Chapter 3

Space Junk

Overview

The term “space debris” is commonly used to refer to both manmade and naturally occurring forms of debris that can be found orbiting the Earth. In contrast, the term “space junk” is typically used a bit more narrowly to refer specifically to the subset of manmade debris that can be found orbiting the Earth.

The problem of space junk is a real and growing one today. When the space age began 50 years ago, there were no manmade objects in space. Since then, however, more than 25,000 pieces of manmade space junk the size of a baseball or larger have been tracked by space experts around the world. Approximately 10,000 of those items to date have re-entered the Earth’s atmosphere and have either disintegrated or landed safely — in this latter regard, it is simply a matter of good fortune that over the past five decades no humans have been injured or killed by space junk falling to the Earth. Without question, space travel has unfortunately, and most likely unintentionally, ended up turning outer space into a giant dump.

The oldest piece of space junk currently orbiting the Earth is Vanguard 1, a small satellite launched by NASA in 1958 that stopped working six years later. By late 2007, it had already circled the Earth approximately 200,000 times and is expected to remain in the Earth’s orbit for approximately four centuries. Although defunct satellites represent one common form of space junk, such debris comes in a wide variety of forms, shapes, and sizes. Examples of space junk include the missing British spacecraft Beagle 2 (which disappeared in space in summer 2003), a 1,400-pound refrigeration tank previously housed in the International Space Station, old rockets and rocket boosters, astronauts’ screwdrivers and other tools that have floated away, nuts, bolts, and a broad range of additional items.

The problem of space junk was intensified dramatically on January 11, 2007, when China tested a new anti-satellite weapon to destroy one of its own weather satellites. In doing so, China generated a debris cloud filled with pieces of the destroyed satellite that immediately spread across 2,000 miles of space. With that single incident, China instantly produced a 10 percent increase in the amount of space junk that has been created over the past five decades. Since then, U.S. space experts have seen the number of collision near misses between satellites and space debris more than double.

Space junk poses a variety of risks and threats. Naturally, its widespread and growing existence threatens collision with spacecraft and satellites. Fast-moving pieces of space junk can pierce the suits of astronauts or distract them while they are engaged in space walks, substantially increasing their risks of falling victim to the vacuum of space. Space junk can also endanger the safety of crewmembers and passengers of airplanes as they fly through the sky, or even individuals on the ground if pieces are falling to Earth and do not disintegrate on their own. Although experts in several countries regularly track the status and positions of numerous pieces of space junk using radar and related means, sometimes the information they provide about where and when a piece of space junk will re-enter the Earth’s atmosphere or land on the ground is not entirely accurate. The ever-increasing accumulation of space junk is also increasing levels of radiation in the environment surrounding the Earth which, in worst-case scenarios, could potentially end up contaminating major portions of near-Earth space or even the Earth’s atmosphere itself.

Currently, space experts agree that there is no viable, affordable way to clean up all of the space junk that currently exists, which means it is being left to continue to orbit the Earth. In addition, some experts believe that it will take a serious collision or two between space junk and other entities, such as spacecraft or satellites, before spacefaring countries will truly begin to address the problems and risks posed by space junk. Perhaps surprisingly, even if no additional manmade items are ever launched into space, the problem of space junk will nevertheless continue to worsen unless mitigation strategies are quickly developed and enacted. That is because all of the pieces of space junk that are already in orbit will continue to collide with other pieces over time, breaking into more pieces and intensifying collision risks. Many people do not know that it is somewhat common for an individual piece of space junk to remain in the Earth's orbit for 100 years or more.

What can be done to begin addressing the various risks and problems posed by space junk in the coming years and decades? A variety of possible approaches are currently being developed. One proposed strategy would require spacefaring nations to build more resilient rockets that do not blow up in space in order to prevent them from spewing additional debris everywhere. Another proposed strategy would provide appealing incentives to high-tech inventors in order to more substantially motivate them to develop advanced laser beams or related creations that are capable of safely "sweeping" space junk from the Earth's orbit. A new breed of nano-satellite is being developed to help satellites avoid collisions with space junk, and a new way to measure remaining fuel levels in satellites can assist their operators in determining how to most effectively thrust them out of harm's way from other objects. New kinds of debris shields are being added to spacecraft to protect them while in flight. International guidelines for appropriate space procedures and space-junk-mitigation methods are being developed, and the existing Outer Space Treaty is being reexamined with an eye toward strengthening international law pertaining to spacefaring activities. Without question, however, a much wider range of potential solutions is needed, and it remains an urgent need for space experts, scientists, and others around the world to begin devising and implementing them as soon as they possibly can.

Questions for Discussion

1. How much have you heard about the topic of space junk to date, and from which information sources?

2. How do you personally feel about the problem of space junk?

3. What sorts of items (if any) do you consider to be "acceptable" forms of space junk, and what sorts of items do you consider to be entirely unacceptable? What is the logic underlying your classifications?

4. With regard to its contributions to the global space-junk problem, what are your reactions to the anti-satellite weapon test conducted by China on January 11, 2007?

5. What do you consider to be the most substantial risks or threats currently posed by space junk, and why do you feel the way that you do?

6. Considering possible scenarios, in what potential ways could space junk have a negative impact on your own life? How likely do you think it is that space junk may one day actually affect you in such ways?

7. Why do you think more has not been done to date to address the global space-junk problem?

8. What noteworthy challenges do you feel stand in the way of enabling successful space-junk-mitigation approaches to be developed and implemented?

9. Kessler Syndrome is the term used to describe the point at which the Earth's low orbit will become so packed with space junk that collisions will make space unusable. How likely do you think it is that the world may encounter Kessler Syndrome during your lifetime, and why do you feel this way?

10. If you had unlimited resources available to you, what one particular way would you recommend for addressing the problem of space junk as effectively and efficiently as possible?

11. Given real-world resources and constraints, what do you feel can be done to begin addressing the various risks and problems posed by space junk in the coming years?