

The History & Evolution of Spacesuits and Spacewalks

David Hughes – NASA JSC EVA Office

(Flight Programs Support)



Mercury



Gemini G5C



Gemini G4C



Apollo A7L



Apollo A7LB



Skylab



Space Shuttle & ISS

Space Suits Developed By NASA-JSC

(1961 - Present)



EIS-A



EIS-B



RX-Series
(7 Models)



AES-A



AES-B



ZPS MK. I



MK. III

(Advanced Technology Support thru 1990)



View of Wiley Post
wearing early pressure suit

NASA Photo S81-37202



Mercury
astronaut L.
Gordon Cooper
Jr., in Mercury
spacesuit

NASA photo
S63-01755
(May 1963)



Mercury full pressure suit
NASA Photo S63-11362



The Gemini spacesuit,
AMU backpack, and
the Extravehicular Life
Support System
comprises the AMU.

NASA photo S66-
33167 (May 1966)

Gemini
extravehicular
suit assembly
NASA photo
S65-27424



Front view of the Apollo
Lunar Surface EVA spacesuit
with Portable Life Support
System (PLSS) backpack

NASA Photo S69-19206



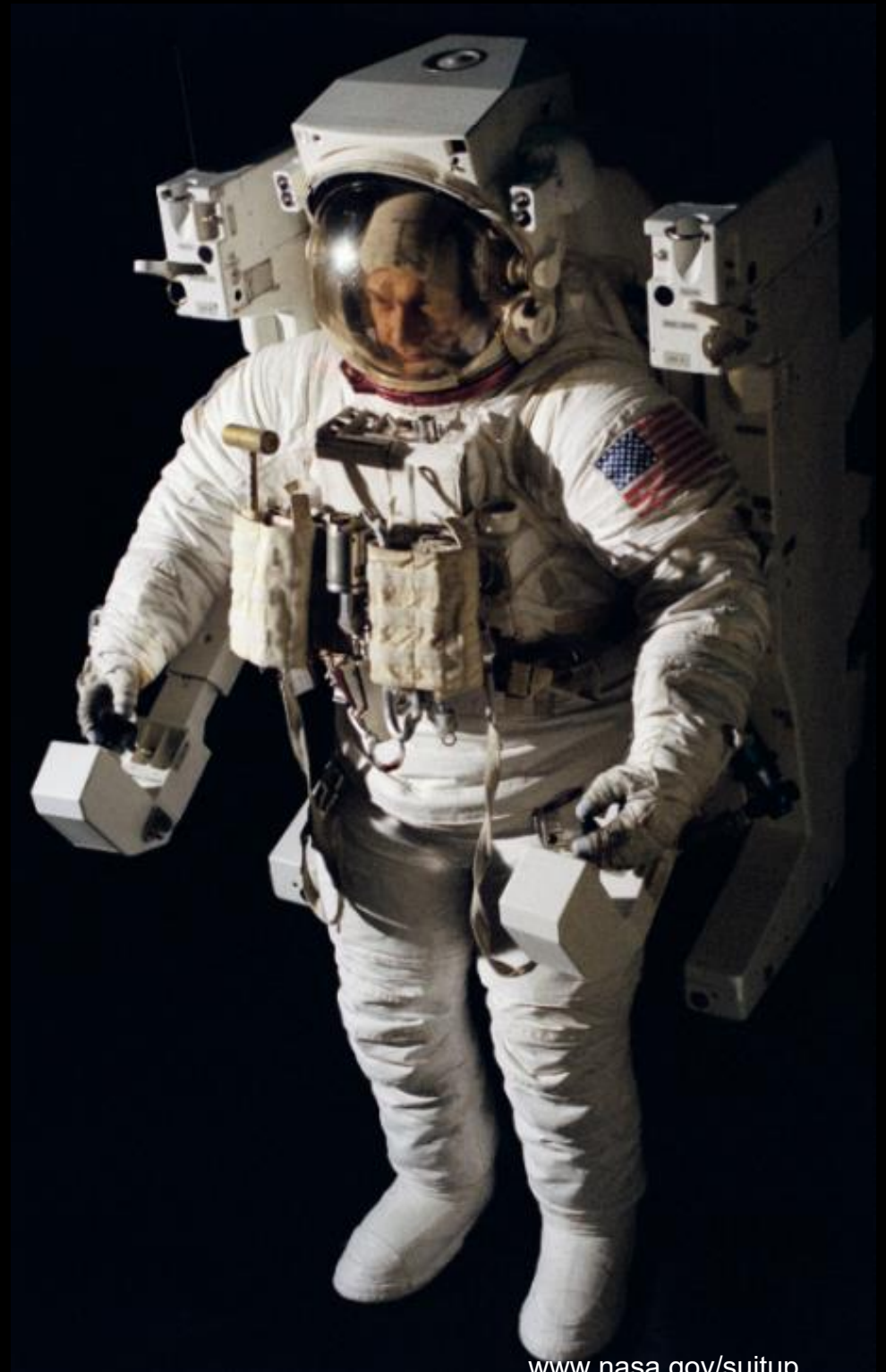


Astronaut Jack R. Lousma,
Skylab 3 pilot, practices
procedures for extravehicular
activity (EVA) in his
Extravehicular Mobility Unit
(EMU) spacesuit during Skylab
3 prelaunch training at
Johnson Space Center.

