Weaponising Space Debris: Britain, 'DARC', and the US military's control of the 'space domain'

Britain is to become part of a global network that will allow the US to 'dominate space'. The UK government are promoting this as a way to create greater 'security' for our technological lifestyle. The reality about what this system is for, and the US military's strategy behind it, is somewhat different to that public message of greater security.

Paul Mobbs, *The 'Meta-Blog'*, issue no.17, 2nd October 2021

America is gearing up to fight a war in space. They want to dominate space to ensure their dominance of the Earth below. That is the core of their strategy, repeated in official reports, Congressional testimony, and the internal newscasts for members of the US military. Pursuing this course risks denying access to space to every nation on Earth for decades to come. And in this US project, Britain is a willing accomplice.

For a few years now I've been keeping my eye on space. It's not just that this empty vacuum, where no human can naturally exist, may precipitate a global war. Irrespective of the politics of that, there are clear 'ecological' reasons why the militarisation of space is bad for everyone on Earth.

The way military and commercial organisations are pursuing their space ambitions risks denying all nations access to space for perhaps many decades to come. And the cause of this is an issue that I have been working on for most of my life: *Waste pollution*. Or more specifically, *space debris*.

In July 2021, I saw some news articles that made me look more closely at the story. The US military wanted a large site for a radome installation, a kilometre across, in either Scotland or Southern England. The reason why I was interested is that a site which fitted that description, USAF Barford St. John, is a short distance from where I live.

This is a complicated issue. **To explain it as clearly as possible I will have to break it down into three parts: Space Debris; DARC; and War-fighting in Space. Then I will tie the issue all together in the final section.**

Space Debris

Space is big; *really big*. However, humans only use an infinitesimal part of it: *The area immediately above our heads*. Therein lies the problem.

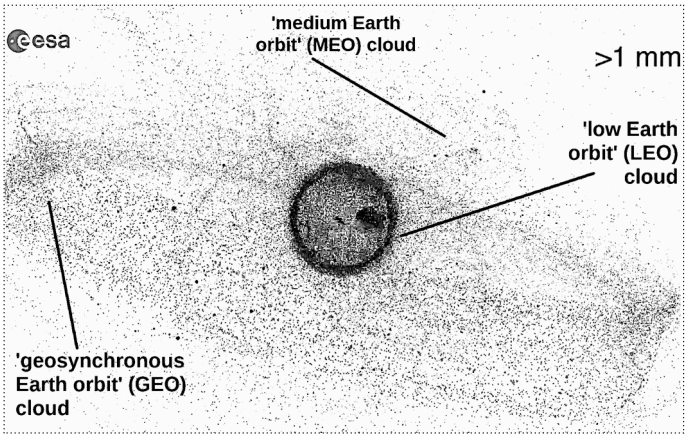
In a vacuum there is no resistance to objects moving. Push an object and it will go in a straight line, forever. What changes that is gravity. The gravity well created by the Earth pulls small objects towards it. But with enough speed, they can orbit the Earth endlessly without the need for fuel. Too much speed, and they fly off into space. Too little and they slowly spiral down into the atmosphere.

This is the key to the ecological issue of *space debris*: Unwanted junk orbiting the Earth which serves no purpose, endangers other satellites, but which we are unable to remove. Like the hubris behind the nuclear waste problem, satellites were launched from the 1950s without any concern about disposal. Today that failure has the potential to deny all of humanity access to space in the future.

Satellites do not randomly occupy a particular orbit. Depending upon the purpose of the satellite, they cluster into a few defined areas, which narrows the space available even more.

The further out they are, the more slowly satellites move relative to the Earth's surface. That means certain altitudes favour certain satellite applications. These different altitudes are classified into various 'orbits' according to those uses:

Low Earth Orbit (LEO) is from the atmosphere up to about 1,200 miles above the surface. The lower limit is about 200 miles, below which satellites begin to drag on the atmosphere and slow down. Most of the satellites are somewhere from 400 to 1,100 miles up, orbiting about every 90 minutes.



European Space Agency mapping of space objects/debris

Most satellites have been launched into low Earth orbit, so it is the most overcrowded. The rocket bodies used to boost satellites to higher orbits can also stay there for some time before their orbit decays and they fall back to Earth. This is also the area for manned space-flight: The International Space Station orbits at around 255 miles; the Chinese Tiangong Space Station around 245 miles on average. More important than manned flight, low Earth orbit is the domain of *'Earth observation satellites'* – which are critical to everything from weather forecasting, to climate change research, to detecting pollution or mapping habitats around the world.

