File: RVOC

University-National Oceanographic Laboratory System

RESEARCH VESSEL OPERATORS COMMITTEE NEWSLETTER

10 December 1990
Volume 15

EDITOR'S NOTE

During the RVOC Meeting in New Orleans, I inquired as to whether the present format and contents of the Newsletter was serving the needs of the membership. My inquiry did receive a positive response, but be assured that I'm always open to suggestions on how the Newsletter might be improved to better serve our needs. Please remember that for the Newsletter to be worthwhile I need your input in the form of articles, clippings, information; anything that might be of interest to other operators.

I plan to publish at least two Newsletters during 1991. Please take note of the following dates:

Volume 16, Number 1	April 15, 1991, deadline for contributions April 1, 1991.
Volume 16, Number 2	August 30, 1991, deadline for contributions August 15, 1991.

Reminders/solicitations for contributions will continue to be posted on telemail.....
Bruce Cornwall

Happy Holidays!!

ANNUAL RVOC MEETINGS

Louisiana Universities Marine Consortium, LUMCON, in New Orleans, Louisiana hosted the 1990 Annual RVOC Meeting October 9-11. Thanks to Steve Rabalais and his staff for contributing to the success of the meeting by arranging for the superb accommodations and enjoyable social activities. Kudos to the crew of R/V Pelican for the fine food and drink served up on board during the reception hosted by LUMCON.

The 1991 Annual RVOC Meeting will be hosted by the Institute of Ocean Sciences, Sidney, B.C., Canada. Tentative dates are September 10-12, 1991. Look for more information concerning this meeting to be posted on telemail.

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ERIC NELSON RETIRES

After 22 years of service to the DUML, Eric Nelson retired June 1, from his position as the Marine Superintendent of the Duke/UNC Oceanographic Consortium.

Eric began his career in 1968 when he was hired as the Assistant Marine Superintendent aiding the Marine Superintendent John Newton in the operation of the EASTWARD. At that time, the Cooperative Oceanographic Program was in need of a professional "Highseas" mariner to provide skill and experience to a program that was expanding from regional work around the southeast coast to general purpose oceanography on the high seas from Nova Scotia to Venezuela. Eric's impeccable credentials in the Merchant Marine combined with his interest in a "shore job" in his native Carteret County made him the perfect choice.

In addition to being a professional merchant seaman, Eric is also a member of the Nelson family of Gloucester. The Nelsons have been working on the water as long as anyone can remember, so Eric probably had an interest in the sea from the time he was born.

Eric's professionalism and, yes, his perfectionism were an important addition to the EASTWARD program. The EASTWARD was staffed by crew and officers from Carteret County who were, for the most part, former fishermen and Coast Guardsmen. They consider themselves the world's best inshore and coastal seamen, but the EASTWARD was beginning to cruise to the Caribbean for three months at a time.

When John Newton left the Cooperative Oceanographic Program in 1975, Eric was promoted to Marine Superintendent. He served in this capacity until his retirement.

Under Eric's able guidance the EASTWARD eventually roamed as far east as the Mediterranean Sea with work off the coast of Algeria, as far north as Nova Scotia, south through the Panama Canal to the coast of Peru and west of the Galapagos Islands. The EASTWARD went into Venezuela's Lake Maracaibo and up the Orinoco River, regions where few oceanographic ships have ventured. EASTWARD never failed to get home under her own power despite the far-flung and perilous places that scientists asked Eric to send the ship.

Obviously Eric and EASTWARD were a good team, so good, in fact, that on the basis of their record the newly formed Duke/UNC Oceanographic Consortium won a competition to operate a new NSF ship.

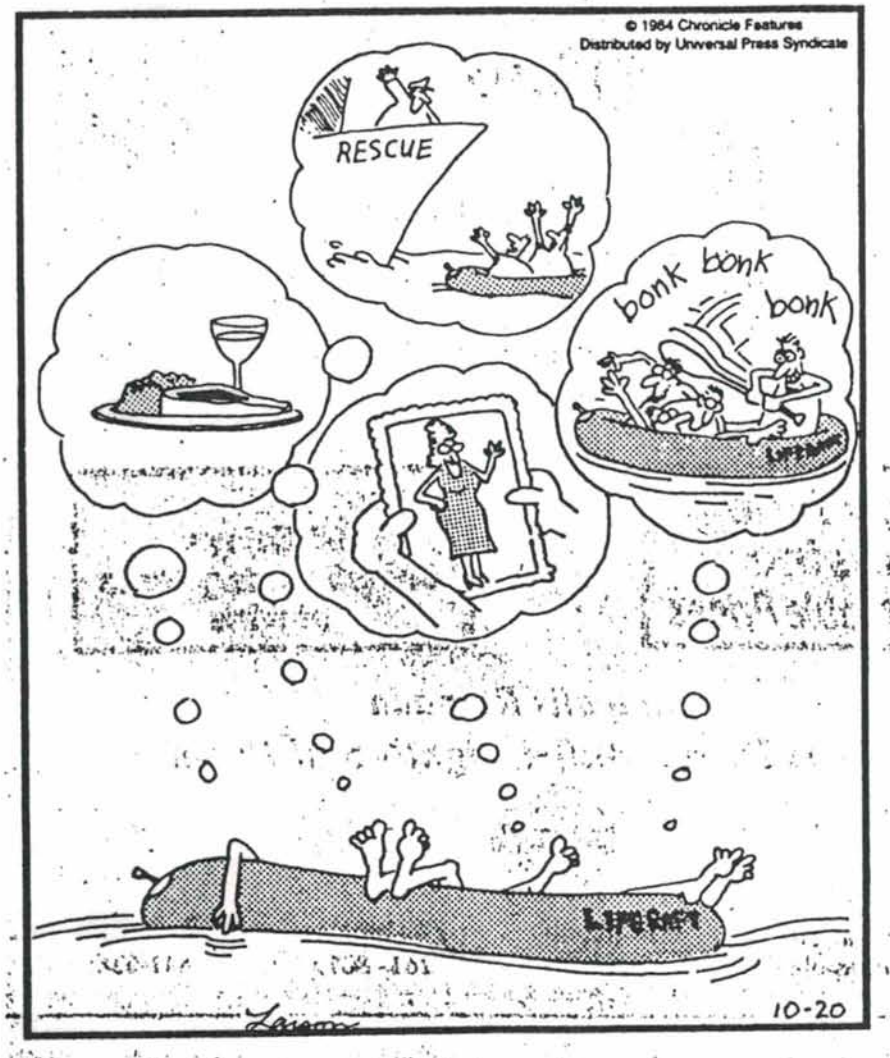
Eric supervised the construction, outfitting, sea trials and delivery of the vessel. The new ship, named CAPE HATTERAS, was delivered in early October 1981 and began its first year of operation the following January.

Eric, always the consummate professional, followed Henry Ford's rule, "Never explain; never complain."

Eric always looked ahead, never made the same mistake twice, never gave excuses and ended up with the best managed small ship operation program in the U.S.

The Duke community and the community of oceanographers will miss Eric, but both groups know they benefitsed from his service with EASTWARD and CAPE HATTERAS.

THE FAR SIDE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RESCUE
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10-20

To Mr. Sutherland
Ms. Deiter

DEPARTMENT OF THE NAVY
NAVAL OCEANOGRAPHIC OFFICE
STENNIS SPACE CENTER, MS 39522-5001

IN REPLY REFER TO:
3140
Ser FA/14306
19 OCT 1990

From: Commanding Officer, Naval Oceanographic Office

Subj: 1991 UPDATE FOR NATIONAL OCEANOGRAPHIC FLEET OPERATING SCHEDULES

1. Preparations are in progress for the 1991 edition of the National Oceanographic Fleet Operating SchedulesP-34). To facilitate the publication of RP-34, please update the ship information data field under your cognizance and complete the following action items:

a. Changes, additions or corrections to ship characteristics and point of contact information. Target date: 01 December 1990;

b. New pictures or new ship layout diagrams. Target date: 15 December 1990; and

c. 1991 ship schedules. Target date: 01 January 1991, or as early as possible, to allow time to load the data in the computer, complete publication layout and forward the camera ready copy to the U.S. Navy Printing Office.

All updated information and the 1991 ship schedules should be forwarded to:

Commanding Officer
Naval Oceanographic Office
Attn: Operations and Readiness Office Assistant, Code FA
Stennis Space Center, MS 39522-5001

2. Future requests for updates will be incorporated in each edition of RP-34 for consecutive years.

3. The Naval Oceanographic Office point of contact is Mr. Angus McMillan, AUTOVON 485-4631 or commercial (601) 688-4631.

Jerry C. Carroll

JERRY C. CARROLL
By direction

IS EVERY COMMERCIAL DIVER A JONES ACT SEAMAN?

Ralph Kraft & F. Douglas Gatz, Jr.,
PREIS, KRAFT, LABORDE & DAIGLE

Is every commercial diver a seaman under the Jones Act?

The answer is no.

The statute 46 U.S.C. §688, commonly referred to as the Jones Act, provides: "Any seaman who shall suffer personal injury in the course of his employment may... maintain an action for damages at law, with the right of trial by jury..."

The statute does not address the parameters determining which maritime workers will be classified as seamen. Seaman classification must be resolved by examining the nature of the diver's work in each case.

Several conditions must be analyzed:

1. Work history during the course of employment.
2. Location of each job in which the diver was engaged.
3. Whether the diver performed his tasks from a dive station located on land or other fixed structures such as docks, piers, fixed platforms or nuclear power plants, as opposed to a vessel or fleet of vessels.
4. Extent and duration of each job.
5. Nature of job tasks.

THE ROBISON TEST

According to Offshore Company v. Robison (Fifth Circuit Court of Appeals, 1959), in order for a maritime worker to qualify as a Jones Act seaman, the worker must show he (1) was assigned permanently to a vessel or performed a substantial part of his work on a vessel or fleet of vessels (defined as an identifiable group of vessels acting together under one control), and (2) contributed to the function of the vessel or to the accomplishment of its mission.

A worker may satisfy the first prong of the Robison test by proving that he was assigned permanently or spent a substantial amount of time aboard a particular vessel or fleet. The Courts have carved out an exception to the first prong in that a "blue water seaman" or one who is engaged in classical seaman's work, such as a captain or anchor handler, may be conferred with seaman's status irrespective of the fact that his work places him aboard randomly owned vessels rather than an identifiable fleet.

With this background in mind, the Fifth Circuit has used the above tests extending seaman status to certain commercial divers.

Play It Again, Sam

Here we go again: there's another Middle East crisis driving up the price of oil. To members of the domestic oil industry, the situation was predictable. Congress and the President had been warned for the past 10 years that market volatility combined with growing U.S. dependence on foreign oil would make the heavy price impact almost a sure bet.

During the 70s, we were taken to the mat twice by crises in the Middle East. Did Congress actually believe that centuries of hatred and mistrust among Arab nations had been buried in lieu of global economics? With all of the Middle East paper tyrants engaging in muscle-flexing, did the U.S. really believe that it was all just a show? And, with our ever-growing reliance on foreign oil surpassing the rate that ultimately caused disaster in the 70s, did Congress really believe we were immune to such circumstances again?

When the Iraq-Kuwait crisis hit, the Secretary of Energy called several oil industry leaders to Washington for a conference on how domestic producers could pick up the slack for embargoed oil. Those leaders repeated the obvious to the Secretary: It will be a long time before domestic energy can gear back up. Too many people suffered through the 80s to jump back before there is stability and a firm price in the long-term energy market.

The oil industry is unique. The public follows the price of oil unlike any other raw material in the world. Ford and U.S. Steel are allowed to have record years of profitability, but not Texaco or Chevron. To the contrary, when the energy industry was riding the crest of drilling fever in the late 70s, Congress decided to limit their alleged "profiteering" and subsequently passed the ill-fated windfall profits tax. Suddenly, the monies that had been available for costly exploration were taxed away. By the mid-80s when the price of oil hit rock bottom, exploration had dwindled to a trickle. The energy states were in the middle of a deep depression while the rest of the country celebrated cheap oil and good times, led down the primrose path by a nearsighted Congress.

If anything positive can come out of this crisis, let's hope one of the primary benefits will be a forward-thinking national energy policy. A policy is needed that restores domestic drilling incentives, tries to develop an environmentally sound, cooperative policy towards new drilling in selected areas, encourages conservation and the development of alternative fuel sources, and formulates a course that maintains a viable, strong domestic energy industry and reduces our reliance on foreign oil.

The "cheap oil at any price" attitude makes it difficult for politicians to deal with tough and potentially expensive solutions in the short term. But clearly, if the Iraq-Kuwait crisis has done nothing else, it has displayed our precarious energy position and the dramatic, immediate need to address the problem. Our politicians must demonstrate the necessary courage to act on the issue in a constructive manner.

ROBERT A. CARPENTER
EDITOR

Drug Policy Goal Is Deterrence

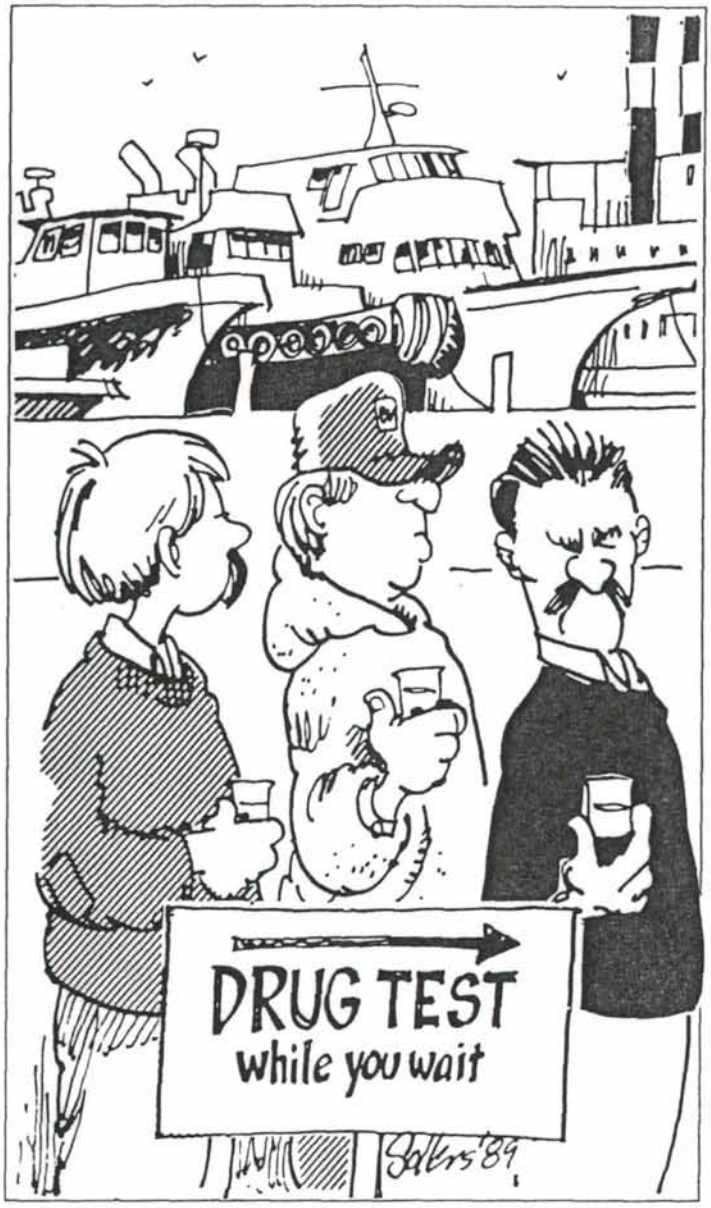
Coast Guard drug regulations are intended to prevent drug use, not to discover and punish drug users; vessel anti-drug programs should not be sting operations

BY JIM ROONEY, JR.

The U.S. Department of Transportation (DOT) released regulations on Dec. 1, 1989, implementing the *Drug Free Workplace Act*. For the work boat industry, drug testing became a reality.

The regulations require urine specimen drug testing of employees who perform "safety or security related functions" within the transportation industry. The U.S. Coast Guard has issued implementing regulations further defining the requirements for commercial vessel operators and requiring drug testing to be in place for employers with more than 11 covered employees; for remaining employers it must be implemented by Dec. 21, 1990. In addition, in case of vessel accident, the crews of commercial vessels can expect post-accident testing soon after coming ashore.

What does this mean for the commercial marine industry, particularly the smaller employers? How does the boat operator/employer comply with the regulations? Are there potential liabilities in running a drug testing program? If so, how are they avoided? A look at the regulations, drug testing programs and potential pitfalls can help employers stay within DOT and USCG regulations and control costs, while still protecting their businesses.



Who Must Be Tested?

In the drug testing regulations, the Coast Guard defines employees subject to tests as those who, in any part of their job duties, perform a "safety or security related function." Besides all the positions listed on a vessel's inspection certificate, this includes employees who perform functions with a significant safety impact on the operation of the vessel or of its crew. This, of course, includes the captain, engineers and deckhands, but also has been interpreted to include other crew members performing functions materially affecting safe operations (such as boarding passengers, inspecting equipment or assigned duties in the vessel's emergency procedures).

The Intent Is Deterrence

The intent of the law is not to "catch" employees using illegal drugs, but rather to deter drug use altogether. This is a critical distinction. Should an employer implement a drug testing program that does not deter drug use, the program fails to meet the regulation's intent and a legal case could be made against the employer by an employee who was sanctioned due to drug test results. (According to legal experts, arguments can be made on the basis of various doctrines, including but not limited to "wrongful discharge," "defamation," "negligence," and "infliction of emotional distress.")

