



ANNEX 3-14 SPACE OPERATIONS

THREATS TO SPACE OPERATIONS

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Airmen should be aware of a variety of threats from all domains against [space](#) operations. As access to space and space technologies become cheaper and more widely available, many countries are acquiring systems and technologies that can deceive, disrupt, deny, degrade, or destroy elements of [space systems](#). The United States controls almost half of the active satellites in orbit and relies on space for [communication](#), [navigation](#), and [intelligence, surveillance, and reconnaissance](#) (ISR) using dedicated military satellites and the communication infrastructure of civil satellites.¹ The effects of potential adversarial [counterspace](#) capabilities can be reversible (temporary), such as from [satellite communications](#) jamming and cyber attacks, or non-reversible (permanent), such as from direct ascent anti-satellite (ASAT) weapons and high-energy lasers. As more nations rely on the effects derived from space, unconstrained testing of counterspace capabilities challenges the security and stability of the space environment. Neutral and environmental threats include weather, space debris, competing for limited resources such as orbital positions and [electromagnetic spectrum](#), and unintentional signal interference. While not intended to do harm, this category of neutral and environmental threats causes increasing concern due to potential impact on space operations.

Weather. Just as [weather](#) affects air operations, space and terrestrial weather can impact satellites, their communications links, and ground segments. For example, solar storms can have a direct impact on the functioning and survivability of our satellites. Thunderstorms can degrade a ground control station's capability as well as interfere with uplinks and downlinks.²

Congestion. As more and more countries position assets in space, the domain is becoming more crowded. Thousands of satellites and tens of thousands of pieces of debris orbit the Earth, congesting the physical environment in which our space assets operate.³ This increases the probability for collision among US space systems and other satellites or space debris.

Electromagnetic Interference. The demand placed on the electromagnetic spectrum continues to grow as the number of users and applications of worldwide satellite

¹ Global Threat Estimate 2010 Annual Report, *Threats to the United States Air Force*.

² Annex 3-59, [Weather Operations](#).

³ See generally, Committee for the Assessment of NASA's Orbital Debris Programs, National Research Council, *Limiting Future Collision Risk to Spacecraft: An Assessment of NASA's Meteoroid and Orbital Debris Programs*, National Academies of Science, 2011.

services increases. International spectrum management practices create uncertainty in gaining access to the required spectrum, increase the probability of interference, and impose limitations on power and coverage.
