

INGRES

Advantage

THE INFORMATION MANAGEMENT QUARTERLY

Volume III, Number 3, 1989
Relational Technology

INGRES IN GOVERNMENT

**Keeping Classified
Data Safe**

**Stonebraker
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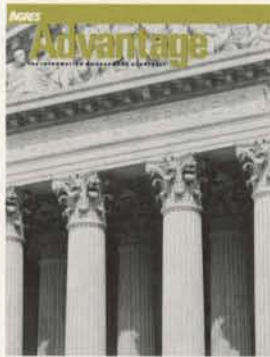
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This spring in New Orleans, Louisiana, over 800 *INGRES* users from all over the country and the world gathered to attend the 1989 North American *INGRES* User Association meeting (NAIUA). They spent four full days covering a broad spectrum of topics—from the how-to's of factory-floor data collection to the latest artificial intelligence techniques.

Like the NAIUA conference, this issue also covers a variety of topics—especially those related to government. Since “government” means many things to many people, the term is used loosely. We cover government applications spanning the offices of the British Tourist Authority to the National Highway Traffic and Safety Administration, the meeting rooms of the Pentagon to California’s State Department of Water Resources, and more.

Each of these applications answers the particular needs of individual agencies for immediate, usable information—information on which most of us ultimately depend for our health, safety and well-being. As the technology used to record, analyze and disseminate this information becomes more and more powerful and useful, our living and working lives improve, too.

Paul E. Newton,
President and Chief Executive Officer

Publisher’s Note

In case you’ve noticed that this issue of the Advantage looks a little different from its predecessors, you’re right. It does.

Our magazine’s new look is right in line with both its growing readership and expanding editorial direction. In addition to its regular features, the publication is covering more trends and issues in information management, and including guest editors and columnists from a wide range of disciplines and industries.

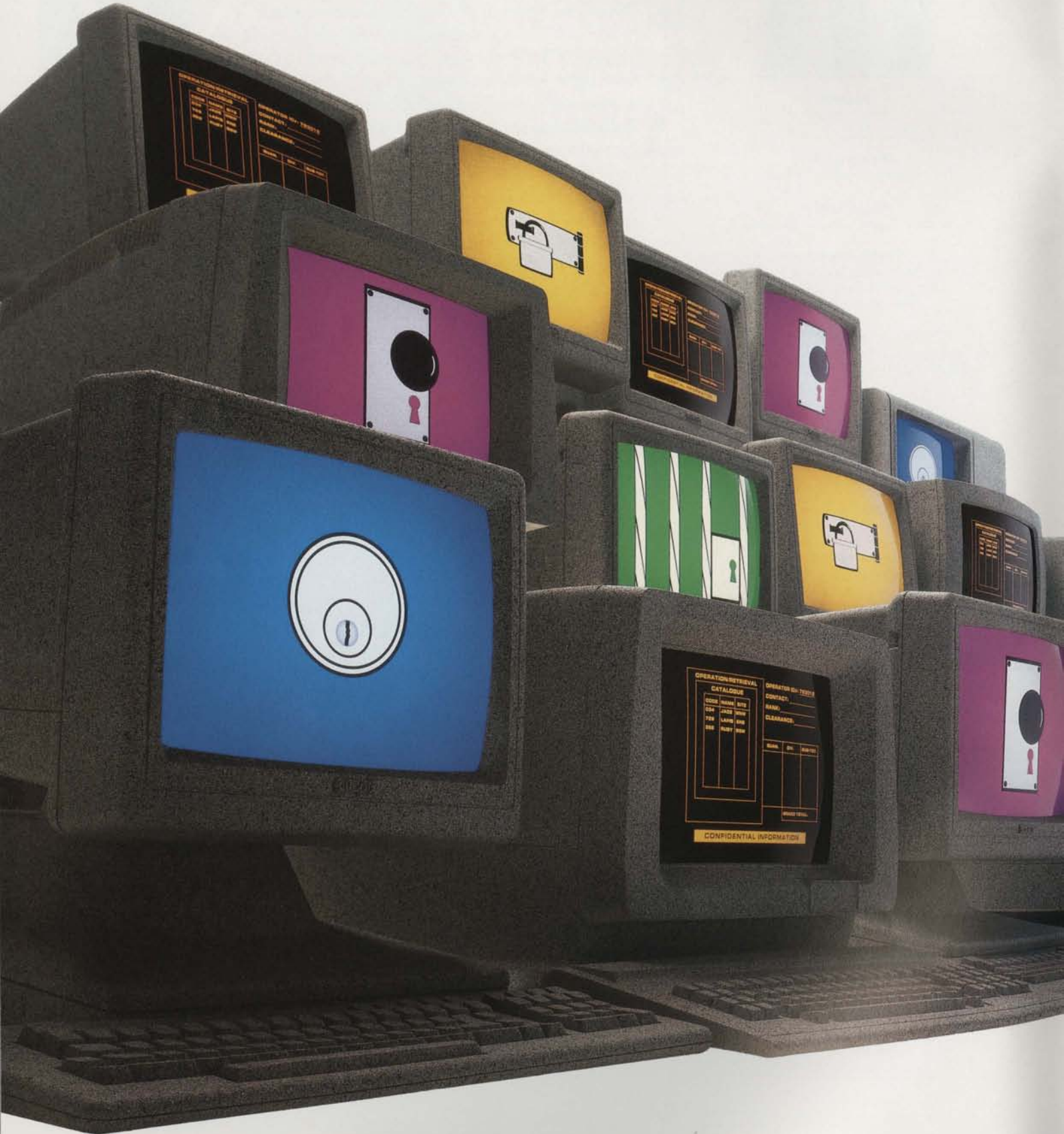
With a standing quarterly circulation of 25,000, the Advantage has become a unique information management quarterly. It provides both our advertisers and our readers a special opportunity to create a publication for information users of all persuasions.

As always, we welcome your questions, comments, articles and opinions. The Advantage is your magazine, and we look forward to hearing from you.

Good reading!

Marc Berlow
Publisher

SECURE



I N G R E S

Keeping Classified Data Safe

Every day, the Navy tracks the position of ships throughout the world. Officials store classified and unclassified data

B y R a e about their missions
B u r n s and destinations.

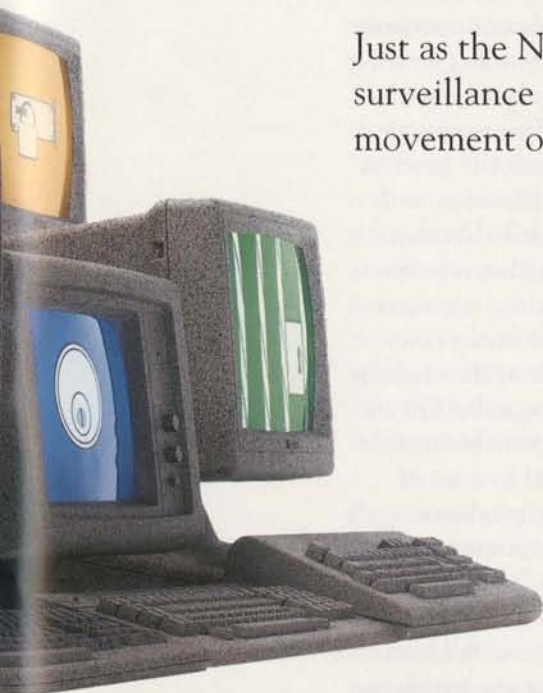
While information on merchant ships is open to almost anyone, data on military ships is available only to analysts cleared to know their locations.

Just as the Navy maintains surveillance data on the movement of ships, the

Army tracks, updates and keeps available data on troop strength and deployment.

Critical decisions, especially in times of emergency, are based on the security of this data, much of it stamped "SECRET" or "TOP SECRET."

Likewise, the Air Force closely monitors the development of sophisticated electronic and avionic systems such as the Stealth bomber that made its recent debut. Until the plane rolled out, all particulars about its design, capability, etc., were highly classified. Much of this information, needless to say, remains sensitive.



These military branches, like all other segments of government, use database management systems to consolidate and maintain the data that is critical to their operations. As more and more sensitive information is stored in databases, however, the need for

controlled access becomes more urgent. How, in fact, does the computer industry provide the government with technology to assure that classified databases containing information vital to national security are kept safe?

The Old Approach to Securing Classified Information

In the past, the U.S. military addressed the problem of securing data through the use of computers in "system high" or "dedicated" modes of operation. To operate in these modes, all users of the system had to be cleared to access the most sensitive data.

This approach to security had many shortcomings. It was costly. There was also the problem of granting clearances to more individuals than necessary, increasing risk. In addition, data was often over-classified because usually only a small percentage is actually highly sensitive.

This outmoded approach to security points to the need for an automated solution. But, despite research and development efforts by the Department of Defense since the 1970s, today's

commercial computer systems simply have not provided security mechanisms powerful enough to guarantee that users have access only to the data for which they are cleared.

This fact is confirmed in the recent invasion, for example, of "the German spy." This individual got around the UNIX password system and into the files of the Air Force, the Navy, several defense contractors and a medical research facility. There, he almost endangered the life of a patient in a medical experiment. Consequences could be far more serious.

More Dependable, Secure Systems

Step by step, however, the National Computer Security Center (NCSC) is getting closer to providing more secure systems to preclude this kind of activity; first, with the development of a set of criteria for evaluating the security mechanisms of commercial operating systems.

When the NCSC evaluates a security system, it assigns the product a rating and then places it on the Evaluated Products List (EPL). The rating, or evaluation class, reflects the security functions the system provides, and at the same time, assures that these functions are performed in a secure manner. Therefore, when a government organization initiates a computer system acquisition, the security requirements of the organization are matched with the criteria ratings; then they are matched to a set of evaluated commercial products.

Currently, the most common operating system rating is "C2." The security mechanisms available in most commercial operating systems fall into this group. These mechanisms, which are

To effectively address the government's requirements for data security, Relational Technology has embarked on a project to produce a secure version of INGRES.

ATX Meets DOD Specifications

INGRES helped one company face a major challenge when the Department of Defense (DOD) grew tired of paying for its contractors' manufacturing mistakes.

To force contractors to build reliability into their systems, the DOD introduced Weapons Specification #WS-6536E. The specification allows the government to become actively involved in the manufacturing process, giving it license to monitor assembly, inspection and test operations of every primary and subcontractor in the defense and aerospace industries. Compliance with WS-6536E is mandatory for all new contracts, and strict evidence is required for every aspect of the production process, including the disposition of rejected parts. ATX, a New York City-based manufacturer of advanced quality assurance and manufacturing information systems found a way to comply with WS-6536E.

One important ATX customer was a major defense contractor. ATX had to meet the exacting requirements of the government and still deliver a satisfactory return on investment for the customer.

With INGRES, ATX was able to develop a WS-6536E-compliant Quality Information System for the contractor. "Relational Technology showed again that it is at the forefront with leading tools and technology," says ATX president Moshe Nadby. "INGRES demonstrated full compliance with the DOD requirements, producing extensive evidence necessary for every aspect of the production process."

One extensive function of the ATX application tracks and documents rejected parts. The government dictates accept/reject algorithms, and contractors must thoroughly trace and document causes for part rejection, requiring real-time calculations and process capability. With INGRES, Nadby says, "this process became efficient and paperless."

Accessed through DEC VAX VT-340 terminals placed at the technician and operator stations throughout the manufacturing plant, the system provides immediate access to current performance data, which is required at the end of every shift. Managers and supervisors can track work in progress and, as a result, manage more effectively.

The system has done more than help ATX satisfy the needs of most defense and intelligence agencies for data collection, processing and dissemination, Nadby notes. "INGRES also helps implement quality procedures throughout the weapons manufacturing process, and has improved our customers' return on investment by giving them higher yields and reduced scrap." -B.F.M.



called "discretionary" access controls, mediate user access to files according to permissions granted by the file creator (or owner).

"B," higher than "C," is the next evaluation class. Comprising "B1," "B2" and "B3," this division's access control is modeled after the classifications needs of the U.S. government. So an operating system with a B1 rating must embody "mandatory" access controls based on sensitivity labels (such as SECRET and TOP SECRET) that are assigned to data itself as well as system user clearances.

Requirements for assurance ("how much trust you have in a system that it does what it is supposed to do") also increase at this level. As a result, a model of the security policy the system enforces, and the use of soft-

ware engineering methods during the development of the system, are required.

The highest operating system level, "A," of which only "A1" currently exists, requires even more assurance techniques, including a formal, top-level specification of the Trusted Computing Base (TCB).

Spanning from highest to lowest rating, today's Evaluated Product List contains one A1 system, the

With Secure INGRES as a foundation, it will be possible to design, implement and deploy government applications that require the handling of classified data.

The new Secure INGRES product addresses the federal government's needs by providing, in addition to the current INGRES discretionary access controls, the label-based mandatory controls required by the military.

Honeywell SCOMP; one B2 system, the Honeywell Multics; and a number of C2 systems, including DEC VAX/VMS, IBM MVS and VM with add-on

security packages, Gould UTX/32S, and more. In addition, several vendors are now developing B division systems to meet government security needs.

Among them are Sun/MLS, DEC VAX/SEVMS, IBM Secure XENIX and AT&T System V MLS.

NCSC Publishing Security Criteria for DBMS Products

Until recently, security criteria had been outlined only for operating systems. However, the

NCSC has now published an interpretation of the basic security criteria for evaluating computer networks. Forthcoming is the most recent wave of security criteria; that for database management systems.

Actually, the effort to establish security criteria for DBMS products goes back to 1982, when the Air Force sponsored a study group to look at the military requirements for "multilevel secure" (MLS) databases—databases that contain information at several of the various classifications. Their fundamental goal is to enhance commercial database security mechanisms so that they will support controlled access to multilevel data. At the same time, they will address ways to resist malicious or unintentional subversion of security mechanisms.