An employer is *not* required to fire an employee who tests positive for drug use. A leave of absence can be granted to allow the employee to "clean up." Similarly, an employee with a Coast Guard document or license who voluntarily comes forward to the Coast Guard with a drug problem will generally receive a lighter suspension (three years) than an individual caught as a result of a positive drug test (10 years).

The program must comprehensively deter. For example, in the "consortium" approach, a group of vessel operators form a common pool of employees to randomly test at the required 50 percent rate. Although each employee

within the pool has a 50 percent chance of being tested, the selection rate within each participating company may vary, and a company might have no tests in a given year. Should an employee from that operation later be identified and terminated as a result of drug use, a valid legal argument could be made that the employer failed to effectively deter employee drug use. USCG regulations approve the consortium approach but they do not relieve each marine employer of the responsibility of ensuring that the 50 percent random testing rate is achieved.

Currently, it is the employer's responsibility to ensure that the drug testing program deters drug use. No federal or state agency will approve or disapprove an employer's drug testing program, nor stand beside that operator in court. The employer must take the initiative to implement a program that meets the letter and intent of the regulations and thus protects the business.

Questions about individual constitutional rights and employer drug testing have been raised. Essentially, the U.S. Supreme Court has decided that employers may drug test employees when doing so is in the greater interest of public safety. Unless there are new court decisions, it appears that the marine employers face no significantly increased liability from the courts when conducting employee drug testing in compliance with Coast Guard and other regulations.

Besides the emphasis on deterrence, a drug testing program must also emphasize objectivity. Random selection of those to be tested should be performed either by an outside service provider or by a special office within a company like the health care section. Unrelated to and unaffected by operations management, this selecting agency ensures that the employer is not later accused of harassing an employee who might later be disciplined as a result of a random drug test.

Components of a Proper Drug Testing Program

Because potential liability surrounds an employer's drug testing program, the program's regulated elements must function properly. The regulations are principally concerned with four elements: the employer, the collection site, the laboratory and the medical review officer.

The role of the employer has been discussed at length; the remaining three components and their interrelation make up the balance of a drug testing program.

Collection Site: The collection site is the facility or agent that provides the urine collection service, ensures the specimen is properly collected and documented, prepares the sample for shipment and sends the sample with chain-of-custody documents to the lab and medical review officer. It is here that most of the potential for mistakes is found.

Regulations call for a complex "chain-of-custody" form to be completed at the collection site and to accompany the specimen. This form ensures that the specimen belongs to the documented donor, that the specimen was collected in the correct manner and was accounted for at all times. Over 50 tasks must be completed correctly, in order, by the collection agent and documented on the chain-of-custody form.

An employer should try to select a collection facility that routinely collects urine specimens for DOT drug testing. According to drug testing labs, these facilities make fewer mistakes than others that may offer the service. Also, the employer should select a facility that can make evening and weekend collections in case of a vessel accident.

Laboratory: Selecting a laboratory is less difficult. The regulations require the use of a National Institute on Drug Abuse (NIDA) approved laboratory. Checking into a laboratory's background — litigation history, lost law suits, number of specimens processed daily, average test turnaround time — can help assess a laboratory's reliability. The laboratory should be chosen first on the basis of quality, then on the basis of cost.

Medical Review Officer: The MRO is the "gatekeeper" of the results. The MRO not only reviews the test results from the laboratory, but also ensures that the collection facility/agent and laboratory performed their jobs adequately. Because the difference between a good or bad MRO can mean the difference between accurate or inaccurate test results (and thus make or break a program), the MRO should be selected with care. He or she should have specific professional training in the clinical signs and symptoms of substance abuse or forensic toxicology.

The common deficiency in drug testing programs is lack of separation of the four components; the collection, laboratory

Coast Guard Proposes New Random Test Regs

On July 27, the Coast Guard published a new proposed rule for random drug testing of crews on commercial vessels. Comments are due by Sept. 10, according to Lt. Cmdr. Tom Murphy.

"The proposal addresses the concerns of Judge Hogan," Murphy said. Hogan ruled in December 1989 that the Coast Guard's random testing requirements were too far-reaching, covering vessel employees that might not have safety or operational responsibilities on the vessel.

"I think the marine industry will be receptive" to the new ruling, Murphy added.

The proposal extends random drug testing requirements on towing vessels to all personnel except cooks, according to the American Waterway Operators.

In the published rule, the Coast Guard seeks to apply random testing to all crew members specified on the vessel's certificate of inspection and to pilots serving on the vessel. Most of these crew members work deck or engine room positions.

On passenger vessels, some personnel have safety responsibilities only in case of an emergency. The Court specifically ruled out testing those people.

The proposed rule exempts cooks, messmen, hotel service personnel, concession operators, pursers, bartenders, waiters, entertainers, port assistants, port engineers and port captains not associated with the vessel's operation. These exemptions have exceptions. If a person in these positions is regularly assigned duties such as manning fire hoses, securing air or ventilation boundaries or securing electrical systems, turning on emergency lighting, fire pumps or manning emergency equipment, he or she must be tested.

On offshore service vessels, licensed personnel like the master, deck watch officers, pilots, engineers and radio officers will be required to be tested as well as the offshore installation manager, ballast control operator and barge supervisor on MODUs.

The Coast Guard is also proposing to extend random drug testing to unlicensed as well as licensed persons working on uninspected towing vessels when their job assignment is safety or operation-related. Unlicensed mates standing bridge watches, deckhands standing helm watches, those assisting in mooring vessels or making up tows would be included. Operators of uninspected towing or passenger vessels and those authorized to engage in assistance towing would also be eligible for random drug testing.

The proposal gives the large marine employers 30 days from final publication to implement the random program and retains the Dec. 21 deadline for medium and small vessel owners. Terminal employees sent to work on a vessel will be subject to the marine rules and independent-contractor certificated tankermen will be the responsibility of the company hiring them, according to the Independent Liquid Terminals Association.

— Marilyn Barrett

analysis, medical review and employer responsibilities should never be combined under one management. When a facility or a single physician is contracted by a laboratory to perform both the collection and MRO services, the so-called, "Doc-in-the-Box," problems arise. The difficulties experienced by the NFL (National Football League) and NASCAR (National Association for Stock Car Auto Racing) are due to the catastrophic collapse of "Doc-in-the-Box"-based programs.

The MRO's responsibilities include reporting to the employer deficiencies discovered with the collection site or laboratory. If the physician has financial or business ties to these, how can the employer depend on the MRO for an accurate and objective appraisal of deficiencies?

Critical Liability Issues

The greatest liability faced by the employer is posed by the employer's own employees. Discharged for drug use, and thus publicly labeled a drug user, he is more liable to seek legal redress. Thus an employer's drug testing program must clearly spell out the employer's policy towards substance abuse in the work place and the sanctions and discipline which will be imposed as a result of such use.

The most common situation to arise is a claim of "wrongful discharge." It may be claimed when an employer fires an employee in violation of published or implied contracts, policies or covenants. For example, many companies have implemented a "3-Strike Rule" for managing employee misconduct and discipline. Under this policy, an employee is allowed "3 strikes" — any behavior giving cause for disciplinary action — before the employer may discharge the employee for cause.

However, many employers also have a policy to "discharge on first use" those employees who are determined to be substance abusers, either by drug test result or by visual observation. Employees discharged thus may validly claim "wrongful discharge" under the employer's existing "3-Strike Rule," unless the employer's drug policy makes clear provisions for exceptions to the "3-Strike Rule."

Pointers For Developing A Program

How does an employer protect his business and keep costs down? The easiest way to control both is through a good drug testing provider — one that keeps the program components separated to insure quality and avoid conflicts of interest. Quality must have priority over price. Quality can be affordable, and is worth the added expense over a "cheap" operation based on price alone. These "bargains" can result in unnecessary risk of lawsuit.

The employer must develop three critical documents required or referenced in Coast Guard regulations: a company drug policy statement (a formal statement of company attitudes and fundamental drug testing program guidelines), a company test plan (when the company plans to drug test, who and how), and an employee assistance program (how an employer will educate employees and handle an employee who tests positive). These documents must meet Coast Guard concerns and requirements, or the business may face successful adverse legal action.

Policy concerning employees must be completely explored and developed, and all employees must be educated on the policy and agree to abide by the policy's provisions. Internal procedures must be implemented and supervisors trained on the procedures.

Fortunately, many of the procedures which are implemented are simply good business practice, such as written records of employee disciplinary counseling.

The drug testing issue is complex and still evolving, especially in the commercial marine industry. The requirements add to vessel operating costs. For the moment, questions about random testing will continue until a final rule by the Coast Guard is published. Drug testing is potentially dangerous and fraught with legal risk, and must be done properly to avoid adding to the potential liability of vessel operation.

The author is a drug testing program administrator, considered an expert on drug testing in the passenger vessel industry. He has been asked to speak to many industry groups and has published numerous articles on the subject. He serves as drug testing issue advisor to various marine professional associations throughout the U.S.

High and Sinking

Drugs and the American workplace

By Melissa Hendricks

Just the Facts

An occasional report from Johns Hopkins

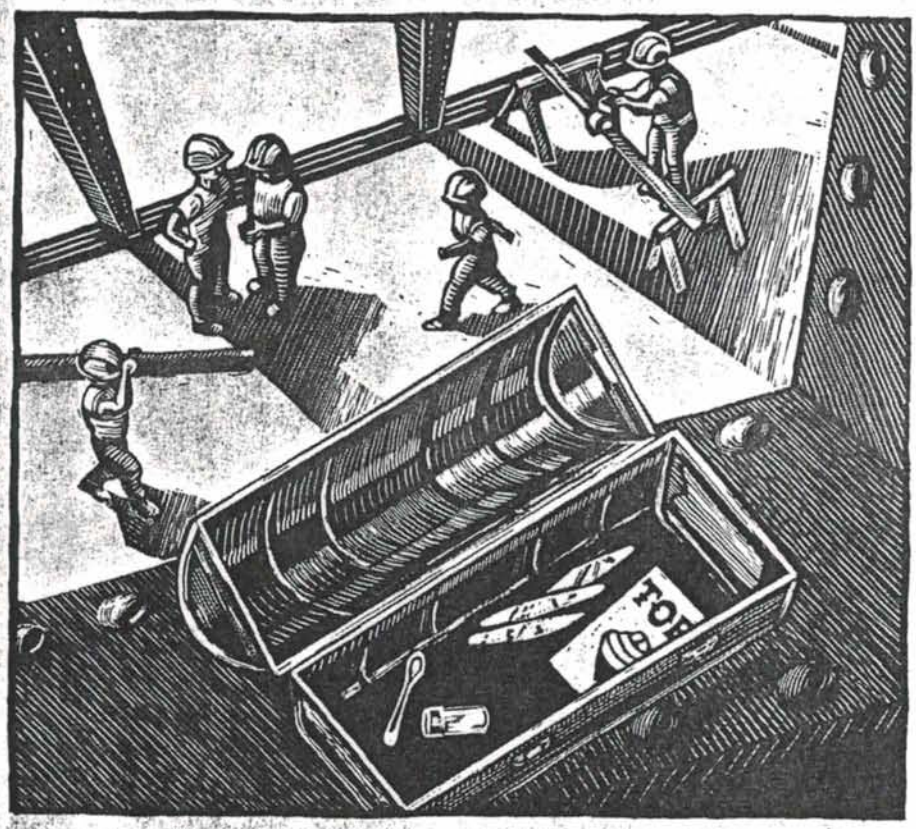
Number 1

Concerns about drug and alcohol use in the workplace have intensified since events such as the conviction of three Northwest Airlines pilots for flying while impaired, and of Amtrak engineer Ricky Gates, who smoked marijuana shortly before the train he was driving crashed, killing 16 people. Today, more than half of all companies (51.5 percent) test for drugs, according to the American Management Association. In 1987, only 21.5 percent did.

How many Americans are actually using drugs on the job? Does testing work? Do we know what works for making the workplace safer?

Answers vary widely because the evidence is far from clear-cut, but some patterns are beginning to emerge. In the following pages, drawing from specialists at Hopkins and elsewhere, Melissa Hendricks presents the evidence.

Reprints available upon request. Send $1 per copy to Johns Hopkins Magazine, *212 Whitehead Hall, Johns Hopkins University, Baltimore, MD 21218.*



ILLUSTRATIONS BY S. SHELDHOUSE

How many people in the United States actually drink or use drugs on the job?

No one really knows, but several studies indicate that the figure is probably at least 10 percent. A 1987 brochure published by the National Institute on Drug Abuse (NIDA) estimates that between 10 and 23 percent of all American workers use dangerous drugs on the job. While journals, drug testing company literature, and anti-drug advertisements have quoted this figure, some NIDA epidemiologists and administrators question its accuracy and admit confusion over its source. "Those figures upset me greatly," says Stephen W. Gust, special assistant to the director of NIDA. "We do not have good estimates of prevalence of drug use on the job."

NIDA conducted a comprehensive survey in 1988 that may come closest to showing how many employed Americans use drugs and alcohol, though not necessarily on the job. The results of the National Household Survey on Drug Abuse indicate that 8.2 percent of employed adults currently use illicit drugs (marijuana, hashish, inhalants, hallucinogens, cocaine, heroin, or a nonmedical use of stimulants, sedatives, tranquilizers, or analgesics) and 6.4 percent drink heavily (meaning they have five or more drinks on the same occasion, five or more times in a month).

NIDA epidemiologists derived these figures by interviewing 8,814 people age 12 and older. Households were selected randomly from census lists, and subjects within those households

were chosen by sex, race, and age to represent the overall population. Of those surveyed, 5,710 were adults employed full time. "Current users" were respondents who had used a particular substance *at some time* during the past month. "There's no way of knowing if the use is on the job," emphasizes NIDA epidemiologist Andrea Kopstein, who wrote a report on drug use among the employed, based on the Household Survey results. Epidemiologists used several different statistical methods to correct for dishonest answers, for questions left blank, and other problems. Still, they note, no survey is perfect.

Studies based on interviews leave open the possibility that workers interviewed will lie about their drug use. They may not understand a question, forget occasions when they have used drugs or alcohol, underestimate or overestimate their past use, or tell outright lies. "Alcoholism and drug abuse are diseases of denial," says Robert Stephenson, special assistant to the director of applied research at NIDA and a graduate of the Hopkins School of Hygiene and Public Health. Thus, substance abusers may be more reluctant than are non-abusers to respond to surveys accurately or even to respond at all.

"We may not in fact have a tool or ready mechanism to assess the extent of drug abuse," says Stephenson. Surveys and studies to date probably tell only a piece of the story.

Many companies only test for marijuana, cocaine, PCP, amphetamines, and opiates. These tests do not catch prescription drugs or alcohol, which is known to be the leading drug of abuse in the United States.

Another strategy, testing employees for drug use, also has shortcomings. Drug tests of urine, the most common form of testing, do not indicate exactly when a worker consumed the substance, nor whether the worker is impaired. Drugs used at a weekend party can show up in urine several days later. Not all workers have been tested, and the ones who have may not be representative of the population as a whole.

Many companies only test their employees for five drugs: marijuana, cocaine, amphetamines, opiates, and phencyclidine (PCP). Most prescription drugs and alcohol, which is known to be the leading drug of abuse in the U.S., often aren't part of the test.

Urine tests do show whether you have used drugs in the recent past, but a "positive" result doesn't indicate when you took the drug; how much of it you smoked, ate, or injected; or how it will affect your work performance, say physicians and toxicologists who have studied drug testing. "Urine drug tests reflect use," says Ian McDonald, president of Employee Health Programs, a company whose services include drug testing. Only breathalyzer tests for alcohol and blood tests for alcohol measure legal impairment.

Drug testing also raises thorny legal and ethical issues (discussed briefly on page 35).

Establishing an effective method to test for impairment is tricky. When does a drug begin affecting your judgment, your manual dexterity, your ability to compute $5X + 32 = 57$? That varies from person to person and from drug to drug. "For each occupation, 'impairment' is very different," notes Liza Solomon, clinic director of the ALIVE Program, a research study to assess the natural history of AIDS in intravenous drug users. "If you're slinging hamburgers or you're a brain surgeon, the standards are different," says Solomon, who has a PhD in health policy from Hopkins.

Tests of hand-eye coordination might be more effective than drug testing, at least for some professions. Such tests might also be more effective in professions where alcohol use is more prevalent than drug use, according to a review of alcohol use among pilots, published in the August 17 *New England Journal of Medicine* by University of Michigan physicians Jack Modell and James Mountz. The authors suggest that a safety device already used in some automobiles be built into planes. Developed by the National Highway Transportation Safety Administration, "the ignition-interlock system" requires a driver to perform tasks that test such abilities as reaction time and short-term memory before the car will start.

In California, some companies are using a video game to test employees before work. Using a keyboard and joystick, test-takers try to keep a roving marker on a target on the computer screen. If employees flunk the test, they are not allowed to work that day. Since the test measures impairment, not the presence of a chemical substance, employees might fail it if they're feeling depressed, or had trouble sleeping the night before.

Testing labs that follow guidelines written by the U.S. Department of Health and Human Services use a two-pronged approach to urine testing. These laboratories, certified by the National Institute on Drug Abuse (NIDA), conduct urine drug tests for many private companies, as well as for government agencies. In both cases, the procedure is the same. First, NIDA labs screen all urine samples using a relatively quick test known as an immunoassay. Common forms of this test are radioimmunoassay, enzyme immunoassay and fluorescence immunoassay. Simply stated, antibodies to drugs are added to the urine sample, along with some type of identifying marker, such as an enzyme or a fluorescent chemical. If drugs are present, the marker is activated. The change in the marker is then detected by a separate instrument.

