

1 Methodology

The ultimate goal of this project was to prepare an extensible software design framework for use in the Autonomous Nano Technology Swarm missions. The framework incorporates strategies and procedures from previous spacecraft missions as well as theories from software engineering. The project team researched the software design that the Deep Space 1 and Near Earth Asteroid Rendezvous missions used to accomplish their objectives. The team also identified specific functionality and feasibility concerns to arrive at an effective system framework that addresses the need for an extensible design. This design allows future modifications and improvements to replace original components of the system while maintaining a consistent overall system structure.

The primary objectives for this project were:

- Identify existing and potential architectures for autonomous spacecraft systems.
- Implement a design that provides an extensible framework in which intelligent components can be added as they are developed.

The rest of this chapter is divided into sections that illustrate the methods and procedures used to complete these objectives. The section *Examination of Existing Frameworks* explains how information regarding system designs was gathered, organized, and analyzed. Finally, the section *Implementation of System Framework* illustrates the steps that were taken to implement an extensible framework for the Autonomous Nano Technology Swarm mission.

1.1 Examination of Existing Frameworks

This section details how the team juxtaposed and summarized the system designs from the Deep Space 1 and Near Earth Asteroid Rendezvous missions. In addition, this section provides a discussion of the methods that were used to incorporate practices from object-oriented software engineering.

1.1.1 Previous Spacecraft Missions

- Deep Space 1
- Near Earth Asteroid Rendezvous

- Differences (focuses, objective, design) between the two (but no conclusions)

1.1.2 System Design Evaluation Methods

- Feasibility for short project
- Achievable with limited knowledge
- Extensibility to accommodate the two previous points
- Appropriateness to ANTS mission

1.1.3 Professional Resources

Conducting discussions with experts on advanced architectures provided information on the feasibility of various approaches to the construction of an ANTS system. Speaking to authorities on agent architectures clarified details of agent communication and functionality. By communicating with software engineers and spacecraft engineers, the team determined additional factors to consider in constructing a system framework.

1.1.3.1 Dr. Michael L. Rilee

- Asking him about interaction with simulation
- Asking him about appropriateness of architecture
- Exchanging specifications
- Mock simulations

1.1.3.2 Agent Technology Group

- Presentations to gather feedback
- Suggestions
- Using their varied backgrounds
- Identifying things that were overlooked

1.2 *Implementation of System Framework*

The overall object of this project was to develop a system framework as well as a basic implementation of that framework. The implementation was intended to provide a basis on which the ANTS project could build a more robust and intelligent system.

1.2.1 Software Engineering Strategies?

1.2.2 Testing?