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THE “MILITARY” SPACE FACING UP CHOICES

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Keywords: *space, warfare, paradigm shift*

Abstract: *The presented skepticism about the future development of the military space research is focused on some of the main global goals’ aberrations from scientific concepts.*

ИЗБОРИТЕ ПРЕД „ВОЕННИЯТ” КОСМОС

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Ключови думи: *космос, военно дело, изменена парадигма*

Резюме: *Представеният скептицизъм относно бъдещото развитие на ‘военния космос‘ е фокусиран върху някои отклонения на глобалните цели от научните концепции.*

Today and even more in the future, as we rely increasingly on space systems for trade, communications, imaging, intelligence gathering, military targeting and navigation, and other functions, the objectives of war planners can and will be achieved by attacking, compromising, or temporarily rendering inoperable a nation’s space assets. Whether or not these objectives are beneficial to the war planner and our national security is another question. This will occur without the need for UN approval, without the need for overflight permission, and on short demand (if the objectives of operationally responsive space become a reality)—if the international community fails to set the “rules of the road” for space.

The sustainability and free use of the space environment is a vital national interest. Purposeful interference with national space systems, including their supporting infrastructure, will be considered an infringement of state rights. Such interference, or interference with other space systems upon which the country relies, is irresponsible in peacetime and may be escalatory during a crisis. The state will retain the capabilities to respond at the time and place of our choosing. The military sustainability is characterized as an increasingly congested and contested space environment, international cooperation and government reliance on commercial space capabilities. The space policy update institutionalizes the changes the military has made in an increasingly constrained budget environment to address the complex set of space-related opportunities and challenges. These also pointed to the new policy’s emphasis on the deterrence value of international coalitions in space to enhance collective security capabilities while forging closer ties with friends and allies. This, along with measures including promoting responsible behavior among spacefaring nations, will help deter attacks on national or allied space systems in part by making architectures more resilient. The new policy also emphasizes the importance of space situational awareness capabilities. Space situational awareness refers to understanding all aspects of the space environment including the location of space objects and potential threats to satellites, both natural and man made. The new plans for European missile defense, the Phased Adaptive Approach (PAA) replaced the plan that aimed to protect European allies from missile threats in the Middle East using powerful ground-based interceptors. PAA would rely on and substantially expand and improve the Aegis missile defense system used and demonstrated to have ASAT capability.

