

## A TAXONOMY FOR MILITARY SPACE OPERATIONS

Michael R. Frater and Michael J. Ryan<sup>1</sup>

**Abstract.** Since dominating the high ground has always been of considerable interest to warfighters, it follows that future warfare will be dominated by the ultimate high ground—space. The most significant problem plaguing terrestrial-based communications, surveillance and weapons systems is that they are often constrained to line-of-sight, which is limited to very short ranges, particularly when the land platform is at low heights. Space-based systems offer enormous potential as platforms for repeating communications, conducting surveillance and supporting navigation over vast areas compared to terrestrial-based systems. One of the difficulties with operations in space is the general lack throughout the world’s defence forces of an agreed taxonomy. While doctrine (such as US Joint Publication JP 3-14 *Joint Doctrine for Space Operations* [1]) and agreed terms do exist for a number of areas of space operations, the taxonomies provided tend to be focussed on particular areas and defined around existing systems and applications. There is therefore a need for a comprehensive top-level approach to the description of the constituent elements of space operations. An important characteristic of this description is that it needs to take into account the impact of space on the providers of space services, as well as the users of these services, and the impact of space on other battlespace entities that are not direct users of space. This paper therefore proposes a taxonomy for military space operations.

### INTRODUCTION

Since dominating the high ground has always been of considerable interest to warfighters, it follows that future warfare will be dominated by the ultimate high ground—space. The most significant problem plaguing terrestrial-based communications, surveillance and weapons systems is that they are often constrained to line-of-sight, which is limited to very short ranges, particularly when the land platform is at low heights. Longer ranges require communications, surveillance and weapons systems to be mounted at higher elevations—hence the interest in space.

Space-based systems offer enormous potential as platforms for repeating communications, conducting surveillance and supporting navigation over vast areas compared to terrestrial-based systems. For example, the coverage of a terrestrial military transmitter is of the order of some 15 millionths of a percent of the Earth’s surface; a transmitter from a geostationary satellite can cover approximately 42%—some 3 million times more [1].

The impact of space on future warfare is therefore very significant. First, commanders can obtain considerable advantages by mounting communications, surveillance and weapon systems on space-based platforms. Second, forces are increasingly vulnerable to the significant improvements in communications, surveillance and weapons capabilities offered to an adversary who can also operate space-based systems.

One of the difficulties with operations in space is the general lack throughout the world’s defence forces of an agreed taxonomy. A taxonomy organises a body of knowledge into an ordered hierarchical classification—of organisms, soils, music, software, and so on. A taxonomy is useful in that it provides a universal system through which all involved can have a common frame of reference. For space operations a taxonomy is essential to help identify the relationships between elements to assist in analysing functionality, allocating requirements, managing procurements, developing doctrine, conducting training, and so on.

While doctrine (such as US Joint Publication JP 3-14 *Joint Doctrine for Space Operations* [2]) and agreed terms do exist for a number of areas of space operations, the taxonomies provided tend to be focussed on particular areas and defined around existing systems and applications. Figure 1 illustrates the taxonomy provided by the doctrine defined within the US joint doctrine JP 3-14. Note that the taxonomy does not distinguish between the provision of effects and means, and there is no coverage of important aspects such as the protection of battlespace assets from the effects of space-based capabilities.

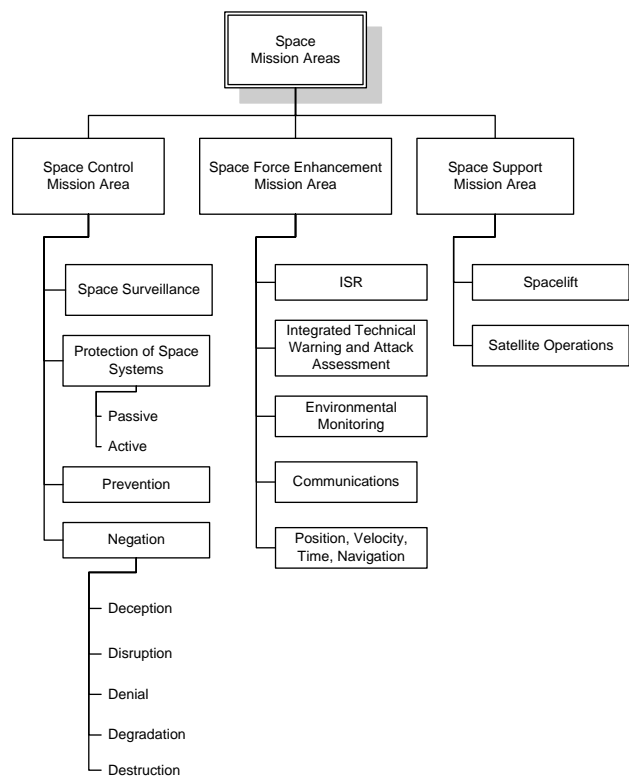


Figure 1. JP3-14 taxonomy for space mission areas. [1]

<sup>1</sup> School of Information Technology and Electrical Engineering, University of New South Wales, Australian Defence Force Academy, Northcott Drive, Canberra ACT 2600, Australia.