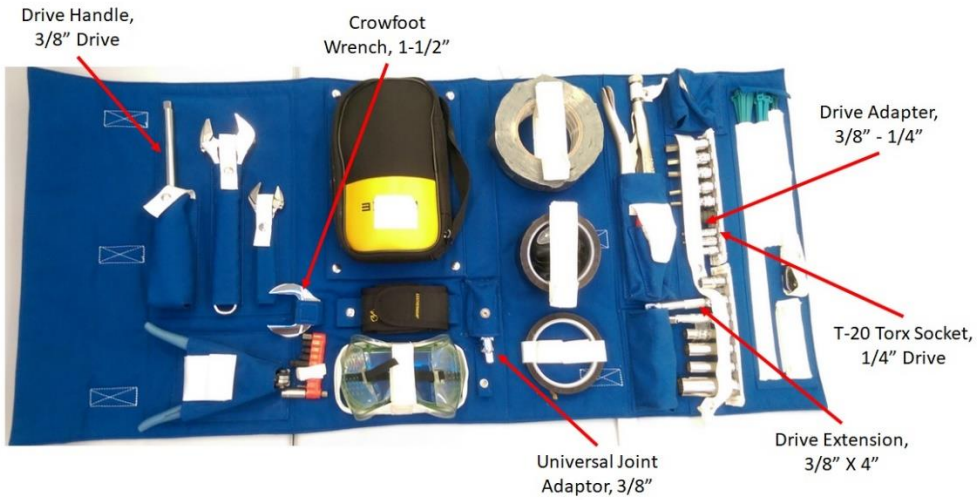
TECHNOLOGY COLLABORATION CENTER

Wearable Technologies Workshop
Challenge Request
April 29 & 30, 2019

hosted by NASA at the Johnson Space Center



Challenge Title: Exploration IVA Common Tool Kit with Loose Items, Spare Parts Restrain System, and iPad Holder

Organization Name: NASA Johnson Space Center

Team Assignments Available: 2

Summary of the Challenge and Team Project

Background:

All spaceflight vehicles and missions have incorporated some form of tool kits to facilitate both in flight servicing as well as mission objectives. IVA tools are used by crewmembers to assist in daily maintenance and repair tasks. EVA Hardware consists of those tools necessary to allow the crewmember to perform EVA safely and productively. Historically the Shuttle In-Flight Maintenance (IFM) kit included a Tool Locker which consisted of nearly 100 different tools and a Repair Locker that housed ORU hardware for fluid lines. The ISS currently has over 300 different hand tools, 8 Maintenance Kits, several diagnostic tools, and IFM Parts Kit with spare screw, nuts, bolts and electrical components. The tool kits in future exploration missions beyond Low Earth Orbit (LEO) will be mass and volume limited and will not be as large or vast as previous kits. Therefore, restrictions need to be placed on spacecraft and hardware developers to ensure their hardware can be serviced by a limited tool kit. This means hardware needs to be designed parts that allows it to be serviced with only the tools in the kit.

Problem Statement:

The current IVA Common Tool Kit is shown in the photo above. It contains a set of tools and equipment for performing IFM. When performing an IFM in 0-G, the crewmembers have to manage many loose items, space parts, and hold an iPad that contains the very detailed IFM procedures. Loose items float away in 0-G if not constrained. The crewmember has to attach zip lock bags with tape or Velcro to the vehicle sides to constraint these loose items. The crewmember also has to get a small swing arm, attach it to a hard point to hold the iPad. These are very time consuming tasks.

Important Design Considerations (These can be discussed, and possibly negotiated, in more detail after the Team has been assigned):

Weight and volume are always design considerations for human space missions. Crew time is very limited, therefore tasks such as IFM, must not be overly time consuming. Losing a small part or tool can be dangerous to the mission.

What funding and/or resources can be provided to each Team? (The details of the payment arrangements must be negotiated with the Team.)

None

Deliverables (the final product the Team is to provide – such as a report, garment, user evaluation, …):

A final report with test results would be desirable.

A prototype roll up tool kit similar to the IVA Common Tool Kit with an integrated soft/textile holder for spare tools, spare parts, etc. that folds out and does not interfere with the tools. The IVA Common Tool Kit with also incorporate an integrated, light weight iPad holder that can be positioned for the astronaut to see while performing the IFM.

How Will the Results Be Used?

The prototype will be reviewed and evaluated during IFMs for potential use in the flight version of the IVA Common Tool Kit.

What deliverables (if any) are to be transferred to the organization at the end of the project?

The prototype soft/textile spares restrain system and tool holder and the prototype iPad holder.