Government development of military space systems is being accelerated specifically regarding programs in the early stages of development, thanks in part to partnerships that blur the line between military research and commercial applications. This blurring is a result of dual-use systems—many military space systems have legitimate commercial applications. As various government agencies become more reliant on space, they are increasingly collaborating on space systems with each other, with support from industry- and university-based research teams. In recent years world military space contracts have been an "oligopoly" of the "Big 6" in the US defense industry: Boeing, Lockheed Martin, Northrop Grumman, Raytheon, General Dynamics and Orbital Sciences. Big companies, big satellites (up to10,000 kg), and big price tags (up to $1 bn). These companies are working in two main areas. The first is affordable launch services. Increased competition in the launch service industry was a driving factor behind the decision to form a joint venture by Lockheed, United Launch Alliance and Boeing, to reduce the cost of their launch services. Additional technologies are space asset protection systems, asset maintenance systems, and anti-satellite (ASAT) systems using small satellites. This industry norm is now being challenged, however, and challenged effectively. No one in private business is sure what they'll face over the next few years, and as long as that uncertainty remains, one shouldn't expect private business to do much hiring or investing -- even in the defense industry. Instead, they'll spend only as much money on goods and services as they have to. This kind of stagnation will remain, as long as the defense industry, like everyone else, is paralyzed with uncertainty. There's worry about business prospects in general, and about cuts in the defense budget in particular. The catalyst for change is affordability, which is leading to a realignment of the space systems industry. This affordability has not yet been realized in a profoundly beneficial sense, but dramatic advances towards affordability are coming. Small space systems companies are getting recognized and, in turn, are receiving space systems contracts and attention by the military and researchers alike. Increases in funding for military space systems and the overall growth of the industry are being partially fueled by a military strategy called Operationally Responsive Space (ORS). ORS objectives are: for development to reduce the timeline from years to months; for deployment to reduce the timeline from months to hours; and for operations to reduce the timeline to continually or seconds. New systems will help make ORS a reality and revolutionize the space industry in two ways: by reducing the cost of space access and by streamlining the time and effort required to place assets in space. Systems under the umbrella of military space systems number in the dozens. There are nearly 50 different technologies in various stages of R&D across multiple programs—not including missile defense technologies that have direct connection to possible space weapons systems. The first technology tier involves increasingly affordable launch vehicles and next-generation expendable launch vehicles. Although these system has not been tested one must ask that, if this technology is developed, what are the implications of such technological leaps? The combination of affordable, short-notice launch capability with small satellite technology has the potential to revolutionize the space industry, especially military space systems. This would further reduce the cost of military space programs and commercial space launches**.** ASAT capabilities are project objectives. The eventual applications are as follows: Monitor space around a large satellite to detect attacks; Stealthily inspect and monitor a large satellite; Stealthily attack to permanently or temporarily disable a large satellite; Actively defend a large satellite against attacks by microsatellites. Applications such as monitoring the international space station and OTV are also foreseen, underscoring the dual-use potential of such systems. A technology called MoTV, maneuverable orbital transfer vehicle can be used as a standard propulsion module to transport a customer's payload in orbit. The MoTV provides the change in velocity (delta-V) and maneuvering capabilities to support a wide variety of applications for on-orbit maneuvering, proximity operations, rendezvous, inspection, docking, surveillance, protection, inclination changes, and transfer. Future options for "TacSat" small satellites are to test new space capabilities will assess the future utility of such systems, to improve communications, search and rescue, data extraction and ship identification in the Arctic. The spacecraft would consist of a mothership and four cubesats flying in formation. Another recent advance involves what are called **"**re-docking cubesatellites**."** Imagine a mother satellite with multiple "cubesats" loaded on board. Each would be no larger than 25 centimeters per side. These satellites could fly in formation, dock with other space assets, provide imaging, and, most importantly, perform inspections of other satellites. In theory, a cubesat might, for example, place a black swath of adhesive material over a satellite lens or solar array, and then remove it once the objective (concealment of some activity) has been met. This is referred to as a "stealth" satellite attack, an attack that duplicates natural phenomenon or is reversible. Once this act was executed the cubesat would return to the host satellite and re-dock via various means, such as electromagnetism. Once the cubesat returns to the host it would recharge its batteries and transfer images or data collected. With such systems the cubesat could return to the target satellite and reverse the attack once a conflict had passed or an objective had been achieved. This is a technology currently in the research stage, though universities—which make up for a large portion of the experiments in this arena—have been very active with re-docking cube satellites, with some projects being supported by the Air Force. XSS, the Experimental Satellite Series, is one of the better-known rendezvous-capable satellite programs. The objective of the XSS is to perform on-orbit experiments to develop a satellite-oriented space logistics and servicing capability such as to intercept, image and, if needed, take action against a target satellite. Such tasks are achieved by the deployment of a microsatellite or satellites from a carrier vehicle to perform precision maneuvering to and around orbital assets. XSS-11 is expected to rendezvous with up to eight objects and perform proximity operations that will add to the military's space toolkit. XSS-11 is supposed to get within two kilometers of the rocket. Such a capability to engage either with a rocket, enemy space asset, friendly space asset, or object in theory could be a precursor to an active defense capability or ASAT system. XSS-11 is another example of a rendezvous-capable satellite that blurs the line between commercial, civil, and military space applications. The DART (Demonstration of Autonomous Rendezvous Technology) spacecraft during its time in space it successfully demonstrated a rendezvous capability, acquisition of the target spacecraft, and approach, then boosted it into a slightly higher orbit. DART was designed to approach within five meters from a satellite without any guidance from spacecraft operators on the ground and to perform a series of maneuvers, these applications are in fact precursors to an operable ASAT. The Orbital Express Space Operations Architecture program seeks to validate the technical feasibility of robotic, autonomous in-orbit refueling and reconfiguration of satellites in support of a broad range of future national security and commercial space programs. Refueling satellites will enable frequent maneuvers to improve coverage, change arrival times to counter denial and deception and improve survivability, as well as extend satellite lifetime. These abilities are revolutionary and will provide extensive benefits to the military and commercial space systems, reducing costs and thus passing value to customers using various services. Orbital Express can support deployment and operations of microsatellites for missions such as space asset protection and sparse aperture formation flying, or deploy nanosatellites for inspection to provide data to support satellite repair. In sum, we have three rapidly evolving technologies that will accelerate military space projects and make them more affordable. These are: short-notice launch capabilities; next generation small satellites that significantly reduce launch costs and are capable of direct engagement; and ESPA-ring technologies and similar deployment stages for launch vehicles. Technology forecasting suggests that once fully integrated, these technologies will significantly reduce the cost of the militarization of space process and its transition to weaponization. There is no adequate international legal framework in place to ensure that ASAT systems and weapons will not be placed in space. Weaponization will first be initiated in space asset protection systems, built on small satellite platforms, under the guise of asset protect systems with active defense capabilities. Once such systems are in place, the act of attacking or compromising an enemy space system will be limited only the intention of the user. The road to space being weaponized may also be shortened thanks in part to a space-based missile defense system—should it be developed. The Multiple Kill Vehicle platform (MKV**)** links missile defense technology with potential space weapons systems in the here and now. MKV is a generational upgrade to ground-based midcourse (GMD) interceptors to increase in the presence of countermeasures their hit-to-kill capability to seven shots per interceptor. Technology development areas include radar, optics, interceptors, lasers, information systems, space control, and space applications and could be employed in future space-based defenses. Where the overlap into weaponizing space takes place is in regard to the carrier vehicle (CV), which for the MKV is the in-space deployment unit housing the MKVs. One could assume that stationing a constellation of CVs in space for long periods could offer a mechanism not only for space asset protection and missile defense, but also for attacks on enemy spaced-based systems. The Common Aero Vehicle (CAV) program is featuring a low-cost, mission-responsive, reusable hypersonic cruise vehicle that could take off from a conventional military runway, would carry a payload comprising several CAVs: unpowered, maneuverable, hypersonic glide vehicles and strike targets halfway around the world in less than two hours. The CAV capability could be matched against an anti-access environment and still deliver a conventional payload precisely on target within minutes of a valid command and control release order. This is the type of Prompt Global Strike. A future CAV launch platform based in space would have major diplomatic implications since there are no international treaties prohibiting the placement of conventional weapons in space. A space-based CAV system would perform the functions of a forward-deployed force, would not require overflight permission to do very rapid attacks in areas that are difficult to reach. Other capabilities are: Avoid risk to flight crews; Remain relatively invulnerable to anti-access threats; Cost competitive with other platforms. The requirements currently set for the system are: Precision strike; Variety of conventional payloads; In-flight target updates; Worldwide all-weather range. The Hot Eagle concept is space insertion and terrestrial extraction of ground troops as a squad-sized unit of Marines to any place on Earth in less than two hours. Hot Eagle has key technology links to the Hypersonic Cruise Vehicle (HCV) and CAV programs and may be operable in just a few years. Another revolutionary technology under development involves the SMARTBus or "six-day satellite". This is a "plug, sense, and play" system, meaning that each component, once assembled, recognizes the others without the need for special programming or software drivers. It is a customizable off-the-shelf satellite system that will significantly reduce the cost, complexity, and the development time required to assemble a small satellite bus to meet a satellite developer's mission requirements. Military applications might include asset replenishment in the event of an attack on space assets and could require imaging, communications, and intelligence gathering abilities. Such a system might also be deployable in the theaters of military operations. The United States, NATO, and the European Union are getting ready to dispatch military missions around on demand, setting up fast and temporary satellite intelligence and communications capabilities. As satellites get smaller, jets like a Eurofighter Typhoon could be used to launch microsatellites into orbit as quickly as forces deploy on the ground. Boeing built two(A&B) reusable space-worthy **Orbital Test** Vehicle X-37s. The X-37B resembles a space shuttle orbiter and is about a quarter of the size of an orbiter. The space plane's tiles are tougher than the shuttle's, its electromechanical flight control system replaces the orbiter's hydraulic actuators, and the X-37B is powered by a deployable solar panel instead of cryogenic fuel cells. X-37B was launched in orbit on. 05.03.2011. To further explore the craft's capabilities, including an up to 270 days stay in orbit, and accepting worse weather conditions for landing, the flight ended after 224 days in space, accomplishing the first U.S. automatic landing from space on a 15,000-foot runway at Vandenberg. The X-37 does flips and zig-zags and is capable of deploying and retrieving cargo. It's absolutely revolutionary. A fleet of autonomous unmanned reusable drones that can service & support human spaceflight in LEO will be critical to repair, re-supply, point-point cargo transport, experiments, and more. In a budget environment that leaves virtually no room for new starts of big programs, the military are looking to better leverage the robust commercial satellite sector to get new capabilities on orbit. Military telecom payloads are not ideal candidates for placement aboard commercial satellites in the near term, however there are realistic near-term hosted payload opportunities in at least three other applications: space situational awareness, space-environment monitoring and wide-field infrared surveillance. Mission opportunities for commercial operators is protected tactical communications.Currently this service is provided by the Air Force's Advanced Extremely High Frequency (AEHF) line of secure communications satellites, which also carry payloads used by national authorities, including the president, for command and control of nuclear forces. But under a concept known in military space parlance as disaggregation-flying the strategic and tactical AEHF payloads on different satellites, because the tactical AEHF payload does not require the same level of nuclear radiation hardening as its strategic counterpart.

