

**Written Evidence Submitted by Dr. Michael Mulvihill and Chloë Barker,  
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(SPA0038)**

Dr Michael Mulvihill and Chloë Barker are researchers working the UKRI/AHRC-funded project *Turning Fylingdales inside out: making practice visible at the UK's ballistic missile early warning and space monitoring station* (AH/S013067/1).

**Who we are and why we are submitting this response.**

We are making submission to the Parliamentary inquiry into *UK Space Strategy and UK satellite infrastructure* as researchers working on a major UKRI-funded research project on RAF Fylingdales, the UK's ballistic missile early warning and space monitoring station.<sup>1</sup> Our submission focuses on the aims and focus of a new UK space strategy, and on necessary action to ensure that the UK has an appropriate space and satellite infrastructure to meet future applications and requirements.

To address these questions, we draw upon our experience of establishing the Fylingdales Archive in partnership with RAF Fylingdales and English Heritage, at the RAF Fylingdales station in North Yorkshire. The archive will be an online resource that will make public documents, photographs and artefacts that have been amassed by RAF Fylingdales since becoming operational during the Cold War in 1963. The work also draws upon practice-led doctoral research by Dr Michael Mulvihill.<sup>2</sup>

Our research responds to the fact that there exist little in the way of public awareness of the work that RAF Fylingdales carries out, both in terms of the station's contribution to maintaining the US-UK nuclear deterrent through its Ballistic Missile Early Warning mission, and in terms of the station's day-to-day task of providing space tracking services to government and non-government space agencies to sustain safe and secure operations in Low Earth Orbit (LEO). Our point of view has been maintained by the omission of RAF Fylingdales's space missions from several recent policy documents, the most prominent of these being *Global Britain in a Competitive Age: The Integrated Review of Security, Defence, Development, and Foreign Policy* (CP403, 2021). This submission therefore addresses the above questions by providing an overview of over 50 years of UK space operations carried out at RAF Fylingdales and makes recommendations for this experience to contribute to future-proofing space and satellite infrastructure.

**“Everything in Orbit looks like a nuclear warhead”**

RAF Fylingdales, situated on the edge of the North York Moors between the towns of Whitby and Pickering, operates a Solid State Phased Array Radar (SSPAR). As of April 2021, RAF Fylingdales now

<sup>1</sup> <https://fylingdalesarchive.org.uk/>

<sup>2</sup> Mulvihill, M. (2019) *The Four Minute Warning Drawing Machine: Revealing the Assemblages of Nuclear Deterrence*. The thesis was the basis for BBC Four's Arena film *A British Guide to the End of the World* broadcast first in November 2019, that prominently features RAF Fylingdales. We have also published findings from our archive work at Fylingdales in the photo essay 'Returned to Ground' in *The Modernist* magazine (June 2021) and '[Purple Haze: The psychedelic sound of nuclear deterrence](#)' for *Inkstick Media* (February, 2021).

operates through a partnership between UK Space Command and Space Delta 4 of US Space Force. The primary mission of this partnership has been to watch for signs and provide warning of Intercontinental and Submarine Launched Ballistic Missiles (ICBM/SLBM) being launched against the United States, United Kingdom and NATO Allies.<sup>3</sup>

However, what is often not appreciated by policy, campaign, and military communities is that the early warning mission depends upon the keeping a careful catalogue of all objects in and launched into LEO. To quote a retired Space Operations office from RAF Fylingdales “unless we know what it is, to the radar everything in orbit looks like a nuclear warhead.” Consequently, RAF Fylingdales contributes to the United States Space Surveillance Network (USSSN) operated by NASA and US Space Force.

Daily, the SSPAR at RAF Fylingdales tracks and provides collision warnings for around 2000 operational space craft in LEO. These craft consist of infrastructure for maintaining civilised life on Earth, encompassing communications and navigation functions, and human-crewed craft such as the International Space Station, Soyuz and the Space X Dragon capsule. Crucially, RAF Fylingdales also tracks 30,000 pieces of space junk larger than a cricket ball that has amassed in LEO since the launch of Sputnik 1 and comprises defunct satellites and debris from space launches. Collision between any of these fragments and operational satellites and craft poses a serious risk to LEO space operations with the potential to cause catastrophic disruption to life on Earth.

### **Half a century of space operations on the North York Moors.**

Ever since RAF Fylingdales became operational on September 17<sup>th</sup> 1963, space operation crews at RAF Fylingdales have been trained to identify and distinguish the signal of a threatening nuclear weapon from the space operating environment of LEO. RAF Fylingdales space operation crews are aided in their task by civilian SERCO Space Analysts who provide real-time identification of anomalous objects. SERCO was established to operate and maintain the radar at RAF Fylingdales in 1987 by way of a management buyout from Radio Corporation of America (RCA GB) Service Company. This ensured continuity of service as RAF Fylingdales upgraded from the original tracker radars with their distinctive “golfball” radomes, to the SSPAR radar that became operational in 1992.