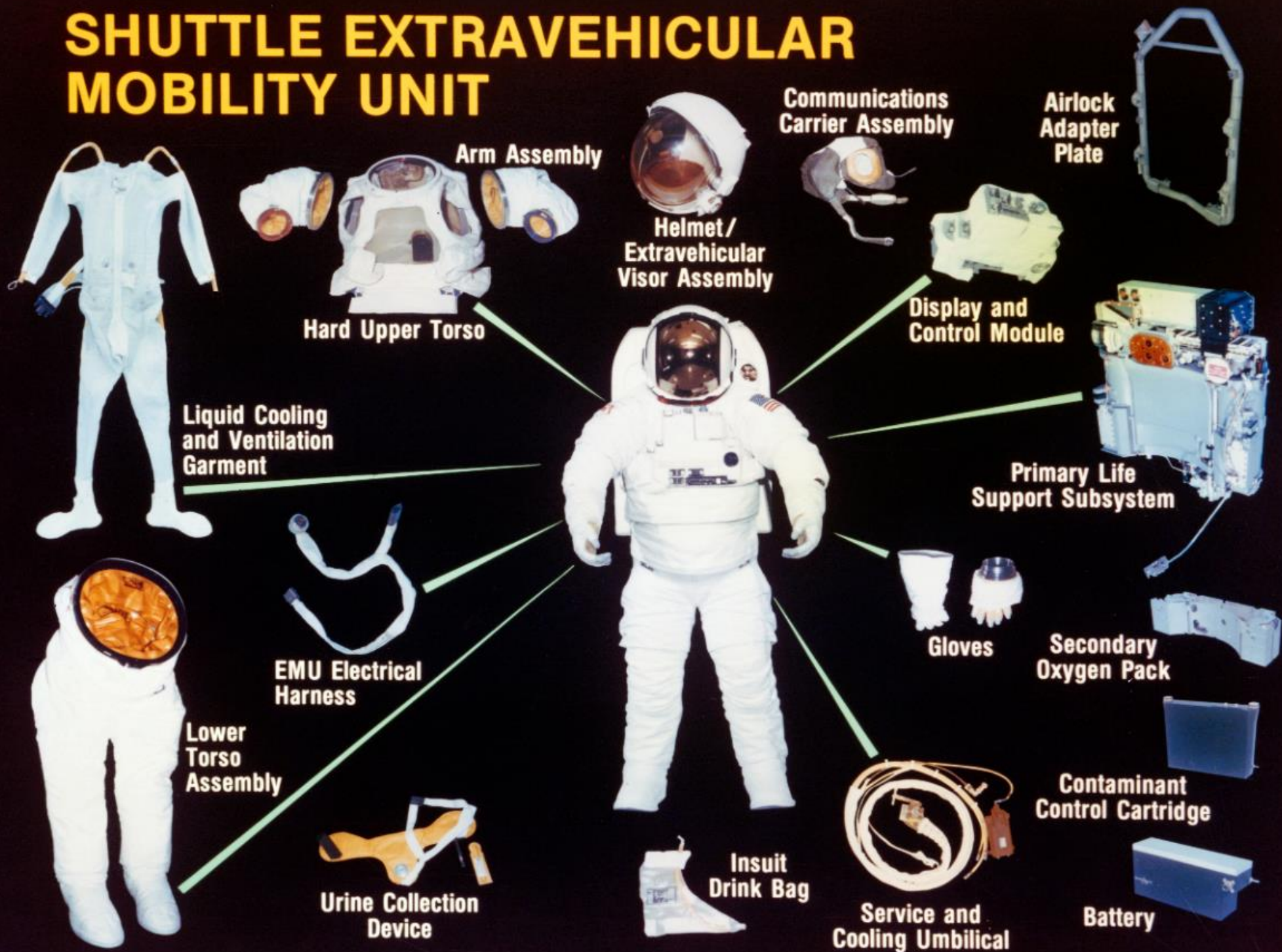
S73-31323 (30 June 1973)

Astronaut Bruce McCandless II in
NASA's Extravehicular Mobility
Unit (EMU) and Manned
Maneuvering unit (MMU) at the
Johnson Space Center (1982)

NASA photo S82-27596



SHUTTLE EXTRAVEHICULAR MOBILITY UNIT





Astronaut John L. Phillips
Expedition 11 NASA ISS
science officer, prepares
for an Extravehicular
Mobility Unit (EMU)
spacesuit fit check at the
Johnson Space Center
(JSC).

NASA Photo
jsc2004e48741



ISS EMU
NASA Photo
jsc2004e48741



Z-2 prototype spacesuit
NASA photo JSC2014-E-
035315 (14 April 2014)



Prototype spacesuit at
Remote Field
Demonstration Test Site
JSC2004-E-39665 (19
August 2004)

The image features the NASA logo, which consists of the word "NASA" in a bold, sans-serif font. A red diagonal line runs from the bottom-left to the top-right, crossing through the letters. The background is a dark blue space-themed image with a glowing blue globe, white stars, and a white orbital path. The NASA logo is centered in the image.

