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Related Categories: Military Innovation; Science and Technology; SPACE; Russia

DARPA PUSHES LIMIT ON LOW SATELLITE ORBITS

The U.S. defense and intelligence communities rely heavily on satellites traveling in traditional low Earth orbits (450-1,000 km altitude range) for high-quality imaging and other sensor capabilities. However, researchers at the Pentagon's Defense Advanced Research Projects Agency, or DARPA, are now shifting their focus to the very low Earth orbit (VLEO) range, defined as 200-450 km, as part of their Daedalus program, in an effort to further improve geospatial positioning accuracy and gather enhanced imaging. Though the capability is desirable, it faces a significant challenge; Earth's atmospheric drag will continuously decrease the orbiting altitude of the satellites and necessitate frequent orbit adjustments — which in turn requires more propellant. On the positive side, the satellites deployed in VLEO will be exposed to less space radiation and potentially less space debris, theoretically making them more durable and extending their lifespans with the benefit of enhanced sensing capabilities. Commercial firms, including SpaceX, are also exploring opportunities in VLEO. (*Bloomberg*, November 2, 2022)

BRAIN ENHANCEMENT WILL HAVE OPTIONS

As in rockets and electric vehicles, billionaire entrepreneur Elon Musk is a leading player in the brain computer interface (BCI) market. Musk's Neuralink company is developing a coin-sized brain implant that will aid in the treatment of quadriplegics and those with neurological disorders — and, over the long term, enhance cognition (see *Defense Technology Monitor* no. 65). However, it appears that Neuralink has some competition in this space; a former employee has launched Science Corp, which also focuses on brain implants, but with a distinct advantage — the latter's brain computer interface technology does not rely on a surgical drill for brain installation, but rather the use of photonics. Their prototype device transmits data via 2-millimeter-wide LED film, known as "Science Eye," that is installed on the retina. Science Corp's development trajectory is comparable to that of its predecessor, however. It plans to focus first on solving physical ailments before using its technology for human enhancement. (*Gizmodo*, November 22, 2022)

DTRA AUTOMATING DECONTAMINATION

In warfare, not all nations operate under the same rules, and there is always a risk that soldiers and their vehicles could be exposed to chemical or biological agents. Detecting and decontaminating such exposures is a dangerous job — and one that the Defense Threat Reduction Agency (DTRA) hopes to automate through the development of its Autonomous Decontamination System (ADS). According to DTRA's William Buechter, "these decontamination operations require a large, designated area and immense logistic support such as water, decontaminants, and intensive manpower... There is also the risk of spreading contamination during decontamination operations... ADS will mitigate chemical, biological, radiological, and nuclear contamination using multiple, scalable processes that reduce the hazard, manpower, and time and resources, and increase commanders' flexibility to support multi-domain operations." (*Homeland Security*, November 26, 2022)

JOINTLY COUNTERING HYPERSONICS

As adversaries make advancements in hypersonic weapons, the Pentagon continues to search for solutions to defeat them, and is increasingly exploring international partnerships in this domain. The State of Israel has emerged as an important ally in this regard. The nation is known for its robust, multi-layered missile defense architecture, encompassing the Iron Dome and Arrow systems, which was developed as part of its longstanding strategic partnership with the United States. But Israel's defense industry has been working on developing countermeasures against hypersonics as well — and Iran's recent announcement that it has a hypersonic weapon capability under development has assuredly accelerated this work. The U.S. Missile Defense Agency and the Israel Missile Defense Organization have now partnered and plan to develop interceptors and space tracking capability to address the hypersonic threat. (*Jerusalem Post*, November 10, 2022)

RUSSIAN EXOSKELETON DEVELOPMENT CONTINUES

The Pentagon is not the only nation focused on developing an "Iron Man" suit, it seems. Like the U.S., Russia has made numerous attempts at building modern battle suits and exoskeletons to protect its warfighters (See *Defense Technology Monitor* no. 25). The latest model, dubbed "Legionnaire," will reportedly consist of a full body supported exoskeleton capable of guarding against small arms fire. Additionally, a fourth-generation "Centurion" armor system is also in development, and is designed to protect a soldier from direct .50 caliber machine gun fire. The suits are designed to be durable but not restrictive, constructed from ultra-high molecular weight polyethylene fiber. However, Samuel Bendett, an unmanned systems expert at CNA, cautioned that "[The Russians] can make a proof of concept, but scaling it up across the services is a different story, and is unlikely... Much depends on the state of the Russian defense industry, which may not have enough capacity to undertake this on a large scale." (*Task and Purpose*, November 18, 2022)