

# the GTRI connector

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## ECSL Assists NASA with Space Station Research

by Alton Dunn and Joann Ward

The Electronics and Computer Systems Laboratory (ECSL) is currently working with the National Aeronautics and Space Administration (NASA) to evaluate antenna designs for the initial configuration of the U.S. Space Station.

The research is centered in the Antenna Development Branch of ECSL's Electromagnetic Effectiveness Division. Alton Dunn, Bill Cooke, Vic Tripp, and Pat Montgomery are conducting the study, along with Dick Johnson (GTRI/OOD).

NASA has established several requirements for the coverage and use of the antennas. They will be used in two types of zones—one for command and control and the other dedicated to co-orbiting satellite operations.

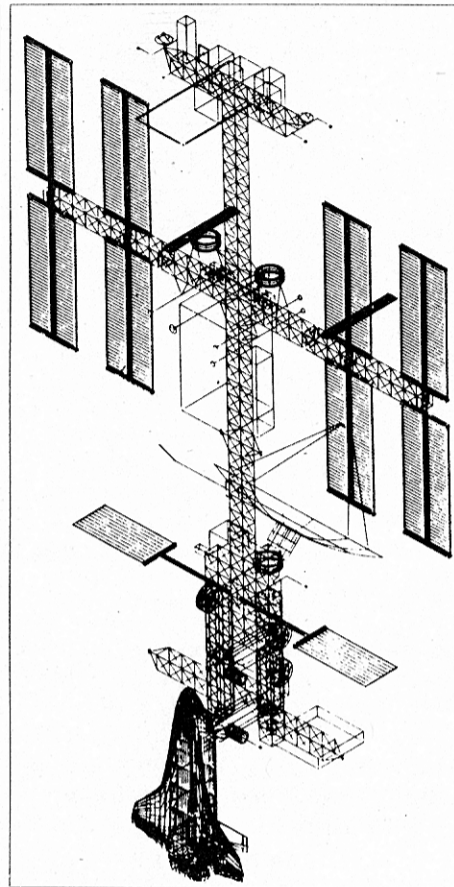
The control zone is a very large area beyond, behind, above and below the Space Station which is designed for command and control functions. Here status information will be forwarded to a decision maker in order to determine requirements or allocation of resources. This function must be capable of accommodating

six users simultaneously.

There will be two co-orbiting satellite zones, one in each orbital direction. Each zone must be able to handle five users simultaneously, and plans are to expand this requirement to 12 to 16 simultaneous users. These zones will be used during such operations as:

- servicing spacecraft within the Space Station's orbit;
- retrieving satellites from high orbits such as geosynchronous orbits and bringing them into the same orbit as the Space Station;
- dispatching repair crews to a designated spacecraft, or even the Moon.

The team already has surveyed a number of candidate antennas to determine their suitability to these functions. Some known factors which limit selection are bandwidth, reliability, packaging constraints, and switching network complexity. Other constraints have yet to be identified. Preliminary findings suggest that mechanically steered antennas (such as flat-plate arrays) may be most suitable for the control zone and multiple-beam reflector antennas for the two co-orbiting satellite zones.



Proposed initial operational configuration of the U.S. Space Station. (NASA drawing)

The study is expected to extend into 1990. Future work will encompass electromagnetic interference analyses, determination of the optimum location for antenna mounts, and development of the antenna management system.

## Tech Protests Federal Limits

The Office of Management and Budget (OMB) is proposing to put a ceiling on the amount that universities can claim for the administrative costs of conducting federally sponsored research.

An OMB announcement in the Federal Register on February 12 proposes to limit administrative charges to 26% of the "modified" direct value (cost) of the grant or contract, beginning April 1 of this year. On April 1, 1987, that ceiling would drop to 20%.

The proposal would affect only administrative costs, which represent about two thirds of Georgia Tech's 63.5% indirect cost rate. The ruling would not apply to indirect costs related to such things as use charges for buildings and equipment, facilities expenses and maintenance, and libraries. The ruling, as we understand it, would apply to expenses normally charged to H-accounts in our Laboratories.

OMB invited responses, and Dr. Thomas Stelson, vice president for research, replied in a three-page letter that the proposal is an "arbitrary, unilateral and unreasonable action." Several members of Georgia's congressional delegation also have protested to OMB, suggesting that rate reductions be negotiated instead of mandated.

