nationals)** and **April 14 (Virtual Attendance for US Citizens)**

Working Group Process Overview

LOGIC

Scope and Requirements Definition → Use Cases, Scenarios, Limitations → Gap Analysis / Mapping to Existing Standards → Risk Analysis and Recommendations → Standards Recommendation Report

We'll spend the next few months iterating here

Scope and Requirements Definition
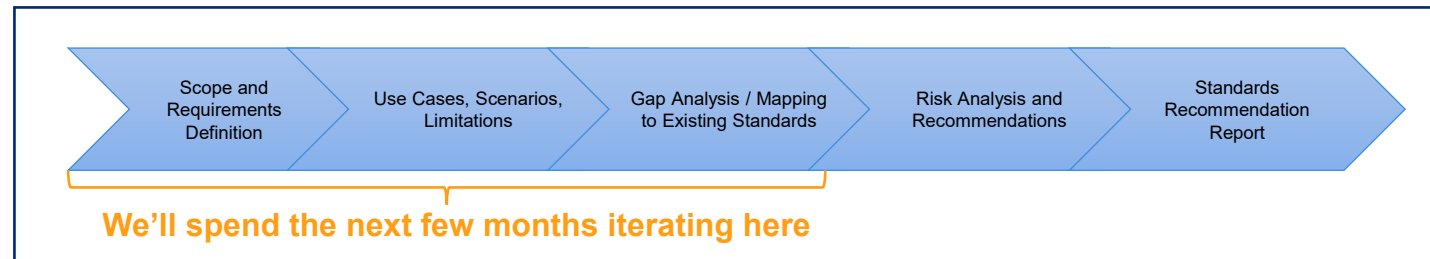
- Initial Scope: Focus on standards for interfaces between systems, subsystems, users and service providers

- Future Scope: Expand to cross-cutting standards that span one or more focus area (e.g. planetary protection, contamination control, thermal, modeling & simulation, environmental testing, etc.)

Use Cases, Scenarios, Limitations

- Leveraging System Modeling Language (SysML) to model a generic architecture inclusive of <u>as many use cases provided by the community</u>.
  - Initial block definition diagram and Power internal block diagram will be focus of today's working session
  - Follow-on "homework" will dive into Communications / PNT internal block diagram and use case modeling (use case diagram, activity diagram, sequence diagram, etc.)

Gap Analysis / Mapping to Existing Standards

- Internal block diagram mapped to existing standards gathered after kick-off meeting
  - We need community feedback and help in mapping these to lower-level specificity
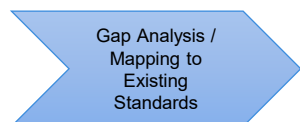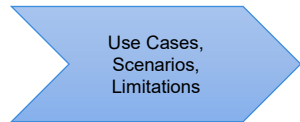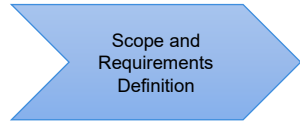
How Will We Collaborate at Today's Meeting?

LOGIC

- Go to MIRO – https://miro.com/app/board/uXjVNjiL93c=/?share_link_id=616544037714

- Link in the chat!

Activity 1 (5 min)	Activity 2 (10 min)	Activity 3 (10 min)	Activity 4 (10 min)
Introduce yourself via post-it notes on Miro. Write your name, company/org, and any interesting tidbits you'd like to include	Review and annotate on the Initial Block Diagram and Power Internal Block Diagram	Review and annotate on Mapping to Existing Standards	Review and annotate on Use Case Example and Provide More Use Cases

