



ATC – PILOT INTELLIGENT AGENTS (APIA) “DEMONSTRATION OVERVIEW”

DEMONSTRATION OBJECTIVE

The National Airspace is a complex environment that has historically been a challenge to accurately simulate, test, and validate new technology and products that will operate within the National Airspace (NAS). The “missing piece” in simulation for the FAA Next Generation Air Transportation System (NextGen) is the human behavior component, which is essential to “complete” the full solution set. To meet this challenge, ASI developed a simulation environment using intelligent agents that model and emulate air traffic controller and aircraft operator human behaviors in thought process, speech, and action. The intelligent, adaptive agents are capable of adjusting to new and changing situations that occur within the NAS. The APIA demonstration illustrates the power of modeling the ATC and Pilots with Intelligent Agents.

WHAT IS AN INTELLIGENT AGENT?

Associates are intelligent agent-based decision aids that assist human operators in complex environments requiring high cognitive load. Associates have been shown to be effective in three basic activities: (1) perception, (2) decision making, and (3) assisting in taking courses of action. An intelligent agent simulates the behavior and decisions of a human, whether in battle field operations, a medical diagnosis, or the complex environment of the air traffic controller and pilot. Intelligent Agents obtain their behavior characteristics through knowledge extraction of domain specific plans and goals associated with the ATC personnel and/or Pilot.



WHY IS THIS IMPORTANT?

As the FAA continues to adjust policy and procedure and add new or upgrade existing technology, it is necessary that a valid simulation model is created and tested *before* decisions are to be made. Decisions made without proper validation and verification of proposed changes literally become a “life and death” resultant. Simulation modeling is all about coming as close as possible to simulating the real world. Because APIA uses the power of intelligent agents, the ATC and Pilot personnel can be modeled with near real world characteristics.

WHAT WILL YOU SEE?

The APIA demonstration exhibits simulated behaviors of Pilots and ATC personnel through complex decision making abilities of the intelligent agents. APIA simulates aircraft movement and ATC handling of multiple, simultaneous aircraft within the Atlanta Terminal Radar Approach Control (TRACON) area. The AIPA demonstration includes scenarios with increasing levels of ATC behaviors such as runway changes, convective weather (thunderstorms), and high traffic volume - all common daily events in the life of an Air Traffic Controller. The ATC behaviors exhibit critical timing and execution, reallocation of airspace and changes in controller assignments in order to maintain safe separation and efficient flow of traffic.



HOW DOES IT WORK?

In order to accurately simulate the experience, judgment, and decisions of ATC and Pilot personnel, ASI translates the experience, judgment and decisions of these experts into an Intelligent Collaborative Engine (ICE). In tandem with ICE, ASI extracts data from the world and converts the data to smaller chunks of information that are used to create various states of the world. ICE then uses its knowledge bases to reason about this information, with the output being intelligent decisions and actions. ICE also looks for significant events contained in the data and responds appropriately to these events.

The Power of Intelligent ChoiceSM



ATC – PILOT INTELLIGENT AGENTS (APIA)

APIA - HOW IT IS BUILT, HOW IT WORKS

The Air Traffic Control System

- ATCT (Air Traffic Control Tower)
- TRACON (Terminal Radar Control Center)
- ARTCC (Area Route Traffic Control Center)
- Terminal Radar Control (TRACON)

ATLANTA TRACON SOP

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Federal Aviation Administration (FAA)

The Federal Aviation Administration is responsible for ensuring the safe, efficient, and secure use of the Nation's airspace, by military as well as civil aviation, for promoting safety in air commerce, for encouraging and assisting civil aeronautics, including new aviation technology, and for supporting the requirements of national defense.

Aeronautical Information Manual (AIM)

Basic Flight Information and ATC Procedures

This manual is designed to provide the aviation community with basic flight information and ATC procedures.

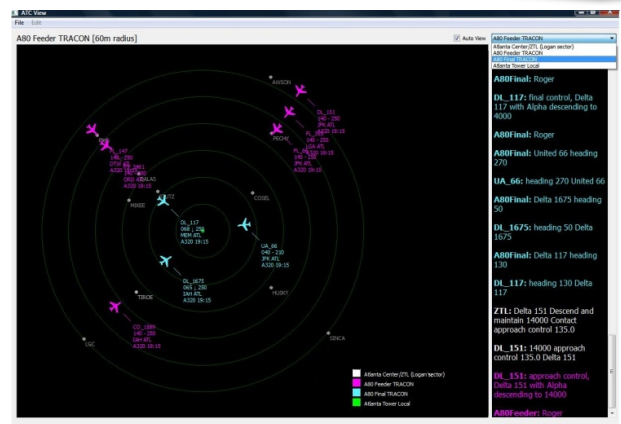
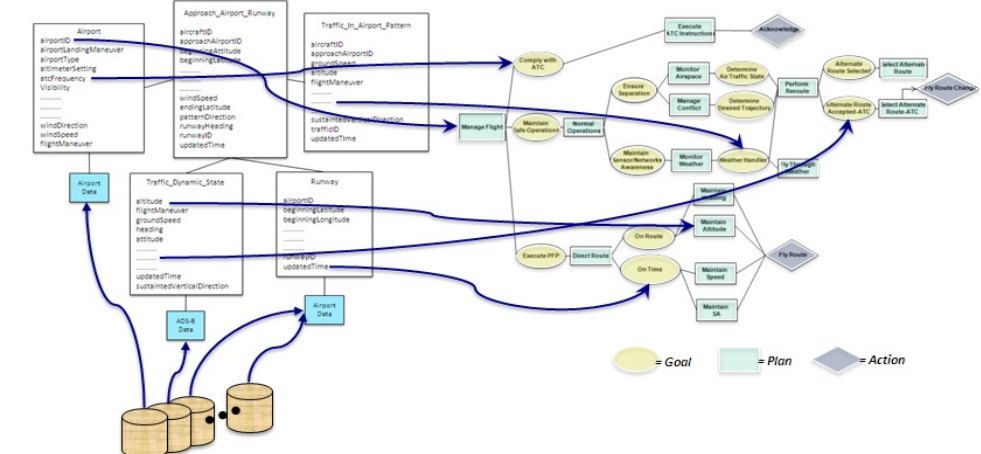
Universal Air Traffic Control Knowledge Base

- FAA Airman's Information Manual
- Air Traffic Plans & Publications
- Atlanta TRACON SOP
- ATC/Pilot - Subject Matter Experts



Concept Node Graph (CNG) "Observe & Orient"

Planning Goal Graph (PGG) "Decide & Act"



Simulated ATC Human Behaviors

- Multi-agent Collaboration
- Prioritized Situational Data
- Critical Timing & Execution
- Efficient Flow of Traffic



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