As a result of this research, several government-sponsored projects have developed trusted DBMS prototypes, security policies for multilevel databases and architectural designs for integrating database management systems with trusted operating systems in the B division. To effectively address these security requirements, Relational Technology has embarked on a project to produce a secure version of INGRES.

Enforcing Mandatory Security Policy

The new Secure INGRES product addresses the federal government's needs by providing, in addition to the current INGRES discretionary access controls, the label-based mandatory controls required by the military.

Targeted for a B1 rating, Secure INGRES can be implemented with operating systems evaluated at B1 or higher (B2, B3 or A1). For each row of data within a table, the INGRES mandatory access controls provide security labels. In addition, the INGRES reference monitor mediates all user access to information within the database. This mediation is controlled by the INGRES mandatory security policy, which authorizes the release of rows of data only if the user has the appropriate clearance.

From now on, as databases are designed for use with Secure INGRES, the design process will include an analysis of the security requirements and security semantics of the application. The resulting database schema will contain the mandatory access requirements of the application, as reflected in the security labels associated with each row in the database. When a user or application program accesses data,

INGRES will enforce both discretionary and mandatory controls.

Secure INGRES enforces a mandatory security policy that reflects the semantics of databases, while maintaining compatibility with the underlying operating system's file-oriented, mandatory policy. The INGRES security architecture takes full advantage of the security features of the operating system; the operational assurances provided by a B division operating system can be used to protect INGRES software and databases. In addition, all of the INGRES application development and end-user tools can be used just as they are today to build multilevel database applications.

With Secure INGRES as a foundation, it will be possible to design, implement and deploy government applications that require the handling of classified data. Database power and

flexibility can be brought to more situations in which both the availability and the security of information are critical. As a result, the military services, government agencies and contractors can manage their critical information more effectively and more economically. ▼

Rae K. Burns, principal consultant for Kanne Associates, Inc., a software engineering company specializing in database security, has developed a prototype multilevel secure DBMS. She has consulted to the Air Force on several database security projects and has published on database security technology as well as the design of multilevel database applications. Ms. Burns holds a bachelor's degree in mathematics from Stanford University and a Master of Software Engineering from the Wang Institute of Graduate Studies.



Ogden Air Logistics Center Keeps Massive Inventory in Order

Imagine having to distribute more than two million supply items, maintain 1,300 aircraft, 7,300 engines, 1.3 million exchangeable components and procure a wide range of goods. That's the job of Hill Air Force Base in Ogden, Utah—home to the Ogden Air Logistics Center (OO-ALC), one of five centers throughout the country with headquarters at Wright-Patterson Air Force Base in Dayton, Ohio.

The Logistics Command managed \$45 billion in contracts in fiscal 1988 and manages all Air Force materials. The Ogden ALC supports ICBM missiles, F-16, F-4, C-130 and RF-4 aircraft, and specializes in the repair and management of all landing gear, wheels and brakes, photo reconnaissance equipment and aircraft simulators.

Managing such a huge inventory requires a myriad of computer applications. The INGRES RDBMS is used for many applications on the base within a larger system called LOGDIS (Logistics Data Integration System). LOGDIS integrates and manages data using a communications-oriented programming language and the INGRES RDBMS.

One application called IMACS, the Interservice Material Accounting & Control System, will provide visibility, accountability and repair status of assets assigned to one service and repaired by another.

One example where the IMACS application has already proven beneficial and saved money involved a Federal Stock item. The item had been shipped to Hill AFB for repair but maintenance and supply clerks lost track of it. The item was scheduled for induction into the maintenance cycle but its location was unknown.

Staff members reviewed the IMACS Mismatch program for the item and found the stock number in two IMACS mismatch suboptions. The mismatch gave the Automated Warehouse System locations and a one year history for the National Stock Number. In less than thirty minutes, the National Stock Number was located in the Warehouse. The item has since been repaired and sent back at a cost of \$17,220.00. If the item had not been found, it would have cost \$135,000.00 to replace. *(continued on page 39)*





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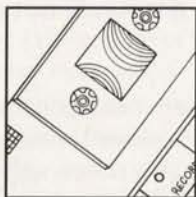


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New Dimensions in Data Management

Dr. Michael Stonebraker, one of the original architects of INGRES and a founder of Relational Technology, is a professor of Computer Science at the University of California, Berkeley. Since 1971, Dr. Stonebraker has published more than 100 research articles and has been a pioneering computer scientist, researcher and teacher.

In this interview, Dr. Stonebraker discusses past and present relational database management technology and its horizons in object-oriented programming and artificial intelligence.

Advantage: You've been involved in RDBMS technology since its inception. Your brainchild has grown to become a gigantic industry, and INGRES is the information foundation of industries all over the world. To what would you attribute its success?

Stonebraker: To answer that question, you have to compare today's relational database management systems to their predecessors. First-generation systems consisted of CODASYL and IMS—what we might today call “tired” technologies, made up of unwieldy languages and inflexible structures. Relational systems, the next generation, came along at exactly the right time.

In fact, the concept of relational database management has been fabulously successful. Imagine: just five years ago, relational systems had virtually no market penetration. Today we're to the point where relational systems have essentially taken over the market and no one buys any other kind of system.

Advantage: Do you think this demand for current RDBMS technology will last?

Stonebraker: In fact, no. The current technology has some limits. I expect the industry will be in transition for the foreseeable future as companies address these shortcomings.

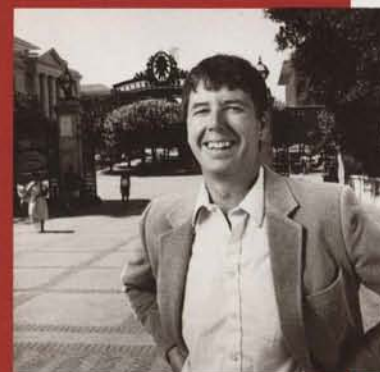
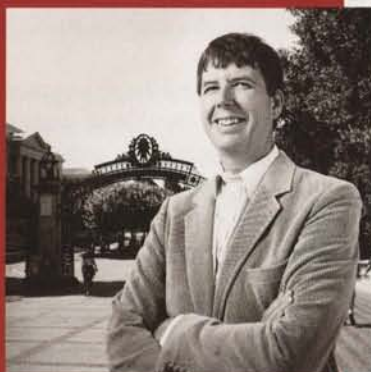
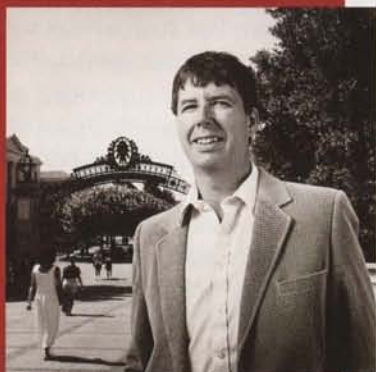
Advantage: But if RDBMS products are so fantastically popular, why do you think the current technology is limited?

Stonebraker: Certainly, compared to first-generation systems, today's systems give you a flexible means of sorting through the information you feed into them.

Current RDBMSs all evolved from either the original INGRES prototype or IBM's System R. The goal of those prototypes—the Adam and Eve of today's RDBMS technology, if you will—was to come up with something more flexible and useful than the first-generation database systems. The objective was to handle business data processing data better.

Advantage: What do you mean by “business data processing data”?

Stonebraker: If you take a look at the research that was published at the time—Ted Codd's papers, Chris Date's books, my papers—all of these used standard sets of examples about “employee,” “supplier,” “parts” relations and the like—all founded upon business data



processing models. Of course, most companies have to deal with a fair amount of this kind of information.

Advantage: Understandably. Isn't this the only kind of data most companies need to do their work?

Stonebraker: Not entirely. Most companies also need to process a fair amount of other kinds of data, too. Take the contents of this magazine, for example. You wouldn't use a relational system to write it. Not only does text data not go well with relational database systems, but CAD data is similarly difficult. If, for example, you want to store the geometry of a building in an RDBMS, you're going to have an awfully hard time of it.

In fact, storing spatial data of any kind in today's RDBMSs is virtually impossible. For example, the California State Department of Water Resources would like to track all of the water in California. That's one giant spatial database.

Advantage: What else can't today's relational systems do?

Stonebraker: Well, they can't correlate data processing data with other kinds of data. For instance, one INGRES customer, Chrysler Corporation, has a database consisting of suppliers and parts and prices; they also have a CAD application that tracks what a car looks like. They would probably like to be able to correlate the CAD data with the non-CAD data. They might like to ask, for example, how changing a supplier of rubber hoses will affect the overall cost of a car.

So, to really serve diverse industries, it's necessary for us to build better facilities.

Advantage: Okay, so to provide these businesses with the facilities they need, where does the technology need to go?

Stonebraker: We need to add more dimensions to our data management thinking. We will need to move from simply managing data processing data

to object management and knowledge management.

Current data managers are one-dimensional. A three-dimensional system incorporates data management, knowledge management, and object management. These multidimensional systems will replace the one-dimensional systems of today. Instead of just managing information in flat data processing form, we will additionally manage both objects and knowledge.

Advantage: Let's back up. What do you mean by "object management"?

Stonebraker: To appreciate object management, let's look at time as an example. There are many kinds of time—geological time, historical time and different kinds of chronological time. Of course, current relational database management systems don't understand this: they rely on SQL. SQL supports "time" to mean calendar time, but it cannot differentiate between different kinds of time.

An object management database would understand several concepts of time that allowed the expression of these semantic differences.

What we need is a database management system that is capable of storing many kinds of objects, each semantically different. So, for example, one could have an object called "time" that contained characteristics of geological time, historical time and different kinds of chronological time. The object would be much more sophisticated than our current building blocks in SQL.

Advantage: But SQL is a standard language; it's surely not going to go away.

Stonebraker: No, but in spite of its virtues of set-oriented retrieval and simplicity, SQL is not enough to perform the complex task of managing objects.

Advantage: Why not? What's the advantage of being able to work with "objects" over SQL alone?

Stonebraker: First of all, with object-oriented programming tools, programmers can stop chipping their teeth on problems that current SQL, with its fixed types and

"We're talking about a whole new way of managing information, because we're combining artificial intelligence with relational databases. Instead of relying on sticks and flint and hope to build a fire, we will have lighters and kerosene."

operators, is simply not up to doing. And users can use new data types and operators without having the foggiest idea of how they work.

In addition, with an object-oriented database, you could have a company-wide library of reusable code that implements the operators, meaning that everyone in the company can use the new operators without worrying where they came from.

Advantage: And what do you mean by "knowledge management"?

Stonebraker: I'll answer with an example. In most companies, there are procedures for assigning office furniture. Every person gets a certain kind of furniture depending on his or her position. Every business operates around hundreds of these kinds of rituals or, as artificial intelligence people call them, rules. Rules are usually built on "if-then" statements: for example, if Joe is a vice president, then he gets an oak desk; if Steve is a program-

mer, then he gets a steel desk.

Now, the worst possible place for the knowledge of these kinds of procedures, or rules, to be is in someone's head. If that person quits or dies, the knowledge disappears. The second worst place for it to be is written down on a piece of paper in a filing cabinet: if the building burns down, there goes the knowledge. The third worst place for it to be is in an application program—at least if the procedure is in a program you have some chance of enforcing it. But if a rule changes, it's difficult to change an application program appropriately, because you have to figure out the programs and make sure you're changing them correctly. Also, if you add a new application program, it must have enforcement code for the current rules. The application designer must somehow be aware of all the rules.

By far the best place to put rules is in the database itself. This way, the system itself can make sure that rules are enforced. Moreover, the database can allow the rules to be changed at any time, so there is great flexibility. From my point of view there's immense leverage to putting rules inside the data manager itself.

Advantage: By putting the rules inside the data manager, then, the DBMS itself becomes the rule-keeper?

Stonebraker: That's right. And by incorporating a knowledge manager into a database manager, rules can be supported efficiently.

Advantage: "Three-dimensional" systems, as you call them, sound impressive, but tell me—will they really bring about a revolution in the way we use data or are they just another incremental development in existing RDBMS technology?

Stonebraker: These systems will be revolutionary. We're talking about a technology that can't be bolted on to existing systems. We're talking about a whole new way of managing information,

because we're combining artificial intelligence with relational databases. Instead of relying on sticks and flint and hope to start a fire, we will have lighters and kerosene.

Advantage: But some RDBMS vendors are already claiming that their data manager stores rules, triggers and objects too. What's wrong with those?

Stonebraker: True, other vendors make that claim, but their implementation is too inefficient to be of much service. Let's return for a moment to the rule concerning an oak desk for Joe. In one of these vendors' implementations, every time any employee gets a change of title, the Joe rule "fires" only to find out the rule conditions are not satisfied. Such "brute force," if you will, is unacceptable. INGRES will have a much more sophisticated firing mechanism.

Advantage: So what will this future incarnation of INGRES mean to these other vendors?

Stonebraker: The INGRES structure is already in place. Vendors other than Relational Technology will have a hard time putting a good implementation of this kind of technology into place. That's because SQL has a fixed collection of operators and types of objects. So all that hard wired logic that other RDBMS vendors have built into their systems will have to be ripped out. They'll have to rebuild their systems.

Advantage: Do you see anything else in the current Release 6 of INGRES that supports this new way of handling data?

Stonebraker: Well, Relational Technology is at a distinct advantage here, because when Release 6 was developed, the system was rewritten the right way. We've been working on this for years, and have been making these changes all along. We already use rules in our data manager. Others who didn't start as early as we did will have a lot more work to do. INGRES will not just utilize SQL—it will

understand objects, and the objects and operators will be customizable to each installation.

Advantage: What will it take for me to learn to use this completely new way of managing information?

Stonebraker: If you understand SQL and its collection of objects, you won't be restricted in future versions of INGRES. You can still have SQL, but you also have the benefit of being able to use other kinds of objects and operators. INGRES will be upwardly compatible. It's as if instead of being in a room with cement walls you can move the walls back. It won't involve a lot for people to understand and use.

