AIR FORCE RESEARCH LABORATORY
ROME, NEW YORK

STATEMENT OF WORK

FOR

AXIS: AGENT-ASSISTED, CONTEXT-BASED COLLABORATION ACROSS INFORMATION SPACES

PR NO. T-3-4513

17 OCTOBER 2002

(Contract Number F30602-03-C-0009)
<table>
<thead>
<tr>
<th>SECTION</th>
<th>DESCRIPTION</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>Objective</td>
<td>3</td>
</tr>
<tr>
<td>2.0</td>
<td>Scope</td>
<td>3</td>
</tr>
<tr>
<td>3.0</td>
<td>Background</td>
<td>3</td>
</tr>
<tr>
<td>4.0</td>
<td>Technical Requirements</td>
<td>4</td>
</tr>
</tbody>
</table>
1.0 OBJECTIVE.

1.1 The objective of this effort is to address the problem of empowering a broad range of traditionally non-collaborating groups and entities to collaborate more effectively while adhering to the local policies and procedures of individual organizations. The AXIS effort will enable a level of workgroup interoperability across various collaboration tools and frameworks.

2.0 SCOPE.

2.1 The scope of this effort involves the development of new prototype tools and techniques for modeling workgroup goals and activities that increase collaborative capabilities; the development of automation using agent technologies that leverage Workgroup Context to improve overall inter and intra team capabilities and performance. This work will be conducted with and for the Intelligence Community.

3.0 BACKGROUND.

3.1 The goal of the Total Information Awareness (TIA) Program is to provide significant improvement in the ability to detect asymmetric threats to national security. TIA is an umbrella program aimed at detecting, classifying, linking, tracking, and understanding information gathered from traditional and non-traditional information sources. It is focused on bringing prototype tools and capabilities to the DoD intelligence agencies so that analysts will be better able to identify potential threats to DoD forces and to the nation. Program efforts are intended to provide a series of increasingly powerful leave-behind prototypes with a limited number of proof-of-concept demonstrations in extremely high risk, high payoff areas. Technology areas include data repositories, collaboration, and prototype systems, as described below.

3.1.1 Data Repositories (TIA/Geni.sys). In the context of this program, the term repository is intended to convey a new kind of extremely large, omni-media, virtually-centralized, and semantically rich information repository that is not constrained by the limited commercial database products available today. Much of the existing database and repository technology is based on a paradigm defined in the 1980's. Today, computer processors, storage media, and networks are a thousand times more capable. The goal is to reinvent database technology consistent with today's needs and capabilities. To predict, track, and pre-empt attacks requires a full coverage repository containing all information relevant to the tasks of identifying potential
terrorists and their supporters, activities, prospective targets, and operational plans. Innovative
technologies to architect, populate and exploit such a repository for combating terrorism will be
developed under this technology area.

3.1.2 Collaboration (TIA/GENOA II). The focus of collaboration is on developing information
technology needed by teams of analysts and operations and policy personnel to anticipate and
preempt threats to U.S. interests. The goal is to make such teams faster, smarter, and more joint
in their day-to-day operations. It will apply automation to team processes so that more
information can be exploited, more hypotheses created and examined, more models built and
populated with evidence, and overall, more crises dealt with simultaneously. Specific areas
include: a) cognitive aids that allow humans and machines to think together in real-time about
complicated problems, b) means to overcome the biases and limitations of the human cognitive
system, c) cognitive amplifiers that help teams rapidly and fully comprehend complicated and
uncertain situations, and d) the means to rapidly and seamlessly cut across and complement
existing stove-piped hierarchical organizational structures by creating dynamic, adaptable, peer-
to-peer collaborative networks.

3.1.3 Prototype Systems (TIA/TIA Systems). The TIA program will develop and integrate
information technologies into fully functional, leave-behind prototypes that are reliable, easy to
install, and packaged with documentation and source code (though not necessarily complete in
terms of desired features) that will enable potential users to evaluate new technologies through
experimentation and rapid transition to operational use. The goal is to create a series of
prototype, closed-loop, end-to-end systems. Software products resulting from the two technical
areas above as well as other technologies will be integrated to provide these systems.