- MIRO tools/widgets
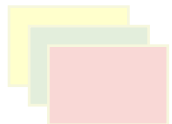
Post Its for adding inputs/comments/thoughts – Please include your name at the bottom if we need post-meeting clarification
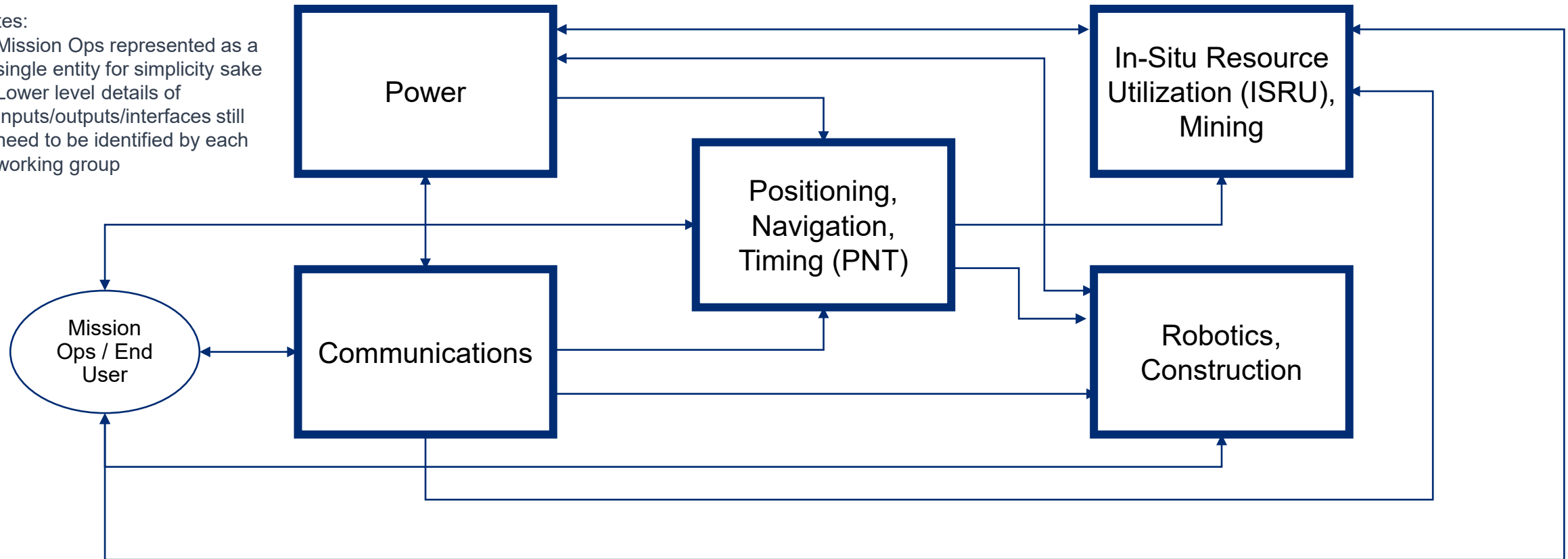
Stars for emphasizing or agreeing with another person's comment

Initial Block Definition Diagram

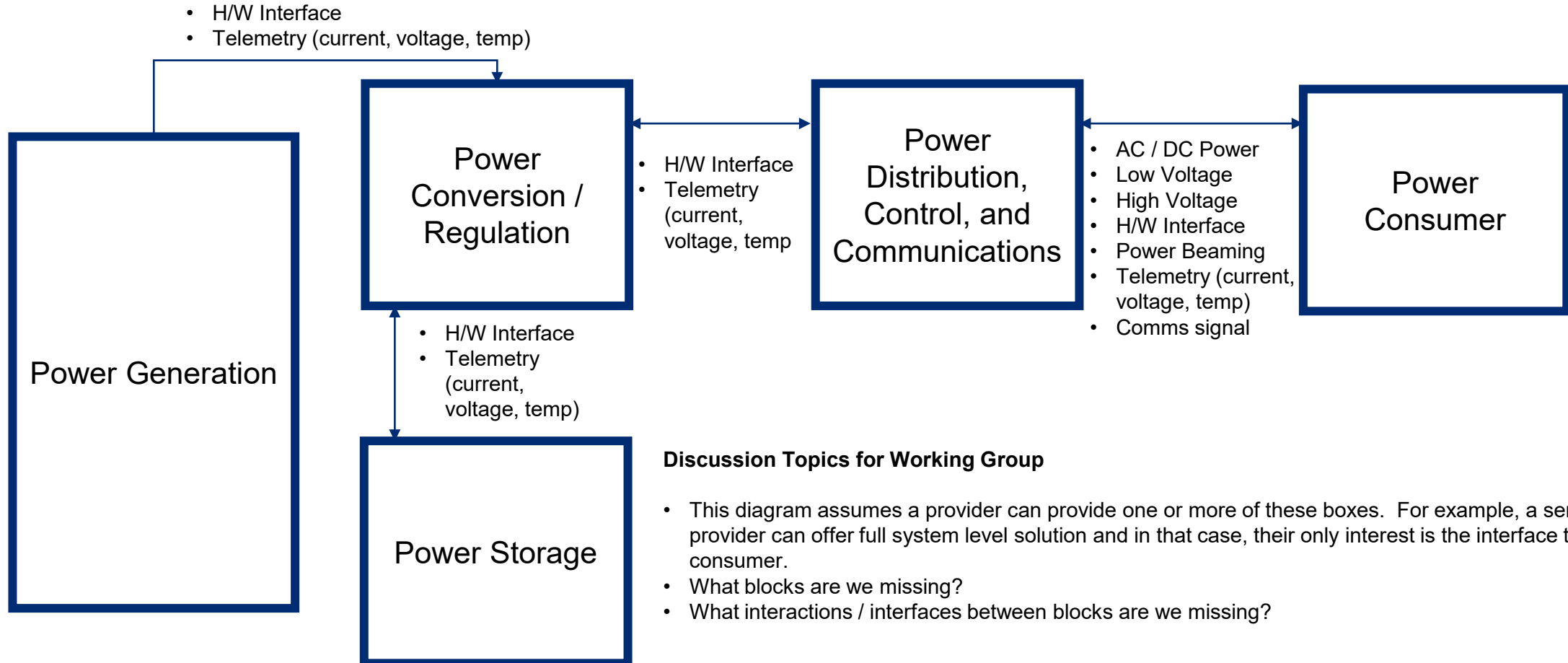- Go to MIRO – https://miro.com/app/board/uXjVNjiL93c=/?share_link_id=616544037714

