Oversight Discussion

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S. STANLEY: One of the things that struck me especially about today's session was its title "oversight." I always have a problem with oversight because "overseeing" means so many different things to so many different people. In some people's minds it's that you're a policeman—a cop, you're keeping industry in check. In other people's minds you're merely observing, you're forming ideas, and you're trying to get industry to do something you think they should do. And there are probably a lot of gray areas in between.

There are a lot of people who think everything should be black and white, and thank God the world is colorful. There're all different shades and there is very little that's absolutely pure black and white. So to those who say oversight is one thing and those who say it's another; yes, you're right, that's what it is. It's all of that and probably more.

From my point of view, I think that we have oversight agencies who are tasked by law to provide regulatory oversight. We have federal agencies and we have state agencies and we have groups like our group, the RCAC, who have no legal authority to direct anyone to do anything, but we have a legal mandate to at least observe what's going on, to advise, and try to influence activities.

Does anyone have a specific question for any of the presenters that are sitting at the front table?

QUESTION: I have a question for Barbara Herman. When you're doing your risk screening of the vessels, do you have access to the Coast Guard database?

B. HERMAN: We have access to the Coast Guard MSIS information through the 13th District, and we have access to the new database, MSIX, which doesn't have much information yet but eventually it will.

QUESTION: Is there any provision in your plan to notify next port of call if you have an extremely high risk, or do you work with the Coast Guard.
B. HERMAN: We definitely work with the Coast Guard and before we
even go out on inspections we'll call the captain of the port office for
Seattle and coordinate so that we're not duplicating effort. We are very
anxious to work with the other members of the States/BC task force and
ultimately what I'd like to see is that we all have the same program and we
cannot only alert each other if there's a problem with a vessel, whether it's
been fixed while it's in Washington or it's headed on down to California or
up to Alaska, but that we can also coordinate on the inspections, because
everybody's got the same problem, there are not enough people to inspect
vessels. I'd like to see an information highway where all the coastal states
are sharing information and the responsibility to inspect vessels. Then we
can all compare our information—we still have a way to go.

S. STANLEY: I'd like to hear from Jean Cameron on what the States/BC
task force is doing in that direction, as far as trying to get other states to do
an inspection of their own tankers or other vessels that are coming in.

J. CAMERON: Nobody else has taken the initiative that Washington has
at this point, but we see that down the line. As I said earlier, the task force
has stated that that's one of the things they want to look at. I don't think
they included it blindly without recognizing that one of the things that will
come out of the consistency review is the fact that California and Alaska
do not regulate and require contingency plans from cargo and passenger
vessels as do Washington and Oregon. The screening program Barbara has
currently got in place, as she explained to you earlier, is for that class of
vessels. There are some big pieces of the puzzle that need to be put into
place to have exactly that program occurring up and down the coast. I
believe there is a goal on the part of the task force to ultimately have a
costwide program in place, perhaps for tankers as well as cargo and
passenger vessels.

B. HERMAN: I think we're closer on the tanker side. In fact, we've been
in touch with California, where there is a fairly extensive inspection
program and a better budget than anybody else. They're aware of what
we're doing on the screening program and its application to tankers as
well. So we might get there sooner on tankers with a state like California.

J. CAMERON: You mentioned that OMS is also providing a leverage for
Oregon's Department of Environmental Quality to have a screening
program on the Columbia River. Oregon and Washington have always
cooperated on their rules pertaining to the Columbia because they're
shared waters. And the Washington Legislature just funded extension of
this field office program to the Columbia and DEQ will be cooperating
with it and providing office space. Barbara may want to elaborate, but that’s another example of cooperation occurring between two of the states at this time.

QUESTION: I have a question on funding of this type of screening program. I understand it’s authorized by the Washington State Legislature. What is the source of funding for your program, is it collected from just taxpayers or from shippers?

B. HERMAN: Right now funding is based on a five cent a barrel tax that’s paid by the refinery, and it’s similar to what I heard discussed yesterday that is being proposed here. The current breakdown of the five cents is three cents goes to fund all the programs, and two cents goes into a response fund. So we already have that division.

QUESTION: I have another question for Barbara. I was surprised by your presentation in that it seems like the actual history of the vessels was not scrutinized, it didn’t seem to be nearly as important as the history of the personnel on board the vessels. Why is that?

B. HERMAN: It was a fairly important factor, casualty history and violation history, and I think it’s not as important as the personnel history, understanding that personnel history includes casualty and violation history. Under the theory that whether it’s 60%, 80%, or 90% of all oil spills and accidents are caused by human error as opposed to hardware problems, it makes sense to have your personnel information a higher priority or a higher risk than the hardware. I think that’s the way the distinction was made.

W. PARKER: With a follow-on to that, someone yesterday made reference to the importance of the pilot, as in many cases the sole safety factor in the system. In the last three years I’ve looked at all 29 major ports in the U.S. and talked to all the pilot organizations and others who said that assumption was right. It’s hard to say how much further we can go with this. Alaskans just don’t realize how lucky we are in that almost all the ships that come in are of the domestic fleet and bound by domestic relations. At Euromcort when you go out to meet some ships, they have not just one pilot, but they take two pilots out initially. After you get to where you meet the pilot boat, they bring on board a whole line handling crew and as much additional crew as they feel necessary to take that ship safely on in. The cost of all that is, of course, put directly on the bill to the shipper. As the main entry port, it’s the only way the Dutch have figured out to affordably operate Euromcort the way they want to since the crews coming in are so
dramatically different from each other. As I said, most U.S. ports are not facing that problem now, but most probably will to some degree in the future.

P. SLYMAN: I’m from Oregon DEQ. Maybe I’m cherry picking, but over the last couple of days we’ve talked about a lot of things that OPA 90 just brought about, but something seems to be missing from the discussion because it’s only been given what I would deem lip service, and that’s salvage requirements. And when the Exxon Valdez was up here on the rocks, Fred Devine sent the Salvage Chief, up from Oregon. It’s one of the few vessels left in the United States with capabilities for lightering and bollard pull. I’m a little fearful that that whole industry is on the wane right now, and they’re not well represented in any of these conferences or meetings. I don’t know how we can best address the salvage industry. We seem to address quite well spill response companies and oil spill response organizations (OSROs), for which the Coast Guard has an elaborate classification, but there’s nothing near so elaborate for salvage. Salvage is one aspect of the greater picture, because 80% of the Exxon Valdez’s cargo did not spill from the ship. You could say it’s prevention or maybe a form of response. In any case, it’s an industry that is not healthy right now.

S. STANLEY: Walt, did the Commission look at salvage? That was in your report, too, wasn’t it?

W. PARKER: There was a little bit on salvage, but the marine board just set up a committee on the salvers which has been meeting for the last couple of years and their report should be out in a couple of months, I think. Essentially it’s a dormant industry and there are a few salvers working in western Europe but not doing well financially. I don’t think there’s any salvage tugs, unless the Japanese have some, working in the North Pacific.

J. CAMERON: We’ve added it to our list of policies to look at, but it’s my understanding that the Coast Guard is developing some salvage policies. California made some comments on the national contingency plan about the need to address it, that there was a sense of timing being off.

M. MILLER: It seems to me that the salvage interests congregate around those areas which have the propensity for accident. If you look at the history, salvers were active in New Orleans; on the Mississippi River there was an accident a day, if you will. The problem is enticing them economically to be available in areas other than those that have problems, and we haven’t addressed that yet. I agree.
B. HERMAN: One initiative of the Office of Marine Safety is to get a dedicated rescue tug stationed somewhere near Neah Bay so that we can help vessels in distress for that area of the straits as well as the coast. One of the types of vessels that's being considered is a salvage vessel, but it might not quite have the horsepower of some of the others. That's our small contribution to the salvage industry in this country. We'd like to see a large, powerful vessel out there.

S. STANLEY: Bob Levine can correct me if I'm wrong, but I believe the salvage master who did phase one of the disabled tanker towing study recommended that we have a salvage tug at Hinchinbrook Entrance.

R. LEVINE: That's correct. The salvage master, Capt. Per Haar, worked with Smit Tak International, one of the two largest salvage companies in the world. He was master of the largest salvage tug in the world at one time. His experience says when you have a ship that is in open waters and high seas, you need very large ships to go out and rescue it. Large in this case is a vessel in the range of 15,000 HP, 250 to 300-foot long. Due to fuel capacity, a typical Svendt salvage tug is capable of running about 13,000 miles without refueling.

