

Argus Development and Support

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LONG-TERM GOAL

The long term goal of nearshore processes research has been to develop a predictive understanding of the fluid dynamics of a random wave field shoaling over the complicated bathymetry of a natural beach, and the response of the beach to those overlying wave and current motions. Traditionally, this has involved forward prediction based on models and seed data of initial and boundary conditions. However, it has now been broadly recognized that prediction of nonlinear systems such as the nearshore will inevitably fail at long time scales, so that knowledge of a coastal environment will depend on frequent data updates, likely acquired through innovative remote sensing techniques. The Argus Program, developed by the Coastal Imaging Lab (CIL), is one such approach (<http://cil-www.coas.oregonstate.edu:8080>). Technology developments in Argus are important to a range of nearshore dynamics research programs and apply readily to other remote sensing programs of Naval interest.

OBJECTIVES

Argus is a global program, with 12 stations in 5 countries. While the program was invented at Oregon State University and we continue to be the intellectual lead, major complementary development programs have begun in Europe (Netherlands and England), the US (NRL-SSC) and Australia. With the research benefit associated with these efforts come corresponding complications of organizing and maintaining coherency among the groups. This is particularly true in Europe where research is funded as part of the three-year EU CoastView program.

The objectives of the work in this grant are threefold:

- a) to provide support for operations including replacement parts and maintenance to cover normal system attrition, as well as mirrored archive with Stennis Space Center
- b) to allow the design and testing of the third generation Argus Station based around digital firewire cameras and all-digital networks, and
- c) to maintain connections and coherency with other world Argus developers.

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APPROACH

This work continues to involve reactive and proactive components. The reactive component involves: i) replacement of failing system components, primarily by shipping parts to colleagues and tutoring the fix by phone or email, ii) bug recovery usually associated with changes in firewalls or other aspects of site infrastructure, and iii) response to a wide range of queries and requests from collaborators. The proactive component involves: a) improvements in the system, particularly the development of the new, digital Argus III, b) improvements in operations and development of new base-level routines and techniques that are the foundation of Argus. In addition, this grant supports regular operations, although these are almost entirely automated at this stage.

WORK COMPLETED

Now in its second year, the primary activity has been the development and testing of the digital Argus III stations. Based on digital firewire cameras, these stations offer many advantages including an approximately two-fold improvement in linear resolution, capability for collection from five cameras simultaneously, total flexibility in data collection tasking (including mixing of short and overlapping long data runs; Figure 1), and truly synchronous image acquisition from multiple cameras. The first Argus III station is currently being tested as part of the NCEX field experiment and will form the heart of our field data collection effort.