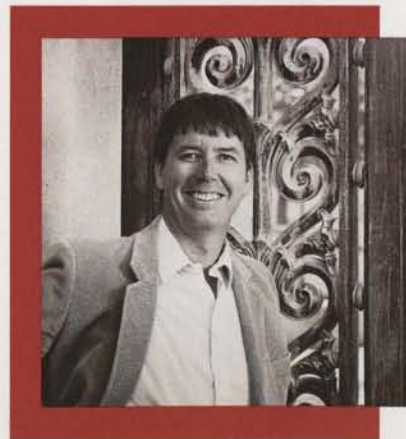
Advantage: Will this object-oriented programming affect performance negatively?

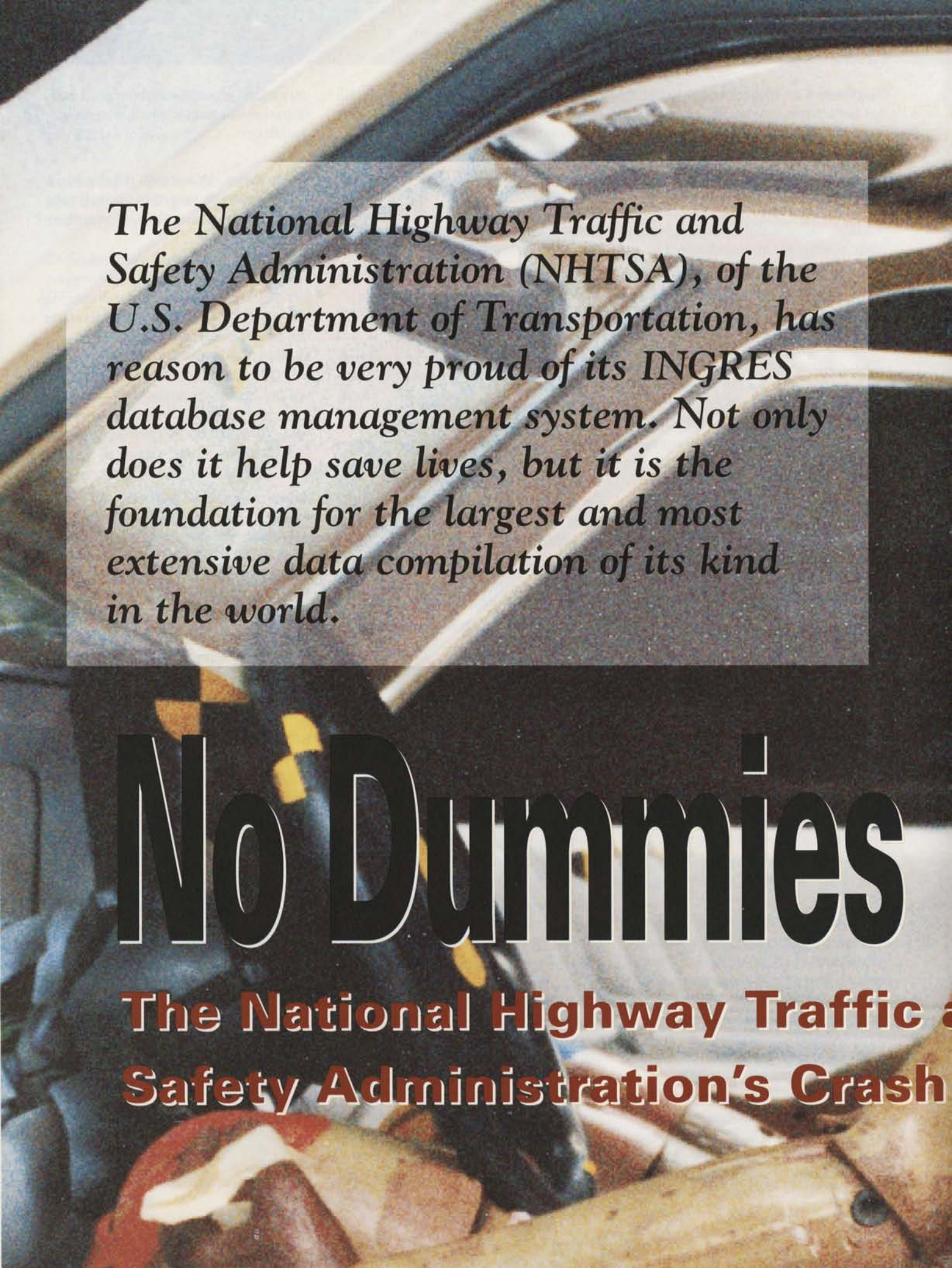
Stonebraker: No. A good implementation of objects simply gives you more flexibility without a loss of performance on existing tasks.

Advantage: Who's going to use this new kind of data manager?

Stonebraker: Everybody is going to use a three-dimensional data manager, simply because everyone has a three-dimensional problem. And when this technology appears, one-dimensional solutions will quickly become obsolete. ▼

by Bronwyn Fryer-McCulloch





The National Highway Traffic and Safety Administration (NHTSA), of the U.S. Department of Transportation, has reason to be very proud of its INGRES database management system. Not only does it help save lives, but it is the foundation for the largest and most extensive data compilation of its kind in the world.

No Dummies

The National Highway Traffic and Safety Administration's Crash



nd
Project.

Over 20 years ago, the National Traffic and Motor Vehicle Safety Act mandated that the NHTSA develop Federal Motor Vehicle Safety Standards to reduce the number of deaths and injuries caused by motor vehicle accidents. The Office of Crashworthiness Research was set up to study safety requirements for automobiles. Today, NHTSA supports its

The engineering research data contained in the INGRES system is crucial not only to NHTSA, but to most domestic and foreign automobile manufacturers.

research with vehicle crash test, biomechanics and component databases. The engineering research data contained in these INGRES databases is crucial not only to NHTSA, but to most domestic and foreign motor vehicle manufacturers. The DBMS provides a standardized format that allows for exchange of data among participating researchers. With a DEC VAX 8350 running INGRES/NET (the INGRES networking facility) added to a VAXcluster, NHTSA has enhanced its ability to provide vital automobile engineering data to the world.

Researchers from the federal government, as well as domestic and international manufacturers such as Volkswagen, Renault, Fiat and Volvo, rely on the data culled from crash tests performed at government sites throughout the United States. At the crash test facilities, vehicles and their dummy occupants are wired with up to 100 sensors and then bashed against barriers or other cars at a variety of speeds and under various configurations. While engineers observe and control the crashes from a booth above the crash pad—usually an outdoor track—the sensors digitally record everything about the crash, from the strength of impact to the most minute movements of the dummies.

The results of the crash, accumulated and sent on magnetic tape to the Department of Transportation building in southeast Washington, D.C., are input to INGRES for analysis by engineers. To allow maximum user access to the database, communications links with INGRES are utilized by the Transportation Systems Center (TSC) of Cambridge, Massachusetts (an organization chartered by Congress to provide engineering and technical services to the Department of Transportation), and the NHTSA Vehicle Research Test Center, a primary crash test site located in East Liberty, Ohio.

In addition, NHTSA often responds to data requests

from universities, consumer reports publications and litigators representing both the vehicle manufacturers and the public.

Data processing services for NHTSA are provided by Automated Sciences Group (ASG), located in Silver Spring, Maryland. ASG has more than 50 people working on the government contract, 12 of whom work specifically with the Office of Crashworthiness Research to provide support for the project.

Gary Bell, a 15-year NHTSA veteran who oversees the government contract with ASG, remembers the old days when NHTSA's Office of Crashworthiness Research received virtually no attention for its efforts. "We didn't get much in the way of funding and had a very small staff," he recalled. "In order to get more funds for our research, we had to prove ourselves to management as we went along. We decided to try to keep track of crash test data, since crash testing is so expensive. ASG implemented our first database management system back in 1978—it was a handwritten program running on an old DEC-PDP/1140—to store the crash test data. When our engineers would go to conferences and it got around that we had such a database, a lot of people started to take interest. 'Oh, so you have a database that has the data from a 35 mile per hour crash test on a Chevy in it? Oh, I'm interested in that!' And when the management saw the kind of feedback we were getting, they let us do more things. But it wasn't long before our ambitions outgrew the system."

Encouraged by the increased attention and funding, NHTSA engineers and ASG programmers began wanting to formulate new queries for their database. Frustratingly, though, their needs could not be met without rewriting the entire

"With INGRES, we've been able to develop an internationally known database for vehicle crash test data. It's allowed us to do things we never thought were possible."

system. This lack of flexibility became increasingly irritating as the potential of the new research data grew.

Accordingly, flexibility was at the top of the list of criteria when ASG began looking for a new database management system in 1982. "We wanted to have something that would allow our users to formulate ad hoc queries," Bell added. "We also wanted to be sure that the performance was adequate; that's an ongoing concern, particularly when you have a large number of tables that you have to join together. We also had to have some-

thing that was callable from FORTRAN, because our engineers use that language a lot. So we needed a very close interface between FORTRAN and the query capability. That eliminated a lot of database management systems right away.”

By using INGRES's embedded FORTRAN preprocessors, the engineers can use both INGRES and FORTRAN at the same time. “With EQUOL and FORTRAN, we've been able to build in logic checks to the data which help us determine, from what we know about the test conditions, what the values of certain fields should be,” said Anne Corner, senior project manager for ASG. “For example, if there are two vehicles, the closing speed field should contain the sum of the two vehicle speeds. It's almost like an artificial intelligence program. That's really something. One of the other things which we like very much about INGRES is the ease with which you can transform data from other formats.”

ASG is excited about adding to its computing power with a new VAX 8350 and new INGRES tools. Local area networks in Washington, Boston and Ohio are aided by INGRES/NET, a transparent software layer that provides INGRES protocol support by conducting the “dialogue” between INGRES components running on two different machines. In addition, ASG is investigating implementing the INGRES/Gateway to RMS and INGRES/PCLINK.

INGRES has allowed the NHTSA's Office of Crashworthiness Research to expand its operations. From the scattered handful of users in 1978, the number has grown to over 500 users accessing data at any one time. “With INGRES,” says Gary Bell, “we've been able to develop an internationally known database for vehicle crash test data. It's allowed us to do things we never thought were possible, and we're very happy with it.”

by Bronwyn Fryer-McCulloch



NHTSA's vehicle crash test database compiles data from 1,110 vehicle-to-vehicle and vehicle-to-barrier impact tests.

In the end, the choice came down to two commercially available relational database management systems—Relational Technology's INGRES and a competitor, ORACLE. The decision for INGRES was made easy for two reasons: the former's long-standing reputation as a reliable DBMS, and the fact that Relational Technology provided customer support that was far superior. “We got a lot of wonderful attention from Relational Technology,” said Bell, “and we still do. That says a lot about the kind of company they are. They'll do anything they can to help you find the answer to a problem. And you get the feeling they're really listening to you. Their support was—and is—of great importance to us.”

The vehicle crash test, biomechanics and component databases under the INGRES system each contain data from thousands of tests conducted separately. The vehicle crash test database is a compilation of data from 1,110 vehicle-to-vehicle and vehicle-to-barrier impact tests, including descriptions of and damage to the vehicles involved. The biomechanics database consists of data culled from 2,071 dummy and cadaver tests, and records pre- and post-test injuries according to their severity; this information is calibrated with the vehicle crash test data. The component database, created in 1987, is currently in the process of being filled with data from tests on parts of dummies or vehicles, such as windshields, bumpers and steering wheels.

Because ASG's people have a scientific orientation in engineering and programming, they rely heavily on FORTRAN.

Tell Your Story to the Advantage!

Our editors are always on the lookout for good application stories. Tell us how you use INGRES to solve a business or manufacturing problem. We'll work with you to produce an article you'll be proud to pass around.

For more information contact Bronwyn Fryer-McCulloch, Managing Editor, (415)748-2787.

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WATER, WATER everywhere

BY
BRIAN
ALEXANDER

As California's population grows, more people use the state's natural resources. The increased usage contaminates remaining resources. And the population keeps growing.

The impact of this vicious cycle is felt everywhere. When an underground plume of toxic waste comes to the surface, it endangers a rural population's water supply. When a new town appears in a region where no town existed before, the demand for water increases. When a winter snow pack is inadequate for summer irrigation, drought forces state and local governments to ration water. And to resolve all these issues for us, our civil servants rely on the information they receive from environmental agencies and other sources.

For officials who measure and manage our resources, scientists who study them and all of us who use them, information is a critical commodity. Information about aquifer locations, snow-pack levels, chemical spills, well depths, stream flows, ambient temperatures, pesticide residues, silt deposits and more has to be tracked and analyzed. If this vital information is poorly managed, so is the resource.



Linked with WDIS, the California State Water Resource Board will be able to determine not only if there is a water shortage, but how much of a shortage there is.

Finding a Solution

Picture a groundwater well located off a remote dirt road. A pickup arrives. An employee of the county water district climbs out and onto an embankment leading to the well. He or she spends the next few minutes measuring its depth and condition. A few hours later, a field engineer from DWR comes to perform a similar ritual. Later that week, an engineer from the U.S. Geological Survey (USGS) repeats the process. Why all this duplication of effort?

Because the USGS computer system is incompatible with the state's system. And the county hasn't yet computerized its data.

Recognizing the need for accurate, cohesive information about California's water, the California Department of Water Resources (DWR) knew it had to alter its information system—dramatically. DWR asked us at the consulting firm of Mervine & Pallesen, Inc., to help them develop what was to become the common language so desperately needed by the

natural resource managers isolated in separate agencies. In response, we built the Water Data Information System (WDIS).

WDIS was built with INGRES and runs on a distributed network of heterogeneous personal computers and high-resolution Apollo workstations located throughout the state. The system is specifically designed to promote consistency between the system's users, local water districts and federal agencies such as the USGS and the Environmental Protection Agency (EPA).

Because WDIS can handle millions of records on a large network or run on a single workstation, any agency, big or small, can use it. This feature breaks down the proprietary database barriers that keep agencies isolated.