S. STANLEY: Jonathan, did they bring a salvage tug to the Bracqer?

J. WILLS: Well, there happened to be a large downloaded tug in the main port; she didn't have a lot of gear on her afterdeck, she was being used as a supply ship at the time. So they called her out and she got there, but she got there half an hour after the crew of the tanker had been evacuated, so there was nobody to take a line in. You need a system where the Coast Guard can call out the tug. Our problem was that the Coast Guard didn't have authority to call out the tug without checking first who was going to pay for it. After the Bracqer, the British government told the local Coast Guard on-scene commander that now they have authority to order out a tug. As soon as you're worried about anything, you order a tug, don't worry about paying for it. So that's the new rule. Meanwhile the official inquiry criticizes the Coast Guard for operating under the old rule which says you have to get authority before you call a tug. What is your contingency plan if a large loaded tanker breaks down 20 miles off seal rocks in a storming gale? What is your contingency plan? I haven't heard it as yet. I think that's the most likely next scenario.

D. LAWN: Let me add a couple of comments to what Jonathan said. It's quite likely that had the Coast Guard been aware the Bracqer had broken down, maybe as many as six hours before she reported it to the Coast
Guard, there was time to get that tug of opportunity to the vessel had the vessel been equipped with a bleeper, as Jonathan likes to call them, or a GPS system with some kind of a transponder, the Coast Guard would've been aware that the ship had stopped and then they could have taken some action. Those are the kinds of things that we are fighting for around the world; those are the kinds of things that we need here in our own system. We just happen to be in the unique situation of requiring them on our TAPS vessels, and because they’re a little bit different than the rest of the trade, we can do that if we want to. Certainly the Coast Guard’s going to have that system inside Prince William Sound, but what happens off of Juneau, what happens off of British Columbia, what happens off of Washington, Oregon, California, Mexico, Panama? We’re in the same position, we have to rely on the good graces of the vessel operator’s crews on board to tell us they have a problem. We don’t have the opportunity to protect ourselves, and that’s where we need to move a little bit.

S. STANLEY: Max, as the captain of port for southwest Alaska, can you call a tug out without finding out who’s going to pay for it and then what they’re going to pay?

M. MILLER: Certainly I do. For example, in Dutch Harbor we had the potential of spilling the bunkers of a large processing vessel, a 300-foot processor. I spent $1.6 million without having any oil in the water, just to prevent it from happening.

T. LAKOSH: I think you’ve noticed my question earlier. I’ve been trying my best for the last three days to illuminate a conspicuously deficient policy with regard to responding to a burning oil spill. In the last week we’ve had two burning ships. Mr. Banta informed me that there were two ships that exploded on their own. I would like Mr. Banta to elaborate on some of that information, and I’d like the rest of the panel, if there’s any opinion or expertise, to analyze the present fire-fighting capacity and propose the proper equipment, which might fill the gap of this conspicuous deficiency in response.

J. BANTA: What I was telling you about I had gotten from some of the newsletters we get. Within the past month two tankers carrying crude oil in the Middle East, one of which at least was under heavy weather and I’m not sure about the second, caught fire. The report figured flexing of the hull contributed and something inside gave out a spark causing an explosion. In both instances the tankers that exploded were loaded, caught fire, and spilled. And I guess your question is what capability do we have in Alaska to address that type of problem?
T. LAKOSH: Yes, and what equipment would address the problem? I've ascertained from Alyeska and from Capt. Aspland yesterday that there's no fire boom on any of the Alyeska vessels or the Crowley tugs, and that Crowley tugs, although they have a small firefighting capacity, would probably not be capable of responding to a large tanker fire. The policy in responding to a burning spill is to try and contain the spill with nozzle pressure from water monitors or fire monitors. That has been proven to be totally and wholly ineffective in containing the Bosporus Straits spill. What type of policy should be adopted to see that a burning tanker will not discharge all of its cargo without containment? The present boom that the Alyeska vessels have for surrounding a tanker is not fireproof, and it will not contain a burning spill. I would like to hear from the Coast Guard in particular what policy they feel should be adopted toward containing a burning spill?

M. MILLER: The current policy states that if you have a tanker and a spill, you secure the source of the spill, if possible, and stabilize the platform it's spilling from. You do not endanger the tanker or its crew by engulfing it with fire boom to allow the fire to stay there.

T. LAKOSH: Are you going to leave the crew on the ship? If the crew's gone, then booming the tanker isn't a safety problem.

M. MILLER: The idea is to stabilize the tanker and save the rest of the remaining product so you don't lose the whole ship.

T. LAKOSH: I don't understand how that conflicts with placing fire boom around it. Is it the policy not to boom the tanker at all, to promote stability and crew safety? Why is there boom; is it a policy to boom the tanker first of all, fire or not?

M. MILLER: The question is balance between what kind of product you have, how big the spill is, how much boom you have, and where the tanker is.

T. LAKOSH: Is there a written policy that says that the tanker must be boomed, is there policy that says the tanker must or must not be boomed when it is burning, and where are these policies written?

M. MILLER: I think it's a case by case basis, depending on the circumstance. I can't answer you specifically.

T. LAKOSH: So it's totally discretionary whether to boom a tanker?
M. MILLER: I’m just saying it’s a case by case decision.

J. BANTA: I think the more interesting question really is what equipment is available to fight the fire, like fire monitors. Do we need better and more fire monitors for our region up here?

R. LEVINE: The two Crowley tugs that are equipped for firefighting are equipped as fire boats. They each have three monitors and they have foam capacity to go with the monitors. They are equipped to fight fires in accordance with normal firefighting practices. Each of the ships is also equipped with fire monitors in accordance with the Coast Guard rules. Most operators, to my knowledge, are also carrying extra foam beyond what they’re required to have. There is also at CISPRI a system for firefighting which is high capacity, high pump and portable to the scene of a fire. The smaller tugs also have the capacity with small monitors, water only, in Valdez. You also have to look at the dock facility. The firefighting systems have just been replaced with high capacity, remote operated fire control systems. Right now, the firefighting capacity for tanker fires at Valdez is among the best in the United States.

T. LAKOSH: Alyeska said it’s their policy not to respond to any fires seaward of the berth. They have a potential source of burning spills from the pipeline south of Thompson Pass, from the terminal, and from shippers which they’re required to respond to and they have. Alyeska itself has no vessels with fire boom on them, or fire monitors, or fire foam above 50 gallons per vessel. Is Alyeska going to respond to a fire that is the result of a pipeline leak, at the tank farm, or from the vessels to which it’s required to respond to the tune of 200,000 barrels of recovery in 72 hours? If it’s burning, there is no way they can put it out or contain it. My question is, are they fulfilling their obligations under the contract, under the constitution, and under House Bill 567, the contingency plan requirement to respond to a spill if it is burning? Are they required to pick up that 200,000 barrels of stuff in 72 hours and what equipment do they have to do it with?

QUESTION: What’s the benefit in not letting it burn if it’s not going to get out of control?

T. LAKOSH: The idea is if you don’t contain it, it will get out of control.

S. STANLEY: The only fire boom we have is for the purpose of corraling oil and burning it off.
S. STEPHENS: I think the area you’re covering is very important, and the RCAC knows it has to look into fire both at the terminal and offshore. We don’t have any answers for you today, but I can tell you it’s an area that we intend to look at. We have had one drill that included a tanker on fire and we had a drill at the berths; both went fairly well. We know there are a lot of problems out there that we have to look into and we need to know what the capacity is. The questions you ask are good ones, but I don’t think we have the answers for you at this time.

S. STANLEY: We can spend all afternoon talking about this one topic and still not come to closure. I’d like to shift a little bit. One of the things Walt Parker mentioned in his presentation was the best available technology. In the back of many people’s minds are the promises that were made before the pipeline went in about having the best available technology. That means different things to different people. I’m finding that one of our biggest and most interesting problems is that everybody has a different interpretation of everything. From time to time industry has expressed the view that no matter what it buys, and buys, and buys, every time something new comes on the market there’s a great hue and cry that we need that on board, too. Is that where we need to go, is that what we’re talking about with best available technology?

QUESTION: I think one of the key issues in best available technology involves how to integrate that technology with the existing systems. And there are tendencies just to integrate gadgets, as Jerry Aspland mentioned several times earlier this week, without considering what the overall effects will be on the performance and system safety. I think one thing that’s really lacking in maritime transportation is this approach, this systems level approach, that you find in aviation, nuclear, and other industries.

T. ROBERTSON: Another thing about best available technology is research and development. In order to develop best available technology, you need an ongoing consistent commitment to research and development. Many of you have probably heard about the OHMSETT facility in New Jersey, a tank built and designed to test oil spill equipment. It was originally built in the 1970s and fell into disrepair. By the time the Exxon Valdez came along, it was no longer in use; it had been mothballed. Exxon Valdez happened, and all of a sudden there’s money for R&D again. They refurbished the facility, we visited it this fall, and they’re again at the point where they have no funds. They can keep water in the tank but they have very limited funds to actually evaluate equipment. There’s no gain to be
made if we can’t test things. That’s very important and it needs to be a consistent commitment from the industry and from funding agencies to allow these programs to go on and on and on. I wouldn’t be surprised to see that facility closed in the next year or two based on the way it’s going right now unless there’s another big oil spill.