NASA

National Aeronautics and Space Administration

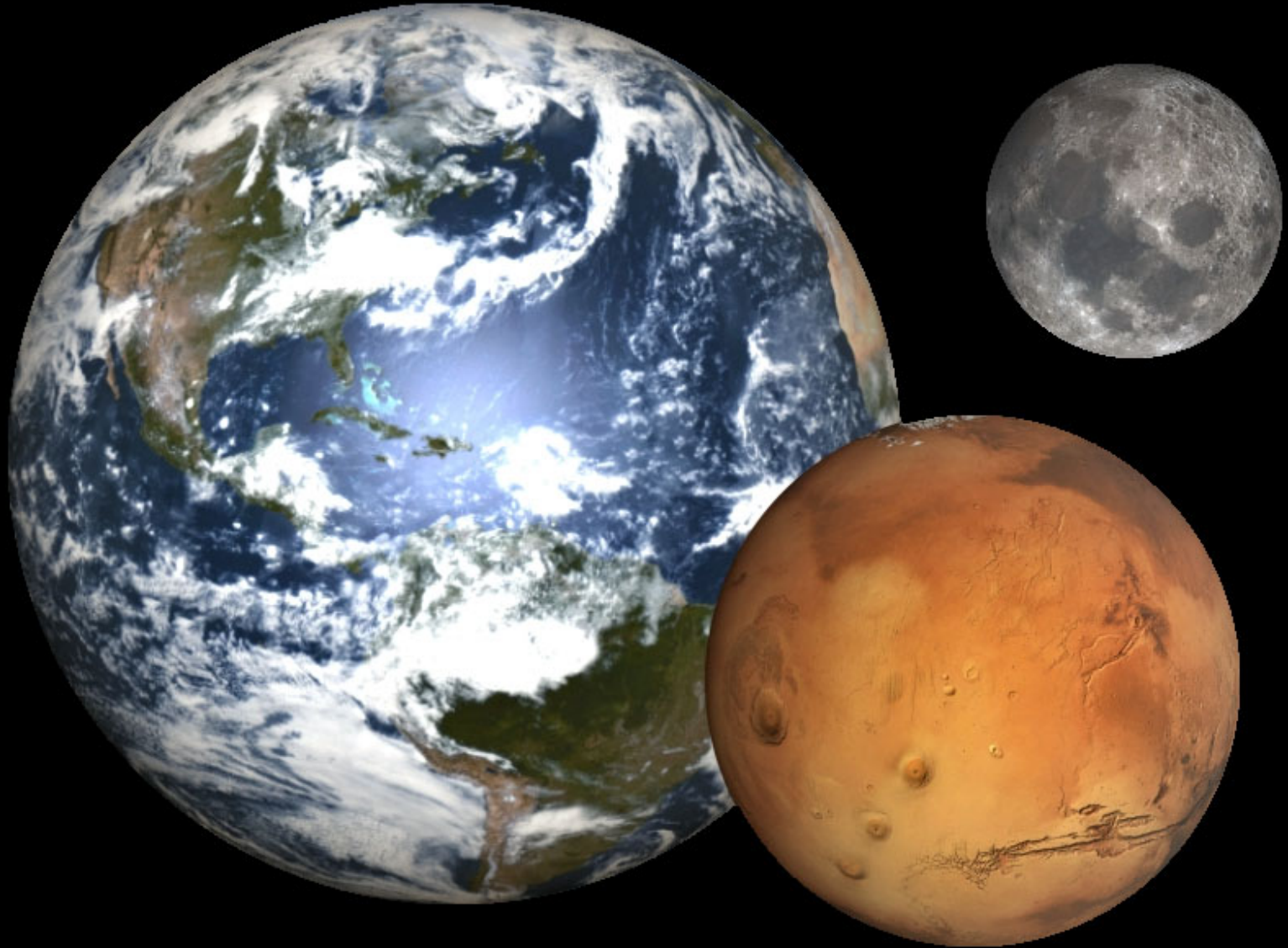
Walking In Space

Jonathan Miller

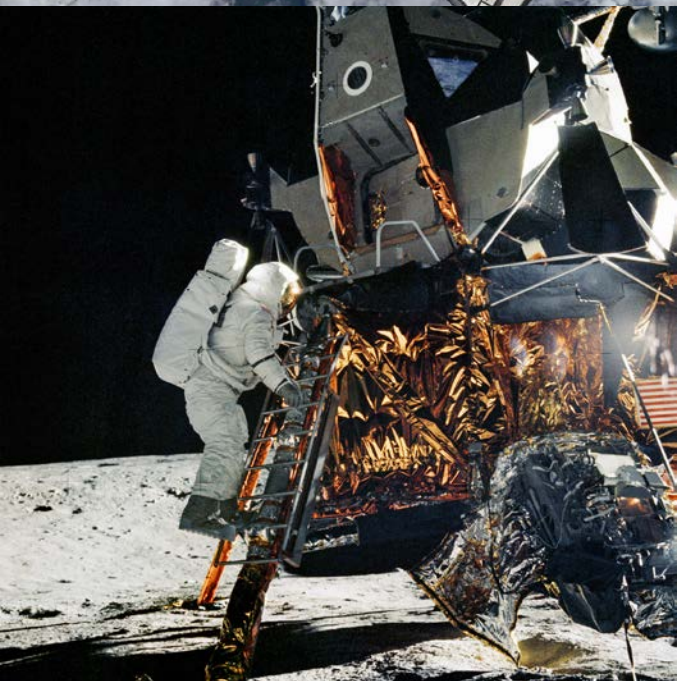
NASA Johnson Space Center
EVA Office

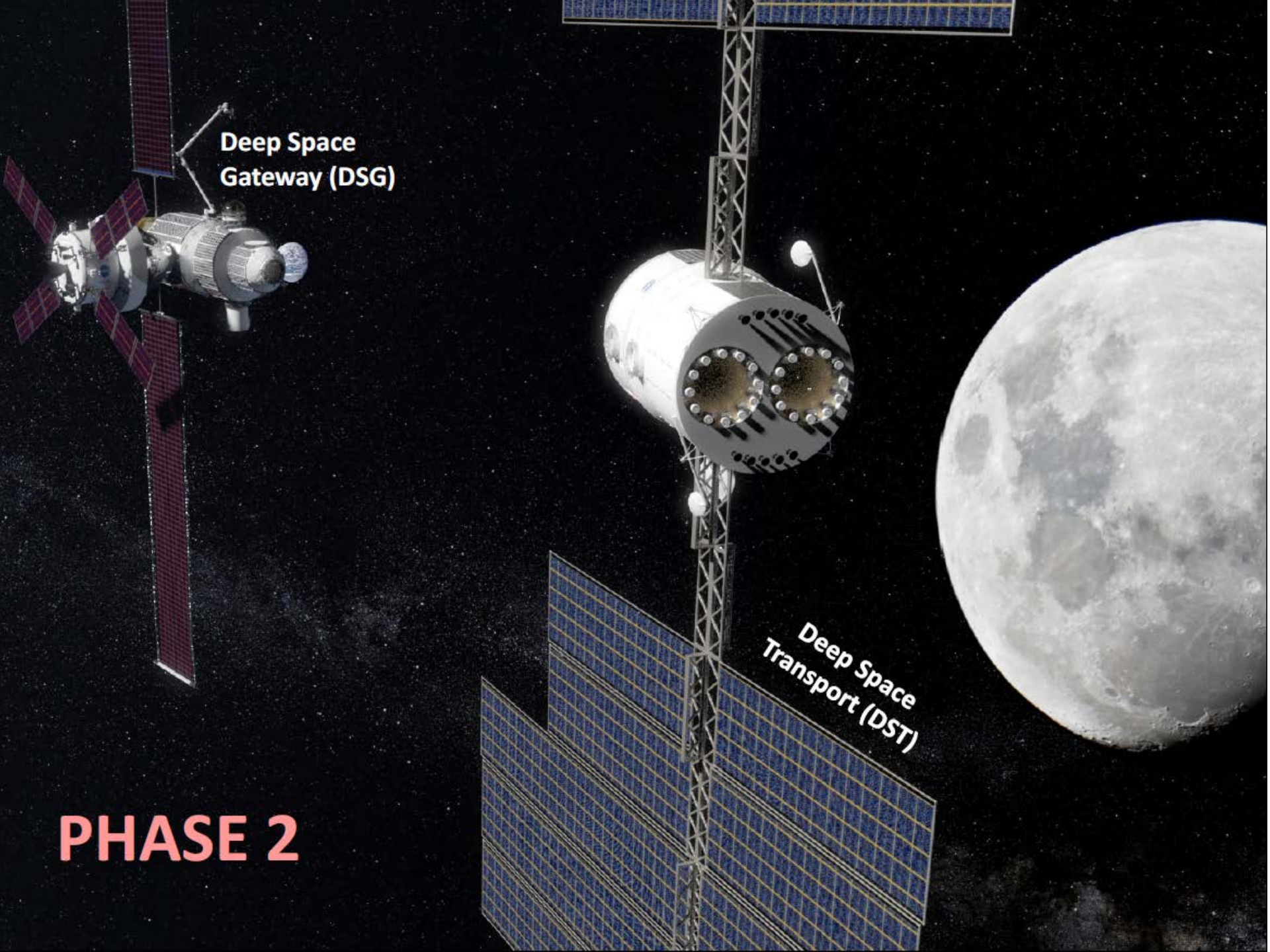


Human Space Exploration



NASA Spaceships



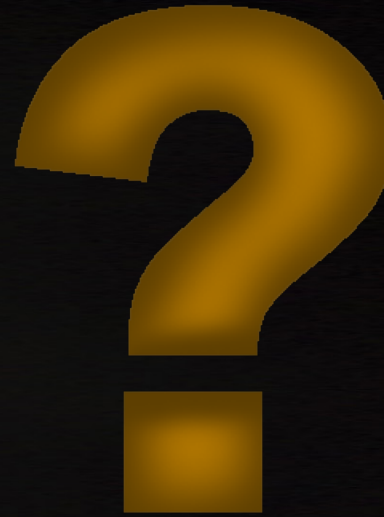


Deep Space
Gateway (DSG)

The image shows a conceptual rendering of NASA's Deep Space Architecture. On the left, the Deep Space Gateway (DSG) is depicted as a small, modular station with a central hub and four large, rectangular solar panel arrays extending outwards. In the center, the Deep Space Transport (DST) is shown as a large, cylindrical spacecraft with a complex structure of solar panels and antennas. The DST has two large, circular, gold-colored heat shields or radiators on its side. The background features a large, detailed view of the Moon's surface, showing craters and lunar maria. The overall scene is set against the blackness of space.

