

Aircraft Communication Addressing and Reporting System (ACARS/ATN) and Future Air Navigation (FAN)

- Aircraft Communications Addressing and Reporting System (ACARS) is a digital data link used to transmit short, but important aircraft-related messages automatically and directly to the Air Traffic Command (ATC), without pilot action.
- This transmission protocol uses radio and satellite datalinks and replaces the conventional VHF voice channels used by the pilots to report information about aircraft such as present position, altitude, speed, etc., to the ATC.

ACARS and ATN

- Prior to the introduction of ACARS, before 1978, all intercommunications between the pilots and ATC, relied solely on voice communication using VHF (~300 MHz) communications, using VHF or HF voice radios. This was further augmented with satellite communication (SATCOM) since 1990s. **ATN is a modem digital data link replacing ACARS.**
- The main purpose of having ACARS/ATN is to reduce pilot workload and improve data integrity in communicating vital aircraft data to ATC.

Aircraft Communication and Reporting System (ACARS)

- ACARS is a digital data link system for transmission of short, relatively simple messages between the aircraft and Air Traffic Controller (a ground station) via VHF/HF radio and satellite.
- ACARS is designed by Aeronautical Radio Incorporated-ARINC, which is a consortium of US airplane manufacturers and avionic equipment manufacturers.
- The protocol was designed to replace the VHF voice service and was brought into service in 1978.

- ACARS consists of ACARS Management Unit (MU) and CDU (Cockpit Display Unit) of Flight Management System-FMS.
- The MU is designed to send and receive digital images from the ground using existing VHF radios, automatically without pilot participation.
- On the ground, the ACARS is made up of a network of radio transceivers which receive and transmit the data link messages, as well as route them to various airlines on the network.
- SATCOM was later included using Satellite Data Unit (SDU), High Power Amplifiers-HPAs and antenna for satellite communication.
- SATCOM is designed to support both digital datalink channels and voice channels.

Aeronautical Telecommunication Network (ATN)

- ATN is a replacement system, superseding ACARS for automatic communication between aircraft and ground ATC. ATN allows ground/ground and air/ground communication.
- ATN offers interconnectivity of various CNS/ATM (Communication Navigation Surveillance system/Aircraft Traffic Management) sub-networks to enable point-to-point communications among the end users.

- ATN provides worldwide data communication between the host computers--on the ground, and airborne equipment.
- The ATN enables interoperability between the aircraft, airlines, Air Traffic Controllers (ATCs), and aviation authorities.
- ATN utilises satellite, VHF, data links and other specific subnetworks to communicate digitally from one end-system to another.