J. WILLS: Yes, BAT, that can mean best available technology, but how come it doesn’t mean best affordable technology? Best affordable technology just refers to the economics, your main source of information on what’s affordable is usually assurances by the oil industry, which by definition cannot be checked because of their confidential nature. So I think when a piece of new technology comes on scene, it’s reasonable to argue with the industry about whether or not it’s reasonable for risk benefit assessment. Say, for how many dollars will we get “X” percentage improvement in safety. That in fact can be argued.

What I find intolerable is that proven technology that’s been around for years is still not being used. Take the example of the lifeboats on the ARCO ships, the open lifeboats on the ARCO ships that were mentioned in Eric Nalder’s book. They still argue about whether a tanker should have an open lifeboat. This would be ludicrous if it weren’t so sad and dangerous. Another example is the use of coastal radar linked by ordinary telephone lines to central control rooms and computer display screens. No technical problem anymore, no big financial problem. Not happening. The technology is there to keep an eye on those ships even before we put bleepers on them. We also have salvage technology. Well, it’s available but it isn’t there, and that’s a major problem. The technology to have rapid clip-on towing packages for even abandoned tankers is there. It’s available, but it’s not everywhere. And aerial surveillance is there to go and check that people are where they say they are. And we’re just not using available technology to the best practical ends. I think on some of these decisions we’re very soon going to have to ask the regulators to start discussing these with the industry and start issuing instructions. The industry, of course, will threaten to close down and go away, but they always do that. Don’t worry.

S. STANLEY: Well, Max, do you want to issue a regulation or have somebody pass a law that directs you to issue a regulation that all the latest bells and whistles will be assessed to determine whether they should or should not be put on the vessel?

M. MILLER: Well, we’ve seen the process work to the benefit, I think, of the new regulations here with the regulatory process. I can’t create new regulations on my own. The RCAC in Cook Inlet helped initiate a project
on the tug issue in Cook Inlet. That type of interaction is happening now. And perhaps a similar process will come out of this discussion.

B. HERMAN: In Washington State, one of the tasks the Legislature gave us was to establish regulations for the best achievable protection for the environment using the best available technology. This is a program that applies only to tank vessels. We started that program a year ago by asking all tank vessel owners and operators who enter Washington waters to file prevention plans with us. These are the prevention part of the contingency plans where we have all the information from every tank vessel on its operating procedures, its personnel procedures, its training and crew, and the technology it has to offer. We’ve just started the next phase of that program, we’ve reviewed the plans and we’re now going to be working on regulations which we hope to have adopted within six months. But we hope at that point, after having reviewed the plans and had some hearings, to define what is the best achievable protection and what is the best available technology for tank vessels.

W. PARKER: The key word is available. It’s not available if you don’t know how to use it. So the other side of technology is that training programs have to be funded so everybody learns how to use the newest technology, if you choose to go that route. The high reliability organizations usually expend a good part of their budget in training. A carrier air group will expend probably 98% of its operating budget in training to maintain that high degree of reliability that gets you on and off a carrier deck. It’s important that it not be a catchall, but that it be used, as was pointed out, as a continuing program. I tried to get that point across today. You have to have a continuing program that’s always probing for a better way to do it. If the United States hadn’t had the Bell Labs operating for the last century, we certainly wouldn’t be where we are today in electronic technology.

One of the problems we have is that as a port state operating a very limited merchant fleet, we have very little research capability on the civil side in the marine area. In aviation we have a tremendous research capability. The Navy has a tremendous research capability, some of which gets transferred to the civil side. Essentially the big problem in R&D in civil shipping is that it’s just a small industry. If the United States is going to continue to operate as a port state and protect itself, it’s going to have to make the R&D investment to make them safer irrespective of how many of those ships are flying the stars and stripes.

R. LEVINE: If it makes you feel any better, I got an approval yesterday by the Alaska Department of Environmental Conservation (ADEC) that says
that it was conditional on some research that is being done and that the approval on the equipment will be subject to review and upgrade after the research is completed. So ADEC is definitely looking at its best available technology. They know it’s in the regulations, and they’re going after us real hard with the idea that it’s up for evaluation.

S. STEPHENS: Technology, and the best available technology, depends on economics, not whether or not the technology is there. It depends on who’s willing to spend the money. In the City of Valdez, the pipeline has been running some 17 years. It’s one of the biggest emitters of hydrocarbons. Whether or not it’s been affecting the health of the community, I don’t know, but it’s been affecting the way of life. Technology’s available to solve that problem, but the regulators haven’t seen fit so far to do the proper thing and enforce a regulation that requires Alyeska to put some kind of technology in place to either burn the vapors or capture them and turn them into product. They are, however, working on it now. If the regulations had been enforced or if the people in the City of Valdez had yelled loud enough, instead of being very quiet, Alyeska would have put something into effect earlier.

The problem is even if the technology is available, the industry’s not going to use it or spend the money until they’re forced to. When you’re talking about best available technology, you have to look at the economics. It’s too bad that that’s the case, but people are secondary; profit is first.

J. WILLS: I’ve heard a very dispassionate and factual account of promises these people gave when they were given permission to operate the pipeline in federal and state lands and waters. They promised to use the best available technology to run it just so that it wouldn’t spill oil. If those promises mean something, add them together with the state and federal laws, then surely the regulators can say, “Look, you promised this, don’t get us involved in your technology arguments, just fix it. Here is the outcome we want and which you promised. Fix it, here’s a deadline.” It’s the failure of your politicians to give the people in the Coast Guard and in the state and federal agencies the support to exercise powers which they already have, to enforce laws which have already been passed, and to insure that the oil industry meets promises which it gave. These weren’t off the cuff remarks, these were carefully considered promises. Why are you getting so involved in all their technical problems? They love to do that to you, because that wastes time, you see. Why don’t you just tell them, “this is the deal, fix it.”
S. STANLEY: We’ve been leaning pretty heavily on the Coast Guard here. How about a State regulator?

W. PARKER: On that matter of promises, how about the west tank farm? It was the state who had the job of making sure the west tank farm was built, but the west tank farm was never built. Pipe to the west tank farm was supposed to be in place before the pipeline went past a million eight a day. But it never got built and that’s the responsibility of the State of Alaska.

S. STANLEY: Dan, can DEC just go out there and say “you guys promised this and by golly you’re going to do it?”

D. LAWN: Speaking as a private citizen, in past times DEC has said some of those things. As I recall, in 1988 after a rather long discussion about air quality, there was a commitment. DEC said “we want you to solve the problem, collect the vapors,” there was some agreement to do that. We changed DEC people and politicians and we seem to be back to “we’re going to study it some more.” I agree completely with Jonathan. Politicians need to give the regulatory agencies the money and the independence to do the job. Also, they should quit appointing people who are politically correct and appoint people who are problem-solvers. At the same time, the industry needs to live up to their commitment and quit lobbying the politicians to reduce oversight. I mean, it’s silly for us to be doing oversight anyway if the industry would just do what it said it’d do. We’d all be happy. That’s what I was trying to say. Changing the system starts with us as individuals. You can’t make it happen by paying attention every ten years when you have a major catastrophe. You’ve got to keep after it. Those of us who are parents know that if we just tell our kids to do something without a little bit of follow-up, it’s likely not to get done unless they choose to do it. We, the citizens, have to be involved. I know there are a lot of dedicated, hard-working people trying to make the system better, but we ought to all start working together, including the regulators and the industry.

J. CAMERON: Personally, I think technology is being used here too much as a panacea or an excuse, and that in most cases the technology does exist. Take the problem with overfilling of tanks during bunkering operations, which is a very common problem. Why aren’t there alarms, why aren’t there mechanisms for that sort of operation similar to what you have when you put gas in the tank of your car? There’s really no excuse. States and regulators shouldn’t fall into the trap of constantly determining
what's the current best available technology. They should set performance standards and let the private sector develop the technology. As Dan said, it really is a matter of political will. Right now the political memory is dimming outside of the state of what happens when a large spill occurs. People are more focused on crime and people are certain that government regulators are just twiddling their thumbs and hanging around the coffee pots wasting their money anyway. Funds are being cut everywhere, not just here in Alaska. I agree completely that a concerted effort is needed and you can't reduce your vigilance at all whether you're a citizen, a regulator, or a concerned member of the industry.

