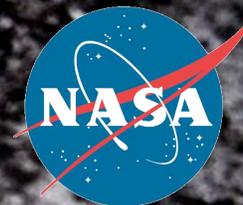




EVA Systems Project



EVA Systems Project Office
February 25-27, 2008
AIAA Exploration Conference



Outline

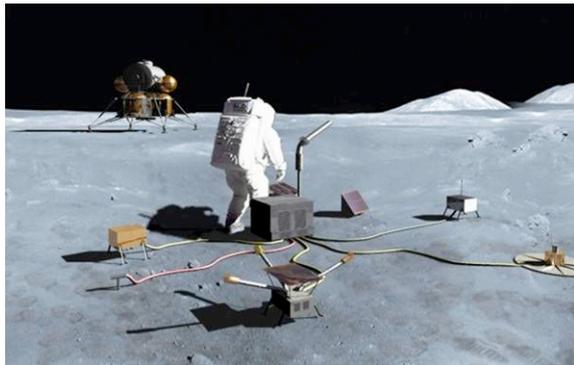
- ◆ **Goals/Objectives**
- ◆ **Vision**
- ◆ **Concept of Operations**
- ◆ **Architecture**
 - EVA System Description
 - EVA Systems Reference Configuration

- ◆ **Note: Limited Content due to current Competitive NASA Procurement**

***A Bold Vision for Space Exploration,
Authorized by Congress***



- ◆ **Complete the International Space Station**
- ◆ **Safely fly the Space Shuttle until 2010**
- ◆ **Develop and fly the Crew Exploration Vehicle no later than 2014 (goal of 2012)**
- ◆ **Return to the Moon no later than 2020**
- ◆ **Extend human presence across the solar system and beyond**
- ◆ **Implement a sustained and affordable human and robotic program**
- ◆ **Develop supporting innovative technologies, knowledge, and infrastructures**
- ◆ **Promote international and commercial participation in exploration**



