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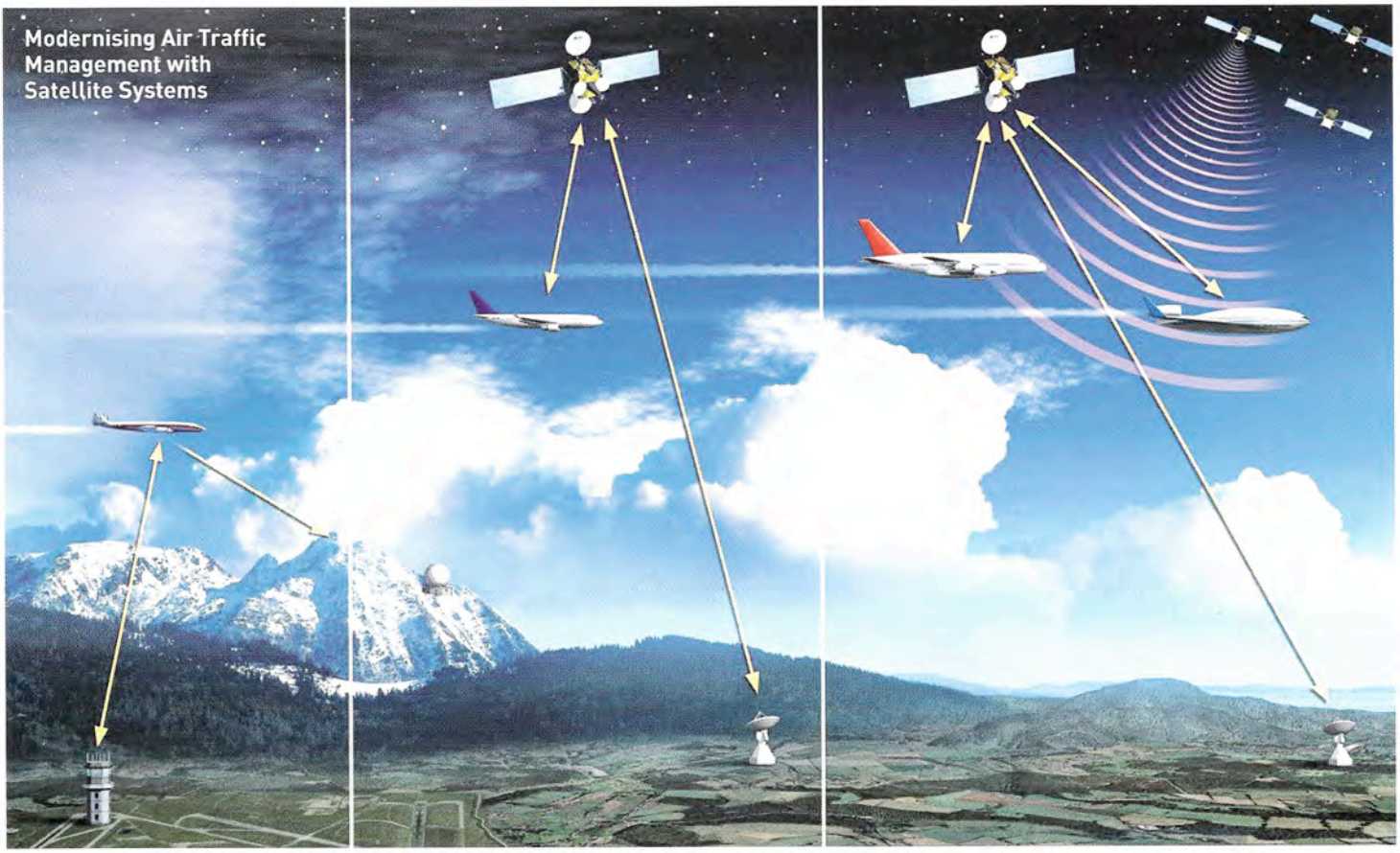
DWARKA: THE REALM OF THE LORD

CNS Safety: A challenging issue world wide



With developments in aviation with wide-bodies and supersonic aircrafts and high density of air traffic movement, there has also been a historical change in the Air Traffic Control System i.e. the Communication, Navigation, Surveillance and Air Traffic Management (CNS-ATM) System