QUESTION: It seems like one of the big problems that comes up again and again is economics. Alyeska makes the argument that they can't afford to invest in R&D because the system is winding down. To me the overall big problem is that we don't pay enough for oil. As Stan pointed out, we're all responsible. There's a problem with greed here, and as consumers we're all part of the problem. We're not paying enough for fuel and for the damage it's doing to our environment, not just the water but the atmosphere, too. There ought to be a carbon tax in this country for use of fuel.

The problem is that as consumers, we're not paying the price for shipping oil and for burning it. We need to change that in this country, and it needs to be everybody's responsibility. I don't know how we're going to fix it, it's a very big political problem, and I know Vice President Gore has been talking about something like that, and there's a lot of arguments for not doing a carbon tax because it's going to damage the poor. There's probably some way to get around that. Just a couple weeks ago, I paid $4 or more a gallon for fuel in Norway. How come we're paying just a little over a dollar a gallon? That's ridiculous.

W. PARKER: That $4 a gallon in Europe is mostly to take care of the old folks and the babies, that's what they spend it on. We don't believe in that in the United States anymore.

K. STAHL-JOHNSON: We put so much energy into exploration, development, transportation, oversight, all of this stuff so we don't spill oil, so we can continue our dependence on our oil-based economy. If the price of oil was even double, there would be competitive advantage. If you're talking about economics, it'd be a competitive advantage for alternative energy sources and the use of fossil fuels would decrease and the industry would lose money. There's not an incentive to increase prices, there's an incentive to have cheap gas so that we can all stay on this dependence. We will get off the dependency if the price of oil goes up.
J. CAMERON: There are a few other things that you can do, but they’re not usually in the purview of the folks around this table. For instance, in Oregon, they were looking, at a smog fee, based on mileage traveled between registrations multiplied by a factor determined by the emissions of your car. That would be a polluter-pays approach that would come right to us.

T. LAKOSH: On the issue of the best available technology, there is a review process. As a matter of fact, I just got a memo today from the Joint Pipeline Office that GAO is coming in next week starting Monday. I have a letter here from the Director of Natural Resources and Management Issues from the GAO, and they are here specifically to study if the Trans Alaska Pipeline System (TAPS) is operated in a safe manner. During these audits, there is a considerable window for people to ask for the best available technology whether they be a scientist who is exercising a professional responsibility, a government trustee performing his mandated duty of office, or a citizen seeking to have protection of his or her constitutional rights to freedom from pollution generated by state and federal leases. You have to ask. I went to Mr. Brossia about a month ago and asked him to consider these fire tractor tugs, and he responded appropriately. He wrote a letter directing Mr. Flint of ADEC to tie the three C plans from the pipeline, the terminal, and the shippers, together to consider the threat of fire and the use of a firefighting tractor tug. What I’ve done is petitioned Commissioner John Sandor, Commissioner Harry Noah, and the Governor, to generate attorney general opinions and issue a notice of deficiency to Alyeska to require them to have the best available technology, which is at this point a firefighting tractor tug carrying fire boom.

S. STANLEY: I’d like to throw out one other idea which you may or may not want to talk about, and that is there’ve been several things said today with regard to regulators working with industry. I alluded to the situation over in the Shetlands where they meet behind closed doors, discuss issues, make decisions, and marvelous things happen and the public doesn’t know what’s going on. We’ve got the opposite extreme where you can’t meet behind a closed door with anybody. Recently Stan and I were meeting with the senior vice president of Alyeska at his request in an Alyeska office—with the door open—to discuss something that is very important to the community of Valdez, the impact of all the additional people that are coming into the town this summer and how they’re going to deal with that. It really struck me later when a reporter came up and said he’d heard we had a meeting with Alyeska. The tone and attitude of the reporter was, “How could you?” Well, you can’t go stand in the middle of the intersection every time you want to talk to somebody from industry and invite all
the press to gather around and stop all the traffic. How much closed-door interface should there be between people who provide oversight, whether they’re citizens’ groups, regulators, or what have you, with industry? How open does that need to be?

D. LAWN: I agree that you need to have some sit-down quiet meetings where you’re trying to work out some consensus. But I also understand the public’s concern about wanting to know really what’s going on because they don’t trust any of us, and they have a right not to trust any of us. I suggest that if we do some real simple things which change the way we think about things, perhaps, we can bring that level of trust up. Let me give you an example.

There’s been a big flap in the paper in Valdez for the last three months, there’ve been some hard feelings about a decision that was made to bring in one of ARCO’s ships where the winds were higher than the established rules for normal transits would allow. I have several opinions about that, but where I’m really going with this is had the industry looked at the problem? We all knew the weather was going to get bad, it was probably going to be bad for several days. Had the industry really looked at what could be done to not get into a bind? We don’t have enough tanks in Valdez, we don’t want to move ships in bad weather, we don’t have enough down in Puget Sound, so what can we do? Well, if they really had been thinking about that, they could’ve taken one or two of the ships anchored at Valdez waiting for their portion of oil that wasn’t there yet. When the weather was still good they could have looked into the future and seen that it was going to turn to pretty nasty in a day or so. It would’ve been an easy process not to put the Coast Guard into a situation to violate their own normal rules and bring that ship in and get it loaded. That’s a easy fix; that’s a thought process.

It’s a thought process to say “we think the weather’s going to last for five days and we’re probably not going to move any ships so instead of waiting ‘til the fourth day we’ll slow the pipeline down, slow it down a little bit on day one.” The industry certainly could’ve done that. Had that been done, it’s likely that the Coast Guard wouldn’t have been put in the position to hope with their fingers crossed that everything would go right with that ship coming in, ARCO wouldn’t have been put in that position. Stan wouldn’t have had to write some letters, and we wouldn’t have had a big flap. There’re things that we can do right now just by working at it. I suggest that if the industry and the regulators would approach some of the things that way, then the public trust in us would elevate and then we could sit down at a table without the public getting irate that they aren’t there listening to what we’re saying.
R. FINEBERG: Aside from the all the case studies we have developed collectively, there is no question but that secret meetings erode fundamental processes of a public government just by definition. In terms of the quality of decisions that get made, it is crystal clear that in a closed room you are more vulnerable to log rolling and poor decisions. When there are only a few players in the room, it’s easy to say “yeah, this is all you can do right now only because you didn’t build the fourteen other tanks,” or some other things people don’t want to hear. It is crystal clear as a general proposition of public policy that more open is better. Jonathan has said that we are superior to the Shetlands in that regard. From our case studies, it’s very clear we do much better with a more public process. Why would you want to have the decisions take place among a smaller number of people which makes it much more boring for other people because they can’t play? People like Tom, who continue to play when no one is invited into closed meetings, are very rare and we need them. If we want to exclude the public and have complacency, let’s go to closed meetings.

S. STEPHENS: I believe you need to have open meeting laws, that all meetings, if at all possible, should be open. We are advisors to Alyeska, and let’s say that they have an item they want our advice on. They don’t know which way it’s going to go, they don’t want it out in public until they’ve had a chance to ask our advice because it isn’t a decision yet. Where do we go from there? We either have to honor the commitment to give them advice about it and not go public with it, or we can’t give them advice because we have to be open and public. An industry should have some right to make decisions without everyone having to know about it, and the point is where do you draw the line?

J. WILLS: The difference between Shetland and here is that the Shetland Islands Council has executive power. RCAC is an advisor. But the principle I’ve always gone on is there really are only two things that ought to be discussed in private. One is staff matters, which should never be discussed in public, and the other is legitimately confidential commercial matters. Now, sometimes that’s commercial confidence affecting the industry and other times it’s affecting the public. As councilors we’re also trustees of the permanent fund, the charitable trust in Shetland. We have a responsibility to protect that money. If we go to a negotiation with the oil industry as we do now, showing our hand to the oil industry and members of the public before the negotiations finish, then they’re going to know what the backup to our bargaining ploy is. So I found myself in a strange position in supporting private negotiations with the oil industry, which are just starting for the next phase of our deal with them after the end of the
century, and having to say on local radio that I'm not going to tell people what's going on. Actually I don't know what's going on because the deal there is we give our negotiators instructions of the outcome we want, and they report back to us on what they can get.

However, when you get to the science which is carried on by the Shetland oil terminal environmental advisory group, then I really don't see the need for confidentiality at its meetings. It doesn't even publish agendas. It does a lot of good work and all of the industry associations and relevant members of the public are represented on it, but the representatives are expected to observe confidentiality, and their various recent reports on its workings showed up with some serious problems with peer review and respectability of the scientific results obtained. When this was set up, the argument was that chaps were more likely to speak frankly and candidly to other chaps in a closed meeting. That's just the argument the British establishment has always used to cover its tracks.

The ideal would be the regional citizens' advisory council to have the legal powers like the Shetland Islands Council's got, and you've gone halfway to it. Would it be a good idea for the public to own and control and direct the port of Valdez? We'll say the public does it already through the Coast Guard, but with all due respect they're not a local agency. Would you have more accountability if you had that kind of system?