There are now some 1,100 active spacecraft on orbit and more than 60 states and/or commercial entities owning and/or operating satellites. Some have argued that to protect military and civilian satellites, the state may have to place weapons in space itself. Threats possibly countered by space weapons are: Small satellites/space mines; Ground-based directed energy ASAT; Ground-based kinetic energy antisatellite weapon (ASAT). Threats that cannot be addressed by space weapons are: Jamming of GPS signals; Jamming of satellite links; Orbital Debris. This presentation offers a snapshot of military space and dual-use technologies that are in various stages of research and development. Some of these systems may be "dream" technologies that will never reach the point of viability. For systems that are technically possible, however, we must ask, are they desirable? If deployed, will their impact on international security be positive or negative? If negative, what steps might be taken to prevent such developments? Could they create a global climate of insecurity both by enhancing current risks and by creating new problems. These is valid for responses by China, Russia, the European Union, and perhaps Japan too. Perhaps the most consequential impact would be increasing the probability of accidental nuclear war. Space-based weapons could shorten the road to armed conflict, whether nuclear or conventional. Once employed regularly, anti-satellite systems and space weapons would litter LEO with debris, which in turn would permanently compromise our collective ability to explore the heavens and use space for constructive commercial purposes. After a systematic review of the threats to space assets were found ways to make space systems secure and robust without weaponization, at least for the next five years. 2010-2011 saw the emergence of a consensus around the notion that multilateral cooperation/action on several fronts is now required to avoid harmful competition, accidents, and the increased potential for conflict in the global commons of outer space. Before new governance practices and/or structures can be developed, transparency and confidence in state to state relationships in space must be increased. There are 2 UN & 1 EU three current multilateral platforms in which the discussion on Transparency and Confidence Building Measures (TCBMs) for Space have a central role.