If a sample tests positive, the labs retest it using a very precise procedure called gas chromatography/mass spectrometry (GC/MS).

"GC/MS is the gold standard for analytical chemists and toxicologists," says Donna Bush, chief of the Drug Testing Section of NIDA. "When done properly, it is 100 percent accurate."

The gas chromatograph measures the amount of time it takes for chemicals in the urine to flow through a column of gas. Each type of drug takes a slightly different amount of time.

The mass spectrometer smashes the drugs into smaller fragments of various shapes and sizes, somewhat like pieces of a jigsaw puzzle. Each type of drug breaks down into its own identifiable puzzle pieces.

GC/MS, which gives information about the actual molecular anatomy of a drug, ends up being more precise than the immunoassay, which detects the presence of a drug only indirectly (through antibodies). Able to distinguish between almost any two types of drugs, GC/MS helps distinguish the true positives from the false positives and from samples that might or might not contain drugs. About 12 percent of the urine samples run through the initial screening test are positive at the Maryland Medical Laboratory, estimates Ira Dubey, head of forensic toxicology at that NIDA-certified lab. He says GC/MS confirms about 83 percent of those.

But that statistic varies from lab to lab. At the NIDA-certified Employee Health Programs, which retests all positive samples using GC/MS, only about 25 percent of samples testing positive on the initial test are confirmed by GC/MS, says that company's president, Donald Ian McDonald.

Not all laboratories retest samples showing up positive on the first test, as NIDA-certified labs do.

Even using the NIDA approach, urine testing is not infallible. False positives can occur during the initial screening procedure because some immunoassays cannot distinguish between some types of legal drugs and certain illegal drugs. For example, take Dilaudid, the medication prescribed for pain. An opiate drug, Dilaudid sometimes make people test positive for opiates, which are illegal substances, explains NIDA analytical chemist Edward Cone. Another drug, a decongestant, yields a positive result for amphetamine, says Cone. The decongestant contains L-methamphetamine, he explains, a legal substance. (D-methamphetamine is the illegal form.) GC/MS can usually resolve these misleading results. For example, labs using GC/MS can distinguish between the two types of methamphetamine, though only by performing a special chemical procedure on the urine specimen before analyzing it through GC/MS. Most labs do not routinely perform this extra step.

Another quirk in testing is caused by poppyseeds, which contain small amounts of the opiate morphine. Eat a poppyseed bagel (which may contain a milligram or two of morphine), and, chances are, you'll test positive for morphine. Even GC/MS cannot distinguish between morphine cooked by a drug dealer and morphine cooked in a bagel.

Of course, whether or not a test is "positive" depends on the relative threshold of the tester. While NIDA follows one set of criteria for judging whether a drug urinalysis is positive, businesses lean toward stricter rules. NIDA's cutoff for marijuana, for example, is 100 nanograms per milliliter on an initial screening test, while many businesses consider levels as low as 20 ng/ml a positive result, according to Carlton Turner, CEO of the drug testing company Princeton Diagnostic Laboratories.

NIDA's test standards are designed to be liberal enough so that samples have to be very positive to be "positive" at all, explains Bush. "We allow some false negatives as a result," she admits.

And despite the technical precision of some drug testing procedures, say the drug testing experts, human errors still occur. A lab technician might pour a drug-free urine specimen into a bottle contaminated with drugs from a previous sample, for instance, or might mislabel a specimen bottle.

Conversely, people have learned how to outsmart the test giver. Some drug addicts buy $5 bags of "clean" urine, heat it to body temperature, and give the sample to their test administrator. Some drug abusers even inject drug-free urine through catheters into their bladders before going to a test. (Of course, these strategies

The CAGE Questionnaire: Red-alert for substance users

1. Have you ever felt you should **Cut down** on your use of [drugs or] alcohol?

2. Have people **Annoyed** you by criticizing your use of [drugs or] alcohol?

3. Have you ever felt bad or **Guilty** about your use of [drugs or] alcohol?

4. Have you ever had a drink [or used a drug] first thing in the morning **(Eye-opener)** to steady your nerves or get rid of a hangover?

Known as the CAGE questionnaire for its key words (**Cut down, Annoyed, Guilty, Eye-opener**), this brief instrument has been repeatedly validated as a screen for alcoholism, but many authorities believe it is useful for any mind-altering substance. We have adapted it here.

One "Yes" answer should raise suspicions, while two or more are a strong indicator that substance use has become a problem requiring treatment.

What these questions get at is whether the substance is interfering in your life. We do not commonly think we should Cut down on celery, because celery does not become a problem. We don't feel Guilty about celery. The idea would never occur to you. So if you feel guilt about using something, or wonder about cutting down, that means the substance, whatever it may be, is interfering with your life.

Similarly, Annoyance indicates that members of your intimate circle are inconvenienced or worried by your substance use—again, it is interfering with your work and your relationships. In fact, your intimates are bothered enough to mention it, even though the subject is sensitive. And you in turn find the substance so vital that you're annoyed. Would you be annoyed if someone declared you should never again eat ice cream? You'd probably laugh. Annoyance indicates that the denial so characteristic of addictions has set in: the drug or alcohol is no longer a casual pleasure, but so important that you cannot easily consider doing without it.

An Eye-opener means that the addictive process is advanced, so that something is needed to stave off withdrawal. Note that use need not involve only one drug, nor does a user need to recognize consciously what he or she is doing. Prescription drugs like Valium, for instance, are often used by people who sincerely believe their nightly drinking is "social," while their daily use of Valium is for "stress."

—Elise Hancock

work only if the employee knows the test date ahead of time, and do not work for random, unannounced tests.)

Employers have launched counter-attacks to catch any workers attempting evasion. They add dye to toilet water so that employees cannot substitute it for urine. Sometimes they test employees on Fridays and then again on Mondays, says Edward Piper, a consultant with Security Solutions Unlimited, a firm that helps companies set up drug testing programs and investigate suspected cases of drug abuse. An employee, thinking the testing is over, might use drugs on the weekend, only to be caught by the "double-punch."

Legislation establishing standards for all laboratories performing drug tests is now pending in Congress. In the past, some drug testing laboratories were inept, as chemist Hugh Hansen of the Centers for Disease Control reported in 1985. Hansen sent urine samples spiked with known quantities of drugs and other samples not containing drugs to 13 drug testing laboratories. The study was "blind": technicians did not know if the samples they were testing were spiked. Hansen compared the laboratories' results to the known quantities of drugs in the urine.

"You could have flipped a coin and come closer to the right results," quips Hansen. Almost all of the labs failed to find barbiturates, amphetamines, methadone, cocaine, and other drugs known to be in the urine samples. Several of the labs had unacceptable false positive rates as well. That is, they had determined that a sample contained drugs when it did not.

Some employers conduct investigations on their own, "often with disastrous results." They invade workers' privacy, break search and seizure laws, and still may not stop their employees' drinking or drug use.

Now, however, most major commercial laboratories are already certified by NIDA, which regularly inspects the labs to make sure they continue to follow specified procedures. NIDA has certified labs only since 1988, when the Department of Health and Human Services (HHS) established regulations for drug testing of federal employees, including mandatory guidelines that laboratories conducting those tests must follow.

Recent studies suggest that since these guidelines were put into place, drug testing labs (at least those following HHS standards) have become more careful and accurate. False positives are extremely rare, NIDA officials report, about one in 2,000. The false negative rate is slightly less than 1 percent.

Still, even only an occasional false positive is not good enough, says Stan Gitlow, a professor of medicine at Mt. Sinai School of Medicine, who specializes in alcohol and drug addiction. "One false positive out of 1,000 still can mean the total ruination of one person's life."

HHS guidelines are mandatory only for federal agencies and labs doing federal drug testing, says NIDA's Robert Stephenson, though many non-federal employers now use the NIDA labs. Some hospital laboratories and some small clinical labs also conduct employee drug testing. Their record of accuracy is not public knowledge, and not all those labs confirm positive test results with a GC/MS test or other second test.

Besides drug testing, some employers are using private investigators to remove drugs from the workplace. These private investigators search through an employee's credit profile for suspicious expenses, says security consultant Edward Piper. Some companies have hired undercover agents as employees to spy on workers. One of the most common weapons in the war on drugs, according to Piper, is detector dogs. For $75 to $150 per hour, a set of canines will sniff out drugs in desk drawers, lockers, behind walls. Dogs may be used not so much to find drugs, he says, as "to send a message loud and clear to employees" that drugs will not be tolerated in the workplace.

Other employers conduct investigations on their own, says Piper, "though often with pretty disastrous results." They invade workers' privacy, break search and seizure laws, and still may not stop their employees' drinking or drug use. "I know of a chief executive officer who took drugs from an employee's desk and put them in his car," recalls Piper. "The CEO was stopped for running a stop sign, and the police found the drugs in his car. His attorney got him off but it was a real hard sell."

Estimates of how many American workers have tested positive for drug use vary widely. Tests of particular groups give estimates from .1 percent to more than 10 percent.

Only about half of 1 percent of random drug tests conducted on Federal Aviation Administration employees have been positive, and even fewer of the more than 37,000 Department of Transportation employees who have been randomly tested since September 1987 have tested positive. The Association of Flight Attendants reports that just four of about 2,000 random tests have been positive.

On the other hand, a survey of 1,021 companies by the American Management Association shows that 8.1 percent of employees tested in 1989 were positive, and 11.4 percent of job applicants tested positive.

Similar figures appeared in a 1988 Bureau of Labor Statistics report based on surveys of 7,500 companies. About 9 percent of the roughly one million drug tests given to employees during the preceding year were positive. Of the approximately 4 million drug tests administered to job applicants, 12 percent were positive.

Several inherent problems with these surveys limit their conclusiveness. Tests are often conducted "for cause," meaning an employer has reason to believe the employee is using drugs. Since drug use among these employees might be higher than the rate among employees overall, for-cause test results do not give an accurate picture of drug use in the entire working population.

Another problem with some studies (such as the Bureau of Labor Statistics survey) is that they show only the numbers of *tests* administered, *not* the

numbers of employees or job applicants tested. Since a single person can be tested more than once, and test positive more than once, the data may overestimate the number of employees whose drug use comes into play in the workplace.

Conversely, since many companies test only for illegal drugs, and not for alcohol or legal medications, these data probably underestimate substance use.

Finally, surveys of drug test results may be biased since the data come from employers themselves, NIDA's Stephenson points out. Positive drug tests imply a dangerous, incompetent workforce under poor management, he explains. "Employers are reluctant to disclose results of drug tests."

In terms of illegal drugs, marijuana accounts for most positive drug tests in the workplace, according to several surveys. Of 759 railroad employees who were tested for drugs (other than alcohol) after being involved in accidents, 23 out of 27 who tested positive had used marijuana, according to a 1987 report.

In 1988, investigators sponsored by the California Department of Alcohol and Drug Programs examined drug test results from four commercial testing laboratories. Positive test results were highest for marijuana and alcohol and lowest for cocaine, opiates, and amphetamines. Among the groups of employees tested during the preceding year, between 1.5 percent and 7.5 percent were positive for marijuana, and between 0 and 2 percent were positive for cocaine. The researchers note that most of the samples were tested only once.

Industrial psychologist Jacques Normand conducted a study of applicants to U.S. Postal Service jobs in which testing results were kept confidential for the purposes of research. Of the applicants who were hired, 9 percent had tested positive, broken down as follows: 68 percent for marijuana, 23 percent for cocaine, and 9 percent for one or more other drugs.

Though most tests don't check for alcohol, it leads all drugs in causing problems in the workplace, according to Richard Bickerton, information officer for the Employee Assistance Professionals Association, an umbrella group for programs helping employees deal with substance abuse and other problems. He cites a June 1987 survey of 1,974 employers in a wide range of fields, from education to manufacturing, conducted by Business and Legal Reports. In response to the question "What is your most troublesome problem in the workplace?," 86 percent of employers indicated alcohol. Some 64 percent listed marijuana as the second biggest problem. Cocaine was the third most important problem for 38 percent of employers.

"Coke and heroin are probably less likely in the workplace," says John J. McClanahan, director of the alcoholism outpatient program at Washington Adventist Hospital, "but they happen. There are guys sitting at the typewriter doing a couple of lines of cocaine right there."

The stimulation cocaine provides may make it a uniquely appealing drug to the driven, ambitious worker, says addictions counselor Jim O'Hair, manager of an Employee Assistance Program for Westinghouse Corporation in Baltimore. "In the last 10 to 15 years, drugs are becoming more performance-oriented. In our society we want to do everything: play more, work harder. Cocaine really has played into that American mentality."

Prescription drug abuse is relatively easy to hide in the workplace. Employers and co-workers are less likely to be suspicious of a prescription bottle in someone's drawer than of a whiskey flask or coke spoon. "My guess is that the prevalence of prescription drug abuse is probably somewhere between that for cocaine and alcohol," says Charles Whitfield, a Baltimore physician who specializes in treating professionals addicted to drugs and alcohol. "The symptoms of alcoholism come on a little earlier and more obviously than symptoms for abuse of prescription drugs," he explains.

Other doctors point out that much of the prescription drug abuse actually may be by people already abusing illegal drugs and using prescription drugs as a supplement.

Casual drug use and experimentation seem to be decreasing, while addiction is on the rise. "The overall picture," says Hopkins psychologist Richard Kilburg, head of a counseling and referral program for Hopkins faculty and staff, "is that people are experimenting less with drugs."

The NIDA Household Survey shows that illicit drug use declined from 15 percent in 1985 to just over 8 percent in 1989 for full-time employed persons aged 12 and older.

"We don't know why people are experimenting less," says Hopkins professor of mental hygiene James Anthony, who is conducting research on the epidemiology of substance abuse. Perhaps the decline correlates with a decline in the number of 18-year-olds, he speculates. Some of today's baby boomers who began experimenting with drugs as teens during the '60s and '70s advanced to harder drugs, prompting the recent cocaine epidemic, Anthony posits. "Maybe we'll see another rise in the 1990s when more people will be turning 18."

Another hypothesis: "Education programs are probably responsible for the decrease of marijuana and cocaine use," Kilburg proposes. "Experimentation with the riskier drugs is falling as people see publicized the deaths caused by those drugs," agrees addiction specialist Whitfield. He adds a caveat: "Though drug use comes in waves, I don't see any decrease in the use of alcohol."

While drug experimentation may be down, addiction is not, say drug abuse counselors. "In terms of real bodies seen in emergency rooms and in the clinics, there doesn't seem to be a decline. In my own practice I don't see any decline," says John J. McClanahan, director of the alcoholism outpatient program at Washington Adventist Hospital. Treatment centers, as busy as ever, and with waiting lists of weeks and months, bear out this view.

In examining the NIDA Household Survey data as part of a doctoral pro-

gram at the Johns Hopkins School of Hygiene, NIDA director of epidemiology Edgar Adams found that though the number of people who had used cocaine in the past year decreased from 12 million in 1985 to 8 million in 1988, heavy use increased. In 1985, about 5 percent of respondents who reported trying cocaine in the past year said they used the drug weekly. In 1988, that rate had doubled.

Overall, everyone agrees the trend is toward polydrug use—the use of more than one drug. In the past five to 10 years, workers in treatment centers report, most clients come in addicted to two or more drugs: alcohol and cocaine, cocaine and heroin, marijuana and alcohol, alcohol and barbiturates. At the Johns Hopkins/Francis Scott Key Center for Chemical Dependency, 80 to 90 percent of Director Donald Jasinski's patients abuse more than one drug, he says. NIDA chemist Edward Cone says simply, "I haven't seen a case of single use in Baltimore."

Workers in certain types of jobs tend to use drugs and alcohol more than those in others. Twenty percent of men in the construction industry, wholesale trade, finance, repair services, and professional jobs reported using illicit drugs within the past month, according to the Household Survey. The rate for male workers in manufacturing, transportation, and retail trade was approximately

In the past five to 10 years, report workers in treatment centers, most clients come in addicted to two or more drugs: alcohol and cocaine, cocaine and heroin, marijuana and alcohol, alcohol and barbiturates.

11 percent, the survey reported.

In terms of past-month use of alcohol, about 17 percent of construction workers and of retail trade workers reported heavy use, compared to less than 10 percent for male workers in each of the other professions included in the survey.

Hopkins professor of mental hygiene James Anthony studied the rates of drug and alcohol abuse in 11,789 working men and women from five urban areas. He found that skilled laborers (8.8 percent) and unskilled laborers (6.7 percent) are more likely to abuse drugs than are those in management/professional positions (4 percent). Looking specifically at the 18-to 29-year-old age group, he found higher rates but a similar relationship: 22 percent of skilled laborers and 13 percent of unskilled laborers abused drugs, compared to 8 percent of managers/professionals.

Examining the data in more detail, Anthony and professors of mental hygiene William W. Eaton and Wallace Mandell found some of the highest rates of alcohol or drug abuse among construction laborers, carpenters, and waiters and waitresses. Among groups having the lowest rates were doctors, nurses, teachers, managers, and administrators.

Many completed and ongoing studies have focused on professions likely to come under scrutiny by an American public concerned about safety: train conductors, for example, or airline pilots. One such group is physicians.