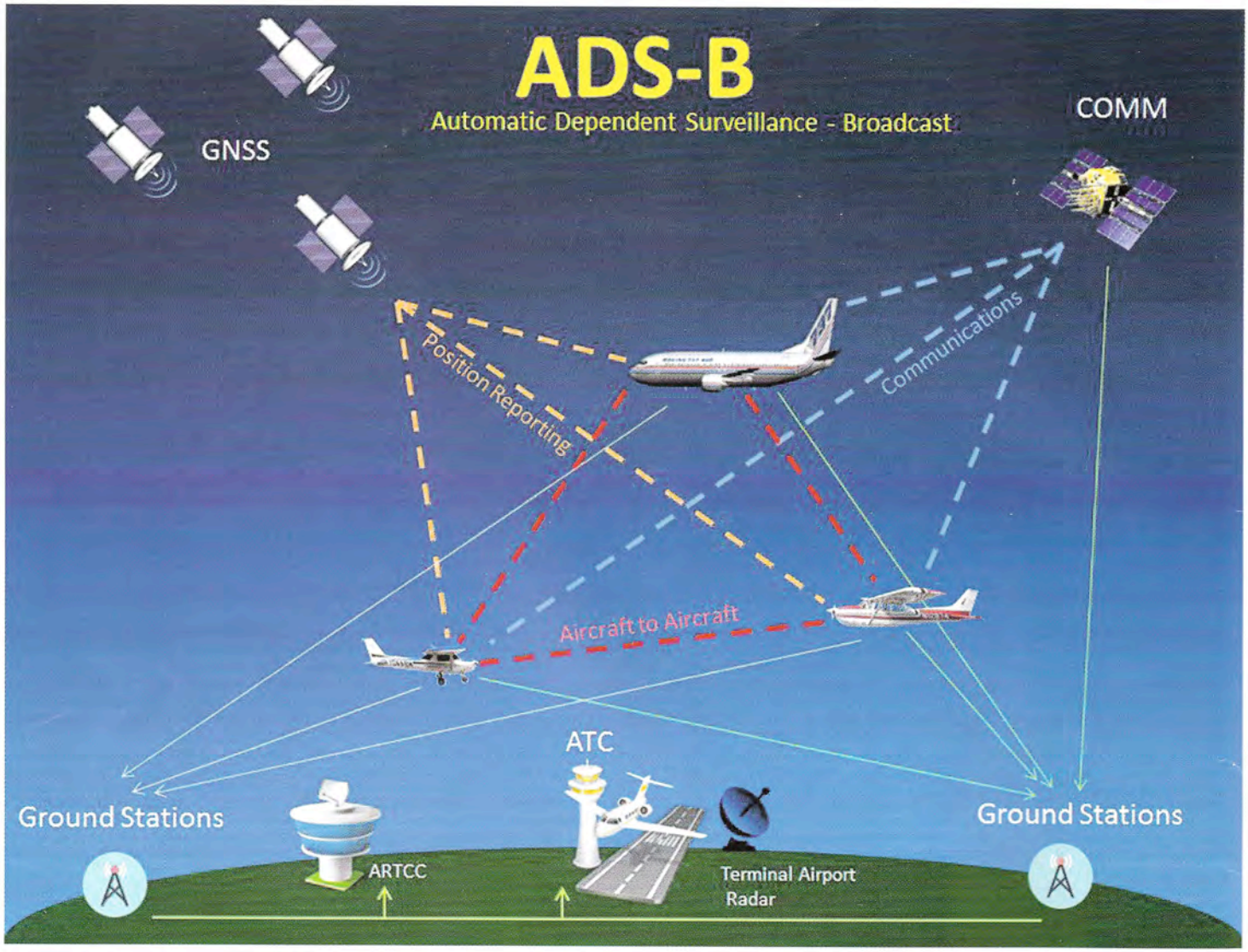
Aviation began with the lighter-than-air flight of a hot air balloon designed by the Montgolfier brothers. There are many competing claims for the earliest powered, heavier-than-air flight. However, as we all know, the most widely accepted date of the first flight is December 17, 1903 by the Wright brothers. The Wright brothers were the first to fly in a powered and controlled aircraft. Previous flights were gliders (control but no power) or free flight (power but no control). Aircraft began to transport people and cargo as designs grew larger and more reliable.

By the 1950s, the development of civil jets grew, beginning with the de Havilland Comet, though the first widely used passenger jet was the Boeing 707. Wide-bodies and Supersonics - 1969 marked the debut of another revolutionary aircraft, the Boeing 747. It was the first wide-body jet, with two aisles, a distinctive upper deck over the front section of the fuselage and four engines, with seating for as many as 450 passengers.

With developments in aviation with wide-bodies and supersonic aircrafts and high density of air traffic movement, there has also been a historical change in the air traffic control system i.e. the communication, navigation, surveillance and air traffic management (CNS-ATM) system.