Out of the Dark Ages

Over the past several years, the DWR has amassed millions of water-related measurements from sites numbering in the tens of thousands.

This data was only accessible from magnetic tape through a central mainframe computer. Once a year, a voluminous book of water resource data, the Hydrologic Data Bulletin 130, was printed. Distributed annually, these huge volumes became the only feasible means of access to information. Querying the "database" required a sturdy bookshelf to hold the dozens of volumes, a moist thumb for turning lots of pages, excellent eyesight and plenty of patience.

In recent years, even producing these legislatively mandated annual reports had outstripped the capacity of the department's computer. The data might as well have been stored in a granite crypt.

Getting the data out was only half of the problem. Getting it in was equally troublesome. Data was gathered by district personnel, and each district had

developed its own tools and procedures for handling its most irreplaceable resource. Those who administered the central database could not fully mesh such diverse inputs. As a result, overlapping data slipped in. To the dismay of staff members, inconsistencies emerged. They began to distrust the central database. With distrust came the threat of disuse.

A third major difficulty involved the isolation of data. Measurements of surface water flow rates were stored separately from statistics relating to ground water levels, water quality and rock formations. Investigating broad-based correlations among these different types of data was difficult and sometimes impossible. In fact, there was no provision for some relevant types of data, including measurements related to weather, contamination and patterns of water usage.

Heavy Criteria

When the DWR decided to modernize its computer systems, Mervine & Pallesen helped them to integrate the hardware and software and to develop the applications. We sought a portable, productive relational DBMS that ran under UNIX. The system had to have a good fourth generation language (4GL), networking and distributed data capabilities, high performance and be able to be finely tuned. But perhaps most importantly, Mervine & Pallesen was looking for a software vendor that we could work with—one that would listen to our needs and those of our client.

We chose INGRES. "We found that other packages didn't meet our expectations," says our company president, Fred Mervine. "When we compared systems, we found that things like system administration and performance for complex queries seemed to be better with INGRES. It also provided the most sophisticated distributed solution available. But, most of all, we were impressed that the company was willing to work with us and with the DWR to develop the system."

INGRES made it possible to minimize the burden of data entry, reduce data storage requirements and improve access times. Its 4GL helped shorten the software development and maintenance cycles.

Modular Design

After more than three years and much hard work, WDIS is installed today at three DWR sites around the state of California. An extended version is also in use at the hydrologic engineering firm of Harding and Lawson Associates in Novato, California.

WDIS is modular in design, so it can quickly respond to changing government and agency standards and the requirements of the resource management industry. Because the modules are integrated, the system encourages cross-correlations that were previously impossible. Ground and surface water flow measurements can be compared with lithologic (rock) characteristics, contamination levels, climatological influences and other factors.

The DWR is busy incorporating data into two completed WDIS modules: the Ground Water Measurement module and the Surface Water Measurement module.

The Surface module holds water flow data collected at thousands of measuring stations in streams, lakes, rivers and other bodies of water. The Ground Water Measurement segment stores and analyzes lithologic, hydrologic and geologic data for more than 50,000 wells throughout the state.

A third module, installed at Harding and Lawson Associates (the Environmental Quality module), records laboratory sample data including dirt, water, gas, flora, biota and other elements affecting water quality.

"The impact of the fully implemented WDIS upon water resource planning will be tremendous," says Harold Knight, program manager for Water Rights at the DWR. "Linked with WDIS, the State Water Resource Control Board will be able to determine not only if there is a water shortage, but how much of a shortage there is. If, for example, there are 20 people on a stream, each with a right to irrigate ten acres to a depth of 12 inches, that's 200 acre feet of annual flow. Therefore, if the stream averages 150 acre feet annual flow, the Board will be able to determine the best use of water in a dry year. That knowledge is of immeasurable value."

Mervine & Pallesen is planning additional modules to store climatic and other types of data. As the user commu-

nity widens, so will the variety of modules available.

Sharing Data

Because of its distributed capabilities, INGRES made it possible to decentralize data control and provide data access to the people who need it. The distributed nature of the database provides centralized access while decentralizing input. The benefit is that users located anywhere in the network will be able to access data from everywhere in the network.

A typical node in the network is a bit-mapped workstation that provides a large amount of memory and processing power. The incremental nature of a network allows a heterogeneous mix of computer platforms to be integrated for specialized functions. Integrating a diverse array of hardware and software systems is an important aspect of WDIS.

This improved access has already brought the DWR many benefits. For example, the Hydrologic Data Bulletin 130, which is required by California law but had lagged for years because of inadequate information technology, is now back in production.

The "Environmental Monitor"

The WDIS system has drawn a great deal of interest at recent conferences of

resource managers, including representatives of the EPA, USGS, water districts and health departments. By helping to establish the emerging data standards of the water industry, WDIS promises to provide a sorely lacking means of sharing data among these agencies. In response to the large interest in WDIS, Mervine & Pallesen created a generic version of WDIS called the Environmental Monitor.

With WDIS, environmental scientists, hydrologic engineers, well owners and others who use resource information have fast and flexible access to a broad base of integrated data. Finally, the custodians of the state's water resources can make better informed decisions involving legislation, flood control, toxic site cleanup and water allocation—both in periods of drought and in times of plenty. ▼

Brian Alexander is marketing director at Mervine & Pallesen, Inc.

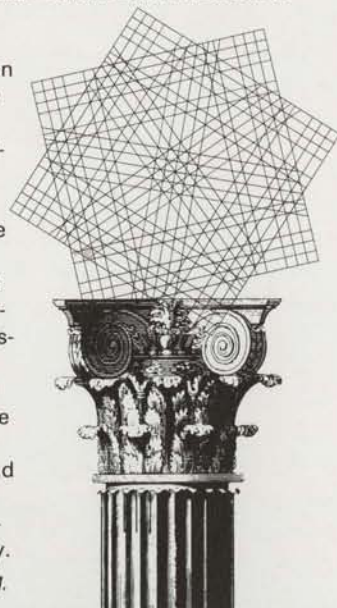


INGRES Users Finalists for Computerworld Smithsonian Awards

Mervine & Pallesen's innovative use of INGRES recently brought the consulting firm to the attention of both the press and the venerable Smithsonian Institution. The company is one of six organizations that have achieved outstanding progress for society through their implementation of INGRES. These six have been named as finalists in the 1989 Awards for Innovative Use of Information Technology, co-sponsored by *Computerworld* magazine and the Smithsonian Institution.

The five other organizations recognized for their outstanding achievements with INGRES include Princeton Plasma Physics Laboratory of Princeton, New Jersey, whose scientists are relying on INGRES to help them manage and analyze data collected during nuclear fusion experiments; the University of Wisconsin at Madison, for its research project on the causes of segregation, poverty and welfare; General Electric of Lynn, Massachusetts, for its "factory of the future"; the Fred Hutchinson Research Center of Seattle, Washington, for its cancer patient database; and Codd and Date International, for its pioneering work in relational database theory. The finalists were honored at an award dinner on June 21 in New York City.

-B.F.M.



Shall we pl



ay a game?

War games and the technology behind them hold special fascination for science fiction lovers, which translates into money-making opportunities for Hollywood. But, to the military and the NATO forces in Europe, these war games not only save money—they can, in the event of war, save lives.



The Warrior Preparation Center (WPC) at the Einsiedlerhof Air Station in West Germany provides a suite of interactive computer simulated war games for senior European battle commanders and their staffs. The games include air, ground and naval forces as well as NATO communications simulation. They are designed to provide training for the operational level of war using interactive computer simulations which as closely as possible replicate NATO's real-world environment.

The most immediate benefits of this type of training are cost- and security-related. Computer-simulated warfare is less costly than field exercises, which require ammunition and supplies. In addition, computer-simulated warfare can be accomplished indoors to avoid risk of unauthorized surveillance.

Equally important, this type of training breaks with traditional training that has concentrated on peacetime drills of commanders and staffs at the battalion level and below. Operational-level forces, in NATO, are created only in wartime by merging the forces of the various NATO countries. Thus, inadequate training of senior commanders in peacetime can translate into higher numbers of casualties in the initial battles during wartime. These games stress operational-level training to better prepare senior commanders relative to advances in weapons technology.

Games Test Overall Strategy

Tom Doyle, the WPC's senior database specialist explains how the games work. "All of our models—ground, air, etc.—are interactive," says Doyle. "In our simulations, there is a group of people playing the 'Blue' side. We also have WPC employees trained in Soviet doctrine who play the 'Red' side. Basically, the computer resolves the battle between the Red and Blue forces." Commanders work together, communicate and give orders to

computer-simulated forces. Master Sergeant Scott Wilson, non-commissioned officer in charge of communications at the WPC, adds, "The main benefit is for commanders to test their policies and then to practice them here. The gaming is not used to change policies, only to practice against what might happen."

The Warrior Preparation Center uses INGRES extensively for reporting and communication aspects of the gaming exercises as well as for in-house management tools. According to Doyle, "We use INGRES for auxiliary functions to the game such as reporting. We're able to transfer data from the games into a database. We can then use the data to supply reports and on-line query capability to the players."

Meeting Short Term Deadlines

In August of 1986, Doyle arrived with the specific task of improving a difficult development situation. They evaluated several databases and chose INGRES because of its networking ability, the INGRES 4GL and the user-friendly frontend.

Before installing the database, the game resolution information provided to commanders was not as detailed. In addition, since software was developed using FORTRAN, people had to wait longer for software and the WPC faced a large development backlog. Doyle recalls, "Developing software for game resolution and reporting required lengthy FORTRAN programs and expertise in other screen formatting systems. The development and maintenance time was much longer. Now we can globally replace data in a database in a matter of minutes. Before, this would have taken a programmer one to three days to accomplish. We also have fairly standardized screen formatting now. This consistency has reduced the learning curve for users."

An additional benefit to the WPC is the ability to prototype systems quickly and make improvements or changes easily with

SYSCON Supports Joint Chiefs

SYSCON Corporation, a subsidiary of Harnischfeger Industries, is a systems engineering firm that supports the Joint Chiefs of Staff in developing war games and simulations for defense planning. These games are used by Commanders-in-Chief (CINCs) worldwide to help plan the deployment of military forces.

The models process large volumes of information representing forces, combat effectiveness, supplies, equipment and transportation capabilities. To enhance these models, SYSCON has created a comprehensive set of INGRES applications that quickly develop war game scenarios, synthesize model results and continuously display situation status during gaming exercises.

According to senior program analyst Linda Vitella, SYSCON is pleased with INGRES Release 6's windowing and dynamic SQL capabilities, which have promoted the development of user-oriented applications. "Users enjoy the flexible query and reporting through the dynamic SQL-based window displays," says Vitella. "We've been able to reduce our scenario development time by over 200 percent and have enabled our planners to analyze and report results quickly."

SYSCON is now developing a war gaming support system that uses INGRES/STAR to link distributed data, and is participating in the beta test of INGRES/STAR for Release 6.

—B.F.M.



Applications-By-Forms (ABF), a menu-driven development environment. Plus, as MSgt. Wilson explains, "The project does not have to be finished to be usable. That's a benefit of the ABF component."

Wilson has simulated NATO communication systems using the 4GL and VIFRED (Visual-Forms-Editor), an interactive tool for creating and modifying full-screen forms and pop-up windows. He explains, "We simulate approximately five different NATO communication systems. We use INGRES VIFRED and the 4GL to simulate the user's own system. We also interface the various communication systems."

The new DBMS offered many benefits to the communication system development. "At the time most of the communication software was designed, we only had two people working on it," Wilson recounts. "Yet, we were able to re-create every single NATO communication system we use in a matter of months." To give an idea of the magnitude of this accomplishment, Wilson continues, "The individual NATO organizations have as many as 12 programmers working full time on their single systems alone. Not only were we able to replicate multiple systems with only two people, in most cases I think that our simulations are better than the real-world products."

Within the game, the database is used as an interface to provide status information that can then be used as a tool to make decisions and to communicate. Additionally, as Wilson explains, "We use the system as much as we can because it is the best tool to manage any type of data we have. Our main use, of course, is war gaming, but we also use it for such things as tape libraries and gaming initialization routines. And since we deal with so many countries, we receive data from different computer systems in different formats. We use the database to format that data for our exercise."

The analysis group at the WPC uses the system to analyze exercise data. They use products such as VIGRAPH (Visual-Graphics-Editor), a utility that produces presentation-quality graphs and charts, to plot out information such as total number of missions versus number of missions accomplished to statistically analyze the game.

At the WPC, "wars" typically last between one and two weeks. According to Doyle, "We have very short deadlines to meet. We get short-term and short-use requirements and, within four to six weeks, we must be able to produce a product for the exercise. Our new system has helped us reduce the programming backlog that has traditionally been a problem here."

Expanding the System

The WPC is now able to network as well as distribute data through INGRES/NET and INGRES/STAR. "Recently we used INGRES/NET for an exercise with a remote site. We were able to run the frontends at the remote site and the backends here. It was very fast and worked well for us," Doyle says.

The WPC will be expanding their distribution capability from three or four sites to almost 20 sites within the European theater. They have also run successful exercises with remote sites in the United States and will be expanding that capability through satellite links to remote sites all over the world. ▀

by Debora Tidwell

NATO Coordinates Communications

NATO must ensure that regardless of any acts of sabotage or terrorism its communication network will continue to function securely and link NATO members in a common defense strategy. NACISA (NATO Communications and Information Systems Agency), a NATO agency located in Brussels, has introduced an INGRES application to assist in planning and monitoring communication systems. It holds data pertaining to a major international network and simulates failures and outages. At the other end of the scale, PC INGRES collates vital technical and management-level information about these communication systems to assist future planning and coordination.

These databases are widely used at various NATO headquarters for planning new facilities and day-to-day communication systems operation on a variety of hardware and operating system configurations.

