**High Altitude Platforms**

**ABSTRACT:-**

High Altitude Platform Stations (HAPS) is the name of a technology for providing wireless narrowband and broadband telecommunication services as well as broadcasting services with either airships or aircrafts. The HAPS are operating at altitudes between 3 to 22 km. HAPS shall be able to cover a service area of up to 1'000 km diameter, depending on the minimum elevation angle accepted from the user's location. The platforms may be airplanes or airships (essentially balloons) and may be manned or un-manned with autonomous operation coupled with remote control from the ground. HAPS mean a solar-powered and unmanned airplane or airship, capable of long endurance on-station possibly several years.  
  
A high altitude telecommunication system comprises an airborne platform typically at high atmospheric or stratospheric altitudes with a telecommunications payload, and associated ground station telecommunications equipment. The combination of altitude, payload capability, and power supply capability makes it ideal to serve new and metropolitan areas with advanced telecommunications services such as broadband access and regional broadcasting. The opportunities for applications are virtually unlimited. The possibilities range from narrowband services such as paging and mobile voice to interactive broadband services such as multimedia and video conferencing. For future telecommunications operators such a platform could provide blanket coverage from day one with the added advantage of not being limited to a single service. Where little or unreliable infrastructure exists, traffic could be switched through air via the HAPS platform. Technically, the concept offers a solution to the propagation and rollout problems of terrestrial infrastructure and capacity and cost problems of satellite networks. Recent developments in digital array antenna technology make it possible to construct 100+ cells from one platform. Linking and switching of traffic between multiple high altitude platforms, satellite networks and terrestrial gateways are also possible. Economically it provides the opportunity for developing countries to have satellite-like infrastructure without the funds flowing out of the country due to gateways and control stations located outside of these countries.

**MOTIVATIONS:-**

- HAPS COMBINE BEST FEATURES OF SATELLITE AND FIXED WIRELESS ACCESS (FWA) SERVICES.

- A QUITE SHORT ROUND TRIP DELAY.

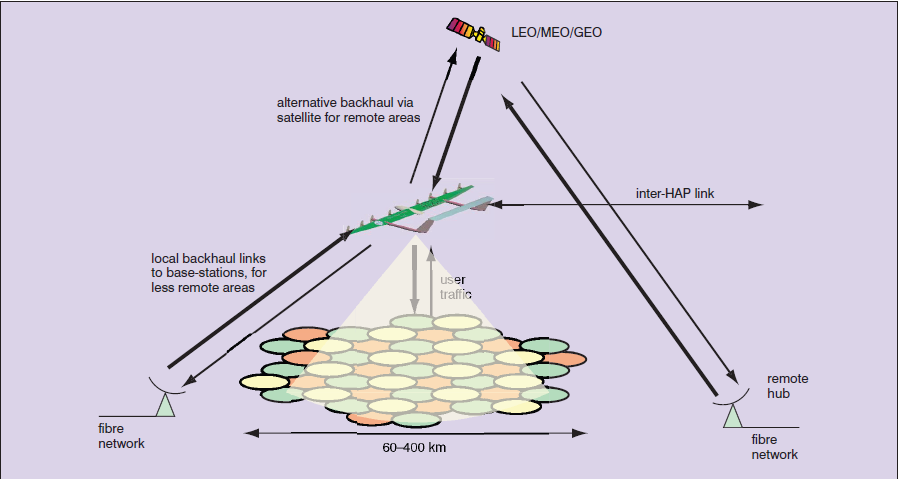
- A QUITE SMALL PROPAGATION LOSS.

- ONE HAPS CAN COVER QUITE LARGE AREAS.

- ENVIRONMENTALLY FRIENTLY SOLUTIONS.

- RE-USE.

- LARGE CAPACITY.



**HIGH ALTITUDE PLATFORMS, TECHNOLOGY:-**

* **AIRSHIP HAPS:-**

- VERY LARGE SEMI RIGID OR NON RIGID HELIUMFILLED CONTAINERS.

- LENGTH IS 100M OR MORE.

- ELECTRIC MOTORS AND ROPELLERS ARE USED FOR STATION KEEPING.

- PRIME POWER IS USED FOR PROPULSION AND STATION KEEPING AND ALSO

PAYLOAD AND APPLICATIONS.

- SOLAR CELLS MAY WEIGH TYPICALLY BELLOW 400g/m2.

