ACKNOWLEDGMENT

David J. Sheftel, Chairman, TRB Committee on Airfield and Airspace Capacity and Delay

The organization and conduct of this workshop on a subject of such depth as expert systems and the possible application of this technology to air traffic control automation has been a task of challenging proportions. As Chairman of the sponsoring Transportation Research Board Committee, I am especially aware of the amount of time and personal dedication James P. Loomis contributed to make this workshop the success which it was. I express my gratitude to Jim and to Battelle Columbus Laboratories for making him available for this important work.

INTRODUCTION AND SUMMARY

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This is the report of the workshop on artificial intelligence and air traffic control conducted by the Transportation Research Board Committee on Airfield and Airspace Capacity and Delay, A1J05, October 23, 1985, at the National Academy of Sciences, Washington, D.C. Participation in the workshop was by invitation only and was limited to those who were considered expert in the field.

The purpose of the workshop was to assemble key national figures involved with the development of the air traffic control system and/or with artificial intelligence (focus on expert systems) research and development with the intent of better defining how artificial intelligence (AI) may be incorporated into the air traffic control (ATC) system of the future. As far as is known, this was the first formal meeting dealing with this particular AI application. It is useful, and of some interest, to describe the circumstances leading up to this workshop.

The Committee on Airfield and Airspace Capacity and Delay is one of several TRB committees focused on air transportation concerns. It is chaired by David J. Sheftel, former Director of Research and Development for the Federal Aviation Administration. In 1984, as part of its renewal, the committee created several subcommittees through which it would conduct its activities. One of these, chaired by James P. Loomis of Battelle, was given the charter to focus on future ATC technology. Joining Loomis in this endeavor were Henry Lum of the National Aeronautics and Space Administration (NASA) Ames Research Center, Amedeo R. Odoni of the Massachusetts Institute of Technology, and Alfred C. Robinson of Battelle Columbus Laboratories.

In exploring work already under way, the subcommittee recognized that other bodies were already assessing requirements/opportunities in several technology areas. A case in point was the work of the Radio Technical Commission for Aeronautics, Special Committee 155, which was dealing with future navigation, communications, and surveillance technology. After some deliberation, artificial intelligence was selected for emphasis. The subcommittee believed that the work in this field held great potential for the future ATC system, and that, by contrast, little visibility was being given to this area's possible contributions to future ATC needs.

As its contribution to the AI/ATC arena, the subcommittee decided to sponsor a closed workshop where experts in the field could report on the status of work under way and exchange ideas on areas of opportunity deserving increased emphasis. It planned for the issuance of a proceedings as the means for disseminating the fruits of the workshop.

The AI work under way, mostly on expert systems, which was directly related to ATC, was fairly limited and was, not surprisingly, being funded by the Federal Aviation Administration (FAA). This work was viewed as an important centerpiece for the workshop. At the same time, however, related expert-systems work was seen as important. This work was under way at such places as the NASA Johnson Space Center and the Department of Defense Advanced Research Projects Agency (DARPA) and was included in the workshop.

Six presentations were made at the workshop on various aspects of the problem. These were followed by dividing the attendees into two small groups for discussion. Finally, the groups joined together for a plenary session. The remainder of these proceedings reflects, in substantial detail, what transpired during the workshop. They also include invited comments from the participants.

The report is organized as follows: (1) Introduction and Summary; (2) Presentations; (3) Group Discussions; and (4) Individual Inputs. A list of participants is included at the end of this circular.

Six presentations were made to set forth what is taking place in AI in other areas which has applicability to ATC. These were not intended to be all inclusive but do represent an interesting and varied sampling and were intended to provide a common point of departure for the subsequent group discussions.

The speakers were not asked to prepare papers in connection with their presentations. Rather, they were asked to make liberal use of visual aids. This was done with the objective of enhancing the quality of the presentations and providing graphic material for the proceedings.

To provide coverage of each presentation in the proceedings, the plan was to combine the graphics for each talk with its corresponding part of the workshop transcript. That is basically what was done for each of the six presentations which follow. While editing their part of the transcript, some authors made extensive changes. Others incorporated their graphics by reference. The result is that, in some cases, the final product looks very much like a formal paper.

The small group discussion summary reports provide the reader with the most concise summary of the conclusions reached by the workshop participants. Among other results, this workshop reaffirmed some of AI's more important attributes -- in any arena, such as ATC, it can provide much needed speed to decision making, capture valuable expertise, facilitate training, and improve all parties' understanding of a system and its operation. Participants highlighted some functional areas where AI might usefully be employed in the not-too-distant future. These areas include flight plan generation, real-time conflict resolution, severe weather detection, and flow control (traffic management). Various AI research needs were emphasized. Finally, some guidance was set forth for selecting and carrying out AI demonstrations in the ATC system.