NACISA plans, procures and implements communication and information systems for use in the operational field. Although INGRES is used also for personnel management and technical library management, the principal mainframe application is the communications systems management database.

These systems comprise a message switching system and a telephone switching system in operation throughout NATO. The INGRES database contains a complete picture of the connectivity against which NACISA personnel and system operators run algorithms to simulate the configuration of nodes and switches, evaluate performance and assess the impact of rerouting requirements or simulate effects of outages.

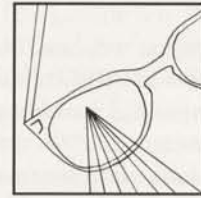
In addition to the network topology, switches, connectivity and details on end users, the INGRES database also holds funding, forecasting and monitoring information. There are plans for transferring data, such as engineering modules, from this system to other systems.

These databases will provide the flexibility offered by INGRES's relational structure and will be invaluable in a constantly changing environment.

Another area NACISA has to consider is portability and coordination of systems among the NATO community, where a variety of hardware configurations and off-the-shelf or in-house developed software is in use. In order to achieve this integration, a central information system for all NATO systems is planned. A PC INGRES application has been designed to build a "computer questionnaire" to collect global and detailed information on systems in use throughout NATO.

-D.T.

An Open Systems Platform for Government



By meeting both federal government and industry standards for open systems, Open Desktop offers the solutions many organizations have been waiting for. By Betsy Burton.

In this time of federal deficits and concern over government waste, MIS managers in the U.S. government are searching for ways to cut computer costs while improving functionality and communications with other agencies. Strapped to proprietary computer systems that were often purchased by their predecessors, these MIS managers are trying to achieve what may seem to be mutually exclusive objectives. How can you cut costs while adding new features to improve functionality?

Like others in information processing, they are counting on two trends that promise a solution. First is the declining cost and increasing power of PCs and second is the emergence and establishment of open systems standards.

An open system can function in a multivendor environment without sacrificing functionality or access to data and applications. Therefore, it must be portable across multiple hardware platforms, provide for development of portable applications and be able to share information with dissimilar systems. Windows for open systems need to be based on industry standards to support a variety of user interfaces.

A Portable Applications Environment

In a portable applications environment, developers can write programs, confident that they will run on a variety of systems. By adopting such an environment, the federal government ensures that applications can be used by multiple agencies, saving money on software development and training.

POSIX (Portable Operating System Interface for Computer Environments)

takes the crucial first step toward creating a standard interface to operating systems and a standard architectural framework for applications portability. As an open systems standard, POSIX frees the federal government from depending on any single vendor for applications that will run on their operating systems.

The federal government has adopted the IEEE POSIX standard for its Federal Information Processing Standard Publication (FIPS PUB 151-1 POSIX). This standard will make it possible for the federal government to develop a wide range of applications with source code that is portable across many different machines and operating systems.

A Standard User Interface

By adopting a standard graphical user interface, government agencies can again reduce the cost of retraining that goes hand-in-hand with incompatible systems. With a standard interface, federal employees can move from one agency to another, or from one system to another, without having to learn how to use a new interface.

It appears that the X Window System Version 11 (X11), a de facto industry standard based on the protocol developed by the Massachusetts Institute of Technology's Project Athena, will be the likely model for a federal standard.

A Standard Query Language for Databases

Recognizing its need to standardize methods for accessing information, the federal government has followed the lead of the American National Standards Institute (ANSI) and adopted the Struct-

ured Query Language (SQL) for their own FIPS. Since SQL can be used on a number of database platforms, with minor differences in dialect, the government reduces the high cost of retraining its people on new systems.

Additionally, the federal government needs a standard application interface protocol. This would allow MIS managers to integrate database engines and front-end tools from a variety of vendors, giving them the flexibility to satisfy their department's specific requirements and utilize existing databases. The Remote Data Access (RDA) standard currently under development by the ANSI RDA committee defines a standard protocol for interconnecting applications and database systems.

With the definitions of the FIPS SQL and ANSI RDA, the government will be able to migrate easily to future standard hardware platforms without sacrificing its current databases. Again, the strategy is to preserve its current investment while keeping up with advances in technology.

DOS-UNIX Functionality

Federal MIS managers are looking for a way to reconcile their large base of DOS systems with their need to convert to the more reliable and cost-effective UNIX System platform. They will want to run DOS applications on a UNIX System and develop applications that share both DOS and UNIX system files and resources.

Again, their goal is to reduce training costs and to preserve their investment in DOS software. With a platform that lets them run different operating systems from the same platform, they gain the added functionality that a UNIX System offers, such as support for multiple users and the ability to run more than one application at a time. *(continued on page 38)*



CASE Tools

In most applications development environments, maintenance activities absorb over half of total resources and software costs. As a result, organizations face an ever increasing applications development backlog. Because more and more software developers, project leaders and applications development managers are looking for faster ways to do their work, we are devoting this "INGRES Users Ask" to CASE.

Q: What Is CASE?

A: CASE, which stands for "Computer-Aided Systems Engineering," doesn't lend itself to a pat definition. That's because different CASE tools meet the needs of different users, no one tool being capable of everything.

But, in its broadest sense, CASE refers to any tool that speeds any phase of the software development life cycle. In a more narrow sense, CASE automates the analysis and design phases of software development.

Q: Why do software application developers need CASE?

A: As recent research (by the U.S. Government Accounting Office, TRW, Inc., and Carnegie-Mellon Software Engineering Institute) indicates, most errors in systems occur not while they are being created but in the earlier planning stages.

This means that many projects are handicapped right from the start, because of incorrect or misinterpreted requirements. With CASE tools these errors are detected before moving on to development.

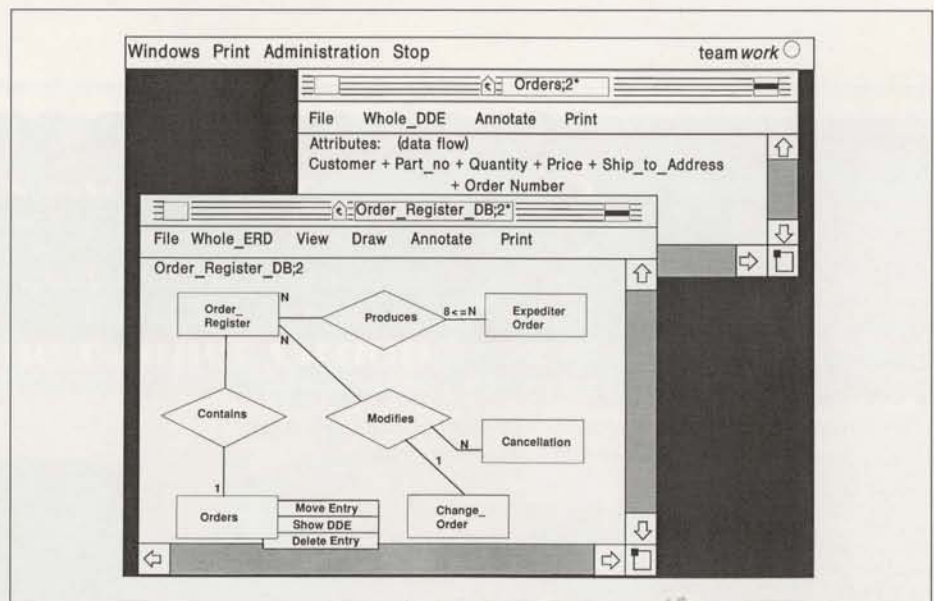
This is made possible largely through the use of a data dictionary, which any solid CASE product will have. User requirements are captured and collected as a single set of data definitions. The data dictionary is the repository that stores all of these data objects, making it possible for development team

members to share a consistent set of data.

Since everyone—analysts, designers, subcontractors and end users—can agree on this common project library, team communication is greatly improved. Better awareness and agreement on systems objectives and strategies make it easier to detect and avoid errors. As a result, users get the systems they actually

CASE supports structured methods that make project management much easier. Each step of the software development life cycle is identified. The input and output expected at each step, and what is required of development team members, are well defined and capable of being measured. What we normally call the "black art" of software development now becomes an engineering discipline.

Q: I understand that in developing its CASE product, Relational Technology chose teamwork, the CASE product from Cadre Technologies, to extend the power of INGRES. Why?



A CASE tool interface to INGRES means rapid application development

need, while developers enhance team productivity and build higher quality software. In the end, systems get to users on time and within budget.

Applications developers need CASE for another important reason: development projects are often hard to manage.

A: Teamwork brings today's workstation power to systems analysis and design. That's important because a network of workstations supports the entire development team, offering ease of use and lots of graphics ability, a must for CASE drawing tools. INGRES, according to DEC,

HP and others, offers the best application development tools around.

You put these two products together and the result is pretty exciting—technology that addresses the whole software development life cycle. So INGRES/teamwork I-CASE takes you through requirements, analysis, design, prototyping and database development, system development, testing, deployment and maintenance.

Q: On what major workstation platforms does INGRES/teamwork I-CASE run? What are the minimum software and disk space requirements?

A: At present, INGRES/teamwork I-CASE runs on the Sun3 and VAXstations. Minimum software requirements are INGRES Version 6.1 and teamwork version 3.0. In addition to what is required for INGRES, disk space requirements are 20 megabytes.

Q: How would I use INGRES/teamwork I-CASE to support the analysis stage of my software development project?

A: By means of a powerful drawing tool, you can create entity relationship diagrams (ERDs)—the graphical, visual representations (or models) of your data and data relationships.

This tool, along with a consistency checker, automatically validates the models for you. With the structured analysis tool, you can rapidly draw data flow diagrams (DFDs), models of the business functions within your organization, to show visually what the system you are analyzing will do.

So during these early phases of development you both reduce human error and, thanks to these graphical editors and checkers, save hours of time normally spent on clerical tasks.

There is also a real-time analysis tool, an extension of the system analysis module, that is geared toward system development in real-time environments.

Q: How can I actually generate a database using INGRES/teamwork I-CASE?

A: The INGRES/DBD (database design) module lets you design logical and physical data models, and lets you automatically generate the database.

In addition, there are facilities to create, from the ERDs, a default logical data model, a default physical data model and a prototype database. As a designer, you can tune and enhance these models; for example, normalize or denormalize the logical data model or tune the physical data model.

Q: Can I automatically produce documentation during the software development process?

Yes. With the teamwork Document Production Interface (DPI), you define the organization of your documentation, which can also include special commands to pull in the textual and graphi-

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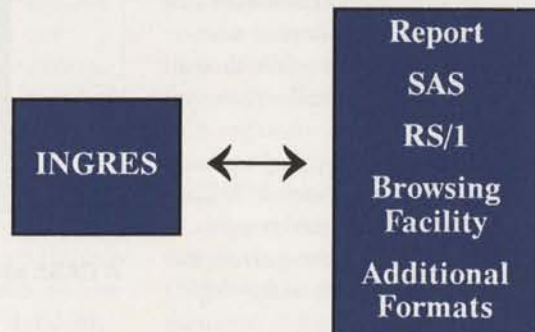
SQLASSIST enables you to build a SQL query without knowing the SQL language, view the output, convert the data into a format compatible with your application, and call your application all from within one environment.

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cal notes. These can be attached to any object in the *teamwork* dictionary during all phases of software development.

At any time during the software development process, DPI pulls together all pieces, automatically producing the latest version of the documentation. Finally, DPI can create document formats for popular document preparation systems, including VAX Document, Interleaf and Scribe; or simply create a Post-Script file.

This capability is especially useful to organizations that must satisfy specialized corporate standards or government requirements such as Department of Defense STD-2167.

Q: Can I prototype with default forms and reports from the *teamwork* information models?

A: Yes, you can prototype as soon as you begin the analysis stage, using the DBD facility to create a prototype database.

Later, in the coding phase, you can use the same tools, including default forms and reports, for rapid development; further refining the system while not losing any earlier work. In effect, INGRES/*teamwork* 1-CASE has merged formal CASE methods with early prototyping tools. The result is a very powerful capability few products have available today.

Q: What is CDIF?

