Appendix 1

POSSIBLE SPACE WAR SURRENDER CRITERIA

Examples of Terrestrial War Termination Criteria

- Country X's borders are secure.
- Country Y no longer poses an offensive threat to the countries of the region.
- Country X's national security force is sufficient to repress internal rebellion.
- Percentage of US forces have redeployed with sufficient combat power postured in theater to support Country X's national army.
- X capability destroyed/eliminated.
- Legitimate government restored.
- Hostages returned.
- Forces separated.
- Agreement to start negotiations.

Possible Space War Termination Criteria

- Political goals met.
- Red space force reduction goals met.
- Red space disarmament.
- The balance of power in space between Red and Blue is sufficient to deter Red from any near-future space attacks for the next 10 years.
- Red will and ability to continue fighting in space have been severely restricted.
- Red maneuvers satellites outside immediate threat zones that endanger Blue critical space assets.
- Blue space assets and antisatellite (ASAT) systems remain in ready strike positions to assure Red treaty compliance.
- Red ceases production of space weapons.
- Red cannot image battlefield with less than 1-meter resolution.
- Red cannot recover major space capabilities in less than 10 years.
- Red space launch capabilities reduced by 50%.
- Red on-orbit military space assets supporting current conflict region (area of responsibility [AOR]) delta-v maneuvering capability reduced by 50%.

- Red on-orbit ASAT capabilities reduced to 10% remainder (capabilities deorbited).
- 90% of Red space assets have been visited by Blue inspector satellites and verified in compliance.
- Red forced to negotiating table over ASAT weapons.
- Red open to inspection of space launch sites, rocket-fuel production facilities, and space research facilities.
- Red returns control of any Blue or Gray satellites held hostage/captured through cyber means.
- Red mobile ASAT systems returned to garrison/storage.
- All Red terrestrial ASAT sites and programs revealed.
- Red provides war reparations for Blue and Gray space systems degraded/destroyed.
- Red develops program to clean up space debris caused by its military actions.
- Control of Red inspector satellites handed over to Blue.
- Red ASAT technologies provided for inspection by Blue scientists.
- Red space scientists provided for Blue interrogation.
- Red dismantles terrestrial-based space surveillance radars and optical tracking/imaging telescopes.
- 50% of Red terrestrial space surveillance radars, optical telescopes, and space-based sensor systems are nonoperational.
- Red allocates/donates a portion of its remaining space launch, space communications, and imagery capabilities to future UN disaster relief efforts.
- Red surrenders some of its internationally assigned geosynchronous orbital position slots.
- Red establishes a hotline connection between its space command centers and Blue space command centers.
- Red reveals communications frequencies and telemetry, tracking, and commanding (TT&C) encryption schemes for its satellite control to Blue.
- Red reveals orbital locations of all national space objects.
- Red provides 30 days' notice of all planned future space launches.
- Red deactivates/deorbits all on-orbit space mines.
- Red space-based lasers continue with nominal thermal profiles (no charging up to initiate immediate attacks).

- Red conducts no new shipments of reactive chemicals to terrestrial-based laser weapon sites.
- Red does not approach any Blue critical satellites within 100 meters.
- Red does not initiate any new missile launch development programs for five years.
- 80% of Red satellite refueling on-orbit depots and servicing satellites shut down.
- Red reveals all cyber codes used in previous space system attacks.
- 50% degradation of Red organic navigation satellite capabilities and accuracies for those coverages over the AOR battlefield.
- 50% degradation of Red organic imagery satellite capabilities and resolutions for those coverages over the AOR battlefield.
- 75% degradation of Red organic military communications satellite capabilities and bandwidth for those coverages over the AOR battlefield.
- 25% degradation of Red organic civilian communications satellite capabilities and bandwidth for those coverages over the AOR battlefield.
- Embargo established against Red import of sensitive space technologies and subsystems.
- Red provides technical specifications of all its space systems to Blue.
- Red provides technical samples of solar panels, bus structural materials, and paint chips for all its space systems to Blue (helps in future Blue space surveillance, identification, and treaty verification efforts, along with Red vulnerability assessments).
- Red required to place tracking beacons on all future launched satellites. Blue establishes declaratory policy to immediately neutralize any Red satellites without these tracking beacons for the next 10 years.
- Red must formally state mission of each newly launched space object for the next 10 years. Mission is subject to verification by Blue and neutralization if any satellites with surreptitious missions are discovered.
- Red key managers at ASAT research facilities will be fired and moved to civilian pursuits.
- Red national leader publicly declares that his country will no longer pursue space weapon development programs.
- Blue and Allied forces experience access and use of space for 90% of the time over the duration of the conflict.