3.2 This effort addresses the TIA technical area of Collaboration (TIA/GENOA II).

4.0 TECHNICAL REQUIREMENTS.

4.1 The contractor shall design, develop, document, demonstrate, test, and deliver a prototype
distributed cross-architecture team collaboration environment that includes a formal model for
the team collaboration context sufficient to support agent automation and augmentation of
workgroup activities.
4.1.1 Design, develop and support collaboration infrastructure Workgroup technology within the AXIS framework to construct a formal computational model of both the process and the data associated with the distributed collaborative team.

4.1.1.1 Design, develop, document, and deliver a formal team collaboration context model that enables augmentation using agents or similar technologies.

4.1.1.2 Explore and determine appropriate underlying technologies and methodologies for developing and maintaining this context including knowledge frameworks and representation formalisms such as DARPA Agent Markup Language/Ontology Inference Layer (DAML/OIL) ontologies.

4.1.2 Design and develop agent-based mechanisms to support and enhance interoperability between distributed collaborative workgroups. Focus this interoperability on supporting information and resource sharing across groups.

4.1.3 Develop a Layer Business Rule system for operation within a given workgroup to provide reasoning services that affect and moderate the behavior of the workgroup and the participants based on the business rules in effect for that group or individual.

4.1.3.1 Develop a layered business rule system that will support "Individual Rules," set by members of the organization to control individual interactions with the collaborative workgroups (notification preferences for example). Develop "Workgroup Business Rules" that govern the operation of individuals in various roles within a given workgroup.

4.1.4 Develop methods for storing digital histories for individual workgroups to provide snapshots of evolving workgroup context.

4.1.4.1 Assemble digital histories to contain situation information (e.g., world state, event-related information, and inferred information (including tasks and goals)).

4.1.4.2 Design and develop tools for effective and efficient searching within digital histories, provide for re-instantiation of a digital history snapshot, and for human and agent comparison capabilities of various digital histories.

4.2 The contractor shall develop templates to facilitate collaboration.
4.2.1 Explore automated context acquisition and support to the extent practical within the team collaboration environment, including both process (activities) and information content (data) being produced and used by the workgroups.

4.2.2 Develop a class of agents, based on a DARPA CoABS Grid compatible agent framework, aimed at leveraging a workgroup context to help identify information needs of the workgroup based on both process and data within that workgroup. Develop the agents to pro-actively search for and provide candidate information back to the working group based on current and evolving context of the workgroup.

4.2.3 Develop a set of parameterizable rule templates for each class and level of business rule identified. Design rule templates to enable the rapid instantiation of a "policy" for individual, group, and inter-group interactions. Enable the limited tailoring of rules to fit the needs for specific cases.

4.3 The contractor shall develop new and modify existing tools to support an automated augmentation process.

4.3.1 Develop an interface to aid a user in augmenting and correcting context elements that have been directly acquired by the system based on user activities and events. User context interfaces will include those to support acquisition of context information and those targeted at aiding in context re-acquisition or change.

4.3.2 Develop a Business Rule System that provides a rule engine for rule evaluation, a simple rule editor to support power-user construction of additional parameterizable rule templates, Event Listeners to monitor for events requiring rule evaluation and consideration, and Action Listeners that take specific actions based on the rule firings.

4.3.3 Design and develop the infrastructure services and utilities necessary to create, access, maintain, and support workgroup digital histories.

4.4 The contractor shall develop analysis assessment methods and tools which support distributed collaboration.
4.4.1 Develop a class of agents, based on a DARPA CoABS Grid compatible agent framework, to help identify key resources (both human and electronic) that may be of use to a given workgroup based on the workgroup context information.

4.4.2 Develop a tool for interfacing with individual workgroup digital histories that accomplishes searching based on any and all context information within an individual digital history. Design views of the context information, with the capability for user-defined filters enabling the user to focus on specific aspects of the context.

4.5 The contractor shall develop a visualization tool.

4.5.1 Develop a tool to compare two (2) contexts within a digital history and complete operations such as a "context diff."

4.5.2 Enhance context re-acquisition when a user re-enters a workgroup by providing focus on simply those context elements that changed since last attendance.

