I received a faculty development grant which was intended to be used to support myself and one student. I instead used the money to support two students, Chris Phillips and Chris Ritchey, and a third student, Ben LaBarbera, joined the work on a voluntary basis.

The objectives listed in the proposal for this faculty development grant were as follows:
1. Involve students in scientific research
2. Make advances in research area (survivable distributed systems)
3. Write a paper to be submitted to a conference
4. Produce a poster and report for the Student Summer Research Symposium
5. Collaborate with a faculty colleague at Carnegie Mellon University

I am very pleased to be able to report that all of these objectives were satisfied.

Our work focused on the design and implementation of the Starfish system, work which is being done in collaboration with Dr. Priya Narasimhan, Assistant Professor of Computer Science at Carnegie Mellon University. This is a long-term project, estimated to take place over a five year period, for which we hope to attain outside funding. Dr. Narasimhan currently has three graduate students working with her on this project.

Starfish[1] is a new system that provides intrusion detection and intrusion tolerance for middleware applications operating in an asynchronous distributed system. The Starfish system contains a central, highly secure and tightly coupled “body.” This body is augmented by “arms” that are less tightly coupled and that have less stringent security guarantees, each of which can be removed from the body if a significant security breach occurs. New arms can be “grown” as needed. Residing between the body and arms are “shoulders” that have intermediate guarantees. The Starfish system aims to employ a number of techniques for providing proactive survivability, allowing the system to provide critical services even after the occurrence of attacks, accidents, or faults. Starfish is aimed at supporting distributed applications such as Web Services.

The specific contributions that we made this summer were to identify dimensions in the survivability space, to provide a mapping of a number of prior systems to the survivability space, and to give a mapping of the three regions in Starfish to that space. We designed the architecture of the Starfish system, and identified specific mechanisms present in each of the regions of Starfish. We also began implementing (writing the software for) Starfish.

We wrote a paper [2] summarizing the work that we did this summer, and submitted it to the IASTED International Conference on Parallel and Distributed Computing and

---

[1] Starfish are known to have small bodies, out of which spring forth a varying number of arms, which break off when damaged. These arms subsequently heal and re-grow.
Systems. The full paper was subjected to anonymous peer review, which is typical for computer science conferences, and accepted for presentation at the conference and publication in the proceedings. The three students will attend the conference with me in November, and one of them, Chris Phillips, will participate with me in the paper presentation. I will also serve as co-chair of the session on software architecture.

We also produced a poster describing our work, which we displayed at the Student Summer Science Research Symposium. Chris Phillips served as one of the three student speakers for that event.

This is the first summer in which I have had the opportunity to engage students in research, and it was a great experience. I was encouraged both by the amount of work that they were able to accomplish and the ideas that they generated and stimulated. I would like to express my profound appreciation for the faculty development grant that made this possible!

References