- Blue and Allied forces achieve absolute control and authority over the orbital space near their satellites—including the ability to maintain freedom of action in, from, and to space—sufficient to sustain mission assurance and deny the same to the adversary and its Red Allies during the terrestrial conflict. Space superiority may be localized in time and space (e.g., over the immediate AOR), or it may be broad and enduring.
- Blue and Allied space sensors are able to predict pre-conflict buildup of adversary space forces, along with their maneuvering to key jump-off orbital positions. Blue and Allied intelligence agencies are able to detect and properly assess adversary intentions to initiate conflict, both in space and through terrestrial forces. Blue and Allied leaders possess the fortitude to address these threats in international forums.
- Diplomatic efforts have achieved agreements with some key Allied and neutral countries that they will support most Blue actions during the ensuing space conflict, at least at the covert levels.
- Diplomatic and legal efforts have achieved agreements with some key Red Allied and neutral countries that they will not support Red actions during the ensuing space conflict. Also, some commercial satellite owners have agreed not to support Red military space efforts with imagery and communications satellite resources.
- Introduction of treaties in the international realm concerning limits to space warfare capabilities has induced some indications that Red and its Allies have been deterred from committing some key space actions.
- Blue and Allied space resources are positioned in key jump-off orbital locations (in accordance with future Blue space courses of action [COA]), have sufficient fuel reserves, have on-board batteries fully charged, and appear to have avoided detection by Red and its Allies' space surveillance sensors.
- Threats and actions by Blue and its Allies against unlawful employment of space weapons by Red and its Allies appear to deter them to some degree in causing space debris generation and damage to neutral nation space systems. In addition, due to Red and its Allies' space attacks, many neutral countries are calling for new space treaties and enforcement mechanisms, such as loss of internationally recognized orbital location slots.

Appendix 2

SPACE CENTERS OF GRAVITY

Examples of Political/Military "Needs" COGs as Applicable to Space Warfare

- Enjoy freedom of navigation of space/celestial bodies for economic opportunities.
- Enjoy freedom of navigation of space for military benefits and to dominate the space arena.
- Limit adversary use of space/celestial bodies that give it military and economic benefits.
- Display space technological and scientific capabilities to potential allies to enhance prestige and world leadership.
- Impress own country's population to enhance internal political standing, silence critics, inspire youth, and stimulate the economy.
- Advance country's general technologies and science and provide political/economic intelligence on adversaries.
- Understand adversary military space capabilities and warn of space attacks.
- Understand adversary military terrestrial capabilities and warn of terrestrial attacks.
- Understand the space environment to predict own country's satellite failures.
- Understand and predict the terrestrial environment for benefit of own citizens.

Examples of Political/Military "Will/Resolve" COGs as Applicable to Space Warfare

- Willingness to adhere to peaceful norms, treaties, and international relations concerning the use of outer space.
- Willingness to *covertly* push the boundaries of "normal" behavior in space for political/economic/military gain.
- Willingness to *overtly* push the boundaries of "normal" behavior in space for political/economic/military gain.
- Willingness to directly attack space systems for perceived gains outweighing possible downsides.

- Willingness to dominate celestial bodies for political/economic/military gain.
- Willingness to dominate key choke points in space for the long term.
- Willingness to maneuver antisatellites (ASAT) for pre-conflict buildup and positioning as a prelude for massive space attacks.
- Willingness to risk generating space debris from attacks in space.
- Willingness to risk the lives of astronauts due to collateral effects of space attacks.
- Willingness to implement new doctrine, strategies, and tactics for space control beyond traditional terrestrial military doctrine.
- Willingness to link space attacks with terrestrial political/military actions and goals.
- Willingness to spy on adversary and neutral countries' space system capabilities and risk public exposure.
- Willingness to suffer condemnation on the world stage for space attacks.
- Willingness to lose allies over space attacks.
- Willingness to suffer from potential space counterattacks.
- Willingness to accidently attack the wrong satellite due to poor space situational awareness (SSA).
- Willingness to respond with force to possibly mistaken assessments of who conducted space attacks.
- Willingness to generate political unrest internal to country over initiating a space war.
- Willingness to reveal critical technologies by conducting space attacks.
- Willingness to employ close inspection satellites that risk accidently damaging targeted space systems and/or neutral satellites.
- Willingness to employ high-power lasers in space attacks that risk collateral damage to neutral satellites from reflection "splash."
- Willingness to degrade/damage other countries' space systems during peacetime.
- Willingness to "blockade" other countries' access to space (by cyber means or denying space launches).
- Willingness to "hijack" another country's satellites.
- Willingness to act as a space "policeman" in investigating and implementing international agreements involving the conduct of operations in space.

- Willingness to attack terrestrial systems supporting space assets.
- Willingness to insert cyber Trojan viruses into adversary and neutral country space systems in their manufacturing stages.
- Willingness to employ economic and diplomatic means against adversary space capabilities.
- Willingness to lure adversary space scientists away from their countries' employment.
- Willingness to conduct a misinformation campaign against your adversaries' confidence in their space capabilities.
- Willingness to deny your adversary's ability to import critical space technologies.
- Willingness to drive a wedge between your adversary and its allies over space capabilities.
- Willingness to threaten adversaries' space capabilities to resolve a dispute.
- Willingness to publicize adversary violations of international laws applicable to space.
- Adversary country's resolve to see the current conflict through no matter what the costs.