Robert M. Rosenzweig, president of the Association of American Universities, asked members of Congress to urge OMB to withdraw its rule, which he warned will cause "losses in the millions of dollars a year . . . by individual institutions, and virtually all universities will suffer noticeable reductions."

Howard Dean, associate director of GTRI, said, "For years, the government has negotiated indirect cost rates based on audits of expenditures. Now, a bureaucratic arm of the government proposes to dictate those rates regardless of the actual research expenses we incur. We're in favor of saving money, but we are resisting their method of settling the issue. And we're considering alternatives to ease the impact on our research programs."

## 3-D Sound Cues: Help for Aircraft Pilots

(Condensed from an article by Mark Hodges in the Winter 1986 issue of *Research Horizons*.)

The fighter pilot races his jet through the valley behind enemy lines, 100 feet off the ground. His mission is to destroy a munitions plant 30 miles away. At 1,200 miles an hour, he has only a half minute before his bombing run begins. He must spend these last 30 seconds navigating his plane, scanning passing terrain, watching the skies for enemy aircraft, tracking jets in his squadron, "locking in" on a target with radar, and using another video monitor to evade enemy missiles.

If this set of tasks sounds a little like trying to play two games of Pac-Man at once, consider another problem: the design of the cockpit itself. The console confronting the

pilot in a military fighter plane contains a dizzying array of dials, displays and indicators. In a job where seconds count, there's a definite need to simplify cockpit design as much as possible.

"Pilots face an overload of information to process," says Dr. Ted Doll, a psychologist in the Systems Engineering Laboratory (SEL). "They must lean too heavily on their vision in their work routines. They could perform many of their tasks better, quicker and more 'naturally' using their sense of hearing."

To make this possible, Doll and his colleagues are researching techniques for adding a three-dimensional quality to audio messages delivered through an aircraft pilot's headset.

When a pilot flies a mission, the headphones in his helmet deliver non-directional auditory

messages. The research program under Doll's direction would deliver directional auditory cues through the pilot's earphones. Doll believes that auditory cues could simplify cockpit routines in which the pilot must determine location.

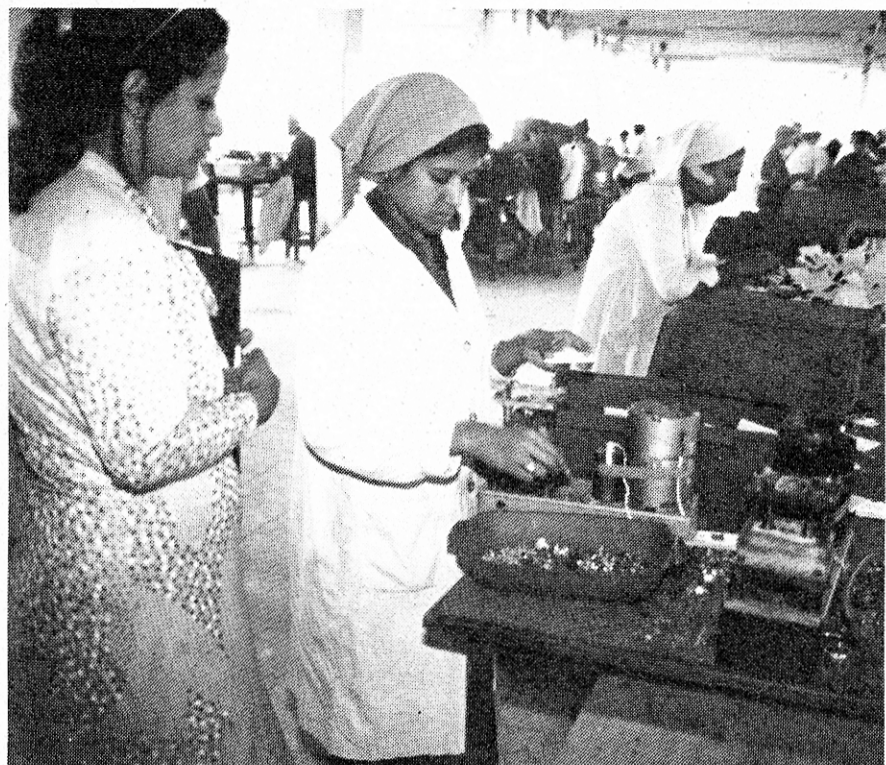
To evade enemy missile-guidance radars, for example, the pilot would hear a beeping noise or a synthetic voice through his headphones. It would appear to come from a distinct direction—the location of the enemy radar. If a synthetic voice were used, it could reinforce its directional message with words like: "Radar at 8 o'clock."