R. LEVINE: From my point it'd be great as long as the public wants to take the liability with it. And that is probably the biggest issue. If the public wants to take all the liability and the responsibility with it, that's fine.

QUESTION: What about nationalizing the pipeline? What about turning it into a public utility? How would people like that idea and would that solve anything?

W. PARKER: I know of no organization which operates with more secrecy and more care to keep the public out of its decision making than the publicly owned Alaska Railroad.

T. LAKOSH: The reason why RCAC should not hold secret meetings is because oil transportation and production is an ultra-hazardous activity in which the public health, safety, and decency is imminently threatened. To withhold any negotiations or information which would allow the public to best protect its interests in a fiduciary relationship established by OPA 90 is criminal, fraudulent concealment.

K. STAHL-JOHNSON: Discussions, when you're dealing with oil spills, are what RCAC's responsibilities are. The fact that this grew out of a lack
of trust and fear, because fear drives lack of trust, the only way you can make the relationship comfortable is if you can get the public on board with the trust issue. RCAC is a group that’s come together dedicated to a specific thing. They have to work intently on their relationship with the oil industry to create a consensus or understanding, agreeing to disagree. That’s a relationship the public doesn’t have, so you always have to work on the perception of independence and openness. In many ways, it’s a matter of discretion and integrity within the organization. It’s a trust-building process with both the public and the RCAC. It’s a level playing field for everyone. That’s the fair play that I think RCAC’s really striving hard to meet for everyone’s interests.

S. STANLEY: I have a hard time describing as a secret meeting going to someone’s office to sit and have a conversation with them to acquire information to better assist in forming a position.

B. HERMAN: I don’t think government has any business conducting its business behind closed doors. To me it’s a very simple issue, but I also don’t think you have to call a public meeting every time you pick up the telephone to find out facts or talk to somebody to do your job. If you did that, government would be at a standstill. However, when you’re in deliberations and in a process where you’re making decisions and answerable to the public, then the public ought to be involved and know what’s going on. Sometimes it slows the work down and some people who come into meetings can be very disruptive so you wish they weren’t there, but so what? We have an obligation to the public, that’s why we’re here.

K. STAHL-JOHNSON: But RCAC’s not public.

S. STANLEY: Thank you.

B. HERMAN: Yes, I mean, I don’t know enough about your situation.

QUESTION: I appreciate Stan’s comments. Those of you in the upper ranks of RCAC might have almost daily communication with industry so where do you draw the line without seeing everything you say on the front page? I think the bottom line is probably in the definition of meetings.

J. WILLS: I’d like to clarify one thing. I wouldn’t like to leave this country with people thinking I’m advocating nationalization; it doesn’t work. What I advocate is small-scale local public enterprise working in partnership with large-scale private enterprise, like we have at the Sullom Voe Terminal. That works.
Oil Spill Prevention Measures Undertaken in the Wake of the Exxon Valdez Oil Spill

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This paper discusses oil spill prevention measures undertaken in the wake of the Exxon Valdez oil spill. The purpose is to give you some update and insight into where we are, relative to where we were in March of 1989, regarding preventing a major oil spill such as we saw with the grounding of the Exxon Valdez. I think you will see that we are much better off now than we were prior to March 1989. Are we where we need to be? We all have our own opinion on this issue. I’m sure if we polled everybody here today, we would have a wide difference of opinion as to how far we’ve come, and where we need to be. Again, my purpose is to update you on where we are now. You will have to draw your own conclusions, and develop your own opinions.

First, I’ll talk about pollution prevention measures that have been mandated by federal law and regulation. Then I would like to discuss prevention measures that have been initiated voluntarily by the oil and product carrier industry here in Alaska.

What better place to start about where we are than to talk about law changes and regulatory mandates that resulted from the Oil Pollution Act of 1990 (OPA 90). OPA 90 was unanimously signed by Congress in the wake of the grounding of the Exxon Valdez, with the hopes of preventing another similar incident. This single piece of legislation had a large and far-reaching impact on the oil transportation industry in the United States, and in essence stated “that things need to change.” This change was a mandate of the people. And change they did. Significant mandates that resulted from OPA 90 include the following:

- Review of alcohol and drug abuse and other matters in issuing licenses, Certificates of Registry, and Merchant Mariner’s Documents. Requires merchant mariners to be tested for the use of dangerous drugs. This change also provides discretionary authority
to review the criminal record of each merchant mariner applicant, and requires applicants to make available information in the National Driver Register.

- Term of validities for Certificate of Registry and Merchant Mariners’ Documents were established at five years. Allows for review of records and drug testing at time of renewal.

- Suspension and revocation of licenses, Certificates of Registry, and Merchant Mariners’ Documents for alcohol and drug abuse. Provides for pre-employment, periodic, random, reasonable cause, and post-accident testing. Also allows the United States Coast Guard (USCG) to temporarily suspend and take possession of a license or document under certain circumstances.

- Removal of Master or Individual in Charge. Allows next two most senior licensed officers on a vessel who reasonably believe the master or person in charge is under the influence of alcohol or a dangerous drug, to relieve him/her and temporarily take command.

- Manning and crew standards for foreign tank vessels. Revises the requirements for evaluating manning and crew standards of foreign countries which operate in U.S. waters.

- Vessel Traffic Service systems. Provides for upgrade of VTS Valdez and establishes additional VTS systems around the country. Also allows the USCG to make participation in appropriate VTS mandatory.

- Periodic gauging of plating thickness. Establishes minimum plating thickness standards for tank vessels and requires periodic gauging of vessels over 30 years old.

- Critical area inspection plans. Program established by USCG to monitor Trans Alaska Pipeline Service (TAPS) vessels with history of fractures.

- Overfill devices. Requires devices and standards to warn of tank overfills on oil cargo vessels.

- Tank level or pressure monitoring devices. Requires tank level or pressure monitoring devices be used for leak detection.
• Study on tanker navigation safety standards. Requires the USCG to report on the adequacy of existing laws and regulations to ensure safe navigation of vessels transporting oil. The study is divided into 12 parts.

• Tank vessel manning. Mandates maximum working hours on board tankers in 24 and 72 hour periods.

• Autopilot, unattended engine room, and second licensed officer on the bridge. Establishes tanker navigation regulations which govern the use of autopilots and establishes minimum bridge manning levels.

• Establishment of double hull requirements. Requires phased in program of double hulled tank vessels based on age and size.

• Research in tanker grounding. Non-mandated USCG study being conducted at MIT to explore the behavior of tanker structures during grounding.

• Escorts for certain tankers. Designates certain U.S. waters (Prince William Sound [PWS], Rosario Strait, and Puget Sound) where at least two towing vessels must escort single hull tankers greater than 5000 GT.

• Revision of National Contingency Plan.

• Clean Water Act of 1977 (FWPCA) penalties. Increases penalties and creates new class of penalties.

• Terminal and tanker oversight and monitoring. Establishes Regional Citizens Advisory Councils (PWS and Cook Inlet).

As you can see, there are numerous preventive measures resulting from OPA 90. Now I would like to briefly talk about recent initiatives the oil industry here in Alaska has taken with the hope of preventing another major oil spill.

TAPS Vessel Owners/Operators Initiatives

• Providing an “ice scout vessel” for laden tankers in PWS when ice has been reported in the ship lanes.
• Laden TAPS tankers departing PWS will be escorted by Ship Escort and Response Vessels System (SERVS) vessels until they are clear of Seal Rocks.

• Laden TAPS tankers will not depart PWS if the prevailing weather conditions would prevent the SERVS escort vessels from rendering assistance near Seal Rocks.

• Feasible, cost effective recommendations from the Disabled Tanker Towing Study initiated in 1992 will be implemented.

• Once clear of Seal Rocks, laden tankers bound for the lower 48 will remain at least 100 miles offshore of the coastline of Southeast Alaska.

Nonpersistent Tank Barge Owners/Operators Initiatives

• Only twin screw tugs will tow member barges.

• Emergency tow lines present on all barges.

• Retrieval hooks on all coastwise tugs.

• Stricter tow wire maintenance and replacement standards.

As you can see, industry has instituted numerous voluntary initiatives that should assist in the prevention of a major oil spill, or in some instances mitigate its effects.

