CADRE Quick-Look

Catalyst for Air & Space Power Research Dialogue

Near-Space as a Combat Effects Enabler

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Problem. Strategic space assets currently provide capabilities such as command, control, communications, computer, intelligence, surveillance, and reconnaissance (C4ISR). These assets are typically highly sensitive, centrally controlled, very expensive, and in most cases do not provide 24/7 persistence. Theater commanders require their own organic, affordable assets to provide persistent stay-and-stare space capabilities for operational and tactical missions. This requirement is not being met with currently fielded technology. Additionally, the practice of using strategic space assets to solve operational and tactical issues during contingencies diverts these critical resources from completion of their primary missions.

Discussion. Currently fielded space assets do an amazingly good job of providing C4ISR space capabilities. In fact, they have done such a good job that in many people's minds when they think of space they see the platform and the medium (satellites orbiting in the vacuum) as primary and the capability (C4ISR) as secondary. This view is so pervasive that it is even written down as doctrine in the three service-specific and the joint space doctrine documents.

Warfighters engaged in direct combat, on the other hand, could care less where their information comes from; they are interested in the information itself, not the platform. Warfighters are interested in exploiting capabilities and are not generally concerned with the platforms from which those capabilities arise. As long as they have the communications they need when and where they need it, as long as they have the weather information they need when and where they need it, and as long as they have the target imagery they need when and where they need it, the capabilities they currently receive from space could just as easily come from some other medium or platform. From the warfighter's point of view, it is clear that contrary to doctrine and mindset what matters is capability, not platform. The primacy of "space" as a set of enabling capabilities rather than a location or a set of platforms is a true paradigm shift.

Until recently, this distinction would have been somewhat pointless because almost all long-term C4ISR capabilities were delivered by satellites orbiting in the vacuum. C4ISR had essentially become a "space" capability since in general that was the only place from which the capability could come. However, with the advent of viable near-space platforms "space" capabilities can now come from someplace other than space. Near-space platforms operating at sub-orbital altitudes can now enable the delivery of many traditional space capabilities, complementing similar capabilities delivered from satellites and unmanned aerial vehicles (UAVs).

Near-space is the region between where satellites and air breathers typically operate, roughly defined as being above internationally agreed upon controlled airspace and below the point where space treaties take effect, an admittedly nebulous altitude. Most discussions of near-space thus include the region between 65,000 ft and 300,000 ft, although most envisioned platforms would not fly much higher than 120,000 ft. Near-space is above almost all weather and has relatively benign winds, especially in the 65,000- to 80,000-foot range. The environment is harsh due primarily to ultraviolet radiation as you go higher and ozone near the bottom of the region.

Near-space platforms are primarily high-tech, helium-filled balloons. There are some winged near-space platforms such as Helios, but those vehicles typically suffer from the disadvantage of continuously having to pay for their lift while lighter than air platforms can instead devote all onboard power to navigation and to their payloads. Commercial communications applications are currently being performed using simple free-floating balloons in near-space. More sophisticated free-floaters are also currently available that use gliders to return high value payloads autonomously from over 500 km away.

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Both of these near-space concepts require replenishment of the constellation in order to provide persistence. The real promise of near-space, however, lies in maneuvering vehicles, lighter than air platforms that should be available in the next few years. They will be able to provide weeks to months of persistence from a single vehicle, lifting a wide variety of payloads of hundreds of pounds into near-space to complement current C4ISR capabilities.

In general satellites are national assets. They are extraordinarily expensive, centrally controlled, and unless stationed in geosynchronous orbits only provide the ability to see a spot on earth for only a brief time as they pass by in their orbits. UAVs work in conjunction with strategic space assets to provide ISR on the tactical level, but again they are in general too expensive to field in sufficient numbers to fulfill current and future requirements. Prioritization in favor of ISR appears to have all but eliminated C3 from the UAV mission set as well.

A critical unfilled requirement for C4ISR is that of long-term stay-and-stare persistence. UAVs can stay on station for a maximum of a day or so, far short of this requirement. The stroboscopic persistence characteristic of most ISR satellites also fails to supply the necessary continuous time on station unless costly constellations of platforms are fielded. Additionally, one of the major lessons learned from recent conflicts was that operational (theater-level) commanders need direct control of their own C4ISR assets to adequately collect and disseminate the information required to accurately prosecute the battle. The delays and uncertainties associated with requesting C4ISR support from strategic-level organizations in the CONUS during recent operations has been an unwieldy and many times unworkable solution.

Satellite assets are also notoriously unresponsive to rapidly changing operational conditions. While minor changes in orbits are possible and are routinely accomplished, major changes are either impossible to do or can be done only at the cost of substantially reducing the life of the asset. Satellite launch responsiveness is similarly constrained. Currently it takes months for an existing satellite to be mated to its launch vehicle and moved to the pad for launch. Efforts to employ so-called tactical satellites with significantly reduced costs, design schedules, and launch times, while laudable, seem rather fantastic in the near term. Satellites are also generally unmaintainable; once they fail they will never be repaired. The technology that is frozen into their designs years to decades before their end of service life cannot be changed. Satellites do, however, have a freedom of overflight that near-space platforms likely would not enjoy.

Solution/Possible Courses of Action. Near-space assets, on the other hand, seem ideally suited to satisfy the requirements of operational and tactical commanders. They are relatively inexpensive, costing thousands to millions of dollars per platform (excluding payloads) instead of tens of millions to billions of dollars. They can provide stay-and-stare persistences on the order of days, weeks, and months. They can be on station within hours of being called for by a commander and do not have predictable flight paths that would allow an adversary to defeat them by the timing of his actions. They can be returned to base and repaired. Near-space is the operationally responsive space that warfighters have been pursuing for years.

The limiting factor for deploying near-space assets is money. The science is known. Some design and manufacturing difficulties are bound to arise, but appropriate funding can generally solve those sorts of problems. It would certainly seem plausible that such problems would also be commensurately less expensive to solve for balloons than they would be for rockets, satellites, or aircraft. Near-space assets cannot replace satellites; it is not our intention to suggest they do so. They are primarily envisioned to be operational-level assets and cannot do many of the deep-look missions currently assigned to satellites due to likely overflight restrictions. However, it seems that a balanced mix of UAVs, near-space assets, and satellites would satisfy national C4ISR needs, from strategic to tactical, much better than the current implementation. The most beneficial course of action would therefore seem to be to include development of near-space platforms, especially maneuvering vehicles, as a significant portion of the operationally responsive space funding stream.

Lt Col Tomme's paper on the same subject will be published Fall 2004 at http://research.airuniv.edu.