Deep Space
Transport (DST)

PHASE 2



Why do we Need a Space Suit

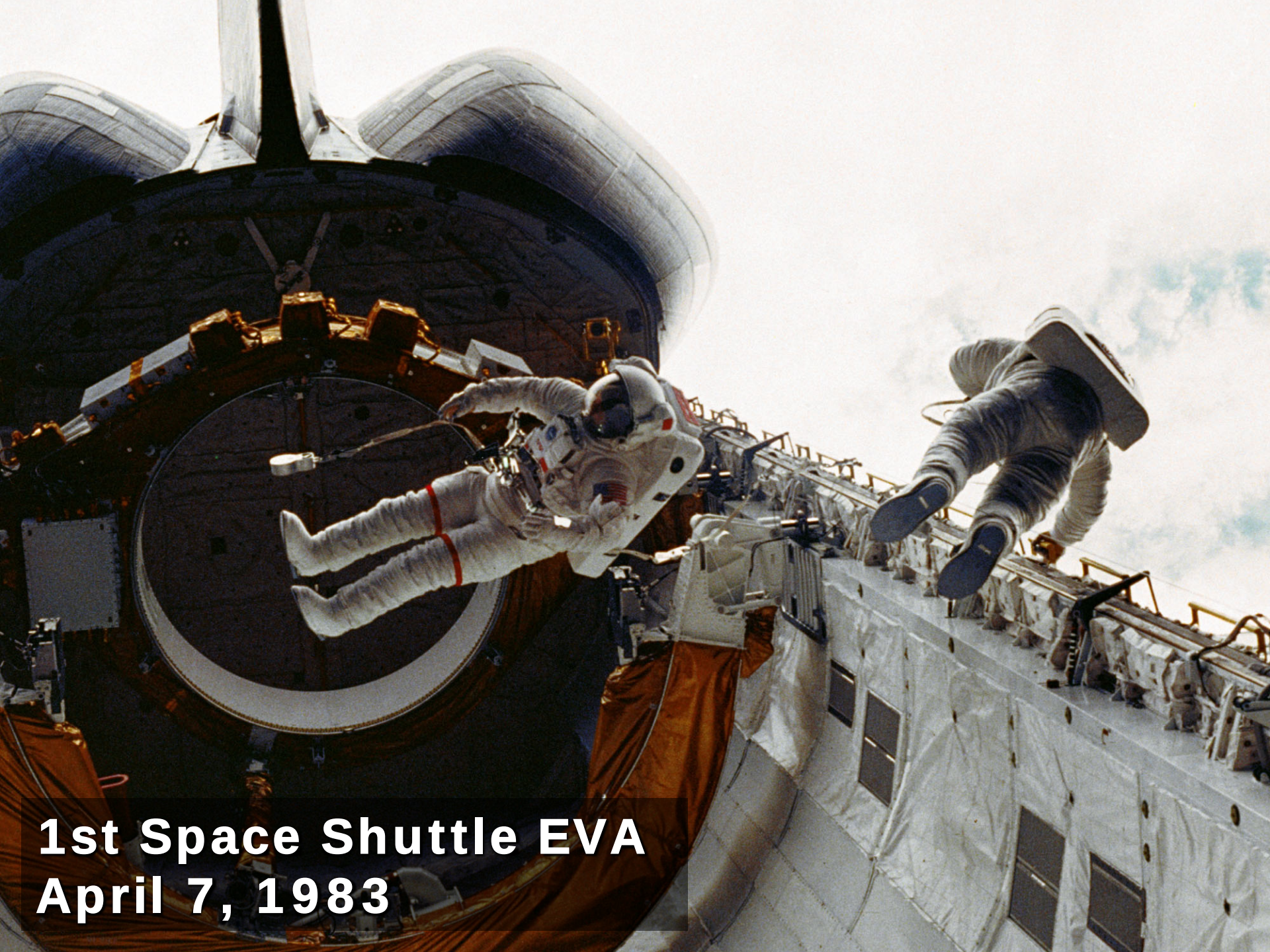
- To keep you alive in Space !
- To let you do your job like building a space station
- Lets you get close to the action!
- Lets you do what we call EVAs !!!

WHAT IS EVA ?

- EVA = ExtraVehicular Activity
 - Extra ... Outside
 - Vehicular ... of the vehicle (spacecraft)
 - Activity ... Doing something fun!
- So an EVA is a spacewalk outside the protection of the spacecraft
- A typical EVA takes from 4-8 hours
- Always 2 or more Astronauts perform an EVA together ... the “buddy system”



Buzz Aldrin
Apollo 11
July 20, 1969



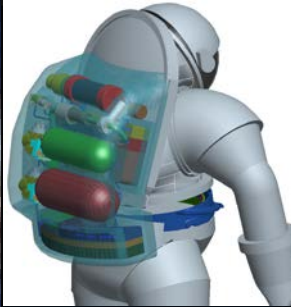
1st Space Shuttle EVA
April 7, 1983

WHAT KEEPS YOU ALIVE ON EARTH MUST BE PROVIDED IN A SPACESUIT!



Earth	Spacesuit
Air to Breathe Photosynthesis	Oxygen in a bottle
Air Pressure	Pressure Garment “bladder”
Sun and atmosphere to keep us warm	Insulation and cooling systems “Air conditioning”
Clothes / shoes to protect your skin / feet	Micrometeoroid Garment
Food / Water	Drink Bag
Gravity / Balance	Foot Restraints / Tethers
Hygiene “toilets”	Diapers “MAGs”

Suit Development Using the Scientific Method



Concept
Development



Component Testing



System
Testing



Integrated
Testing

Concept: Imagine the answer.

Build: Try to build what you imagine!

Test: See if it works???

Does it work? Yes: Great !

No: Learn and try again !!!!