A: CDIF stands for the "CASE design interchange format." One of the more significant standards efforts, it originated in the computer-aided engineering industry as EDIF (electronic design interchange format) and then was extended to accommodate CASE design objects. CDIF's goal is to provide an information exchange interface among different, vendor upper-CASE tools in order to foster industry-wide tool integration standards. The CDIF subcommittee makes standards recommendations

to ANSI. Members include: Cadre, Hewlett-Packard, Mentor Graphics and Nastec. INGRES/*teamwork* 1-CASE complies with CDIF standards. ▼

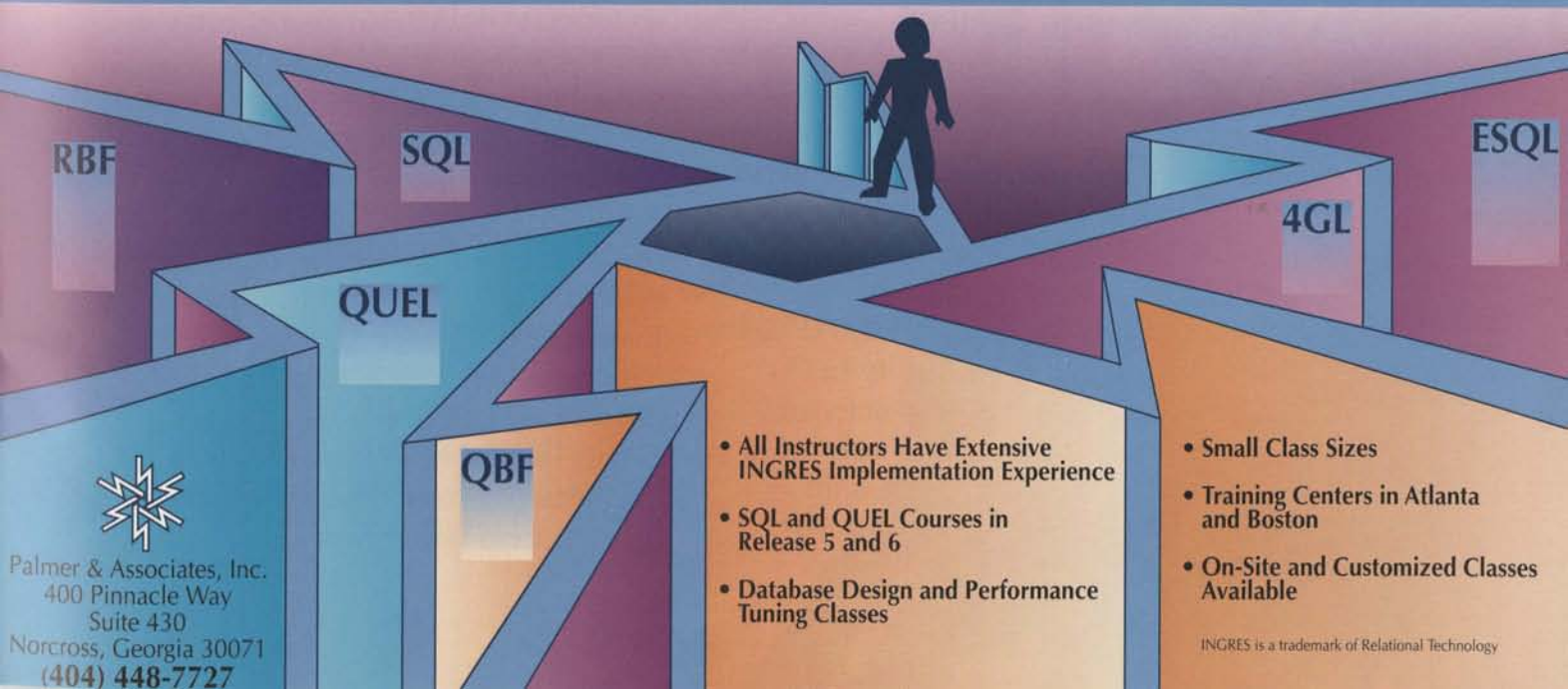
by Beverly Matheme

If you have questions you would like us to answer, write:

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terling Successes in

INGRES in England?

Yes. In fact, the information management system has enjoyed resounding success in a number of British government agencies. The British Tourist Authority and English Tourist Board,

Devon County Council, Trent Regional Health Authority, and Government Statistical Service are just a few of the many INGRES applications in the UK ranging from stocks, banking and finance to recreation and health care.

Britain's Tourist Industry Helps Travelers with "TRIPS"

Tourism is big business in the UK. The tourism industry employs more than one million people, is second only to Britain's manufacturing base in revenue and, by the 1990s, will create an estimated 200,000 more jobs.

The English Tourist Board (ETB) and British Tourist Authority (BTA) conduct marketing-related activities that included printing and worldwide distribution of more than 25 million pieces of literature in 1986 and 1987.

These activities account for much of the tourism industry's success. The BTA, for example, published 24 editions of its main promotional guide in 13 languages and ran over 100 advertising campaigns in 26 markets.

Therefore, when the English Tourist Board and the British Tourist Authority were partially consolidated, they needed a system providing up-to-the-minute information to plan marketing strategies and provide an efficient and comprehensive service for tourists anywhere in the UK. This involved the integration of different computer based information resources spanning 12 regional tourist boards, 26 overseas offices and some 600 tourist information centers.

The new Tourism Resource Information Processing System (TRIPS), based on INGRES, is set to have a significant impact on the efficiency and success of Britain's tourist services and the way in which they are marketed.

Generated from information obtained from questionnaires, the database is scheduled to phase out the existing system and become fully operational by 1990. It will contain information on over 50,000 accommodation resources, over 10,000 tourist attractions, and over 10,000 special events ranging from flower festivals to medieval pageants. The information on each item is highly detailed with,

the UK

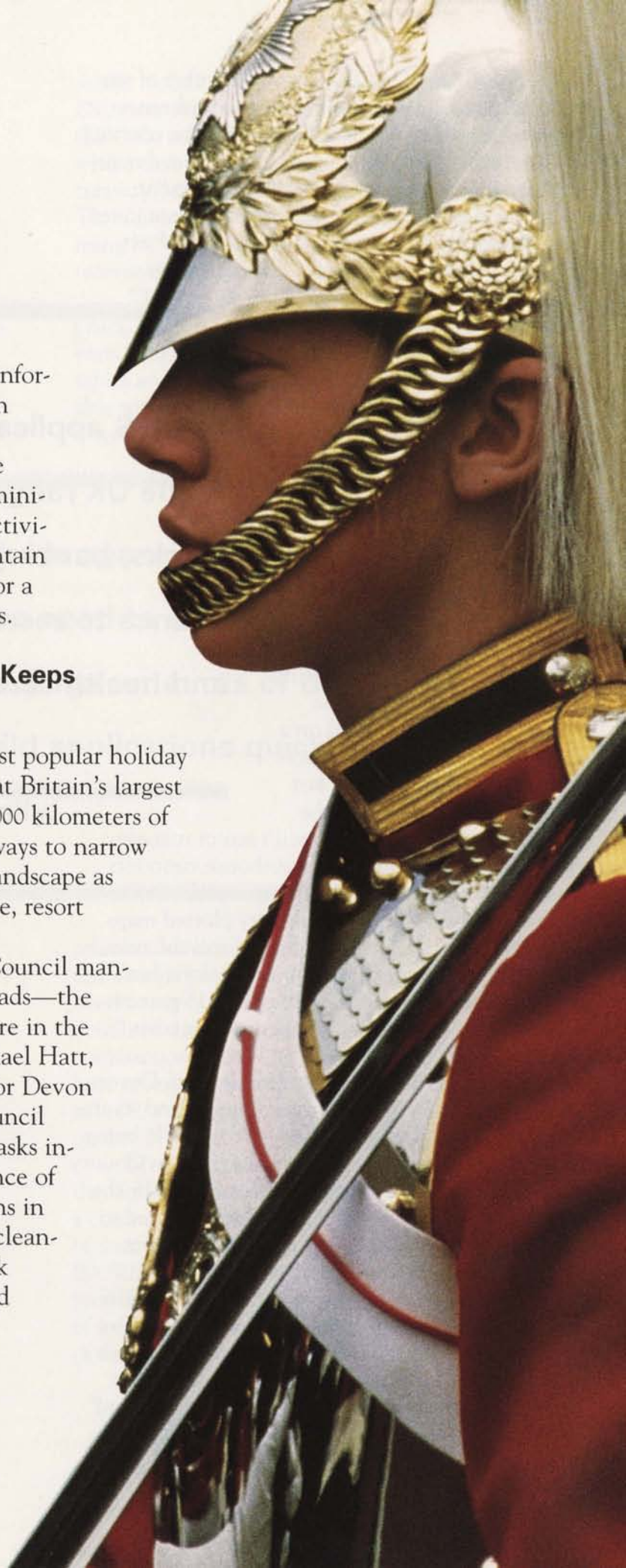
for example, 27 screens of information per accommodation resource.

TRIPS will support the regional tourist boards' administration and commercial activities. In addition, it will contain and produce mailing lists for a whole range of publications.

Devon County Council Keeps the Roads Open

Devon, one of the UK's most popular holiday destinations, contains Great Britain's largest network of roads. Over 14,000 kilometers of roads, ranging from motorways to narrow lanes, are spread through landscape as varied as rugged countryside, resort areas and cities.

The Devon County Council manages Devon's network of roads—the largest piece of infrastructure in the county. According to Michael Hatt, assistant county engineer for Devon County Council, "The Council oversees a wide variety of tasks including physical maintenance of the roads, keeping road signs in good repair, changing and cleaning light bulbs, cutting back verges, clearing ditches, and trimming farmers' hedges." Additionally, the Council sees that accident reports are filed and their causes investigated.



The Council has developed a number of systems with INGRES, including its main reference system—Devonet which helps manage the county's road network. Devonet stores details on road maintenance policies, cleaning routines, treatment history and accident reports. A separate data inventory contains all physical details of the road network, including widths, signs, lines and verges.

To handle highway information and enable people working on separate tasks to share information, the Council has also developed a referencing system called Devonet/HIMS (Highway Information Management System). The INGRES database holds a digitized diagram of the network against which information is logged as well as a wide range of facilities.

INGRES has particularly benefitted ditch maintenance and cleaning and accident reporting.

All ditches within the county have to be cleaned on a regular basis. All details—location, size, problems, when last cleared—are now held in the INGRES database. The Council's senior management uses the information to authorize contracts and to organize the daily cleaning rounds. Drivers of the ditch-cleaning vehicles carry plotted maps so that ditches are no longer missed and the risk of flooding is reduced. "This practice alone has improved our efficiency, resulting in a 15 percent labor savings and a reduction in contract costs," Hatt says.

There are 9,000 recorded accidents in Devon every year, of which 5,500 involve injury and 90 are fatal. Thanks to Devonet, the figure is slowly being reduced. Accident investigators from Devon County Council now store accident details supplied by the police in the database. The information is used to study road conditions and to help investigators decide on changes to help prevent accidents.

The Council is extending its use of INGRES to cover more aspects of maintenance control. The database will soon include information about traffic counts derived from traffic signals all over the county and will store a history of "on the road" weather conditions from sensors embedded in the road surface.

**INGRES applications
in the UK range from
stocks, banking and
finance to recreation
and health care.**

Trent Regional Health Authority Cures Data Management Problems

Geographically, the Trent Regional Health Authority is one of the largest of England's 14 Regional Health Authorities (RHA). It covers a population of more than four and one half million people living in five counties and administers 29,700 beds in 183 hospitals throughout the region. Information about every patient's visit to every hospital in every district is stored in an INGRES database under a range of different headings.

An INGRES-based Trent RHA system was completed in April 1987 and now holds nearly two years' data—approximately two gigabytes. "The aim is to hold up to five years' data," says Linda Little, development team leader for Trent RHA's central information systems. "The capacity of the database is being expanded by some 1.5 gigabytes per year."

Under the "Patient" category, the system records personal information such as name, sex, age and address. It also stores information on his or her medical history such as the name of the primary care provider, the names of specialists to whom he or she has been referred, and at which hospital each of these doctors practices. This category also follows the patient through admission to a hospital in the region including ward stay and bed occupancy, diagnosis and treatment, referrals and transfers to other hospitals for specialized treatment.

Another category lists each physician's main specialty, all inpatient treatment and diagnosis, details of other physicians called in for "shared care" of individual patients where two or more specialties are involved, diagnoses made

and operative procedures carried out. District records show details of each hospital site, together with details of hospital stays, wards and ward occupancy.

Keeping Score for the Government Statistical Service

The Government Statistical Service is Great Britain's largest single statistical information provider. Its Central Statistical Office (CSO) coordinates and manages information gathered from the statistical divisions of all major government departments, as well as the two leading collecting agencies—the Business Statistics Office and the Office of Population Censuses and Surveys.

The main purpose of the CSO is to supply compiled statistics to the Treasury for use in economic analysis and forecasting. Data includes figures for the nation's Gross Domestic product, the balance of trade and the index of production. This same information is made available in computer-readable form to the treasury and other government users, and to the public through the CSO Databank. It is also published regularly in book form.

Using the INGRES application development facilities, the CSO built its Central Shared Database (CSDB), a central store of economic data measured at various points in time, including national accounts data and data for publication. The CSDB holds more than 28,000 different variables spread across some 800 published tables. The wealth of statistical information provides detailed figures for economic analysis and forecasting.

"We are using our INGRES database as a central repository for storing, distributing and coordinating all important economic time

series, including all economic data published by the CSO, unpublished data that is regularly used outside the CSO, and major economic time series from elsewhere that are used regularly by the CSO and the treasury," explains Graham Giles, a CSO statistician. Throughout the office, approximately 80 compilers using PC-compatible microcomputers send and receive data from the CSDB.

"The whole process is menu-driven," explains Giles, "which makes our day-to-day work extremely easy. Single key inputs allow us to browse through tables and applications, or make changes, and we are able to examine 'camera ready copy' of tables on-screen before they are printed out." In addition, the

system is linked to a number of laser printers, which allows the CSO to produce very high quality publications direct from the database.

The screen-based nature of the INGRES database makes it very easy for the CSO to develop new applications, and its

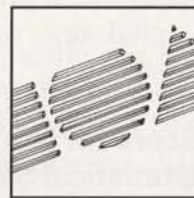
relational architecture ensures flexibility to meet unforeseen needs. As Giles recounts, "We no longer need to maintain our own software to handle the details of the user interface and database access. In conjunction with SQL, which further simplifies database access and manipulation, this has enabled us to achieve very significant gains in productivity and quality."

Mr. Giles' sentiment seems to ring true throughout Great Britain. All of these agencies have a common need to effectively manage large amounts of data and build applications quickly and easily. INGRES is making a tremendous difference in productivity, quality, and day-to-day accessibility of information for a variety of agencies and a variety of data. ▼

by Debora Tidwell

All of these agencies have a common need to effectively manage large amounts of data and build applications quickly and easily.

News From the IUA



Becky Stokes, the newly-elected president of the INGRES User Association, reports on the annual conference in New Orleans.

No doubt about it: the 1989 Annual North American INGRES User Association (NAIUA) Conference was a smash success. Held April 23-27 in New Orleans, Louisiana, the conference was the best attended in the organization's history. More than 800 attendees—including over 100 Relational Technology employees—attended 50 user and 16 Relational Technology presentations during those four intensive, informative days in Cajun country.

We were very pleased to welcome Espen Gisvold, President of the European INGRES User's Association, to the conference as part of the INGRES Ambassador Program, sponsored by Relational Technology. The most popular presentations covered topics such as "Converting to INGRES Release 6," "Programming with Release 6," "QUEL vs. SQL," "Nulls in Release 6," and various developer panels. The Technical Campground and Birds-of-a-Feather sessions were also very well attended.