Example: Argus III Collection Strategy

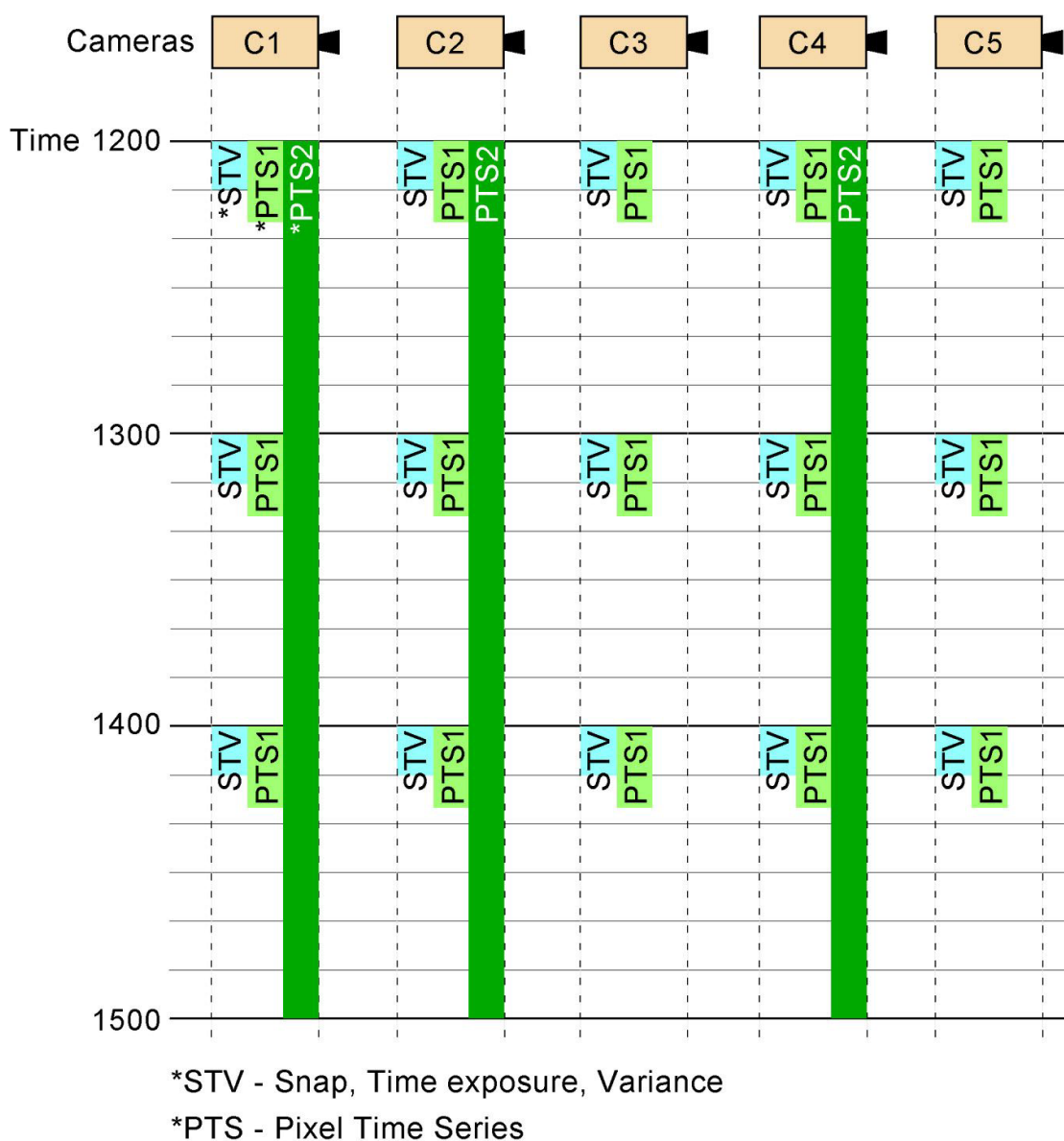


Figure 1. Example camera tasking for Argus III. The new system allows synchronous sampling from all cameras in a station as well as multiple simultaneous processes. Thus, standard images (snap, timex and variance) can be collected every hour while pixel time series of various lengths are also being collected. This is a major advantage over the previous two-camera limitation of Argus II.

A number of new base-level routines have been developed to assist with a range of Argus requirements. We have developed an analysis of sensor MTF based on spectral analysis of a random Gaussian white noise target. We are now able to carry out objective lens focusing, based on the variance of collected images. Many of the signal processing concepts needed for a variety of nearshore analyses have been captured in a pixel instruments Matlab toolbox. Collectively, these and other improvements have greatly enhanced the usability of Argus.

A new (final) Argus station has been installed at Monterey Bay, California. This site, collaborative with Professor Ed Thornton of the Naval Postgraduate School, is a dynamic intermediate beach with active rip currents. As such, the site offers a data set that should be valuable in understanding fluid-morphology interactions at intermediate time scales, as well as offering collaboration opportunities with NPS.

IMPACT/APPLICATION

Argus has become increasingly important in Europe and Australia, with installations now in seven countries over three continents and serious Argus research in five countries. Approximately 30 stations are now in operation. Within the US, Argus and associated spin-offs will play a major role in the NCEX field experiment, now in progress. Argus is also an increasingly important part of Naval nearshore remote sensing research, for example in the VISSER program, run by Dr. Todd Holland at NRL-Stennis Space Center.

TRANSITIONS

Aspects of Argus research development have been integrated in Naval nearshore remote sensing programs through the PI's connections to the LRS program. Transition to the WSC of some of these results is ongoing or complete as of the time of writing.

RELATED PROJECTS

- 1 - Joint work with Dr. Todd Holland, NRL-SSC
- 2 - Collaboration and data sharing of pixel time stack data with Dr. Jim Kaihatu or NRL-SSC
- 3 - Collaboration with WSC personnel at Navocean (headed by Melody Bledsoe and Houston Costolo) on nearshore remote sensing
- 4 - LRS program collaboration
- 5 - EU CoastView Program (2002 - 2005)
- 6 - Numerous collaborations with the Field Research Facility
- 7 - Participation in the NCEX field experiment, 09/19/03 - 11/15/03

REFERENCES

None

PUBLICATIONS

Holman, R.A. Stanley, J.A, and H.T. Özkan-Haller, The application of video sensor networks to the study of nearshore oceanography, IEEE Journal of Pervasive Computing, in press.

PATENTS

None

HONORS/AWARDS/PRIZES

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