Examples of Political/Military "Intents" COGs as Applicable to Space Warfare

- Political/military adversary intent.
- The most difficult, but most important, intelligence collection mission.
- Many conflicts have started due to misreading adversary intents.
- Intent estimation can only be more difficult with the remoteness of satellites from Earth's space surveillance sensors, the novelty of space warfare, and lack of extensive previous space warfare experiences.
- Intent from one organization may not reflect the intent from country's senior leadership.
- Space warfare intent estimation can be categorized by
  - strategic intent.
  - operational intent.
  - tactical intent.

Space Warfare Strategic Intent Examples

- Show resolve and willingness to escalate conflict.

  - Can range from reversible to nonreversible effects on satellites.
  - Can include or be limited to attacks on space systems' terrestrial support elements.
  - Can be linked to some conflict on Earth that has nothing to do with space systems.
  - May be threats only (e.g., maneuver close to adversary satellite to appear threatening).
  - May inspire adversary to counter space threats with terrestrial counterthreats.
- Demonstrate one's military space capabilities and technological superiority.
  - Sows doubt on adversary planning.
  - Gives pause to adversary's execution timelines.
  - May inspire your adversary to develop future counters.
  - May raise terrestrial or space conflict escalation ladder.
- Show support to Allies.
  - Demonstrating willingness to escalate space conflict provides solidarity with current allied actions (space or terrestrial).
  - Increases status with local political supporters.
  - May energize political support both in country and with allied populations.
  - Force internal opponents to come on board with political/military objectives.
  - Show displeasure with United Nations sanctions and prohibitions.
  - Energize and inspire own military forces and industrial base.
  - Demonstrate "ownership" of certain regions of orbital space (e.g., geosynchronous belt above own country).
  - Change the emphasis from terrestrial to space warfare.
  - Adversary may perceive it is better at countering adversaries in space rather than by terrestrial warfare means.
- Attempt to rebalance worldwide political alliances by defeating major space players.
- Make certain orbital slots are unusable by the Western world through deliberate debris or radiation generation.
- Pre-conflict, have very visible, but relatively harmless, space control development programs while the real space weapon systems are covertly developed.

- Adversary threats and actions in space may only be to influence space control agreements and treaties.
- Make a lot of noise about development of a major space weapon that ultimately is never built and deployed to inspire your adversaries to waste time and resources trying to counter it.
- Attacks in space may serve only to redirect public opinion from terrestrial conflicts.
- The purpose of space attacks that are dramatic and complete in their destruction may be to shock and awe adversaries and influence them to make hasty, but ill-informed, decisions in response.

Space Warfare Operational Intent Examples

- Determine types of operational space attacks.
  - Decapitation of command authorities (anti-BMC3 [battle management command, control and communications]).
  - Deny visibility of terrestrial battlefield from space.
  - Deny positioning/timing information to terrestrial forces.
  - Deny weather information to terrestrial forces.
  - Deny missile warning information to terrestrial forces.
  - Spoof perceptions of actual terrestrial and/or space events.
- Provide a "loud" demonstration attack in one orbital location to draw attention away from the main attack axis occurring elsewhere.
- Employ multiple attack points of application to confuse adversary perceptions of your actual plans.
- Isolate one portion of the terrestrial battlefield from space support.
- Isolate one portion of the space battlefield from space actions and support.
  - Isolate one space defense region (SDR) from adversary space activities (including surveillance) for a given time period.
- Use types of space weapon systems that first isolate an adversary's satellites from terrestrial control—and thus fix the target into inaction—until more effective, but possibly slower responding, space weapons can be made to close onto the target.
- Probe/test potential adversary space defenses to determine adversary's intentions, plans, doctrine, strategies, and tactics.

- Defend and hold the high ground of space (centers of gravity and choke points) to exclude adversary use, thus frustrating adversary's war aims in space.
- Display intent to conduct surprise attacks.
  - Employ orbits (such as highly eccentric) that make it difficult to track threatening space objects and enable surprise attacks (see missing satellites).
  - Conduct multiple fake space system maneuvers (and terrestrial mobility redeployments) to draw an adversary's space systems away from the main point of attack.
  - Conduct covert information dominance attacks to confuse your adversary and inspire it to lose confidence in its space systems.
  - Start maneuvering specific space assets as decoys to draw attention away from covert assets that are preparing for separate attacks.
  - Constantly maneuvering toward your adversaries' space assets as if to attack, but then not attacking, will confuse adversaries and also mask your real attacks.
  - If your weapons appear to be particularly effective against their assigned targets, then these targets may be simply baits or decoys from your adversaries.
- Employ multiple phenomenologies of space weapon systems against the same target to foil defense measures and increase probability of kill (Pk).
- Attack space targets with multiple ASATs coming from multiple directions.
- You may sacrifice low-value or aging satellite systems for the sole purpose of confusing your adversaries through meaningless attacks.
- Demoralizing your adversaries' operational space forces can lead to their divided efforts and leadership.
- Deploy space systems in unusual orbits to confuse your adversary as to their true missions and purpose.

