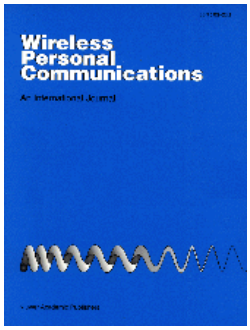

High Altitude Platform Station (HAPS): A Review of New Infrastructure Development for Future Wireless Communications

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Abstract This paper looks into the relatively new field of high altitude platform stations. HAPS is seen as a 'middle ground' between the terrestrial and satellite cases, and aims to exploit of the advantages of both types of system. Since HAPS is such a new field, this paper focuses on the technology behind a HAPS communications system, how this has developed, and compares it to the terrestrial and satellite equivalents. One important area that is being investigated is the applications for which HAPS should be used. This is a critical issue if a significant business case is to be made for HAPS. Worldwide HAPS projects and research issues are also highlighted. Finally, the review concludes with the remarks on the future of HAPS for wireless communications systems.

Keywords Wireless Communications - Broadband Wireless Access - Mobile communications - High Altitude Platform Station

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1. Introduction

The increasing demand for higher data rate wireless mobile communications services has accelerated the need to develop more innovative communications infrastructures. Terrestrial ground-based systems and satellite systems are the existing well-established ways of providing mobile communications services.

Terrestrial tower-base systems have advantages such as low-cost, low-power user terminals, short propagation delays and good scalability of system capacity. However, they have various disadvantages as well. The radio signal is subjected to high scattering and multi-path effects that affect the quality of service (QoS) delivered. Furthermore, as the base stations are dispersed over a wide geographical area, communications resources cannot be optimally utilised. In addition, it is expected that more infrastructure is required, as smaller cells will be required to provide high quality broadband services.

Although satellites can provide similar services with much less infrastructure and higher elevation angles, they have their own limitations. Geo-stationary satellite systems suffer large signal delays due to their large distances from the earth, while non geo-stationary satellite systems are more complex in design. Furthermore, high launching costs and limited orbit space lead to high connection costs.

An innovative way of overcoming the shortcomings of both the terrestrial tower-based and satellite systems, is to provide cellular communications via High Altitude Platform Station (HAPS) [1]. HAPS is defined in Radio Regulations (RR) No. S1.66A as "a station located on an object at an altitude of 20 to 50 km and at a specified, nominal, fixed point relative to the