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REVIEW BASED ON AIRCRAFT TRACKING SYSTEM

Janmeet Kour
(University of Petroleum and Energy Studies, Aerospace Dept.)
janmeetmehta5@gmail.com

ABSTRACT

With the tremendous increase in technology, life is becoming easier for man. Man has developed so many techniques to save his time. One such innovation was made by the Wright brothers on December 17, 1903. They are known as the pioneers of aviation.Since the day aircraft was invented, many people have been working to make it better. One such innovation is the development of aircraft tracking devices. The tracking of an aircraft is made possible by fitting the airplane with a GPS (Global Positioning System) device. The GPS (Global Positioning System) satellite communicates with the ground server and passes the real time data on flight variables to the ground server. The server then works by storing the flight data. The information is transmitted to the telecommunication networks. These networks in turn interpret the information given by the server. Although these systems are really useful, there are some problems that are faced by the aviation industry. One of the major problems that today the aircrafts face is the loopholes in the aircraft tracking system. The disappearance of MH 17 made people to prompt on this problem. When an aircraft is flying over the ocean or Polar Regions, tracking it becomes difficult. While flying above the ocean or the Polar Regions, the pilot starts communication with the ground servers through High Frequencies (HF). Although these High Frequencies are not limited by the line of sight but they are shared.This isnot practical. To overcome this problem a system is being developed which will work on the foundation of installing receivers on the satellites. This system is expected to solve the problem and provide 100% global air traffic surveillance.

Keywords

GPS(Global Positioning system), HF(High Frequencies), global traffic surveillance, aircraft tracking system, real time.

1. INTRODUCTION

The Air traffic control (ATC) is used to direct the aircrafts from ground in the non-controlled airspace. The main purpose of the ATC is that it monitors and organizes the air traffic flow, prevents collisions and provides the important information to the pilot. The aircraft control tower is used to monitor and control the immediate airport environment. The ATC also performs a task of tracking of an aircraft. ATC works on the principle of the radar system to monitor and track aircrafts. The primary radar was developed in the early 1930's. The primary radar detects the approximate position of an aircraft by making use of the radio signals. The primary radar tracks the aircraft regardless of the fact whether the aircraft needs to be tracked or not. The secondary radar has a transponder and it relies on the targets that are equipped with the transponder. Unlike the primary radar, the secondary radar transmits the information in case of an emergency. The transponder also transmits the altitude and identity. The transponder is also known as transmitter responder. The transponder is arrayed in almost every commercial aircraft. The transponder after receiving the radio signal from the radar transmits a 4 digit code. The four digit code helps to identify the plane's identity and the speed and direction of the aircraft is also monitored by the radar stations. The information received is then transmitted to the air traffic controllers. There are many methods that have been devised to track the aircraft. One among them is installing a GPS device inside the aircraft. The servers on the ground communicate with the GPS satellites to extract the flight data. The flight data is stored by the servers and these servers transmit the data to the telecommunication devices. There are many telecommunication networks that are used to interpret information. The various telecommunication networks are ACARS, the transponder mode "S" (ADS) network, satellite networks like Globalstar, Inmarsat, IRIDIUM and Thuraya. ACARS (Aircraft communication Addressing and Reporting system) is a technology in which on board computers communicate with the computers present on ground. These computers provide the information about the health of the system. In ACARS radio and digital signals are transferred through satellites and they provide information about any minute fault in the aircraft. These devices although have proved to be beneficial also have their own flaws.

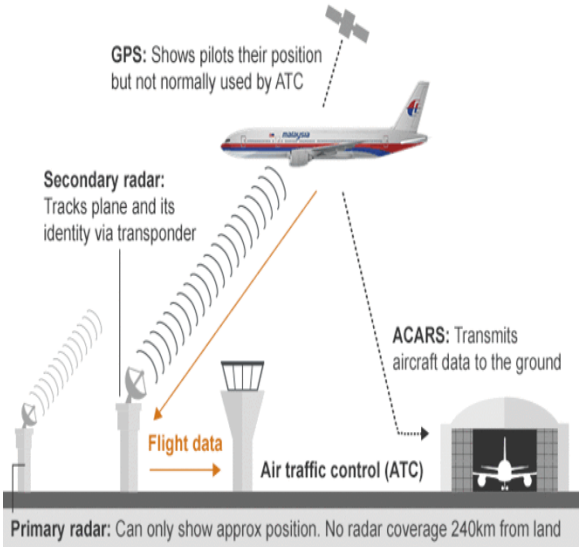

Fig 1: Air traffic control unit.