Auditory localization presented researchers in Doll's Human Performance Branch with a formidable challenge. The manner in which the human ear and brain localize

See "3-D," page 3



## Egyptian Industry Gets Help From GTRI Office in Cairo



This firm which makes electrical products is one of the Egyptian industries receiving diagnostic and technical services in the Industrial Technology Application Program, a joint project of GTRI and EIDDC, an Egyptian organization. (Photo by Ben James)

### An On-Site Report by Martha Ann Stegar

Suppose you were the manager of a large dairy company in Egypt. How would you rate an industrial assistance organization that showed you how to save \$2.8 million\* a year?

For this company, engineers in the Industrial Technology Application Program (ITAP) designed a new method of producing white cheese that is expected to increase productivity by 25%. The method utilizes the new technology of ultra-filtration and includes procedural and equipment improvements.

But this is just one example. If Egyptian industrial companies implement the recommendations for productivity improvements resulting from 32 diagnostic studies completed by ITAP engineers in the last half of 1985, they will be able to save an aggregate \$5.5 million annually.

\*Savings are calculated at the official exchange rate of \$1.00 = 1.33 Egyptian pounds.

### What Is ITAP?

ITAP is an organization offering technical services to Egyptian industry. A joint project between the Engineering and Industrial Design Development Center (EIDDC) of Egypt and GTRI, ITAP is funded by the U.S. Agency for International Development (USAID). From its offices near the Great Pyramids in the Cairo suburb of Giza, ITAP strives to increase industrial productivity in Egypt by transferring and applying American know-how and expertise.

Who are ITAP's industrial clients? Let's look at some specific examples.

#### Some Success Stories

- A steel fabricator was experiencing problems with surface treatment and finishing of parts. ITAP recommended several modifications to the phosphating line and assisted in implementation. Estimated savings: \$60,000-\$75,000 a year.

- Recommendations on pouring techniques in a die casting machine enabled a small brass foundry to increase the output of acceptable parts from 20% to 80%.

- ITAP pinpointed the cause of excessive equipment downtime in a candy factory. Implementation of ITAP's recommendations immediately increased productivity by 20%. ITAP also made recommendations for preventive maintenance, spare parts inventory control, and work flow, and trained plant personnel. Estimated savings: \$230,000 a year.

- ITAP helped two textile companies achieve a 15% improvement in weaving efficiency. One company saved about \$30,000 a year; the other, \$22,000.

- Suggested procedural improvements will help a garment company improve productivity up to 75%. Estimated savings: \$75,000.

- ITAP has begun assisting a large automotive company to establish a total quality control system in the assembly of trucks and buses. Assistance in 1985 included training company managers and engineers, solving quality problems in the crankshaft machining and rear-axle assembly departments, establishing quality circles, and planning seminars to help feeder plants that supply parts to the company improve the quality of their products. ITAP also trained 12 of the company's engineers in computer-aided design.

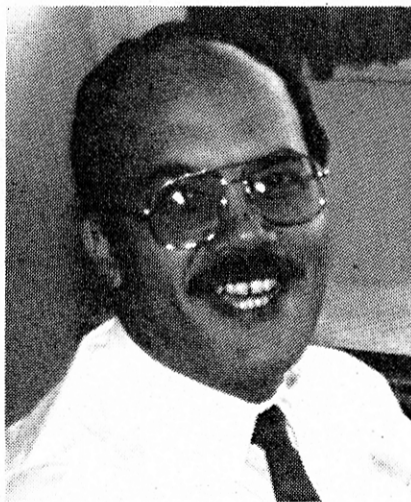
#### Counterpart Training

A major aim of the project is

to train Egyptian engineers to take over management of the industrial assistance services. In 1985, the technical services work was performed by teams which included U.S. and Egyptian short-term consultants as well as ITAP/EIDDC staff members. Management of technical services was made a dual U.S./Egyptian responsibility, and Egyptians assumed full responsibility for information services, computer services, and several industrial service areas.

