

PIPELINES

Covering Microware's Real-Time Solutions

Volume 10 Number 1

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On The Cover

MORE POWERFUL MICROPROCESSORS ARE DRIVING A growing number of embedded applications that can be found in every facet of life. Microware's real-time operating systems, I/O support and integrated development tools help power those applications.

Welcome Back to PIPELINES

INCREDIBLE CHANGES AND FAST-PACED MARKETS have made it difficult to keep you up on the latest developments. This issue of PIPELINES recaps many of our dynamic happenings and new products.

For some readers, this is your first glance at Microware's corporate magazine. Each issue includes the latest news on Microware products and services, news about the company, application articles and third-party products.

For those who have followed PIPELINES, welcome back. Many of you have waited anxiously for each new issue of the magazine. We look forward to bringing you more issues in the coming year.

We appreciate any comments regarding PIPELINES. Please contact the editor at the location above.

Looking for Application Successes, Programming Helps

Each issue of PIPELINES includes application briefs from OS-9 users. Programming hints and helps are also published when appropriate. If you have an interesting OS-9 application or a helpful programming article, please submit an abstract and outline to the editor at the location above. Please include a description of the application, why OS-9 was selected and details of unique implementations of OS-9. The editor will contact you to schedule your article in an appropriate issue of the magazine.

A Clear Vision of the Future

*Building on recent successes,
Microware is poised for an exciting
future.*

*by Ken Kaplan
President*



Ken Kaplan
Microware's President

IT'S BEEN ANOTHER YEAR OF CONSTANT AMAZEMENT. Microware has become one of the most watched firms in the computer industry. We've taken a leadership role in emerging technologies, particularly interactive television. We are consistently scoring new, more lucrative wins in every field imaginable. And we're still having fun doing it.

That's in the past; Microware has always focused on the future. Now we look to the future with a clear vision. We've stated it simply: "Make OS-9 the standard operating system for mass produced, embedded products." This vision is squarely based on our 18 years of leadership in real-time system software and poises Microware for an exciting future.

Putting It In Perspective

You might ask, "What does Microware's 'vision' have to do with me?" Our vision is based on the fact that you — the OS-9 Community — are designing OS-9 into a broader range of intelligent products. These devices are finding their ways into every facet of daily life, not just into scientific and industrial settings. You have helped proliferate real-time embedded systems into our offices, our homes, our cars, even our pockets. You are helping drive incredible growth in areas that seemed unreachable just a couple of years ago.

This growth can be attributed to several factors. One is the convergence of diverse technologies. For example, the convergence of television and computing was the impetus for interactive television. Another is the price/performance curve of advanced microprocessors, essential to powering mass produced systems such as automobiles and cellular telephones. Finally is the fact that you have powerful software available to aid in the development of these systems.

Software That Enables

Microware's system software is designed to enable your real-time project without regard for its scope.

OS-9's modular (dare I say "object oriented") design is just as innovative today as it was when we first introduced the operating system. Continual refinements make OS-9 the premier OS for real-time embedded systems. Add to that the broad I/O support we've developed to target almost any need.

But OS and I/O support don't mean much without solid tools for development. That's why Microware develops and sells its own set of powerful development tools, compilers and more. Our tools offer the tightest possible integration with our OS. This gives you a level of optimization which is unmatched.

Building On A Solid Foundation

Microware has been actively pursuing new vertical markets that might incorporate OS-9. Successes include compact disc interactive (CD-i), intelligent transportation systems (see the story on page 13 about Caltrans) and interactive television. But these vertical markets incorporate products from Microware core technologies, namely OS-9, our I/O support and development tools. Some specialized add-ons have been created to address particularly needs of these emerging vertical markets. However, the OS-9 at the heart of Microware's DAVID package, for example, is the same version of OS-9 that is in cellular telephones from AEG, bowling systems from Brunswick and particle accelerator systems at CERN.

Into New Arenas

While interactive television has been Microware's most visible vertical market, there are many more markets emerging. The cost of microprocessors has made them feasible for devices throughout industry, business and the home. We're just starting to see the potential for automotive applications, home automation and personal communications, as well as industrial controls and factory automation.

As new markets present themselves, Microware will look carefully at the product needs of the segments. Most vertical markets will perfectly suited to standard OS-9 configurations. Where special technologies are required, Microware will strive to meet those needs with specialized software products.

There's a reciprocal effect at work. While OS-9 drives the development of new markets, the specialized software from these markets is often applied back into our core technologies. This provides benefit to many existing users, as well as new users.

The Hottest Real-Time Design Win

Microware has been fortunate. We've been on the ground floor of interactive TV development. We offered the first system software solution for interactive TV set-top decoders. We're still the only real-time operating system driving these decoders.

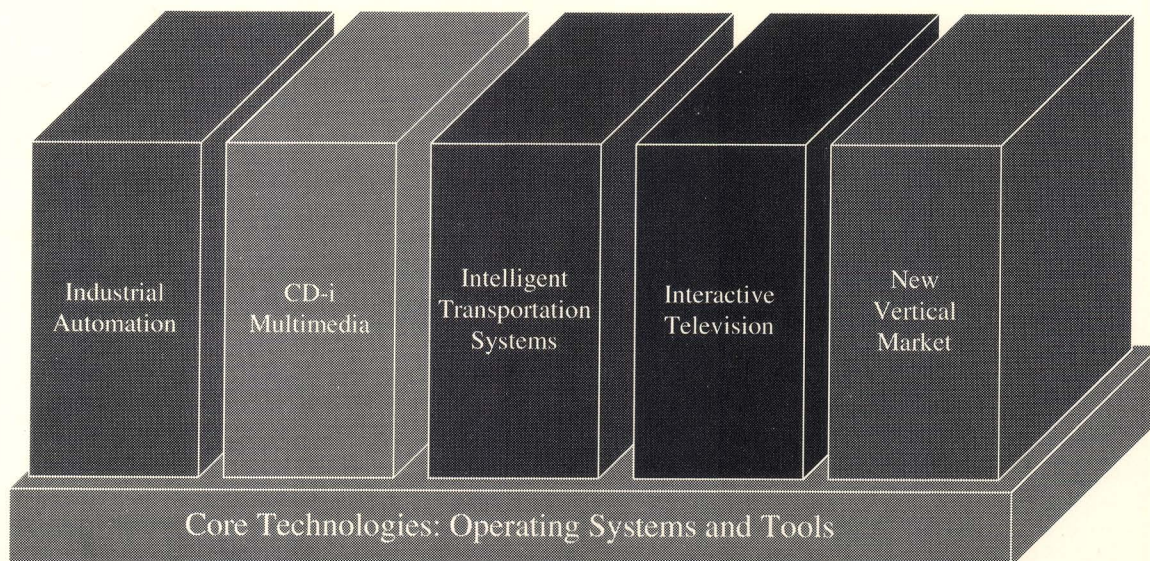
While being first in an industry doesn't guarantee success, Microware has maintained its leadership in the interactive television market through a high level of commitment both in terms of products and support. It's the same level of commitment Microware provides across the board.

What's Next?

The falling costs of advanced microprocessors is making intelligent, mass produced devices a reality. They'll appear in appliances, vehicles, your walls, your entertainment centers, your desks and throughout your daily life.

Microware's software was originally designed with the flexibility needed to cover a range of computing environments. That design still provides a technological advantage to designers of the next generation of intelligent devices.

Join us as we take OS-9 into areas beyond imagination.



Microware's vertical market strategy is based on building on the solid core of its operating systems and tools.

Introducing FasTrak for Windows

Microware's development environment is now available for Windows, as well as UNIX.



MICROWARE'S FASTRAK IS A COMPREHENSIVE SOFTWARE programming and management environment designed to increase the efficiency of OS-9 real-time system development. FasTrak's inherent tight integration with OS-9 gives programmers an edge in their development.

FasTrak integrates teamware productivity tools that automate the creation, debugging, analysis and management of complex real-time software development projects. Built around Microware's Ultra C optimizing ANSI C compiler, FasTrak addresses all aspects of the project development cycle, including source code creation and revision, code generation, source-level debugging, system and application profiling and software version control. This focus on the entire product life cycle means reduced time-to-market and improved project management.

Your Window to OS-9 Development

FasTrak for Windows, a PC-hosted version of Microware's popular FasTrak development environment, is now available. Hosted under Windows 3.1, it is optimized to target Motorola's 680X0, Intel's 80X86/Pentium, and soon PowerPC processors. FasTrak for Windows is an Integrated Development Environment (IDE) that includes these modules:

- Integration with Windows File Manager
- Makefile Editor Tool

- FastFix Debugger Tool
- Target System Tool

File Manager

The File Manager — FasTrak for Windows' primary interface — lets the user manipulate files and directories, set user preferences and run-time options, launch other FasTrak for Windows tools, and automatically build and execute programs.

The File Manager provides an icon-based, menu-driven interface to the host file system and drag and drop capabilities.

Makefile Editor Tool

The Makefile Editor Tool automates the process of creating and maintaining program makefiles. With the Makefile Editor Tool, users can graphically specify the tools, options, procedures and I/O files used when building programs.

The Makefile Editor Tool scans source files for "#include" statements, then automatically generates the required dependency lists. Compiler, assembler and linker options are selected via push-buttons and menus, and can be applied globally to all files or to individual files on a case-by-case basis.