The Precursor Study follows the health of approximately 1,000 males graduating from Hopkins Medical School between 1948 and 1964. In 1986, each participant answered the CAGE questionnaire, a routine screening device used to assess alcoholism. The rate of physicians who were alcoholic at the time of the study was about 10 percent, based upon CAGE and follow-up questionnaires. (See box on page 31.)

"That's about the same or a little higher than the overall population," says lead investigator Richard Moore. The assistant professor of medicine reported his results in *The American Journal of Medicine* in April. "There's nothing striking here that physicians are any worse or any better than the population as a whole." Other studies seem to bear out Moore's conclusion.

Although drug and alcohol abuse appears at higher rates in some groups than in others, treatment specialists say it occurs in every segment of the workforce. "I get people from all over," says substance abuse specialist McClanahan, "blue collar, white collar, police officers, ditch diggers, PhDs."

Much of the remaining drug and alcohol abuse problem exists among the unemployed and homeless. "In the so-called 'underclass,' I think drug use is on the rise," says Curtis Price of the Baltimore-based Health Education Resource Organization. "The cocaine epidemic may have peaked in the general population, in the middle class, but it's stable or rising in the underclass."

In the month prior to the NIDA Household Survey, about 23 percent of the unemployed adult men and 13 percent of the unemployed adult women had used illicit drugs, compared to approximately 10 percent for employed men and 6 percent for employed women. For heavy alcohol use in the month, the figures were roughly 14 percent for unemployed adult men and 10 percent for employed adult men. (Rates of alcohol use for women are not available.)

A survey produced by the Public Health Service of 109 projects caring for the homeless shows rates of substance abuse at individual projects ranging from about 40 to 90 percent, according to the latest report, issued in September 1989.

The controversial question of what drug testing accomplishes has sparked many different opinions, emotions, and controversy.

In summary: From an employer's point of view, drug testing has appeal on the grounds that it may save money by identifying drug users before they cause accidents, injure themselves, or do other damage. "No one wants to get into a plane or a train where the driver has imbibed alcohol or drugs," says psychologist Richard Kilburg, director of the Faculty and Staff Assistance Program (FASAP) at Hopkins. Proponents of testing maintain that accidents, absenteeism, and medical claims decrease dramatically once a company institutes testing.

Others see drug testing as a way to dissuade people who use drugs or alcohol recreationally from using those substances more frequently. Testing therefore might reduce the numbers who become addicts, says FASAP's Kilburg. "It's a deterrent for casual users," he says. "I think, at least, it will change some people's behavior. But it's not going to deter *addicts* in the workforce. Drug testing itself is no panacea."

From a legal standpoint, employers may find themselves in a catch-22. Hospital administrators, for example, may be inclined to adopt drug testing to protect their institutions from being sued by patients who claim damage from an impaired physician, points out Kilburg. "If they don't do testing, the lawyers will get them. They'll be liable." Those who object to testing for Hopkins physicians, which is planned to begin this fall, point to such concerns.

At the same time, employers face potential litigation from those they have tested: applicants who allege discrimination if they've been screened out of a job, or employees who have a false positive test and sue for damages.

Many opponents to drug testing say it is an invasion of privacy. Others go farther. They say drug testing has not been proven to improve productivity or rates of absenteeism. "Drug testing does no good," says pharmacologist John Morgan, of the City University of New York Medical School. "It's a false promise, a lie to America." Drug testing is a tool for enforcing morality, claims Morgan, a former fellow in clinical pharmacology at Johns Hopkins Hospital. "It has become a crusade to help promote the industries sponsoring it."

Others critics object only to random, mandatory drug testing of employees, but approve of drug testing for job applicants and workers suspected of substance abuse.

If you apply for a job, and test positive on a pre-employment drug test, you probably won't be hired. More than 96 percent of companies conducting drug tests of job applicants do not hire those applicants who test positive, according to a survey of 1,021 companies released this year by the American Management Association.

If you are already employed and you test positive, what happens next varies from workplace to workplace. In the ideal situation, an employer follows guidelines established by the Department of Health and Human Services (HHS).

HHS prohibits laboratories from disclosing test results directly to an employer. A positive test should first be taken before a medical review board—composed of physicians knowledgeable in pharmacology and toxicology who are hired by the employer to review drug tests.

The medical review officer is supposed to check to see if a legal medication or other interfering factor caused the positive result. The officer may examine the employee and conduct other investigations to determine if the positive test is valid. This part of the process should identify the poppyseed bagel eater, or the weekend warrior who's taking codeine for a sports injury. The medical review officer then reports back to the employer only the names of employees who do not have some valid excuse for their positive test results.

For employees who are found to have used drugs illegally, companies will—ideally—provide Employee Assistance Programs (EAPs) or other centers for educating and counseling about substance abuse. A well-funded EAP at a large business might provide psychologists and other therapists to counsel substance abusers and even their families, refer them to centers providing intensive treatment, provide follow-up counseling, and train supervisors in spotting signs of substance abuse.

Testing helps if it is part of a larger, drug-awareness program designed to help—not punish—employees, say some of testing's supporters. "If the word is that management is on a witchhunt, that's when employees start coming up with all these neat ways to beat drug testing," says Ed Piper, a consultant with a firm that helps employers eliminate drugs from the workplace. "But when word gets out that a drug test means a positive step to help an employee, that's when the union rallies around them."

In reality, not all employers follow HHS guidelines for drug testing. Some employers do not do the second, costly retest on urine samples that are positive on an initial screening. Some do not use the services of medical review officers, do not guarantee the confidentiality of test results, and do not refer substance abusers to treatment or counseling.

The American Management Association's survey shows that the majority of employees testing positive (70 percent) are referred to treatment and counseling, about 8 percent are fired, another 8 percent or so are forced to take a leave of absence or are put on probation, and 1.5 percent are reassigned to different jobs.

A survey of actions taken against employees at the U.S. Department of Transportation (DOT), the Army's Depot System Command, and the Drug Enforcement Administration (DEA), shows just how differently a positive drug test is handled. At the DOT, 94 of 115 employees who tested positive either completed or are undergoing rehabilitation, according to an April 1990 report prepared for Congress by management consulting firms. Of 110 Army employees who tested positive, 54 underwent rehabilitation. The story is different at the DEA. While only five employees out of 1,222 tested positive for illegal drug use, none underwent rehabilitation: four resigned and one was fired.

Only about 34 percent of employees have access to company-sponsored EAPs, according to Richard Bickerton, information officer for the Employee Assistance Professionals Association. And not all of those companies provide extensive services. At many small companies, EAPs only distribute a statement that drugs and

alcohol are not allowed in the workplace. Even at relatively well-funded EAPs, such as the Faculty and Staff Assistance Program at Hopkins, staffs are overburdened. "It's hard to keep up with everyone," says Kilburg. "We're a small shop."

Another problem is relapse—returning to drug or alcohol use after a period of sobriety. "Just about all recovering addicts go through it," says addiction specialist Charles Whitfield. For most people a series of relapses is part of the process, as with successfully dieting or quitting smoking.

In general, relapses are not tolerated by employers. After one positive drug test, employees are generally required to sign a statement that they agree to submit to drug testing on a random basis, and may even promise to remain drug-free, says Bickerton. "Employees violating these agreements," he says, "are usually fired."

Whether a positive drug test means a poor job performance is debatable. Two studies, one of postal workers, another of hospital workers, arrived at contrasting results. Beginning in 1987, industrial psychologist Jacques Normand examined drug tests of applicants for post office jobs at 21 sites. He then followed the employment status of those hired, including their rates of absenteeism, turnover, firing, and accidents. The identities of those in Normand's study have remained confidential to all but the research staff.

The results indicate that 9 percent of those applicants who were hired had tested positive. Employees who had tested positive, Normand found, had rates of absenteeism 59 percent higher than those who tested negative, and they were 47 times more likely to be fired.

A critic of the study, professor of pharmacology John Morgan, of the City University of New York Medical School, points out that most of the employees who tested positive were young, black males, who as a group often have trouble adjusting to their first jobs. Normand did not compare young, black men testing positive to young, black men testing negative, says Morgan.

Normand acknowledges that blacks had higher rates of positive tests than whites did. However, he says, "the study was intended only to see whether for individuals testing positive, their probability of being fired or absent is higher."

In a study of hospital workers, the results were very different. David Charles Parish, assistant professor of medicine at Mercer University School of Medicine, followed the employment status for one year of all employees hired by a large teaching hospital during a six-month period. New hires were given a drug test at the start of their employment.

The drug test results, kept confidential, were positive for 22 of the 180 employees, the majority for marijuana. During the year following hire, Parish found, none of the employees who had tested positive for drugs were fired, while 11 of the employees who had tested negative lost their jobs. Job performance, based upon supervisor evaluations and numbers of commendations and warnings, showed no significant differences between employees who tested positive and those who tested negative. After Parish reported his results, the hospital ended its drug testing program.

Parish notes that the small sample size of his study, which he calls a "fishing expedition," shows that further studies are needed. He adds, "The most distressing thing is that over 30 years of this program, no one has ever assessed the efficacy of drug testing."

It is difficult to put a dollar figure on the amount of money industry loses to employee drug use. Powerful anecdotal evidence suggests that workers with drug or alcohol problems are more likely to be late or absent from work, to make mistakes, to break or steal products, and to use subsidized health care programs more frequently, thus running up the costs of health insurance and of doing business in general. Estimates vary of just how much drug use costs American industries. The largest estimate may be the U.S. Department of Labor's: as much as $100 billion dollars per year.

"Any figure is just guess work," says Howard Hayghe, an economist at the Bureau of Labor Statistics. "We really don't have any idea how many people are using drugs. When there are accidents, we have no idea whether drugs caused them or not. As far as medical costs derived from drug use, who knows? There are just so many factors involved."

Since job applicants who test positive have little chance of being hired, drug testing may tend to create a drug-free workforce but concentrate drug abuse in the unemployed. If much of the most serious drug and alcohol problems concentrate among the unemployed, warn drug abuse analysts, then workplace drug testing will not attack the substance abuse problem in the U.S. population. Poor people, unable to afford treatment, are more likely to remain addicted, says H. Westley Clark, a psychiatrist at the substance abuse service of the Veterans Administration Hospital in San Francisco and assistant clinical professor of psychiatry at the University of California at San Francisco. The poor then flunk pre-employment drug tests or random drug screenings, and are shut out of employer-subsidized health care. Instead, they are forced to rely upon overburdened tax-subsidized treatment centers, where their chances for recovery are slim. "It's a vicious circle," says Clark. Drug testing will serve to further stratify society, he contends.

Firing workers who test positive for drugs forces employers to spend money searching for and training new employees. "It's in the interest of the employer to rehabilitate rather than fire employees testing positive," says Donald Jasinski, director of the Johns Hopkins/Francis Scott Key Center for Chemical Dependency. "Employers should consider the estimated incidences of drug users, the fact that these may be valuable employees, and that there are labor shortages."

"From a medical viewpoint," he says, "we can rehabilitate and we should rehabilitate drug abusers, but there needs to be cooperation between employers and the medical community. The ultimate goal is to recognize abuse and to treat drug abusers and alcoholics the same way we treat people with other problems. A drug addict who relapses should be considered not any different from a diabetic who stops taking insulin or goes off a diet."

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DEPARTMENT OF THE TREASURY
U.S. CUSTOMS SERVICE
WASHINGTON, D.C.

ENF-1-IC:I MM

OCT 5 1990

Dear Carrier Initiative Program Participant:

Recently there has been an increase in the number of seizures made of drugs affixed to the hulls of vessels. A list of such discoveries made over the past 18 months is enclosed for your use.

Please be aware that this is an ongoing problem. Customs believes that we will be seeing this type of smuggling attempt more frequently. If through diligent efforts, your personnel discover illegal drugs while searching one of your vessels, and turn them over to U.S. Customs, in the vast majority of cases a penalty will not be written.

If, on the other hand, Customs locates drugs in such areas during a search, the situation will be viewed differently. In aggravated circumstances, in which extensive detection efforts by the carrier are not in evidence, discoveries of this nature by other than carrier personnel will be considered by District and Area Directors to be serious indications of failure on the part of the carrier to exercise the highest degree of care and diligence. In such circumstances, vessels may be seized.

Because of the variety of concealment techniques utilized in smuggling attempts of this kind, the number of incidents, the numerous ports of entry involved, and the amounts of illegal drugs, the Customs Service views this trend as the gravest of situations, and will respond in each instance with the strongest actions available to us.

The Customs Service looks forward to working with you as a partner in the struggle against the smuggling of illegal drugs. We want you to use the enclosed information to enhance security measures aboard your vessels, and thereby prevent them from being utilized by traffickers. Thank you for your continued strong cooperation.

If you have any questions, please contact Mr. David Kahne, Manager, Carrier Initiative Program. He can be reached by telephone at (202)566-9796, or by facsimile at (202)535-9519.

Sincerely,

Charles W. Winwood
Assistant Commissioner
Office of Inspection and Control

Enclosure

ILLEGAL DRUGS AFFIXED TO THE EXTERIOR OF VESSELS

Discoveries from 2-89 through 9-90

Date	Location	Vessel	Wt./Substance	Concealment
2-11-89	Pt. Everglades, FL	Seaward Bay	56# marijuana	Metal box affixed to bow thruster screen
9-27-89	Kingston, Jamaica	Zim Savannah	700# marijuana	7 metal boxes bolted to hull
11-4-89	London, UK	Profitis Elias	44# cocaine	"Torpedo" attached to bilge keel
11-9-89	New Orleans, LA	Gregory	120# hashish oil, 75 # marijuana	"Torpedos" attached to bilge keel
12-11-89	Setubal, Portugal	Alameda Star	134# cocaine	"Torpedo" attached to bilge keel
12-31-89	Jacksonville, FL	Cartagena	257# cocaine	2 "torpedos"
4-19-90	Tampa, FL	Scottish Star	120# cocaine	Rudder trunk with 2 stowaways
4-24-90	Galveston, TX	Spring Bride	914# cocaine	Rudder trunk with 6 stowaways
9-10-90	Zeebrugge, Belgium	Tasman Star	440# cocaine	Rudder trunk
9-14-90	Zeebrugge, Belgium	Chios Faith	88# cocaine	Fiberglass box attached to hull
9-15-90	Turbo, Colombia	Atlantic Star	1210# cocaine	Rudder trunk

ILLEGAL DRUGS AFFIXED TO THE EXTERIOR OF VESSELS

Discoveries from 2-89 through 9-90 (cont.)

Date	Location	Vessel	Wt./Substance	Concealment
9-18-90	Bridgeport, CT	Potomac	145# cocaine	2 "torpedos" attached to stabilizer plate
9-20-90	Zeebrugge, Belgium	Cat Valiente	213# cocaine	"Torpedo" attached to hull
9-20-90	Savona, Italy	Pacific Star	440# cocaine	Rudder trunk
9-21-90	Colombo, Sri Lanka	Heinrich Hine	115# marijuana, 20# cocaine	"Torpedo" attached to hull

MAIL BUOY

More 'zero tolerance' harassment

The following is an open letter to the Coast Guard commandant in Washington, D.C.

Dear Sirs:

I hereby request, under the Freedom of Information and Privacy Acts, that I be provided a copy of all information (i.e.: records, attachments, enclosures, messages and files) that your office, or any office of the U.S. Coast Guard, including but not limited to the 5th Coast Guard District, Group Cape Hatteras and Station Oregon Inlet holds on either myself, Malcolm S. Daniels Jr., or the F/V Mr. Big, of which I am part owner and master.

I returned from a 55-day scalloping trip to my home port of Wanchese, N.C., on the morning of July 15, 1990, and was met at the dock by the Coast Guard (Group Cape Hatteras and Station Oregon Inlet personnel, including their drug dog), two North Carolina fisheries agents and three Dare County deputy sheriffs. They went through the boat with a fine-tooth comb looking for an alleged 1,000 lbs. of marijuana.

Nothing was found — not a seed, not a leaf, no evidence that marijuana or any other drug had ever been aboard. You can't even begin to understand my embarrassment, my frustration or my complete humiliation in front of my family, friends and crew.

I am tired of being harassed. This is the seventh time I have been boarded in the past two years, all without probable cause, and all boardings have produced absolutely nothing, not even an equipment violation. Please don't attempt to insult my intelligence by calling these repeated searches "safety boardings."

While I'm confident that you know my background, let me take this time to remind you that I retired from the Coast Guard as a Master Chief Boatswainsmate. During my career I was OIC of a WPB, numerous SAR stations, etc., so I feel I am well-qualified to know a routine safety boarding from a dedicated search.

Since my retirement, I have resumed my family's heritage of making my living from the sea. In the past, the commercial fisherman and the Coast Guard enjoyed a bond that truly made us "brothers of the sea." I am very sorry to say that we (the vast majority of the U.S. commercial fishing fleets) no longer feel we have a friend in the Coast Guard. We are continually being harassed under the guise of safety searches and other "routine boardings," and if we need assistance you are slow to come (if you come at all).

I would like to meet with Adm. Kime to discuss the Coast Guard's policy of "routine boardings" and other matters of interest to the commercial fishing fleet. I feel it would be appropriate that Congressman Jones and Sen. Helms of North Carolina also attend this meeting. I would be more than glad to set up this meeting in the Manteo/Wanchese, N.C., area, or area of your choice, including journeying to Washington, D.C. You could expect a large turnout of concerned fishermen.

Malcolm S. Daniels Jr.
Wanchese, N.C.

NATION

Over-the-counter cold remedies fool drug test lab

WASHINGTON (AP) — Officials of the National Institute on Drug Abuse are trying to find out why drug testing by a government-certified laboratory in North Carolina incorrectly identified five people as using illegal methamphetamines.

