Review Paper on Airborne Internet Access through Submarine Optical Fiber Cables

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Abstract— *Today is the era of high technology and information exchange world. Everyone is in need of sending or downloading a huge amount of data. Further being connected on the go and all the time is what people want today. Broadband and wireless connectivity in homes and offices is what being used by users that keep them wire free and make the accessibility easy and fast. Further to this providing a robust, fast and reliable connectivity network to the people on the go in vehicles and even aircraft is a challenge. In this paper we explore such a technology that talks about connectivity in aviation and aircrafts i.e. Airborne Internet. The idea is to take all the facilities and implementation of the ground networks and provide a high speed network connecting aircraft and ground.* [1]

Keywords—Airborne Internet, ANP, HALO, LoS.

I. INTRODUCTION

The need to hook up and exchange information everywhere and each and every time is the requirement of today's modern world. Everyone wants to get linked wherever each will go or move. Further to stay connected, the speed of exchanging data is of utmost importance as there is huge amount of information being exchanged in form of large measured audio, video, graphics, textual content and videos.

Furthermore to remain connected while moving is another |progression which makes use of broadband and wireless systems in home and office buildings giving a clutter free high speed network infrastructures to users of different domain, and age.[5][3]

Nowadays of online connectivity has become a basic necessity. The web has not only revolutionized traditional mailing, banking, commerce, and entertainment systems but also created new ways of information sharing and social networking. The advent of modern mobile communication systems has extended the provision of Internet to land mobile passengers. Passengers travelling in aircraft across the world likewise require the Internet service to utilize their traveling time for working online. While on-board, they can also enjoy their interpersonal, sociable and cultural life through chatting, |enroll in meetings through video and audio tracks conferences, use mail services, and surf the web.

Nevertheless, the provision of unlined Internet connectivity to airplane is a challenging job. Satellite links provides Net coverage in such remote distant areas; however, their services are still costly with low bandwidth and much longer delays. Fortunately, the fiber optical cables deployed across the oceans pass along the same busy air routes. These cables can be utilized as high speed Internet backbone for cellular Internet.

II. WHAT IS AIRBORNE INTERNET

The Airborne Internet is a proposed network in which all nodes would be positioned in aircraft. The network is meant to be used in aviation communications, navigation, and police work (CNS) and would even be helpful to businesses, personal web users, and government agencies, particularly the military.

For example, a mobile network may change military planes to work while not the requirement for a communications infrastructure on the bottom. Such a network may additionally enable civilian planes to repeatedly monitor every other's positions and flight methods.

The basic principle and plan of airborne internet is to supply an information channel in craft wherever the nodes of the network are connected in craft.[2][4]

III. EARLIER APPROACH

Aircraft acts as Airborne Internet Platforms (ANP). In the above figure there are five ANPs showing their circular path and coverage space. These ANPs communicates with each other so that they can provide uninterrupted internet facility to another aircrafts and these communication links are shown using dotted black lines. These hubs are connected with each other using a star topology. In the figure we have three fighter planes which are moving through the area and network are going to be provided by the hubs ANP1 to ANP5. Whenever these planes pass through the trail, they cross through coverage space of

various ANPs but network will be continuously provided even though these planes are moving from coverage space of one ANP to a different ANP. The transition between ANPs is incredibly swish and uninterrupted. [1]

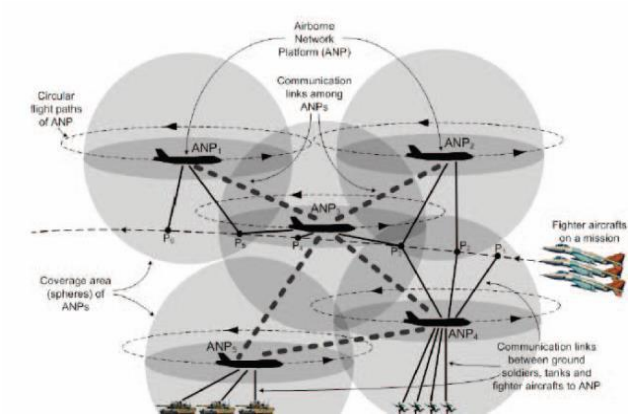


Fig.1: Schematic View

This design uses HALO (High Altitude Long Operation) Aircraft as a hub. First HALO aircraft was created by a NASA which was named as Helios Aircraft. Parameters of HALO aircraft are shown.

Topology	Star topology to connect hubs
Area Covered	75b miles
Flying height of Aircraft	51,000 ft (15,500 m)
Frequency	28-38 GHz

IV. PROPOSED COMMUNICATION NETWORK DESIGN

The submarine optical cables are deployed across the oceans pass on a similar busy air routes. These cables are utilized as high-speed net backbone for wireless net access to the craft. Dedicated ships stationed on these submarine glass fiber cables are exploited to supply net, security, and navigation services to aircrafts and ships.