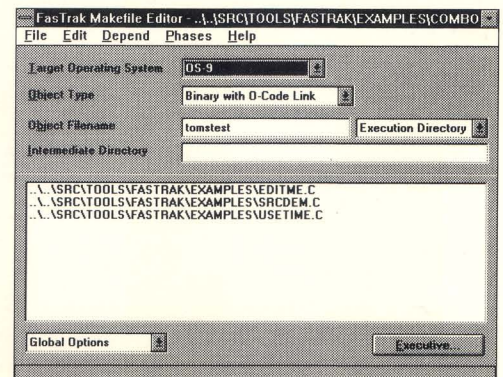
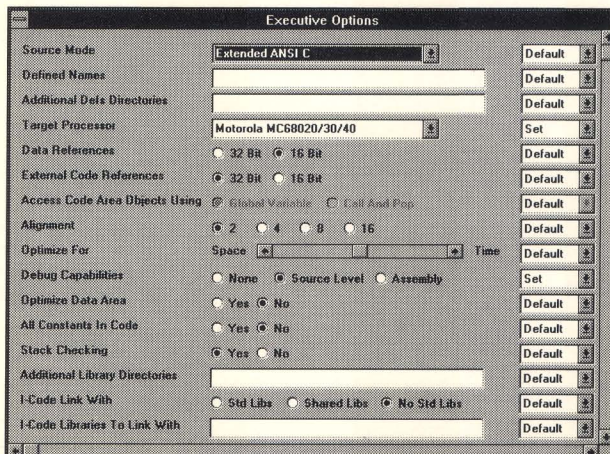
Ultra C Compiler

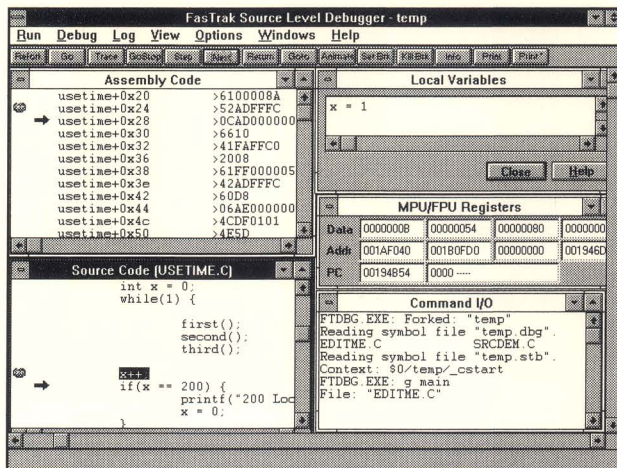
FasTrak for Windows contains a copy of Microware's Ultra C ANSI C compiler — the only highly-optimizing C compiler designed expressly for real-time applications by an RTOS vendor.

Ultra C is an advanced technology C compiler that performs interprocedural, global and local optimizations to maximize performance for embedded applications. It produces compact, ROMable, position-independent code compatible with the OS-9 Family object module format.

Ultra C fully complies with ANSI X3J11 1989 and ISO/IEC 9899:1990 specifications for the C programming language, and is the only C compiler targeted for the real-time marketplace that has passed the Plum Hall ANSI C/ISO Validation Suite.

FasTrak's Makefile Editor is a graphical tool for creating and editing Ultra C "makefiles."





FastFix Debugger

The FastFix Debugger provides an extensive set of debugging facilities to accelerate the software testing process. Its distributed, network-based architecture uses a small server process on the target system to control program execution and communicate with the host-resident debugger.

The FastFix Debugger command set permits debugging at the C source and Assembly language level. During execution, a wide range of displays are available, including MPU registers, FPU registers, C and Assembly language source code, stack frame, local variables and target system memory. FastFix's "animate" feature steps through the application and puts displays in motion.

The FastFix Debugger supports command recording and playback, making it easy to recreate debugging sessions for later review.

Target System Tool

FasTrak for Windows' tight integration with the OS-9 Family makes it possible to provide application and system performance information that isn't possible with other cross development packages.

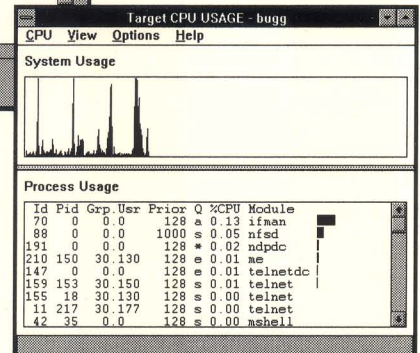
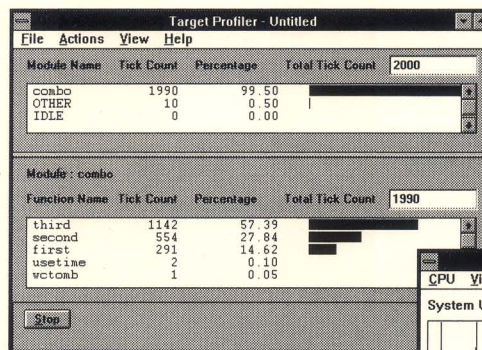
The Target System Tool gives the embedded system developer a profile of an application's execution, providing valuable information such as the time spent in each function, variable usage and overall performance statistics.

The Target System Tool also provides a global view of the target system to monitor and maximize overall performance.

With the Target System Tool, the user can open one or more windows to display a variety of global system information, including:

- Module and function profiles (process- or system-wide basis)
- CPU utilization
- Internet status
- Target console

Many of the Target System Tool's displays allow the user to change the state of the system, such as load new memory modules or link to an event variable.



The FastFix debugger (left) graphically displays debugging information. The Target System Tool allows you to profile the functions within your application (center) and monitor CPU usage (right).

Any standard utility from the OS-9 Family may be executed from the host system's disk, or from the target system's disk or memory.

Windows Demo Available

To introduce users to FasTrak for Windows, Microware has released a demo diskette. Contact Microware or your authorized Microware representative to order a copy of the FasTrak for Windows demo.

FasTrak is currently available for UNIX workstations including Sun 4, HP 9000 Series 700, RS6000, and Silicon Graphics, as well as for Windows.

The Next Step for FasTrak

The next release of FasTrak will include significant changes for both the UNIX and Windows hosted version. New features include system state debugging, user-process debugging enhancements, C++ support, emulator support and new processor support.

System state source level debugging allows debugging of system level modules (file managers, device drivers, OS extensions, etc.). This provides quicker, more efficient debugging of system code written in high-level languages such as C and C++.

C++ support will also be available to users who wish to program using the advanced features of C++ (see "Introducing Ultra C++ V1.0" on page 9).

FasTrak will add support for Hewlett Packard's line of 68K emulators. HP's software tools will also be integrated with FasTrak. Emulator support enables the downloading and debugging of code without software residing on the target.

New processor support will include the Motorola 68060, PowerPC processors (MPC601, MPC603, MPC505, PPC403), and Intel Pentium. Providing more processor support allows you the flexibility to switch from one processor to another without having to learn a new development environment.

1995 DAVID Developers Conference Slated for September

Inaugural event drew sellout crowd.

by Andrew Davidson
Director of New Media Applications

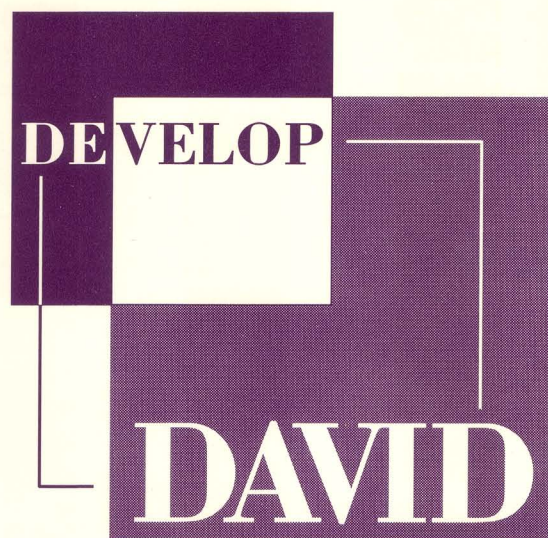
PLANS ARE WELL UNDERWAY FOR THE 1995 DAVID Developers Conference to be held September 26th to 29th at the San Jose Convention Center, San Jose, CA. As with last year's inaugural conference, the 1995 DAVID Developers Conference will be held in conjunction with Multichannel CommPerspectives Convergence '95 Interactive Television Conference and Exposition.

Building on the enormous success of last year's conference, this year's event will again feature real-world, end-to-end interactive solutions targeting Microware's DAVID (Digital Audio/Video Interactive Decoder), the emerging operating system standard for interactive television (ITV).

Solution-Oriented Sessions

Exhibits and live demonstrations will showcase current products, services and technology offerings from ITV industry leaders working with or supporting DAVID. Conference keynote addresses and seminars will address the urgent needs of both technologists and business developers. General sessions, as well as business and technical tracks will focus specifically on:

- **Broadband Network Deployment:** Through panel discussions, leading network operators will cover critical issues in building today's ITV networks.
- **DAVID Applications:** Actual case studies will highlight real applications created for DAVID-based networks.
- **DAVID Authoring Tools:** Leading authoring tool vendors will discuss development systems targeting the DAVID environment.
- **ITV Commerce:** Key industry analysts will provide insight into the commercial aspects of the ITV industry.
- **DAVID Software Technology:** Technical presentations will take an in-depth look at the DAVID System Software architecture including MAUI (Multimedia Application User Interface), UpLink and other operating system APIs.



**September 26-29, 1995
San Jose, California**

- **Standards Update:** Leading standards organizations will review their current activities and analyze the impact of their efforts on the ITV industry.

In addition to these hands-on seminars, attendees will be able to visit Microware and DAVID partner companies in the separate DAVID Developers Area of the exhibit floor. A premier group of ITV industry leaders implementing DAVID in their set-top decoders, video servers, authoring tools and other ITV products and services will be poised to demonstrate their DAVID-based products.