- Pressure vessel for the head
- Visor provides visual, thermal, impact, and micrometeoroid protection in space



Helmet and Extravehicular Visor Assembly (EVVA)



Communications Carrier Assembly (CCA)

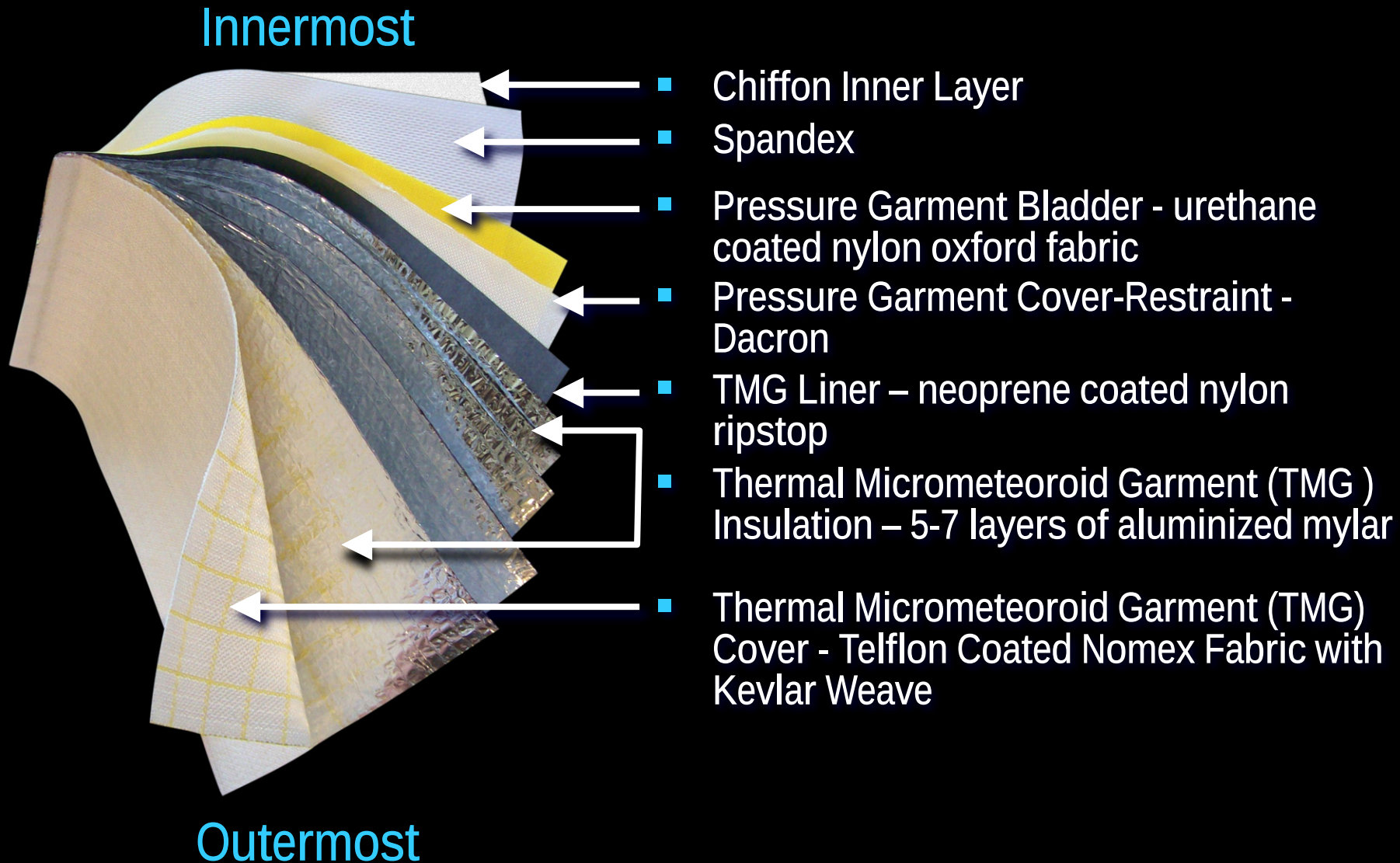
- Contains microphones and headphones for communication and caution and warning tones



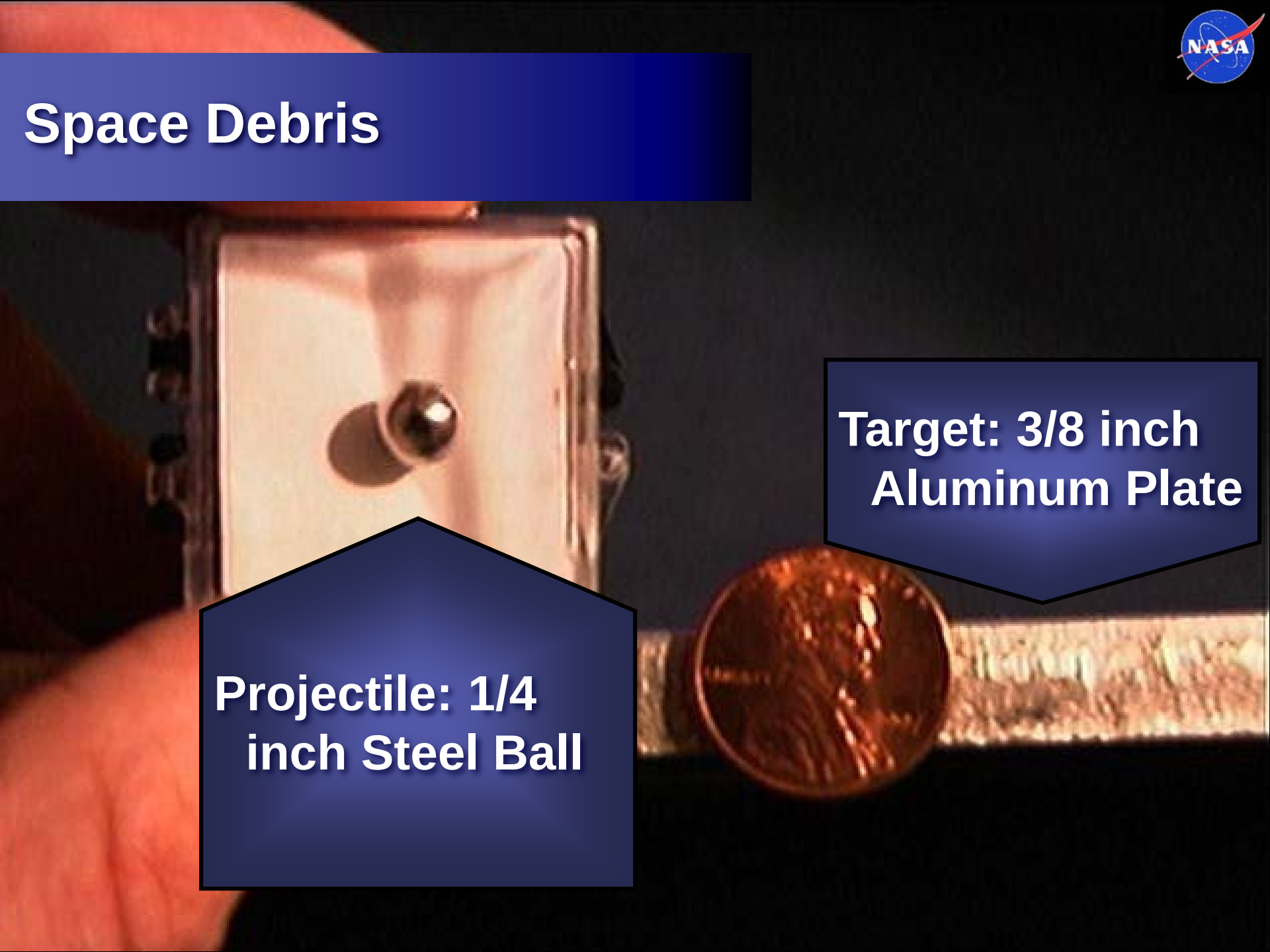
-
- A photograph of a white, cylindrical, multi-layered object, likely a space station component, secured with numerous red and white straps. The object is labeled with various identification tags, including "ITEM TRANS", "PART NO. 0", "SERIAL NO. 0", "CODE ID 74", and "SUBASSEMBLY". A NASA logo is visible in the top right corner.



