

## AGENT TECHNOLOGY GROUP

Gerstner Laboratory for Intelligent Decision Making and Control  
Department of Cybernetics, Czech Technical University in Prague

ATG is a university research center performing fundamental and applied research in the field of agent-based computing, multi-agent systems and agent technologies. There are (as of January 2008) 22 researchers and 6 PhD students working in ATG. ATG researchers work on various cutting edge research projects, have unique set of skills and broad international experience. ATG collaborates extensively with other research units within the Gerstner Laboratory, with the national Centre for Applied Cybernetics, university spin-off companies, top international universities, leading industrial organizations and EC/US governmental agencies.

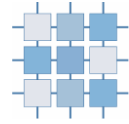
The main objective of ATG research is to contribute to:

- applied agent research mainly in manufacturing, automotive industry, network security and defense
- fundamental research in agent-based computing and multi-agent systems
- large scale prototype and demonstration systems development and
- application of agent technology in simulated environments and collective robotics

Research and technology development is funded in parts by the Czech Technical University in Prague, by the Czech Government, European Commission, European and US industry and US research and defense agencies.

ATG investigates complex problems of distributed decision making and autonomous reasoning with particular emphasis on following research themes:

- *multi-agent simulations*: scalable simulation of communities of deliberative, interacting actors who perform participate in collective decision making, competition or self-interested action; particular interest in seamless migration from multi-agent simulation to real, physical environment (e.g. in the field of collective robotics),
- *distributed learning and intelligent data fusion*: the capability to collect, process and partially share knowledge in distributed, semi-trusted communities, where actors are ready to share only part of their knowledge in peer-to-peer manner; applied to distributed intrusion detection and network security in general,
- *distributed planning and coordination*: advanced methods of planning and resource allocation within communities of multiple autonomous actors, techniques of plan merging and plan repair, advanced methods of coordination; applied e.g. in Unmanned Aerial Vehicle free-flight collision avoidance, logistics or virtual organizations,
- *adversarial reasoning*: theoretical models of adversarial behavior, advanced methods of intent prediction and opponent modeling, design and development of adversarial planning techniques.



## ATG Technology Offer

ATG authored, currently maintains and further develops AGLOBE, an open-sourced multi-agent platform written in Java language. Compared to other multi-agent platforms, AGLOBE offers superior performance and low overhead, as well as advanced features such as distributed load balancing, agent mobility and computational reflection (i.e. autonomous runtime reprogramming). The platform is especially suitable for development of large scale simulation scenarios. The techniques tested in agent simulation can be seamlessly ported to real-world deployment platforms using a standard methodology. AGLOBE has already facilitates development of several distributed intelligent systems:

- *UAV air traffic control, mission planning*: an AGLOBE based application supporting free-flight, peer-to-peer collision avoidance process among high number of Unmanned Aerial Vehicles (UAVs), re-planning, autonomous flight formation, collaboration with US Air Force, license purchased by BAE Systems
- *collective robotics*: deployment of AGLOBE to modeling of underwater mine-sweeping exercise, where autonomous robots are searching underwater surface and forming information relay feeds,
- *network security*: high-performance intrusion detection system based on anomaly detection and multi-agent trust modeling for gigabit networks (collaboration with US ARMY)
- *logistics*: complex, multi-player asymmetric game modeling different types of adversarial behavior in the context of humanitarian relief logistics
- *design process modeling*: Industrial deployment of AGLOBE for modeling of the integrated circuits process with (CADENCE Design Systems),
- *diagnostics*: car electronics distributed diagnostics solution (DENSO Automotive)

AGLOBE is available under Common Public License, and specific licensing arrangement can be agreed upon request.