DAVID Developers Association Announcement

In addition to seminars and exhibits, the DAVID Developers Conference will also feature the launch of the DAVID Developers Association (DDA). Conceived and implemented by Microware with a commitment to supporting DAVID developers, the DAVID Developers Association will provide marketing and technical support for the development of applications and authoring tools.

The DDA will give developers the inside track to Microware news and support. Through print and electronic publications such as an association newsletter, a technical newsletter and technical notes, DAVID developers will get Microware and ITV industry news, product updates, help and support directly from Microware's top-notch technical and corporate staff.

For More Information

To receive more information about the DAVID Developers Conference or the DAVID Developers Association, please contact the New Media Systems Department at Microware.

DAVID System Version 2.0

AS THE MOMENTUM OF THE INTERACTIVE TELEVISION industry increases, Microware continues to provide enhancements to the DAVID (Digital Audio/Video Interactive Decoder) system software platform for interactive television set-top decoders. The DAVID System Software Version 2.0 provides additional features required for second-generation set-top decoders being developed for interactive television networks around the world. DAVID Version 2.0 include the following changes.

A next-generation graphics system called Multimedia Application User Interface (MAUI) has been developed for DAVID. MAUI features modular, hardware-independent APIs for more flexible graphics management.

The Serial Protocol File Manager has been enhanced to handle higher-bandwidth communication channels such as hybrid-fiber coax (HFC), fiber-to-the-curb (FTTC) or switched digital vide (SDV) networks. The new SPF also includes a unique stacked protocol architecture for supporting UDP/IP, Q.2931 and other protocols across bi-directional control channels.

An expanded Motion Picture File Manager is incorporated in DAVID V2.0. This new MPFM provides support for the demultiplexing and decoding of both MPEG-1 and MPEG-2 audio and video streams.

Finally, an integrated communications environment (ITEM) has been developed. ITEM provides a consistent interface to telephony and cable TV networks including session management, channel/program management and application download management.

For more information about DAVID V2.0, please contact Microware or your local Microware representative.

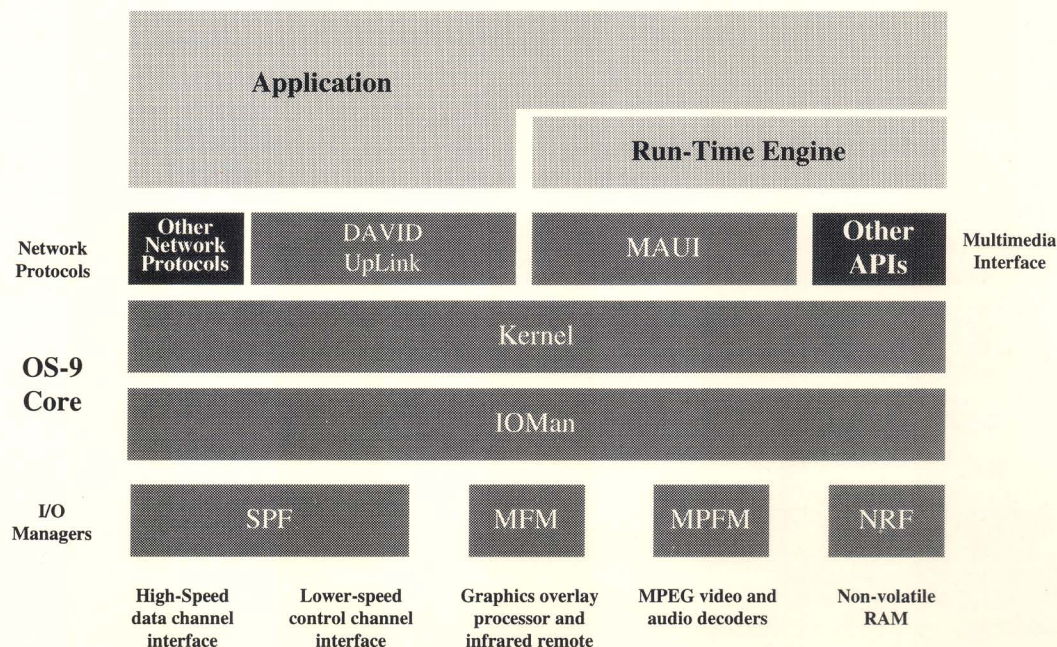
The DAVID Application Development Environment

MICROWARE PROVIDES A COMPLETE LINE OF SOFTWARE products and services for end-to-end interactive television networks targeting the DAVID environment. The following table provides an overview of our software products.

Software Products and Services for Interactive Television Networks

Application Development Environment	Video Server Platform	Set-Top Decoders
<ul style="list-style-type: none"> • DAVID Application Developers Pak • OS-9 FasTrak for UNIX • OS-9 FasTrak for Windows • Third-Party Authoring Tools* 	<ul style="list-style-type: none"> • DAVID Mini-Server Pak • UpLink Protocol Source Code License 	<ul style="list-style-type: none"> • DAVID Installation Software License
*Please contact Microware for a complete list of third-party vendors who supply authoring tools for DAVID application development on PC-, Mac-, CD-i- and UNIX-based platforms.		

► **DAVID Application Environment**
Please turn to page eight



The DAVID software architecture.

DAVID Application Environment

Continued from page seven

The DAVID Application Developers Pak provides easy-to-use C language functions for creating multimedia applications targeting DAVID set-top decoders. The DAVID Application Developers Pak enables programmers to develop a variety of interactive applications such as navigational menus, movies-on-demand, interactive retailing and educational applications, as well as specialized multimedia run-time engines and high-level authoring tools. The DAVID Application Developers Pak contains header definition files and C library bindings for all DAVID system software modules as well as source code to sample programs and graphic images.

FasTrak

FasTrak's highly integrated toolset simplifies and automates the creation, debugging, analysis and management of DAVID application software development. FasTrak uses popular graphical user interfaces on UNIX or Windows systems to access its robust development tools including the advanced technology Ultra C Compiler. (See page 9 for further information.)

Third-Party Tools

Several leading multimedia authoring tool providers, including Macromedia, Oracle, Scala and Sybase/GAIN, are developing support for the DAVID system software platform. This allows application developers to use popular asset creation and management tools on UNIX, PC, MAC or CD-i

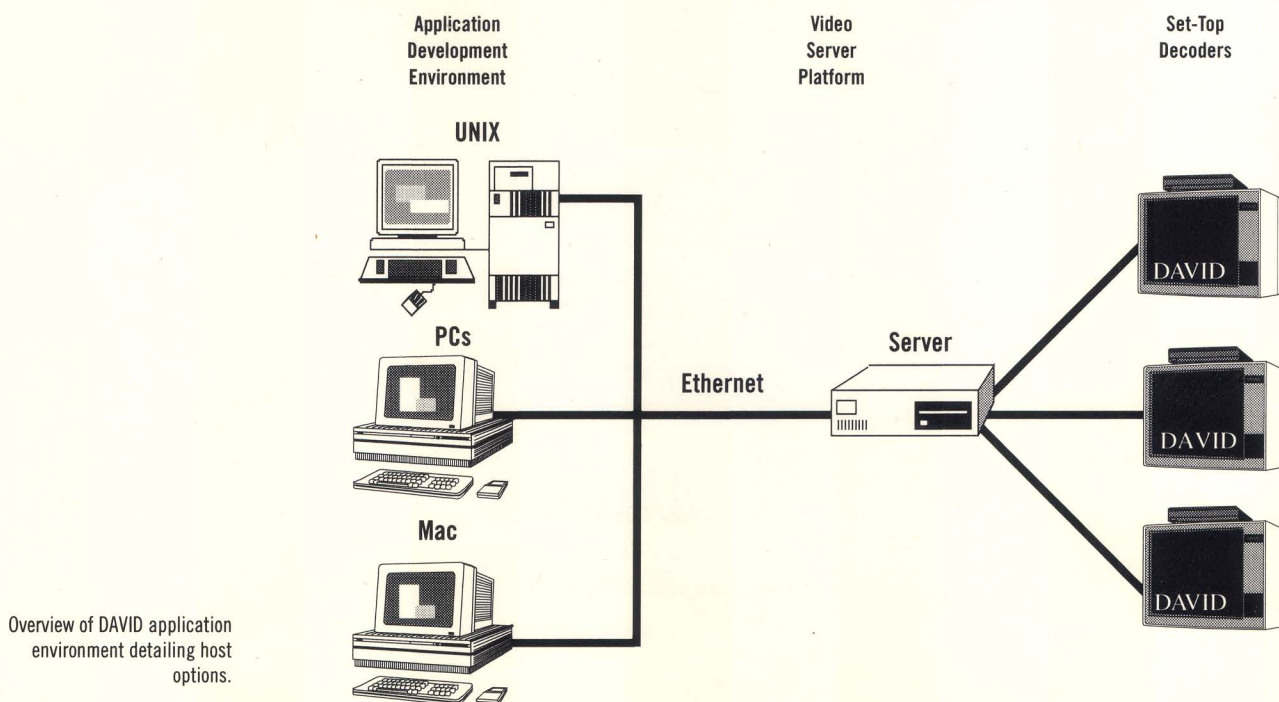
platforms to complete the DAVID Application Development Environment.

DAVID Mini-Server Pak

The DAVID Mini-Server Pak provides a video/application desktop server environment for application developers to test and validate networked interactive applications targeting DAVID set-top decoders. The DAVID Mini-Server acts as a data storage and retrieval system for multimedia assets and applications created on UNIX, MAC, PC, CD-i or OS-9 systems. These data files are transmitted upon UpLink command requests from the DAVID set-top decoder. The DAVID Mini-Server Pak for VMEbus systems contains the OS-9 Board Support Pak and resident OS-9 Tool Kit as well as the Real-Time Network File Manager (RT-NFM), Serial Protocol File Manager (SPF) and the UpLink Control Channel Protocol. A DAVID Mini-Server Pak for PCs supporting OS-9 for X86 is under development.

