

>>> ***INTERIM REPORT*** <<<

**Advances in Networked Video to Improve Safety, Effectiveness, and Security  
of Florida Spaceport Operations**

**Kenneth J. Christensen**

Associate Professor

Department of Computer Science and Engineering

4202 East Fowler Avenue, ENB 118

University of South Florida

Tampa, Florida 33620

Email: *christen@csee.usf.edu*

Web: *http://www.csee.usf.edu/~christen*

**Reference:** FSREGP Spring 2001 cycle grant (Christensen, "Advances in Networked Video to Improve Safety, Effectiveness, and Security of Florida Spaceport Operations")

**Project website:** *http://www.csee.usf.edu/~christen/space/main.html*

**Date of report:** February 10, 2002

**Period of performance:** 1 year (starting September 1, 2001)

**Total Funding:** \$30,000

**Name of organization:** University of South Florida, Department of Computer Science and Engineering

## 1. Summary of Project

This project has two goals. The first goal is to explore the feasibility of adding video cameras to the clothing of spaceport technicians, or *video-enabled technicians*. Wearable video cameras can enable real-time consultation with off-site experts and allow for archiving of procedures for later safety audits or for use as training instruments. The second goal is to investigate technologies for deployment of 100's to 1000's of video cameras in the local area. Video infrastructures based on such *wired sensor networks* have great promise for improving safety and security.

We are focusing on evaluating COTS hardware and software products for the video-enabled technician. We will complete a formal evaluation of existing products and prototype a "proof of concept" video-enabled technician. We expect to deliver video clips and images of mock procedures to demonstrate the feasibility of a video-enabled technician. For the wired sensor network part of the project, we are focusing on the emerging IEEE 1394b FireWire [1] technology as a means of building large-scale and high bandwidth wired sensor networks. We are also studying the feasibility of passive fiber connection methods that will be lower in cost and more reliable than a FireWire based solution. This work is focused on simulation modeling of fireWire and of new proposed protocols.

A website has been created for this project and is shown in the appendix of this interim report.

## 2. Accomplishments to Date

This grant is supporting two students and allowing for faculty release time. The students currently supported are (and will be supported until the end of project):

- Christine Bexley (<http://www.eng.usf.edu/~bexley>) – Undergraduate honors student
- Vijay Chandramohan (<http://www.csee.usf.edu/~vchandr2>) – Graduate student

In Fall 2001 the grant supported

- Christine Bexley (<http://www.eng.usf.edu/~bexley>) – Undergraduate honors student
- John Shahbazian (<http://www.csee.usf.edu/~jshahbaz>) – Graduate student

Christine is focusing on the video-enabled technician (with assistance from John in the Fall) and Vijay on the wired sensor network. The wired sensor network portion of this project has great potential for future funding. I intend to submit an NSF Network Research [2] proposal based on the preliminary results from this work. To date we have accomplished the following for the first goal:

1. Identified, acquired, and installed eight video conferencing and streaming video products on a PC test bed
2. Purchased off-the-shelf cameras and microwave communications for the video-enabled technician
3. Developed an evaluation procedure to be followed for the formal evaluation of the software and hardware
4. Developed a mock "procedure" to be used to demonstrate the feasibility of the video-enabled technician
5. Built the video enabled technician prototype and are ready for evaluation. Figure 1 shows the current system.



A bullet camera is mounted in the visor of a hat worn by the technician. This is shown in the head model on the top of the monitor. A wireless link transmits the video to a base station from which a network connection transports the packetized video to a remote viewer. We are currently experimenting with how much of the hardware can be placed on person and whether, or not, a tether is needed to a surface mounted transmitter.

The monitor shows a "procedure" in which a disk drive is being removed from another PC.

**Figure 1 – Prototype video enabled technician**

We have accomplished the following for the second goal:

1. Identified FireWire [1] as a possible best choice technology for building high-bandwidth wired sensor networks.
2. Begun simulation modeling of a FireWire video network.
3. Begun to track and evaluate future developments in FireWire, include IEEE 1394B fiber physical layer.
4. Begun to investigate passive fiber optical networks as a means to achieve a lower cost and more reliable network than possible with FireWire.

Figure 2 shows a video surveillance network with the key ideas of clustering around a backbone. Each link from a cluster can support multiple daisy-chained cameras added in an ad-hoc fashion. Our problem is to investigate the technologies that can implement such a network and then model them.