Notes:
- Mission Ops represented as a single entity for simplicity sake
- Lower level details of Inputs/outputs/interfaces still need to be identified by each working group

Internal Block Definition Diagram – Power

LOGIC

- Go to MIRO – https://miro.com/app/board/uXjVNjiL93c=/?share_link_id=616544037714

- H/W Interface
- Telemetry (current, voltage, temp)

Power Generation

Power Conversion / Regulation

- H/W Interface
- Telemetry (current, voltage, temp

Power Distribution, Control, and Communications

- AC / DC Power
- Low Voltage
- High Voltage
- H/W Interface
- Power Beaming
- Telemetry (current, voltage, temp)
- Comms signal

Power Consumer

- H/W Interface
- Telemetry (current, voltage, temp)

Power Storage

Discussion Topics for Working Group

- This diagram assumes a provider can provide one or more of these boxes. For example, a service provider can offer full system level solution and in that case, their only interest is the interface to the consumer.
- What blocks are we missing?
- What interactions / interfaces between blocks are we missing?

Mapping to Existing Standards – Power

- Go to MIRO – https://miro.com/app/board/uXjVNjiL93c=/?share_link_id=616544037714
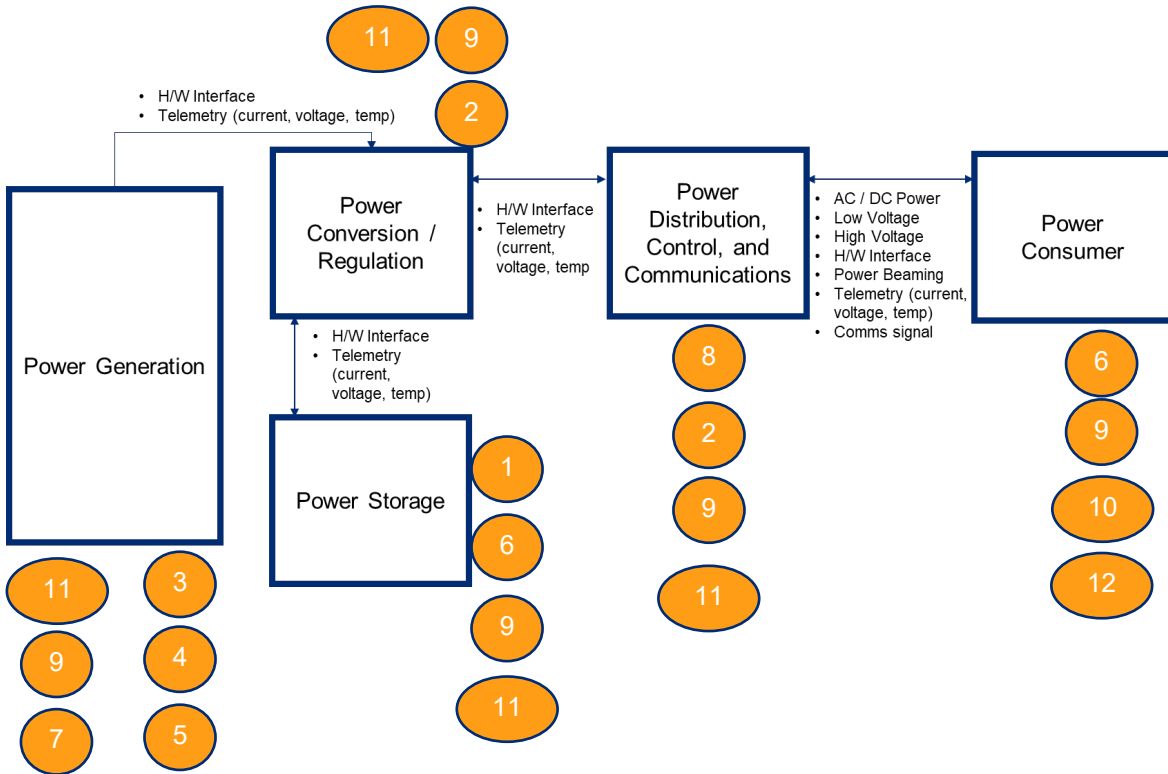
1	Guide to Lithium Battery Safety for Space Applications (AIAA G-136-2022)
2	Electrical Power Systems for Unmanned Spacecraft (AIAA S-122-2007)
3	Qualification and Quality Requirements for Electrical Components on Space Solar Panels (AIAA S-112A-2013)
4	Qualification and Quality Requirements for Space Solar Cells (AIAA S-111A-2014)
5	Electrical Components on Space Solar Panels Qualification and Quality Requirements for Electrical Components on Space Solar Panels – Amendment 1 (AIAA S-112A-2013/A1-2019)
6	Lithium ion battery for space vehicles (ISO 17546:2016)
7	New Practice for Safe Operating Practices In-Space for Space Fission Reactors Used for Nuclear Power and Propulsion (ASTM WK86387)
8	International Space Power System Interoperability Standards (NTR 20220009953)
9	Space Power Standard (AS5698A)
10	SAE Electric Vehicle and Plug in Hybrid Electric Vehicle Conductive Charge Coupler (J1772_201710)
11	International Thermal System Interoperability Standards (ITSIS)
12	IEC standard voltages (IEC 60038:2009+AMD1:2021 CSV)