Most air passengers are familiar with the term, 'Air Traffic Control' (ATC), but not the large CNS-ATM infrastructure for making air traffic control safe, secure and seamless. The ATM system is a system that provides air traffic management through the collaborative integration of humans, information, technology, facilities and services, supported by air, ground and/or space-based communications, navigation and surveillance.

Early Air Traffic Control: Initially, in 1910s - relatively few aero planes flew close to the ground, flying from one landmark to another to navigate. In 1920s, pilots fol-



lowed a series of ground-based bonfires — forming first air highways. In the late 1920s, the earliest air traffic controllers waved flags to instruct pilots when to land and take off. In 1930s, bonfires were replaced by thousands of rotating light beacons, forming the Transcontinental Lighted Airway.

In mid 1930s, beacons emitting radio waves to onboard receivers began replacing the light beacons. Most of us in the present day know about the use of Non-Directional Beacons (NDB), though the principal of operation of the initial radio beacons were slightly different.

During World War II, radar technology was developed. In 1950s, radars were widely deployed to control U.S. commercial traffic; planes continue to fly along fixed air corridors. Air traffic control remains based on radars and corridors, but the systems become increasingly computerized.

The new systems: The demand for improved safety, integrity and efficiency due to the rapid growth of aviation sector and the growing concern for environmental sustainability issues pose significant challenges on the development of future Communication, Navigation, Surveillance and Air Traffic Management (CNS-ATM) systems. High-integrity, high reliability and all-weather services are the key issues in the Air Navigation Services.

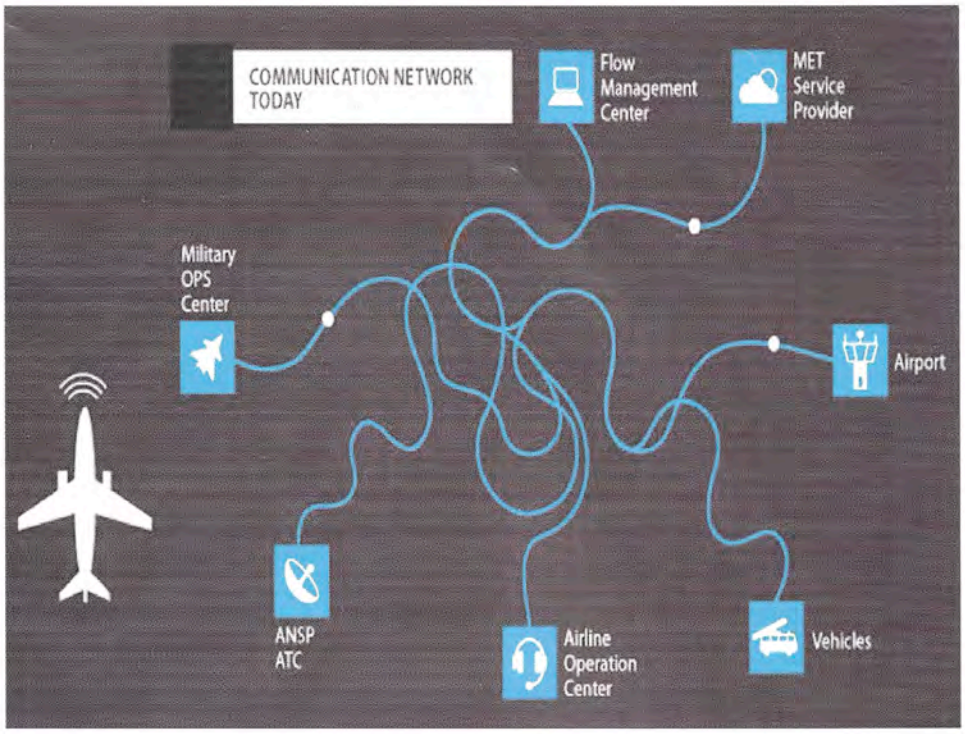
Technological advancements have led to significant operational improvements in the performance of safety-critical tasks in air navigation services. The global air traffic is growing at a rapid pace and its increase is predicted to double in the next 15 years. At the same time, a scenario is witnessed wherein civil and military applications of Remotely-Piloted Aircraft Systems (RPAS) have much expanded in recent years.