Space Warfare Tactical Intent Examples

- Reconnaissance of targeted satellite (rendezvous and proximity operations [RPO]).
  - Antennae characteristics and frequencies.
  - Sensor aperture sizes, types, and shutters.

- Solar panel type, size, and power.
- Maneuvering/attitude change capabilities.
- Assessed satellite lifetime left.
- Self-defense capabilities and reaction timelines.
- Covert war-reserve modes and subsystems (hidden doors).
- Spacecraft bus and radiator material types.
- Vulnerability assessments.
- Threat assessments.

- Detection of hidden escort satellites.
  - Probing of targeted satellite.
    - Physical response to visiting space object (VSO).
    - Response to radio frequency/laser injections.
- ASAT actions.
  - Insert cyber code.
  - Attach space mine.
  - "Paint" sensors (including Earth limb and star sensors), solar panels, radiators, and antennae.
  - "Tilt" or attach weights to unbalance satellite.
  - Force maneuver of satellite outside normal orbital bounds.
  - Drill, cut, bend, mask, etc. satellite appendages.
  - Intent may also be determined by how VSO approaches target satellite.
- Intent to conduct surprise attacks.
  - Attacking a space target from the direction where the satellite's self-defense sensors are pointing toward the Sun, Moon, Earth, or Earth limb in order to blind it (similar to "Hun in the Sun" attack for WWI aircraft).
  - Attacking a space target when it is out of range of an adversary's terrestrial telemetry, tracking, and commanding stations, in addition to not being within a sensor envelope of its space surveillance assets.
  - Employing low-observables spacecraft for close approaches of targeted satellites.
  - Attacking satellite "acting" like a harmless commercial satellite or space debris.

Examples of Political/Military "Means" COGs as Applicable to Space Warfare

- Terrestrial-to-space attacks.
  - Direct-ascent ASATs.
  - Directed energy (lasers, high-power microwaves).
  - Cyber, spoofing, jamming, seize control.
- Space-to-space attacks.
  - Kinetic kill vehicle (KKV) ASATs.
  - Directed energy ASATs.
  - Satellite inspectors.
  - Reconnaissance.
  - Insert cyber attacks.
  - Mechanical arm manipulation (cut, change attitude/orbits).
  - Paint sensors, solar panels, antennas, thermal control surfaces.
- Terrestrial-to-terrestrial attacks (space-related).
  - Special operations forces'/cyber/bombing attacks against space ground sites.
  - Space data receiver sites.
  - Satellite controller sites.
  - Space launch sites.
  - Space command centers.
  - Space research and development centers.
  - "Soft" attacks.
    - Economic.
    - Diplomatic.
    - Negotiations.
    - Bribery.

Detailed Political/Military Space Warfare Centers of Gravity

Strategic COGs

- Launch corridors.
- Geosynchronous Earth orbit (GEO) belt sectors above the area of responsibility (AOR).
- Atlantic/Pacific communications relay points.
- Sun-synchronous low Earth orbits.

- Geosynchronous Earth transfer orbits.
- Earth-lunar orbits.
- Space launch facilities.
- Petrochemical facilities producing rocket fuel.
- Terrestrial-based space telemetry and control systems.
- Space-related command centers.
- Space-related commanders.
- Terrestrial-based space weapon systems.
- Space-based space weapon systems.
- Terrestrial-based space surveillance systems.
- Space-based space surveillance systems.
- Space weather systems.
- Terrestrial-based satellite heavy communications terminals.
- Space technicians.
- Space scientists.
- Electric grid serving ground space facilities.
- Roads, bridges, tunnels, and passes serving ground space facilities.
- Space design and manufacturing facilities.
- Space-related intel centers.
- Air Force Satellite Control Network (AFSCN)
- Leaders' confidence in their new space technologies
- Blue and Red side political will to start and continue a space war.
- Key phases of the battle.
  - Pre-conflict use of space war.
  - Just before major terrestrial offenses.
  - Just before the end of the conflict.
- Space-related decision cycle times (Observe-Orient-Decide-Act [OODA] Loops).
- Knowledge of classified space systems existence or war reserve modes.
- Status of space forces.
- Attack on alternate country space systems.
- Blue may be self-deterred from attacking Gray space systems.
- Space alliances and treaties.