This portal is still open for data inputs (standards, use cases, and pain points): https://logic.jhuapl.edu/Our-Work/Surveys/index.php

Use Case Example – Power

- Go to MIRO –https://miro.com/app/board/uXjVNjiL93c=/?share_link_id=616544037714
- Narrative: Robotic asset sends a signal to power grid system. Signal requests power via power beaming at a specified location to charge its onboard battery pack.
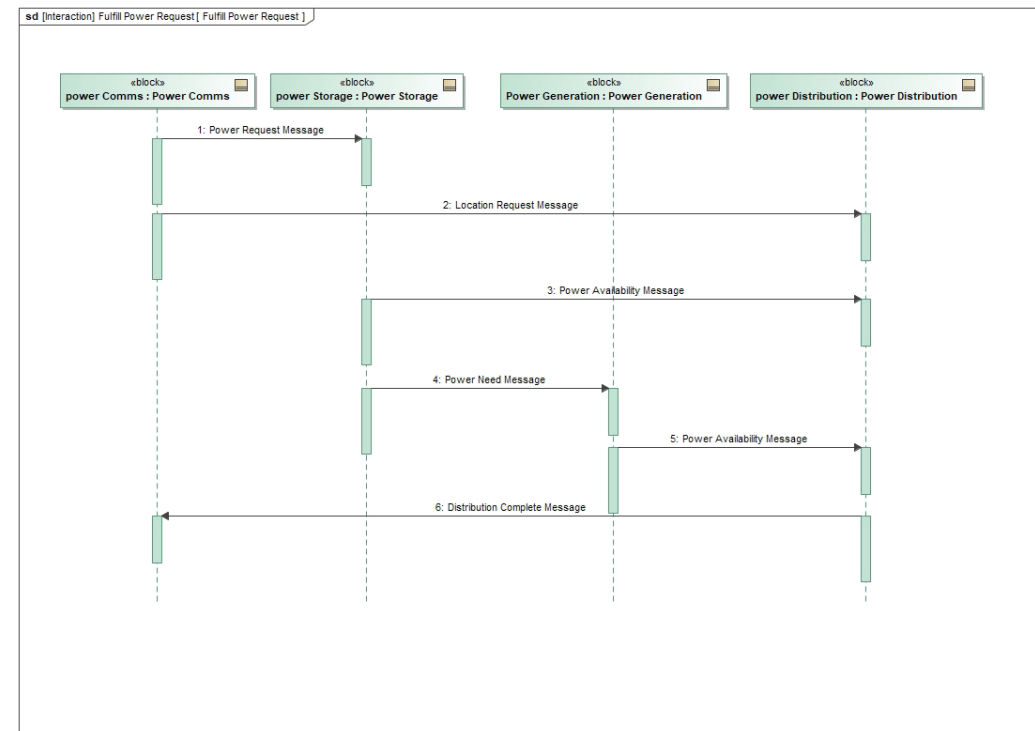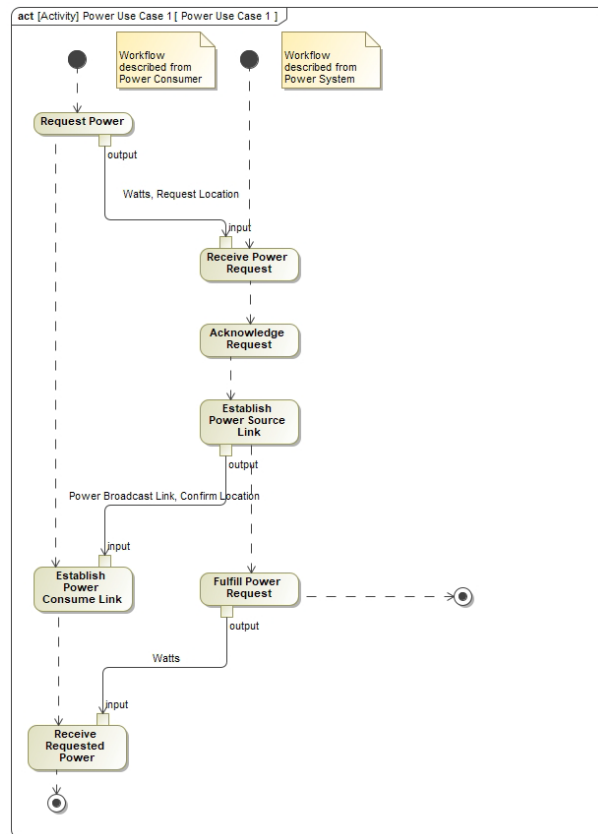
Homework Assignment / Post Meeting Tasks

