



CONSORTIUM FOR SPACE MOBILITY
AND ISAM CAPABILITIES

COSMIC Capstone Challenge (C3) Student On-Boarding

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C3 Organizers

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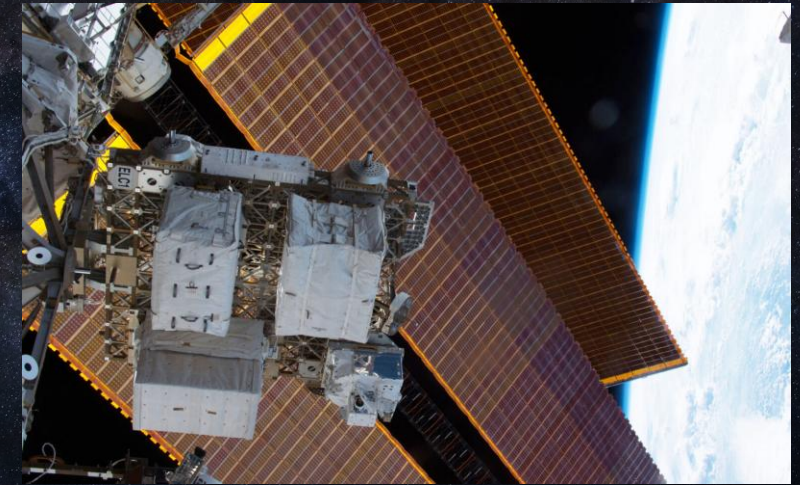
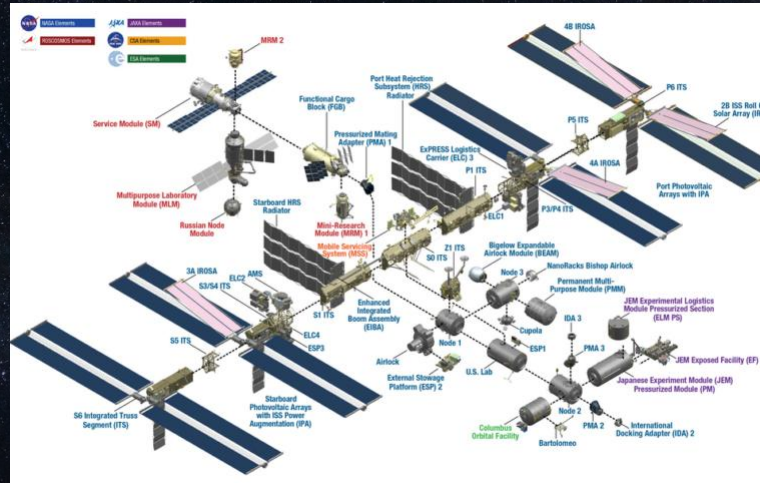
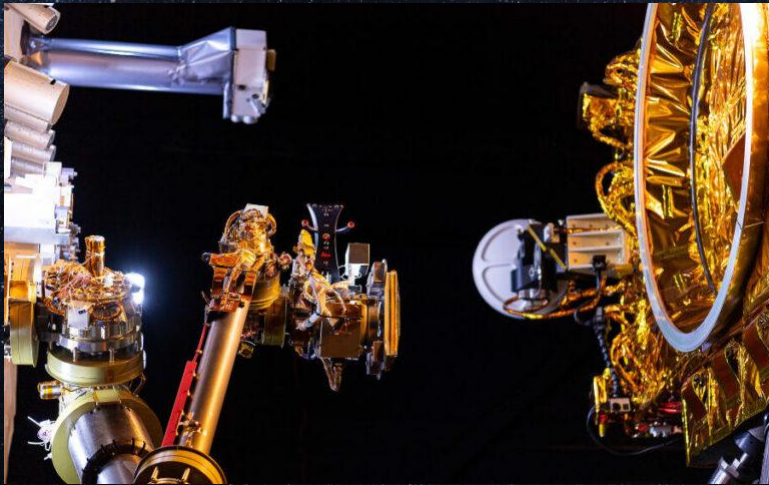
C3 Student On-Boarding Agenda



- Gather and Review Meeting Agenda
- Introduction to COSMIC
- Overview of the COSMIC Capstone Challenge (C3)
- Review of Student Responsibilities
- Perspectives from Past Participants
- Participant Q&A
- Wrap-up

What is ISAM?

