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Deep Space Advanced Radar Capability

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The Battle of Britain in 1943 showcased how the technology of RADAR turned the course of the battle in favour of Britain. The effective and innovative radar arrangement in a chain ensured the detection of ingressing aircraft at all levels, including the ultra-low level. The detection inputs from all radars were connected to a networked system called the "Dowding System," which further managed the 'detection to shooter' cycle. Drawing an analogy with the Dowding System, a similar idea is realised in the space domain nearly 80 years later. The idea of Deep Space Advanced Radar Capability (DARC) has been at the forefront of technological discussion in recent years. Its initial successful technology demonstration (DARC-TD) was carried out in 2017.

Space and Deep Space

Before delving into the deep space radar capability, the primary differentiation between 'space' and 'deep space' needs to be put into perspective. These terms generally refer to different regions within the broader context of the universe or celestial objects. The distinction is somewhat relative and depends on the context in which the terms are being used.

'Space' is a general term used to describe the vast, seemingly infinite expanse beyond Earth's atmosphere. It includes the regions near Earth, such as low Earth orbit (LEO), medium Earth orbit (MEO), and geostationary orbit (GEO). These regions are relatively close to Earth. Meanwhile, *'Deep Space'* typically refers to regions of outer space that are significantly farther away from Earth. The exact boundary where space is considered 'deep space' can vary contextually, but it often includes regions beyond Earth's immediate vicinity, such as the outer solar system, the interplanetary medium, and the areas between stars in a galaxy.

What is DARC?

Taking a significant military step, the United States, the United Kingdom, and Australia have signed an agreement to develop a deep space radar capable of monitoring objects in geosynchronous orbit. This agreement is part of a trilateral initiative that will last for 22 years.

Satellites operate in this region, situated at an altitude of approximately 36,000 km above the Earth's surface and among the most distant regions. It is interesting to note that every spacecraft in geosynchronous orbit always hovers over the same region of the Earth. This is accomplished by synchronising the duration of its orbit with the rate at which our planet rotates once in relation to the stars in the background.[1]

The proposed surveillance system for this space region is known as the "Deep Space Advanced Radar Capability" (DARC). Present ground-based optical systems are constrained by inclement weather and daylight, but DARC is capable of delivering global monitoring that transcends these constraints. DARC claims enhanced sensitivity, improved accuracy, increased capacity, and more agile tracking capabilities compared to existing radar systems capable of monitoring objects in GEO. Additionally, the capability will be employed to safeguard critical services that are dependent on satellites and space-based communication, such as television and mobile phones, which are integral components of modern life.[2] DARC intends to enhance the Space Surveillance Network (SSN) by integrating an additional sensor into GEO, augmenting its capacity and capability to monitor deep space objects.[3]

DARC will empower the AUKUS nations to maintain a robust posture in the space domain against Russia and China, in addition to bolstering their security partnership. As an integral component of effective Space Domain Awareness (SDA), this agreement will expedite the detection and identification of emerging threats in space and facilitate the identification process.[4] SDA is the capability of space object tracking, identification, and characterisation. Responsible space operations rely on this fundamental principle, whether in response to routine or hostile activities.

Location of Radars

By the end of the decade, the United States, the United Kingdom, and Australia will reportedly host and operate the Deep Space Advanced Radar Capability (DARC), a cutting-edge ground-based radar system. The defence chiefs of these three nations convened at the Defence Innovation Unit headquarters in Silicon Valley on December 1 to formalise several new agreements as part of the AUKUS agreement's "Pillar II," which focuses on developing advanced military technologies. This move boosted the DARC initiative and other cooperation between the three nations. The joint statement reveals that many of the AUKUS-related advanced capability activities are classified. However, the DARC initiative remains unclassified.[5]

The United States desires to install a massive new radar system in the UK to track objects in outer space. Additional locations to be considered are Texas and Western Australia. Each site would house 10 to 15 parabolic antennae (large satellite dishes) for tracking and four to six for transmitting, covering an area of about 1 square kilometre. It will be able to detect a football-sized object from a distance of 36,000 km.[6]

Space scientists[7] opine that it is almost mandatory to have the sites scattered around the world for effective coverage. The countries are “optimally positioned” geographically for the DARC system being developed by Northrop Grumman. It is expected that “geographically spacing around all these radars and telescopes, linking them all together, sharing data between them, will provide a much better network than any

country can do by itself."[8] The first site of the chain of telescopes and radars is anticipated to become operational in 2026.