DAVID Set-Top Decoders

More than fifteen consumer electronics manufacturers including General Instrument, IBM, Philips and GoldStar, are developing DAVID set-top decoders for implementation in a variety of interactive television networks. Several of these manufacturers are also providing DAVID set-top decoders specifically for use in application development environments. Please contact your local Microware representative for additional information regarding the availability of DAVID set-top decoders for application development.



Introducing Ultra C++ V1.0

MICROWARE ANNOUNCES THE RELEASE OF ULTRA C++ V1.0 for OS-9. Although C provides a flexible, low-level programming environment, C++ combines C programming with object-oriented capabilities. Object-oriented programming (OOP) will become more common in the real-time embedded market due to the simplicity of combining different modules to create programs.

C++ source code is translated into an intermediate code (I-Code) format that is independent of the source language and target microprocessor. An I-Code optimizer performs various optimizations as determined by the user. At the final stage of compilation, the back end modules translate the optimized I-Code file into assembly language for the target microprocessor. This code is further optimized, assembled, and linked into an executable module.

To enhance development in C++, Microware is bundling the tools.h++ class library developed by Rogue Wave (Corvallis, Oregon), the recognized market leader in C++ libraries. Tools.h++ offers a range of C++ classes for:

- Hash tables
- Bags
- Ordered and sorted vectors
- Dictionaries
- Tokenizers
- Sets
- Iterators
- Basic data types
- Regular expressions
- Singly- and doubly-linked lists

And with the added I/O stream and complex class libraries features, C++ can be used in a variety of applications. C++ fully complies with the ANSI C++ draft standards, the AT&T 2.0 and 3.1 C front C++, and the C++ ARM (Annotated Reference Manual). Conforming to these standards ensures compatibility across any development environment.

C++ will be available in the OS-9 Tool Kit as well as FasTrak. Customers who wish to add this support to their existing products simply upgrade to the new product. For more information on how you can purchase C++, contact Microware or your authorized Microware representative. ◀

OS-9 for PowerPC Update

Last Fall, PowerPC was positioned to become the dominant embedded RISC platform of the future, and now the demand for this new technology is surpassing original expectations.

OS-9 is available for a wide range of PowerPC offerings, including the 601 and 603 family of PowerPC processors, and two microcontroller versions of the PowerPC that target embedded systems applications like set-top boxes, Motorola's MPC 505 and IBM's Power PC Embedded Controller 403GA.

Microware offers complete PowerPC support, including OS-9 for PowerPC, FasTrak, resident PowerPC development and DAVID.

An optimized PowerPC development and run time environment, the OS-9 Real-Time Operating System, Ultra C compiler and FasTrak development toolsets have all been optimized to take full advantage of the PowerPC's RISC architecture.

Microware has provided PowerPC-specific optimizations at the operating system level. To ensure deterministic real-time response, for example, OS-9 takes advantage of the PowerPC's Visual Caching mechanism, which enables users to lock time-critical sections of code in the cache. Users can ensure that critical routines like ISRs (interrupt service routines) will never be displaced from the cache.

The FasTrak debugger has also been optimized for the PowerPC. For example, to optimize the use of the PowerPC's watchpoint registers, which generate an exception when a particular memory location is written, both the kernel and debugger are given access to the exception model. This enables designers to test an application with hardware interrupts activated, while still taking advantage of watchpoint register exceptions that must be handled by the debugger.

OS-9 for PowerPC is now available in the form of an Embedded Board Support Paks for Motorola's MVME1603 and PowerStack PowerPC-based boards. OS-9 for PowerPC is also available in the form of OEM Developer's Licenses for the 403, 505, 601, and 603 processors.

Complete FasTrak support targeting PowerPC will soon be available. The Ultra C compiler component of FasTrak is available today on various UNIX hosts, including Sun 4, Solaris, and RS 6000. Contact Microware or your authorized representative for information regarding Microware's FasTrak beta program and release information. ◀

Database Drives Shuttle Applications at NASA's Kennedy Space Center

Sculptor 4GL+SQL database powers STS systems

by Sherry Sitzler
KD Consulting Group

THE EARTH LITERALLY SHAKES WHEN THE SHUTTLE lifts off, and the billows of exhaust can be seen for miles against the Florida sky. But the real power and beauty of a NASA shuttle launch begin long before lift off, in the steady click and hum of computer hardware and software at work.

The National Aeronautics and Space Administration (NASA) sends shuttles aloft from the Kennedy Space Center so frequently and with such accuracy that a launch now garners just a mention on the evening news. Sculptor 4GL+SQL is a powerful, pivotal factor in that reliability, working behind the scenes to monitor launch data, communications, equipment, and even budgets.

Distributed Launch Control Programs

Sculptor has been one of the databases of choice for NASA's shuttle launch program for more than ten years, and that long-term relationship is grounded firmly on Sculptor's portability. NASA programmers develop and test software in the DOS environment, but then transfer compiled programs to various targeted production systems.

Because Sculptor-compiled code is not dependent on a particular operating system, programs can run on OS-9, DOS, Interactive UNIX, AIX, SunOS and other platforms currently in use or part of long-range plans. This gives programmers the freedom to choose the operating system that best fits the project without reconfiguring or recompiling code. They simply write the program once in Sculptor and then use it wherever it is needed, saving time and money, and reducing the chance for errors. In addition, Sculptor runtimes are available for multiple platforms. NASA systems devel-

opers rely on Sculptor's powerful programming language for both screen forms and reports. Its ability to link and cross-reference many databases and its multiuser capability allow users to telnet to a server and run different reports, retrievals and updates without waiting in line.

Up-to-the-minute data is vital to a successful shuttle launch, and communication must be maintained. NASA depends on several Sculptor-written databases to track cable locations and connections and IP address/MAC address assignments in its communications system. This information is cross-referenced by system name, cable number and location, and any communication breakdown can be traced and repaired immediately.

Serial line, network and high-speed data cables carry real-time data directly from the shuttle, as well as programmer's communications with the mainframe, printer data and simulations in the firing room, where engineers can simulate maneuvers before going live on the shuttle itself. Everyday upkeep and trouble-shooting of the communications system is handled by these databases, which are used and maintained by Grumman Technical Services, Inc. One of many subcontractors at work for NASA, Grumman maintains the communications for the mainframe. They control system communication configuration and update engineering drawings every time equipment and cable locations change. Communications databases run on the OS-9 Real-Time Operating System.

Power Monitoring System

The shuttle goes nowhere without power. A second group of Sculptor-written databases tracks power connections and loads for the Central Data Subsystem, Mobile Launch Platforms 1, 2 and 3, Launch Control Center Firing Rooms 1, 2, 3 and 4, the Record and Playback Subsystem, and the Checkout Command and Monitoring Subsystems. These databases run on an IBM RS6000. A mainframe computer system, the Central Data Subsystem stores all information from the shuttle sensors on-line for immediate access. Engineers also can pull up data about previous launches from the Central Data Subsystem, although this retrieval comes from archived data.

The Mobile Launch Platform, where the shuttle rests before launch, is essentially one big interface unit linking the shuttle to Ground Support Equipment (GSE). To work these power databases, field technicians input equipment loads and wiring locations. Sculptor generates reports that automatically add all loads for each circuit, and the resultant information is used for trouble-shooting and engineering and management review. The weekly engineering and management review meeting allows managers and systems

engineers to examine the power database for possible circuit overloads.

Keeping Track of Equipment

An IBM RS6000 also runs the equipment tracking databases. Equipment can move anywhere within the 140,000-acre Kennedy Space Center; a complex so vast it has its own ZIP code. Each piece of computer equipment is assigned to an engineer, who is responsible for its whereabouts. Multiple databases link each employee with their equipment, tracking location, cost, manufacturer, model and user information. A barcode reader scans all NASA property tags in each room and downloads the information as a text file on the host system. A report generator updates the database with the new location of any piece of equipment that has been moved, as well as the inventory date. If a piece of equipment has not been moved, that also is noted. A look at the report details who used the equipment, for what division, and in what room, and notes when the data was last updated. Although anyone with access to the application can look at any data and run reports, only certain users — such as property custodians, system programmers and system administrators — can modify data. The operating system's built-in user number is used to identify those users who have access as well as those who have privileged access. The system's user number is compared to a lookup table containing privileged user numbers and access levels. If a user number is not found in the table, the user is blocked from using the applications.

Budget Planning Through Sculptor

The power behind the power is, of course, money, and NASA has used Sculptor to plan its budgets for the TE (Ground Engineering) Directorate for the past five years. A true multiuser application, the budget databases can be accessed by any authorized user who inputs their password to gain authorized access. Authorized users, who are spread among several buildings, can modify only data for which they are responsible. For example, branch users can modify only single branch files and division users can modify only single division files, but a Directorate user can modify all files. To access printers, a user enters their password, which the database matches to that user's assigned printer. The Sculptor program reads the printer information and then calls the report program with the redirection to the remote printer. Sculptor is used to produce PostScript forms that match NASA budget forms, and the reports summarize all tasks for a particular project budget. In addition, the reports calculate totals by branch for each division and by division for the Directorate.

The Sculptor-written budget databases originally ran on an OS-9/6809 system, and then were moved to Xenix. They later were migrated to an Interactive Unix (486/33), but now rest on AIX on an IBM RS6000, a move made to handle user loads. Thanks to Sculptor's portability, the impact to migrate was minimal in each case, with no recompilation of source code and no conversion of data required.