In each case, the lab's confirmatory tests confused the stimulant drug with high doses of over-the-counter cold medications containing ephedrine and other stimulants, said Dr. Joseph Autry, director of applied research at the government institute.

"This is one (type of) test in one lab for one drug, and it's the only time a false positive has happened in a NIDA-certified lab," Autry said. "We're taking it very seriously."

The case that brought the problem to the government's attention was that of a truck driver, who was removed from his job last July despite his vehement denials that he was falsely accused, officials said.

Officials did not identify him and said his case has resulted in litigation. He was tested under Transportation Department regulations requiring drug testing of employees in department-regulated industries. This testing must be done by one of the 57 labs certified by the institute.

The laboratory that conducted the tests was suspended last week while institute officials try to determine whether the problem was with the lab's testing or was inherent in the testing procedure itself, Autry said.

The testing problem could have broad repercussions, such as if the case were used by critics to try to block drug testing altogether, he said.

The lab was identified in the Federal Register as Roche Biomedical Laboratories of Research Triangle Park, N.C. Company officials did not return a telephone call for comment yesterday.

In the case of the truck driver, his vehement denial of methamphetamine use prompted more confirmatory testing by the lab. This further testing showed the previous result to have been incorrect.

When institute officials learned of the false positive, they checked the seven other samples that had tested positive for methamphetamines by Roche in recent months, and found five were negative, officials said.

NIDA officials alerted the 56 other laboratories the institute has certified for drug testing, and found that eight were using the same methamphetamine test Roche was. About 100 samples tested by these labs had come out positive, and all are being rechecked, Autry said. He expected results in about two weeks.

The testing procedure being questioned is used to confirm the presence of methamphetamines. Several other methods also are used and no false positives have been discovered with any of those, Autry said.

He said he did not know how many private testing laboratories may be using the method Roche was using.

Transportation Department testing regulations require that a worker who tests positive for methamphetamines, amphetamines, PCP, opiates, marijuana or cocaine be removed from a safety-sensitive job.

But if the finding is reversed, regulations do not require that the worker be reinstated; they only prevent the employer from refusing to reinstate the worker on the basis of the inaccurate test.

NEWS LOG

Maryland drug test law adds requirements

The state of Maryland has a substance abuse testing law which adds some considerations when implementing the federal law. It requires employers to use laboratories certified by the state of Maryland. If requested, the employer must inform the person being tested of the name and address of the laboratory which will analyze the specimen.

If a notice of a positive test result is received, the employer must provide a copy of the laboratory report to the person from whom the specimen was taken, a copy of the company's drug or substance policy and a notification of the company's intended action, if any. The employee can request an independent test of the same sample and the results must be provided to the employee and employer within 30 days.

Seaman's Family Is Barred From Suing for Future Pay

By a WALL STREET JOURNAL *Staff Reporter*

WASHINGTON—The Supreme Court ruled that the family of a seaman who was killed on board a ship may sue for damages, but may not recover damages for lost future earnings or for loss of companionship.

The 8-0 ruling was the first full decision of the court's term, which began Oct. 1. The decision was written by Justice Sandra O'Connor. Justice David Souter didn't take part because the case was argued before he joined the court.

The high court ruled in a lawsuit filed by the parents of a seaman who was stabbed to death by another crew member in 1984, while the vessel on which they worked was docked in Vancouver, Wash. The parents sued several companies, including **Apex Marine Corp.** and **Westchester Marine Shipping** Co., the operators of the ship, the M/V Archon. The lawsuit alleged that the companies failed to maintain a safe ship by hiring the dangerous crew member.

In September 1989, a federal appeals court in New Orleans upheld a jury award of $140,000 to the seaman's estate for his pain and suffering before he died and $7,800 to his mother for loss of her son's financial support. But the appeals court said federal law precludes the additional recovery of damages by the family for the wages the seaman would have earned during his lifetime or for the value of the family's loss of companionship.

Yesterday, the Supreme Court upheld the appeals court ruling, agreeing that federal maritime law prohibits the recovery of damages for lost future wages and lost companionship.

Tough regulations expected for incinerators

Following a recent meeting in Helsinki an additional annex to Marpol is expected.

AN ADDITIONAL annex to Marpol could be introduced following the meeting of the ad hoc working group on Air Pollution from Ships held in Helsinki last month, to deal with air pollution. This annex (Annex VI) could provide tough recommendations for the incineration of ship generated waste at sea.

At the start of the meeting, all the Baltic Sea states, excluding Denmark, were in favour of prohibiting incineration. Sweden, in particular, wanted to see it phased out by 1999. The sudden move from this commitment by all states at the meeting, resulted from the Danish submission of its document MP AIR 2/5/2.

This document contained information on developments in mobile plant suitable for on board installations for incineration of ship generated garbage, sludge and waste oil; it also included an investigation on the emission measurements from a multistage incinerator.

Capable of handling household wastes, plastics, oil rags and dunnage, the new plant, developed by Vesta, Denmark, is a multistage incinerator featuring a long flue gas retention time of 0.5 to 10 sec, and a combustion temperature of 850 to 1 100°C. According to Flemming Damsgaard, Vesta's sales manager, "the system is a new solution to incineration that makes no more air pollution than present diesel engines".

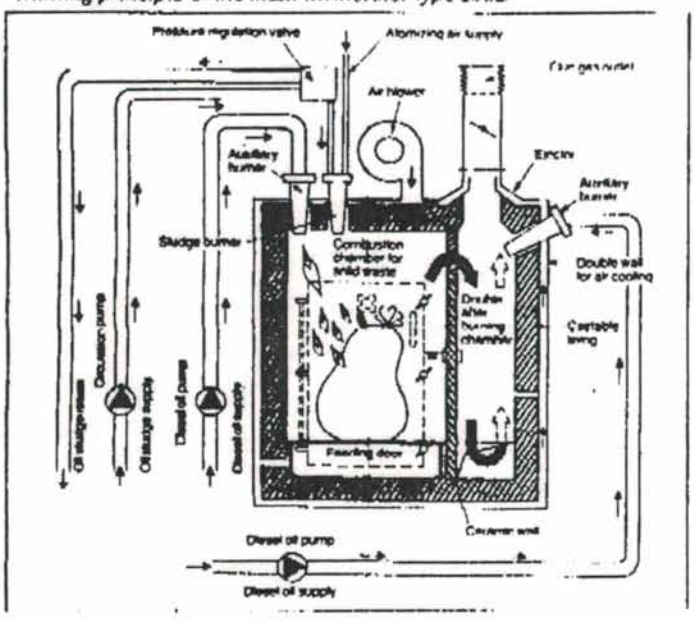
To prove the capabilities of the Maxi multistage incinerator, Vesta hired the Danish Boiler Owners Association to undertake an independent investigation of the system. The results of their research, summarized in the table, were submitted to the meeting.

Vesta argues that both methods of disposing of waste generated at sea, either by incineration or by bringing it ashore for further treatment, relies not on eliminating the pollution, but transferring it and minimizing the consequences realistically and economically. The company believes that if ships abstain from handling waste treatment at sea, then bringing the waste ashore to the harbour, which must accept the 'import', would present control and inspection problems, and infection/bacteriological risks. As a consequence, the receiving countries/harbours will set up import restrictions, and the waste delivery vessels will have to meet considerable taxes and duties, the company maintained. It continued that if, due to the bacteriological risks derived from collection of waste on board for a longer period of time, it is decided to minimize these risks by adding chlorine or a similar substance, this would lead to further pollution.

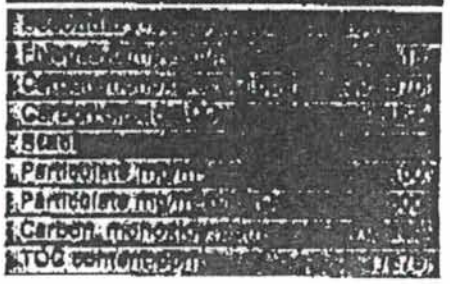
The company also stated that in addition to the bacteriological and odour aspects, a severe storage problem would arise on vessels at sea for long periods — a point raised by the Soviet Union at the last meeting of the Group.

According to Vesta, an important parameter in obtaining effective burnout of waste materials is to have constant energy and mass flow with a fairly constant composition. The quantity of available air in the furnace zone is another important parameter and is dependent on the calorific value of the fuel. Combustion air flow in the Vesta system is divided into two streams, primary and secondary air. Primary air is used in the combustion of the char particles in the main bed and is supplied through the bed, while secondary air is supplied after the bed area to react with all volatiles and lighter particles. In the case of burning wastes with poor calorific value where insufficient heat is produced to sustain combustion, a primary fuel burner is recommended.

Working principle of the Maxi incinerator type 255L



EMISSION MEASUREMENTS



During the combustion of waste, it is impossible to establish constant temperature in the furnace chamber, Vesta said. To destroy organic carbon, it is necessary to have a secondary combustion chamber after the primary furnace chamber, where flue gases have a residence time of one sec at 950°C. This secondary chamber has to be equipped with a burner. No feeding of waste into the incinerator should occur before the back end of the secondary combustion chamber has reached a temperature of not less than 850°C.

Provided these aspects are taken into consideration in the design and operation of the incinerator, waste can be disposed of at sea by incineration within present European Community emission standards, Vesta said.

Denmark has been asked to draft proposals for the next meeting of the Marine Environment Protection Committee of IMO being held in London in November. It is now the target of all the Baltic States to move for a new annex within Marpol that will include stringent levels for incineration.

Vesta is confident that the new annex will be approved. Without stringent regulations both approving of, and governing incineration at sea, Vesta holds a very weak position as its multistage unit costs between 15 to 20 per cent more than a single-stage incinerator. However, if Annex VI is introduced with suitably stringent limits for incinerators, Vesta and, it believes, the German company Formatchimie, will be the only two manufacturers able to meet the new limits. □

DAN NEWS

The Divers Alert Network has announced the availability of new products for divers/dive groups. One is a 20-minute VHS videotape entitled *A Buddy in Need*, which outlines the important basics of early diving accident management. The tape is for teaching new divers about safety information, or as a refresher for advanced divers. The cost of the tape is $20.

DAN has assembled an oxygen kit (shown at right) for dealing with scuba diving injuries. The kit contains a multifunction regulator, non-resuscitator demand valve with clear tru-fit mask, Laerdal pocket mask, non-rebreather mask, jumbo-D cylinder, valve-wrench/hand wheel with chain and waterproof case. The Oxygen Kit sells as a complete unit for $495 plus shipping.

DAN sells 1.2 mm Darlexx fabric skins manufactured by Sport Suits of Australia. These skins provide thermal protection while remaining neutrally buoyant. They are black with red sides and shoulders, and have DAN's logo and emergency telephone number on the left breast. The cost is $198.

To order, contact DAN at Duke University Medical Center, Box 3823, Durham NC 27710 or call 919/684-3542.

Bruce;

Enclosed is the information on the OmniTracs system. As stated during the RVOC meeting this system was designed for the Commercial Trucking industry but the company is expanding to the marine field. This system has been operational on the LONGHORN for the past eight months with no equipment failure during this time. I understand that Qualcomm is going to expand to a three satellite system thus increasing their range of coverage. Presently only using a single satellite with coverage for the U.S.. It advertises satellite communications where there is loran coverage. We have used it as far east as the Bahamas with no problems. Communication package consists of software for IBM 286/386 and all components for the ship for around $10,000. Institution would have to furnish the computer.

Message rates are about $45.00 per month, 10 cents per call and .02 of $.01 per message character, 2000 characters maximum per message.

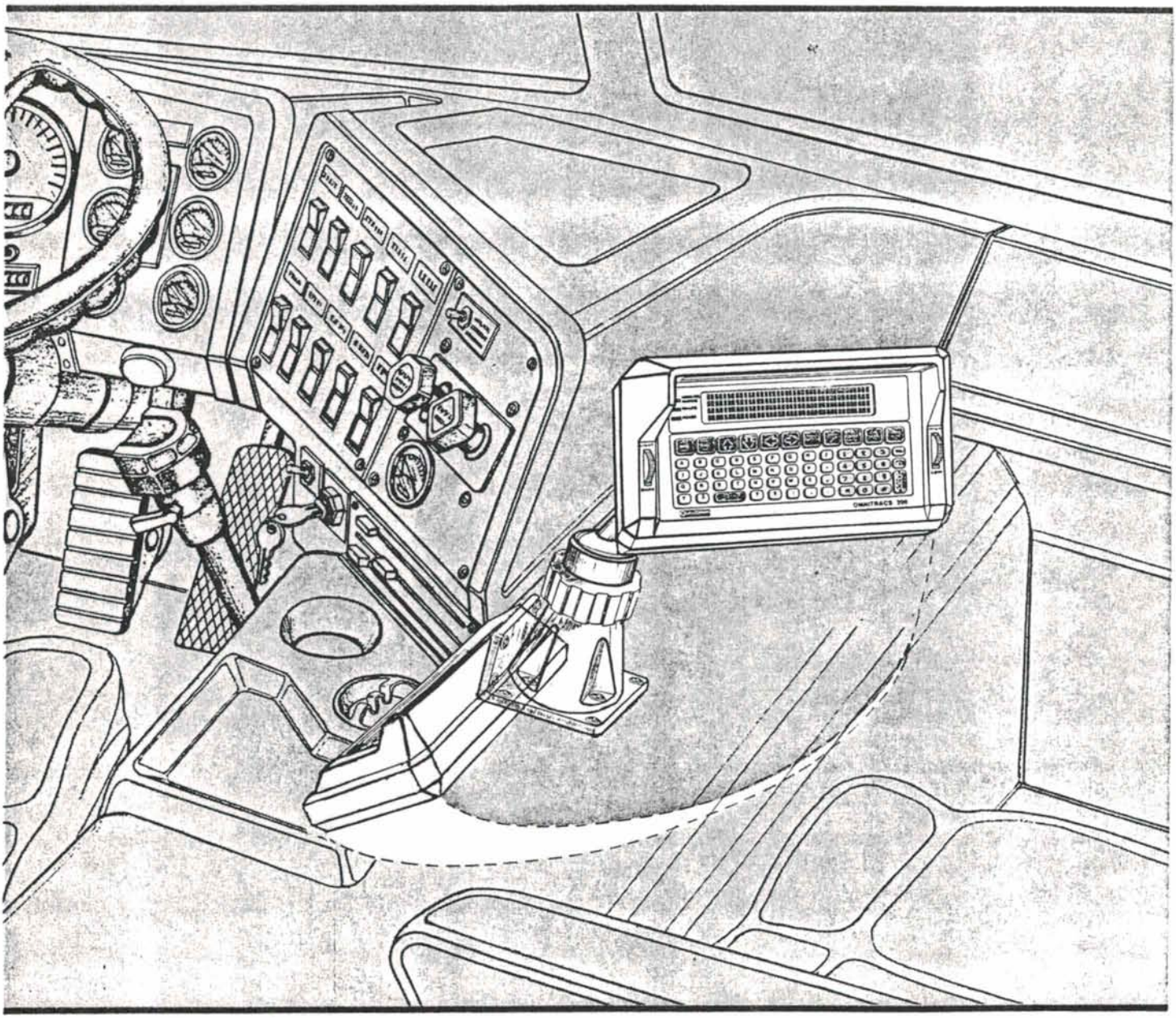
Being a small ship this system has filled a void in our communications between the ship and base station as SSB in our area has not always been reliable due to the amount of traffic and power generated by other SSB stations in the Gulf of Mexico. Small antenna size, the compactness of components and total cost should make this a communication package worth looking into for some of the smaller vessels that do travel out of their local area.