Operational COGs

- Low delta-V/transit time points in space to reach high-value targets.
- Points in space with high/low coverage from space surveillance assets.
- Regions of space and time with advantageous solar phase angles.
- Times of solar alignment interference to communications (two times a year for 4–8 minutes for geosynchronous satellites).
- Gravity wells at GEO disposal orbits where dead satellites tend to group.
- Space radiation belts.
- Times of high solar storm activity.
- Zones outside a satellite's or constellation's collective sensors' field of regard.
- Times when adversary military is concentrating on in-theater actions and is less aware of space-related actions on the other side of the globe.
- On-orbit spares or launch replenishment or ability to reconstitute space capability with terrestrial systems.
- Antipodal nodes 180 degrees from launch sites around the world.
- Other satellites being launched on the same booster.
- Manned launch (shuttle, space station) of satellites.
- Times when a full moon degrades an adversary's ability to optically track dim space objects from terrestrial locations.
- Organizational boundaries between competing space departments' responsibilities (i.e., Air Force, Army, Navy, National Reconnaissance Office, National Security Agency, CIA). Similar to attacking the geographic boundaries between two different infantry divisions.

Tactical COGs

- Space tactics, techniques, and procedures.
- Initial satellite checkout after launch or orbital insertion.
- GEO satellites changing orbital position.
- Periods of solar eclipse for satellites.
- Periods when a satellite has a low battery charge.
- Approach trajectories outside the field of regard of the target's on-board sensors.
- Approach trajectories when the Sun/Moon/Earth is in the background of a target's sensors.

- Approach trajectories outside normally employed orbits.
- Near a satellite's thrusters.
- Near a satellite's high-power antennas.
- ASAT launch/attack rate.
- Just after loss of contact with adversary satellite ground controllers.
- Just after loss of contact with adversary space surveillance assets.
- Times of cloud cover/weather/natural disasters for terrestrial-based space weapons systems.
- Times of cloud cover/weather/natural disasters for terrestrial-based space surveillance systems.
- Times when the satellite passes through space radiation belts.
- Communications or telemetry frequencies that can be jammed or spoofed.

Additional Space COG Examples

- Blue and Allied forces' ability to access space (launch services) to the maximum extent possible, especially for those Blue space assets critical to current Blue military operations in the AOR.
- Blue and Allied forces' ability to use space to support terrestrial forces to the maximum extent possible, especially for those Blue space assets critical to current Blue military operations in the AOR.
- Blue and Allied forces' ability to maneuver in space to the maximum extent possible, especially for those Blue space assets critical to current Blue military operations in the AOR.
- Red and its Allied forces' ability to access space (launch services) to the maximum extent possible, especially for those Blue space assets critical to current Blue military operations in the AOR.
- Red and its Allied forces' ability to use space to support terrestrial forces to the maximum extent possible, especially for those Blue space assets critical to current Blue military operations in the AOR.
- Red and its Allied forces' ability to maneuver in space to the maximum extent possible, especially for those Blue space assets critical to current Blue military operations in the AOR.
- Blue and its Allied forces' perceptions of the existing space threat and their ability to counter it.
- Red and its Allied forces' perceptions of the existing space threat and their ability to counter it.

- Blue and its Allied forces' perceptions of the value of their space systems to the terrestrial battlefield and how to best implement that value.
- Red and its Allied forces' perceptions of the value of their space systems to the terrestrial battlefield and how to best implement that value.
- Blue and its Allied forces' perceptions of the value of commercial space systems to the terrestrial battlefield and how to best implement that value.
- Red and its Allied forces' perceptions of the value of commercial space systems to the terrestrial battlefield and how to best implement that value.
- Blue and Allied beliefs in their ability to achieve and the value of achieving space supremacy, or at least control and authority over their orbital space near their satellites—including the ability to maintain freedom of action in, from, and to space—sufficient to sustain mission assurance and deny the same to the adversary and its Red Allies during the terrestrial conflict. This space superiority may be localized in time and space, over the immediate AOR, or it may be broad and enduring.
- Red and its Allies' beliefs in their ability to achieve and the value of achieving space supremacy, or at least control and authority over their orbital space near their satellites—including the ability to maintain freedom of action in, from, and to space—sufficient to sustain mission assurance and deny the same to Blue and its Allies' space forces during the terrestrial conflict. This space superiority may be localized in time and space over the immediate AOR, or it may be broad and enduring.
- Blue and Allied beliefs in their ability to conduct and the value of conducting space control operations that increase their space survivability and resilience, particularly localized tactical satellite defense and preservation of space-related terrestrial systems, and deny Red and its Allies' use of space systems that support their military objectives.
- Red and its Allies' beliefs in their ability to conduct and the value of conducting space control operations that increase their space survivability and resilience, particularly localized tactical satellite defense and preservation of space-related terrestrial systems, and deny Blue and its Allies' use of space systems that support their military objectives.
- Blue and Allied beliefs in their ability to obtain and the value of obtaining good situational awareness of their own space orbital elements, mission status, command relationships, and communications for both their satellites and terrestrial space systems.

