

# Appendixes

# Survivability of Space Capability

All panelists agreed that survivable space capability is important to the United States with or without an ASAT treaty. An irreducible residual ASAT threat will remain under any treaty, making survivability measures essential. Without a treaty, of course, satellites will face dedicated ASAT systems in addition to residual capability, making survivability requirements that much more difficult.

“Survivable space capability” includes measures both to protect and to supplement satellites. U.S. satellites have been hardened against nuclear effects and are spaced so that not more than one at a time should be vulnerable to any one nuclear explosion. Protection includes hardening against radiation, hardening against system-generated electromagnetic pulse (high voltages induced within components by radiation from nuclear explosions), and hardening against other nuclear effects. There are additional protective measures which can and should be applied to satellites to guard against non-nuclear threats. Satellites can be made to evade direct-intercept ASATs or space mines by maneuvering or by interfering with (jamming or confusing) the ASAT’s homing sensors. In the absence of an ASAT ban, satellites could conceivably also be given active defenses.

Another way to protect satellites is to proliferate them. Various functions can be distributed on a

wide variety of satellites, and duplicate satellites can be orbited. These spares can be left silent until needed and they can be decoyed, making their detection and destruction more difficult. One of the most important motivations for distributing capability is to buy time—it will take much longer to destroy many satellites with shared functions than it will take to destroy any single satellite. Proliferated systems should be simpler and more basic than the full-fledged, highly sophisticated equipment now used in military satellites. Non-space assets such as ground stations would have to be proliferated as well, with the proviso again that the proliferated stations not be as complex as the main ground station.

Satellites can also be replaced by other systems. Today, satellites are used in support of strategic forces but they are not essential. Ground-based radars can be used for early warning. Nuclear detonation detection, besides being proliferated onto many small satellites, can be done for our own warheads by placing transmitters on them, if needed. Tactical theater support now done with satellites can be replaced with a variety of systems—remotely piloted aircraft, sounding rockets, balloons, and low-cost replacement satellites launched on cheap boosters or ICBMs or SLBMs. There are many alternatives to space for functions which are now carried out in space.