On The Drawing Board

Plans on NASA's drawing board include moving its IPR/PR Status Display System to Sculptor. The IPR/PR Status Display System is a real-time display of all interim problem reports (IPR) and problem reports (PR) affecting the launch countdown. The application generates a status display which can be updated at any time during the launch. This in turn is displayed on the Management Display Subsystem (MDS), a closed-circuit television distribution system that gives NASA engineers the real-time status of vital systems. The application currently is written in Foxbase and runs on a Xenix server. Foxbase is not written as a multi-user program, and much time and custom code were required to make it pseudo-multi-user. NASA plans to move the system to Sculptor running on the OS-9 MDS display generator.

Another future Sculptor application will provide increased security for the NASA Launch Processing Systems (LPS) computer network. Currently, a NASA subcontractor is responsible to maintain firewalls and security of Internet connections. The planned Network Security Monitor will provide real-time capture of computer network traffic packets to help determine possible security violations in the secure computer network. Programmers will use the Sculptor C API to move the data from C programming to the Sculptor database, which will run on a Sun SPARCstation 10. Sculptor report generators will then process and analyze data to determine whether security violations have occurred or system/network break-ins have been attempted.

Leading the list of changes is a move to upgrade Launch Control Firing Room consoles, which date from the Apollo era of the 1960s and 1970s. According to Bradley Blix, Computer Engineer with NASA, this equipment, though functional, is obsolete and now irreplaceable, and the redesign is a primary design goal.

The KD Consulting Group would like to thank Bradley Blix for his generous and invaluable assistance with this article. A graduate of the Florida Institute of Technology, Brad is a computer engineer with NASA. His responsibilities include long-range designing and planning of the launch support computer network; network monitoring and troubleshooting; and designing and writing office automation software for OS-9, Windows, DOS and UNIX.

Sherry Sitzler is Marketing Manager for The KD Consulting Group, Inc., sole distributor in North and South America of Sculptor 4GL+SQL Application Development System. For more information about Sculptor, call 1-800-837-1619 (U.S. and Canada) or (513) 887-0337.

Microware Corporate Reorganization and New Offices

Microware's business units focus on markets, while new offices in the U.S. and Europe extend services

TO ASSURE THE FURTHER DEVELOPMENT OF LEADING edge products and services, and to sharpen the focus of resources, Microware has undertaken several restructuring moves and added new offices. Microware now consists of three distinct business units; Core Technologies, New Media and International Operations.

To extend regional and local support, new technology centers and offices in the U.S. and Europe have been established.

Formal Business Units Established

Microware recently formed three distinct business units within the company to address the tremendous growth the company has faced. The Core Technologies division covers Microware's traditional operating system and tool product lines. The New Media Systems division has been established to address the growth of DAVID in the interactive television arena. Complete R&D, marketing, sales and operations groups have been established within these first two units to focus on each division's needs. Microware's International Operations division has been established to provide a global approach for Microware's business.

To oversee these Units, the following officers have been assigned:

- Mike Burgher, executive vice president and general manager of Core Technologies

- Steve Johnson, executive vice president and general manager of New Media Systems
- Andy Ball, executive vice president and general manager of International Operations

In addition to these new assignments, two new corporate officers have been named. First, George Barry recently joined Microware as its chief financial officer. George joins Microware from Dynatech, where he served as CFO. Second, Eric Miller was recently named vice president in the New Media Systems division. Eric is an 11 year veteran of Microware and has been instrumental in both DAVID and CD-i product development.

Microware Establishes Technology Centers on Each Coast

To address the specific needs of Microware's interactive television partners and customers, Microware has opened Technology Centers on both the west and east coasts. These centers will provide a local presence for RBOCS, MSOs, hardware manufacturers, software developers and other firms involved in interactive television, working with Microware's DAVID System.

Service to network, content and hardware providers is a crucial part of Microware's commitment to providing premier system software for interactive television. Microware's early successes and ongoing work with firms designing DAVID into interactive trials necessitate placing teams close to key partners. "The placement of regional business development staff," says Steve Johnson, executive vice president and general manager of Microware's New Media Systems division, "allows us to quickly get a Microware representative into key meetings and presentations that often spring up on short notice. Our regional teams can get on-site more efficiently and effectively."

Miles McNamee heads up the East Coast Technology Center, while Carl Suarez heads up the West Coast Technology Center. Miles comes to Microware from Tele-Communications Incorporated (TCI) where he most recently was the director of sales and marketing for the Wilmington, Delaware cable operation. Carl

joins Microware after serving as director of product development for RasterOps.

DAVID Development Office

In addition, a DAVID Development Office has been established in the Los Angeles area. Directed by Andrew Davidson, this office will focus on supporting content providers around the world. Davidson comes to Microware from Philips Interactive Media America where he served as director of engineering.

Contact Microware's corporate headquarters to reach the Technology Centers and the DAVID Development Office.

New European Satellite Offices

To address the special needs of regional European markets, three new satellite offices have been established by Microware's European subsidiaries.

Microware U.K. established its Amsterdam office to cover the Benelux market.

Microware France, located in Aix-en-Provence, recently set up its Paris branch. This office puts Microware at the heart of French trade and government.

To contact these new European offices:

**Microware Systems
Amsterdam Office
World Trade Centre
Strawinskylaan 521
1077 XX Amsterdam
The Netherlands
Phone: (31) 20-575-3001
Fax: (31) 20-575-3004**

**Microware Systems
Paris Office
St Quentin en Yvelines
46C, Avenue des Freres Lumiere
78190 Trappes
France
Phone: (33) 1 30.13.15.76
Fax: (33) 1 30.13.15.77**

OS-9: The Traffic Control Standard

Caltrans chooses OS-9 as standard for next- generation traffic controllers

THE CALIFORNIA DEPARTMENT OF TRANSPORTATION (Caltrans) along with the Los Angeles Department of Transportation, has adopted OS-9 as a standard in next-generation traffic control systems. With most domestic and international traffic agencies following Caltrans' technological lead, the new specification makes OS-9 a de facto standard operating system for traffic applications worldwide.

Caltrans' Model 2070 Advanced Transportation Management System (ATMS) Controller will be used in a broad range of applications, including automatic toll collection, urban traffic control networks, and weigh-in-motion systems for weighing and classifying moving trucks. In addition to being utilized as a basis for software development, the ATMS Controller will also act as a real-time multitasking host for deployed application programs and as a test bed to ensure that ATMS controllers from different suppliers comply with the standard.

Having a standard controller specification ensures that engineers can develop software without starting from scratch on each project. The open architecture also drives costs down by eliminating Caltrans' dependence on proprietary traffic control systems and costly third-party maintenance contracts.

Prerequisites to using the ATMS Controller range from support of the OS-9 Kernel to providing OS-9 drivers, file managers and libraries. Caltrans is looking to Microware's broad range of development tools to help simplify the writing and debugging of programs.

The ATMS Controller, based on the OS-9 open architecture, utilizes a 3U (single-height) VMEbus and a Motorola MC68360 microcontroller. The VMEbus CPU card includes 4 MB of RAM, 2 MB of FLASH memory, a real-time clock, and six serial ports at a minimum.

Airborne Short Wave Infrared Full Spectrum Imager Data Acquisition System

An OS-9 multitasking application with RAVE

by Richard Marois
Canada Centre for Remote Sensing, Canada

The Canada Centre for Remote Sensing (CCRS) is a branch of the Geomatics Canada sector of the Canadian government's Department of Natural Resources.

CCRS is the Canadian government's research and development arm of various remote sensing technologies and applications. Within the centre, the Data Acquisition Division is responsible for sensor development (prototyping) with research in the areas of scene physics and specialized applications, as well as for airborne and satellite data acquisition.

The Project

In 1989, the division's optical group undertook the development of an airborne imaging spectrometer in the short wave infrared (SWIR) range (1.2 to 2.4 μm). High spectral resolution in the range of 10 nm and spatial (50 cm) resolution from an airborne platform were desired. This new sensor would open a window to some as-yet-undetermined target signatures and also be a valuable research tool in the areas of geology and environmental monitoring.

The sensor head utilizes a Loral Fairchild CAM6003 PtSi camera with an onboard digital signal processor, coupled to a custom spectrograph designed by Canada's National Research Council. It has an effective spatial width of 496 pixels by 120 spectral bands covering a range of 1.2 to 2.4 μm , with a 13-bit digital output (from the camera interface). With a sensor frame rate of 50 Hz, the continuous data rate is about 6M/sec.

System Design

The data acquisition system computer was to be based on a DELTA 1147 VMEbus computer with a 25

MHz 68030 CPU and 8M of memory because of the higher bus bandwidth (as opposed to the PC bus). OS-9 was chosen because the development was to be done on the target machine and Microware was the only company who offered an end-to-end solution with multiuser capability. As it turned out, Microware was about to release the RAVE GUI development software tools that were promptly integrated into the system, permitting the user interface and imagery display to reside together on the same display at minimal cost.

For camera data capture, Datacube offered a universal solution with their MAX-SCAN multipurpose data grabber/converter with 32M of video memory together with their Imageflow software that supports OS-9. At a 50 Hz frame rate, the 32M video memory will provide about 11 seconds of recording time (currently only 8 bits out of 13 are recorded), or 560 spatial lines in the along-track direction. These blocks of 496 pixels by 120 spectral bands by 560 lines are referred to as "image cubes."

