The Aerospace Corporation in the Lee Center

by Paul Anderson and Fletcher Wicker

Participation in Lee Center activities has provided a clear benefit to The Aerospace Corporation. The topic of communication networks in space is of significant interest to our government customers. Knowledge of current research topics, interaction with Caltech faculty and students, and Caltech faculty exposure to significant space network design issues have all helped to advance the use of communication networks in national security space programs.

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The Aerospace Corporation operates a federally funded research and development center (FFRDC) that is sponsored by the United States Air Force. FFRDCs are unique, independent nonprofit entities that are funded by the U.S. government to meet specific long-term technical needs that cannot be met by any other single organization. FFRDCs typically assist government agencies with scientific research and analysis, systems development, and systems acquisition. They bring together the expertise and outlook of government, industry, and academia to solve complex technical problems.

For national security relating to space, The Aerospace Corporation supports long-term planning and the immediate needs of our nation's military and reconnaissance space programs. The Aerospace Corporation provides scientific and engineering support for launch, space, and related ground systems. It also provides the specialized facilities and continuity of effort required for programs that often take decades to complete. This end-to-end involvement reduces development risks and costs, and allows for a high probability of mission success. The primary customers are the Space and Missile Systems Center of Air Force Space Command and the National Reconnaissance Office, although work is performed for civil agencies as well as international organizations and governments in the national interest.

"unique partnerships"

Within the company, The Aerospace Institute coordinates interaction with universities and colleges such as Caltech, and the Corporate University Affiliates Program was initiated in 1997 to create formal relationships between The Aerospace Corporation and selected universities. Participating universities and academic departments engage in formal agreements with The Aerospace Corporation to accomplish specific tasks and share technical information. The agreements create unique partnerships between faculty, students, and The Aerospace Corporation technical staff as they work together to exchange technology in critical skill areas. In addition, there is an Informal University Relations Program that provides support for employee participation in ad hoc activities at local colleges and universities. These informal activities may include faculty collaborations, technical seminars/colloquia, student mentoring, research reviews, etc. It was through these programs that The Aerospace Corporation became aware of the Caltech Lee Center. Participation in Lee Center activities began in the fall of 2006 and continued until the termination of Lee Center activities in the spring of 2009.

Interest in networking technologies has dramatically increased in recent years across many national

security space programs. Of particular interest is the application of these technologies to space-based networks. Participation by The Aerospace Corporation in the Lee Center seminars and workshops provided (1) an understanding of current network-related research in academia to better support the company's customers and (2) an interaction with new Caltech graduates for possible employment at the company, either through direct contact with these students or through recommendations by Caltech faculty. It has also exposed Caltech faculty to current network design and performance issues of interest to The Aerospace Corporation.

Specific benefits to The Aerospace Corporation due to past participation in Lee Center activities have included interactions with the following professors at Caltech: Professor Hajimiri on novel methods for modulating signals through antenna switching, Professor Wierman on optimization of queuing systems, Professor Effros on network capacity theory, Professor Yariv

"space-based networks"

on optoelectronic devices, and Professor McEliece on information theory and coding. In addition, the sponsorship of the 2008 summer undergraduate research fellowship (SURF) for student Arthur Chang was inspired by Lee Center interactions, as was the company's 2009 hiring of engineering intern Daniel Thai, who was a company-sponsored Caltech SURF fellow and whose interests are in network theory. Moreover, on May 6, 2009 Professor Steven Low of Caltech visited The Aerospace Corporation for discussions of possible research collaboration on the use of fast TCP protocols over satellite links.

Dr. Fletcher Wicker, Dr. Mark Coodey, Mas Sayano, and Paul Anderson of The Aerospace Corporation attended many of the lunchtime seminars sponsored by the Lee Center. Dr. Wicker and Paul Anderson also presented material on two of these occasions. In the fall term of 2006, Dr. Fletcher Wicker discussed quality of service issues for space-based routers serving downlinks with time-varying data rates, and in the winter term of 2009, Paul Anderson discussed satellite sizing and capacity trends and the use of networks in the commercial satellite industry. LEE


Dr. Paul Anderson (left) and Dr. Fletcher Wicker (right); The Aerospace Corporation.

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