- Design of modular, serviceable, upgradeable, and evolvable systems
- Assembly of simple to complex space systems
- Manufacturing in space using Earth- and locally-sourced materials



Why Now?

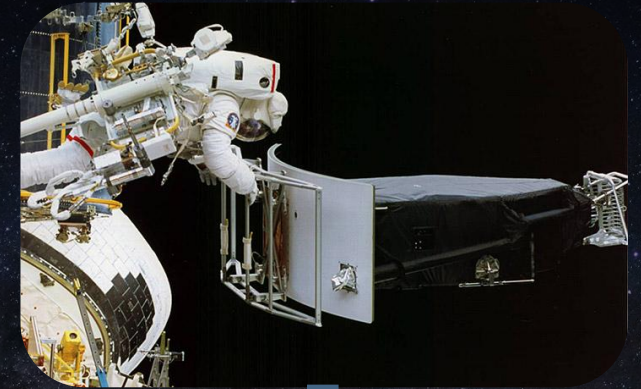
ISAM National Strategy and Implementation Plan

Foster an ecosystem to leverage ISAM capabilities

- Support and stimulate USG, academic, and commercial ISAM capability development
- Consistent with US Space Priorities Framework (Dec 2021)

Strategic goals

1. Advance ISAM research & development
2. Prioritize expanding scalable ISAM infrastructure
3. Accelerate the emerging ISAM commercial industry
4. Promote international collaboration and cooperation
5. Prioritize environmental sustainability
6. Inspire a diverse future space workforce



COSMIC: A Nationwide Alliance for ISAM



- Vision:
 - Create a nationwide alliance that enables the U.S. space community to provide global leadership in ISAM.
- Mission:
 - Making ISAM a routine part of space architectures and mission lifecycles.

Goals and Objectives

Capability Development

Develop, mature, and demonstrate ISAM technologies that enable and enhance mission utility.



Ecosystem Economics

Promote U.S. leadership in ISAM technologies and capabilities that change the business model away from single-use space assets.