EMU Suit Layers

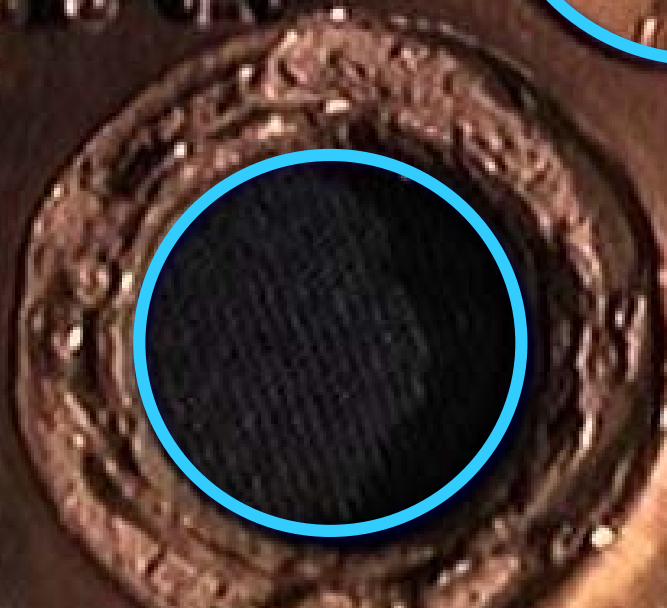


Space Debris

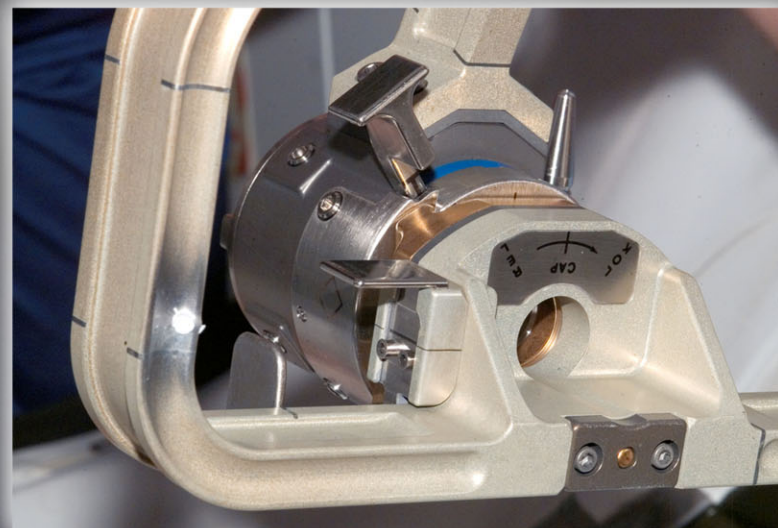
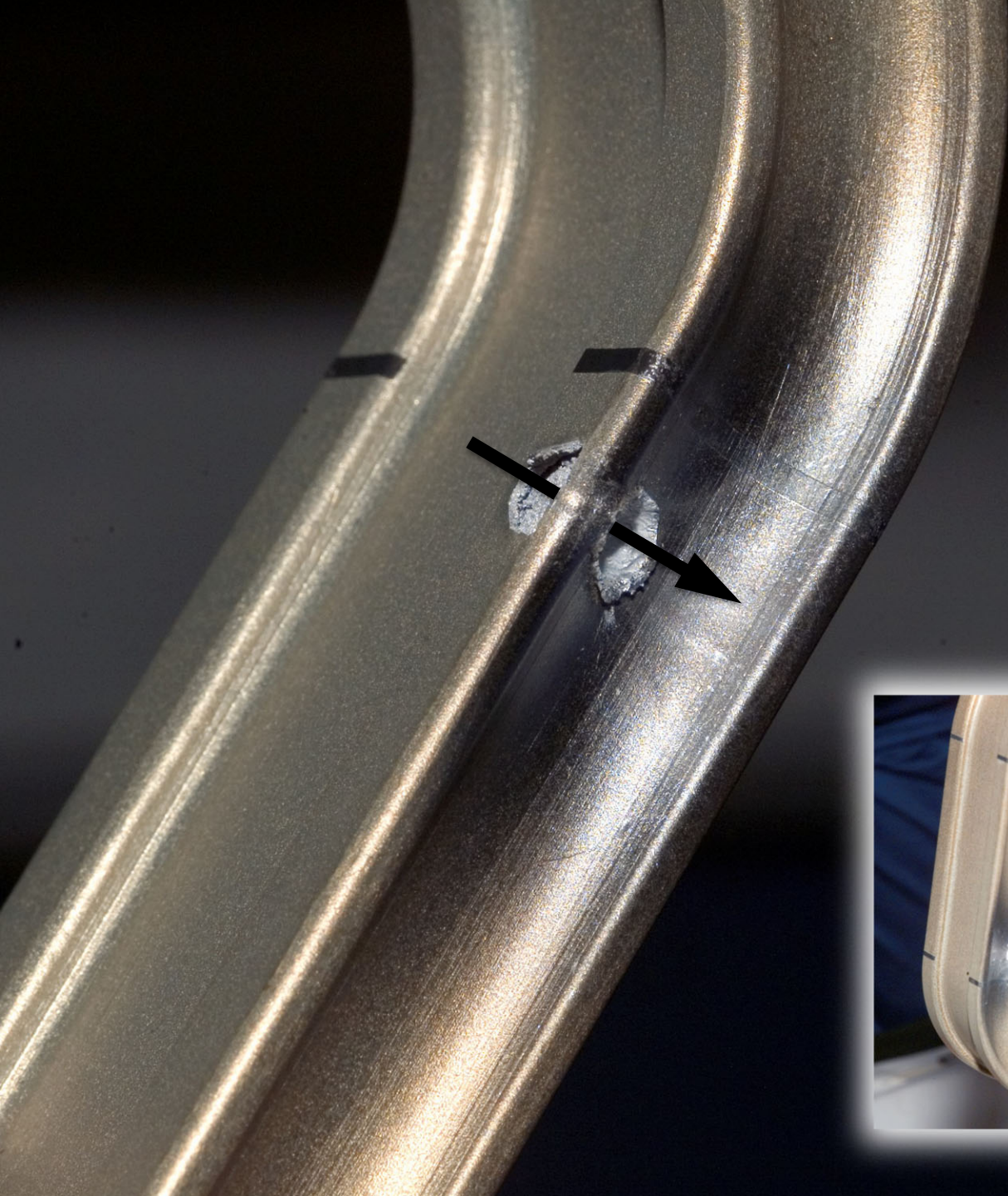


