

7. Solar Array Repair (STS-120, Expedition 16)

****Field:**** Engineering / Energy Systems

****Description:**** Astronauts repaired a torn solar array using tools and teamwork during EVA to restore power to the ISS.

****Benefit to Humanity:**** Improves solar power maintenance techniques and satellite servicing methods for Earth applications.

****SDG Contribution:**** SDG 7 – Affordable & Clean Energy; SDG 9 – Industry, Innovation & Infrastructure.

****Simulation Possibility:**** ✓Yes – Real EVA repair operation trained in the NBL using underwater mockups.

****References:**** NASA STS-120:

https://www.nasa.gov/mission_pages/shuttle/shuttlemissions/sts120/main.html

8. Cooling System Maintenance (Ammonia Pump Module Replacement, 2010)

****Field:**** Mechanical & Thermal Engineering

****Description:**** Replaced a failed ammonia pump during EVA to maintain the station's cooling systems.

****Benefit to Humanity:**** Improves cooling technologies and maintenance methods used in robotics and industry.

****SDG Contribution:**** SDG 9 – Industry, Innovation & Infrastructure.

****Simulation Possibility:**** ✓Yes – Trained in the NBL; involves fluid line management and coordination.

****References:**** NASA Expedition 24 EVA:

https://www.nasa.gov/mission_pages/station/expeditions/expedition24/eva_20100807.html

9. Truss Assembly (STS-110 to STS-134)

****Field:**** Aerospace / Structural Engineering

****Description:**** Installed truss segments that form the ISS backbone, expanding its power and structure.

****Benefit to Humanity:**** Supports future modular construction methods for space and industrial use.

****SDG Contribution:**** SDG 9 – Industry, Innovation & Infrastructure.

****Simulation Possibility:**** ✓Yes – Central EVA training activity in the NBL.

****References:**** NASA ISS Truss:

https://www.nasa.gov/mission_pages/station/structure/elements/truss.html

10. Canadarm2 Operations

****Field:**** Robotics & Automation

****Description:**** Controlled the Canadarm2 robotic arm for payload movement and EVA assistance.

****Benefit to Humanity:**** Advances teleoperation, robotic surgery, and automated industrial systems.

****SDG Contribution:**** SDG 9 – Industry, Innovation & Infrastructure.

****Simulation Possibility:**** ✓Yes – Robotic coordination and control tasks can be simulated in an NBL app.

****References:**** CSA Canadarm2: <https://www.asc-csa.gc.ca/eng/iss/canadarm2/default.asp>

11. External Module Installation (Columbus, Kibo, BEAM)

****Field:**** Engineering / Logistics

****Description:**** Attached new scientific modules to the ISS exterior using EVA and robotic operations.

****Benefit to Humanity:**** Demonstrates advanced precision engineering and modular construction.

****SDG Contribution:**** SDG 9 – Industry, Innovation & Infrastructure.

****Simulation Possibility:**** ✓Yes – Ideal for simulation; involves alignment and teamwork.

****References:**** ESA Columbus:

https://www.esa.int/Science_Exploration/Human_and_Robotic_Exploration/Columbus

12. Handrail & Safety Tether Procedures

****Field:**** Safety / Human Factors

****Description:**** Trained astronauts on how to navigate and stay secured using handrails and safety tethers.

****Benefit to Humanity:**** Improves safety design and ergonomics for high-risk industries on Earth.

****SDG Contribution:**** SDG 3 – Good Health & Well-being; SDG 8 – Decent Work & Economic Growth.

****Simulation Possibility:**** ✓Yes – Core EVA activity regularly trained in NBL; perfect for simulation.

****References:**** NASA EVA Training:

https://www.nasa.gov/mission_pages/station/expeditions/expedition27/eva_training.html

13. EVA Emergency Scenarios (Lost Tool, Tether Break)

****Field:**** Safety / Psychology

****Description:**** Trained astronauts to respond to emergencies during EVAs, such as equipment loss or tether failure.

****Benefit to Humanity:**** Improves human response to crisis situations in space, aviation, and industry.

****SDG Contribution:**** SDG 3 – Good Health & Well-being; SDG 8 – Decent Work & Economic Growth.

****Simulation Possibility:**** ✓Yes – Essential NBL emergency training scenario, interactive and realistic.

****References:**** NASA EVA Safety:

<https://www.nasa.gov/audience/foreducators/spacesuits/factsheets/eva.html>

14. xEMU Suit Mobility & Efficiency Tests

****Field:**** Biomechanics / Physiology

****Description:**** Evaluated astronaut endurance, movement range, and oxygen management using the next-gen xEMU suit.

****Benefit to Humanity:**** Informs ergonomic wearable technology and protective suit designs for industrial workers.

****SDG Contribution:**** SDG 3 – Good Health & Well-being; SDG 9 – Industry, Innovation & Infrastructure.

****Simulation Possibility:**** ✓Yes – Suit movement and constraints are trainable underwater.

****References:**** NASA xEMU: <https://www.nasa.gov/suitup/exploration-spacesuit-xemu/>