

Right Tool for the Job

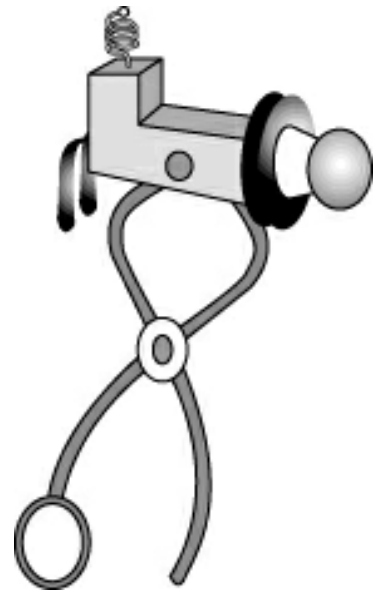
Objective: To design and construct a prototype tool for spacewalkers to use to complete a specific job while assembling the International Space Station.

Standards:

- Science Content Standards
 - Motions and forces
 - Abilities of technological design
- Universals of Technology
 - Physical Systems
 - Linkages
 - Utilizing Technological Systems

Materials (one set for the class):

- Paper
- Pencil or marker
- Miscellaneous materials for making prototypes such as sticks, springs, paperclips, tape, straws, etc.



Background:

A good workshop contains many tools. Each tool has a specific function. Using the right tool for a job guarantees success. Using the wrong tool often leads to damaging the object on which the tool is being used. Spacewalkers need tools to complete their jobs in space but the cost of sending a complete tool shop to space is prohibitive. Furthermore, the tools have to be accessible while astronauts are scrambling outside the Space Station. Where would the tools be placed when they were not being used? A tool chest would work great until it is opened. In microgravity, wrenches, pliers, hammers, and screwdrivers would all start floating away. A lost tool is hazardous because it is traveling at high speed in Earth orbit. Someday it might collide with a future spacecraft and cause extensive damage.

Spacewalkers are limited in the number of tools they can carry in space and they have to be carried in such a way that the tools can never escape the spacewalkers control. In this activity, students are challenged to design and construct a prototype tool to do a job during a spacewalk.

Procedure:

1. Discuss the tool problem with your students.
2. Select a particular job an astronaut needs to do on a spacewalk such as:
 - cut and splice a wire
 - connect fluid lines end-to-end
 - remove bolts to reposition an antenna and reinstall and tighten the bolts
 - straighten a metal strut that got bent during docking operations
 - remove machine screws to open a panel, etc.
3. Have students work in small groups to design a tool to do the selected job. The tool must meet a few criteria:
 - cannot get loose from the astronaut's control
 - sharp edges and pointed structures are protected so that they don't accidentally puncture the spacesuit
 - the tool will not be damaged by the temperature extremes of outer space
 - are able to successfully complete the required job.
4. Have students demonstrate their tool to the rest of the class.

Extensions:

- Bring in a variety of standard tools for students to examine. Ask them how the tools might be modified for space use.