(By the way, if you're interested in purchasing a copy of the proceedings, send a check for \$100 to Relational Technology's meeting planner, Mary Ellen Kay, 1080 Marina Village Parkway, Alameda, California 94501-9891. For summaries of the sessions and technical articles, details of the NAIUA Executive Board meetings, survey results and news about next year's conference, don't forget to

check out the NAIUA Newsletter.)

Formerly operated under the umbrella of Relational Technology, the NAIUA was this year given the go-ahead on an eight-point plan to become an independent organization within the next three years. Watch for more details in the next issue of the *Advantage*, and in the NAIUA newsletter.

The NAIUA's bylaws note that the organization's purpose is "...to foster the exchange of information among IUA members and Relational Technology." In an effort to promote this information exchange, we circulated a number of surveys at the conference, covering everything from local user groups and user requests to INGRES tools and IUA programs. The results of these surveys will enable the executive board to better meet the needs of our growing INGRES user community.

Of course, as our numbers continue to grow, the burden of volunteer time and expense is also reaching an unprecedented level. The burden to volunteers is one of the issues which challenge the NAIUA and Relational Technology as we explore ways to meet the demands of an active, growing and very knowledgeable user group.

We are excited about these challenges, and welcome your suggestions as our fledgling, independent NAIUA tests its wings. If you would like to

talk to an NAIUA executive board member, please feel free to contact any of the following people: Rick Angelini, vice president, (301) 278-6266; Ann Corner, past president, (301) 587-8750; or myself at (801) 544-7778. To be included in the NAIUA mailing list, please contact Al Hayes, (801) 582-5847 ext. 6863, or me at the above number.

Of course, as soon as one conference ends, we're already planning another. So plan now to attend the 1990 annual conference to be held May 6-10—and we'll see you at next year's conference in Salt Lake City, Utah. We look forward to meeting you there! ▼



Becky Stokes, president of Database Developers, an INGRES training and consulting firm, was last year's NAIUA vice president. She has been an active member of the organization for many years.

TELL YOUR STORY AT THE MAY, 1990, NAIUA CONFERENCE!

We know...you haven't written anything longer than a memo since college.

But we have news for you. You've got plenty of valuable things to say—and an eager, attentive audience of people just like you at the NAIUA.

Tell us about:

- Your favorite tricks for getting 4GL to do what you want.
- Your latest brainstorm in designing a friendly user interface.
- Your innovative design techniques.

Interested? It's mutual!

Just fill out the form below and send it with a detailed outline or abstract of your presentation by October 1, 1989, to:

Pamela M. Barker

NAIUA Program Committee Chairperson

744 63rd Avenue North

St. Petersburg, FL 33702

The committee will review your proposal and notify you of acceptance by November 15, 1989, with a letter verifying your participation in the conference.* (In an effort to make program notes available as soon as possible after the conference, the committee requests camera-ready copy of your paper/presentation by May 1, 1990.)

Be a Presenter!

Questions? Call Pam Barker at (813) 526-5265.

* Registration fee not included with acceptance.



YES! I WANT TO BE A PRESENTER AT THE 1990 NAIUA CONFERENCE!

Name _____

Title _____

Company Name _____

Address _____

Phone _____

Presentation Title _____

How does your company use INGRES? _____

How do you use INGRES? _____

How long has your company used INGRES? _____

How long have you used INGRES? _____

What release of INGRES are you using? _____

What type of audience would be interested in this presentation?

(Check all that apply)

MIS manager Programmer System manager

End user System designer Trainer

System analyst DBA Other/name _____

Are hardware or other operating system-specific issues covered in your presentation?

VAX Workstation ULTRIX/UNIX PC

Other/name _____

What software and languages will you be speaking about?

SQL 4GL QUEL Embedded Language

Announcing INGRES 6.2

A new release of INGRES, Release 6.2, includes significant improvements to INGRES's professional applications development tools. The INGRES toolset now enables developers to create and deliver applications more quickly and efficiently, and also helps ensure that applications more accurately meet end-user requirements.

Release 6.2 follows the December, 1988 announcement of INGRES Release 6 in which the multi-server architecture of INGRES was completely redesigned to provide the necessary foundation for distributed processing, applications portability and high performance OLTP.

Release 6.2 includes numerous additions and extensive enhancements in the Applications-By-Forms (ABF) interface, the Forms System and 4GL capabilities. The 4GL Interpreter is an entirely new addition to the INGRES toolset.

Tandem Chooses INGRES Tools

Tandem Computers and Relational Technology announced an agreement to develop and market the INGRES tools for use with the Tandem NonStop SQL relational database management software.

The INGRES tools will enable Tandem database users to develop customized applications cost-effectively and provide easy access to a number of leading minicomputer and mainframe databases. These database tools reside on personal computers and workstations and include database query and reporting capabilities, a graphic user interface and a sophisticated fourth generation language application development environment.

Tandem's endorsement of INGRES tools for NonStop systems follows a series of similar agreements between Relational Technology and companies such as Digital Equipment Corp., BiiN, Data General and others who wish to take advantage of the INGRES world-class application development toolset. "The INGRES tools are well known and

respected," said Tandem director of project management Chris Erikson. "They will hasten application development and will enable easy access to information stored on Tandem databases."

And Ross Systems, Too

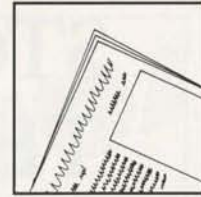
Ross Systems and Relational Technology announced a cooperative marketing agreement whereby both companies will market the INGRES toolset with Ross's Renaissance Series of financial management and accounting software for Digital Equipment VAX computers.

As a result of this agreement, a comprehensive, integrated family of accounting applications, designed specifically for VAX/VMS, will be available to INGRES customers. These applications can readily tie into existing relational databases.

The INGRES toolset is now available for Ross's RMS-based version of its Renaissance Series applications using the INGRES RMS Gateway. Ross recently announced its intention to develop a version of its Renaissance applications based on VAX Rdb/VMS, Digital's relational database management system. These Rdb-based applications will also be supported by INGRES. In addition, Ross and Relational Technology will work together to prototype an INGRES-based version of Ross's applications for Digital's ULTRIX operating system.

Access Technology Extends Partnership With Relational Technology

Access Technology, developer of the popular 20/20 integrated spreadsheet software package, and Relational Technology, announced their intention to develop and jointly market the 20/20 Database Connection, providing a bridge between 20/20 and INGRES on UNIX-based hardware platforms. The announcement reflects an extension of an initial agreement between the two companies in late 1987, which resulted in the 1988 introduction of the 20/20



Database Connection to INGRES for DEC VAX computers.

Under the terms of this agreement extension, both companies will initially concentrate their development efforts on porting the 20/20 Database Connection to Sun Microsystems and AT&T UNIX-based hardware. Other platforms are also being evaluated for 20/20 Database Connection portability. Announcements of shipping dates for these products are forthcoming.

U.C. Berkeley INGRES Team Wins ACM Software Award

At this year's conference of the Association for Computing Machinery (ACM) in Louisville, Kentucky, ACM presented its 1988 Software Award to the U.C. Berkeley researchers responsible for creating INGRES. The ACM Software System Award was established in 1980 to honor organizations and individuals responsible for the development of software systems that have significantly influenced fundamental concepts of design or commercial software acceptance.

The award went to EECS professors Michael Stonebraker and Eugene Wong, and former Berkeley graduate student Gerald Held. INGRES was selected by ACM for its "pervasive impact on database system research and the development of commercial database products. Software developers and users of systems from the smallest personal computers to the largest mainframes have been the beneficiaries."



COI Germany Selects INGRES

The Consulting for Office and Information Management GmbH (COI), a division of INA Waelzlager Schaeffler KG in Herzogenaurach, West Germany, has entered into an agreement with Relational Technology whereby it will offer the electronic archiving and information retrieval system, ODIN, with INGRES. This offering is a result of a recently signed VAR arrangement between COI and Relational Technology.

ODIN allows documents like construction drawings, pictures, illustrations, contracts and patents to be scanned and compressed in digitized form on an optical disk. The software accepts data from paper, microfilm, magnetic plates and other information sources. Input once, the information can be accessed through key word combinations for instant query or transferred to CAD or desktop publishing systems. ODIN runs under UNIX-based workstations from Siemens, Nixdorf or Apollo, as well as the IBM PC.

Northern England Office Opened

Relational Technology's United Kingdom division, Relational Technology Limited, has opened a new office in Manchester, England, to meet the expanding demand for INGRES in the UK (see "Sterling Success," p. 30). The new office will be managed by Bob Shears, recently appointed Relational Technology's Northern England manager of operations.

The Manchester office will be the base for a 20-person staff responsible for customer sales, support, consulting and training, and for developing strategic

partnerships with major hardware and software companies based in a region extending from Birmingham to the Scottish border.

UK Expands Partners Program

Relational Technology Limited has expanded its business partners program. The recently formed INGRES Partners Group extends the company's partnerships to major systems houses, provides them with extensive technical and marketing support, and encourages joint product development. The group has already announced agreements with a wide range of leading UK software houses.

One such agreement was signed with Pinpoint Analysis Limited, one of the most sophisticated exponents of geodemographic analysis techniques in Britain. Pinpoint will use INGRES as the base of a major new geographic information system to provide a wide range of information to its clients.

Another recent agreement was concluded with Compass Systems, one of the UK's leading developers of software for accounting applications, office automation, general tools and utilities. Compass will use INGRES as the base for its new CARDINAL accounting package targeted at a wide range of users in commercial, government and legal professions.

ICL Responds to Increasing Demand for INGRES in Britain

Due to an increasing demand for INGRES on ICL systems, ICL (UK) Limited, a wholly-owned subsidiary of the STC PLC Communications and Informations and Systems Group and chief supplier of INGRES in Britain, has agreed to allow Relational Technology Limited to supply and support INGRES on ICL systems throughout the UK. Previously, INGRES running on ICL systems was only available from ICL, which already markets

INGRES on all its strategic products as part of an agreement signed with Relational Technology last year.

The agreement covers INGRES for ICL's Series 39 VME-based mainframes, DRS Series 300/400/500 UNIX-based computer systems, and DRS Series workstations. INGRES is fully compatible with ICL's OSLAN and X.25 communications networks, and is an ideal partner for ICL's OFFICEPOWER office automation solution.

Introducing Eurodesk

Softools B.V., a major European software developer and distributor based in Nijmegen, the Netherlands, recently formed a strategic alliance with three other leading software vendors, including Relational Technology International, to develop and market Eurodesk within the Intel 30386 environment.

Eurodesk is designed to be the complete operating environment for 386-based computer systems. Built with industry standard components from Relational Technology, Interactive Systems Corporation, Westmount Technology and Softools, Eurodesk provides the user with a complete integrated package for the Interactive 386/ix operating system. The package includes an INGRES database application development environment incorporating Westmount's CASE tools, an X11.3 window application and integration development environment, and Softools' own Management Information System tools and office automation modules.

PC INGRES Distributed Down Under

Relational Technology Limited has signed the first Australian distributorship agreement for the PC version of INGRES with User Friendly Computing, a distributor based in Sydney.

"We are very pleased to have appointed User Friendly Computing as

(continued on page 38)

the first PC INGRES distributor," said Alan Jervis, Managing Director of the Asia-Pacific region for Relational Technology. "The company has a long and distinguished presence in the computing industry, with sales and support offices throughout Australia."

According to Managing Director of User Friendly Computing, Zed Zawalski, PC INGRES provides users with a cost-efficient development environment. "One of the areas in which I see PC INGRES being particularly useful is that of development," he said. "Users can develop entire applications away from the host machine, transferring them to the mini or mainframe once the applications are completed."

Two benchmark comparison studies, one by the University of Stuttgart in West Germany and the other by Palmer and Associates in the U.S., show PC INGRES to be number one in performance.

Kanji INGRES Release 6 Available

Following an Australian research & development initiative, Relational Technology has released a Kanji version of its relational database and application development tools for use in Japan. Kanji INGRES provides Japanese-speaking end-users with a Kanji interface.

According to Alan Jervis, managing director of Relational Technology's Asia-Pacific Region, the release of the product now gives developers in Japan a new avenue for increasing productivity. "Systems using Kanji INGRES can be easily converted to other languages, thus making international markets accessible to Japanese software houses," said Jervis. "Kanji INGRES is also expected to be of great interest to multinational corporations wishing to deploy application systems in different parts of the world."

Kanji INGRES is available for Digital VAX/VMS systems and will soon be available on UNIX platforms. ►

(continued from page 26)

Connecting Heterogeneous Systems

The government also needs to connect systems from different vendors without sacrificing the critical functionality of its current networks. Today, government networks are predominantly based on TCP/IP protocols, but are in the process of migrating to the GOSIP (Government Open Systems Interconnection Protocol) standard.

GOSIP, a federal specification for developing common data communication protocols between systems, is based on the International Organization for Standardization's seven-layer Open Systems Interconnection (OSI) Basic Reference Model. It addresses protocols, process-to-process, mail and terminal access between computer systems and across government agencies. The two major areas defined are file transfer and message handling. Once GOSIP is fully implemented, users on networked systems will be able to transparently exchange critical data and communications.

Network File Systems (NFS)

A person at a workstation should also be able to interact with software running on remote systems in an organization-wide network. This need is most prevalent at command centers where one user may require multiple terminals to tap into the various independent information resources. To be interoperable, systems must be able to access data that resides in other file systems. NFS is the de facto standard for distributed file systems today.

Open Desktop: An Integrated, Open Systems Platform

Open Desktop, announced at UniForum 1989 by The Santa Cruz Operation, Inc. (SCO), Relational Technology, Inc., Locus Computing Corp., Digital Equipment Corp. and Tandy Corp., draws upon open systems standards to provide a powerful integrated operating environment for 386 workstation computing.