That covers my presentation today. I hope I have given some of you additional insight as to what has happened since the grounding of the Exxon Valdez relative to prevention. Have we come a long way? I think the answer is yes. Have we come far enough? That depends upon who you ask. I do know changes have been made, additional requirements are in the wings, and it is no longer business as usual. I think most people would agree that that is a good thing.
The Significance of Human Factors in the Prevention of Oil Spills

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Abstract

The development of automated systems arises in part from widely held concern about high operating costs. Driven by new technology, owners have partially automated marine systems. There has not been a clearly defined allocation of functions. Operators, owners, and regulators have been slow to reengineer the marine industry. Expectations of new technology have yielded new solutions, but with new problems, e.g., a user-centered approach. There is little doubt that advancing technology can assist people in the performance of tasks, but the human-computer interaction is still uncertain.

This paper discusses human factors and organizational behavior as it relates to the marine and oil industries. The paper’s theme is stress. Stress comes from job displacement, reengineering, workplace design, and more. Stress can move a person in a positive or negative direction. This paper points out needed modifications in the quality of life at sea.

Introduction

Not recognizing the applicability of human factors has tremendous consequences. The Exxon Valdez oil spill is only one example of such a consequence. The Vincennes and Three Mile Island are examples that “became the center of that uniquely American mega-event: a media blitz. Screaming headlines blared the worst oil spill in U.S. maritime history.” Besides the environmental damage and destruction of catastrophic proportions, we cannot afford repeat performances (Peak 1990). With a company’s image, reputation, and profits at stake, management in the oil industry cannot afford to ignore the importance and relationship of human factors in the prevention of oil spills.

Mastery and control of future events are more likely by applying human factors principles. Some principles are allocation of functions, human reliability analysis (HRA), job design or reengineering, perfor-
mance aids, workload or manning, proficiency, selection, training, and task analysis. For example, a person's situation awareness is needed for job performance. The marine industry has yet to consider situation awareness. Each of these principles, if gone unchecked, will yield a stressful environment.

Getting the oil to market as cheaply as possible is not the bottom line. Getting the oil to market with minimum risk of an accident, or a potentially catastrophic event, is the bottom line. This implies consideration of all the human factors caveats. Critical decisions are biased by any impediment. Psychological stress is "a particular relationship between the person and the environment that is appraised by the person as taxing or exceeding his or her resources and endangering his or her well-being" (Lazarus 1989). This state of well-being has important consequences on the performance and productivity of an organization's members. Sutherland and Cooper explain that in an organization in the oil industry, "the costs are enormous...in terms of reduced physical and/or psychological well-being and increased accident potential" (Lazarus 1989). When an employee's well-being is at stake, an organization's ability to effectively conduct its mission is impaired. Excessive stress may cause erroneous interpretation of radar data, jeopardize the safety of the vessel, or go undetected. Industries can prevent excessive stress by applying human factors principles.

Discussion

Management has recognized the value of teamwork or shipboard resource management (SRM). SRM is founded on a premise of value added and support where individuals work to a common goal. SRM is an allocation of functions. The allocation of functions designates who or what performs a task. Another example of function allocation is determining human-computer equivalency (HCE) aboard vessels with sophisticated automation. The human that operates and controls this technology cannot be ignored and must be in the hierarchy of control. Humans are preferred and needed, for human control cannot operate effectively without adequate communication or information of functions and performance. Humans are to remain in the loop. SRM and HCE will create a synergism that will yield both user acceptance and cost savings. The operation of today's and tomorrow's ships is different from yesterday's. Vessel safety has been a paramount concern. The anxiety about safety and risk will be alleviated when the marine environment realizes and implements the new paradigm, i.e., SRM and HCE.

Conditions are exacerbated by the perception of risk. The sea is perceived to be inherently risky and hazardous. Work with chemicals such as oil dispersants and related errors, such as oil spills, are hazardous and
call for caution. Sutherland and Cooper (1989) show that "awareness of the dangers and the consequences of making a mistake were significant predictors of depression." The solutions are in educating or training personnel in situation awareness (Wilson 1994). Sutherland and Cooper's studies show "accidents, media attention and the need for special training to deal with emergency routines heighten the level of risk awareness. . ." Situation awareness is training to cope with emergencies and will alleviate anxiety and stress. When organizations incorporate situation awareness and invest in reengineering, safety and risk perceptions will be reflected.

The at-sea or offshore environment requires working hours atypical to most other industries. These hours include long working shifts and night shift work that lead to fatigue, more specifically sleep deprivation. When the crew is tired, the skill to make decisions is impaired. Risk and safety issues are aroused and induce stress. The work, rest, sleep times (WRST) need to be determined. Workload analysis needs to be determined. More than a 70-hour work week is too much. Thompson elaborates that automation, "has allowed ship operators to reduce the size of the crew. But according to the Coast Guard's Report in October 1989, "The effects [of automation] seem to be crew fatigue and neglected vessel maintenance due to reduced manning."" (Thompson 1990). Currently, manning is set by laws pertaining to watch standing, enacted over 50 years ago. It seems proper that workload vs. human error be the catalyst as justification for determining the manning requirements.

Automation or technology is the primary reason human factors is more important than ever before in industries and can be most beneficial in the offshore and at-sea environment. The task analysis is the justification for what work an individual is to perform. The intelligent vehicle highway system (IVHS) is an excellent model for how to use human factors and is the most dramatic example of HCE. For example, what are the hand-eye motions to maneuver a car of the future? IVHS America is looking at a car that is still to be manufactured. The user perception of future technology has not been implemented by the Coast Guard nor the shipping industry. The Coast Guard has used equivalency before and will probably use it again. Industry must make the case. For example, since many vessels already have periodic unattended engine rooms, it makes sense to have main control in the wheelhouse, yet regulations still require main control to be located below the main deck. With the introduction of more sophisticated automation, personnel will be displaced for the watchstanding task, but not for maintenance or reliability. In order to have the benefits of technology, sophisticated automation needs to be user-centered. Management cannot downplay the risks of human error when automation is solely technology driven.
Another significant factor is profit pressure from management. In the effort to meet deadlines and profit goals, shortcuts are made or at least considered. This is where reengineering fits into job design. With crews operating at manpower minimums, many incentive programs support the quick fix or shortcut. Thompson states that, "the owners and managers of some ships have certainly stretched the envelope of safety—and common sense—to the breaking point. Some cost-cutting measures appear to cut too many corners. Among them: schedules that don't leave enough time for travel; maintenance or safety; hiring cheaper foreign crews that may have inadequate training or experience; registration of ships with 'flags of convenience' from countries that offer relaxed enforcement of safety and crew certification standards" (1990). It is not just organizations related to the merchant marine. It is management in general that has perpetuated this business practice. Managing a 9:00 am to 7:00 pm operation five days a week is different from managing a 24-hour-a-day, seven-day-a-week operation for 90 to 120 days at a time. Marine transportation management cannot operate with a financial management mentality without incurring increases in risk. Reengineering the shipping business has yet to occur.

Workspace affects personnel. The physical work environment on board vessels is traditional and needs to be redesigned. This is partly because of the old but current regulations that administer the merchant fleet. The unions and the private sector have met "the physical demands of the living arrangements...still on many ships berthing is in close proximity to the working areas. The sharing of confined spaces, lack of societal norms, or inadequate recreation—leisure facilities" can be counterproductive during long voyages. The confines of the ship dictate the relationships on board. Feeling "lonely in the company of other people" is often exacerbated by the conditions where social networks are confined too (Sutherland and Cooper 1989). Working relationships can be affected. Peers and management are forced to get along with each other. For many, these conditions are worsened by lengthy voyages, stays away from the support of friends and family. The feeling of isolation or sensory deprivation (Sutherland and Cooper 1989) is another significant factor and it is usually a dissatisfier. As the crew size decreases, the sensory deprivation increases. Workplace design is a job satisfier and can counter sensory deprivation. Physical well-being contributes to mental well-being. Facilities such as a workshop, fitness center including a swimming pool, and satellite television reception brings societal norms to the at-sea environment. Mental well-being is also important to an employee's state of mind. The information age will help to alleviate the mental stress. In any 24-hour society, the constant peer-to-peer and manager-to-labor relationships may not be smooth. Leadership, motivation, and productivity
are achievable, but the challenge is greater. Workspace design is more important than ever before. Redesigning the ship’s workplace will have positive affects on behavior and performance (Sutherland and Cooper 1989). For improved productivity, the wheelhouse needs substantial redesign. All wheelhouses should be standardized like the cockpit of an aircraft. Aircraft standardization is by design not by chance.

**Measurements of Effectiveness**

The relationship between the effects of human factors on organization behavior and the linkage to potentially harmful accidents has been examined. The costs of ignoring human factors are high. With such high stakes, management must be concerned with implementing human factors. The maritime environment has characteristics particular to itself (Wilson 1992). Therefore, a means of measurement can only be effective if it is marinized.