**Projectile: 1/4
inch Steel Ball**

**Target: 3/8 inch
Aluminum Plate**



6.7 km / second (14,987.5 mph)



Dealing With Zero Gravity

Foot Restraint



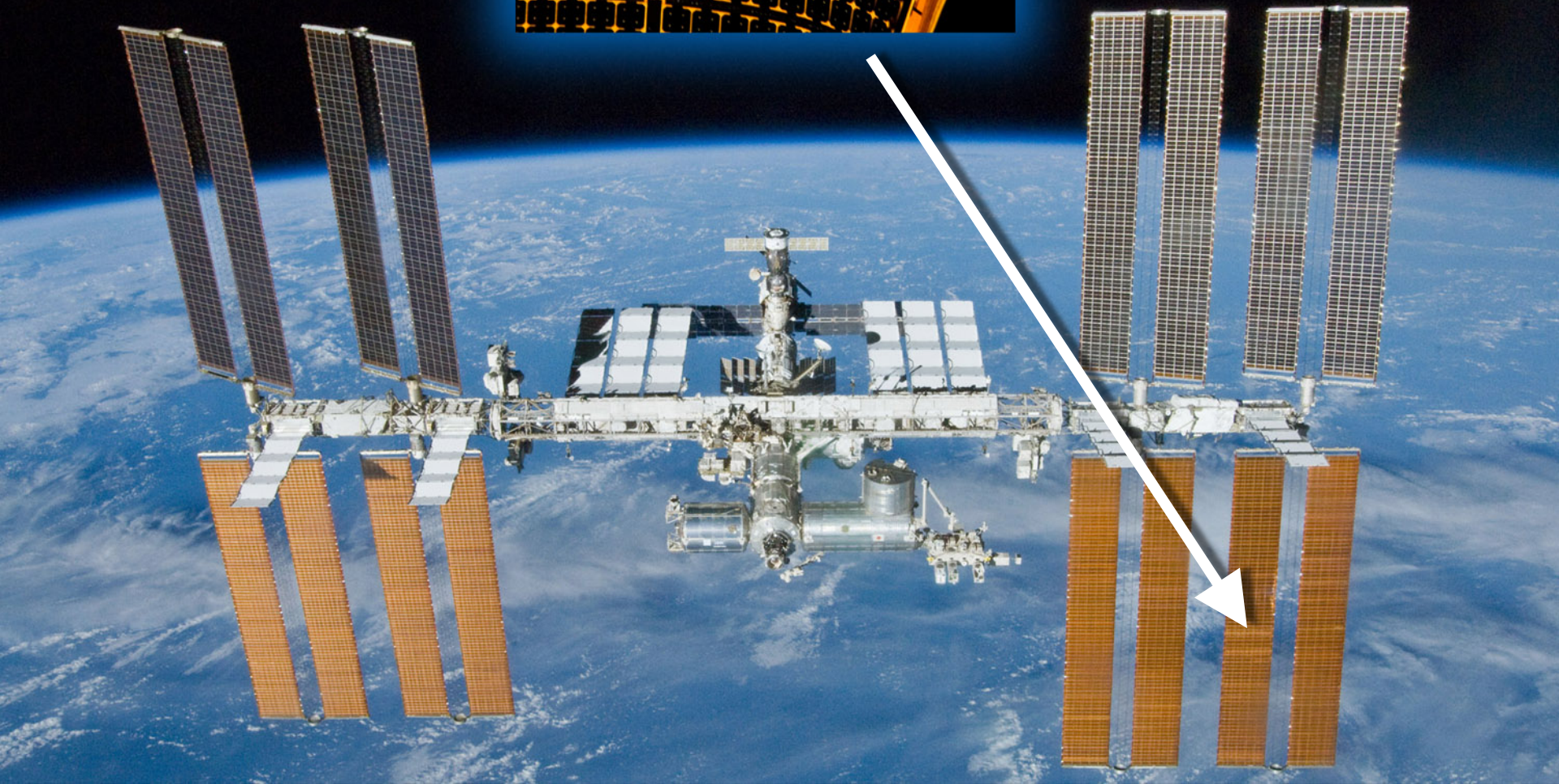
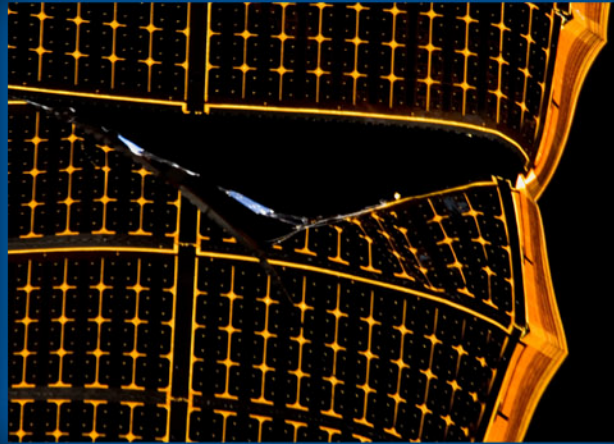
Free Float