- Red and its Allies' beliefs in their ability to obtain and the value of obtaining good situational awareness of their own space orbital elements, mission status, command relationships, and communications for both their satellites and terrestrial space systems.
- Blue and Allied beliefs in their ability to deny and the value of denying good situational awareness to Red and its Allies for space orbital elements, mission status, command relationships, and communications for both their satellites and terrestrial space systems.
- Red and its Allies' beliefs in their ability to deny and the value of denying good situational awareness to Blue and its Allies' for space orbital elements, mission status, command relationships, and communications for both their satellites and terrestrial space systems.
- Blue and Allied beliefs in their ability to predict and the value of their space sensors' ability to predict pre-conflict buildup of adversary space forces, along with their maneuvering to key jump-off orbital positions. This also includes a belief that Blue and Allied intelligence agencies would be able to detect and properly assess adversary intentions to initiate conflict, both in space and through terrestrial forces. Finally, this includes a belief that Blue and Allied leaders, while possessing verified intelligence data, would actually confront their adversaries' actions by addressing these threats in international forums, such as the United Nations.
- Red and its Allies' beliefs in their ability to predict and the value of their space sensors' ability to predict pre-conflict buildup of Blue and Allied space forces, along with their maneuvering to key jump-off orbital positions. This also includes a belief that Red and its Allied intelligence agencies would be able to detect and properly assess adversary intentions to initiate conflict, both in space and through terrestrial forces. Finally, this includes a belief that Red and its Allied leaders, while possessing verified intelligence data, would actually confront the Blue and Allied actions by addressing these threats in international forums, such as the United Nations.
- Blue and Allied beliefs in their ability to organize and the value of organizing Blue intergovernmental space agencies and Allied space forces to develop a joint space warfare plan with delegated responsibilities.
- Red and its Allies' beliefs in their ability to organize and the value of organizing Red intergovernmental space agencies and their Allied

space forces to develop a joint space warfare plan with delegated responsibilities.

- Blue and Allied beliefs in their ability to organize and the value of organizing Blue space and terrestrial military authorities into developing a joint space-terrestrial warfare plan with delegated responsibilities.
- Red and its Allies' beliefs in their ability to organize and the value of organizing Red space and terrestrial military authorities to develop a joint space-terrestrial warfare plan with delegated responsibilities.
- Blue and Allies' beliefs that diplomatic efforts can achieve agreements with some key Allied and neutral countries that they will support most Blue actions during the ensuing space conflict, at least at the covert levels.
- Red and its Allies' beliefs that diplomatic efforts can achieve agreements with some key Allied and neutral countries that they will support most Red actions during the ensuing space conflict, at least at the covert levels.
- Blue and Allies' beliefs that their diplomatic and legal efforts can achieve agreements with some key Red Allied and neutral countries that they will not support Red actions during the ensuing space conflict.
- Blue and Allies' beliefs that their diplomatic and legal efforts can achieve agreements with some key commercial satellite owners that they would not support Red military space efforts with imagery and communications satellite resources.
- Blue and Allies' beliefs that their leaders making declaratory statements condemning Red and its Allies' space warfare efforts, along with requiring counter-threatening new space force deployments, would actually deter Red and its Allies from committing some key space actions.
- Red and its Allies' beliefs that their leaders making declaratory statements condemning Blue and its Allies' space warfare efforts, along with requiring counter-threatening new space force deployments, would actually deter Blue and its Allies' from committing some key space actions.
- Blue and Allies' beliefs that efforts to introduce treaties in the international arena concerning limits to space warfare capabilities may actually deter Red and its Allies from committing some key space actions.
- Red and its Allies' beliefs that efforts to introduce treaties in the international arena concerning limits to space warfare capabilities may actually deter Blue and its Allies from committing some key space actions.

- Blue and Allies' beliefs that conducting information operations against the adversary and its Allies' space systems to influence their senior military and political leaders to lose confidence in the reliability and accuracy of those space systems would actually be effective.
- Red and its Allies' beliefs that conducting information operations against Blue and its Allies' space systems so that their senior military and political leaders will lose confidence in the reliability and accuracy of those space systems would actually be effective.
- Blue and Allies' beliefs that conducting information operations against your adversary and its Allies' space systems so that their senior military and political leaders will take confusing and nonsensical actions detrimental to their overall war effort would actually be effective.
- Red and its Allies' beliefs that conducting information operations against your Blue and its Allies' space systems so that their senior military and political leaders will take confusing and nonsensical actions detrimental to their overall war effort would actually be effective.
- Blue and Allies' beliefs in their ability to shape the space battlefield during the pre-conflict phase to the advantage of Blue and Allied space systems by positioning space resources into key jump-off orbital locations (in accordance with future Blue space COAs), having sufficient fuel reserves, having on-board batteries fully charged, and appearing to have avoided Red and its Allies' space surveillance sensors' detection.
- Blue and Allies' beliefs in their ability to shape the space battlefield during the pre-conflict phase to the disadvantage of Red and its Allied space systems by influencing their Red space assets to be in poor orbital locations (according to future Blue space COAs), have significant loss of fuel reserves, experience poor communications with ground controllers, and unintentionally reveal hidden war-reserve capabilities. Blue would also influence Red space assets to appear to be in a confused military command and control state with Red command centers and poorly coordinated with Red Allied intentions and plans.
- Blue and Allies' beliefs in their ability to frustrate adversary abilities to improve military space capabilities and replenish space resources. This also includes Blue and Allies' beliefs in their ability to enable effective economic and technologies embargos against the adversary and its Allies importing critical space technology and systems. In addition, this also includes Blue and Allies' beliefs in their ability to