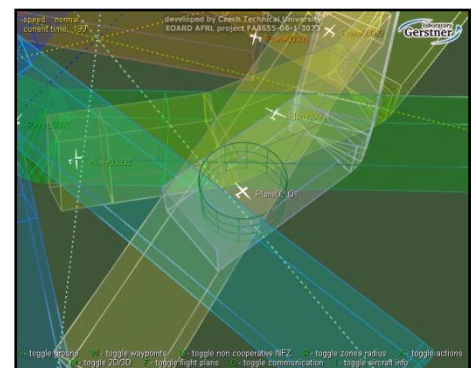
## ATG Prizes and Awards:

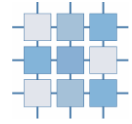
- The 2007 Engineering Academy of the Czech Republic Main Prize for AGLOBE multi-agent technology
- The 2007 CIA (Cooperative Information Agents) Workshop Best Paper Award nomination
- The 2006 DARPA Award for Best Industrial and Applied Paper at AAMAS 2006
- The 2005 Czech Technical University Chancellor Research Team Award to the Agent Technology Group,
- The 2005 IEEE/WIC/ Intelligent Agent Technology Best Demo Award
- The 2004 Czech Technical University Chancellor Award (3rd main prize) for excellence in industrial deployment of research results
- The 2004 CIA (Cooperative Information Agents) System Innovation Award (for collective of authors)
- 2nd main prize for the X-Security package at AgentCities, Agent Technology Competition in Barcelona 2003
- Best paper award at the European Symposium on System Man and Cybernetics, Vienna 1998
- Siemens Dissertation Award 1998
- CTU Chancellor Award - III main prize for industrial deployment of research results CTU Chancellor Research Team Award 2005

## Industrial Collaboration

ATG has a long tradition of working with leading industrial companies on applied research, on building industrial demonstrators and on industrial validation of research concepts. Successful industrial collaborations include e.g.

- BAE Systems (UK): Deployment of the AGENTFLY multi-agent system as a test-bed for probabilistic collision avoidance strategies (2007-2008)
- CADENCE, GmbH (D): consultation services in design and development of an agent-based system for IC design management and planning, deployment of AGLOBE multi-agent environment, in collaboration with CERTICON (2006-2007)





- DENSO Automotive, GmbH: Agent based diagnostics in vehicle electronics directed towards facilitating graceful degradation (2005-2007)
- SIEMENS/Transportation Systems, Prague (CZ): Planning and scheduling for in-store logistics, in collaboration with IPK Fraunhofer Institute, Berlin (2006)
- MADEVIA, a.s. (CZ): design and consultation in development of a multi-agent system for planning and control of logistics in the dairy products dispatching domain (2005)
- SKODA AUTO, a.s. (CZ): design of the production planning solution for engine manufacturing, in collaboration with GEDAS and CERTICON (2004)
- MODELARNA LIAZ (CZ), pattern manufacturing and HATZAPOULOS packaging (GR): development of ExPlanTech/ExtraPlanT multi-agent system and application towards project-driven production planning and supply chain management; co-funded by an EC project (2000-2003)
- NASA HYRES project: development of an agent based root-cause detection, in hydrogen production facility, subcontract provided by IHMC (2003)
- ROCKWELL AUTOMATION RESEARCH CENTER in Prague (CZ): design of the agent-based reconfiguration shipboard automation for the chilling system (2002)

### Defense Collaboration

Since its foundation in 1999, ATG has been collaborating intensively with the *Air Force Research Laboratory*, NY on the following projects funded by AFOSR, OSD and EOARD:

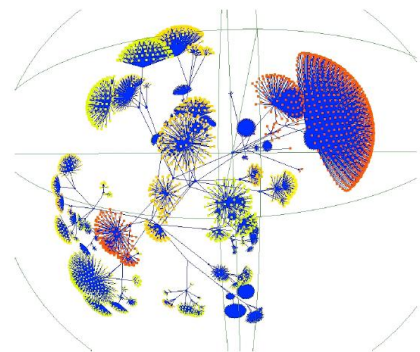
- Agent-based Computing in Distributed Adversarial Planning, FA8655-07-1-3083 (2007-2008)
- Autonomous Agents for UAV Air-Traffic Control, FA8655-04-1-3044-P00001 (2005-2007)
- Advanced Agent Methods in Adversarial Environment, FA8655-04-1-3044 (2004-2005)
- Meta-reasoning and Monitoring in the Multi-Agent Systems FA8655-02-M4056 (2002-2003)
- Agents Inaccessibility in Multi-agent Systems FA-8655-02-M-4057 (2002-2004)
- Acquaintance Models in Operations Other Than War Coalition Formation F61775-00-WE043 (2002-2003)
- Multi-Agent Systems in Communication, F61775-99-WE099 (1999 - 2000)