The projected airborne internet service avoids expensive satellite links and successively improves the net user capability enormously.[2][4]

A. What is submarine optical fiber cable?

A submarine communications cable is a cable which is laid in the ocean bed between land-based stations to carry telecommunication signals across stretches of ocean and sea. Modern cables are usually one inch (25 mm) in diameter and weigh around a pair of 5 tons.

B. Brief Introduction

The operation, maintenance, and servicing of the submarine cables is performed using service ships. Similar ships are often stationed within the ocean and connected to the Internet backbone via the submarine fiber cables. Other than these ships, infrastructure put in on remote oceanic islands will function base stations (BSs). These ships will then be dedicated to function BSs for not solely providing web to alternative freight ships [denoted as oceanic stations (OSs)] and craft [denoted as ASs)], but also providing navigation services. These dedicated ships will be placed at uniform distances from each other on any of the high-capacity submarine optical fiber cables.

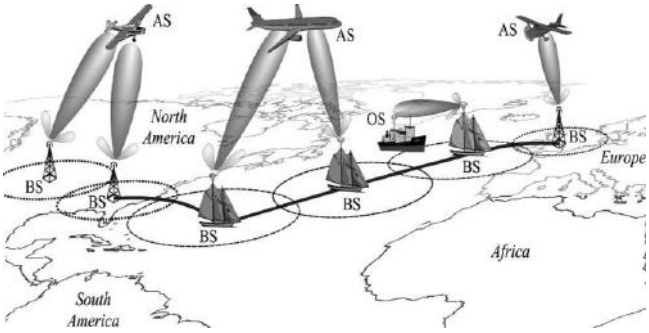


Fig.2: Airborne Internet access through stationary ships stationed along submarine optical fiber cables.

a. LoS Channel

The communication channels between BS and AS, as well as between BS and OS, being terrestrial and oceanic propagation environments are typically unclogged clear line of sight (LoS) channels.

The communication, on the far side the LoS range suffers severe degradation attributable to the absence of rich scattering atmosphere.

Thus, we can calculate maximum LoS communication range ($r_{c,\,max}$) using radius of the Earth and the altitude of the flying aircraft by using following formula

$$r_{c,\max} = \arccos\left(\frac{r_e}{r_e + h_a}\right)\frac{\pi r_e}{180^0}$$

Where,

re is the radius of the Earth and ha is the altitude of the flying aircraft. All the aircraft are assumed to be flying at the same altitude, taken as ha = 10.688 km, and radius of Earth is 6378.137 km.

Therefore, by substituting value of re and ha in the equation, we get rc, max = 368.98km.

Thus each BS is supposed to provide Internet coverage to a cellular region of radius 368.98 km.

b. Transmitted power

Minimum received power required to maintain the up/downlink connection pth = –100dBm

Thus transmission power required to cover the cell of radius 368.98 km is found to be 57.8 dBm.

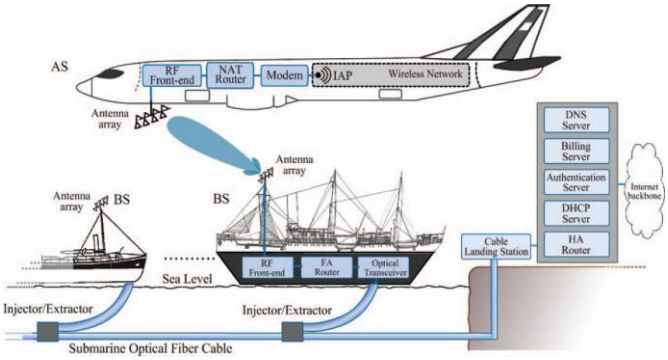
Furthermore, by means of using smart antennas with

incredibly directional profits, power requirements can considerably be decreased. Therefore, BS and AS are assumed to be equipped with planar smart antennas. These antennas are usually used to steer slender beams within the desired direction for A2G and G2A communication links with optimum received signal-to-noise ratio (SNR).

These antennas are capable of computing the precise direction of a signal's arrival in azimuth and elevation planes. The power needed on the base station ships by different appliances like communication system, terminals etc. are often generated through windmills and periodic event stations put in on the ships.

C. Detailed design of communication network

Each BS transmits a beacon or pilot signal. Every aircraft passing through the coverage region searches for the pilot signals from the BSs. It then connects to a particular BS having the strongest pilot signals. the ocean BSs area unit connected to the submarine cable with the interface equipment denoted as "Injector/Extractor,". These connections are often put in by using the maintenance and installation tools on cableships. The injector/extractor maintains the capability of the prevailing optical fiber system while not interrupting the prevailing traffic. Multiple single-mode fiber signals will be inserted into and extracted from the most fiber cable.



V. CONCLUSION

Airborne internet is very much helpful in field of aviation services like craft observation and traffic management etc. It provides aircraft traveler to access the web at terribly high altitude. The planned technique uses the already deployed submarine cables for the web backbone for the dedicated ships stationed within the oceans to act as BSs. The planned resolution doesn't involve the expensive and high-delay satellite links, so it's a plus over the antecedently planned solutions.

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