Medium Earth Orbit (MEO) extends from 1,200 to 22,000 miles above the surface. The main use for this area are slower moving satellites, such as global positioning systems (GPS) – many of which orbit around 12,600 miles up.

Geosynchronous Earth Orbit (GEO) is on the boundary between the 'high' and 'medium' orbits, 22,236 miles up. Here a satellite moves at relatively the same speed as the ground below – meaning from Earth it appears as a fixed point in the sky. Most orbit near the equator, to give a large footprint across the Earth's inhabited regions, and are mainly used for communications and broadcast TV.

According to the UN Office for Outer Space Affairs, up to April 2021, 11,139 objects had been launched into space. Of those, 7,389 were still up there; half of them no longer working. What's more significant is that a third of those launches took place in the last five years.

The first satellite, and the first put into low Earth orbit, was *Sputnik 1* on 4th October 1957. It broadcast for three weeks, ran out of power, and fell back to Earth two months later, in January 1958.

The first satellite in geosynchronous orbit was *Syncom 3*, launched in August 1964. It operated until 1969 when it was switched off; **and it is still there.** It occupies a small part of the geosynchronous orbit, and will continue to do so for many years into the future unless it is physically removed.

The US Space Surveillance Network (SSN) brings together different elements of civilian and military space observatories to map and catalogue space debris. It also shares data with other bodies working on the issue, like the UN and the European Space Agency. This is the source of much of the public data on space debris.

The US military's main tracking capability, adapted from ballistic missile warning systems, is based at six sites around the world – such as Fylingdales in England. It uses radar to track objects as small as 10cm in diameter in low orbit; and around 1m in diameter in geosynchronous orbit. Currently SSN is tracking over 20,000 objects or pieces of space debris larger than ten centimetres.

SSN also uses NASA's Orbital Debris Program sites to detect smaller pieces of debris down to a few millimetres; as well as monitoring the moon and deep space. These systems are currently monitoring another 900,000 pieces of space debris between one and ten centimetres in size.

At present, 'whole' satellites are only a small part of this cloud of debris. There are also spent rockets, and pieces that broke-off satellites or were dropped by astronauts. There are estimated to be 129 million objects in bigger than one millimetre (see diagram). A millimetre may sound insignificant, but a speck of metal moving at tens of thousands of miles per hour has the energy of a bullet; at ten centimetres it has the energy of a large bomb.

The first recorded case of a satellite being hit by a known piece of space debris was in 1995. In the worst case, one satellite may accidentally crash into another. This happened for the first time in 2009. According to the European Space Agency's data, a fifth of satellite failures happen for no apparent reason. This is most likely the result of being hit by unseen pieces of space debris – such as the unexplained damage to two Iridium satellites in 2014, which released more debris after they were hit.

That 2009 satellite collision generated over 2,000 fragments larger than ten centimetres. The risk is that one of those will hit another satellite and create

more debris; which might hit another; and then another. The worst case scenario is that there would be a cascade effect, like a chain reaction, destroying most of the satellites in that orbit. This is called the *'Kessler Syndrome'*, after the scientist who first calculated its probability in 1978.

The probability of cascade is related to the density of satellites: The more satellites, the higher the risk, as there are more satellites to sustain the cascade effect. Today satellite launches are rising exponentially, driven by new commercial satellite constellations in low Earth orbit. Such as Elon Musk's *Starlink* project, with around 1,600 of the planned 42,000 satellites having been launched since February 2018. Other large constellations are planned too, by OneWeb (~900 satellites), Boeing (~1,600), and Amazon (~3,200).

What is required to initiate cascade is a large fragmenting event – like a satellite collision, or a satellite being destroyed by the military. Once initiated, it cannot be stopped, and could be a barrier to getting into space for a number of decades – until most of the debris has cleared by falling back to Earth.

The Deep Space Advanced Radar Concept

In 2016, the US Air Force budget's research appropriations listed a new project, *'DARC'*: *The Deep Space Advanced Radar Concept*. $10 million was allocated in the 2017 budget, and $30-$40 million each year from 2018 to 2021. Successive budget appropriation reports describe DARC as follows:

> *"DARC will leverage ongoing defence science and technology efforts to mature radar concepts and technologies to develop and evaluate prototypes that demonstrate increased sensitivity, capacity, search rates, and scalability to detect, track and maintain custody of objects in deep space orbit...*
>
> *The current and future space domain demands that space systems be responsive to new and changing threats, and can rapidly integrate new capabilities to make our war-fighting force more resilient in a contested battle-space. This agility, survivability, and rapid reconstitution must extend through the entire space war-fighting enterprise, to include how we learn about the threat; develop solutions; acquire, test, deploy, train, operate and integrate new systems into the greater system of systems; and ensure our space mission force is ready to defeat a thinking adversary in a complex, multi-domain battle-space."*

This implies that DARC is not a passive system for space debris tracking. It is an active part of an unstated space weapons programme.