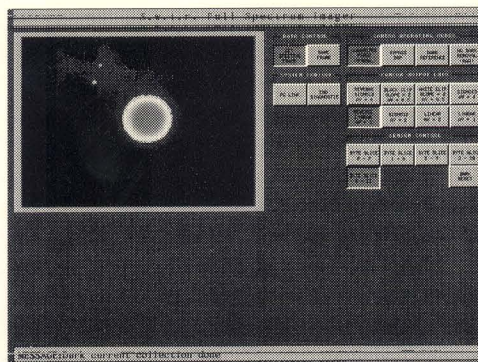
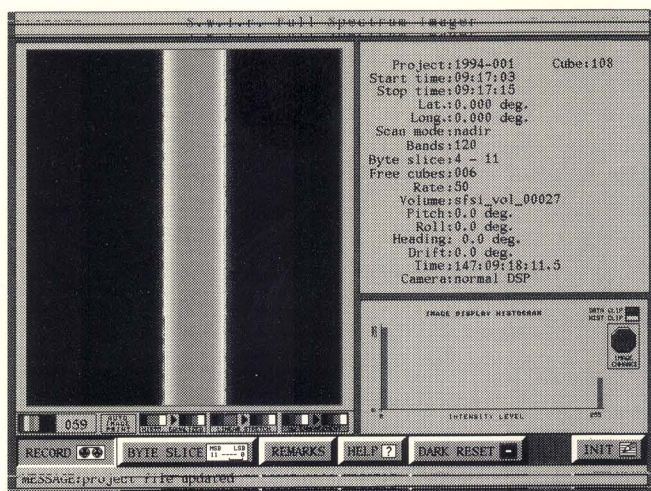
Due to budgetary constraints, a high data rate recorder was to be initially ruled out. It was decided that data would be acquired to video memory and then dumped off-line (non real time) to 1Gig MaxOptix TAHITI magneto-optical disks. The optical disks offered quick data access compared to SCSI helical scan cassettes, and would make use of the new OS-9 support for variable block size devices (RBVCCS) since the disks to be used would have 1024 bytes/sector.

Because an aircraft is the sensor platform, other data is also acquired in real time to provide accurate geometric correction of the imagery. The system incorporates BMC's smart ARTIC429 series of aircraft data bus reader, interfaced to the aircraft's inertial navigation system, an IRIG-A time code reader with external time stamp/interrupt from Bancomm (PC03V), an MMI-250 4M graphics buffer from Vigma for RAVE, an additional 128M of VMEbus memory and a custom camera control interface.

The most critical component of the system software required that there be no missing data frames, and that each one (i.e., 120 spectral bands x 496 pixel width) be accurately annotated with the exact time and the most current selected navigation parameters for each spectral frame with other ancillary data.

The Result

The system makes extensive use of the real-time interprocess communication and synchronization hooks provided with OS-9: data modules, signals, events and semaphores. The system consists of the master process that initializes all data modules and structures, and of the RAVE dispatch loop. The system also incorporates project management software that allows automatic system setup, saving and restoration by project number for quick initialization. The master process spawns four child processes with specific functions for reading the time code, ARINC bus data, providing an operator



display/interface to the system and an image hardcopy utility.

The time code reader process provides the crux of real-time annotation. A driver was coded for the time code reader card that interrupts the system at the sensor frame rate. The chosen file manager is SBF because of lower overhead. The driver is unorthodox in that the standard OS-9 calls to it do not perform normal functions. The SBF-generated tape operation codes are ignored. Special status IDs execute hardware dependent functions; the write routine updates a transfer parameter control block used by the driver during interrupt service.

The video process takes care of all data display updates including the acquired imagery, and has four screens. A startup screen showing the division's logo appears while the system is initializing. This screen is discarded and replaced by the initialization screen where the user sets up the operating characteristics of the system via an edit button. The help button is provided for both screens and guides the user through the system operation. The diagnostic screen features a spectral-only display and is activated by the diagnostics button. This screen contains the functions (added as required) to allow system operational checks and for laboratory calibration. The acquire button activates the data acquisition screen where normal sensor operation is controlled. As can be seen, the acquire screen contains a multitude of buttons (12) which activate a variety of requests and system actions.

The display of image data requires extensive manipulation of the input data and is displayed through a small CLUT value range that is constantly manipulated according to the selected image enhancement button. An input image histogram is also computed and displayed as the bar chart shown. All this data processing requires a significant amount of CPU horsepower and imagery is thus displayed in pseudo real time in

that the image display lags the acquisition in record mode.

Observations

The system was flown successfully on its first flight in November 1993. Considerable effort was put into making the system as robust as possible, especially in regard to error recovery and user interface. As with any software project, the system is continually being improved. The number of active spectral bands is being made selectable, improving the continuous acquisition time of the sensor with the current configuration. In addition, the system now controls two stepper motor indexers for dark reference and pseudo dynamic pitch mirror adjustment to achieve maximum spatial resolution and aircraft-compensated look angles. Future improvements include using the Ironics IV-3272 smart DMAC and the 128M VMEbus memory to store the imagery and at the same time allow 16-bit data recording and longer target dwell times. Another Ironics DMAC card will be used to interface to a high data rate recorder. Addition of an interface to a Global Positioning System is also planned.

All icons and the logo were designed with the Presentation Editor for RAVE. The RAVE Development Pak was selected in large part because of the code generation capabilities of the Presentation Editor which reduced considerably the development time.

During the latter part of the software development the software was converted to use Ultra C. Using full optimization even without the benefit of I-Code linking, speed improvements of 25% were achieved for the display screen update. A sensor data quick look facility using X Windows for OS-9 is also part of the future development plans.

Microware's OS-9 has proven that it can handle the job well even with limited computing power.

Aerial photograph (above) of target area for scanning. Sample screens at left are from the SWIR system.

Richard Marois is at the Canada Centre for Remote Sensing in the Sensor Section, Data Acquisition Division.

See also *Design of SFSI: An imaging spectrometer in the SWIR* by R.A. Neville, I. Powell, Can. J. Remote Sensing, Vol 18, Oct 1992, pp 210-222.

Third-Party Products

THE OS-9 COMMUNITY CONSISTS OF USERS and product providers from around the world. One key group with this community is the third-party OS-9 product vendors. These listings detail the latest hardware and software products that support OS-9.

To submit new OS-9 hardware and software for consideration, please send a press release of your product to the editor of PIPELINES at the address on page 2.

PEP Modular Offers Development Systems, PCMCIA Support

PEP Modular recently announced a series of VMEbus development systems designed for OS-9 developers. These off-the-shelf systems include hardware, software, serial I/O, SCSI drives, and Profibus and Ethernet interfaces. Systems are available in 6U and 3U desktop models, as well as a portable 3U model.

PEP's line of Very Modular 3U VMEbus SBCs was introduced with the release of their VM42. The VM42 features a 68040 at up to 50 MHz, a 68EN360 QUICC at up to 25 MHz, up to 16M DRAM, up to 4M Flash EPROM, 1M dual-ported SRAM, and commercial or industrial temperature range versions.

PEP's VMCI-2 is a 3U VMEbus PCMCIA board that supports PCMCIA 2.0/JEIDA 4.1 Type I, II and III cards. The VMCI-2 supports read and write, as well as programming of all types of PCMCIA memory cards.

The V486 is a double-wide 3U SBC that puts a PC on the VMEbus. The V486 features a 25 MHz 80486SX, 33 MHz 80486DX or 66 MHz 80486DX2 CPU, Western Digital WD90C26A SVGA/LCD controller supporting resolution up to 1024 X 768 X 16, floppy and hard disk interface, keyboard and mouse interfaces, one parallel port, two serial ports and up to 32M DRAM. The board also includes an ISAbus interface for PC mezzanine boards.

PEP's Controller eXtension Module-CAN is a 3U VMEbus mezzanine module supporting Controller Area Networks (CANs). The board conforms to both the CAN standard (ISO 11898) and the public domain CXC specification. Physical interfaces include ISO 11898, RS-485, TTL and transistor.

The VVGA is a 3U VMEbus graphics controller that supports SVGA graphics with resolution up to 1024 X 768 non-interlaced (1280 X 1024 interlaced) and 16-bit true color. The board features a Western Digital WD90C24A graphics processor, and mouse, keyboard, touch panel and CRT ports. Commercial and extended temperature industrial versions are available.

PEP's VM42A is a 3U VMEbus Autobahn Spanceiver SBC. The board features a 50 MHz 68040 CPU, 25 MHz 68EN360 CPU, Autobahn Spanceiver with 128K dual-ported SRAM, up to 16M DRAM, up to 4M Flash, 1M triple-ported SRAM and RJ11 Ethernet connector.

The VGPM-32 is a 3U VMEbus Autobahn Spanceiver graphics controller. The board features a 32 MHz TMS34020 graphics processors, 1M video RAM, local X 11 execution, 4M DRAM, 8 bit/pixel CLUT, hardware cursor, IBM keyboard interface, PS/2 mouse interface, RGB output with resolution up to 1180 X 800 X 256 colors, and TFT color LCD interface with resolution up to 1024 X 768.

PEP's VIX25 is a 3U VMEbus X.25 controller that features a 16 MHz 68302 Intelligent Multiprotocol Processor, 1M dual-ported SRAM and two X.21bis serial ports.

CALL OR WRITE
In North America
Paul Gaudreau
PEP Modular Computers Inc.
750 Holiday Drive, Bldg. 9
Pittsburgh, Pennsylvania 15220
Phone: 1-800-228-1737
Fax: (412) 921-3356

CALL OR WRITE
Outside North America
Norbert Hauser
PEP Modular Computers GmbH
Apfeltranger Straße 16
D-87600 Kaufbeuren
Germany
Phone: (49) 8341 3020
Fax: (49) 8341 803499

PowerPC Board from Radstone

The CPU-601 is a 6U VMEbus SBC built around a 50 MHz PowerPC 601 CPU. The board includes up to 64M DRAM, up to 4M Flash and two RS-423 ports.