- DURING THE DAY, POWER FROM THE SOLAR CELLS IS STORED IN REGENERATIVE.

FUEL CELLS SO THAT THE POWER CAN BE USED AT NIGHT.

- THE ACHHIEVABLE MISSION DURATION IS HOPED TO BE ABOUT 5 YEARS.

* **AEROPLANE HAPS:-**

- UNMANNED SOLAR-POWERED PLANE.

- IT IS FLYING AGAINST THE WIND OR CIRCULAR PATH.

- ENERGY IS A QUESTION.

- HELIOS PLANE (AERO VIRONMENT).

- ALREADY DEMONSTRATED (TO 25 KM ALTITUDE).

* **UAV, UNMANNED AERIAL VEHICLE:-**

- IT IS TYPICALLY UNMANNED AIRCRAFT, ONLY FOR A SHORT TIME MISSIONS.

- OPERATES NORMALLY AT A QUITE LOW ALTITUDE.

- MAINLY USED IN MILITARY PURPOSES.

* **A TETHERED AEROSTAT:-**

- THIS IS AN AIRSHIP ON A CABLE. LENGHT MAY REACH UP TO 5 KM.

**ADVANTAGES OF HAPS, COMPARED WITH THE TERRESTRIAL SERVICES:-**

* **REPLACE EXTENSIVE GROUND BASED INFRASTRUCTURE**.

- 1 HAP CAN PROVIDE MULTI CELLULAR SERVICES OVER LARGE AREAS.

- WE DO NOT NEED A LOCAL TERRESTRIAL BACKBONE.

- BACKHAUL CAN BE PROVIDED TO A PLACE WHERE FIBRE OPTICS ARE AVAILABLE.

* **BETTER PROPACATION IN MANY SCENARIOS (ALTITUDE ~22 KM)**

- LINE OF SIGHT PATHS

- RAIN MAY AFFECT THE HAP SYSTEMS LESS THAN TERRESTRIAL SYSTEMS

* **LARGE SYSTEM CAPACITY**

- USE OF MM BANDS (47/48 GHZ, 2X300 MHZ BANDS)

- FREQUENCY RE-USE

- FLEXIBLE AND ADAPTIVE RESOURCE ALLOCATION

* **RAPID DEPLOYMENT**

**ADVANTAGES OF HAPS, COMPARED WITH THE SATELLITE SERVICES :-**

* **LARGE OVERALL SYSTEM CAPACITY**

- SMALL SPOT BEAMS (CELLS) READILY FEASIBLY WITHOUT HUGE ANTENNAS ON BOARD.

-MUCH BETTER THAN GEO OR LEO SATELLITES

* **SHORTER PATHS => LINK BUDGETS BETTER**

- TYPICALLY ~ 34 DB BETTER BUDGES THAN LEO AND ~ 66 DB BETTER THAN GEO

* **LOW ALTITUDE => SHORT PATHS` LENGTH => LOW DELAY**

- NO PROBLEMS WITH PROTOCOLS? (TCP/IP)

* **LOWER COST**

- NO LAUNCH VEHICLE

- LESS DEMANTING THAN SPACE SYSTEMS

* **RAPID DEPLOYMENT**

- NO LONG LEAD TIME

-EASY UPGRATE AND MAINTENANCE

* **INCREMENTAL DEPLOYMENT**

- NEEDS ONLY ONE HAP TO START

* **ENVIRONMENTALLY FRIENDLY**

- NO LAUNCH VEHICLE/ROCKET

- SOLAR POWER

**HAPS, COMMUNICATIONS DESIGN ISSUES:-**

* **NETWORK TOPOLOGY**:

- HAPS CAN BE WORKED LIKE PROCESSING SYSTEM (OR SWITCHING) OR TRANSPARENTMODE.

- INTER HAP LINKS MAY BE ARE VERY FEASIBLE.

- BACKHAUL LINKS MAY BE A BIG CHALLENGE.

* **AIR INTERFACE AND PROTOCOLS**:

- BASIS IS IEEE 802.16, WHICH IS WIMAX STANDARDS.

- A MODIFIED VERSION OF THAT IEEE STANDARDS ARE USED MAY BE

REASON TO USE THAT IS:

• CAPACITY / USER

• CAPASITY / USED SECTOR

• MANAGEMENT OF USERS

• SECURITY QUESTIONS (DES AND AES ALGORITM ARE USED IN WIMAX)

• POINT-TO-MULTIPOINT USE