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Exploring Near Space: Myths, Realities, and Military Implications

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The recent shooting down of a Chinese high-altitude balloon that drifted over the US airspace has brought the spotlight on the region of the upper atmosphere, which is relatively underutilised. As aerospace technology develops, air-planes are flying higher, while at the same time, satellites are exploiting the lower orbital regions. Effectively, the previously underutilised region of the vertical dimension, which lies sandwiched between the atmosphere and orbital space, is shrinking and has now become a much-desired zone for the armed forces. This region, which lies between 20 to 100 kilometres, is commonly referred to as the 'Near-Space' region.[1] While space law experts disagree with the use of this term, this region is an emerging battlefield, and terming it 'near-space' accrues some benefits for the military.

Why do we want to be in near-space? Is it to achieve specific goals or enhance our capabilities? This exploitation of near-space cannot be viewed in isolation. Significant capabilities have already been established that enable armed forces to operate through the Low Earth Orbit (LEO) region. Near-space can augment and support military applications like surveillance and reconnaissance, communication, and many other applications. Capabilities developed in near-space will have to be integrated with those of LEO and the airspace region. Long-range weapons, such as missiles, have always transited through this region. With other aerial platforms now entering near-space, what are the likely complications that emerge, and how are they to be dealt with?

Although the term 'Near-Space' is an American jargon, the potential for near-space platforms to provide some of the same capabilities as space-based platforms, at much lower costs and with

greater flexibility and persistence, is reason enough to consider the near-space region for military effects. This would contribute to an operationally responsive space capability.

Lighter-than-air vehicles operating in near-space could provide the capabilities that are demanded by the armed forces, albeit with the added advantage of having the liberty of going into enemy airspace without being detected. Communications, network relays, and Intelligence-Surveillance-Reconnaissance (ISR) capabilities could be effectively achieved through near-space. These lighter-than-air vehicles could include balloons, airships, high-altitude drones, etc. The key advantages lie in the persistent loitering ability and survivability of these platforms while escaping detection in covert missions.

Despite the overwhelming benefits of the military exploitation of near-space, some key issues remain unaddressed, as mentioned below:

(a) Demarcation and sovereignty of the near-space region.
(b) Traffic management and collision avoidance.
(c) Integration of airspace and space.

Demarcation and Sovereignty of the Near-Space Region

As regards the extent of sovereign airspace and the near-space region, two fundamental questions arise. Firstly, why is near-space region being called so when it is not space? Secondly, why is the demarcation between airspace and space set at 100 km? Neither of these practices is internationally accepted; rather, they have emerged out of convenience to escape the sovereignty issue with airspace for operating high-altitude platforms beyond the limits of geographical boundaries. In fact, near-space is not space, even though it is being termed as such. If we stop thinking of near-space as space, many issues on regulations will be resolved.

Near-space is not technically space. It is the upper atmosphere. The International Civil Aviation Organisation (ICAO) Convention on International Civil Aviation, also called the Chicago Convention of 1944, states that every state has complete and exclusive sovereignty over the airspace above its territory.[2] The extent of airspace in the vertical dimension is an undefined quantity in legal terms. Hence, it is an accepted norm that airspace would extend up to the limits of space, as nothing exists between airspace and space. Therefore, near-space is the unused upper atmosphere or the airspace where aeroplanes cannot fly owing to the rare density of air. This is an unregulated airspace and can be used by military aeroplanes only.

The boundary between airspace and space is deemed to be the upper limit of airspace or the lower limit of space. However, the existing regulations and treaties are silent on this crucial definition of where space begins. The Kármán line at 100 km is the most commonly accepted demarcation between airspace and space, though the US National Aeronautics and Space Administration (NASA) favours a boundary at 80 km altitude.[3] This understanding of the demarcation between airspace and space has vast implications for airspace regulations as well as space regulations.

It is not science but law that has to decide on where space begins. While many theories have been propounded on this subject, some practical approaches need to be considered. One such approach is to limit airspace up to the highest altitude that can support flight. The second is to have the lowest orbital altitude as the beginning of space. However, there are many indispensable factors that suggest the need to have a buffer zone between airspace and space. Firstly, orbiting is possible only above 160 km, but practical orbits with sufficient orbital life of satellites would be possible only above 200-250 km. Also, the upper atmosphere will increasingly be used as future technologies would support high-altitude aviation. Any traffic transiting between airspace and space, either after launch or on re-entry, would have to pass through the entire range of aviation flight bands. Hence, having a buffer zone between 50 km to 150 km is essential to de-conflict and restrict aviation to lower altitudes (below 50 km). This will also make the implementation of airspace and space regulations a less daunting task.