4.6 The contractor shall perform knowledge acquisition with the Intelligence community as relating to this effort.

4.6.1 Obtain an understanding of the current work processes from potential end users. Build domain models and gain feedback from users on different aspects of the system (e.g., graphical user interface versus design).

4.6.2 Provide designated end-user representatives and integration personnel with storyboards and mockups of planned functionality to obtain feedback on the planned approach as appropriate.

4.7 Program demonstration, evaluation, and participation.

4.7.1 Work with the Genoa II Test and Evaluation contractor to define a generic test suite for the Collaboration and Corporate Memory technology area within the initiative.

4.7.1.1 Design a tailored test suite to the specifics of the AXIS development effort.

4.7.1.2 Conduct annual tests and evaluations of the AXIS software using the tailored test suites.

4.7.1.3 Develop demonstration scripts, document demonstration objectives and describe functions and capabilities to be demonstrated. Include concise, step-by-step instructions on how
to replicate the demonstration, including the target software demonstration environment. (See CDRL A003)

4.7.1.4 Provide the results of testing and the technical evaluation of experimental results to the Genoa II Program. (See CDRL A004)

4.7.2 Program Participation.

4.7.2.1 Participate in program reviews, workshops, demonstrations, annual evaluations, and DARPA Principal Investigator (PI) meetings as specified in the contract schedule.

4.7.2.2 Collaborate and cooperate with other TIA/Genoa II contractors for a) duplication avoidance, b) ensuring the interoperability of languages, tools, and middle-ware to avoid "stovepipe" solutions, and c) ensuring the efficient planning and conduct of demonstrations of developed technology.

4.7.2.3 Conduct oral presentations at program reviews and DARPA PI meetings and workshops. Provide the status of the technical progress made to date in the performance of the contract, and the overall program direction, successes, and significant issues. (See CDRL A002)

4.8 Deliver all computer software developed, assembled, or acquired in accordance with the contract schedule and the following.

4.8.1 Provide commented software source and executable object code for all developed software. (See CDRL A005)

4.8.1.1 Provide the executable code to other TIA program participants for testing, evaluation, and potential integration with other components of the TIA system.

4.8.1.2 Package software releases as self-extracting installation executables.

4.8.2 Install the developed software products at Rome Research Site for demonstrating the advanced technology to prospective Air Force customers.

4.8.3 Document installation, user, and maintenance instructions for all developed software components. (See CDRL A006)
4.8.4 Transfer all purchased and licensed software used during development or as a component for this effort upon completion; include licensing and maintenance agreements and the original media software and documentation. (See CDRL A007)

4.8.5 Developed software shall be completely maintainable and modifiable with no reliance on any non-delivered computer programs or documentation.

4.9 Reports and Documentation

4.9.1 Continually determine the status of this effort. Provide comprehensive, yet succinct reports documenting progress toward the accomplishment of contract objectives and requirements. (See CDRL A001)

4.9.1.1 Supply program documentation, such as, white papers, presentation materials, technical documents, user instructions, and software developed under this effort to the TIA web portal.

4.9.2 Document all technical work accomplished and information gained during performance of this acquisition to permit full understanding of the techniques and procedures used in evolving technology or processes developed. Include objectives, approach, science involved and concepts employed, significant observations, problems, positive and negative results, and design criteria established. Document procedures followed, processes developed, "lessons learned", and other useful information. If applicable, cross-reference each design, engineering, and process specification delivered. (See CDRL, A008)
The Offeror asserts for itself, or the persons identified below, that the Government's rights to use, release, or disclose the following technical data or computer software should be restricted:

<table>
<thead>
<tr>
<th>Technical Data or Computer Software to be Furnished With Restrictions</th>
<th>Basis for Assertion</th>
<th>Asserted Rights Category</th>
<th>Name of Person Asserting Restrictions</th>
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<td>Douglas Lenat</td>
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<td>Assertions in support of: Integrated Knowledge Base and</td>
<td>Both were developed with mixed funding.</td>
<td>Government Purpose Rights for both.</td>
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<td>Integrated Development Environment</td>
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</tbody>
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*Attachment No. 2*