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2. ADVANTAGES

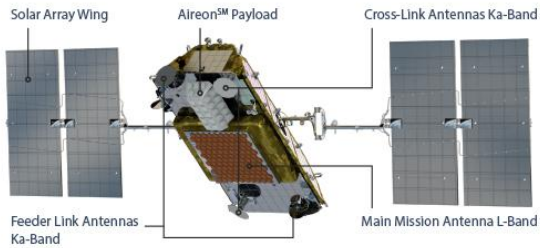
ACARS (Aircraft Communication Addressing and Reporting System) is a system of communication between the computers onboard and computers on ground. It helps in rectifying any major or minute faults.ADS-B (Automatic Dependent Surveillance-Broadcast) transmits accurate data. This reduces the airspace separation.The GPS aircraft tracking is used to track the trainee pilots. This method enhances the safety of the pilots. The aircraft tracking systems are used in emergency. In case of an emergency the secondary radar can transmit radio signals to the ground servers. The secondary radar also provides altitude and position of an aircraft.

3. DISADVANTAGES

The major disadvantage that the aviation industry is facing is that tacking of an aircraft is not possible in the real time till now. Commercial aircrafts transmit their GPS based position twice per second. This comes under the criteria of their Automatic Dependent Surveillance-Broadcast (ADS-B). The major problem related to this system is that it cannot provide the world wide receiver coverage because the frequency used by this system travels through the line of sight and not past the horizon. To provide coverage over large water bodies, large network of buoys will be required. The extravagancy of this project makes it difficult to be used in the industry. The information about the airplanes is constantly added by the airlines through satellite to the ATC. But as the air traffic has increased, uploading information about every aircraft is not practically possible. So, tracking becomes difficult.

4. METHODOLOGY

The new technology that has been devised to solve this problem is by employing the receivers on the Iridium Next satellites. Iridium Communications Inc. launched its first 10 satellites of the Next Constellation this year on 14 January. These satellites were launched in the lower orbit of the earth. These are the company's next-generation constellation satellites that will work in enhancing and replacing the existing work that is done by the low Earth orbital satellites that are spanning the whole globe. The First 10 satellites that were launched on January 14 this year were sent to 625 Km temporary parking orbit where these satellites will be tested. After completing the testing and validation, the satellites will be moved to the 780 Km operational orbit. The satellites in the operational orbit will be able to provide services to the Iridium customers. The new satellites will then be positioned near the current generation satellites. The Iridium's Next generation satellites will start taking over the services done by the old generation satellites. The communication links of Iridium from the nearby satellites will be repositioned to the Iridium's new Next generation satellites. The existing satellites will be de-orbited and de-boosted. The Iridium's Next generation satellites can also be used to enhance the tracking of aircrafts. By fitting specially designed receivers on the Iridium Next satellites, the 100 percent of the globe can be covered. The low latency 66 cross-linked Low Earth Orbit (LEO) satellite which is a part of Iridium's Next generation makes it possible to track the real time of an aircraft. The LEO satellites make the surveillance of global airtraffic easy. These LEO satellites will orbit approximately 485 miles above the earth. Each LEO satellite will be linked to four other satellites, where two satellites will be present in the same orbital plane and one will be present in the adjacent orbital plane, ensuring continuous availability everywhere on the planet. This configuration of satellites will allow the network to remain unaffected by any of the natural disasters like hurricane, earthquake and tsunamis. The unique orbital configuration allows the complete global coverage, including Polar Regions and oceanic regions. This network does not need the ground stations. The communication links between the inter satellites; will enable the real time delivery information the ATC.The 10 satellites were launched on a falcon 9, rocket.



Iridium NEXT Satellite Specifications

Deployed Wingspan	9.4m
Weight	860 kg (approx.)
Stowed Dimensions	3.1m x 2.4m x 1.5m

Fig 2: Iridium next Constellation specifications

5. CONCLUSION

The Iridium Next constellation will deploy a cross-linked Low-Earth Orbit (LEO) configuration. This configuration will provide 100 percent coverage of the earth's surface including the oceans and Polar Regions. Due to this configuration, tracking the real time of the aircrafts will be possible. This system can be modified and mutated into a more efficient and economic method.

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