The U.S. consultants on the teams emphasize cross training of Egyptian counterparts. This is accomplished principally by individualized on-the-job training, but special training events are regularly made available. In another year and a half, when the Georgia Tech contract ends, the Egyptian staff is supposed to be able to handle the entire program with little or no U.S. assistance.

The work in 1985, the third year of the program, was done while Tom Peltier was acting team leader for Georgia Tech. Milan Radovic has just been appointed the new GIT team leader. The counterpart team leader for EIDDC is Engineer Mohamed Kamal, and Dr. Tarek Morad is the project's internal evaluator. The project is lodged in the International Programs Branch of the Economic Development Laboratory, with Bill Larson as project director.



Mohamed Kamal (left) is the Egyptian counterpart team leader for the ITAP project. Tom Peltier (right) was acting team leader for Georgia Tech in 1985.

## Software Training Schedule

Computer Literacy (9-4:30): Apr. 1, 15.  
 Beginning PROFS (10-12): Apr. 3.  
 PROFS Scheduling (10-12): Apr. 10.  
 Advanced PROFS (10-12): Apr. 24.  
 Beginning Lotus 1-2-3 (9-4:30): Apr. 4.  
 Advanced Lotus 1-2-3 (9-4:30): Apr. 18.  
 Beginning dBASE II (9-4:30): Apr. 7.  
 Beginning DOS (9-12:30): Apr. 11. (1-4:30): Apr. 2.  
 Advanced DOS (9-12): Apr. 21.  
 Beginning Wordstar (9-12): Apr. 2.  
 Advanced Wordstar (9-12): Apr. 23.  
 Volkswriter (9-12:30): Apr. 14.

DisplayWrite 3 (1:30-4:30): Apr. 8.  
 Basic CMS (9-12): Apr. 8.  
 Videoshow (1:30-4:30): Apr. 10.  
 On-Line Library Catalogs (1:30-4:30): Apr. 14.  
 C Programming Language (1:30-4:30): Apr. 21-25.  
 All Power Tools (8-12): Apr. 28.  
 VAX Workstation Training Session (9-4:30): VMS - Apr. 28; System Administration - Apr. 29; FORTRAN - Apr. 30.  
 Call ext. 6206 to sign up for classes. For descriptive information on the word processing courses, see the "Software Review" column on page 4.

## GTRI Staff Members Find Jinx in the Shadow of the Sphinx

Veteran travelers Bill Larson and Ken Maddox of EDL have done it again! They were on site in Cairo for an annual review of the ITAP project when some of the Egyptian security forces rioted in late February. GTRI Director Don Grace flew in for the meeting just as President Mubarak was imposing a curfew on the city. They were not in any danger, but they spent several days

confined to their hotels before order was restored and the curfew was lifted.

It may or may not be coincidental, but a year ago in February, Larson and Maddox barely escaped with their lives (and very little else) from a burning hotel in Manila, Philippines. They haven't figured out which one of them is jinxed, but they have vowed never to travel together again!



### 3-D (from page 1)

sounds is complex, and creating a simulated localized sound through stereo headphones requires attention to a number of highly complex factors. A simple (but largely unrecognized) factor undercut previous efforts to develop auditory localization in cockpits. None of these experiments allowed head movement, which has been found to be the most important prerequisite for accurate localization of sound.