*Physiological Measurements*

Alcohol and drugs are a factor in the sequence of events that lead to an accident. Both are considered to be a strong indicator of stress experienced by people everywhere. Naturally, “excessive stress can lead to several health problems in the form of . . . abuse” (Schmermerhorn 1994). Although a drink per day is recommended by the American Medical Association, incidents of excessive alcohol consumption interfere with performance, and are easily recognizable by coworkers or authorities. Sobriety tests are indeed a measure of fitness and readiness for duty.

Another measure of effectiveness is the medical examination. The Federal Aviation Administration requires all commercial pilots to be physically examined every six months. Healthy employees are more productive. Biological measures such as “blood pressure, heart rate, galvanic skin response, and respiration rate are some physiological indexes used to measure stress” (Lazarus 1989) and performance. It is in management’s interest to not only monitor these indicators, but also to provide the resources for activities such as exercise and physical fitness. Access to a fitness center should be provided to employees.

Stress can improve or weaken performance. Therefore, the measurement of performance can be used as an indicator of the presence of stress. Performance tests “measure the after-effects of exposure to a stressor. If subjects show lowered ability to do certain tasks after having been exposed to such stressors as loud noise . . . then it may be assumed that the impaired performance was due to the stress . . . performance tests should not be used alone as an indicator of stress, but should be supplemented by other devices” (Lazarus 1989).
Another method used to measure performance is feedback reporting. As trips or tasks are completed, members can be solicited for feedback on their own performance and the performance of other team members. Review of these reports can alert management to potential problems. Data from these reports should be maintained for building profiles of human reliability. Changes in personnel or workload must be monitored over periods of time as the profiles give a historical perspective for analysis.

Psychological Measurements

Except for drug and alcohol tests, there have been no quantifiable methods to test mental reasoning. Although these are widely accepted in the detection of stimulants and depressants that impair reaction time, the ability to test performance as a function of workload has only recently been explored. New computer software packages have been created to measure performance (McGinley 1992).

Predicting Performance

A performance testing software package called Factor 1000, developed by Performance Factors, Inc., tests mental alertness and coordination of Domino's Pizza truck drivers, warehouse workers, and dough makers. The test is a simple video game that measures hand-to-eye coordination by having the user try to keep a swinging pointer centered on a computer screen. A Domino's employee who fails the test is simply assigned paperwork or other tasks that do not involve much stress or danger (McGinley 1992).

Delta, a more enhanced performance testing package from Essex Software, is being piloted by a Japanese nuclear power utility, a foreign navy, and a major U.S. oil company. This package combines the technology from Factor 1000 with 20 tests that measure perception, reasoning skill, and judgment. Jeffrey Lapides, vice president of commercial products for Essex, claims that the software is not expensive (about $1,000 per copy) in comparison with the liability and employee disability law suits stemming from preventable accidents. Since testing began, many private companies have reported a decrease of on-the-job accidents by 67% (McGinley 1992).

Oil Spill Prevention and Recommendations

Since March 1989, life in the maritime industry has changed forever. If a single solution is chosen for oil spill prevention it must be human factors. Inasmuch as statutory reform is late or absent, training and education is the first step and is one aspect of human factors. Besides past
and current training, human factors principles must be taught. This will reduce or contain the by-products of stress, such as human error. As a marine inspector, I have inspected many ships and evaluated many mariners. Knowledge, skills, and abilities (KSA) ensure performance. "Training was almost always lacking, not so much on the part of the officers but with the rest of the crew... Spills by oil tankers provide an object lesson in the costly failure of a technical-training system to keep itself updated... because an inadequate technical-training curriculum creates the illusion of competence, it virtually ensures the accident it is intended to prevent" (Thompson 1990). Management and industry must address this education issue or the regulator will. KSA will be the determinator for tomorrow's education and training. The feeling of personal mastery and control of a situation is desirable. Human errors are reduced by KSA. Risks are minimized by KSA. Job satisfaction increases with KSA. Users must control technology. It is time for a new paradigm (Wilson 1992).

Training can be accomplished in many ways. Oil spills provide empirical data that must be used. These historical reviews can be used for scenario analysis. An individual's response and decision-making skills can be sharpened through walk-throughs or mental modeling. Technology exists today, i.e., simulation and expert systems that will capture the expertise for different training scenarios in a knowledge base. Today's ship should not sail without simulation games for training and recreation.

The maritime schools are our educational centers of excellence. The simplest and most effective solution to oil spill prevention lies in the education of the maritime workforce. The linkage to performance is clear: providing education and training results in a work crew that is able; esteem and morale improve; job satisfaction improves; stress is reduced; and productivity will increase. In a time where TQM (total quality management) means business, human factors means safe, reliable, and effective performance. Human factors is a part of business that a company cannot afford to do without.

References

Development of a Computer-based Model to Estimate the Staffing Needs of Commercial Ships

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Abstract

Technological developments and economic pressures have led to a 50% reduction in crew requirements on commercial ships. The promise of a “one-man bridge” and other technological changes may make additional reductions possible. However, the effect of these reductions on overall ship safety is unknown. In the past, crew requirements have been based on an evolutionary approach that has slowly adapted the crew size to meet the demands of the ship operation. Rapid changes in technology and operating conditions may render this evolutionary approach unworkable. This paper addresses the problem of specifying crew requirements by describing the development of a model that will provide a formal, objective method for determining the crew complement required for merchant vessel operation. This model will combine the time and expertise requirements of individual shipboard functions to estimate the crew resources required for different ship, technology, and route configurations. The viability of a proposed crew complement will depend on whether the calculated work hours for any of the crew exceed predefined work-hour limits. The primary benefits of this model are the ability to provide consistent estimates of crew requirements, facilitate communication between industry and the Coast Guard, and identify how staffing changes influence the overall safety and efficiency of ship operation.

Introduction

The issue of shipboard staffing is a complicated legal, economic, and human factors engineering question. The worldwide trend in shipboard staffing is toward increasingly smaller crew sizes—in the case of some Japanese ships, crews are composed of as few as 11 persons. Crews
of these sizes are made possible by advanced technologies permitting unmanned engine rooms and one-man bridge operation, as well as reductions of deck crew for cargo handling. A fundamental question that arises as a result of such crew reductions is the extent to which smaller crews compromise ship safety and the ability to respond in an emergency. This question has not been addressed satisfactorily, and there is a need for a systematic method of establishing safe crew levels that can be applied on an international basis. A number of authors share this opinion (Seitz 1981, Knudsen and Mathiesen 1987, Froese 1987, Joseph 1987, Gaffney 1987), and several approaches have been developed.

Although a variety of methods can be used to evaluate staffing requirements, the 1990 National Research Council (NRC) report illustrates the limitations of these techniques. For example, adjusting ship staffing and evaluating the rate of subsequent accidents could be catastrophically expensive. Furthermore, the many concurrent changes that might accompany crew reductions make it very difficult to identify a causal link between crew reductions and subsequent changes in accident rates. Computer-based models provide a safe, cost-effective alternative. A computer-based model that can predict the consequences of changes in staffing levels on ship safety could enable ship owners and regulators to evaluate a wide range of potential staffing alternatives.

In the context of this paper, “model” refers to a simplified representation of a system that translates input variables, such as changes in manning, into output variables, such as changes in ship safety. In essence, a model provides a simplified, abstract representation of an actual system, to evaluate system effectiveness. Therefore, any model developed will have limitations that include the types of scenarios it accommodates, decision support capabilities, ease of use, and the detail with which it describes shipboard tasks. However, as technological and economic pressures combine to modify staffing structures, even limited models of the human element aboard ships will help evaluate the safety consequences of proposed changes.

The need for a model of ship staffing is driven by the need to understand how reduced or modified staffing influences ship safety. The general issue of ship safety involves several more specific concerns, such as the ability of the crew to operate the ship without exceeding work-hour limits, the effects of increased technology, emergency response effectiveness, and maintenance capabilities. In establishing safe crew levels, government and industry need to consider demands on the crew, each vessel’s technology, type of service, crew skills, quality of management, and training programs. Evaluating how these and other issues affect ship safety provides a crucial step toward developing a technical basis for estimating the staffing needs of commercial ships.
One simple criterion of ship safety is work hours completed by the crew. If any crew member exceeds agreed-upon work-hour limits, then the ship requires more crew members to operate safely. Therefore, a basic requirement of a staffing model is the ability to test whether a proposed crew can operate a ship without exceeding work hour restrictions. The need to match crew qualifications to the task requirements complicates this simple requirement. Therefore, the model must incorporate information concerning both the time and skill requirements of each task. Developing a model that matches the time and expertise requirements of shipboard tasks with the proposed crew can help evaluate the effects of automation, the viability of maintenance plans, and emergency response capabilities.