The 68-64 is a 6U VME64 SBC that includes a 68LC060 at up to 66 MHz and a 68360 QUICC. The board features up to 32M DRAM, 2M SRAM, up to 4M Flash and MXbus interface.

The SBCC-2 is a 6U VMEbus SBC that includes a 68EC040 CPU and a 68360 QUICC. The board features four primary Serial Communication Channels (SCCs), up to 32M DRAM, up to 4M Flash, up to 32K EEPROM and MXbus interface.

The SBCC-1 is a 6U VMEbus SBC that features a 68360 QUICC CPU, optional 68040 companion CPU, four primary Serial Communication Channels (SCCs), up to 32M DRAM, up to 4M Flash, up to 32K EEPROM and MXbus interface.

The CPU-44 is a 6U VMEbus SBC. The board features a 25 MHz 68040 CPU, up to 8M SRAM, up to 4M Flash, 128K EEPROM, two serial ports, counter/timers and a real-time clock.

Radstone's RS Series chassis offer 10 and 15 6U VMEbus slots for harsh environments. The chassis are sealed and gasketed, and met MIL-STD-461 EMC requirements.

The APEX-200 is a mezzanine graphics controller well-suited for OS-9/X Windows. The module features a TMS34010 graphics processor with resolution up to 1024 X 1024 X 4 bits.

CALL OR WRITE
Radstone Technology PLC
Water Lane
Towcester, Northants NN12 7JN
England
Phone: (44) 327 359444
Fax: (44) 327 359662

OS-9/DAVID Server from ACT/Technico

ACT/Technico recently announced their **OS-9/DAVID Media Server** for video-on-demand development. The system features a 680X0 CPU, 32-channel full-duplex HDLC controller for E1 or T1 communications, mass storage options, DAVID set-top decoder, X terminal and color video monitor.

CALL OR WRITE
Ken Grob
ACT/Technico

One Ivybrook Boulevard, Suite 180
Ivyland, Pennsylvania 18974

Phone: 1-800-445-6194 (U.S.) or (215) 957-9071

Fax: (215) 957-9074

E-Mail: sales@acttechnico

New Products from EKF

EKF Elektronik introduces the following new products.

44860 WinDOS/RT couples VMEbus-based OS-9 systems and Windows or DOS VME/PCs. Designed for industrial control, the package allows shared hard disk drives to be accessed in the following ways: an OS-9 partition on a PC disk; a DOS "container" file that OS-9 accesses; and original OS-9 disks formatted with 256 bytes/sector.

The **VME 68250-IMod30** is a 6U VME M-Module baseboard featuring a 50 MHz 68030 CPU, 68882 FPCP, up to seven M-Module slots, 4M SRAM, 2M Flash, 1M dual-ported RAM, two RS-232 serial connections, real-time clock, watchdog and power monitor.

MODEM is an OS-9 communications package supporting Hayes-AT compatible modems up to 28,800 bps. Kermit, X-, Y- and Z-Modem protocols are menu selectable from within MODEM.

EKF's **VME 78004-TSC** is a low-cost 3U VME SBC featuring a 16.7 MHz 68HC000, 1M SRAM, 2M EPROM, two RS-232 ports, timer/watchdog, calendar, NVRAM and power monitor.

The **VME 78580-LAN** is a 3U Ethernet controller board. The controller features a

68HC000 CPU, dual-ported RAM, BNC connector and two RS-232 ports. **VME 68570-LAN** for 6U version.

The **VME 78380-MEMCARD** board is a 3U VMEbus PCMCIA adapter that conforms to the JEIDA 4.0 standard.

The **VME 68095-ZAC** is the first in EKF's new family of ZAC, for Zero Access-time Computer, high-performance VMEbus SBCs. The 6U VME 68095-ZAC features a 40/80 MHz 68040 CPU, up to 16M zero-wait-state SRAM and option on-board I/O. All ZAC systems feature zero-wait-state main memory.

The **VME 68660-FBC** is a 6U VME SBC built around a 68302-IMP. The board includes one DIN 19245 serial port, two V.24/RS-422 serial ports, universal parallel port/timer and two piggyback module interfaces.

The **VME 68600-GPIB** is a 6U IEEE-488 interface board. The board can act either as a GPIB controller, or as a remotely controlled listener/talker.

CALL OR WRITE
B. Kleeburg
EKF-Elektronik GmbH
Philipp-Reis-Straße 4
D-59065 Hamm
Germany
Phone: (49) 23 81 68 90-0
Fax: (49) 23 81 68 90-90

MEN Mikro Adds 68060 SBC, M-Modules

MEN Mikro Elektronik recently introduced three new SBCs.

The **A10** is a 6U VMEbus SBC built around a 50 MHz 68060 CPU. The board includes a CL-GD6440 graphics controller for LCD, EL and CRT displays, touch-screen, mouse and keyboard interfaces, 1M video DRAM, 48M DRAM, 2M SRAM, 8M Flash, PCMCIA slot, four M-Module slots and ESD/EMC compliance to the IEC1000 standard.

The **A9** features a 25 MHz 68040 CPU and the other features listed for the A10.

The **A8** is a variant that features a 68360 CPU and other features listed above.

In addition, MEN has released the **M17-4** M-Module, an intelligent communications

module that supports X.25 communication via a X.21bis interface. The board features a 68302 microcontroller.

CALL OR WRITE
B. Schmitz
MEN Mikro Elektronik GmbH
Wiesentalstraße 40
D-90419 Nurnberg
Germany
Phone: (49) 11 99 33 5-0
Fax: (49) 11 99 33 5-99

New Ruggedized Products, Catalog from MATRIX

MATRIX Corporation recently announced the following products, as well as the latest version of their *VMEbus Rugged Technology* catalog.

The **MR-CPU540** is a 6U ruggedized VMEbus intelligent I/O controller. The board features one 68040 CPU and two 68360 QUICC multiprotocol I/O processors each running at 25 MHz. The 68040 is supported by up to 16M Flash, 16M local DRAM and 16M global DRAM, while the 68360s are supported by 4M local DRAM and access to the global DRAM. Serial ports, parallel ports and timers are provided by the microprocessors. The controller withstands high levels of temperature, shock and vibration.

The **MR-CPU360** is a 3U ruggedized VMEbus SBC that features a 68360 CPU, up to 8M Flash, up to 2M battery-backed SRAM and up to 16M DRAM. I/O can be added using MATRIX's I/O Configuration Modules. The SBC withstands high levels of temperature, shock and vibration.

The **MR-CPU302** is a 6U ruggedized VMEbus SBC that features a 68302 CPU, three opto-coupled serial channels, 24 digital I/O lines, up to 2M Flash, up to 1M battery-backed SRAM and up to 4M DRAM. The SBC withstands high levels of temperature, shock and vibration.

The **ENC55** is a ruggedized sealed VME enclosure that can withstand severe shock and vibration. Because it is sealed, it also protects from dust and moisture while restricting internal temperature rises to just 15°C above the outside temperature. The ENC 55 supports up to a 15-slot monolithic

VME backplane, power supply, fans and peripherals in an internal subchassis that is mechanically isolated to reduce the risk of shock and vibration.

CALL OR WRITE

Lisa Williams

MATRIX Corporation

1203 New Hope Road

Raleigh, North Carolina 27610-1474

Phone: (919) 231-8000 or 1-800-848-2330 (U.S. only)

Fax: (919) 231-8001

New Products from Syntel

Syntel Microsystems has announced the following new products.

The **SYN-VME203** is a 3U VMEbus SBC that features a 68030 CPU, 68882 FPCP, up to 4M DRAM, up to 1M EPROM, two RS-232 ports and watchdog.

The **SYN-SBC5** offers three choices for CPUs. First is the combination of both a 50 MHz 68060 and a 50 MHz 68360 QUICC CPU. Second, the board supports a 68040 and 68360 combination. Finally, a single 68360 can be used. The SYN-SBC5 also features up to 32M DRAM, up to 16M Flash, up to 2M SRAM, PCMCIA interface, SCSI interface, 32-bit graphics controller with resolution up to 1024 X 768 X 256, 1M video DRAM and four M-Module slots.

The **SYN-VMEB001** is a 3U VMEbus SBC. The board features a 16 MHz 68331 CPU, up to 4M DRAM, 500K battery-backed SRAM, 3M EPROM, SCSI interface, RS-232 port, and digital and analog I/O.

The **SYN-B301** 6U VMEbus graphics controller features a GD5422 or GD5426 graphics processor capable of resolution up to 1280 X 1024 with 16 million colors. The board features up to 2M video DRAM, audio outputs and serial mouse interface.

The **SYN-VME428** is a 3U VMEbus Ethernet controller that features full IEEE802.3 compliance, a LANCE chip set, thick and thin Ethernet interfaces, up to 1M RAM and EPROM for identification and user firmware.

The **M9** is an Ethernet M-Module that fully conforms to IEEE802.3. The module features data transfers of 10Mbit/sec. over 2.5km to 100 users, and has a thin Ethernet connector (BNC).

The **M311** is a motor controller on an M-Module. The controller features a servo con-

troller IC and a complete one-axis servo controller.

Syntel's **SCM9B** series of signal conditioning modules including sensor-to-computer and computer-to-analog I/O, RS-232/485 converters, RS-485 repeaters and digital I/O units.

Syntel's **ART3000** family of advanced real-time controllers now supports Profibus fieldbus communications.

Real-Time DDE is an OS-9 to Windows communication mechanism. The package supports windows' DDE (dynamic data exchange) protocol to transfer information to and from a PC and OS-9 system.

