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GUEST EDITORIAL

Special issue on Surveillance Systems for Air Navigation Services

GASPARE GALATI AND PIET VAN GENDEREN

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The need for increasing safety, efficiency, and environmental compatibility in the air transport system requires upgrading of the control and traffic management for aircraft in air and in ground operations, as well as for surface service vehicles at the airport. The related communications, navigation, and surveillance (CNS) infrastructures call for enhanced positioning and identification techniques such as non-cooperating sensors (including multi-static and passive radar), cooperating, independent systems such as multi-lateration (MLAT) and wide area MLAT (WAM), and cooperating, dependent systems mostly represented by the automatic-dependent surveillance-broadcast (ADS-B). Most enhanced surveillance infrastructures are spatially distributed (i.e. with many receiving or transmitting/receiving stations) and logically distributed (i.e. with local and central processing and with fusion of different information sources, including the traditional primary and secondary radar). In this frame, new system architectures and new algorithms for integrity monitoring and for multi-sensor data fusion are required. Security and defense systems use similar algorithms for passive location of targets based on measurements of time of arrival (TOA) and its differences (time difference of arrival (TDOA)), as well as of Doppler frequency and its differences (frequency difference of arrival (FDOA)), possibly combined with angular/direction measurements (angle of arrival (AOA)/direction of arrival (DOA)).

The workshop "Enhanced Surveillance for Vehicles and Aircraft", held in Capri in September 2011 (ESAV'11), addressed the various topics highlighted above. Not only did engineering and scientific staff contribute, but also policy-makers from Europe and from the United States of America presented their point of view on the ongoing programmes and the future needs. It appears that the automatic-dependent surveillance, i.e. the cooperative positioning and identification of aircraft and vehicles based on on-board derived data (such as from ground position system (GPS)) and communicated toward other aircraft and ground-based stations is gaining in relevance. Conversely, it is also clear that the independent surveillance (based on radar, specially the "primary" radar, i.e. requiring no cooperation at all from the target, and, in a limited time frame from now, the "secondary" radar, i.e. based on the interrogation of today's standard and mandatory Mode S transponder on-board) will maintain to be relevant for the monitoring of both air and surface traffic. As a matter of fact, there is a general consensus that the stringent surveillance requirements can only be satisfied by the "fusion" of different sensors, including the independent and the non-cooperative ones, the latter being essential for security reasons. From the submissions it is evident that important concepts of passive and/or cooperative and dependent systems are fit for dual use.

The papers that we have solicited for this special issue are concerned with technology, concepts and verification of independent non-cooperative systems, cooperative dependent systems, and independent cooperative systems. In the first group, one may rank systems such as active radar and passive coherent location (PCL). In the context of the workshop, it concerns a multimodal system for the detection of runway debris, waveforms for weather radar, principles for classification of objects using parameters that are invariant to the polarization of the electromagnetic field and PCL based on different types of emitters (FM radio, digital video broadcasting, and so on). The second group mainly consists of ADS-B systems, where the aircraft broadcast their own position. Deployment of such systems is ongoing all over the world, and the main issues are on verification and validation, as it is common practice in the rigorous standards of air traffic control. The third group concerns systems based on emissions from Secondary Surveillance Radar (SSR) transponders, e.g. based on hyperbolic location (MLAT) of these sources. Also issues concerned relate to how to deploy, locate, and exploit the receiving stations in an optimal manner. Finally, we have solicited a paper on technology for locating emitters on the ground from airborne platforms using passive techniques.

We trust that this special issue will provide a true flavor of the current developments and trends, and therefore serve the best interests of the engineering and scientific communities.

Gaspare Galati is full professor of Radar Theory and Techniques at the Tor Vergata University of Rome. He received the Dr. Ing. degree (Laurea) at the University of Rome "La Sapienza" and started his professional career in the company Selenia S.p.A in 1970. His main interests are Radar theory and techniques, Detection and estimation, and Navigation and Air Traffic Management. His present research activity is mostly related to new surveillance systems for Air Traffic Control and to multifunction radar.

Piet van Genderen graduated from the University of Twente in Enschede, The Netherlands in 1971. He worked with the National Aerospace Laboratory in Amsterdam until 1979. He then moved to Hollandse Signaalapparaten, now Thales Nederland, where he held several positions in R&D. In 1994, he was also appointed full professor at the Delft University of Technology. He holds several patents and (co-) authored about 200 publications. He was three times awarded with the prize for the paper that best advances the state-of-the-art in radar at the European Radar Conference. He holds an honorary doctorate of the MTA of Bucharest, Romania. His main research interests are in the design of waveforms and associated algorithms for extracting object features.

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