1. Join a working group!

2. Provide Use Cases in narrative form and / or using SysML for Power, Communications, and PNT focus areas
   - Resources, examples, and tutorials can be found here: https://sysml.org
   - APL core team will incorporate your use cases and inputs in our model

3. Review existing standards for applicability and mapping
   - Now that we have a baseline list of standards, we need working group members to review them in detail and map them to interfaces for applicability

We'll be collecting and collaborating on the above tasks via LOGIC Slack, MIRO (will remain open post meeting), and LOGIC website (https://logic.jhuapl.edu/Our-Work/Surveys/index.php)

How Will Working Groups Collaborate?

- LOGIC Slack (logic-consortium.slack.com)

- To be a working group member and get access to slack, please e-mail logic@jhuapl.edu with your name, company, and focus area that you're interested in contributing to

- Still working on setting up a LOGIC confluence site to supplement slack for collaborating on bigger data set (SysML models, Standards recommendation drafts, etc.)

What's Next?

- Working groups will split off into focus area topics. Keep an eye out for future working group meeting invites: Monthly (Second Tuesday of Every Month)
  - Future meetings will be 90 minutes. First portion will be a combined session for special topics and then breakout rooms discussing each focus area (Power, Communications, and PNT to start)

- The next larger consortium meeting will be on April 9, 2024 at 1 PM EDT
  - Advanced registration specific to the meeting will be required.

Introduction

DARPA

- **Michael "Orbit" Nayak,** *DARPA Program Manager* michael.nayak@darpa.mil
- **Christine White** (contr-dso) christine.white.ctr@darpa.mil
- **Ashley Batjer** (contr-sto) ashley.batjer.ctr@darpa.mil
- **Lee Pele** (contr-dso) lee.pele.ctr@darpa.mil

APL LOGIC Core Team

- **Brenda Clyde**, *APL LOGIC Program Manager* Brenda.Clyde@jhuapl.edu
- **Laura Cosentino,** *APL LOGIC Deputy Program Manager* Laura.Cosentino@jhuapl.edu
- **Wesley Fuhrman**, *APL LSII Lead* Wesley.Fuhrman@jhuapl.edu
- **Anna Shin**, *APL Systems and Mission Assurance Engineer* Anna.Shin@jhuapl.edu
- **Kristin Jaburek**, *APL Systems Engineer* Kristin.Jaburek@jhuapl.edu
- **Katherine L. Morse**, *APL Computer Scientist and Standards Development SME* Katherine.Morse@jhuapl.edu
- **Jason Arcido**, *APL Systems Engineer* Jason.Arcido@jhuapl.edu
- **Danielle Mortensen,** *APL Systems Engineer* Danielle.Mortensen@jhuapl.edu
- **Emily Poyourow,** *APL Public Affairs* Emily.Poyourow@jhuapl.edu