ensure the adversary and its Allies have limited options to replace and replenish space resources, including after the conflict ends.

- Blue and Allies' beliefs in their ability to enforce international treaties associated with outer space and whether this will ultimately affect Red and its Allies' behavior in space, both during and after the conflict.

Appendix 3

SPACE GLOSSARY LIST (PARTIAL)*

Glossary	Definition	Source
Active Space Defense	Direct defensive action taken to destroy, nullify, or reduce the effectiveness of hostile space actions. It includes the use of antisatellite weapon systems, defensive counterspace weapons, electronic warfare, and other available weapons not primarily used in a space defense role. See also Space Defense.	Modified from Joint Publication (JP) 3-01.1
Space Control Operations	The employment of space forces, supported by air, ground, and naval forces, as appropriate, to achieve military objectives in vital areas of concern to space systems. Such operations include destruction of enemy in-space assets, space-related ground systems and surface-to-space forces (launch), interdiction of enemy space operations, protection of vital space lines of communication (links from ground to space to ground), and the establishment of local military superiority in areas of space operations.	Modified from JP 3-01.1
Space Defense Action Area	An orbit and the space around it within which friendly spacecraft or surface-to-space weapons are normally given precedence in operations except under specified conditions. Also see Space Defense Operations Area.	Modified from JP 3-01.1
Space Defense Area	(1) A specifically defined orbit for which space defense must be planned and provided. (2) An orbit and a region surrounding it of defined dimensions designated by the appropriate agency within which the ready control of spaceborne vehicles is required in the interest of national security during a space defense emergency.	Modified from JP 3-01.1
Space Defense Artillery	Weapons and equipment for actively combating space targets from the ground.	Modified from JP 3-01.1
Space Defense Battle Zone	A volume of space surrounding a space defense fire unit or defended area, extending to a specified orbital altitude and inclination, in which the fire unit commander will engage and destroy targets not identified as friendly under criteria established by higher headquarters. In other words, this would be a free-fire zone around a defended satellite.	Modified from JP 3-01.1
Space Defense Control Center	The principal information, communications, and operations center from which all spacecraft, antisatellite operations, space defense artillery, guided missiles, and space warning functions of a specific area of space defense responsibility are supervised and coordinated. Also called Space Defense Operations Center.	Modified from JP 3-01.1
Space Defense Division	A geographic subdivision of a Space Defense Region. Also see Space Defense Sector.	Modified from JP 3-01.1
Space Defense Emergency	An emergency condition, declared by the Commander in Chief, USSTRATCOM, that exists when attack upon space systems of interest to the United States by hostile spacecraft, missiles, or ground weapons is considered probable, is imminent, or is taking place.	Modified from JP 3-01.1

*Contact author for a full list of space warfare glossary and dictionary terms derived from traditional terrestrial military doctrine.

Glossary	Definition	Source
Space Defense Identification Zone	Orbital space of defined parameters within which the ready identification, location, and control of spaceborne vehicles are required. Also called SDIZ. Also see Space Defense Operations Area.	Modified from JP 3-01.1
Space Defense Operations Area	An area and the orbital space around it within which procedures are established to minimize mutual interference between space defense and other operations; it may include designation of one or more of the following: Space Defense Action Area, Space Defense Area, Space Defense Identification Zone, and/or Firepower Umbrella.	Modified from JP 3-01.1
Space Defense Region	An orbital subdivision of a Space Defense Area.	Modified from JP 3-01.1
Space Defense Sector	An orbital subdivision of a Space Defense Region. Also see Space Defense Division.	Modified from JP 3-01.1
Space Sovereignty	A nation's inherent right to exercise absolute control and authority over the orbital space near its satellites. Also see Space Sovereignty Mission.	Modified from JP 3-01.1
Space Sovereignty Mission	The integrated tasks of surveillance and control, the execution of which enforces a nation's authority over the orbital space near its satellites. Also see Space Sovereignty.	Modified from JP 3-01.1
Space Deconfliction in the Combat Zone	A process used to increase combat effectiveness by promoting the safe, efficient, and flexible use of space systems. Space Deconfliction is provided to prevent fratricide, enhance space defense operations, and permit greater flexibility of operations. Space Deconfliction does not infringe on the authority vested in commanders to approve, disapprove, or deny combat operations. Also called Combat Space Deconfliction; Space Deconfliction.	Modified from JP 3-01.1
Space Control Sector	A sub-element of the space control area established to facilitate the control of the overall orbit. Space control sector boundaries normally coincide with space defense organization subdivision boundaries. Space control sectors are designated in accordance with procedures and guidance in the space control plan in consideration of Service component and allied space control capabilities and requirements.	Modified from JP 3-01.1
Space Autonomous Operation	In space defense, the mode of operation assumed by a space system after it has lost all communications with human controllers. The space system assumes full responsibility for control of weapons and engagement of hostile targets in accordance with on-board surveillance and weapon system control logic. This automatic state may occur on a regular basis due to orbital movements outside regions of ground coverage and control.	Modified from JP 3-01.1
Broadcast-Controlled Space Interception	An interception in which the interceptor is given a continuous broadcast of information concerning the space defense situation and effects interception without further control.	Modified from JP 3-01.1
Space Centralized Control	In space defense, the control mode whereby a higher echelon makes direct target assignments to fire units. See also Space Decentralized Control.	Modified from JP 3-01.1