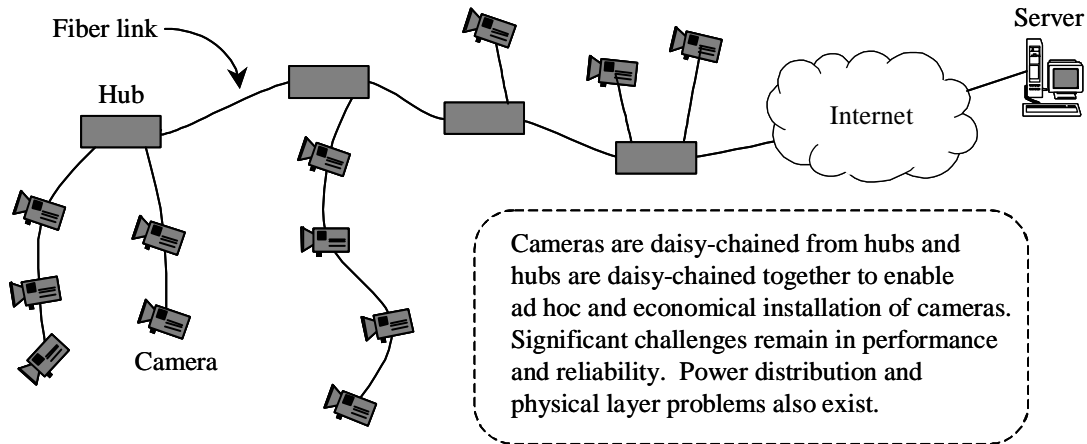


Figure 2 – Large-scale video surveillance network

### 3. Expected Accomplishments in Remaining Time

We have several deliverables to finish before the end of the funded period of this project (August 31, 2002). We intend to accomplish the following:

1. A full evaluation of COTS software and hardware suitable for implementing a video-enabled technician
2. A demonstration of a mock procedure done by a video enabled technician. This demonstration will be done in the Information Systems Laboratory at the University of South Florida. The demonstration will include images of the set-up and video clips all of which will be placed on the project website.
3. A complete report of the video enabled technician evaluation and demonstration. The report and the above demonstration will be shared with our industrial supporter, Bionetics Photo Services in Cape Canaveral.
4. A conference paper and report describing performance evaluation of FireWire as a candidate technology for implementing high-bandwidth, wired sensor networks (e.g., for an application as a video surveillance networks). A technical disclosure may also be filed, if appropriate and desired by Florida Space Grant.
5. An NSF Networking Research proposal [2] (due June 1, 2002) for additional funding to further investigate wired sensor networks including performance evaluation and new ideas at both the PHY and MAC layers. This will be a three-year grant requesting about \$200K.

### References

[1] IEEE Std 1394-1995, IEEE Standard for a High Performance Serial Bus, 1995.

[2] NSF Networking Research Program Announcement, 2002. URL: <http://www.nsf.gov/cgi-bin/getpub?nsf98164>.

## Appendix – The Project Website

The project website is at <http://www.csee.usf.edu/~christen/space/main.html>. Results will be posted to this website.



The screenshot shows a Microsoft Internet Explorer browser window with the title "Florida Space Grant Video Project - Microsoft Internet Explorer". The address bar shows the URL "http://www.csee.usf.edu/~christen/space/main.html". The website content includes the University of South Florida (USF) logo, the title "Florida Space Grant Video Project", and a graphic of a hand holding a video cassette. The main text describes ongoing research for a Spring 2001 Florida Space Research and Education Grant (reference PO A07277) for the principal investigator Ken Christensen. It mentions the grant period (September 1, 2001 to August 31, 2002) and the funding agency, the Florida Space Grant Consortium. A feedback email address, [christen@csee.usf.edu](mailto:christen@csee.usf.edu), is provided. A notice states "UNDER CONSTRUCTION (until 03/15/02)". A list of links is provided: What's new, Project description, People, Deliverables, Publications, Simulation models and trace files, Miscellaneous, and Progress towards goals and impacts. A link is provided for a demonstration of the video-enabled technician. A disclaimer states that the material is based upon work supported by the Florida Space Research and Education Grant Program. The footer includes navigation links for USF, CSE department, and IS Laboratory, and a note that the page was last updated by Ken Christensen on FEBRUARY 7, 2002.

**University of South Florida**  
**USF**

# Florida Space Grant Video Project



---

This page describes ongoing research for a Spring 2001 Florida Space Research and Education Grant (reference PO A07277) for the principal investigator [Ken Christensen](#). This is a one year grant (September 1, 2001 to August 31, 2002). The funding agency is the [Florida Space Grant Consortium](#). Send feedback to Ken Christensen at [christen@csee.usf.edu](mailto:christen@csee.usf.edu).

---

>>> UNDER CONSTRUCTION (until 03/15/02) <<<

---

- [What's new](#)
- [Project description](#)
- [People](#)
- [Deliverables](#)
- [Publications](#)
- [Simulation models and trace files](#)
- [Miscellaneous](#)
- [Progress towards goals and impacts](#)

>>> A demonstration of the video-enabled technician is [here](#) <<<

---

This material is based upon work supported by the Florida Space Research and Education Grant Program. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author.

---

[ [USF](#) | [CSE department](#) | [IS Laboratory](#) ]

---

Last updated by [Ken Christensen](#) on FEBRUARY 7, 2002