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METHODS ABOUT HOW ACARS MINIMIZED OVERSIGHT WHILST ARIEL

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Abstract

This paper is written with the focus of probing how Aircraft Communication Addressing Report System (ACARS) has helped reduce the human error caused while communicating while airborne and also helped enhance the data integrity of the aircraft. This paper also looks into the basic uses of ACARS and how the communication is established to the ground. It will also look at how the communication has been developed and bettered over time

Keywords:*ACARS (Aircraft Communication Addressing Report System), VHF (Very High Frequency), HF (High Frequency), ITU (International Telecommunication Union), EICAS (Engine Indicating and Crew Alerting System)*

INTRODUCTION

What is ACARS? It is a protocol designed by ARINC, a company which revolutionized airborne communication. ACARS provides a digital telecommunication link over which data can be transmitted (data link). It is used to consign specific data, like altitude, system status and diversion information. Before ACARS' establishment for communication about aircraft status, route changes, and so forth, analogue voice communication was used on either HF (High Frequency) or VHF (Very High Frequency) radio waves, and this had its own set of problems, such as, miss pronunciation of words by non-native English speakers, debased audio quality as the signal travels a long distance, and possible audio lag. These are some of the problems of voice predicated communication. Nevertheless, it is still the primary mode of communication for exchange of basic data. On the other hand, since the introduction of data based communication in the 1980s, the communication between the ground and the aircrafts has become much more potent, as the problems listed above are avoided and the process of how that is done is listed further in this paper.

Theory

When it comes to communication while airborne, there are many methods to do so. In the start just after the Wright Brothers made flight possible on December 17, 1903, the most leading methods of communication to the aircraft, in those times, was visual communication, coloured flags, hand signs, flare guns, and with the development of wireless telegraphy, even morse code. But this was a problem at the time, the reason being, only the morse code method was the one that supported 2 way communication, i.e. from pilot to ground and vice versa. After further development, radio communication came to light, its very first tests were performed in Brooklands, England in June, 1915 [3].

Analogue voice communication or radio communication, as stated in the introduction, uses a certain set of frequencies which are unique to each country. These certain set of frequencies are allocated by the International Telecommunication Union (ITU). The ITU has divided the radio spectrum into 12 different bands. However, the ITU has allocated band numbers 7 and 8 for civil aviation, i.e. HF (3-30 MHz) and VHF (30-300 MHz) respectively. They have sub sets in these frequencies which are allocated for different purposes like communication, surveillance, and navigation. Aircrafts usually communicate using the VHF band, the main reason being VHF communicates with towers that are in line-of-sight and the sound quality is much better than that of HF, but it has its own drawbacks, one of them being, it is of no use when long range communication is needed as it cannot penetrate through obstacles like buildings or mountains. HF on the other hand is used for long range communication, since it has the ability to penetrate through these said obstacles, as for the reason as to why it is used for long range communication, it is because it can reflect off the ionosphere with the help of the free electrons. The waves hit the free electrons, which hence causes the electrons to vibrate and re-radiate the energy back down to the ground stations at the same frequency. Its only drawback is that the quality of the communication is very poor, which hence makes it difficult to understand those who are non-native English speakers [4].

But nowadays ACARS is used, for text based communication with other aircrafts, Air Traffic Control (ATC), and/or Airline Operations Control Centre (AOCC). It makes the use of the VHF data link (VDL), HF data link (HDL), and/or SATCOM (Satellite communication) using the Minimum-Shift Keying modulation (MSK) to send data collected from the aircraft's sensors like aircraft position or weather patterns to different stations on the ground. It automatically finds the most suitable and reliable channel of communication if there is a choice, which therefore helps reduce the crew workload and helps in critical times [1] [5].

Additionally, a Datalink Service Provider (DSP) is to oversee the transmission of these messages. The main DSPs are AIRINC and SITA, with AIRINC being the creators of the ACARS protocol. Howbeit, the DSPs can't directly route the messages, they must have the permission/contract from the Air Navigation Service Provider (ANSP) or the Aircraft Operator. Aircraft operators have the ability to often contract out the function to either DSP or any other separate service provider.

One of ACARS' extremely useful features is automatically sending the messages to their respective ground stations, it does this by pre configuring the messages to their message type [5].

