Dynamics & Control Technologies in Air Traffic Management

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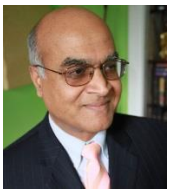
Abstract: Global air traffic is expected to increase by 50% from the current levels by the year 2025, as more and more of the world's population choose this as the preferred mode of transportation. Purely controller-centered traffic management procedures currently employed are unlikely to scale to accommodate safe transition to these traffic densities. In recognition of this fact, in the United States, National Aeronautics and Space Administration and the Federal Aviation Administration have been spear-heading the development of automation tools for supporting the controller as well as the flight deck to create the Next-Generation (NextGen) air traffic management system. Similar initiatives are underway in Europe.

This talk will focus on the application of techniques from dynamics and control to create automation tools to support the controller, as well as to transfer some of the traditional air traffic control functions to the flight deck. Specifically, issues in modeling traffic flows, conflict detection-resolution, navigation through the airspace, demand-supply resource matching and control under uncertainty will be discussed. Research initiatives by the author and his colleagues over the past two decades will be outlined and evolving research opportunities will be highlighted. Finally, application of these techniques to high-density, low-altitude operation of unmanned air vehicles will be indicated.



Bio sketch of the speaker: Dr. Menon has made numerous technical contributions in the fields of Air traffic flow modeling and control, Integrated Guidance-Control systems for missiles, nonlinear flight control systems, high-performance aircraft performance optimization, and Machine Vision techniques for fixed-wing and rotary-wing aircraft guidance.

Dr. Menon's current research is focused on advanced methods for air traffic modeling, control and optimization. He is credited with the development of the first aggregate model of air traffic flow, which permits the systematic application of analytical tools and techniques from Automatic Control Theory to air traffic flow management.

Dr. Menon began his career in the SLV-3 Project at the Indian Space Research Organization. At ISRO, he worked on launch vehicle trajectory simulation, optimization, failure mode analysis, autopilot design, parameter identification, and H-I-L simulation. He has participated in the launch of the first two SLV-3 flights, and the preliminary design of the Agni missile and the PSLV.

He has published over 200 papers, over 50 of them in international archival journals. He has received technical awards from the AIAA, IEEE and NASA. He has served as a faculty member at two major U. S. Universities, and has worked in the U. S. aerospace industry for over three decades. His research has been used in several fourth-generation fighter aircraft and in multi-national missile programs. He founded Optimal Synthesis Inc., a high-technology aerospace research company 1992, and currently serves as its CEO and Chief Scientist. In 2010, he was elected a Fellow of the AIAA for his numerous contributions to the Aerospace Sciences.

Dr. Menon earned a Ph. D. degree in Aerospace Engineering from the Virginia Polytechnic Institute in 1983, a Masters in Aeronautical Engg. from IISc Bangalore in 1975, and a Bachelors from the Regional Engineering College (NIT) Warangal in 1973.