Implications for AUKUS

It would not be incorrect to say that the next war could be won or lost in space. The frequency of China's space activities, including efforts to establish a space station, is increasing in tandem with the nation's growing space launch capabilities. However, China has been especially alarmed by the US plan to construct DARC. It is worth noting that China reacted sharply to the DARC programme earlier in 2021, stating that "It is a significant escalation that has the potential to further change the direction of global military competition."[9]

The AUKUS nations gave logically justified the need for DARC for Free and Open Indo-Pacific (FOIP) from the space threats. Following the ratification of the agreement, the head of Space Forces Indo-Pacific, Brigadier General Antony Mastalir, stated, "Whatever happens, it is imperative that a new radar system be deployed there without delay, given the escalating Chinese threats in the Indo-Pacific." Additionally, he emphasised that the mere possession of such capabilities "does not mean it is wrong. But if you look at our efforts in maintain a free and open Indo-Pacific, you quickly run into a situation where our ends, and what we seen in terms of behaviour coming from China, their ends do not necessarily align."[10]

It is evident that deterring China and Russia and preparing to win a war are undoubtedly the primary objectives of the United States and its allies in developing DARC. Obtaining hegemony in space is considerably more challenging for the United States than attaining it independently on land and at sea. The ability of the United States to unilaterally occupy and seal off outer space from China and Russia is unattainable. Hence, it is prudent to assume a leadership role in space situational awareness (SSA) by implementing DARC. It will solidify the belief among its allies that it controls everything through hegemony, strengthen their support, and force reluctant nations and forces to submit to it even more.[11]

The United States, in particular, anticipates that China will be deprived of the benefit provided by space in order to finalise the kill chain essential for executing long-range precision strikes against air and maritime targets. The US Forces are firm in the opinion that it has to have the ability to deny China the military advantage through space domain as a potential adversary.[12]

NOTES:

[1] Brett Tingley, "US Space Force plans global radar to 'identify emerging threats' in distant Earth orbit," *Space.com*, December 08, 2023, https://www.space.com/space-force-deep-space-radar-capability-emerging-threats. Accessed on December 25, 2023.

[2] United States Space Force, "US, UK, Australia announce trilateral Deep Space Advanced Radar Capability initiative," Secretary of the Air Force Public Affairs, December 02, 2023. https://www.spaceforce.mil/News/Article-Display/Article/3604036/us-uk-australia-announce-trilateral-deep-space-advanced-radar-capability-initia/. Accessed on December 25, 2023.

[3] "Deep Space Advanced Radar Capability – DARC", globalsecurity.org, https://www.globalsecurity.org/space/systems/darc.htm. Accessed on December 22, 2023.

[4] Op. Cit.Brett Tingley,

[5] Chris Gordon, "US, UK, Australia Agree to New Space Tracking System: What It Means, When It's Coming," *Air & Space Forces Magazine*, December 08, 2023. https://www.airandspaceforces.com/us-uk-australia-agree-new-space-tracking-system/. Accessed on December 11, 2023.

[6] Op Cit. DARC, globalsecurity.org

[7] Brian Weeden, https://swfound.org/about-us/our-team/dr-brian-weeden/, Secure World Foundation, Accessed on December 24, 2023.

[8] Ibid.

[9] Op Cit. DARC, globalsecurity.org

[10] Colin Clark "Absolutely critical' to get DARC space situational system to Australia: Space Forces Indo-Pacific head," Breaking Defense, April 07, 2023. https://breakingdefense.com/2023/04/absolutely-critical-to-get-darc-space-situational-system-to-australia-space-forces-indo-pacific-head/. Accessed on December 25, 2023.

[11] Op Cit. DARC, globalsecurity.org

[12] Op. Cit.Colin Clark.