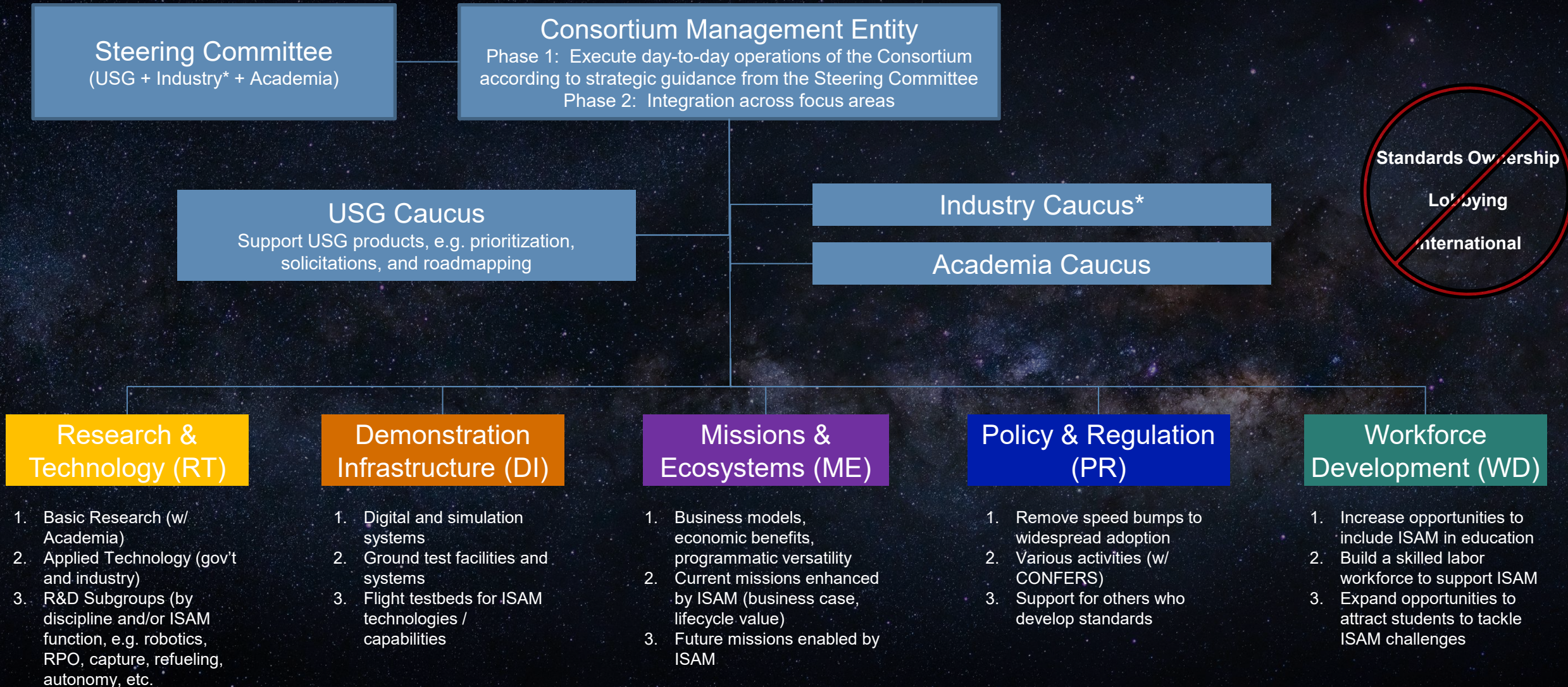
Mission Applications

Encourage and guide missions to use ISAM capabilities as part of commercial and government program lifecycles.



A nationwide alliance working collaboratively to make ISAM a routine part of the space mission lifecycle

Organization



* Includes ties to CONFERS

COSMIC Workforce Development Focus Area (WDFA)



- “To achieve the goals outlined in the ISAM National Strategy, the future space workforce must be diverse and be ready to tackle some of the most challenging space problems.”
- “Education and workforce training programs must **prepare and inspire the next generation** of space scientists, engineers, and technologists to advance ISAM capabilities.”
 - “Expand opportunities at the high school, undergraduate, graduate, and post-doctoral level to attract students from multiple disciplines – engineering, science, technology, policy, law, etc. – to tackle ISAM challenges through **learning activities**, awards and grants, internships, **research opportunities**, and other incentives to inspire a diverse workforce.”

The COSMIC Capstone Challenge (C3)



Review the C3 Information Packet

The Challenge:

- National student competition aimed at developing novel ISAM concepts
- The COSMIC Capstone Challenge is presented to college students who are invited to develop conceptual missions & designs for spacecraft operations in orbit or on the lunar surface.

The Vision:

- Leverage the COSMIC network to connect students and universities to organizations and commercial companies which would collaborate with student teams to adopt these ideas and fund them for internal development, strengthening the ISAM talent pipeline

Review the C3 Information Packet!!!

- It's neither long nor dense, yet covers key material that won't be discussed today