In 2019, the US Department of Defense awarded a $31 million contract to John Hopkins University Applied Physics Laboratory to research prototypes for the DARC system. This will create the engineering designs that the USAF will eventually deploy. With extensions, the contract has cost over $50 million, and is due for completion at the end of September 2021.

The draft budget for 2022, produced in May 2021, lists an appropriation for 2022 of $123 million. US Space Force is now shifting into the deployment of DARC at the first site in the USA – to be contracted and assessed in 2022 for construction in 2023. The current budget draft also notes:

> *"The Space Force intends to develop and field two additional DARC sites in the future to culminate in a final operational system of three global sites to ensure SDA coverage. A follow-on MTA pathway* [in English, they will rapidly copy the prototype elsewhere once it works]*, strategy based on the success of the Site 1 rapid prototype will be developed later for Sites 2 and 3."*

It appears 'Site 2' is planned for Scotland or Southern England, and 'Site 3' is in Australia.

The DARC system uses four to six parabolic dish antennas – or 'radomes' – to send signals into space. The signals bounce off objects and are received on the ground by ten to fifteen dish antennas. To improve signal reception, the receiving antennas need to be spread out over a wide area. The figure suggested is an area one kilometre in diameter. Apart from a central operations complex and associated buildings, the installation would require little other infrastructure, other than a high-capacity data link to integrate the site into the US military's global network.

The current draft budget does not list figures for sites 2 and 3, though earlier budgets did. The schedule described in the budget indicates the UK-based DARC site could commence construction in early 2024, to be completed and operational by 2026. Site 3 would be constructed over 2025/26.

What DARC creates is not just better resolution to track more objects further away. One of the key features of this system is *'increased sensitivity, capacity, search rates, and scalability to detect, track and maintain custody of objects in deep space orbit.'* This means objects can be constantly be monitored across all three DARC sites.

Of course, having the ultimate telescope to see objects in space cannot of itself protect or create security for the military's use of space. And while the DARC plan calls for making *'our war-fighting force more resilient in a contested battle-space'*, what is not stated anywhere is how this passive role of 'looking' at space debris can do this.

War-fighting in Space

In mid-July 2021, the media dribbled out stories about DARC, following the visit of UK Defence Secretary, Ben Wallace, to the US Space & Missiles Systems Center. While they reported what was said, it was not factually accurate in the context of how those statements were reported. Picking these stories apart not only highlights the way Ben Wallace's visit was misreported; but also the way in which 'threats in space' are misrepresented to the public by politicians and the military.

The BBC News item said:

"The US military wants to build a large new radar site in Britain to track targets in deep space. It comes amid growing concerns about a space arms race. The US and Britain have accused China and Russia of developing weapons to shoot down satellites. The US Space Force is developing a global radar system to identify potential threats, up to 22,000 miles in space."

The BBC's Defence correspondent then interviewed a US Space Force Colonel, who stated:

"There are threats in space. I'd say the two countries that are most threatening are China and Russia. There have been anti-satellite missiles that have been developed."

Then they interviewed the Defence Secretary, Ben Wallace:

"Space is a growing domain for both commerce, but also to protect all the key national infrastructure that we need to in today's world. It is under threat in some areas. Our adversaries are weaponising space. So we have to make sure at the very least we are providing resilience."

The correspondent concluded:

"It may prove controversial, but the Government's made clear it wants to be in the vanguard of efforts to keep space safe."