CALL OR WRITE

Paul Wilson

Syntel Microsystems

Queens Mill Road

Huddersfield HD13PG

England

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New Products from BVM

RAMnet allows up to 16 BVME4000 SBCs to be used on a single VMEbus backplane with each processor being able to access the entire pool of installed memory (up to 512M). OS-9 runs on each board with one defined as the system controller for the peer-to-peer topology. RAMnet is compatible with OS-9/Net, OS-9/ISP, FieldLink and PCLink.

BVM's **System 2000** packages four of its RP2000 SBC in a self-contained unit. Each RP2000 features a 16 MHz 68302 CPU and two IndustryPack slots.

The **IP302** is an intelligent serial controller IndustryPack. The IP302 features a 16 MHz 68302, one opto-isolated RS-485 port, two additional serial ports, two counter/timers, watchdog and 256K dual-ported RAM.

The **BVME486 PC** is a 3U VMEbus SBC that features a Cyrix 486SLC CPU at up to 50 MHz, up to 16M DRAM, parallel printer port, two RS-232 ports, IDE hard and floppy drive controller, optional 240M IDE hard drive, optional 1.44M floppy drive, keyboard port and SVGA graphics controller.

The **IP-Design Kit** is a double-size IndustryPack module that gives developers the tools to develop custom IndustryPack modules. The kit includes an IP-Proto prototyping board, interface PLD, ID PROM and

extender cable that allows the module to be removed from its carrier. The IndustryPack specification is also included in the kit.

The **BVME4000** is a 6U VMEbus SBC built around a 68040 CPU at up to 40 MHz. The board features up to 32M DRAM, up to 16M Flash, 512K battery-backed SRAM, two 16-bit IndustryPack slots, NCR53C710 SCSI controller, LANCE 82596CA Ethernet controller, two RS-232/422/485 ports, Centronics port, real-time clock, programmable periodic tick interrupt and two 16-bit timers. The BVME4000 is also available with integrated 2 or 4M 3 1/2 floppy and 125 or 240M SCSI Winchester hard drives in a 6U X 12HP VMEbus board.

CALL OR WRITE

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LCD IP from Snijder

The **IP-SLCD** from Snijder Micro Systems (Deurne, The Netherlands) is an LCD controller on a single-wide IndustryPack module. The controller features a Cirrus Logic GD6440 chipset, 1M video RAM, software control of backlighting and contrast, and keyboard and mouse interfaces. The IP-SLCD supports monochrome, color, STN, TFT, single scan and double scan LCDs.

CALL OR WRITE

Nicolaas Snijder

Snijder Micro Systems

Visser 25

NL-5751 BL Deurne

The Netherlands

Phone: (31) 4930-10725

Fax: (31) 4930-10715

Graphics Package from Raster Graphics

Raster Graphics Inc. recently announced their **VPGS** (Very Portable Graphics System) for OS-9 systems. VPGS supports pre-

emptible, multiple graphics processes while remaining independent of VGA or other graphics hardware.

CALL OR WRITE
Phillip Smith
Raster Graphics Inc.
P.O. Box 847
Redmond, Oregon 97756
Phone: (503) 923-5530
Fax: (503) 923-6475

Consortium Responsible for ISaGRAPH

TranSys Incorporated is a consortium formed by CJ International (Grenoble) and others to market **ISaGRAPH**, a CASE tool for industrial control systems.

TranSys also announced the release of the **ISaGRAPH 2.10 Workbench for Windows**. **ISaGRAPH** is a IEC1131-3 compliant tool that allows designers to develop control code for 680X0, PowerPC and X86/Pentium CPUs in a variety of popular bus architectures. This latest release include DDE server functions, Ethernet connectivity with targets and a separate field debugger tool.

CALL OR WRITE
Robert Lyons
TranSys Incorporated
5010 East Shea Boulevard, Suite C226
Scottsdale, Arizona 85254
Phone: (602) 483-7924
Fax: (602) 483-7202

New Product from o+r Industrial Computers

The **VDIO-40** is a 3U VMEbus digital I/O board. The board features 16 opto-isolated inputs and 16 6 Amp high-current outputs.

The **V0332** is a 3U VMEbus SBC. It features a 16 or 21 MHz 68331/332/335, up to 4M DRAM, up to 2M SRAM, up to 4M EPROM, up to 8M Flash, SCSI-2 interface,

three RS-232/422/485 ports, 20 TTL channels and three 16/32-bit counters.

The **VADM-10** is a 3U VMEbus analog and digital I/O board. The board features 16 single-ended or eight differential analog inputs, eight 12-bit analog outputs, eight digital inputs, eight digital outputs and four relays. The 100 kHz A/D converter is available with either 12- or 16-bit resolution.

The **V-360** is a 3U VMEbus communications controller built around a 25 or 33.4 MHz 68360 QUICC CPU. The board features up to 32M DRAM, 1M SRAM, 4M EPROM, 16M FlashROM, 4K EEPROM, M-Module interface, Ethernet interface, SCSI-2 interface and up to six serial ports.

The **RDIO-10** is a 3U VMEbus digital I/O module. The board features 32 opto-isolated digital channels operating at 5 VDC or 28 VDC. Each channel is capable of generating an interrupt individually on level, status change or pulse catch.

CALL OR WRITE
Mike Horan
or Industrial Computers
23455 Madero, Suite B
Mission Viejo, California 92961
Phone: (714) 855-3235
Fax: (714) 770-3481

FDDI Board from Performance Computer

Performance Computer recently released their **PT-VME600** VMEbus FDDI adapter that conforms to the ANSI X379.5 standards. The board features the National Semiconductor FDDI chipset and 25 MHz LR33000 CPU. The PT-VME600 provides multimode optical fiber interfaces, while the PT-VME602 provides unshielded twisted pair interfaces.

CALL OR WRITE
Performance Computer
315 Science Parkway
Rochester, New York 14620
Phone: (716) 256-0200
Fax: (716) 256-0791

ATM Controller from Dynatem

The **DATM13** is a 3U VMEbus ATM controller. The board features an LSI Logic ATMizer which supports up to 256 virtual channels, performs segmentation and reassembly, and manages contiguous and non-contiguous payloads.

Dynatem's **DPC104** is a 3U VMEbus module which allows insertion of PC/104 cards into VMEbus systems. The module can occupy either short I/O (A16) or standard (A24) address space on the VMEbus, and provides an additional IDE interface.

The **DCOM332** is a 3U VMEbus SBC that features a 68332 CPU, three serial ports, 16-channel Time Processor Unit, up to 256K EPROM and up to 2M dual-ported SRAM.

Dynatem's **DMEM20** is a 3U VMEbus PCMCIA board. The board is compatible with the PCMCIA 2.0 and JEIDA 4.1 standards and accepts Type I, II and III cards.

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Basic Compiler for OS-9

Computer Design Labs recently released its **CDL Basic** native code compiler. The CDL Basic compiler compiles 68000 assembly code and supports macros, compiler variables, named labels, pointers, dynamic memory buffers, intermixed assembler, alias variables, conditional compilation. The compiler includes 50 functions as well as support for user-written functions which are C compatible. A programmer's toolbox is available which includes macros for OS-9 system calls, and definitions and structures for device descriptors.

CALL OR WRITE
Computer Design Lab
RR1 Box 36
Rhineland, Missouri 65069
Phone: (314) 236-4373

OS-9 Primer, OS-9 Insights Edition 3.0 Now Available

*Invaluable resources for OS-9
programmers*

WHETHER YOU'RE JUST STARTING UP WITH OS-9 OR you're a veteran user, Microware has two reference books to help you.

Introducing the OS-9 Primer

The OS-9 Primer delivers basic instruction for programmers who are just beginning to discover the power and flexibility of OS-9. To help you take your application from "square one" through development and testing, *The OS-9 Primer* by Mark Heilpern provides:

- Step-by-step instructions
- Helpful programming hints
- Extensive coding examples.

Mark Heilpern has been an OS-9 user for five years and currently is Microware's training and education manager.

Updated OS-9 Insights

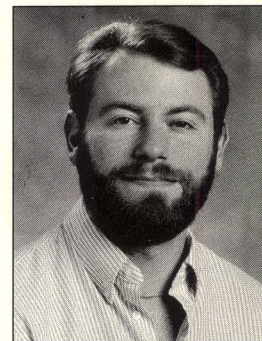
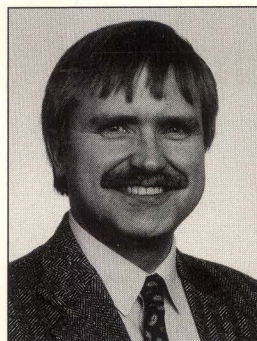
Peter Dibble is well-known in the OS-9 Community. And his *OS-9 Insights Edition 3.0* is required reading for every OS-9 users. *OS-9 Insights* takes a detailed look at the internal structures of OS-9 and gives programmers the knowledge to exploit the power of OS-9. This latest edition helps programmers:

- Get inside the internal structures of OS-9.
- Discover unique tips for customizing OS-9 systems.
- Examine ways to tap additional resources from the OS-9 Kernel.
- Learn from illustrative programs and scripts.

Peter holds a Ph.D. in computer science from the University of Rochester and currently works as a computer scientist at Microware. He also teaches classes in operating systems at Iowa State University.

Special Offers Available

The OS-9 Primer and OS-9 Insights Edition 3.0 are now available. Check with Microware or your local Microware representative for special upgrade and combination offers on *The OS-9 Primer* and *OS-9 Insights Edition 3.0*.



OS-9 Insights author Peter Dibble (left) and *The OS-9 Primer* author Mark Heilpern (right)

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