Sovereignty of airspace is a necessity for Air Defence, but it cannot extend up to the undefined limit of space. The Chicago Convention, as well as the Outer Space Treaties, need a relook, as the effects of undefined limits impact the regulatory processes for Insurance, taxation laws, arbitration, as well as command and control for military activities in this region.

Traffic Management

The near-space region poses a very complex situation for traffic management. This is because the traffic being mentioned is not aircraft, but high-altitude platforms (near-space vehicles), transiting traffic like space launch vehicles going into space and spacecraft returning from space, reusable launch vehicles, responsive and flexible launch systems, and space planes which could be operating in the near-space and lower orbital regions. The situation is complex because these altitude bands in the upper atmosphere will be utilised for military purposes on dual-use platforms. Most missions will be covert, which hinders the identification and deconfliction process. Also, the outbound and inbound traffic to space is set to increase in the coming years, and we may see simultaneous space

transportation activities from multiple places around the globe. Adding to the surveillance nightmare is the presence of stratospheric balloons and the relative ease with which they can be launched and recovered, even by amateurs. The regulatory framework and operating rules for this kind of activity in the near-space region are yet to evolve. Moreover, large surveillance gaps exist, not only in the geographical extent of radar coverage but also in the vertical extent. Near-space awareness is going to become as critical for safe operations as space situational awareness.

Integration of Airspace and Space

The atmosphere, where airspace exists, and space are two distinct mediums with diverse physical properties. It is not possible to have a regulatory coherence between two substantially different mediums. This is perhaps the reason for having a different set of regulations and laws for airspace and space. It is a flaw to apply the laws governing space activities to the near-space region.

It is, therefore, practically impossible to integrate airspace with space without riders. To consider an integration of both these mediums, one must look at the operational imperatives necessitating such an integration. The immediate necessity is to have operational continuity in surveillance, tracking and engagement for objects transiting from the sub-orbital regions into the upper atmosphere for air defence and missile defence. Integration is also required to have continuity for the deconfliction of traffic in this region to prevent collisions. Therefore, while an Air Force may find an operational convenience in gaining continuity, the same is not the case with civilian use of airspace and space.

Hence, the orbital space is beyond reach, and we only need to consider the integration of the sub-orbital space with the upper atmosphere, which is being called near-space. This needs to be addressed at an organisational and operational level. Effectively, we are saying that airspace already exists up to the limits of space defined by the Kármán line. We need to expand our understanding and utilisation of airspace. For operational continuity, sub-orbital space should be integrated with the airspace and managed by the same entity as airspace.

Conclusion

The upper atmosphere is fast emerging as a vital resource for military applications. Advancements in aerospace technologies are enabling the exploitation of the unused portion of the airspace, which is the upper atmosphere. This region is being termed as 'near-space', even though it is not a known region of space. Such a nomenclature of the upper atmosphere has implications for the sovereignty of airspace, which is deemed to exist up to the commonly accepted demarcation between airspace and space. In reality, near-space does not exist. The unutilised upper atmosphere is, in effect, a sovereign airspace till the geographical limits of a State and international airspace beyond the sovereign limits.

The use of the upper atmosphere is beneficial for military applications, which are being derived through satellite services. High-altitude platforms provide most of the benefits of satellites, with the added advantage of providing persistence as they do not orbit. However, the use of high-altitude platforms in this region has several implications in terms of the safety of traffic transiting through the upper atmosphere and the inadequacy of regulations governing the use of near-space.

Misidentifications can lead to hostile situations, resulting in conflicts. Most high-altitude platforms are dual-use systems, hence civilian assets are also under threat of military action. Amongst the many challenges of operating in the upper atmosphere is the issue of inadequate surveillance, which makes it ideal for covert military operations but also creates a nightmare for traffic management.

There is an urgent need to evolve norms of behaviour for the so-called near-space region. It is also a critical juncture to define the limits of airspace and space. A buffer zone between airspace and space with distinct operating rules would rule out any misunderstandings in interpretation.

(Disclaimer: The views and opinions expressed in this article are those of the author and do not necessarily reflect the position of the Centre for Air Power Studies [CAPS])

NOTES:

[1] Hampton Stephens, 'Near-Space', *Air & Space Forces Magazine,* July 01, 2005, https://www.airandspaceforces.com/article/0705near/#:~:text=The%20Air%20Force's%20operating%20domain,spacecraft%20orbits%2022%2C000%20miles%20up. Accessed on March 31, 2024.

[2] International Civil Aviation Organisation, 'Convention on International Civil Aviation - Doc 7300', https://www.icao.int/publications/pages/doc7300.aspx. Accessed on January 20, 2024.

[3] "Karman line", Britannica, https://www.britannica.com/science/Karman-line. Accessed on March 30, 2024.