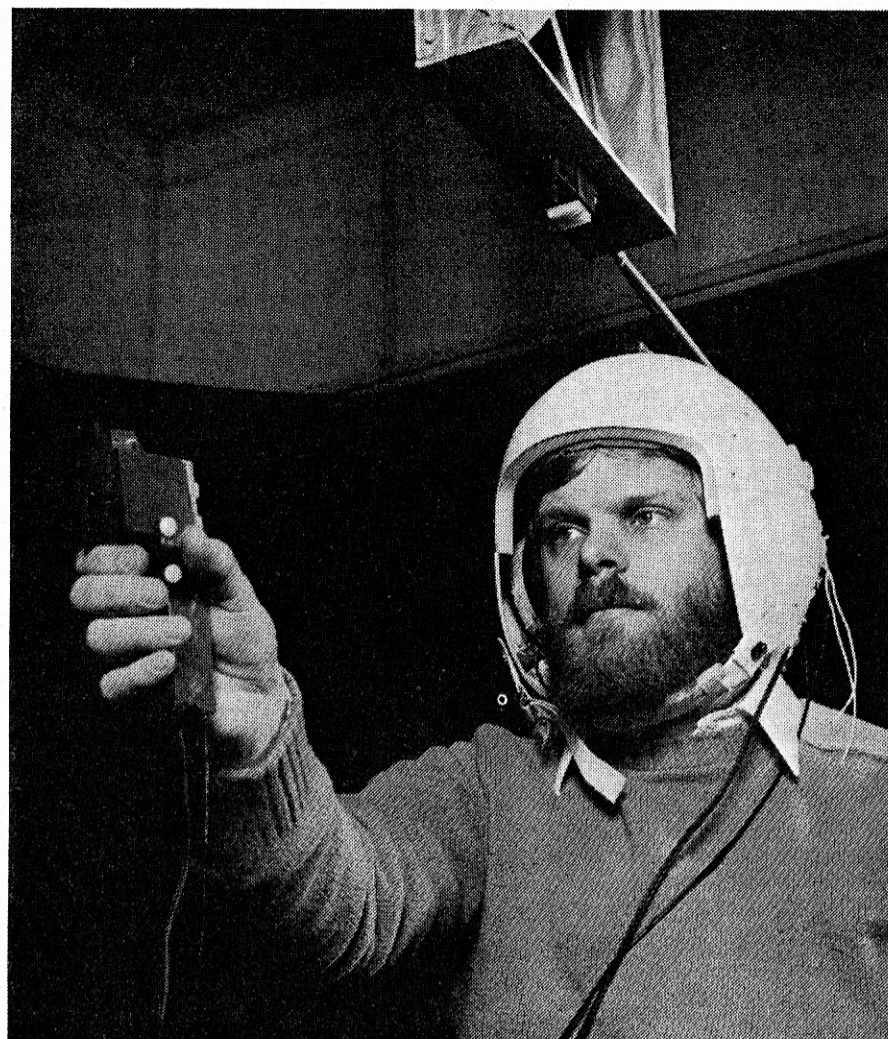
SEL researchers first had to simulate, over headphones, the qualities which make a sound appear to come from a given direction. Then a system was developed which makes a sound appear stationary in space even though the listener moves his head (and the headphones).

The system developed to date is only a physical simulation, which has proven that auditory localization through headphones is feasible. To adapt this technology to the cockpit, researchers must develop an electronic simulation of three-dimensional sound. To assemble such a system, they will have to begin the painstaking chore of documenting the spectral qualities of auditory signals

which give directional orientation. To do this, they will have to determine how many acoustic cues are really necessary to produce localized sound. Then they have to develop mathematical equations on which electronic auditory signals can be based.

The research is funded by the Air Force's Armstrong Aerospace Medical Research Laboratory (AAMRL/HEA) under a subcontract with MacAuly-Brown, Inc. It is one part of an ambitious Department of Defense program to develop a "cockpit of the future." The impetus is the need for NATO to offset the numerical advantage of the Soviet Union in aircraft and pilots by modernizing cockpit designs to allow NATO pilots to be more effective than their opponents. The Federal Aviation Administration also supports advanced cockpit development as a way to lessen pilots' dependence on ground-based air traffic controllers.

Research of this kind may produce improvements in pilot performance which seem subtle on the surface. However, in a business where seconds often seem like minutes, any enhancement in response time is significant. For pilots of the future, more 'natural' work routines, some of which rely on



Jeff Gerth (SEL) is listening to simulated 3-D sounds through a pilot's headset and indicating the direction from which they seem to be coming. (Photo by Charles Haynes)

the sense of hearing, could mean the difference between a

mission's success or catastrophe.

## QUESTIONS, ANYONE?

by Charles McCullough

Here's a question that's not asked nearly as frequently as it should be: "How do I know for sure that all those deductions for Social Security I'm hit with every payday are being correctly credited?"

Surprisingly, the same people who hand-deliver their Christmas cards in October because they don't trust the Postal Service, who recalculate their year-to-date totals on each pay stub, and who keep their own vacation balances on the Cyber are the ones who blithely assume that the thousands of dollars they put into Social Security

each year are in perfect order.