NASA Authorization Act of 2005

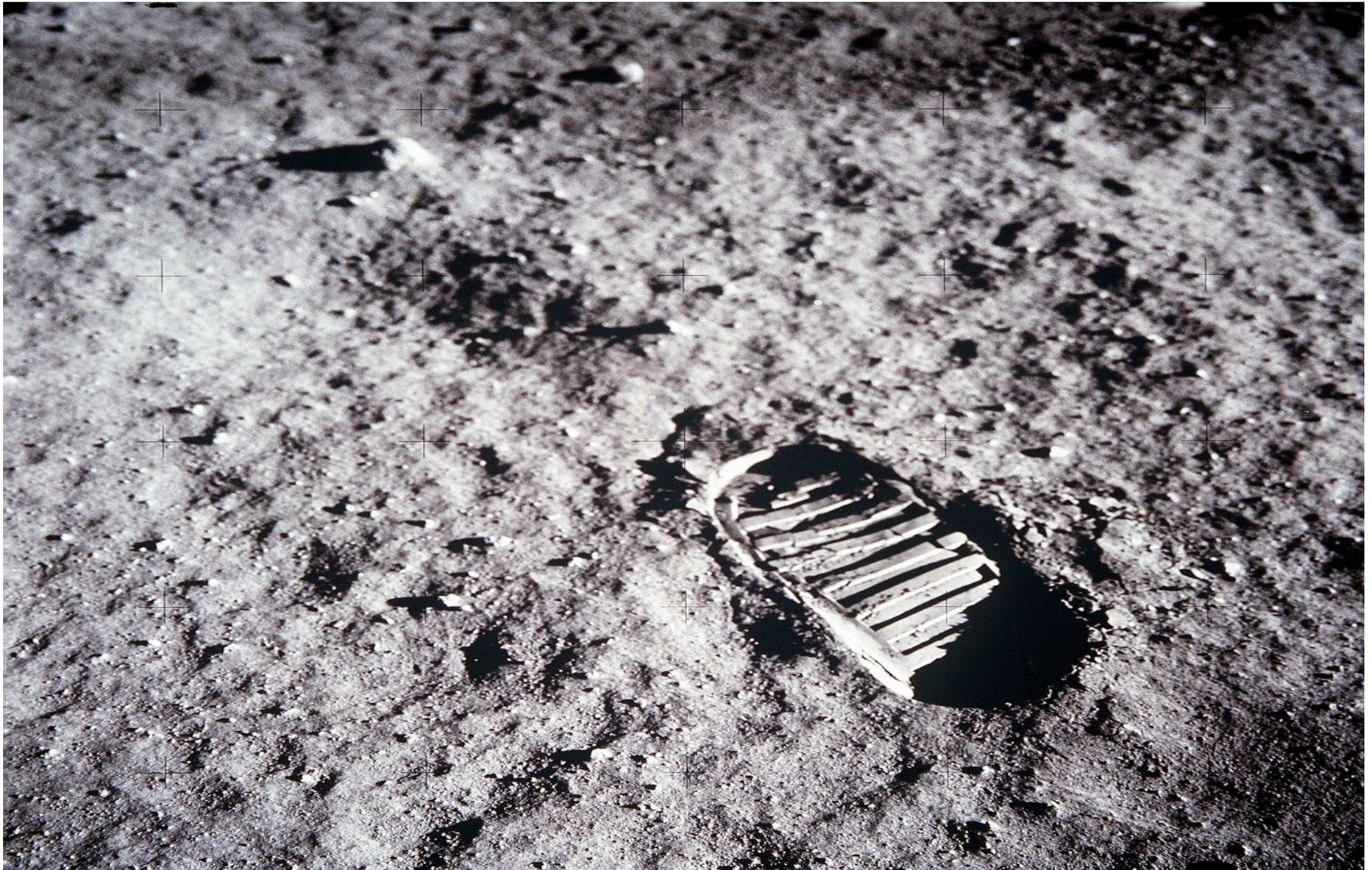
The Administrator shall establish a program to develop a sustained human presence on the Moon, including a robust precursor program to promote exploration, science, commerce and U.S. preeminence in space, and as a stepping stone to future exploration of Mars and other destinations.



EVA Project Manager's Vision

- ◆ ***Robotic missions are amazing and extremely important to our Agency, but Robots discover, Human beings Explore. Exploration is a personal experience and a capable and innovative EVA System will enable that experience.***
- ◆ **Meeting this vision will require Humans to operate outside the pressurized spacecraft environment and explore other planetary bodies. The EVA Systems Project office will protect the crew in these mission phases and allow for exploration of our solar system in a safe, efficient and cost effective manner.**

Success





Operations



Operational Scenarios

◆ **Launch**

- Nominal launch ops
- Emergency Pad Egress

◆ **Orbit**

- Survival in an unpressurized cabin
- Unscheduled/Contingency EVA

◆ **Lunar Surface**

◆ **Landing**

- Nominal & Off-nominal

- Note: Photos borrowed from all legacy and current programs



Nominal Launch Ops

- ◆ **Crew dons their suits in the O&C Building “Suit-up room”**
 - Some checkout of the suit will be performed using GSE
- ◆ **Crew transfers (with closeout crew) to the pad in the Astrovan**
 - Provisions for cooling will be available
- ◆ **Crew rides elevator to the access level (~ 280’ level)**
- ◆ **Crew finishes suit-up process and ingresses CEV with assistance**





Emergency Pad Egress

- ◆ **System must allow for unassisted emergency egress**
 - Closeout crew and rescue crews assist if situation warrants
- ◆ **Emergency escape system under review by Ground Systems**
- ◆ **Bunker at base of current slidewire system will provide services**
- ◆ **Use of emergency escape vehicle (M-113) needs to be assessed**