To make sense of that it is first necessary to know the history of space weapons and their use:

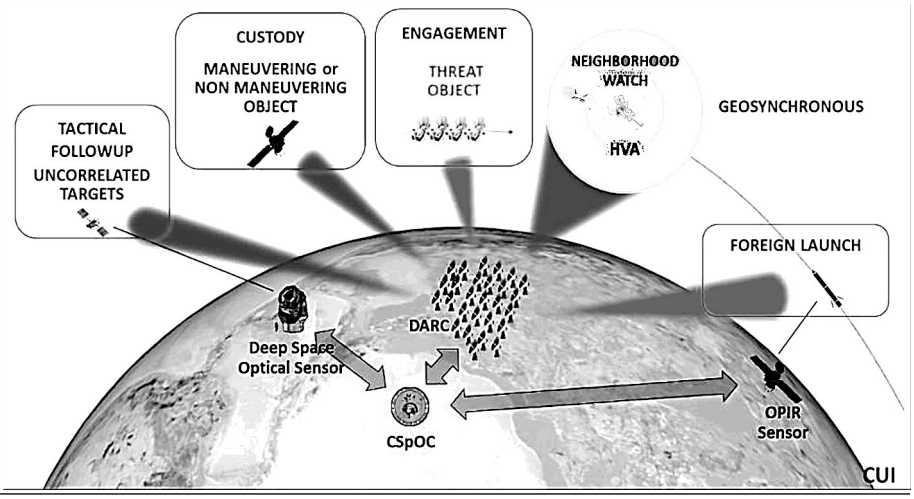
Russia experimented with anti-ballistic missile/anti-satellite systems from the 1960s. These were shot at armoured target satellites in low orbit, designed to register the impacts and feedback data. The project was abandoned in 1983. Unlike a lightweight satellite, these armoured targets do not shatter upon impact.

The first country to develop and test a successful anti-satellite weapon against a real satellite was the USA. On 13th September 1985, an F-35 jet fired an ASM-135 anti-satellite weapon (or 'ASAT') from an altitude of just over seven miles. The missile destroyed a NASA satellite, the Solwind P-78 solar observatory, in low Earth orbit around 330 miles up.

After the destruction of the Solwind satellite, 267 fragments were tracked, some pushed into an orbit 300 miles higher than the satellite. Due to this relatively high orbit, the debris cloud created by the destruction of the satellite continued to orbit for another 20 years.

Two more successful tests of the ASM-135 missile were carried out, not aimed at satellites.

US Department of Defense DARC publicity material for contractors



A year later, in September 1988, the US tested another space weapons system, colliding two satellites together in low Earth orbit, as part of its *'Star Wars'* programme. Due to the concern about the amount of space debris created by the previous test, this test took place close to the atmosphere to reduce the spread of the debris.

China tested an ASAT against one of its large weather satellites on 11th January 2007. To date this was the largest-ever single 'fragmentation event' – generating over 3,000 pieces of debris. China has reportedly used ballistic target satellites in tests.

A year later, in February 2008, in *Operation Burnt Frost*, the US shot down a malfunctioning spy satellite with an ASAT – launched from the *USS Lake Erie* in the Pacific Ocean. As it was nearing re-entry most of the debris fell back to Earth.

Russia did not launch a successful ASAT weapons system, the A-235 'Nudol', until 2015.

What's curious is that in these stories about space weapons and threats, the country they leave off the list is India – who tested its own ASAT, code-named *Mission Shakti*, in March 2019. This generated over 100 fragments, but it was near to the atmosphere to reduce debris.

Sky News also covered Ben Wallace's visit, though it was even less informative. They interviewed Air Chief Marshall Sir Mike Wigston:

"I would say that we need to prepare for the potential to defend our critical infrastructure in space. Right now there are countries like Russia and China that are doing things, developing systems that are a threat to satellites."

The Sky News reporter continued:

"To help counter the threat, the US is planning to build three radar bases that can probe deep space. They'll be able to detect objects as small as a football up to 36,000 kilometres away… Britain says it is focussing on how to defend against space weapons, not build any of its own. But space is viewed as a war-fighting domain."

They also interviewed Ben Wallace, who said:

"I don't think it'd be a stand-alone war in space. And it wouldn't be like Star Wars, or Moonraker with lasers firing all over the place. I suspect in a major conflict space assets would be targeted. We have to now invest, and prepare today to make sure we have alternatives."

Of course, how do we 'defend our critical infrastructure' with a system which only watches? If Britain has no space weapons, what practical use is being able to see our space assets destroyed? Again, as with DARC, that part of the problem seems to be omitted from discussion.

It is true that Britain is not developing its own anti-satellite capabilities. What was not stated in those news items, but which was revealed by The Express in February 2021, was that British pilots are training to use American anti-satellite weapons on British aircraft:

"...pilots have been selected for training missions aimed at combating Chinese and Russian military and communication satellites in times of war. Simulated exercises are set to get under way before flying training exercises take place. Training flights without missiles would see Typhoon pilots fly to 40,000ft before embarking on a 20,000ft vertical climb. During a real-life attack they would target enemy satellites and release anti-satellite (ASAT) missiles at 60,000ft, before returning."

