



# LunaMOTH: Space Suit Attachment Quick Release Device

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## Background and Objectives

In order to increase efficiency of sampling operations during lunar extravehicular activity (EVA), the Tools Team at NASA is investigating methods for attaching tools to the utility belt on the Exploration Extravehicular Mobility Unit (xEMU).

The Lunar Modular Operations Tool Holster (LunaMOTH) fulfills these needs with a modular quick-release attachment mechanism.



LunaMOTH is designed to be used with NASA's xEMU for Artemis missions to the lunar surface (Credit: NASA)

LunaMOTH is a two-part system: one part fixed to the utility belt, one part fixed to the tool. LunaMOTH must satisfy the following requirements:

- Must be operable out of line of sight.
- Must be operable with one hand.
- Must hold 15lb of weight in Earth gravity.
- Must be operable after fully submerged in sand or lunar simulant.

These conditions are accomplished through iterative design and testing, culminating with a final device tested at NASA's Neutral Buoyancy Laboratory (NBL).

## Design

The design of LunaMOTH was created using the following priority hierarchy:

1. **Dust Tolerance**
2. **Ease of Use**
3. **Security**

**Open sides:**  
Allow dust to fall or be pushed out of the device, enabling continued operation in high dust environments.

**Wide V-shaped opening:**  
Easy to attach a tool, especially when operating out of line of sight or with one hand.

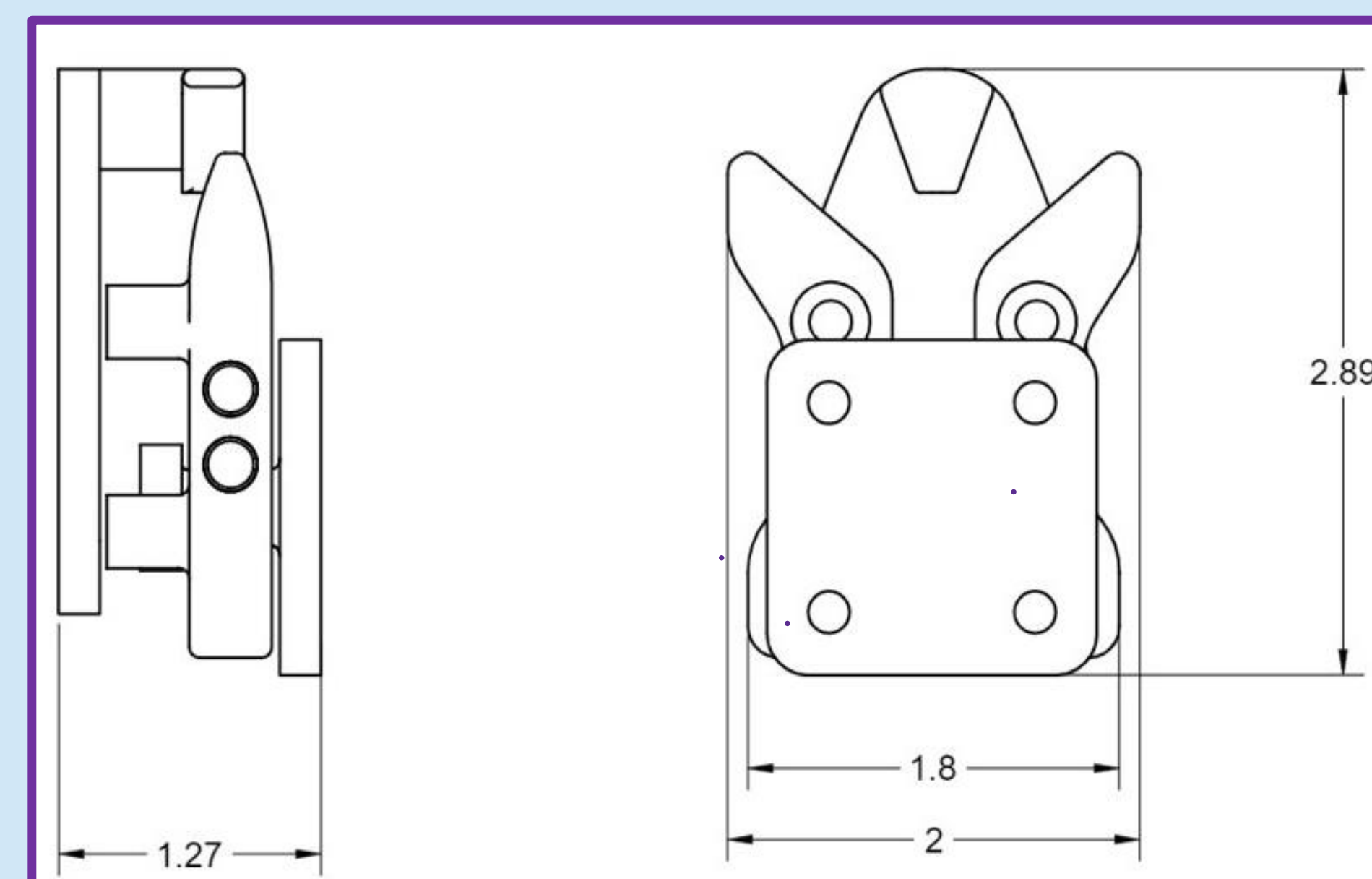
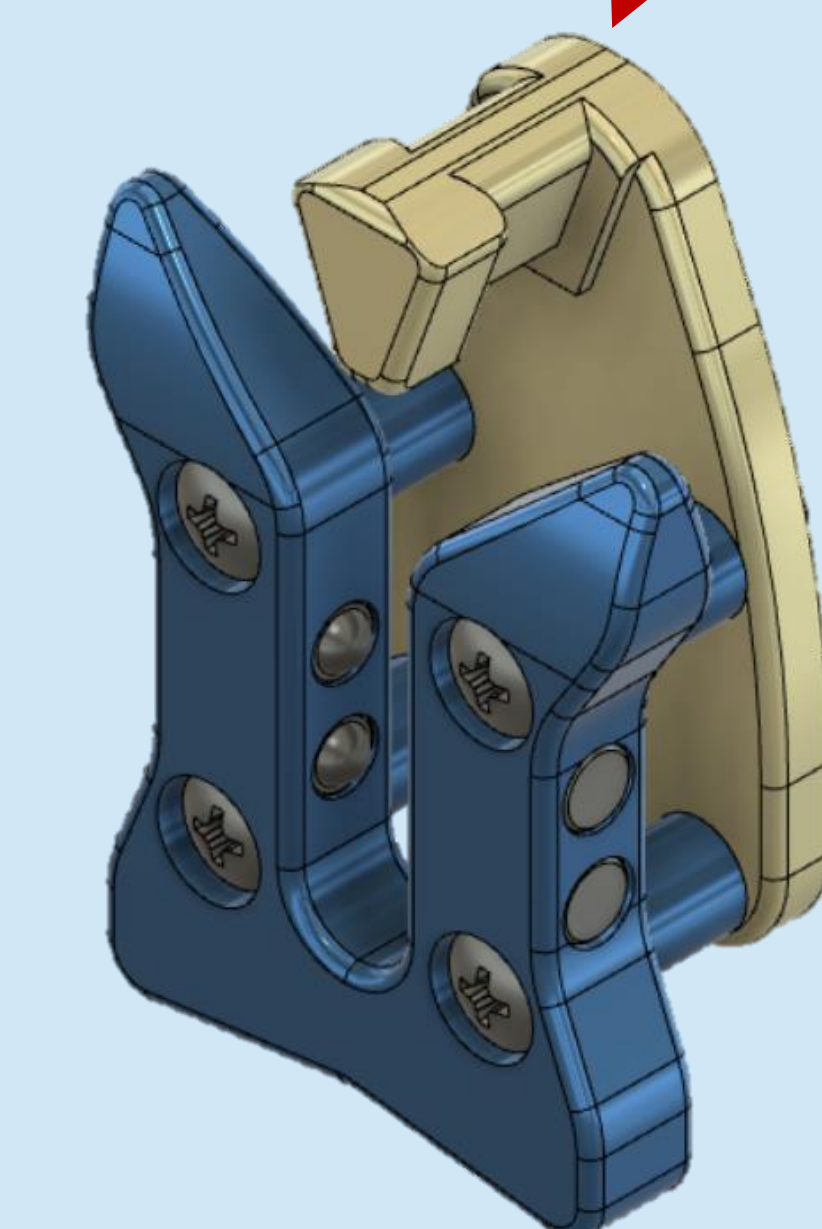
**Single component tool side:**  
Lack of moving parts prevents dust from inhibiting use.

**Divots in Neck:**  
Increases security across spring plungers by doubling the number of interactions. Tool requires sustained force to remove.

**Optional Backplate:**  
Enables additional security but can sacrifice some ease of use. If more security is desired, it may be added.

**Spring plungers:**  
Suit side includes redundant sets of ball nose spring plungers facing each other for improved security.

**Oblong Neck:**  
Guides tool into the suit side, aiding use out of line of sight, and prevents the tool from rotating unintentionally while attached.