So, how can you be sure? You ask, via a remarkably simple form called a "Request for Statement of Earnings," a federal form numbered SSA7004PC. This handy form—a mere 4" x 7", and not even required in triplicate—allows you to confirm that your hard-earned dollars are being credited where they should be. More importantly, this form ensures your right to appeal and correct errors that might have occurred.

How often should you engage in this particular exercise in "consumer awareness"? Every other

year isn't a bad idea, and certainly no longer than three years should elapse from one verification to the next.

To obtain a "Request for Statement of Earnings" form, stop by the Personnel Division offices on Hemphill Avenue, GTRI's Human Resources Department, or a U.S. Post Office.

It's far too easy to insist with a smug air that the burden of responsibility for the integrity of your Social Security earnings lies with somebody else: our payroll department, your accountant, the federal government. If you have that much faith in all the computer systems between here and Washington, maybe you could help me with a small problem I have with my

Reader's Digest subscription.

**Retiring?** Or at least counting the months? When it comes to retirement, it's your job, again, to be an informed consumer! If you're 55 years of age or older, don't toss aside those notices and registration forms you receive from Liz Greene, training coordinator for GIT's Personnel Division, announcing the pre-retirement planning programs. Sign up for as many of the four two-hour sessions as you think you might need. According to Liz, the next program will be around mid-April.

*(Editor's Note: Do you have a personnel-type question you want answered? Send it to Charles McCullough, GTRI/HRD, for possible answer in this column.)*

## PROFESSIONAL ACTIVITIES

### ECONOMIC DEVELOPMENT LAB

Keith Nelms is a coauthor of the recently published book, *The Impact of Office Automation on Clerical Employment, 1985-2000: Forecasting Techniques and Plausible Futures in Banking and Insurance* (Quorum Books).

Harris Johnson is now a registered Professional Engineer, and Larry Edens has become a Certified Industrial Developer.

Paul Middendorf, David Jacobs, and Ken Smith published a paper, "Nitrous Oxide Exposure in Dental Operators," in the March/April issue of *Anesthesia Progress*. Jacobs and Middendorf spoke on "The Highs and Lows of Occupational Exposure to Nitrous Oxide" at the Hinman Dental Meeting, March 21, in Atlanta.

David Hogue has an article, "The Reporting of TEM Results," in the current *National Asbestos Council Journal*.

At the National Asbestos Council (NAC) annual meeting, February 8-10, in Baltimore, William Spain was elected president-elect of the NAC and Bill Ewing was elected treasurer. David Hogue and Mark Demyanek chaired technical sessions arranged by Ewing and Eva Clay. Clay, Demyanek and Spain also received awards in appreciation of their efforts in developing and presenting all four of the NAC's Field Instructor Training Programs.

Costas Soulakos and Wayne Daley presented papers at Agrimation 2 in Chicago on March 4. Soulakos' paper was entitled "Computerized Inspection

Monitoring System," and Daley's was on "Computerized Broiler House Monitoring and Control."

Mike Brown received an award of merit from the Society for Technical Communication for a workshop brochure.

EHSD will present the Third Annual Conference on the Environment, Health, and Safety March 31-April 3 at the Marriott Marquis Hotel in Atlanta. Marty Melton is coordinating the conference, to feature more than 100 speakers from government and industry.

### ELECTRONICS & COMPUTER SYSTEMS LAB

"Robotic Tactile Sensing," an article by Kirk Pennywitt, appeared in the January issue of *BYTE* magazine.

On February 12, Jim Toler, along with Dr. Armand Karow of the Medical College of Georgia, presented a program on "Microwave Thawing of Frozen Kidneys" to the Atlanta chapter

of the IEEE Engineering in Medicine and Biology Society.

### ENERGY & MATERIALS SCIENCES LAB

Tom Starr presented a paper entitled "Improving the Reliability of Zinc-rich Paint Systems" at the Steel Structures Painting Council Annual Meeting and Symposium in Atlanta February 24-27.

An article on the GTRI thermite process developed by Kathryn Logan, entitled "Powders That 'Explode' Into Materials," was published in the February issue of *Advanced Materials and Processes*.

Tom Brown, Jim Lefferdo, and Dan O'Neill attended the annual conference of the DOE Solar Thermal Research Program in Golden (CO) February 18-21. Lefferdo presented a paper on GIT materials research in the solar thermal program, and Brown was a panel member for the workshop on "Receiver Concepts for High Flux."



