This Year's Challenge

You and your team need to design and build a solution that can help rid the Universe of Space Junk one item at a time — and your mission is to get an inoperative satellite to burn up upon re-entry by attaching two Hall Thrusters, Size "D" Batteries will be used to represent the thrusters, to its thruster docking ports — and it must be done from the deck of your temporary home — The International Space Station.

- You'll be 10' away from the Satellite on your 6'x10' section of the ISS.
- The Satellite is floating 6' in the air and is rotating at 2 rpm and the rotation will be clockwise when viewed from the floor. The satellite is suspended at the middle of its longitudinal axis but this axis will not necessarily be completely horizontal at the start of the test.
- You will have 3 minutes to place 2 thrusters on one end of the satellite and if you drop a thruster you'll be adding to the vast amount of Space Junk currently orbiting the Earth and you will lose points - so accuracy is a must!
- Retrieving a thruster or any part of the attaching device that has dropped to the floor is acceptable if it can be done from the 6 ft. by 10 ft test area. If the item has to be retrieved by a team member leaving the test area, it will be considered a Reset. For a definition of what constitutes a reset, see Resets under Operating Guidelines.
- Thrusters are represented by D size batteries. Each team will have to provide their own four batteries and optimally we would like the team to only use two of the thrusters for this mission and retain two.
- Attachment of the thrusters to the satellite will involve Velcro patches - the "hook" (rough) side will be on the satellite and the "loop" (soft) side should be on the flat (negative) end of the battery AND MUST NOT exceed the negative end of the battery. Details of these patches are shown on the satellite drawing. There will be two attachment patches at each end of the satellite and the two patches will be 180 degrees apart. However, their angular position with respect to the longitudinal axis of the satellite will be variable; the device should be designed to accommodate this variability.
- Remember - Size "D" Batteries come in different weights - so use the ones that will work best with your solution!
- Teams - there are many types of Personal Satellite Assistants AKA PSA's onboard the ISS that do all types of necessary jobs - so which one will you build to solve this challenge
- Prior to the three minute test period, there will be a two minute set-up period. All set-up activities must be inside the 6 ft. by 10 ft. test area and no part of your device may extend beyond the boundaries of the test area - either on the floor or in the air.
- Use of the human body for anything other than control and guidance is not permitted.
- Your design must not result in any residue being left on the satellite, or the floor.
- Only one Solution per Team - That solution may use multiple devices, this is acceptable only if the devices are a part of the same design. Multiple devices based on different design concepts are not acceptable.
- Your solution must not damage the Satellite because it will create more pieces of space junk. Also, during The Tech Challenge, each satellite will be used by many teams so we will need to maintain satellite integrity. The judges will terminate a test if they think satellite damage is likely to occur.
- Your solution must not jeopardize the integrity of the Velcro patches.

Why is this Important?

We want you to be part of the solution in trying to help clean up space!

Man has littered our galaxy with tens of thousands of items that can harm the space station and the astronauts. Thousands of nuts, bolts, gloves and other debris from space missions form an orbiting garbage dump around Earth, presenting a hazard to spacecraft. Some of the bits and pieces scream along at 17,500 mph. When these objects fall back into Earth's atmosphere, which they inevitably do, they behave just like any other meteor, lighting up the sky.

A 1999 study estimated there are some 4 million pounds of space junk in low-Earth orbit, just one part of a celestial sea of roughly 110,000 objects larger than 1 centimeter -- each big enough to damage a satellite or space-based telescope. Some of the objects, baseball-sized and bigger, could threaten the lives of astronauts in a space shuttle or the International Space Station. As an example of the hazard, a tiny speck of paint from a satellite once dug a pit in a space shuttle window nearly a quarter-inch wide.

Aware of the threat, the U.S. Space Command monitors space debris and other objects, reporting directly to NASA and other agencies whenever there's threat of an orbital impact.

As of June 21 2000, the agency counted 8,927 man-made objects in the great above and beyond; some are there more or less permanently and the number grows every day. Of the total, 2,671 are satellites (working or not), 90 are space probes that have been launched out of Earth orbit, and 6096 are mere chunks of debris zooming around the third planet from the Sun. The United States leads the former Soviet Union in the total quantity of orbital junk, but some companies and other organizations contribute significantly to the count.

But there are more objects up there.

The Space Command's electronic eyes can spot a baseball-sized object up to about 600 miles high, officials say. But at 22,300 miles up, where geostationary satellites roam — providing weather images used by forecasters — an object has to be as big as a volleyball to be seen. These objects, moving in fixed perches with the rotating Earth, may remain in place for centuries, experts say.

And even with more than a dozen of these electronic eyes arrayed around the planet, the agency admits to not being able to see the entire sky all around the world.

Danger of getting hit on the head?

The threat to satellites and Earth-orbiting deep-space telescopes from orbiting debris is clear. But how much of this junk falls back into the sky? Does this poses a risk to the species responsible for putting the stuff up there in the first place? In the first six months of 1999, 57 of the tracked objects re-entered Earth's atmosphere, according to Major Michael Birmingham of the U.S. Space Command. Birmingham said that 91 objects fell into the atmosphere in all of 1998, and 69 in 1997.

The most spectacular re-entry in the short history of the phenomenon was Skylab. Launched in 1973 (two years after Russia put its first space station into orbit), the first and only U.S. space station stumbled home six years later, part of it splashing into the Indian Ocean and another portion ending up in Australia.

"Most objects that re-enter the Earth's atmosphere burn-up or re-enter over water," Birmingham said, noting that nearly three-quarters of the planet is wet and a great majority of what's dry is uninhabited. "Since the space surveillance mission began, almost 17,000 objects that we track re-entered the Earth's atmosphere. Catastrophic re-entries such as Skylab are rare and the exception."

"When I was working on the Tech Challenge the coolest thing I did was learn how to think outside the box. Everything we did included creativity and of course if we did something very similar to another group they would get mad. One of our goals was to think of something no one else would, and we succeeded."

The Tech Challenge Participant 2007, Paige Marig

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