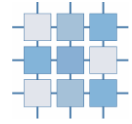
ATG has been working on the following research projects with *CERDEC US Army*, NJ:

- Distributed Planning and Coordination of Team-oriented Activities in a Dynamic Environment, W911NF-08-1-0041 and N62558-06-P-0353, subcontract provided to University of Edinburgh (2006-2008)
- Cooperative Adaptive Mechanism for Network Protection N62558-07-C-0001, subcontract provided to Masaryk University (2007)
- Modeling Individual, Collaborative and Adversarial Reflection in MAS N62558-05-C-0028 (2005-2007)
- Reflective/Cognitive Agent in Distributed Decision Making N62558-04-C-6001 (2004-2005)
- Modeling in Multi-agent Systems: A Technology Primer, N62558-03-0819, (2004)

ATG has been working on the following research projects with *Naval Research Laboratory*, ONR/NRL:

- Meta-reasoning and Adjustable Autonomy in Computational MAS N00014-06-1-0232 (2005-2008)
- Robot coordination using PIM, subcontract awarded by Florida IHMC, US N00014-06-1-07756 (2007)
- Meta-reasoning for Modeling and Simulation in Multi-Agent Systems N00014-03-1-0292 (2003-2005)





## European RTD projects

ATG has participated in several European Commission FP5 and FP6 RTD Projects:

- CONTRACT - Contract Methods for Verifiable Cross-Organizational Networked Business Apps (2006-2008)
- K4Care - Knowledge-Based HomeCare eServices for an Ageing Europe, EU 6FP- STREP Project, IST - No.026968 (in collaboration with GL Nature Inspired Computing Group)
- PANDA - Collaborative Process Automation Support using Service Level Agreements (2006-2008)
- AgentLink III: EU FP6 Coordinating Action in Agent Based Computing, membership in management committee, responsibility for industrial action (2004-2005)
- Ecolead: EU FP6 Integrated Project directed towards automated virtual enterprise creation and reconfiguration (2004-2009)
- ExtraPLANT/EUTIST-AMI IST project, agent-based solution for supply chain management (2003-2004)
- ExPlanTech IST project, development and take-up of production planning multi-agent system (2000-2002)
- MPA GROWTH project, agent-based modular planning and simulation architecture (2002-2003)

## National Projects

ATG has contributed to two major national research programs: Decision Making and Control in Manufacturing (MSM212300013 and MSM6840770013) and Center of Applied Cybernetics (1M6840770004, LN00B096) both funded by the Ministry of Education, Youth and Sports of the Czech Republic

## Collaboration in Research

ATG have been in a close collaboration with numerous leading research centers and institutes. ATG works or worked with the *University of Edinburgh*, Artificial Intelligence Application Institute (prof. Austin Tate, Dr. Michael Rovatsos and Dr. Gerhard Wickler), *University of Southampton* (Dr. Terry Payne), *University of London, Kings college* (Prof. Michael Luck), *University of London, Imperial College* (Dr. Allesio Lomuscio), *University of Liverpool*, Agent group, (dr. Peter McBurney), *State University of New York*, *University of Binghamton* (Prof. Victor Skormin), *Florida Institute for Human and Machine Cognition* (Dr. Jeff Bradshaw, Niranjana Suri, Dr. Marco Carvallho), *Universitat Politècnica de Catalunya* (Dr. Steve Willmot, Dr. Javier Vazquez), *University of Calgary* (Dr. Robert Brennan) and others.

## Publications and further details:

Available for download from <http://agents.felk.cvut.cz>

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