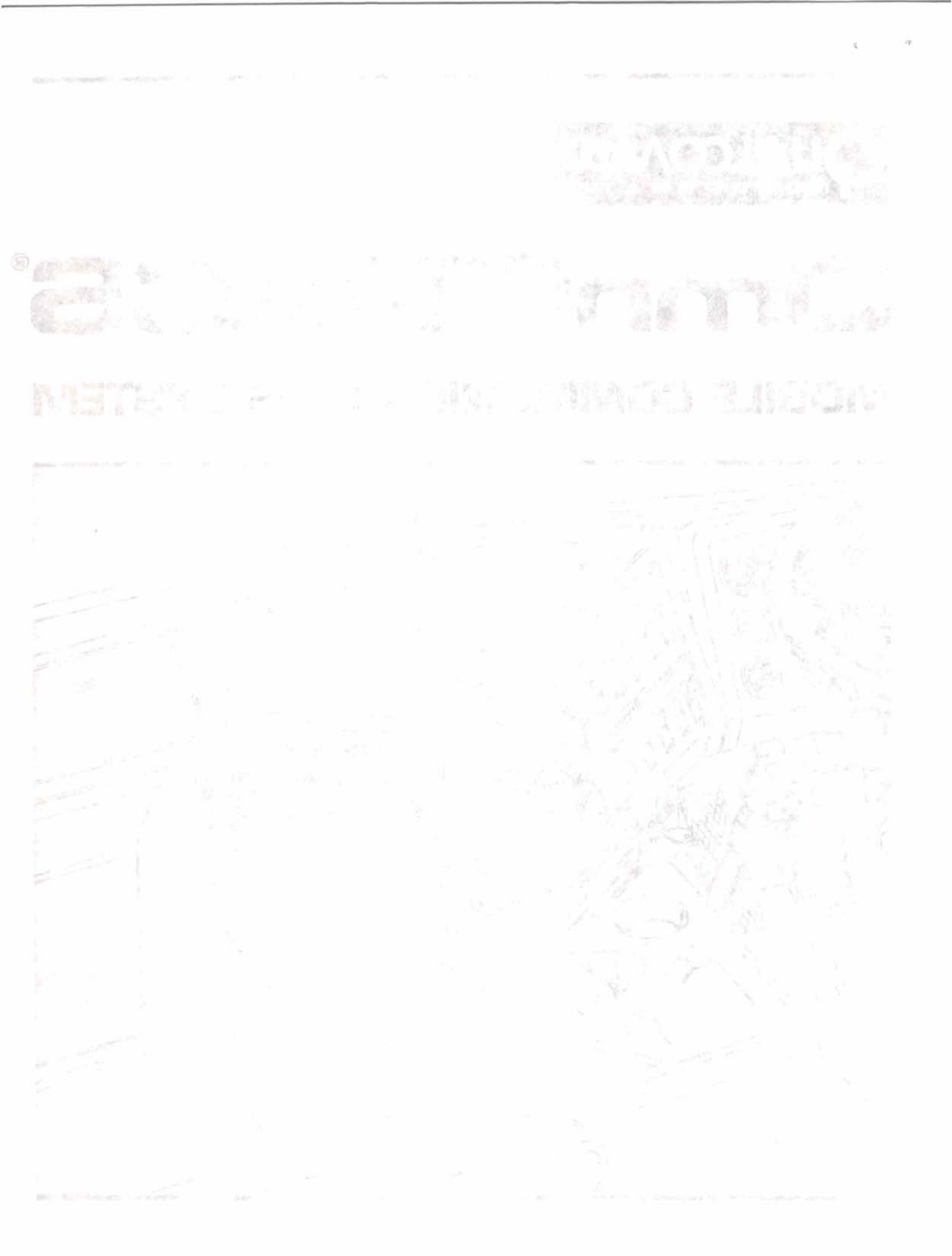
Don Gibson

QUALCOMM INCORPORATED

OmniTRACS®

MOBILE COMMUNICATIONS SYSTEM





COMPANY PROFILE

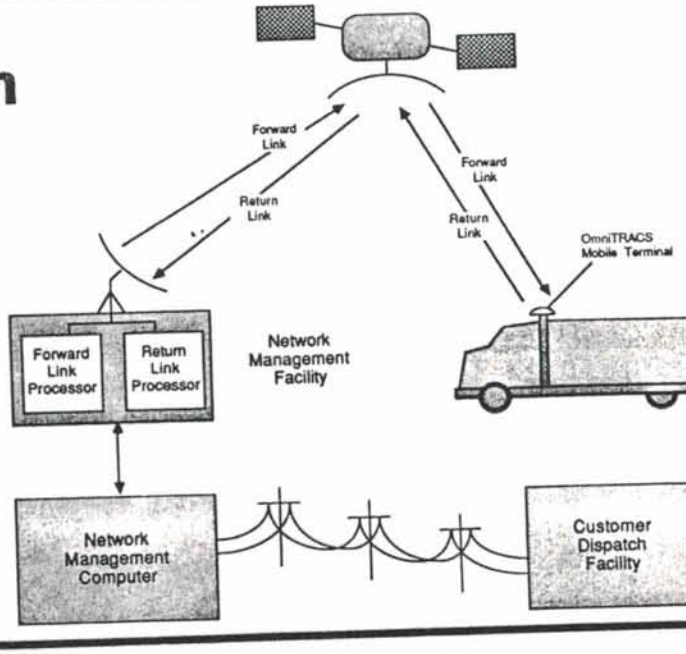
QUALCOMM Inc. is a San Diego based company, established as a systems company specializing in the design, analysis and manufacture of advanced communications systems. Two of the founders of QUALCOMM, Dr. Irwin M. Jacobs, President and Chief Executive Officer, and Dr. Andrew J. Viterbi, Chief Technical Officer, are internationally known in the communications community. QUALCOMM's technical and management team have worked together for years to implement innovative, time-critical programs from concept through development, design and production, and to provide full life-cycle support.

QUALCOMM began development of the OmniTRACS system in 1985. Production operations are in place to satisfy the anticipated high delivery demand for this exciting new mobile communication system.

The OmniTRACS® System

The OmniTRACS Mobile Communications System provides reliable, low cost, two way satellite communications to mobile units anywhere in the continental United States using existing Ku-band transponders. The OmniTRACS components consist of the OmniTRACS Mobile Terminal installed in each vehicle, and the OmniTRACS Network Management equipment at a central Network Management Facility.

Individual customer dispatch facilities connect to the OmniTRACS Network Management Facility to *send a message to* any mobile terminal or to *receive a message from* any mobile terminal in their fleet. Messages are sent using *existing* Ku-band satellite transponders.



OmniTRACS® Capabilities

Text Messages

- Network Management Facility to Mobile Terminal

The customer can send standard or emergency, free form or macro-encoded (predefined) text messages to any OmniTRACS terminal, or group of terminals, (by group name) within their fleet. Messages may be up to 2000 characters in length. The OmniTRACS Network Management Facility accepts the message or macro number from the customer equipment and relays (via satellite) the message to the vehicle. The Network Management Facility then waits for an acknowledgement (via satellite) from the vehicle confirming that the message was received correctly. If an acknowledgement is not received, the Network Management Facility automatically re-transmits the message and waits again for an acknowledgement according to a system wide retransmission algorithm.

- Mobile Terminal to Network Management Facility

Any mobile terminal can reply to a free form or macro-encoded text message, or initiate a free form text or macro-encoded (predefined) message to send to the Network Management Facility. Messages may be up to 2000 characters long. The vehicle waits for an acknowledgement from the Network Management Facility confirming that the message was received correctly at the Network Management Facility. If an acknowledgement is not received, the OmniTRACS terminal automatically retransmits the message and waits again for an acknowledgement according to a system wide retransmission algorithm. The customer equipment can then retrieve the message from the Network Management Facility at customer determined intervals.

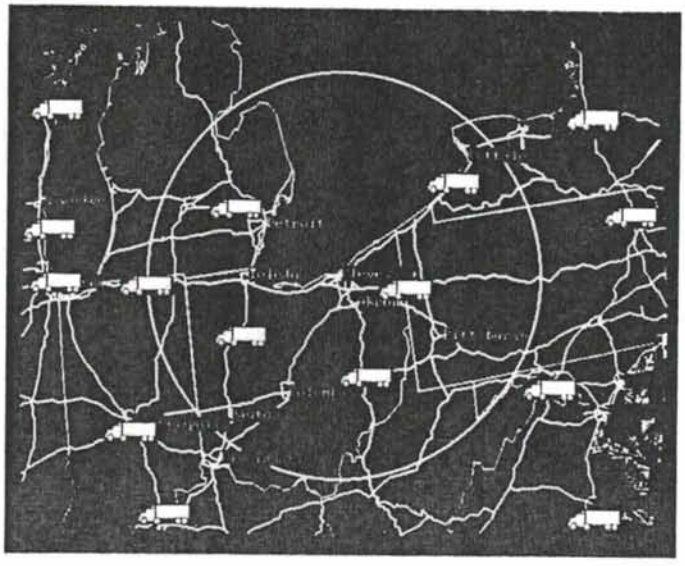
• Message Storage/Recall/Records

The OmniTRACS system allows the mobile unit operator to save and recall important message text. The mobile terminal has the capacity to store up to 256 total displayed lines of received messages. The mobile terminals and Network Management Facility equipment also keep records of all message traffic. Power outages at the mobile terminal do not destroy stored traffic records and message text.

Position Reporting

• Mobile Unit Position Reporting

With the self-contained LORAN receiver, each mobile terminal reports its position to the customer via the Return Link. The OmniTRACS system supports both customer initiated and automatic position reporting (automatic reporting is handled by including the position information in the acknowledgement to forward link messages).



The OmniTRACS on-screen mapping capability allows dispatchers to see vehicles plotted on detailed U.S. maps.

The OmniTRACS® Network Management Facility Equipment

• Hub Antenna

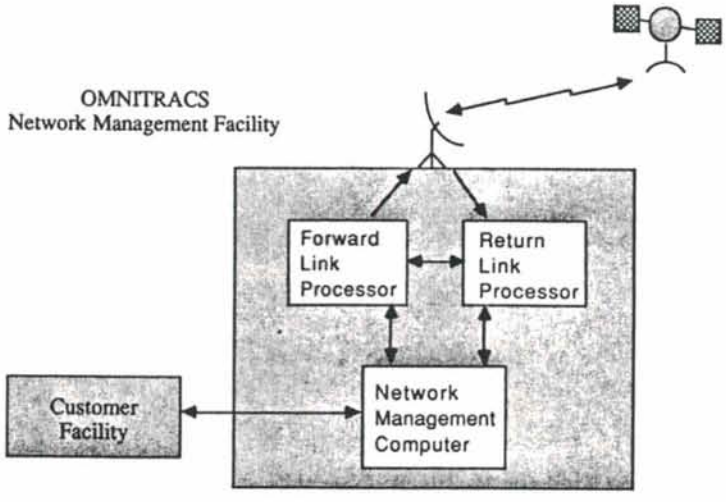
7.6 meter hub antenna located at NMF receives from and transmits to the mobile terminal via satellite.

• Network Management Computer

The Network Management Computer (NMC) controls all message traffic on the network. It keeps track of all messages sent or received by each customer and the time of delivery of every message. The Network Management Computer interfaces to the Return Link Processor, The Forward Link Processor, and is the OmniTRACS interface to the customer dispatch center.

• Forward Link Processor

The Forward Link Processor, located in the Network Management Facility, accepts customer messages from the NMC, reformats those messages and transmits them on the Forward Link. The Forward Link Processor provides the sequencing of several messages over the Forward Link channels. It controls the address and service channel timing. It also corrects the Forward Link for satellite frequency drift.



• Return Link Processor

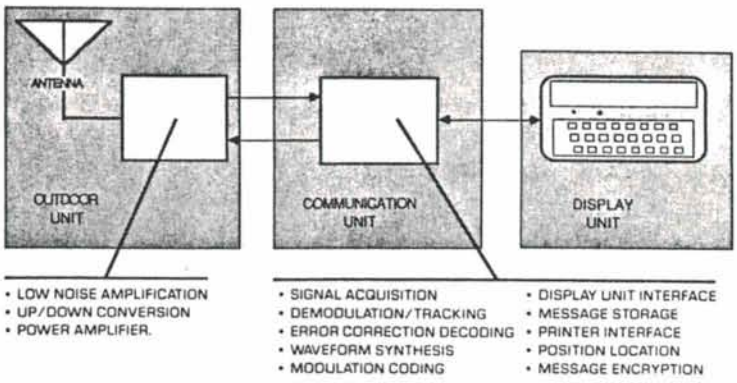
The Return Link Processor, located in the Network Management Facility, monitors the Return Link from the customer vehicles for messages and acknowledgements. The Return Link Processor reformats those messages and transmits them on to the NMC for delivery to the customer dispatch facility.

OmniTRACS Equipment®

• OmniTRACS Mobile Terminal

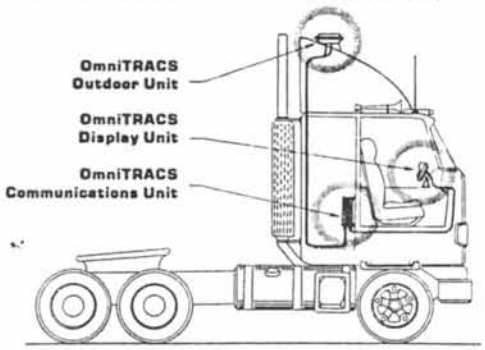
The OmniTRACS Mobile Terminal is located in each of the customer vehicles. The terminal monitors the link for either messages or commands from the Network Management Facility. The mobile terminal is capable of storing many messages according to their time of arrival at the OmniTRACS terminal.

The OmniTRACS Mobile Terminal consists of three units: the Outdoor Unit, the Communication Unit and the Display Unit. The OmniTRACS terminal can operate in a temperature range between -30° and 70°C.



• Outdoor Unit

The Outdoor Unit contains the antenna assembly and front-end electronics. The unit (including antenna) is approximately 11½" in diameter, 6¾" high and weighs approximately 11 lbs. The outdoor unit can be mounted on a vehicle roof or a mast (for a truck cab).



• Communication Unit

The Communication Unit contains an analog section, digital electronics and the LORAN receiver which are contained on four circuit card assemblies (CCAs). The approximate dimensions of the Communication Unit are 12¾" x 9¼" x 4½" and it weighs 16 lbs. It can be mounted anywhere in the vehicle since it does not require operator access.

• Display Unit

The Display Unit consists of a 40 character by four line display and an ABCD or QWERTY keyboard, with several function keys available for preprogrammed user functions. The display contains indicators for message waiting and satellite signal. The display unit also provides a *maintenance mode* for in-field troubleshooting and mobile unit initialization. The display unit is 7½" x 11½" x 2¾" and can be located on the dashboard or any other convenient location.

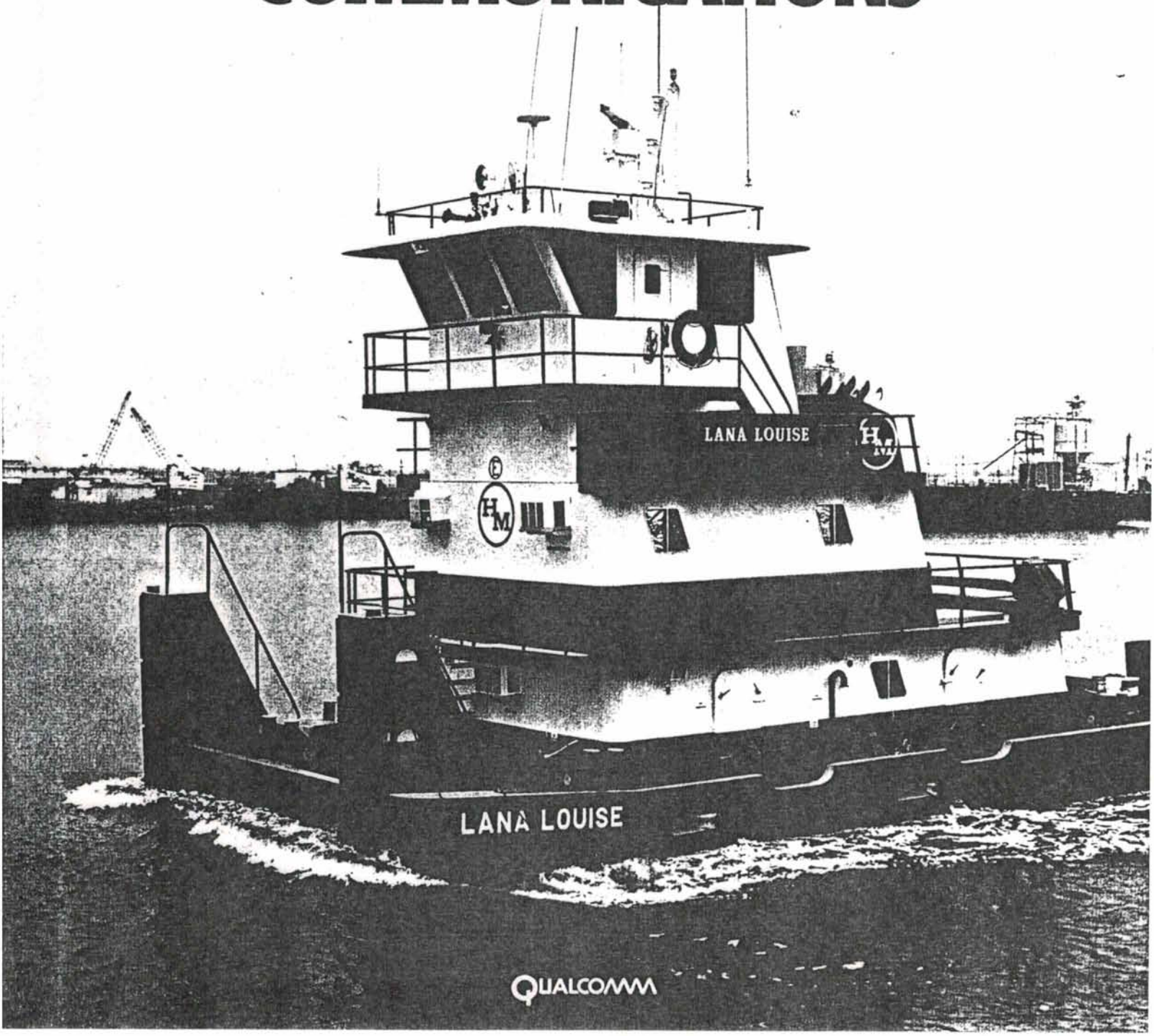
QUALCOMM INCORPORATED

10555 Sorrento Valley Road
San Diego, CA 92121
(619) 587-1121

3-89

For further information on the OmniTRACS system contact Qualcomm Incorporated by writing to 10555 Sorrento Valley Road, San Diego, CA 92121, Attn: Tom Bernard, or call (619) 587-1121.

