BOEING ADVANCED TECHNOLOGY CENTER

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INTRODUCTION

The Boeing Advanced Technology Center (ATC) for Computer Science is a Boeing-wide resource that resides in Boeing Computer Services (BCS), a division of The Boeing Company. The role of the ATC is to identify, understand, and determine how to convert and transfer emerging technology into Boeing's computing environment. The ATC focuses on technologies related to artificial intelligence, knowledge-based computing, and advanced parallel and vector processing architectures applied to both engineering and office environments. Many ATC projects address human-computer interaction issues or related issues such as natural language processing. Reponsibility for managing the ATC is shared by George Roberts, Bruce Wilson, and Miroslav Benda. This review will summarize the ATC projects most closely related to human-computer interaction issues.

MISSION

The ATC shares the mission of BCS, which is to provide information services of superior quality that satisfy the requirements of the other Boeing divisions. In general, BCS does not develop commercial software, but makes innovative use of available technology by integrating existing products. The ATC contributes to the mission of BCS by working with the other Boeing divisions to identify future technology requirements, then tracking the emergence of new technologies and encouraging external research and development of products that will satisfy these requirements. In selected areas the ATC undertakes research projects to accelerate development of new technologies. In other areas we track and encourage new technologies through relationships with universities, corporate research centers, and vendors. Frequently prototypes are constructed to explore how new technologies can best be integrated and exploited.

STAFF AND FACILITIES

The ATC staff collectively has expertise in computer science, cognitive psychology, linguistics, philosophy, mathematics, and engineering. Approximately half the staff has doctorates and the remainder have bachelor and masters degrees. Projects are generally accomplished by multi-disciplinary autonomous teams.

Our computational environment includes Symbolic Lisp machines, Mac II workstations (half with MacIvory cards), TI Explorers, VAXes, a network of Sun 3 and 4 workstations, graphic workstations from both Silicon Graphics and Stellar, and Butterfly, Sequent, and Alliant parallel processors.

PROJECT SUMMARIES

Human Computer Interaction

Contact: Keith Butler

This project reflects the growing recognition that the value of a computer system is defined more by its usability than by its capabilities. The objective of this project is to develop and transfer technology for effectively constructing and evaluating user interfaces. Capabilities under development include rapid prototyping tools, an analytical model for quantitative assessment of user interface complexity, measurement tools to assess situation awareness in the cockpit, and a representation language to model human-computer interaction.

Natural Language Processing (NLP)

Contact: Jim Hoard or Lisbeth Duncan

The ATC's NLP projects are developing and applying text and message processing systems. The overall objec-

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tive of the core system (Sapir) is to interpret, fuse, route, and store textual information automatically. Sapir's syntactic coverage is broad; it is adept at handling writing styles ranging from telegraphic to expository. The system performs text analysis; syntactic, semantic, and pragmatic analysis and disambiguation; and goal-directed inference and database instantiation.

Decision Engineering
Contact: Jeff Bradshaw or Kish Sharma

A general-purpose decision-analysis workbench (Axotl) originated in a joint effort with Strategic Decision Group. Specialized extensions to Axotl have been implemented to address specific problem domains. One such extension facilitates various stages of process management including process modeling, analysis, and monitoring. Users can model a complex process, conduct analyses such as bottleneck identification, and simulate the process. The model can be integrated with the actual process to monitor progress and with databases and software tools.

Knowledge Acquisition (KA)
Contact: John Boose and Sandy Marcus

Expert systems are very expensive to build and maintain. KA tools are intended to reduce this cost by decreasing the role of the knowledge engineer and increasing the role of the domain expert in building and maintaining an expert system. Two of our KA tools are SILICA and AQUINAS.

SILICA acquires domain information to build schedulers that use constraint-directed reasoning. Scheduling experts find it relatively easy to describe constraints on individual parameters of a schedule. They have much more difficulty describing a strategy for addressing these constraints. SILICA elicits the knowledge our scheduling experts find easiest to supply, makes assumptions about how the knowledge should be used, builds a strategy, and asks for required missing knowledge. AQUINAS is a KA workbench that combines ideas from psychology, such as Kelly's repertory grid, and knowledge-based systems. AQUINAS interviews experts directly and helps them organize, analyze, test, and refine their knowledge bases. Expertise from multiple experts or other knowledge sources can be represented and used separately or combined.

Smart Avionics
Contact: Kish Sharma

Effective management of the flight environment faced by military aircrews is becoming increasingly difficult due to (a) increased sophistication of onboard avionics, communication, and weapon systems; (b) increased crew workload; and (c) the need to simultaneously deal with external threats, damage or degradation of aircraft systems, and changing mission objectives. To respond to such situations, the Smart Avionics project is developing decision aids to assist the crew in pilot-vehicle interface (cockpit information management), situation assessment, mission planning, and diagnostics.

Concurrent Engineering
Contact: Steven Poltrock

The way aerospace projects are organized and coordinated is changing. New projects will follow a concurrent product definition model in which multidisciplinary design-build teams are responsible for product development. These organizational changes impose new requirements for technologies to support teamwork, information access, communication, and coordination. Our objective is to provide this support for teams working together in a meeting room or working asynchronously and spatially distributed. We are exploring hypermedia access to technical documents, co-authoring hypermedia, meeting facilitation, and modeling and analysis of organizational processes.