From a military standpoint, analytical standpoint, we were able to take an outside view at what a country does when it comes to spacewarfare The information is intriguing and while it may not offer a concise view of the entire scope of the "gears of war," it does offer much insight. Why we fail and will continue to fail at "spacewarfare analytics? The answer is a complex one and is not based on any of the traditional points of view. The answer typically refers to the state of an identifiable information, being publicly unknown. This is and will forever be the problem with tracing a spacewarfare attack. Sure we can track an indication of where the attack came from however, far too many factors enhance the capability to remain anonymous from an attacker's perspective. Advanced analysis is the high-level cognitive processes producing specific, detailed thought and understanding of the object environment, and knowledge superior to that possessed by the adversary. Advanced analysis has 10 cognitive functions: Decomposition**;** Critical thinking; Link analysis; Pattern analysis; Trend analysis; Anticipatory analysis; Technical analysis; Anomaly analysis; Aggregation analysis; Synthesis**.** While these cognitive functions can help on an actual battlefront, the fact will remain that they mean little in a world that is fuzzy and hardly comprehensible. That is, the spacewarfare is not a world, its is a mesh of networks where anonymity will reign supreme for the unforeseeable future. A change is needed, not meant to give anyone an indication of "how to think" when it comes to analyzing it, but instead give a twist to the 10 cognitive functions, their counterpoints from a spacewarfare perspective. On the issue of space weaponization, there appears no one best option. No matter the choice selected, there are those who will benefit and those who will suffer. The tragedy of power is that it must make a choice, and the worst choice is to do nothing.