OmniTRACS MARITIME COMMUNICATIONS



QUALCOMM

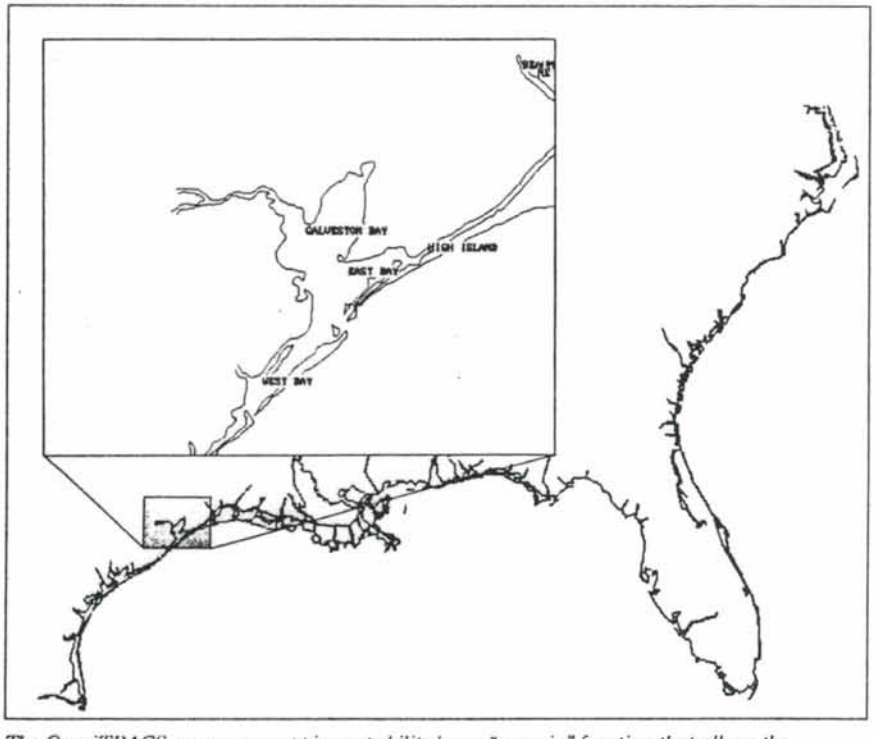
"OmniTRACS uses advanced satellite technology to provide private, secure communications to and from all maritime vessels."

OmniTRACS® is an interactive communications network linking every vessel in your fleet to the operations center. Messages and positioning data are privately beamed, via satellite, through our Network Management Center (NMC) in San Diego to the operations control facility via dedicated or controlled-access phone line, microwave link, VSAT, etc.

OmniTRACS uses existing Ku-band transponders, and is the first commercial system in the world to provide constant two-way messaging and positioning anywhere within the satellite pattern on land or water – regardless of weather, location, or conditions at sea.

Through the OmniTRACS shipboard terminal, latitude/longitude log reports, pre-formatted or free-form messages, estimated time of arrival (ETA), and more are readily available to the base station. Depending on the need, the OmniTRACS system can be upgraded with intelligent interfaces that can monitor and control other parameters of the vessel, such as speed, refrigerated cargo temperatures, engine identification and RPM, fuel consumption, and more.

The shore-side base operations facility can communicate around the clock with any shipboard terminal in their fleet through the NMC. Data can be periodically collected from the NMC at the base station at preset intervals without any human interface whatsoever – providing near real time information to shippers and vessel operators. On-demand exchange of message data between the base station and the NMC is also available.



The OmniTRACS on-screen mapping capability has a "zoom-in" function that allows the operations control center to see and monitor progress of each vessel in the fleet, if desired.

OmniTRACS SERVES ALL MARINE APPLICATIONS

Oil and Gas Operations

OmniTRACS provides necessary private communications and position fixing for tugs, barges, helicopters, and offshore operations support craft. By monitoring position with respect to inland waterway mile markers, precise ETAs for barge operations can be determined. In addition to normal messaging, two-way communications provide tug fleet operators access to fuel management data. Base operations can analyze this data for tug boat captains, ensuring operations at maximum fuel efficiency.

In addition, OmniTRACS provides reliable remote monitoring for Supervision Control and Data Acquisition (SCADA) applications. It incorporates a quiet mode to conserve power during periods between data transmission – an important feature when integrated with a solar cell/battery power supply. Pipeline monitoring is another excellent application for OmniTRACS.

Geophysical Operations

OmniTRACS readily adapts to the precise positioning requirements of the geophysical industry. Differential GPS correction data can be transmitted directly to an on-board computer to support

such tasks as laying pipelines, locating wellheads, determining drilling site locations and geophysical mapping.

Yachting

Currently available ship to shore communications do not provide the reliability and privacy required by the serious sailor or motor boat operator. OmniTRACS ensures that your confidential messages are kept just that – confidential. Unlike other methods of transmission, satellite communications thwart interruption or interception.

OmniTRACS ensures boater safety by providing on-shore, independent, continuous position determination and historical record keeping with every message sent. In addition, two-way communications enable sailors or boat operators to convey the nature of the emergency.

OmniTRACS system hardware is comprised of three components. They are the sealed aerodynamic dome that houses the antenna; the communications unit which is ruggedized for the marine environment; and the "user-friendly" keyboard/display unit.

"When emergencies strike, OmniTRACS not only sends the distress message but it provides pinpoint location as well."

Fishing Fleets

OmniTRACS provides secure communications, without fear of being overheard. The vessel's position will not be exposed to those without a need to know. However, this information can be made readily available in case of emergency for rescue and/or medical support operations. For safety, shore-side service scheduling and fishing management control, OmniTRACS is unsurpassed.

And for fleet operators for which a central operations terminal would be neither practical nor cost efficient, confidential independent communications service networks can handle all communications and position information on a 24-hour basis. Services provided by these networks include: emergency alerts, fish market prices, maritime bulletins, and integrated FAX services.

HARDWARE OVERVIEW

The OmniTRACS shipboard system includes a ruggedized portable keyboard/display terminal, a communications unit that houses the electronics, processor, boards and power supply, and a continuously tracking antenna in a sealed unit.

MESSAGING

With every vessel in your fleet sending and receiving messages, your operations control facility literally has an eye-in-the-sky view of its entire operation.

Armed with information never before available, these centers can expertly coordinate emergency situations, as required. If a vessel encounters an emergency, the control facility can instantaneously and simultaneously advise Coast Guard, and other nearby vessels, of the exact problem and pinpoint location of the troubled vessel.

OmniTRACS allows the vessel captain to save and recall important message text. The vessel terminal has the capacity to store up to 256 total displayed lines of messages. Both shipboard terminals and NMC equipment record all message traffic. Traffic records and message text are protected from power failure at the shipboard terminal.

POSITION REPORTING

OmniTRACS features satellite-based position determination. With accuracies exceeding those of Loran-C, QUALCOMM's Automatic Satellite Position Reporting (QASPR) is the first fully-operational, 24-hour-a-day satellite-based positioning and messaging system.

At the touch of a button, the base control facility can privately determine the specific location, location history, and distance from landmarks of any vessel.

OmniTRACS' on-screen mapping capability allows the base operation facility to privately monitor the position of their vessels – around the clock.

TEXT MESSAGES

With OmniTRACS you can send standard or emergency, free-form or macro-encoded (predefined) text messages to any OmniTRACS terminal, or group of terminals, (by group name) within the fleet. Messages may be up to 1,900 characters in length.

OmniTRACS' NMC accepts the message or macro number from the fleet's operations control facility and relays (via satellite) the message to the vessel. The NMC then waits for an acknowledgement from the vessel confirming that the message was received correctly.

Any shipboard terminal can reply to a free-form or macro-encoded text message, or initiate a free-form text or macro-encoded message to send to the NMC. These return messages may also be up to 1,900 characters long. The vessel waits for an acknowledgement from the NMC confirming that the message was received correctly at the NMC.

If an acknowledgement is not received, the OmniTRACS terminal automatically re-transmits the message and waits again for an acknowledgement, according to a system-wide re-transmission algorithm.

The base control facility retrieves the message from the NMC at user-defined intervals.

DESIGNED BY THE LEADERS

QUALCOMM is shorthand for "QUALity COMMunications." In our many years of gathering experience in the satellite communications business, we've learned how important quality is. That's why it's built into our name – and into every OmniTRACS unit.

But the best test of product reliability is how it performs on the job. Thousands and thousands of drivers in the trucking industry have already logged millions of miles using OmniTRACS, and they are coming back for more. Shipboard users can now reap the benefits of a proven technology fully tested by the trucking industry.

To learn more about OmniTRACS, call 800-541-7490 (in CA call 619-587-1121 Ext. 325), or write: QUALCOMM, Inc., 10555 Sorrento Valley Road, San Diego, CA 92121.

SPECIFICATIONS

OUTDOOR UNIT (ANTENNA UNIT)

Sealed Lexan Radome with Automatically Tracking Horn Antenna.

Diameter	11.5″
Height	6.75″
Weight	11 lbs.

Radiated Frequency: Ku Band

COMMUNICATIONS UNIT

Dimensions	12.75″ x 9.25 ″ x 4.5″
Weight	16 lbs.

Maximum Message Size: 1900 message characters

Memory: Previous 99 messages or 256 lines

Temperature Range: -30° C to 70° C

Operating Voltage: +12 vdc or +24 vdc (AC operation is optional)

Return Message Buffer: up to 3

Construction: ruggedized aluminum with heat transfer fins

Communications interfaces: Two RS 232, One SAE J 1708

DISPLAY UNIT

Dimensions	11.5″ x 7.5″ x 2.75″
Weight	2.5 lb.

Display: Backlit LCD; 4 lines, 40 Characters/line

Keyboard: 69 key Standard Typewriter Function keys

Key Pad: Elastomeric type splash resistant against contaminants and water

Audible alert and visual indicator for message waiting

Call-up auxiliary displays for in-field trouble-shooting

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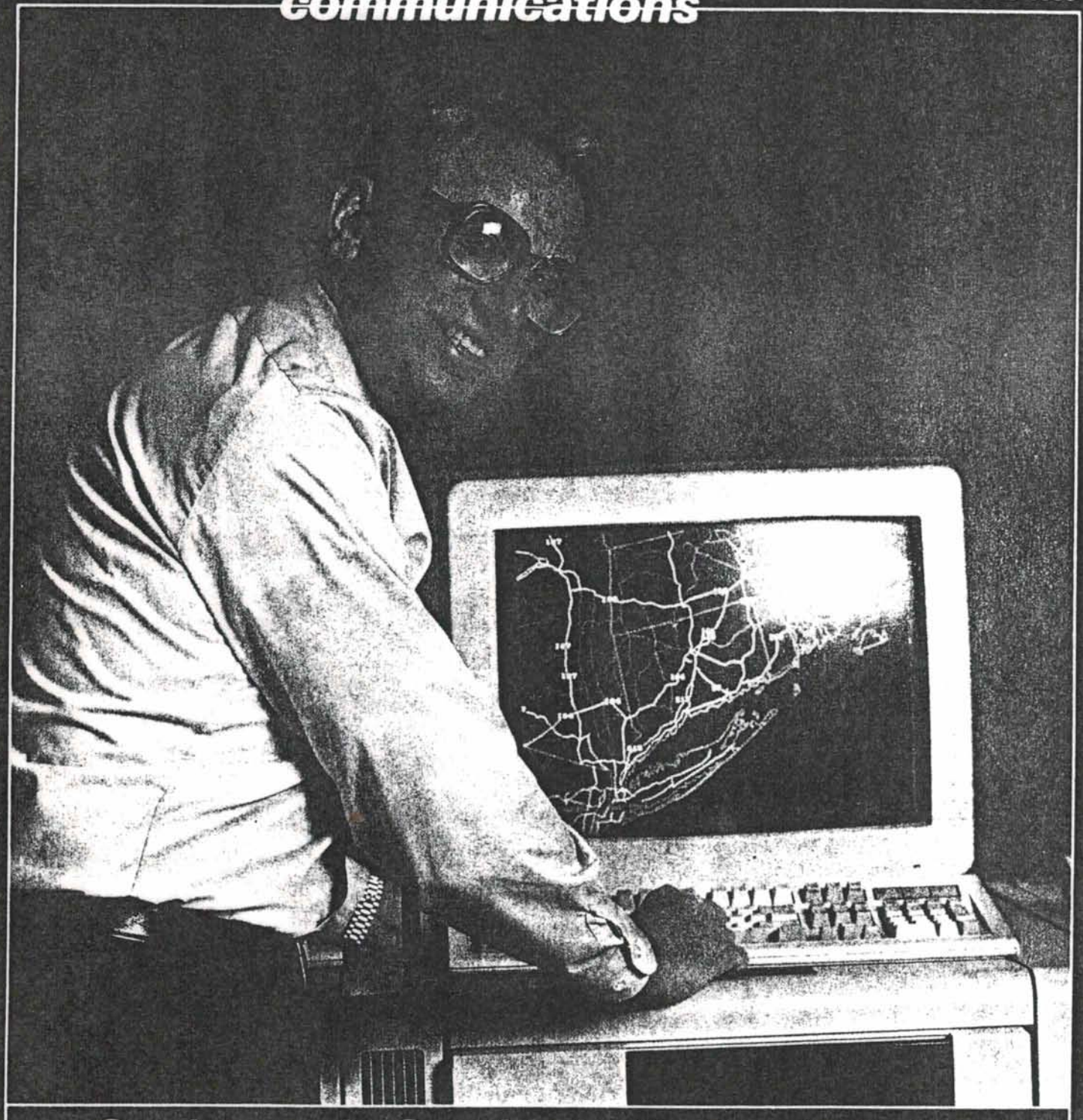
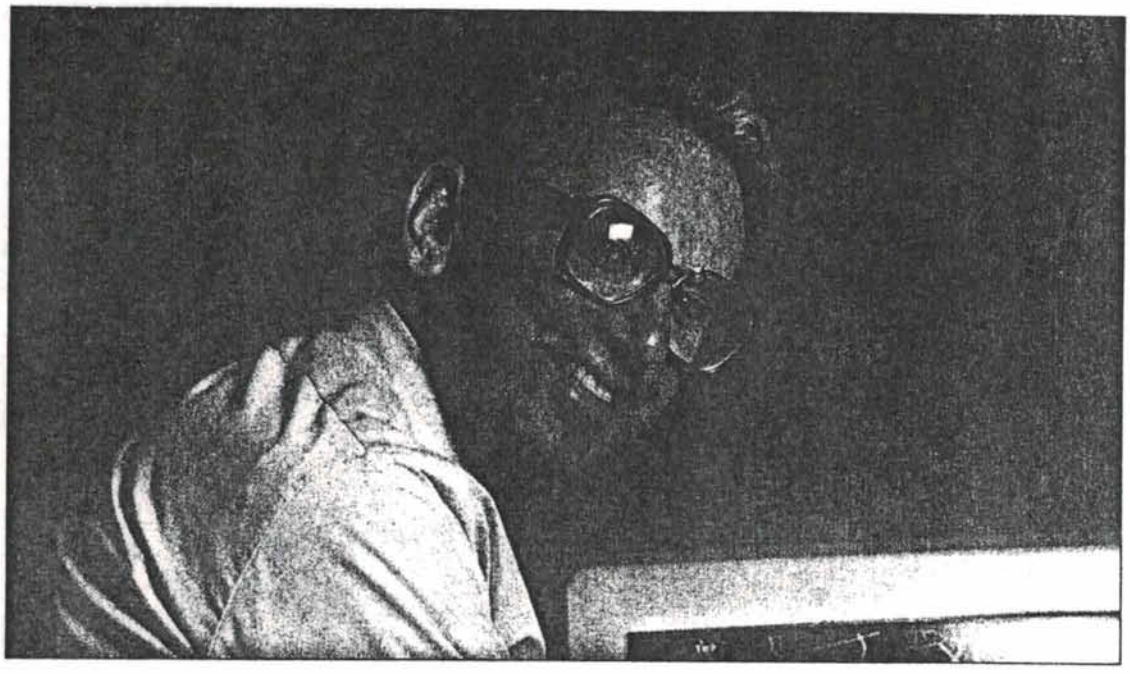


Qualcomm's Gambit in Ku-Band Mobile

Saving Remote Sensing • Remote Broadcasts From The U.S.

Disaster Recovery • Satellite Performance Reference Chart



Mobile at Ku Band Paying Off

While others still talk about mobile satellite technology, Qualcomm's decision to do something about it seems to be working.

By Tom Kerver

"Everybody sets out to do something, and everybody does something. But no one does what he sets out to do." —George Moore

For nearly a decade, a variety of entrepreneurial and other enterprises, principally in the United States and Europe, have been trying to do something: provide sophisticated mobile communications to individual and institutional users in a variety of modes (most particularly voice and/or data) and under a variety of conditions (on land, on water and in the air).

QUALCOMM president, Irwin M. Jacobs. Photo by Ron James.

Satellite technology has been an obvious beneficiary of these efforts, since satellites are ideally suited to connect moving objects together. Thus the generic name for what many have been trying to do has become known as mobile satellite services.

Few of those who initially envisioned some sort of mobile satellite service are today doing what they set out to do. Financial, regulatory and technological problems have plagued entrepreneurial start up companies as well as existing institutions that decided to explore opportunities in the mobile satellite field. Much of that, however, is history. Today new, and previously unforeseen, ways of achieving satellite-supported mobile communications are beginning to make an impact on both sides of the Atlantic Ocean. The subject is discussed at international conferences, and radio frequencies have been allocated at international regulatory meetings.

In July an organization that hopes to play a key role in providing future mobile satellite services, the International Maritime Satellite Organization (Inmarsat) will host a London conference which Inmarsat director general Olof Lundberg has called "a gathering of the cream of the mobile satellite communications crop." Inmarsat plans to bring together an impressive array of telecommunication and mobile satellite figures for this conference.