LinkedIn Group: <https://www.linkedin.com/groups/14485139/>

C3 in Context



Tech Development Roadmap Tie-In

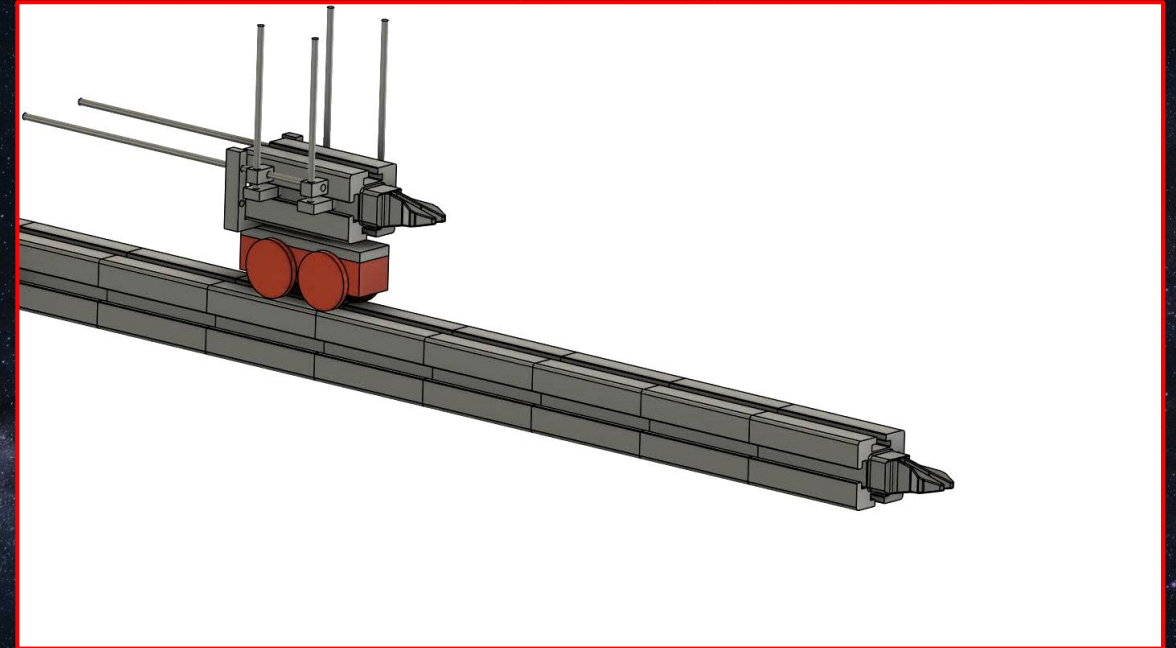
- Technology development roadmap began at Aerospace in Spring 2022 by developing a concept for an orbital satellite factory that could be put into service within 10 years
- Purpose of the goal was to motivate a focus on technologies that seemed viable in mid-term
- Roadmap identified key technologies, which are demonstrated at increasing complexity on orbit
- C3 plays a crucial role in developing orbital experiments that enable functional missions next decade

Example context for Track 2

- 2022-2025 Roadmap development
- 2022-2030 Advance key technology for lunar landings (i.e. NASA's Ignition/Artemis program) and lunar operations
- 2023-2026 Develop & design five technologies that enhance lunar operations or experiments
- **2023-2026 Students in COSMIC Capstone Challenge conceptually design complex lunar operations**
- 2027-2028 Artemis program tests and completes lunar landing capabilities
- **2029-2031 Continued lunar surface missions with operations inspired by Design Challenge**
- 2031 Enable commercial and government agencies to create request-for-proposal for lunar operations/experiments

The Challenge Focuses on Conceptual Design

- Without requiring a prototype, engineering drawings and animations become essential for communicating the conceptual design
- While conceptual design is not focused on analysis, engineering assessments are a crucial part of the process
 - Trade studies
 - Feasibility
 - Size, weight, and power (SWaP) requirements
 - Utility
 - Novelty



Self-assembling modular network for transporting manufacturing, assembly, inspection and servicing tools around a satellite