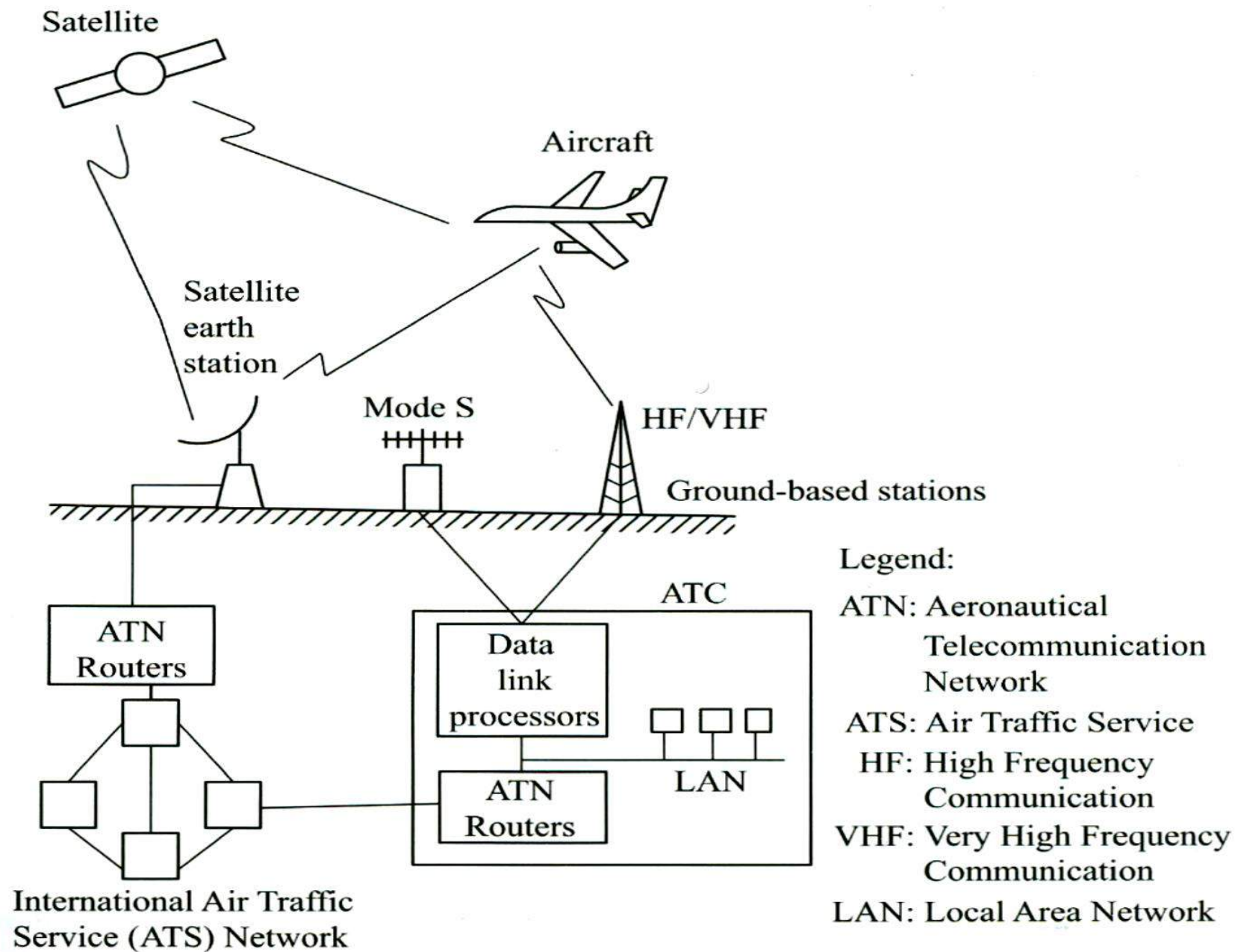


Fig. 13.2 ATN-infrastructure.

- (i) **VHF data link:** VHF data link forms the basic communication system in ACARS. VHF voice link provided the communication channel between pilot in the aircraft and the Air Traffic Controller (ATC). This was later augmented with digital data link for automatic digital data transmission, in addition to voice channel communication. A management unit (MU) coordinated the communication between the aircraft and ATC and vice versa.
- (ii) **Mode S Transponder:** Mode S (mode select) is a means of interrogating an aircraft using a distinct address such as an aircraft address, that only a particular aircraft responds.

(iii) **Satellite Data Link** is primarily invented for ADS-Automatic Dependent Surveillance, and high output communications. The corresponding interfacing unit is known as Satellite Data Unit or SDU.

Future Air Navigation System (FANS)

- Future Air Navigation System (FANS) is designed to establish direct data link between the aircraft and Air Traffic Control-ATC.
- The type of data communicated includes ATC clearances, pilot requests and aircraft position reporting.
- The traditional ATC still uses 1940s technology, based on analog radio systems for aircraft Communications, Navigation and Surveillance-CNS, as well as for Air Traffic Management-ATM. Together the functionality can be called CNS/ATM.

- **Boeing company** developed the first generation FANS product in early 1990s. This is known as FANS-I, and was based on earlier data links-ADS and Controller Pilot Data Link Communications (CPDLC).
- FANS was meant primarily to cover operations over large water mass, such as Pacific Ocean, where ground stations are not feasible. Application of FANS in Pacific route resulted in improved routing and hence reducing fuel burnt.
- Boeing is using FANS-I for their Boeing 767, 777, and 787 aircraft.
- Airbus Industries, parallelly developed their version of FANS, known as FANS-A, for their A-330, A-340 and A-380 aircraft.

- Combined FANS-I and FANS-A system is known as FANS-I/A, which is made applicable to even non-Pacific routes, such as North Atlantic. Many deficiencies were observed and rectified in version FANS 1IA.

Air Traffic Control Methods

- There are two major types of controlling the air traffic:
 - (1) **Positive control**, used over land masses with radars and
 - (2) **Procedural control**, over water masses, which cannot have ground-based radars.
- FANS concept aims at addressing the above traffic congestion problem, and involves improvements in Communication, Navigation and Surveillance-CNS.

- FANS offers a number of benefits to the airline operator, in the present scenario of increasing global air traffic. These benefits include:

1. Reduced separation between aircraft
2. Optimal route changes
3. Satellite communication advantages
4. Cross tracks without altitude change
5. More direct routings, resulting in fuel economy.

THANK YOU