

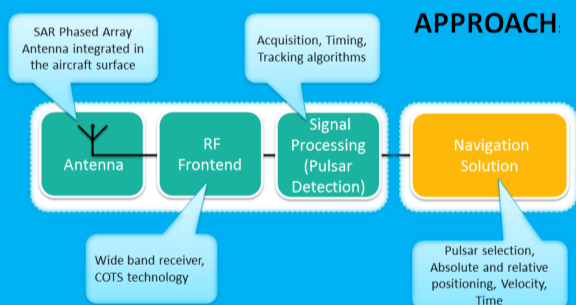
PulsarPlane

A FEASIBILITY STUDY FOR RADIO PULSAR AIRCRAFT NAVIGATION (EC FP7 L0)



Stars have been used - in what is called celestial navigation - since thousands of years by mankind. Celestial navigation was used extensively in aviation until the 1960s. Interests have sparked again with navigation using pulsars. Pulsars are fast rotating neutron stars that emit electromagnetic radiation, which is received on earth as a series of very stable fast periodic pulses with periods in between milliseconds and seconds. These periodic pulses and the known positions (in celestial coordinates) of the neutron stars make them ideal beacons for navigation.

Air traffic management and aircraft operations are currently dependent on the use of ground-based navigation systems. Still, many areas on Earth are not equipped with this kind of infrastructure. In oceanic flights and isolated areas, aircraft fly procedural tracks assisted by inertial navigation and/or GPS, as no ground equipment is available to guide them along their tracks.



We propose a new navigation system, based on the signals received from pulsars. Pulsar navigation enables a mean of navigation without the need for ground-based or space-based equipment. The pulsar signals are very weak. It is believed that with the advance of antenna technology and signal processing algorithms, pulsars can be detected and tracked onboard an aircraft. Moreover the accuracy of pulsar based navigation could be sufficient for aviation.

If pulsar navigation is feasible, at least 5 advantages are identified for aviation:

1. Overcome GNSS vulnerabilities
2. Reducing operational cost of air transport
3. Contribute to greener transport by enabling secure formation flying of commercial airplanes in oceanic and remote areas
4. Improve flexibility and accessibility of air transport
5. Contribute to a common reference time frame for aviation

The objective of this study is to investigate the feasibility of pulsar navigation for aviation, and if found positive, to analyse the impact on aviation and to identify and develop (sections of) the path towards a useable real-time navigation and timing system.



Current antenna, used for detection of pulsar signals, but phased array antenna could be integrated in the aircraft surface.



PulsarPlane investigates efficient and fast pulsar detection algorithms and integration of antenna in the aircraft's wing structures.

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