## PERSONNEL NEWS

### ECONOMIC DEVELOPMENT LAB

Dean Lail has been promoted to staff assistant in the Environmental, Health, and Safety Division. New duties include supervising word processing, editing, managing a new computer network, and participating in the lab's Communications Resource Working Group.

Steve Cowart has joined the Douglas Office as a research engineer II.

### ELECTRONICS & COMPUTER SYSTEMS LAB

Robert B. Utterback has joined the Command and Control Division as a research scientist I and will be working on the continuation of the MICROFIX project. He has a BS in ICS from Georgia Tech and has worked most recently with the General Physics Corporation in Atlanta.

Also joining Command and Control is M. Wayne Miller, senior research associate. He will be involved primarily with an AIRMICS study and rank or decision aids, and will work out of both Huntsville and Atlanta. He is retired from the U.S. Army with a distinguished career in combat services support and logistics management. He holds a BS from the University of Pennsylvania and an MS from the University of Southern California.

Command and Control also welcomes Stanley Hughes, an electronics specialist. Stan is a Georgia Tech student.

### ENERGY & MATERIALS

### SCIENCES LAB

Arleen Edmiston has resigned.

### OFFICE OF DIRECTOR

Judy Cooper is the new senior administrative secretary for Jerry Carey, replacing Marie Harden, who retired. This is a promotion for Judy, who formerly was administrative secretary for SEL's Concepts Analysis Division.

### RADAR & INSTRUMENTATION LAB

Trent Farill has been promoted to chief of the Modeling and Simulation Division, a position formerly filled by Harold Bassett.

Lynn Baxter has joined the Technical Support Group as a clerk typist I.

### SYSTEMS ENGINEERING LAB

Congratulations to February Employee of the Month John Bordelon, chosen for his outstanding leadership in early completion of a project that resulted in production of new hardware that has attracted national attention.

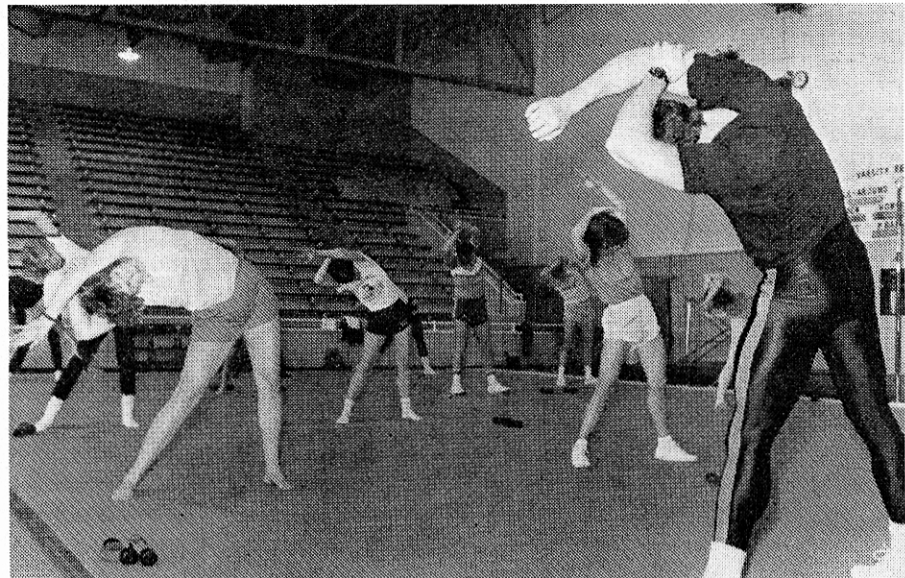
Linda Houseworth has transferred to the Human Resources Department.

Richard Odom has joined the Director's Office as a research engineer II. He has a BSEE from Georgia Tech and an MBA from Georgia State. He previously was employed at Southern Engineering in Atlanta.

### SYSTEMS & TECHNIQUES LAB

The Microwave Systems Division welcomes Lynette Miller, secretary; Dana Robinson, secretary; and Frank Sawyer, student assistant.

Rhonda Okerberg, administrative secretary, has transferred to the STL Director's Office.