Yet one name was conspicuously missing from the roster of speakers first announced by Inmarsat. That name is Dr. Irwin M. Jacobs, co-founder and president of what is probably—at least today—one of the two most active companies providing two-way mobile satellite services. The other, of course, is Geostar.

The company, Qualcomm Inc. of San Diego, Calif., currently has contracts with more than 50 U.S. trucking companies either to provide two-way data communications to those companies or to work with them on an evaluation basis. In addition, the U.S. Department of Energy has contracted to use Qualcomm's OmniTracs system. The company has received U.S. government authorization for 21,600 mobile satellite tracking units and soon expects to be requesting additional authorizations, principally because its existing order base for more than 7,000 units is growing at a pace that will exhaust the initial allocation rather quickly. To maintain that pace, it will soon open a facility that will enable it to double the output of OmniTracs units.

Omission Corrected

Inmarsat's omission of Jacobs from its conference roster has apparently been corrected. ("I believe I'm now scheduled to be there," Jacobs says.) But, in a way, the initial oversight is not surprising. Consider another similar example. A new book, titled *The Market for Mobile Satellite Communications*, contains 10 chapters whose purpose is to provide a comprehensive overview of the mobile satellite systems currently under development throughout the world. Yet none of these chapters focuses on Qualcomm or its OmniTracs system. But Jacobs doesn't seem to be concerned. As he puts it, "We're too busy expanding our customer base and improving our service to pay much attention to those things."

Jacobs and Qualcomm co-founder Dr. Andrew J. Viterbi (the company's chief technical officer) have reputations that are widely recognized and highly respected in the satellite industry as well as other areas of telecommunications-related technology. The two co-founded the Linkabit Corp., which hooked up with the M/A-Com organization in 1980 and pioneered the development of commercial VSAT technology, subsequently evolving into Hughes Network Systems. Together they developed the VideoCipher encryption technology that today is the accepted standard for use by satellite-delivered entertainment and information networks. For their work in development of technologies adopted by the U.S. Air Force, they have been jointly honored by the American Institute of Aeronautics and Astronautics.

In 1985, as Jacobs remembers it, the entrepreneurial impulse seized them again. They left M/A-Com (where Jacobs was on the board of directors) and founded Qualcomm. "Our focus," Jacobs recalls, "was a bit unusual. We were actually looking for government work, and we figured that we'd first find out what government customers wanted and then develop those products for them." The search led almost immediately to the emerging mobile satellite technologies. "VSAT technology was by then established, and DBS opportunities seemed to be going nowhere. The other obvious market was using satellites for mobile applications, but we weren't certain at the time how that could best be accomplished," Jacobs recalls.

Right from the start Jacobs and Viterbi were intrigued with the idea of using existing Ku-band satellite capacity rather than the L-band frequencies that most everyone else was talking about. "We obtained a development contract from OmniNet, which—at the time—had an RDSS (radio determination satellite service) license. Out of that contract came the development of an omnidirectional Ku antenna for use on trucks. But it wasn't the answer," Jacobs adds, "because a return link in L band was required to make it work. We encountered a lot of technical problems, and some of the business relationships became strained."

About the same time, OmniNet began to experience financial problems. But the infusion of new capital into OmniNet brought with it some new ideas. "The new OmniNet investors asked us to take a serious look at a two-way system that confined itself to the Ku band, where substantial new investment in more satellites wouldn't be required. Our challenge was to develop an inexpensive, directive Ku antenna which would use the Ku frequencies on a secondary basis so as not to interfere with the primary users," Jacobs recalls.

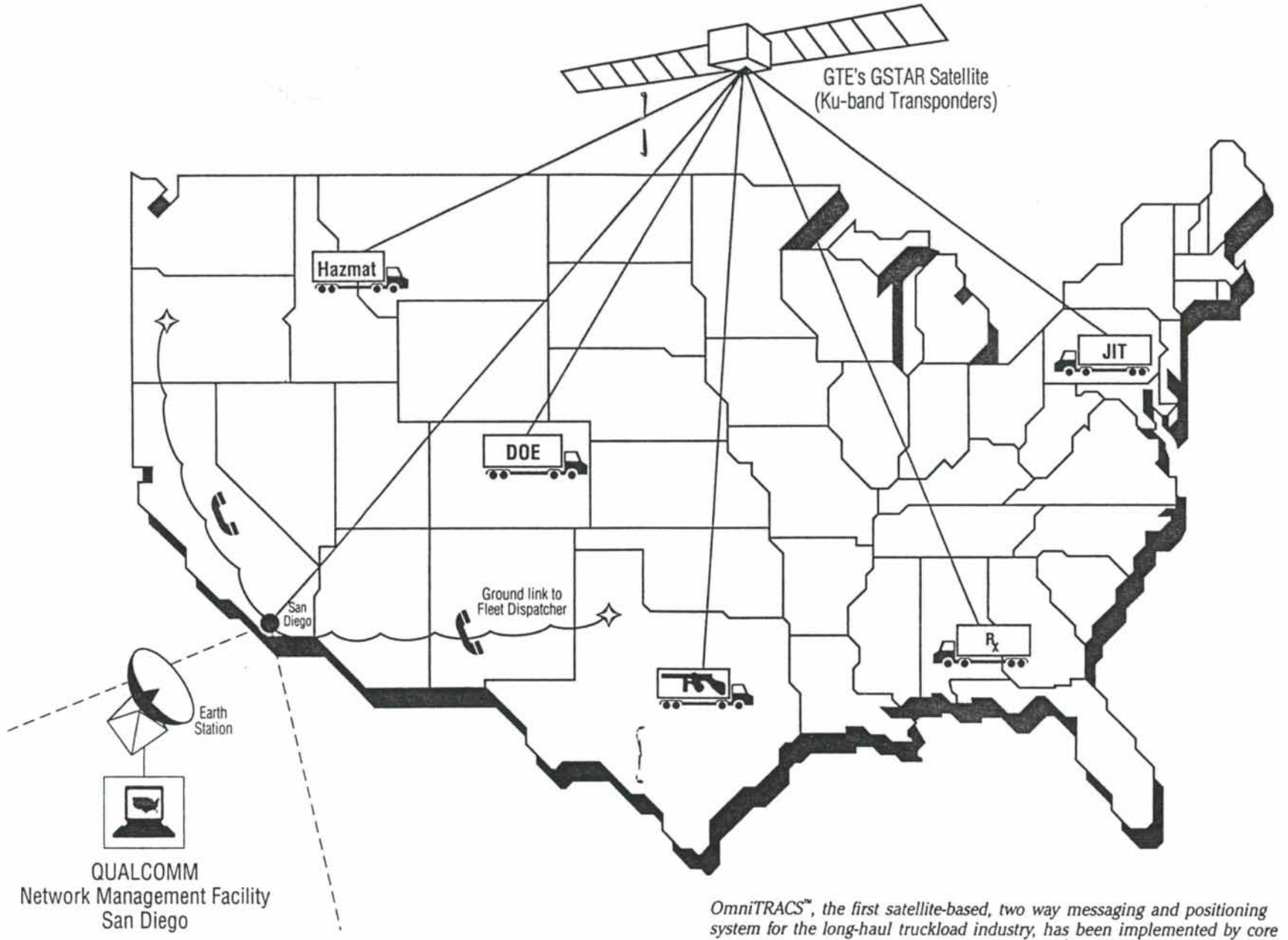
Research Begins

In May 1987 the research began, and by the following January the technology was ready to be demonstrated. "We applied to the Federal Communications Commission for 21,600 units, all relying totally on existing Ku capacity (two GTE Gstar I transponders), and we began to develop and manufacture the units. Under the concept we had at the time, OmniNet would remain a separate entity and would market the product," Jacobs says.

That organizational structure changed over the ensuing months of 1988. As computer simulation and laboratory testing gave way to actual road tests, it became quickly apparent that the marketing and manufacturing functions needed to be unified under a single umbrella. The consequence was that, last summer, Qualcomm acquired the OmniTracs product rights and, along with that acquisition, hired some of OmniNet's people, including its founder, Allen Salmasi. "We did not, however, acquire OmniNet," Jacobs stresses.

As far as Jacobs was concerned, Qualcomm's principal competition was (and is) Geostar Corp. "They had name recognition and had been marketing to trucking companies and other transporters long before we began the move to Ku. To offset that advantage, we had to move rapidly once we were convinced that we had what we believed to be a superior product. We joined the American Trucking Association and became highly visible at trade shows and other events that attracted trucking executives. They became the

OmniTRACS™ Two-Way Mobile Satellite Communications System



OmniTRACS™, the first satellite-based, two way messaging and positioning system for the long-haul truckload industry, has been implemented by core carriers operating in several key sectors of the industry. These include the "just-in-time" (JIT) category, munitions haulers, high-value haulers such as those that haul pharmaceuticals, and hazardous materials haulers including fleets that transport nuclear waste for the Department of Energy (DOE).

focus of our attention because there are approximately 500,000 tractors operating in the regular route truckload business."

As important as marketing was, it was the product itself that counted most to Jacobs. "We had a highly reliable two-way system, and Geostar didn't. The trucking companies wanted a two-way communications capability. So, all of a sudden, that gave us an edge," Jacobs says.

Contracts Received

Qualcomm quickly capitalized on that advantage. In November of last year, even while the application to the FCC was still pending, Qualcomm got its first major trucking company contract—and a whopper it was. Schneider National Inc. of Green Bay, Wisc., ordered 5,000 OmniTracs terminals to outfit its entire fleet during 1989.

(Jacobs adds, incidentally, that FCC approval took 14 months principally because of the corporate restructuring that occurred while the application was pending. "When we go back to the FCC for additional licenses, we have no reason to believe that approval won't be very quick. Our main obligation is to demonstrate that we haven't interfered with anyone's primary use of the Ku frequencies that we are using on a secondary basis. We clearly have demonstrated that. As more and more units go into the field, that fact will become increasingly apparent.")

On the heels of the Schneider contract came a much smaller, but equally important, one. It was the kind of deal that tends to legitimize everything else because the order emanated from an agency of the U.S. government, the Department of Energy. "They will put the system on all their vehicles that haul nuclear waste materials," Jacobs says.

In the wake of these two important initial contracts, other trucking companies began to follow suit. Riss International of Kansas City placed a $1.5 million order, which was quickly followed by an order for 1,000 terminals (value about $4.1 million) from Roberts Express Inc. of Ohio. A similar sized contract was signed with Munson Transportation of Illinois, and Qualcomm was quickly on its way.

These kinds of contracts, says securities analyst John Larkin of Alex Brown & Sons, could tend to force competing transportation haulers to adopt some kind of mobile communications system. "If satellite-based tracking systems (or alternative meteor-burst technologies) become a requirement to maintain a carrier's status as a core carrier, then carriers will be effectively forced to install these systems whether they can be economically justified or not," Larkin says, adding that "the systems will be necessary just to play the game." Larkin speculates that trucking companies such as J.B. Hunt Transport, Werner Enterprises and M.S. Carriers may soon join the parade. "Our guess," he says, "is that most of the publicly traded carriers will be adopting some form of mobile communications system within the next several years to better meet customer requirements."

Support Will Accelerate

Peer pressure is not the only factor that will accelerate the move by trucking companies to adopt mobile satellite technology, such as Qualcomm and Geostar are marketing. Jacobs believes there are at least three reasons for haulers to support this innovation: "First, companies will welcome the cost-saving efficiencies achieved through satellite-delivered compilation of data; second, certain kinds of high value, critical or hazardous cargo can be monitored at all times, and that not only makes shippers more comfortable, it makes many of their customers—such as the automotive industry—much happier; and third, our tests have clearly demonstrated that drivers like it because of the added safety and convenience it offers them, and because it helps speed them to their final destination."

Each trucking customer has proprietary requirements, according to Jacobs, and the Qualcomm system allows for that. For example, preformatted, computer-generated messages are easily adaptable to the system. Transmissions are processed through Qualcomm's control center in San Diego. "We monitor only the signals, not the content, in order to make sure everything is working properly. We maintain a toll-free number where customers can reach us around the clock. If anything goes wrong—and so far nothing has—we're immediately prepared to respond and correct the problem."

New Technology

While all messages from the mobile fleet go by satellite, the backhaul links between Qualcomm and the customer control centers still use a variety of transmission schemes, including terrestrial microwave. That, Jacobs says, will change once Qualcomm has its new QuSat technology in place.

The QuSat (Qualcomm Ultra Small Aperture Terminal—as in VSAT) will have a variety of applications, one of which will be linking the Qualcomm control center with the computers at the customer dispatch or control centers, explains Jacobs. "The QuSat will provide the means of linking their dispatch computers with our control center as well as with the alternate control center that we will be establishing in case some kind of natural disaster such as an earthquake should hit San Diego."

QuSat development plans are more ambitious than merely using the small (varying diameters from .3 meters up to 1.2 meters, depending on the application) terminals for backhaul purposes. For example, Jacobs talks excitedly about using the terminals as a data link between trucking companies and their customers. "In addition," he adds, "there are a number of other fixed applications which lend themselves to the use of these terminals. For example, they are ideally suited for supervisory control and data acquisition (SCADA), and they have excellent potential for use in point-of-sale-transactions."

The company is working on other projects as well, and has even had some successful spinoff from its still emerging projects. For example,

Viterbi and his associates developed an integrated circuit computer chip for use in the OmniTracs system that, Jacobs says, has other applications beyond mobile satellites. "Last year we did about $1 million in outside business from the sale of this chip," Jacobs reports.

"Our strategy has been, and will continue to be, to sense opportunities and respond quickly to them. If they don't prove promising, we'll quickly abandon them. That's where an entrepreneurial enterprise such as ours has a distinct advantage. We can move and shift directions rapidly," Jacobs explains. Right now, for example, in conjunction with Hughes Communications, the company is exploring Code Division Multiple Access (CDMA) protocols, which Jacobs and Viterbi believe to be superior to the more commonly accepted TDMA standard used in almost all satellite transmissions. "We think that, by making more efficient use of the bandwidth, CDMA will increase capacity by as much as 200 or even 300 percent," Jacobs predicts. To date, he adds, in the tests that have jointly been conducted with Hughes, those predictions appear to be proving correct.

Enormous Potential

But, before Jacobs and Viterbi become too deeply involved in moving from the mobile to the fixed environment, they see an enormous development potential in mobile. The U.S. trucking companies, Jacobs says, are very important initial customers. Still, they aren't an exclusive market for Qualcomm's OmniTracs system. "Soon," says Jacobs, "we'll be announcing a significant contract with a major railroad. And we'll also be announcing a contract with an important shipping company in Canada."

Of perhaps even greater significance is the fact that Qualcomm has been exploring the European market and may soon be announcing some contracts there. Should that happen, Qualcomm would be competing not only with Geostar but also with Inmarsat, which hopes that many European trucking firms will adopt its Standard C technology. Qualcomm's strategy in Europe has been to work in conjunction with Eutelsat, thus offsetting the multinational advantage that Inmarsat would otherwise have. "We don't expect to market OmniTracs in Europe as an American company. We'll approach each nation on a joint venture basis. Sometimes our partner will be the PTT, sometimes it will be a company based in the nation we hope to serve."

"...carriers will be effectively forced to install these systems whether they can be economically justified or not."

Larkin

Jacobs adds that he's particularly optimistic about gaining entry into the European marketplace for two reasons. One is the relationship that Qualcomm has established with Eutelsat. The other is, as he puts it, "the fact that we're transmitting data, not voice. In general, the European PTTs are more open to privatized low data rate message transmission than they would be to some other forms of transmission." Jacobs says he gets an almost universally favorable response from PTTs when he asks: "Why use scarce L-band capacity when efficient, readily available Ku technology can do the same thing?"

With Eutelsat having expressed willingness to provide the Ku capacity on its satellites, the Qualcomm approach is already winning favorable accolades from some European PTTs. "We're starting tests and demonstrations in Europe this spring," Jacobs notes.

All this rapid expansion takes money, and perhaps the fact that Qualcomm has ready access to capital says more positive things about the company than anything else. "Thus far we have had no problem raising the capital necessary to support our startup and our expansion," Jacobs says. To date Jacobs has been his own fund raiser. "There have been enough people who supported us on the basis of our track record that we have been able to get everything we needed in the way of money," Jacobs modestly boasts.

Now, however, as the company expands its manufacturing facilities and moves beyond North America, some outside financing is necessary. Qualcomm has never been in the venture capital market, and Jacobs isn't thinking about taking the company public at any time in the immediate future. The other answer, then, is more private placement, and that's what Qualcomm is doing. This time, however, its financial requirements are large enough that it has had to enlist the services of a nationally known investment banking house.

One factor definitely in Qualcomm's favor, when money becomes a consideration, is that it does not have to worry about the costs associated with building and launching new satellites. Perhaps more than anything else, the use of existing Ku technology is a critical benefit for Qualcomm when OmniTracs is stacked up against its competitors. "That," adds Jacobs, "along with the fact that this approach is far more spectrally efficient than anything else in existence or on the drawing boards because we make secondary, non-interfering use of spectrum already being used for other purposes."

Qualcomm, it seems, is well positioned in the emerging mobile satellite marketplace. If, as Jacobs projects, the technology catches on in Europe, some potentially competitive plans and projects may never materialize. As Jacobs puts it, "If you get the customers and they are happy, it makes it very difficult for others to enter the picture with any real effectiveness." Certainly, in the wake of Qualcomm's rapid rise to an impressive position in the mobile satellite business, nothing about that business is the same as a lot of people thought it was going to be as recently as a year or two ago. □