Introducing advanced technology may automate many functions and offer opportunities to reduce crew size. However, it is not always obvious whether automation justifies crew reductions. Automation promises to reduce the physical and mental workload of ship personnel; however, the capability of automation to reduce workload in a way that promotes ship safety, especially in abnormal situations, is poorly understood. Research in the aviation and process control domains suggests that introducing automation often compromises system safety rather than enhancing it (Woods, Potter, Johannesen, and Holloway 1991, Wiener 1985). In many instances designers automate what is most easily automated, leading to a patchwork of systems that inhibit rather than support personnel. In addition, automation often operates smoothly during normal operations, but fails when the personnel need it most, during abnormal operations, leading to workload peaks greater than those experienced without automation (Wiener 1989). A model that matches task requirements to the proposed crew complement will identify workload peaks that might jeopardize ship safety. Therefore, the model will help avoid simplistic assumptions of workload reductions that might justify crew reductions. Thus, the model will help avoid unjustified crew reductions that may jeopardize ship safety.

Besides the problems associated with introducing new technology, emergency response capabilities represent an aspect of ship operations that may be especially sensitive to changes in staffing. Emergency response requires a coordinated effort of the crew, often in unfamiliar and adverse situations. Emergencies may require more people than normal operations, and the demands on these people may exceed those of routine activities. In addition, the ability of personnel to react efficiently to emergencies has immediate implications for the safety of the crew and for the integrity of the ship. Predicting the ability of a proposed crew complement to mitigate emergency situations would provide crucial information concerning how changes in staffing structure affect overall ship safety.
Like emergency response capabilities, the ability of a ship's crew to maintain the ship effectively may be particularly sensitive to changes in the staffing structure. Because ship safety is directly dependent on the quality of the maintenance, conditions which lead to inadequate maintenance require identification. Preventive and shore-based maintenance both act to alleviate unexpected maintenance demands. However, the effectiveness of these techniques, in conjunction with reduced staffing, has not received a detailed examination. A model can examine how different combinations of shore-based maintenance and modified staffing structures combine to affect ship maintenance.

In summary, to estimate the staffing requirements of a commercial ship a model must consider several issues. Most simply, a model that supports staffing decisions must consider whether the proposed crew can operate the ship without exceeding work-hour limits. This criterion can be used to address the impact of increasing complex technology, emergency response capabilities, and maintenance effectiveness. To evaluate the feasibility of producing such a model we examined past modeling efforts in the maritime and non-maritime domains. Past efforts show that no model currently exists that provides answers to these questions; however, previous efforts show that developing a model is feasible.

**Approach**

**Identification of Desired Model Capabilities**

To be most effective, the model developed during this project must include capabilities required by both the Coast Guard and industry. To ensure that the model includes these capabilities the views of labor representatives and ship operators will be solicited throughout the development process. At the beginning of the development process, a list of desired capabilities was generated through discussions with Coast Guard personnel, ship operators, and labor representatives. The interviews with ship operators ranged from oil tankers and container ships to research vessels and tug-barge combinations. Some capabilities were also identified from previous studies, such as Lee and Sanquist (1992), NRC (1990), and Grabowski and Hendrick (1993). Although we have tapped a range of sources, these capabilities represent an initial identification of what the model should be able to achieve. As development of the model progresses, additional capabilities are likely to be identified.

The model capabilities include the ability to examine the impact of automation, the emergency response capabilities, and the feasibility of maintenance programs. Specifically, the model will evaluate the effects of automation by adjusting or eliminating the time requirements of those
tasks affected by the automation. The model will then show how these changes influence the overall staffing requirements of the ship. The model will also evaluate the emergency response capabilities of a crew by examining whether sufficient crew members exist to perform all the tasks associated with a variety of common emergency response scenarios. To evaluate the viability of maintenance proposals the model will enable decision makers to evaluate whether sufficient crew and time are available to perform maintenance tasks when some are allocated to shoreside or riding crews.

Rapid Prototyping Approach to Model Development

Potentially, the model could include a wide variety of capabilities. However, it is not clear how best these capabilities should be implemented. To ensure that a model meets the needs of the Coast Guard and industry, these capabilities will be developed in a series of prototypes. Comments from the Coast Guard and industry will guide the development of successive prototypes so that the capabilities of the model will meet the requirements of the users.

Based on comments from industry and the Coast Guard, each prototype iteration will generate a model that is more useful than the one before. For each prototype, three elements are considered in making a more useful model. Each element is critical and neglecting any one of the three would result in a model that would fail to meet the needs of the Coast Guard. The three elements include:

- Data manipulation capabilities
- User interface enhancements and documentation
- Model accuracy

Data manipulation capabilities concern the ability to combine task/function data with potential crew configurations in different ways to evaluate proposed changes. For example, adding the ability to evaluate the consequences of a variety of shipboard automation alternatives facilitates analysis of shipboard data in a different way. User interface enhancements and documentation do not change the data manipulation capabilities of the model; however, these changes make the model easier to use. These changes also make the output of the model more comprehensible. For example, enabling users to view the output of the model in different formats (graphs or tables) and save results in a convenient format will help them take advantage of the data manipulation capabilities. Enhanced model accuracy is a requirement if the results are to be trusted and used to set
policies. Model accuracy depends on how well the relationships within the model reflect reality. For instance, the first prototype will assume that the tasks occur independently with a fixed frequency. The accuracy of future models will increase as additional information will be used to define when and how frequently tasks occur. Each prototype will include enhancements to the data manipulation, user interface, and model accuracy.

The goal of this project is to develop a model of ship staffing that will help the Coast Guard and industry to determine minimum staffing requirements. One of the primary objectives in developing the model is to ensure that its capabilities reflect the needs of potential users. To achieve this objective, model development will consist of a series of prototypes. Each prototype will be evaluated by ship operators, Coast Guard personnel, labor representatives, and modeling experts. The modeling experts will guarantee model accuracy and the others will ensure that the model contains the requisite features and capabilities. Based on comments from these groups, the model will be revised and a new prototype will be developed (see Figure 1).

Framework for Model Development

To arrive at an accurate estimate of crew size will require sophisticated data processing and modeling mechanisms. These mechanisms must be paired with an extremely flexible user interface that can deliver information in an easily comprehensible form. Furthermore, these requirements must be satisfied in the context of a limited budget and time.

![Diagram](attachment:image.png)

*Figure 1. An illustration of the process used to create a model to estimate the staffing needs of commercial ships.*
To satisfy these criteria, a customized user interface will be developed as a shell that surrounds a powerful computational engine. The primary benefits of this approach include:

- A user interface, free of computer jargon and simulation syntax, that eliminates the need for specialized modeling expertise

- Access to the power of task network simulation and a relational database

- A powerful, customized application that avoids the majority of software development costs

Figure 2 illustrates some of the main features associated with a custom tailored shell that surrounds task network simulation and relational database engines. The user interface manages the flow of information so that the user never needs to encounter the database or simulation engine. The left side of the figure shows several information flows into the model, and the right side shows several information flows leaving the model. For example, the model will enable users to enter a variety of emergency scenarios, such as engine room fire. The right side of the figure shows a variety of output information. One of the more important types of output are model diagnostics. These include assumptions, such as those that might accompany work-hour estimates and workload reductions associ-

![Diagram](image-url)

**Figure 2.** An illustration of how the user interface shell will work with the database and simulation engines to support users.
ated with various types of automation. The diagnostics, combined with screen-based charts and tables, clearly describe the implications of manning configurations on personnel work hours.

**Conclusion**

The capabilities included in the model will provide an effective way to augment the intuitive heuristics that justify the current staffing levels of commercial ships. The model embeds a powerful task network simulation within a user interface that can be tailored to the specific needs of regulators, ship owners, and labor representatives. In this way, the model avoids burdening decision makers with the need to develop, execute, and analyze simulations. The model will support analysis of three critical aspects of ship operation: the effect of increased automation, the effectiveness of various maintenance programs, and emergency response capabilities. Because the model considers all phases of ship operation, the entire crew, and a variety of voyage scenarios, the model can provide a realistic analysis of these issues. This will help avoid indiscriminate crew reductions that might follow the introduction of automation and jeopardize safety.

Developing a series of prototype models will identify the potential scope, flexibility, and role of a computer-based model in the decision making process associated with ship staffing. The rapid prototyping process outlined in this paper provides practical method for examining these issues. In this process, prototypes are developed and presented to the Coast Guard and industry. Based on comments from these groups, these prototypes can be refined and presented for further evaluation. The end product of this process will be a basic staffing model that provides a first step toward a technical basis for evaluating crew requirements. In addition, this process will identify the need for subsequent data collection and model development.

**Disclaimer**

The views and conclusions contained in this document are those of the authors and should not necessarily be interpreted as representing the official policies, either expressed or implied, of the United States Coast Guard, Washington, D.C., or the U.S. Government.

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References