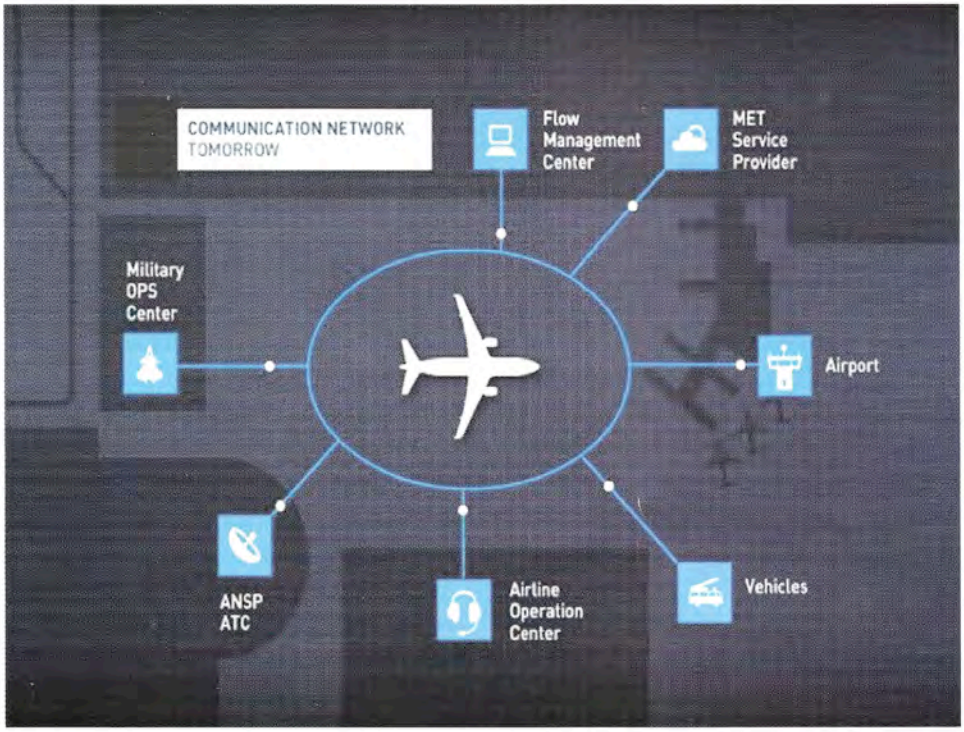
Air Traffic Safety Electronics Personnel (ATSEPs), more commonly known as the CNS engineers, play most safety critical role in providing the communication, navigation, surveillance and air traffic management systems for safe flying. There are two end users of the system provided, the Pilots and the Air Traffic Controllers (ATCOs). Pilots and Air Traffic Controllers heavily depend on these CNS-ATM infrastructures. Any degradation or non-availability of the CNS-ATM systems is a very serious issue. In the modern age, safe air traffic control is directly linked to the facilities provided for the air traffic services. To simplify the safety criticality of the systems, communication and navigation systems are the ears and eyes of the pilot. Similarly, communication and surveillance systems are ears and eyes of the ATCOs. Air Traffic Management system is the nerve center of the Air Traffic Services.

To mention few of the present day advanced air traffic engineering systems, to support the present day air traffic services, we have the highly advanced state-of-the-art systems like the Satellite Based Communication System (SBAS), Ground Based Augmentation Systems (GBAS), air-ground data communication, Automatic Surface Movement Ground Control Systems (A-SMGCS), Automatic Dependent Surveillance Systems- Broadcast (ADS-B), Radar Data Processing System (RDPS) and Radar Networking, Flight Data Processing Systems (FDPS) etc.

Airports Authority of India has also taken up modernization and up gradation of Air Navigation Services (ANS) and airport infrastructure. The initiatives have yielded tangible benefits in terms of enhanced safety and operational efficiency and international recognition as well. ANS Initiatives are network of ASR/MSSR ensuring 100% overlapping radar surveillance cover throughout the entire continental airspace. Automatic Dependent Surveillance – Contract (ADS-C) has been implemented for surveillance over the oceanic airspace. Automatic Dependent Surveillance – Broadcast (ADS-B) is a surveillance technology in which an aircraft determines its position via satellite navigation and periodically broadcasts it, enabling it to be tracked. The information can be received by air traffic control ground stations as a replacement for secondary radar. It can also be received by other aircraft to provide situational awareness and allow self-separation. Advanced Surface Movement Guidance & Control System (A-SMGCS) is a system providing routing, guidance and surveillance for the control of aircraft and vehicles in order to maintain the declared surface movement rate under all weather conditions within the Aerodrome Visibility Operational Level (AVOL) while maintaining the required level of safety.

For the ATCOs to handle the traffic more effectively with enhanced safety, reduced flight time and better airspace utilization, the concept of Upper Airspace Harmonisation (UAH) for Flight Information Regions (FIRs) at Chennai and Kolkata have already been introduced, and the same is under process at Delhi and Kolkata. This is the amalgamation of all ACC-s under each FIR into 1-ACC and formation of 4-Upper ACC-s - Chennai, Kolkata, Delhi and Mumbai.