There are 3 types of ACARS messages, Air Traffic Control (ATC), Aeronautical Operational Control (AOC), and Airline Administrative Control (AAC) and their configuration is done based upon their contents. ATC messages include Pre Departure Clearances (PDC) and Oceanic Clearances (OCX). They are usually used throughout the duration of the flight, as OCX requires that pilots ask for the clearance approximately 40 minutes before entering an oceanic entry point. Similarly, AOC messages are also used throughout the duration of the flight, they are used to automatically report the engine status to the airline maintenance department to see if it is working properly.Reporting the flight times and receiving the load sheet, which states the distribution of mass and the balance condition throughout the aircraft to determine if the balance limits of the aircraft are exceeded or not, is all done by the AOC messages. These type of messages have helped save numerous lives as any problem with the equipment can be known beforehand which can help prevent any possible catastrophes. The next type of messages are

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AAC messages, they provide admin information to the pilots such as Passenger Information List (PIL) which has information about the passengers and available seats etc [2] [5].

Coming to how ACARS helps forestall tragedies, it is managed and monitored by the crew in the cockpit. This is done by the help of the Control and Display Unit (CDU). This is the only unit that's provides and interface to manage the data transmitted and received. The CDU is a unit used to access the Flight Management Computer (FMC) which is connected to the Engine Indicating and Crew Alerting System (EICAS)which is used to alert the cabin crew in the event of failure or malfunction of any electronic device onboard the aircraft [7]. Furthermore, the CDU is also used for text based communications with other aircrafts and to ground control, it accomplishes this with the help of Communication Management Unit (CMU) and VDL, HDL, and/or SATCOM and a printer [6].

Given ACARS' ability of automatically reporting engine failures, change in pressurization, and hydraulics etc. it could possibly help allay the damages or give out an early Mayday call. It also played an important role in the endeavor to locate the aircraft Malaysian Airline 370 to an approximate location, it could achieve this because of the secondary ACARS system onboard the aircraft. The secondary system kept on attempting to ping one of the fourteen Inmarsat geostationary telecommunication satellites [8]. Furthermore, it also played a cardinal role in indicating the faults in the cockpit temperature sensors and the activation of the optical smoke detectors because of the pilot's habits of smoking in the cockpit on an EgyptAir flight MS804 before the aircraft crashed into the Mediterranean Sea on May 19, 2016 [9].

CONCLUSION

In conclusion, although there aren't many facts and incidents about how ACARS saved the day, it is undeniably one of the most useful systems in the aircraft. This protocol was easily one of the biggest breakthroughs of the 20th century as it enabled pilots to better communicate with the ground and ameliorated data integrity and accuracy. However, it has a couple of drawbacks. It has problems of data privacy. Since ACARS uses the VHF channels as a mode of communication and since these are line of sight channels, there is a chance that the data can be intercepted by unauthorized personals. Additionally, the data isn't encrypted so it may directly give out the possible position and condition of the aircraft. On the contrary, weighing the drawbacks and the benefits, it is safe to postulate that ACARS has helped refine the safety of an aircraft and its passengers to a prodigious extent.

REFERENCES

1) JxJ AVIATION. "Understanding Aircraft's Communication System | ACARS | Voice & Data | Antennas on an Aircraft!" youtube.com https://www.youtube.com/watch?v=iTJUHGGErp4 (accessed May. 21, 2022)
2) Pete. "ACARS: what is ACARS and how airlines and pilots use it" aviationmatters.co https://www.aviationmatters.co/what-is-acars/ (accessed May. 26, 2022)
3) BAATraining. "Did You Know When Pilots Started To Communicate Using Radio?" baatraining.comhttps://www.baatraining.com/pilots-using-radio/ (accessed May. 28, 2022)

4) Jim Sparks. "Aircraft Communications: A look at analog and digital communications." aviationpros.comhttps://www.aviationpros.com/aircraft/article/10381753/aircraft-communications (accessed May. 29, 2022)
5) SKYbrary. "Aircraft Communications, Addressing And Reporting System" skybrary.aero https://skybrary.aero/articles/aircraft-communications-addressing-and-reporting-system (accessed Jun. 1, 2022)
6) UKEssays. "Importance of Using the ACARS system." ukessays.com https://www.ukessays.com/essays/computer-science/importance-using-acars-system-5324.php (accessed Jun. 2, 2022)
7) Chris Brady. "Flight Management Computer" b737.org.uk http://www.b737.org.uk/fmc.htm (accessed Jun. 3, 2022)
8) Gordon Rayner. "MH370: Britain finds itself at centre of blame game over crucial delays" telegraph.co.uk https://www.telegraph.co.uk/news/worldnews/asia/malaysia/10720009/MH370-Britain-finds-itself-at-centre-of-blame-game-over-crucial-delays.html (accessed Jun. 3, 2022)
9) Bart Noëth. "Egyptair flight MS804 that crashed in the Mediterranean Sea caused by cigarette being smoked in the cockpit" aviation24.be https://www.aviation24.be/airlines/egyptair/flight-ms804-that-crashed-in-the-mediterranean-sea-caused-by-cigarette-being-smoked-in-the-cockpit/ (accessed Jun. 4, 2022)