**Stainless Steel Material:**  
Stainless steel resists abrasion from sand or dust over many attach and release cycles.

**Small profile:**  
Complete assembly is small enough not to interrupt EVA operations

## Testing and Operations Plan

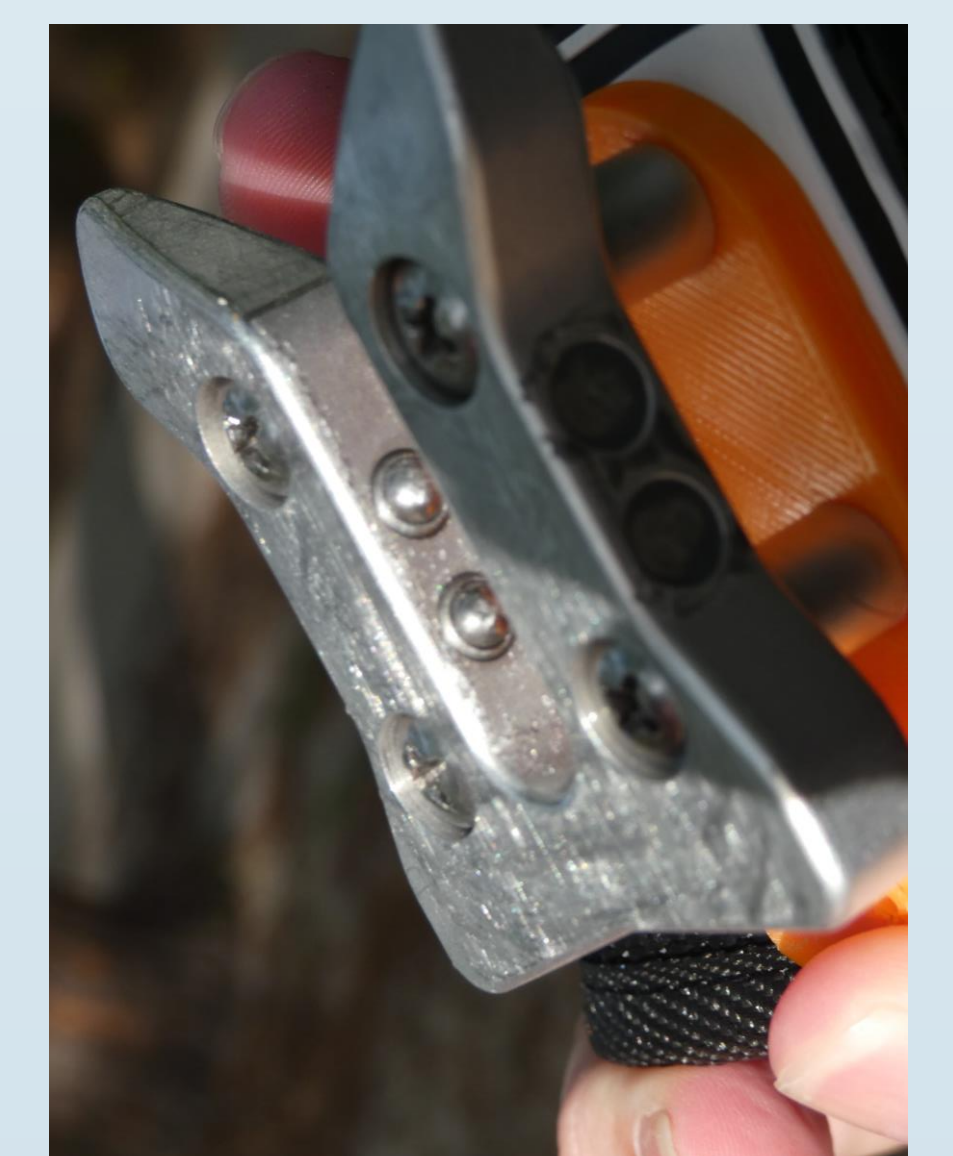
Prototype testing procedures were designed to evaluate LunaMOTH's performance regarding our priority hierarchy.

- **Dust tolerance:** plastic and aluminum prototypes were completely submerged in sand and then cycled 10 times
- **Ease of use:** tools were attached and released from multiple positions on the user's body, including those out of line of sight
- **Security:** tools of varying sizes and weights were tested, including those in excess of 15lb of weight

Further testing will evaluate dust abrasion mitigation strategies and refined tolerances between the suit and tool sides.



First metal LunaMOTH prototype



LunaMOTH during water/sand testing

During NBL testing, LunaMOTH will demonstrate its effectiveness in a simulated lunar environment during use by NASA test divers.

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