Unscheduled / Contingency EVA

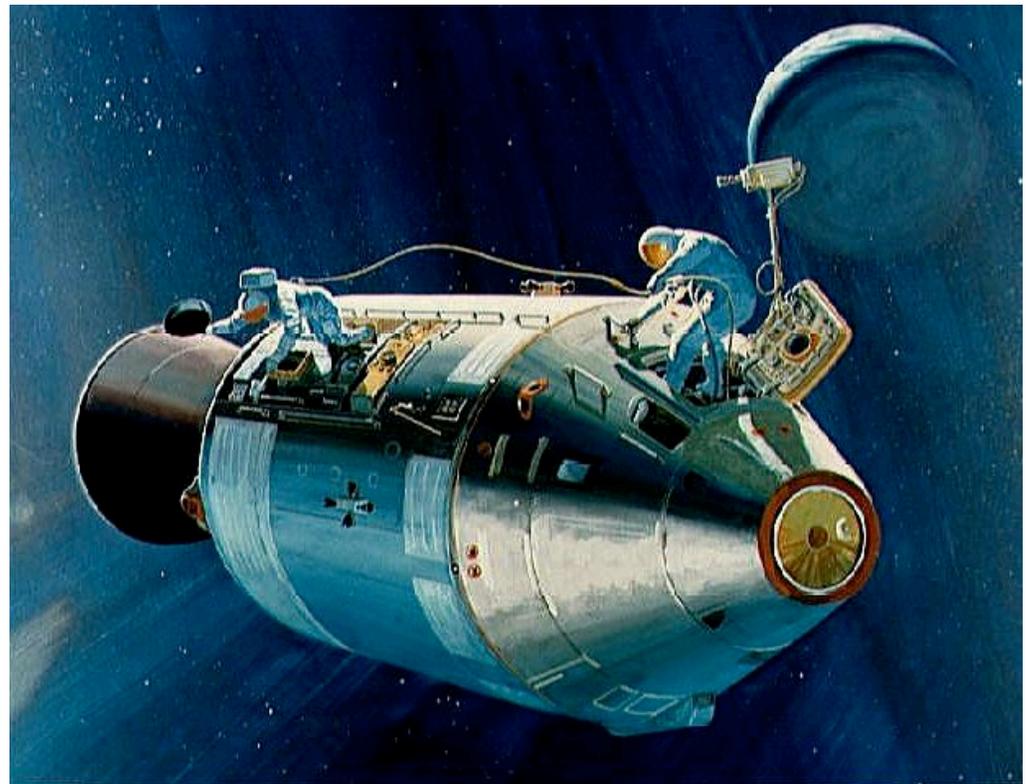
- ◆ **Unscheduled / Contingency EVA requirement levied on the Constellation Architecture (Microgravity)**
 - Currently allocated to CEV, Altair, and EVA
 - Unscheduled – Mission Success
 - Contingency – Crew Safety