Glossary	Definition	Source
Close-Controlled Space Interception	An interception in which the interceptor is continuously controlled to a position from which the target is within local sensor range.	Modified from JP 3-01.1
Space Decentralized Control	In space defense, the normal mode whereby a higher echelon monitors unit actions; it makes direct target assignments to units only when necessary to ensure proper fire distribution or to prevent engagement of friendly spacecraft. See also Space Centralized Control.	Modified from JP 3-01.1
Passive Space Defense	All measures, other than Active Space Defense, taken to reduce the probability of and to minimize the effects of damage to space systems caused by hostile action without the intention of taking the initiative. These measures include camouflage, deception, dispersion, and the use of protective construction and design. See also Space Defense.	Modified from JP 3-01.1
Space Point Defense	The defense or protection of special vital elements, orbital positions (geosynchronous slots and advantageous orbits, such as sun-synchronous), and installations (e.g., command and control facilities; space launch facilities; telemetry, tracking, and commanding facilities; space surveillance sensors; and high-value satellites).	Modified from JP 3-01.1
Space Positive Control	A method of space control that relies on positive identification, tracking, and situational assessment of spacecraft within a Space Defense Area, conducted with electronic means by an agency having the authority and responsibility therein.	Modified from JP 3-01.1
Space Weapon Engagement Zone	In space defense, orbital space of defined altitude and inclination within which the responsibility for engagement of space threats normally rests with a particular weapon system. Also called SWEZ. (1) Direct-Ascent Engagement Zone (DAEZ). In space defense, that orbital space of defined altitude and inclination within which the responsibility for engagement of space threats normally rests with a direct-ascent antisatellite system of terrestrial launch origin. (2) Directed Energy Engagement Zone (DEEZ). In space defense, that orbital space of defined altitude and inclination within which the responsibility for engagement of space threats normally rests with a directed energy (laser or microwave) ASAT or electronic warfare system of terrestrial location. (3) Electronic Warfare Engagement Zone (EWEZ). In space defense, that orbital space of defined altitude and inclination within which the responsibility for engagement of space threats normally rests with an electronic warfare system of terrestrial location. (4) Close Attack Engagement Zone (CAEZ). In space defense, that orbital space of defined altitude and inclination within which the responsibility for engagement of space threats normally rests with an ASAT system stationed within 10 kilometers of its target. (5) Long-Range Engagement Zone (LREZ). In space defense, that orbital space of defined altitude and inclination within which the responsibility for engagement of space threats normally rests with long-range space defense weapons that are space-based but normally stationed at more than 10 kilometers from their target. (6) Joint Engagement Zone (JEZ). In space defense, that orbital space of defined altitude and inclination within which multiple space defense systems (from both terrestrial and space-based locations) are simultaneously employed to engage space targets.	Modified from JP 3-01.1
Space Weapons Assignment	In space defense, the process by which weapons are assigned to individual space weapons controllers for use in accomplishing an assigned mission.	Modified from JP 3-01.1

Glossary	Definition	Source
Space Weapons Free	In space defense, a weapon control order imposing a status whereby weapons systems may be fired at any target in orbital space of defined altitude and inclination not positively recognized as friendly. See also Weapons Hold; Weapons Tight.	Modified from JP 3-01.1
Space Weapons Hold	In space defense, a weapon control order imposing a status whereby weapons systems may only be fired in self-defense or in response to a formal order. See also Weapons Free; Weapons Tight.	Modified from JP 3-01.1
Space Weapons Tight	In space defense, a weapon control order imposing a status whereby weapons systems may be fired only at targets recognized as hostile. See also Weapons Free; Weapons Hold.	Modified from JP 3-01.1