Design Tracks for C3



- There are 6 design tracks that teams can participate in:
 - Track 1 Challenge: Orbital Manufacturing and Assembly (C3-Manufacturing)
 - Design a payload to be hosted aboard Arkisys's Bosuns Locker that would demonstrate a chain of 3 or more operations providing a capability important for orbital manufacturing or assembly.
 - Track 2 Challenge: Lunar Operations (C3-Lunar)
 - Design a payload to be delivered by Astrobotic's Griffin lander that can prepare the lunar surface for a Fission Surface Power reactor with humans residing within 1km. Prototype required.
 - Track 3 Challenge: Orbital Servicing (C3-Servicing)
 - Using Northrop Grumman's Mission Robotic Vehicle (MRV) and Mission Extension Pod (MEP) as a fixed servicer capability, design and analyze candidate on-orbit attachable components (OACs) that the MRV could use to alter a client spacecraft already on-orbit in geostationary orbit (GEO) or cislunar space.
 - Track 4 Challenge: In-Space Construction (C3-Construction)
 - Design orbital or surface infrastructure element(s) and outline the mission describing its construction using autonomous robotic assembly technologies. Teams should leverage previous work in modular building blocks and "builder robots" as referenced; teams may choose NASA's Project ARMADAS or other types of building blocks and robotic systems to address their mission needs.
 - Track 5 Challenge: In-Space for Earth (C3-Return)
 - Design a manufacturing payload hosted by Dispatch's Free Flyer 1 reentry vehicle to produce materials in space with properties that are impossible to achieve on Earth.
 - Track 6 Challenge: Architecture of Autonomous Space Clusters (C3-Cluster)
 - Develop an architecture and key elements that would enable a cluster of vehicles that would autonomously perform important functions in orbit or on the lunar surface (U.S. persons only).

The 2026-27 COSMIC Capstone Challenge



Mentoring-based approach

- Provide guidance to student teams and advise them in setting professional expectations and viewing the mission lifecycle holistically
- Drawn from across COSMIC membership to provide expertise and diversity of perspective
- Mentors will meet with students at least biweekly to support students and answer questions
- Students will mainly be focused upon addressing key milestones and completing coursework

Showcase events

- A midpoint showcase is planned for December to get informal feedback
 - This includes the **statement of intent** for each team which should effectively encapsulate the team's overall mission
- Industry professionals will judge during the 30-minute outbrief in mid-April at the C3 Final Showcase
 - In-person options at The Aerospace Corporation in Los Angeles and at a NASA facility
 - Other COSMIC member organizations are invited to host presentations on-site

Timeline for Academic Year 2026-2027



All days were week of and based on a 2-semester Capstone

- July 8 C3 launches & registration opens
- September 9 Separate on-boarding briefs for professors, mentors & students
- September 11 Team registration deadline
- September 16 Begin distinct weekly office hours for professors, mentors & students
- September 16 Recommend teams have selected Program Manager
- October 14 Select operations to form the foundation of the target capability
- October 17 Submission of Mission Statement
- November 15 Present internal Systems Requirements Review (SRR)
- December 9 Midpoint showcase/ "Pitch" Presentation (5-minute flash talks open to all)
- January 13 Complete trade studies
- March 3 Complete Internal Conceptual Design Review
- April 1 Develop plan to reach Preliminary Design Review
- April 14 Presentation & judging at C3 Final Showcase (Virtual & on-site in El Segundo)
- Late May Recommended time to submit paper or abstract to technical conference or journal

The Student's Role

Students, advisors (professors/ teachers), mentors and organizers each have different roles

- Classroom priorities take precedence over C3 goals
 - Your advisor, not your mentors or C3 organizers, will be grading you
- Review the C3 Information Packet
 - Make sure you understand the challenge and deliverables
 - If you are unsure, reach out to advisors, mentors or organizers for clarification
- Act like professionals when interacting with your mentors
 - They can be a great resource & your best ally
 - Come to meetings prepared, communicate in advance of meeting, be direct
- Work as a team
- Be creative!
 - Students have been tasked with this challenge because we want different ideas
 - There is flexibility within the challenge- better to pursue ideas you are passionate about

Student Perspective – Devin Mroz



Next Step & Questions



- All student teams should register at: <https://forms.gle/gvanwxr988ANpTKv8>
 - This allows us to track the teams and communicate directly with the students
- Beginning next week, C3 organizers will host weekly office hours for students, mentors & advisors

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Next Step & Questions



Questions?

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