RCA had been responsible for the construction of RAF Fylingdales and its sister BMEWS stations at Thule, Greenland, and Clear in Alaska during the late 1950s and early 1960s. BMEWS was a direct response to the launch of Sputnik on the 4<sup>th</sup> of October 1957. In January 1958, the BMEWS programme was approved by US congress, and in late 1959 the Ministry of Public Works and Buildings cleared a site on the North York Moors for engineers of RCA Great Britain to begin construction of RAF Fylingdales. RCA GB system engineers developed and maintained RAF Fylingdales’s subsystems including the Satellite Information Program, devised by RCA programmers Hannah F Duncan and James J Duncan, which allowed the radars at RAF Fylingdales to acquire space-object information from the USSSN, then known as USAF Space Track System.

Since that time LEO has become an increasingly crowded and is set to become a complex environment. The Oneweb fleet has recently surpassed 200 satellites,<sup>4]</sup> and in the next ten years Space X alone aims to launch 12,000 microsat systems to support the Internet of Things

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<sup>3</sup> RAF Fylingdales also provides warning of reconnaissance satellites positioning to observe submarines of the UK Continuous at Sea Deterrent leaving their basing at HMNB Clyde.

<sup>4</sup> [OneWeb surpasses 200 satellites with Soyuz launch – Spaceflight Now](#)

infrastructure.<sup>5</sup> [ref:] There is a proliferation of new launch systems by a variety of non-governmental space operators such as Virgin Galactic and Orbital Express Limited. Into this environment in addition is the expressed intention by several state actors to deploy space and anti-satellite weapon systems.<sup>6</sup> Commentors have expressed concern that these weapon systems could be indistinguishable from proposed solutions for extracting space junk from orbit.<sup>7</sup>

### Meeting the challenges

Since the very beginning of the Space Age, RAF Fylingdales has met the space domain aspirations set out in the 2021 Integrated Review, namely to

Develop [...] critical space capabilities for military and civil use, including Space Domain Awareness, which uses integrated in-space and ground sensing to track space debris, investigate incidents in space, and detect, anticipate and attribute hostile activity. (Integrated Review page 58)

RAF Fylingdales has been a significant government, service, and technology employer in the Northeast of England. SERCO can attribute its origins to RAF Fylingdales and computer systems engineering developed for space tracking operations migrated into companies such as British Steel, and transport system such as the Tyne and Wear Metro. Recently, former space operation crew members have established their own boutique Space Situation Awareness company NORSS, with an operations hub in Durham.

RAF Fylingdales itself through the work of their Media team continue to make the work of the station visible to the public. This transparency followed historic tensions with campaign groups such as CND Yorkshire in 2003 that were prompted by an upgrade to the SSPAR completed in 2007.<sup>8</sup> Through engagement and communication RAF Fylingdales relations have greatly improved with the local community and authorities. RAF Fylingdales Station personnel have also championed the UK's enduring role in the space environment through conferences and other high-level public engagement events.

Nevertheless, as researchers with detailed knowledge of RAF Fylingdales, we fear that the accumulated space operations skills and experience amassed RAF Fylingdales could be overlooked because of the continued invisibility of RAF Fylingdales in space policy discussion. This invisibility could be compounded as a reflection of the aviation rather than space domain backgrounds of the leadership in the UK Space Command and Space Directorate,, which reflects Royal Air Forces promotion structures.

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<sup>5</sup> [Musk says SpaceX is 'fixing' brightness from satellites - BBC News](#)

<sup>6</sup> [Death from Below: Anti-Satellite Weapons and the Current Outer Space Security Crisis : OPR \(oxfordpoliticalreview.com\)](#)

<sup>7</sup> [Making a Moral Case for Nonconflict in Space: Expanding Strategic Norm to Taboo > Air University \(AU\) > Article Display \(af.edu\)](#)

<sup>8</sup> The upgrade was to enable RAF Fylingdales to supply data to the US National Missile Defence Network. However, since assets such as the Ground Based Inceptor missiles were removed from their bases in Poland by the Obama Administration in 2009. This system is now concentrated on threats from North Korea over the Pacific Ocean with data is supplied by radar on the West Coast of America. Protests were exacerbated by the closure of a public right of way following the attack on the World Trade Centre attacks, without the knowledge of the North Yorkshire Park Authority.

## **Recommendations**

We recommended

1. Greater visibility of RAF Fylingdales' role in the history of space operations, to better inform the public, policy communities, and the UK government.
2. Increased focus on how the lessons of over fifty years of space domain operational experience at RAF Fylingdales can be incorporated into the leadership expertise of the UK Space Command and Directorate.
3. Clearer objectives and communication to public, policy and campaign groups when developing infrastructure or upgrades at RAF Fylingdales that draw upon archival accounts of lessons learnt from site security.

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