The Heavy Hands aerobics class warms up in the Old Gym. Participants Linda Martinson and Jerry Carey are in the center of the photo, and Coach Lawton Hydrick is in the right foreground. (Photo by Charles Haynes)

## Conditioning Coach Works on GTRI Employees

by Linda Martinson

Physical fitness is a new American grail (older ones are money and success). In the quest for a stronger and more attractive body, more energy, increased productivity, and greater ability to handle stress, many GTRI employees commute to work on bicycles, run at noon, or swim after work. Some are seeking not only increased fitness, but success at road races, bicycle trails, swimming meets, or triathlons as well.

Nearly a dozen GTRI employees, including Associate Director Gerald Carey, are finding new heights of aerobic fulfillment in Coach Lawton Hydrick's Heavy Hands noon aerobics class. Heavy Hands are hand-held weights that are swung while jogging and skipping to music. Working both the arms and legs provides a superior cardiovascular activity similar to cross country skiing. Several young football players, cross country runners, gymnasts, volleyball and tennis players are in the class, providing further inspiration.

Hydrick is the strength and conditioning coach for the Georgia Tech Athletic Association. His philosophy, as quoted recently in *The Atlanta Constitution*, is: "Life is like a bench press."

The Heavy Hands class is a total body workout including stretching, pushups and situps, as well as aerobic exercises. Coach Hydrick, who is working toward an M.S. in Exercise Physiology, provides handouts on nutrition and fitness, didactic commentary, advice and encouragement: "Ya gotta love it, people! I said **high knees!**" Beginners are welcomed and encouraged to work at their own pace to physical exhaustion.

Georgia Tech faculty, staff and students can sign up for next quarter's class (or watch) in the Old Gym every day at noon. Classes resume the first week in April. The price is \$1.75 per class if prepaid for the quarter, or \$2.00 per class on a daily basis. Classes are available M-F, MWF, or TTh. Heavy Hands weights of all sizes are provided by the Athletic Association.

## PERSONAL NOTES

EDL: Debbie and Ned Ellington have a new daughter, Sara Whitney, born February 12.

Sympathies are extended to Stephanie Staples on the death of her mother, to Ralph Lamade on the death of his mother-in-law, and to Bill Larson on the death of his mother.

ECSL: Gerald Owens was married in December to Ann Richardson.

Judy and Cal Jameson are the proud parents of Lisa, who made her debut on February 24.

STL: Frank Lee plays banjo in a bluegrass band named Clearwater that has just released its first album.



## Software Review

by Pat Mathiasmeier, RSTF

Word processing software has gone from an option to something that is considered by manufacturers and users alike to be a standard part of a computer system. Hardware manufacturers have started "bundling" word processing packages in with computer systems. Software companies have started including word processors in integrated software like Symphony and Framework. Word processing is no longer used only by secretaries to type memos and letters, but also by engineers and scientists writing reports and articles and by programmers writing computer programs.

To help meet these differing needs, RSTF offers several courses in word processing. Included in the Basics of Computer Literacy course is an Introduction to Word Processing which covers what a word processor can do for you, how to decide if you really need a word processor, what you should look for in selecting one, and what basic features are available.

RSTF also offers courses on specific word processing packages for different uses. Beginning DOS is a prerequisite for the following courses:

### Personal Editor

For programming, the IBM Personal Editor offers a fast, easy way to create ASCII files used in running programs.

This course teaches the user to assign personal key definitions for editing functions and save these definitions in a separate file, as well as other features.

### Wordstar

Wordstar caters to the user who needs to merge programs, create form letters, and use spelling and indexing capabilities. Both beginning and advanced courses are offered.

### Volkswriter Deluxe

New Volkswriter 3 offers many of the special features of the more advanced word processing packages, yet remains easy to learn and use. Some of the more powerful new capabilities include spelling verification, math and sorting, automatic reformatting, queued printing, conversion to other word processing formats, and network support.

### DisplayWrite 3

This is a powerful package for the serious word processing user. It offers such features as keyboard programming, math functions, cursor draw, spell check and aid, footnoting, and outlining. The course is an introduction to this complex package. An advanced class is planned for the future.

Symphony is one of several integrated environment packages that have added a word processing capability. The prerequisite for the following course is Beginning Symphony or 1-2-3 experience:

### Symphony Word Processing

This course covers the text handling capabilities of Symphony. Many advanced word processing features are available for entering text directly on the worksheet. Entering and editing text, establishing document formats, setting print attributes, and printing the text are included.

## the GTRI connector

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