Open Desktop meets federal standards by integrating the SCO UNIX System V/386 Release 3.2 operating system, the OSF/Motif graphical user interface, SCO and Locus' X11 (X Window) standard, Xsight, Relational

Technology's INGRES/386, TCP/IP and Network File Systems (NFS) for Ethernet and asynchronous network communications and Locus' Merge 386 and PC-Interface server for MS-DOS and UNIX System integration. Open Desktop, in fact, matches requirements cited in such federal procurements as the Air Force's Desktop III, the Treasury Department's Multiuser Acquisition Contract and the Army's Small Multiuser Computer procurement. To meet future networking technology requirements based on the GOSIP OSI standard, SCO plans to release the separately available SCO ISO-NET and SCO X.400 products, a full seven-layer OSI solution that incorporates standard protocols. SCO ISO-NET and SCO X.400 can be used with Open Desktop to provide connectivity to GOSIP or other ISO network environments.

Because it meets both industry and federal open systems standards, SCO's Open Desktop offers federal MIS managers a one-stop solution to the challenge of cutting costs and maintaining security while increasing the performance and utility of their computer systems. ►



Betsy Burton is the product marketing manager of database products at The Santa Cruz Operation. Ms. Burton has also held product management and engineering positions at Britton Lee Inc. and Digital Research Inc. She received a B.A. in Computer Science from the University of Colorado.

INGRES is used at the OO-ALC for several other applications. One application, an Automated Testing Program, compiles aircraft simulator test results for reporting and analysis. An F-16 support equipment application provides information on F-16 support equipment requirements and aircraft configurations for foreign and U.S. versions of the aircraft. Additionally, an application named LOGBOOK enhances the management of a huge supply system.

One particular Air Force Logistics Center procedure has been dramatically improved by using the LOGDIS system to release supply items from warehouses for shipment to worldwide military customers. This process required thousands of inventory managers to interact frequently with multiple, menu-oriented applications on mainframes.

Using the old procedures, the inventory manager (IM) had to log in to several different computer menus, enter the appropriate stock number (and other data) several times, and write down information presented on the screen. Only after considerable manual effort, time and frustration could the IM collect the required information. And, only then could a decision be made on whether sufficient stock was available to release a requisition for shipment to a military customer.

Under LOGDIS, an automated procedure prompts the IM to enter all the appropriate stock numbers and then uses this input to do the information processing work. The communications-oriented programming language connects to the mainframe, logs the user in and inputs all systems data with all account information. It navigates through the various mainframe menus, inputting required information along the way, and captures the actual data screens into files on the LOGDIS machine. These temporary files are automatically reformatted and entered into the INGRES database. A concise, one-screen report, combining all the information previously gleaned from several screens, is presented to the user. The LOGDIS system also helps the user to fill out an on-line form to release the requisition for parts—a task that was previously done manually.

LOGDIS has demonstrated it can reduce time needed for this process by over 60%. The system also ensures higher quality decisions because the chance for input errors has been virtually eliminated. In addition, far fewer training hours are needed to prepare the Item Managers for using LOGDIS since they only need to learn one menu system to deal with multiple computers. ▼

—D.T.

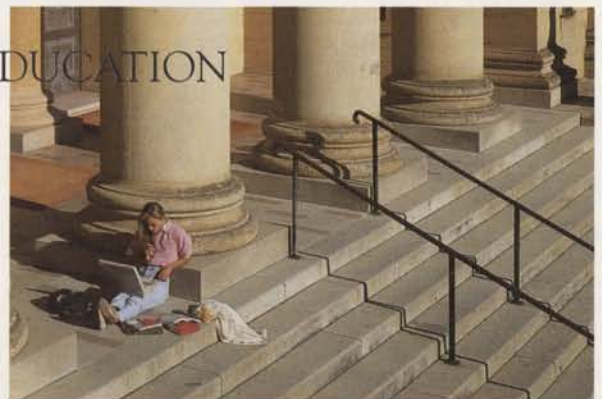
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In the next issue . . .

JOHN SCULLEY ON TRANSFORMING
INFORMATION INTO KNOWLEDGE

HIGH TECH IN HIGHER EDUCATION

LIFE ON LINE AT JOHNS
HOPKINS HOSPITAL



Digital Business

**JOHN GANTZ**

RTI Looks Better All The Time

In the business world, crossing the \$100 million mark in yearly revenues separates the men from the boys. And for a software company to cross that magical threshold is particularly notable. There just aren't that many \$100 million software companies around – less than 15, in fact.

In the Digital Equipment Corp. arena, the newest member of the club is Relational Technology Inc. of Alameda, Calif., which, by our calculations, made almost \$110 million in calendar year 1988. Relational Technology is also third, but going on second, in Digital-related revenues as totaled up in the last DIGITAL NEWS 50 listing [*"DEC Discovers Life in a Bigger Pond,"* DIGITAL NEWS, April 3, page 1].

Although it has been overshadowed in the market somewhat by Oracle Corp.'s blazing rise to superstar status, Relational Technology's success is no less shining. For that matter, the company's business strategy and management may be even tighter than Oracle's.

Blessing in disguise

In fact, living in Oracle's shadow may have been a blessing in disguise for RTI, because it has helped propel the company into a market strategy that takes it out of the direct line of fire of its major hardware DBMS competitors – IBM Corp., Digital and Tandem Computers Inc. Oracle, on the other hand – pushing the half-bil-

lion-dollar revenue mark – has embarked on a strategy to embrace the entire market by selling applications software, consulting and systems integration, along with DBMSs. Despite its size, the company's strategy is riskier. Did not Cullinet Software Inc. of Westwood, Mass., stumble when it tried to enter the applications business?

But this is a column about what RTI has done right, not what Oracle might be doing wrong. Some examples:

- Compared to Oracle and Informix Software Inc. – RTI's two biggest competitors – RTI spends twice the research and development dollars as a percent of revenues that its two competitors do. This has given RTI major capabilities in getting the product out the door (versus Informix's troubles getting its personal computer software out the door, followed by the resultant layoffs in January) and in developing tools and gateway products along with its basic DBMS.

- Although Oracle and Informix spend less than 50 percent of the company revenues on marketing and sales, RTI spends more than 60 percent. As the DBMS market begins to cool – and it cannot keep doubling every year – this marketing muscle will come in handy. RTI still has less "feet on the street" than Oracle, but it has got quite a seasoned team on board.

- RTI's alliances with other software and hardware vendors appear to be going well. Digital has just about admitted that RTI offers better relational DBMS tools and has inked an agreement to resell RTI's Ingres. At the end of March, RTI announced that Tandem Computers had agreed to a similar arrangement.

But the real bet for RTI is in its product architecture, and I believe the bet is well-placed.

Essentially, RTI bit the bullet in 1988 by redesigning its Ingres RDBMS to suit the modern world of multiserver processing. The architecture previously embodied in Ingres 5.0 was one that supported multiple database access points to a single common database. It was sort of a centralized DBMS architecture that emulated a distributed one. In Release 6.1, which reached volume shipments in Janu-

ary, according to RTI, the architecture is much more distributed. Its multiserver architecture allows for more load balancing across multiple CPUs running multiple applications against that common database.

To describe the differences between the old and the new architecture beyond this summary would take a multipage tutorial and a level of familiarity with RDBMS that I do not have, but the advantages come out in fewer I/Os per transaction and less CPU memory required per user at a ratio of 4-to-1. Moreover, there are back-end economies as well – a single RDBMS table can now be spread across multiple disk drives, for instance.

The other product decision that will place RTI in good stead is its commitment to offering interoperability with other DBMSs – including gateways between SQL (Structured Query Language) databases and older, non-SQL databases. This is nontrivial capability.

Even within the SQL world, in which SQL is an ANSI standard, there are enough "dialects" of SQL to make interoperability difficult. IBM's, Oracle's and RTI's SQLs, for instance, have some common commands and some unique commands. For example, they handle error messages differently. Therefore, writing an application that can work with two or all three requires writing to three different interfaces, anticipating different error codes, understanding different data catalog structures and hoping that everything will work right. RTI's solution has been to build gateways that start with an open, documented subset of Ingres SQL that has been chosen to match the most prevalent RDBMSs, to deal with selected standard data types and to issue generic error messages.

The gateways then must contend only with the variations between the full Ingres SQL and the parts of the other DBMSs that are not already contained in the common Open SQL.

Abstruse as all this sounds, it means that software and applications developers will have much less work writing applications that will work across multiple database systems, and throughput of transactions that work across the data

bases will be higher than if there were not a generic SQL system to begin with.

Now, will it all pay off?

If you believe the world is heading toward multiprocessing, multiserver computing, the answer is, "You bet."

As RTI explains it, Ingres 5.0 represented the last of a long series of improvements on the older architecture – it was about as optimized as it could get. More R&D effort would not make it much better. Release 6.1, though, starts a new curve. Investments in it will yield nice jumps in the ability to maintain and enhance it.

The payoffs in the switch of architectures are already visible. In a transaction processing environment, RTI's Ingres 6.1 is capable of 30 transactions/sec. on a VAX 8700, according to RTI, versus half of that under Ingres 5.0. What is more, RTI believes that with Ingres 6.1, it is nearing the theoretical limits of transactions per second on a uniprocessor – and that major improvements will now come not in software but in scalability across multiple CPUs. Its "silver bullet" transaction processing optimization – conducted last year with a special version of Ingres 6 on a number of Sequent Computer Systems Inc. processors – ran the transactions per second rating up to more than 100. Release 6.1 is ready for this "new" world of multiprocessing.

Actually, with its product architecture, RTI has placed two bets: The world really is moving to multiserver and multiprocessor computing; and users will want their old and new DBMSs to work together in their bread-and-butter applications.

Now that doesn't sound cockeyed to me. Not at all. ■

John Gantz is a principal of Technology Financial Services Inc. of Westford, Mass., and is the editor of the "Tech Street Journal" financial newsletter. He can be reached through DIGITAL NEWS, 33 West St., Boston, Mass. 02111. He welcomes your questions and comments.



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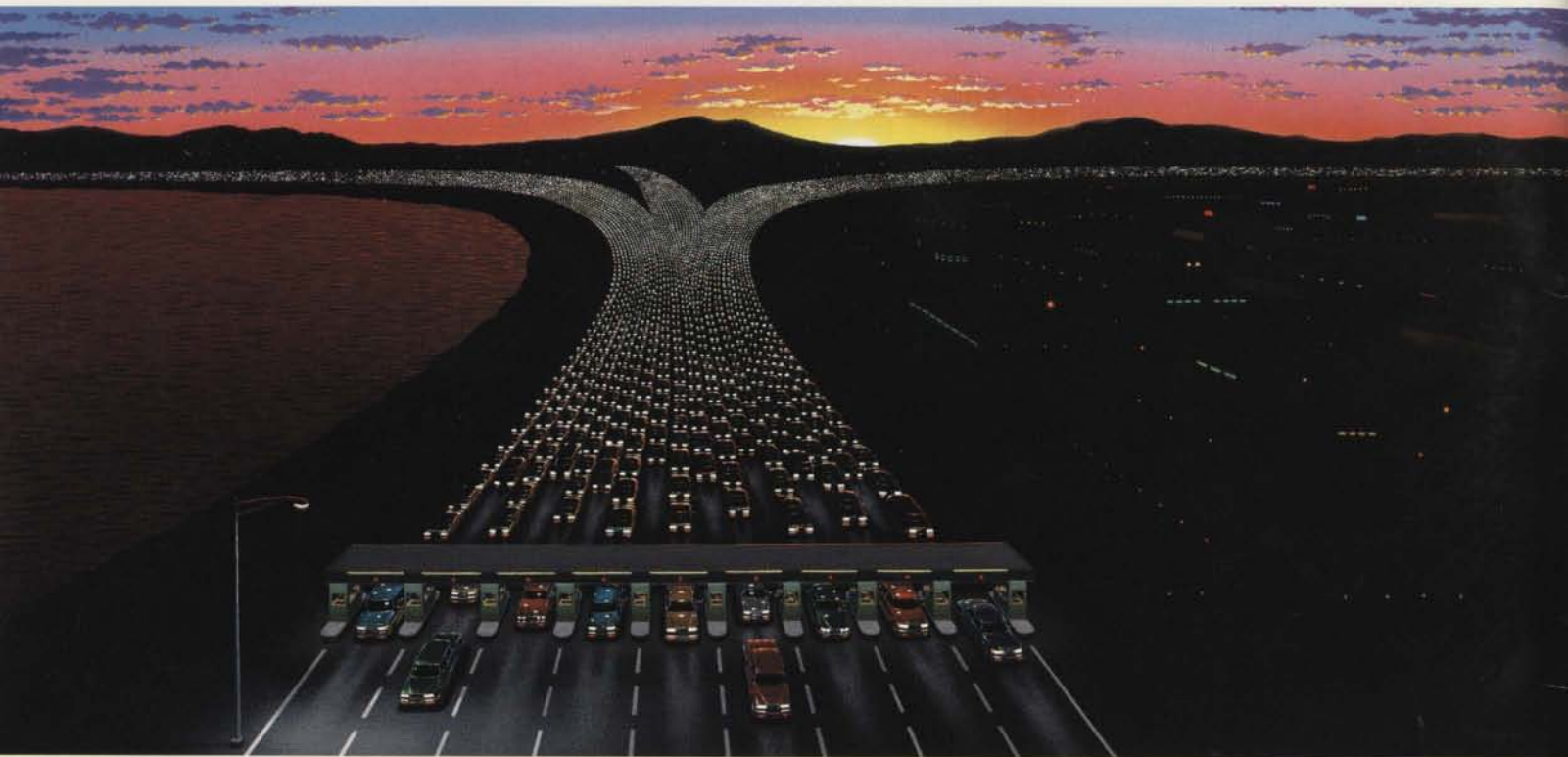
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Madison, Wisconsin
Meets every last Wednesday of the month
Contact: Alice Erickson (608) 262-3665

Chicago, Illinois
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Contact: Mark Davison (815) 226-8439

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