The upper airspace harmonization requires increased communication and surveillance coverage. The surveillance data from the RADARs has been networked with the Flight Data Processing System (FDPS) and electronically processed with relevant flight data to produce an integrated track data on RADAR display monitor. This electronic FDPS along with other automated tools like Airspace situation awareness track displays, Automatic co-ordination and Hand-off, Controller Decision Support Tools, Flow management tools, Conflict detection and Safety alert tools, Route conformance warning tools etc. forms the integrated ATS automation system.

In phases, for increased communica-

tion and surveillance coverage for Upper Airspace Harmonization over Indian airspace, the following integration has been completed –

Chennai: 9 VHF communication stations, 8 Radar stations and 5 ADS-B systems has been integrated.

Kolkata: 13 VHF communication stations, 9 Radar stations and 8 ADS-B systems has been integrated.

Delhi: 12 VHF communication stations and 5 Radar stations has been integrated.

RADAR

The Future Systems: The technical foundations of the CNS-ATM approach are information sharing, automation, and the use of ground and/or satellite-based facilities. These enable fresh approaches to air traffic management — including a more active role for flight crew and onboard systems, movement away from traditional fixed-route airspace structures to free flight, the use of 4D contracts in trajectory-based flight planning and operations, and the possibility of delegating separation responsibility to the flight deck.

The need to transform Air Traffic Management (ATM) has for some years been acknowledged world-wide and not least in Europe and the US. There is now an increasing emphasis on the need for all the world's ATM systems to work together smoothly. The Europe's Single European Sky ATM Research (SESAR) and US's NextGen are playing in the delivery of a seamless, performance-based global air navigation system — the International Civil Aviation Organization's 'One Sky' vision. ICAO created the overall blueprint for a new global system. Since then, the concepts have been explored and refined, strategic plans have been developed, and the required technology has matured. Over the past decade, ICAO member states have initiated a number of programmes based on the ICAO blueprint. Their aim is to increase airspace capacity and reduce costs and delays. Currently NextGen (US) and SES/SESAR (Europe) are among the most advanced in terms of co-operation.

'System Wide Information Management' - SWIM - covers a complete change in paradigm of how information is managed across the whole European ATM network. SWIM is SESAR's most important enabler for assuring that the right information will be available with the right quality to the right person at the right time. It covers all ATM information, including aeronautical, flight, aerodrome, meteorological, air traffic flow, and surveillance. SWIM consists of standards, infrastructure and governance enabling the management of ATM information and its exchange between qualified parties via interoperable services.

All stakeholders will share access to the information they need, including more reliable information about the future state of the ATM system and its environment. Greater automation of ATM will allow Air Traffic Controllers to focus more on monitoring and contingency planning and this will also reduce data entry errors.

Facing the demands of increasing air traffic capacity and operational efficiency, the countries of the Asia Pacific region have also launched various programs to adopt recent advances in Air Traffic Management and advances in avionics technology over the past couple of decades. For example, Collaborative Action for Renovation of Air Traffic Systems (CARATS) is Japan's solution to the airspace challenge. A principal technical component of CARATS is the shift from sectorized airspace to trajectory-based operations within Japan's airspace, dynamically managing flights on an end-to-end time basis, promoting user-preferred flexible routes. This will also fulfill a second objective of CARATS, namely the improvement of predictability, which will be enhanced by performance-based operations and the use of satellite-based navigation for all flights within a consolidated FIR.

Cyber Security has become another major concern in Civil Aviation. Future systems will increasingly rely on information-sharing and the use of new technologies. It is therefore vital to protect ATM assets if we are to enable the level of safety, integration and interoperability required under future operational concepts. ATM assets include aircraft, people (e.g. passengers, crew and ATM personnel), physical infrastructures, Communication, Navigation & Surveillance (CNS systems), ICT (Information and Communications Technologies) systems and operational data.

Last, but not the least, the Human Factors – the men behind the machine: A couple of decades ago, the scenario was different; the importance of CNS systems was not as much as in the present day aviation. This may have been the reason that safety criticality of the CNS systems and the Human Factors, the men behind these machines, were not discussed.

Not many documents or references were available on the Human Factor of Air Traffic Safety Electronics Personnel (ATSEPs). There was a missing link in the safety chain. The Human Factor was completely ignored.

In today's aviation world, we thus see that CNS is safety critical. It is indeed a challenging issue worldwide. By planning, procuring, installing, maintaining and operating CNS-ATM and associated systems, Air Traffic Safety Electronics Personnel (ATSEPs) play a major safety critical role in ensuring safe Air Navigation Services.

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