- ◆ **2 EVAs of 4 hours (TBR)**
 - Independent of other vehicles

- ◆ **EV1 performs task**

- ◆ **EV2 SEVA, ready to assist**

- ◆ **Currently no tasks ID'd by CEV project other than Altair – CEV transfer**

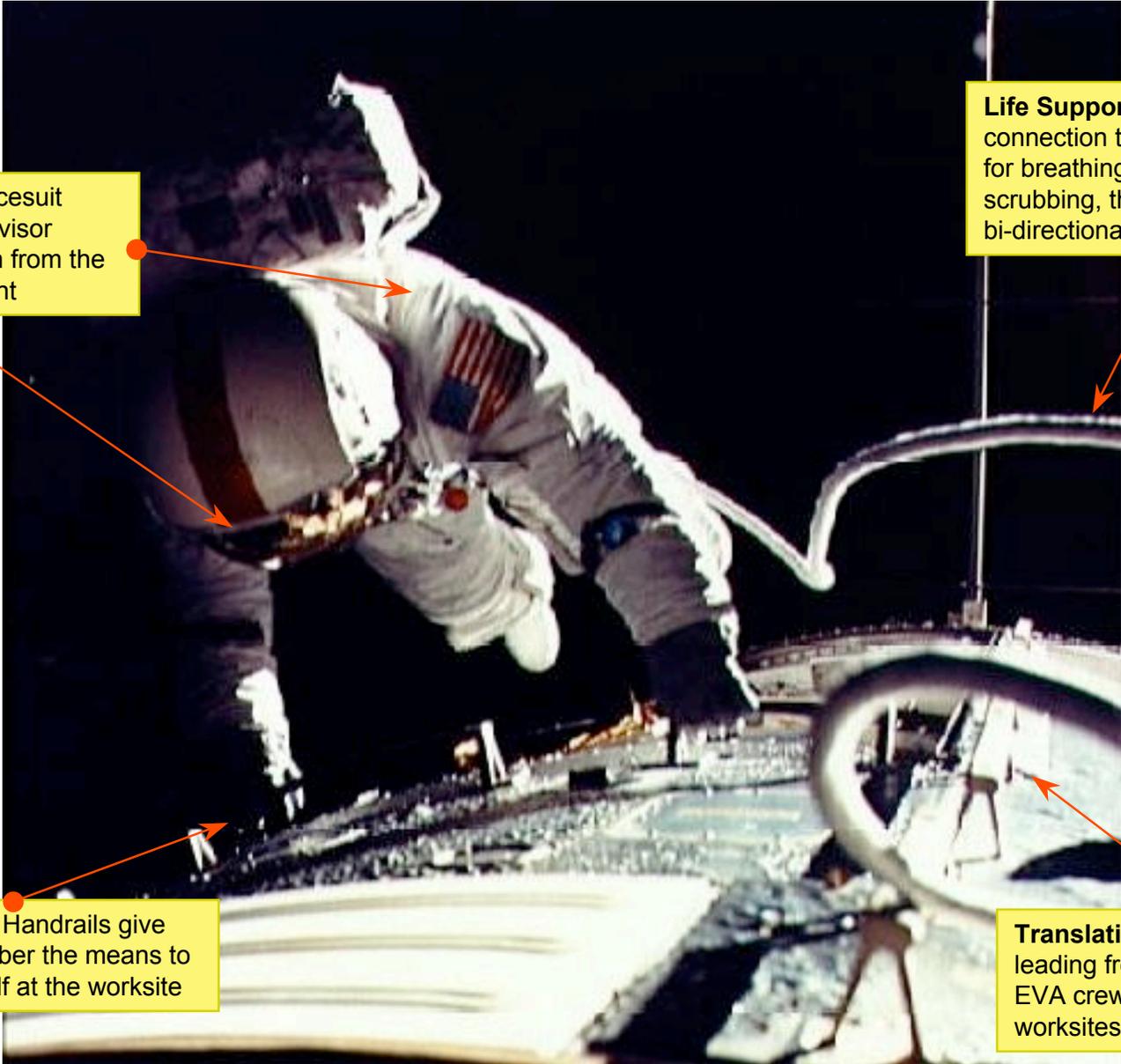


Apollo EVA on Service Module



Protection: Spacesuit TMG and helmet visor provide protection from the space environment

Life Support: Umbilical connection to spacecraft ECLSS for breathing gas supply, CO2 scrubbing, thermal control, and bi-directional data/voice



Stabilization: Handrails give EVA crewmember the means to stabilize himself at the worksite

Translation Path: Handrails leading from the hatch allow EVA crewmember safely reach worksites



- ***“...One small step for man, ...”***



Nominal & Off-Nominal Landing

- ◆ **Nominal landing scenario is on land with full assistance by ground ops recovery forces**
 - Crew would likely stay suited through transport (cooling services provided)
- ◆ **Off-nominal scenarios:**
 - Land-landing not at the designated site
 - Water-landing
 - In either case, the crew has the option of staying with or leaving the vehicle (appropriate survival gear will be provided by EVA & FCE)





Suit Architecture



EVA System

Since Cx PBS, conducted 'Architecture Assessment' that focused on mitigation of occupant protection and mass/volume issues associated with first EVA System Reference (ESR 1)* - resulted in ESR 2 (shown below)

