FROM SWIMMING POOLS TO VACUUM CHAMBERS: HOW WE TEACH ASTRONAUTS TO SPACEWALK

ALLISON BULINGER
NASA JOHNSON SPACE CENTER
WHO IS ALLISON?
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Grew up in central Ohio loving math, science, and space
- Attended Space Camp at Kennedy Space Center in 6th and 12th grade

Attended Purdue University in West Lafayette, IN
- Majored in Aerospace Engineering

Participated in the co-operative education program
- Alternated between semester at school and semester at NASA

Working at NASA for ~12 years in the Extravehicular Activities (EVA) Operations Group
INTERNATIONAL SPACE STATION (ISS)

Only scientific laboratory orbiting 250 miles above the Earth
International collaboration between 5 space agencies representing 15 countries
Assembly started in 1998; Crewed since 2000
Currently have 6 people living and working there
Habitable volume of an average 6 bedroom house
Including solar arrays, size of a football field
HOW WE BUILT ISS

37 Space Shuttle Flights and ~150 EVAs to assemble and maintain
EXTRAVEHICULAR ACTIVITIES (EVA)
Provides basic life support functions to protect astronauts while working in the extreme environment of space

- **PLSS** – Primary Life Support System, delivers oxygen to breathe and maintain suit pressure, scrubs carbon dioxide, provides battery power to keep things running
- **HUT** – Hard Upper Torso, fiberglass upper part of the EMU that the helmet, arms and waist attaches to
- **TMG** – Thermal Micrometeoroid Garment, white outer layer that provides protection to the suit bladder from thermal extremes and small micrometeoroids
- **DCM** – Display and Control Module, has a digital display and mechanical pressure gage to allows you to check out your suit’s performance
- **LCVG** – Liquid Cooling and Ventilation Garment circulates water around the astronaut’s body for cooling
- **DIDB** – Disposable In-suit Drink Bag holds 32 ounces of water to drink
- **MAG** – Maximum Absorbency Garment...for when you’re done with the 32 ounces of water!
- Helmet lights for when it is dark and a sun visor for when it is sunny
- **Radio** to talk to Mission Control and your partner, also to downlink suit parameters to Mission Control
EVA TOOLS
VIDEO FROM US EVA 30

<iframe width="560" height="315" src="https://www.youtube.com/embed/26QWMMT1c8Y" frameborder="0" allowfullscreen></iframe>
HOW TO TRAIN TO WORK IN SPACE

New astronauts learn the basics of EVA including how the EMU works and how to perform basic tasks during an EVA.

Once assigned to an ISS Increment, astronauts spend ~22 months learning all about life on the ISS, including more in depth EVA knowledge.

EVA Training facilities include:
- Neutral Buoyancy Lab (NBL)
- Virtual Reality (VR) Lab
- Space Station Airlock Test Article (SSATA) Vacuum Chamber
- Space Vehicle Mock-up Facility (SVMF)
  - Airlock
  - Partial Gravity Trainer (POGO)
  - Active ResponseGravity Offload System (ARGOS)
NEUTRAL BUOYANCY LAB (NBL)
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VIRTUAL REALITY (VR) LAB
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SPACE VEHICLE MOCK-UP FACILITY (SVMF)
SVMF AIRLOCK
PARTIAL GRAVITY TRAINER (POGO)
ACTIVE RESPONSE GRAVITY OFFLOAD SYSTEM (ARGOS)
CLASS I LAB
MAJORS IN THE EVA OPERATIONS GROUP

- Aerospace Engineering: 20
- Mechanical Engineering: 13
- Physics: 7
- Electrical Engineering: 5
- Math: 3
- Industrial Engineering: 3
- Computer Engineering: 2
- Environmental Engineering: 1
- Space Studies: 1