Exploration Extravehicular Mobility Unit Outer Rendering
Configuration Control Computer-Aided Design Model
User’s Guide

National Aeronautics and Space Administration
Johnson Space Center
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The Exploration Extravehicular Mobility Unit (EMU) (xEMU) Computer-Aided Design (CAD) models are configuration controlled. This is a managed copy of the development xEMU system prior to Preliminary Design Review (PDR). Please do not transfer this model to others or modify it. The model may be obtained by emailing lee.coggins@nasa.gov. Please include your organization/company and designated point of contact (email and phone) along with your request. This will ensure that you are working with the most up-to-date copy while tracking those who have it. The model is not meant to be used as a volumetric simulator for any engineering work, but rather to allow for a good visual rendering of the suit.

The design and delivery of an exploration-class space suit, called the xEMU, will be demonstrated on the International Space Station (ISS) first, then upgraded with future extensibility for missions in cislunar orbit and on the lunar surface. To achieve this goal, an incremental approach has been developed that consists of two suit configurations, which are hybrid configurations encompassing elements of the current ISS EMU with enhanced mobility and complex informatics. The configuration planned for the ISS mission is referred to as the xEMU Demo. The configuration planned for microgravity cislunar and lunar surface missions is applicable to this User’s Guide and referred to as simply the exploration space suit or xEMU. It allows crew members to perform autonomous extravehicular exploration, science, construction, maintenance, and contingency operations in pressure and thermal environments that exceed human capability for lunar surfaces and cislunar orbit. Views of the configuration control CAD model of the xEMU are provided in Figure 1, for reference.

The xEMU is a rear entry suit in which the Portable Life Support System (PLSS) rotates away from the Pressure Garment, thereby allowing the crew member to enter and exit the suit. The rear entry suit is ingressed thru a suit hatch, as shown in Figure 2. The don/doff envelope is dimensioned, also as shown in Figure 2. Note: The images in this figure are not representative of the xEMU suit features; specifically, the green plate indicates a suit port, which is not a requirement for the xEMU suit. Regardless, the approximate dimensions are still applicable, per EVA-EXP-0031, EVA Office Extravehicular Activity (EVA) Airlocks and Alternative Ingress/Egress Methods Document.
The work envelope for early CAD visualization purposes can be considered equal to the existing EMU requirement. Design and early testing of the xEMU engineering units indicates that it will be able to exceed the EMU work envelopes shown. However, these data are preliminary only, and are not sufficient to update the requirements. Please use the envelopes shown as they are within both EMU and xEMU work envelopes. One- and two-handed work envelopes are illustrated in Figure 3.

Additionally, the approximate distance from the xEMU work envelope to an ISS-style worksite interface used to secure an Articulating Portable Foot Restraint (APFR) is shown in Figure 4. An additional requirements box is able to locate APFR ingress/egress handrails and local restraints to be used while reacting loads during EVA.
The volume required for the suit, either for translation purposes or working volume, is shown in Figure 5. A 43-inch cylinder may be shown around the suit to analyze the amount of room required for 5th%-95th% EVA crew. It is recommended to use the 43-inch diameter work and translation envelope for reference and show the xEMU within it for clarity, per EVA-EXP-0035, EVA Office Exploration EVA System Compatibility.

![Figure 5. Translation and work volume.](image)

The xEMU model is intended primarily for visualization and reference use. It should not be used to program reach and range parameters, as it is for static use only. It is approximately a 99th% range size. Do not rely on the physical volume of the xEMU CAD model alone because the xEMU is currently in development.

The models are available in two file formats: .fbx or .obj/.mtl files. These were chosen as being the most current and acceptable formats that many CAD applications can read. The .png files provide the texture maps and color data for the model and need to accompany the fbx or obj/mtl files.