STS-120

Solar Array Repair

Nov. 3, 2007





STS-120
Solar Array
Repair
Nov. 3, 2007



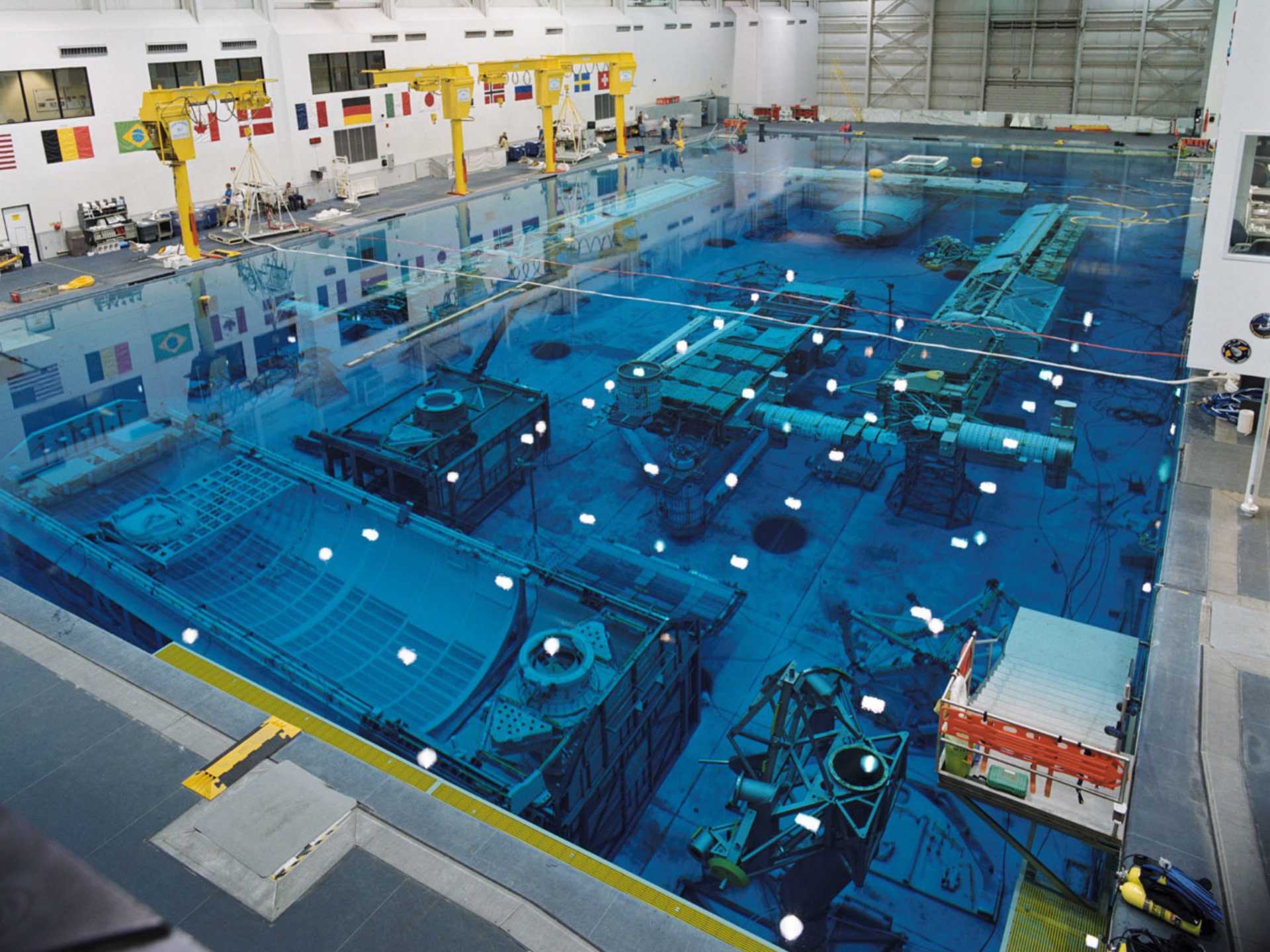
Zero Gravity Training







Neutral Buoyancy Laboratory (NBL)



Questions?



The image features the NASA logo, which consists of the word "NASA" in a bold, sans-serif font. A red diagonal line runs from the bottom-left to the top-right, crossing through the letters. The background is a dark blue space-themed image with a globe, stars, and a grid pattern. The logo is centered in the image.

NASA

New Spacesuit Development

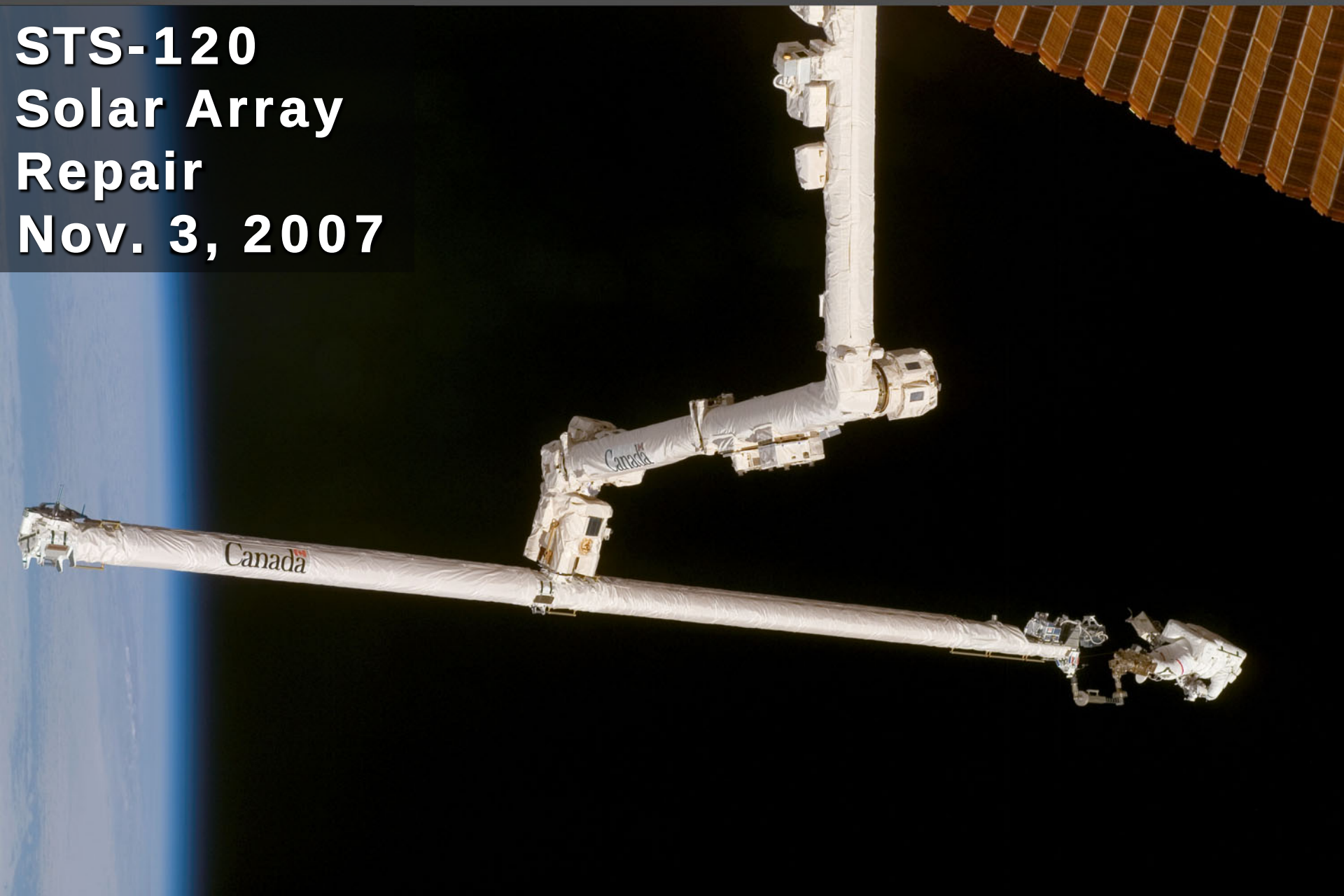
Backup Material

STS-120

Solar Array

Repair

Nov. 3, 2007





STS-120
Solar Array
Repair
Nov. 3, 2007

STS-120
Solar Array
Repair
Nov. 3, 2007





Lunar Surface EVA Suit