Currently the USA has the most advanced anti-satellite system. As demonstrated from past events, that system can be launched from the ground, or from a ship at sea. Recent media accounts would also indicate that the British military are training to use these same weapons from British aircraft.

If any of those systems were ever used in the most congested part of low Earth orbit, between 400 and 1,100 miles, at a time when even more satellites are being crammed into this space, it risks initiating a cascade event. At which point, can a *'space weapon'* be considered a *'weapon of mass destruction'?* Put simply, their 'space security' system actually endangers the use of space by everyone should it ever be put into action.

That is not the situation which was conveyed by the media in July 2021. Quite the opposite. What is clear from Ben Wallace's US visit is that the British Government is in an advanced state of planning to deploy American anti-satellite weapon systems for use by the British military; using Britain as one of the major operational hubs to run this global system. Forgive the pun, but we are being deliberately, *"kept in the DARC"*, about the facts of these systems and their safety.

No 'final frontier' for the military

Space represents one of the last truly global 'commons'. The *1967 Outer Space Treaty* prevents states laying claim to space, albeit that has not stopped certain states trying to roll-back those restrictions for certain commercial activities. Just like common land, the treaty permits the use of the 'void' of space, and prohibits the assertion of national sovereignty on natural moons or planets.

The problem with the treaty is that, created in the early years of the space race, it's vague and out of date. In particular, while it prevents weapons of mass destruction in space, the wording of that is vague in the context of today's weapons systems.

In 2002, Russia and China jointly submitted a proposal for a *Treaty to Prevent the Deployment of Weapons in Outer Space, the Threat or Use of Force Against Outer Space Objects*. An updated treaty was submitted by Russia and China in 2008, and a third in 2014. In 2017, following a review by the General Assembly, a proposal was made to ban an arms race in space. The first step was to convene a group of experts to review the existing treaty framework and make recommendations to update and extend that system to other space weapons. In October 2017 the USA, backed by the UK, opposed this and it was defeated. These are exactly the same wrecking tactics which the US and UK tried to use against the recent *Treaty on the Prohibition of Nuclear Weapons*.

Just as the US and UK have consistently stalled the obligation under the *Nuclear Non-Proliferation Treaty* to negotiate disarmament – which Britain is in breach of with the proposals to enlarge the stockpile of warheads – so the US and Britain have opposed moves by China and Russia to negotiate a new treaty banning weapons and offensive actions in space.

Therefore, Ben Wallace, in stating the 'threat' to space that China and Russia represented, without acknowledging the previous history of space militarisation and UN negotiations, was deliberately misleading the public as to past events relating to these issues – and deflecting any discussion about the USA and UK's opposition to a UN process that would prevent the threats he was talking about.

The rationale for the militarisation of space is that one state (the USA) must have 'dominance' over it to prevent it being denied to them by another state. The reality, though, is that as the number of satellites in low Earth orbit grows exponentially, any military action in space has the potential to create a cascade reaction, destroying many essential civilian satellites in orbit belonging to non-combatant states, and denying access to space to all nations for decades or even centuries.

The ultimate truth is that the US and UK governments, by their actions in preventing negotiations through the UN, while simultaneously stoking an arms race in space, are *'weaponising space junk'*: Under the guise of tracking space debris, they are constructing a system whose primary purpose – as stated in the budgetary statements for it – is to function as the targeting system for offensive space weapons; and to dominate space by preparing plans for 'war-fighting' there.

Though no state can have sovereignty or control space, the struggle to assert military control over it threatens the use of it by all nations. That our species can litter, pollute, and so ultimately deny our use of space is just a small facet of the greater ecological crisis today. With space, though, militarisation acts as a barrier to solving that greater ecological crisis. It is a reflection of old political fights on Earth which have no relevance to – and actually exacerbate – the global ecological crisis.

Therein lies the contradiction which must prohibit the militarisation of space: *The military of any state cannot be allowed to have dominance in space, since any action to create 'security' could lead to an escalating cascade that would deny access to all.* And due to the high risk, even single use of an anti-satellite weapon could lead to widespread destruction targeting essential civilian and non-combatant infrastructure – which is the very definition of a 'weapon of mass destruction'. Any system which is essential in the preparation, launching, and guidance of such weapons – such as the *Deep Space Advanced Radar Concept* – must be considered to be equally reprehensible as the weapon itself.