RADIO TECHNICAL COMMISSION
FOR MARITIME SERVICES

---

PLACE: Tradewinds Hotel
St. Petersburg Beach, Florida

DATE: April 29, 1997

TIME: Commencing at 9:00 A.M.

REPORTED BY: KELLEY N. SIMPSON, R.P.R.
Notary Public, State of Florida

VOLUME II - Sessions IV-A, IV-B

ROBERT A. DEMPSTER & ASSOCIATES
OFFICIAL COURT REPORTER
Post Office Box 35
Clearwater, Florida 34617
(813) 443-0992

PROCEEDINGS

MR. STRONG: I'd like to welcome you-all to day two of the Radio Technical Commission for Maritime Services Annual Assembly. We are glad to have you here. We hope you've had a good night's rest.

My name is Harry Strong; I'm a member of the board of RTCM and the planning committee. I work for Myer Tech Systems, a not-for-profit organization that evolved this year, supporting the federal government since 1958.

I'm very pleased to be your daily coordinator. If you have any problems or concerns, things that I can do to make your day more comfortable, head you in any direction you might need, I would appreciate it if you would come and see me and I'll try to do whatever I can for you.

I have a number of administrative announcements. First of all, we would very much appreciate it if you would go to microphones. We have Eddie over here on the sound system. I'm sure he would rather be mixing a rock and roll band, but today Eddie is going to be looking after us with our aging equipment and our microphones, so please go to the mic and identify yourself, and that will help all of us.

Secondly, please wear your badges. Helps us to get to know you, you get to know us. And put those right here where they're visible. We appreciate that.

Also, since overnight, despite computer problems and printer problems, there are piles of lists of attendees out on the table out here beside the bulletin board, and also lists of the suites and the organizations who are exhibiting in those suites. It's a very handy list to have as you migrate around through the second and third floors of the hotel.

And I would urge you -- I went to most of the suites last evening. I would urge you to go and to visit the vendors, the people representing the products here. Some excellent exhibits, demonstrations I think you'll find very, very much worth your while.

The organizations spent a lot of time, money and effort coming, we appreciate that and you can express your appreciation by dropping by and talking with them.

Just a brief overview of the program today.

First off, we're going to have the morning sessions looking at the communications and transponder technology, someone will follow on from yesterday. Then we're going to turn to integrated NAV and shipboard systems prior to lunch.

After that we'll be looking into charting and charting technologies in the afternoon period. And then again we will adjourn in time for folks to get a chance to go to the suites and to see some of the exhibitors.

So with that, let me introduce our moderator for the morning, that's Bob Perris. Mr. Perris is a senior electronics engineer with the United States Coast Guard. He serves as the technical leader for the Vessel Traffic Service Project Office, which he joined in 1994.

Mr. Perris is a graduate of the University of Massachusetts. Prior to joining the Coast Guard, he spent 26 years working for the U.S. Marine Corp. and the Space and Naval Warfare Systems Command, Spa War.

In his career with the Navy, he developed a field of variety of tracking and communications systems for vessels, land, mobile units and personnel. A number of those systems went on to Desert Storm and were credited with numerous rescue extractions and saving lives.

He has also been the project manager for the Royal Saudi Navy, C-3 Program, and head of Spa War International Programs in foreign military sales office, and also was a U.S. Navy fleet systems engineer.

Keeping with our divulging of what we sail in, Bob tells me that he owns a canoe fully equipped with DGPS, a transponder and a small radar.

MR. PERRIS: Thank you. Thank you, Harry, for that kind of introduction.

This morning we're pleased to have a panel of six distinguished members of industry.

Can you hear me back there okay? Okay. They will present telecommunications technology as with respect to AIS and VTS. Before I introduce the panel, I would just like to briefly go over the agenda, and the first chart.

We'll have two presentations this morning, first one will be given by Tom Braithwaite and the second by Mr. Don Sitsma. Then we'll have a 20-minute break.

And next slide, please. We'll reconvene at ten o'clock and have the remaining three presentations. And now I'd like to present our panel.

Our first paper was co-authored by Mr. Tom Braithwaite and Mr. Scott Rockhold, and it's entitled Spread Spectrum as a DSC Gateway Destination. And Mr. Braithwaite currently is director of business development for the AIRINC Corporation. He is responsible for surface transportation, including rail, transit, highway and marine systems.

Mr. Rockhold, seated right next to him, is the chief engineer at Hughes Maritime Systems, responsible for all technical matters related to maritime systems.

And our second paper this morning will be given by Mr. Don Sitsma, sitting at the end of the table. Don is the president of Meteor Communications Corporation located in Kent, Washington with offices in the east coast and Europe?

MR. SITSMA: Also one in England.

MR. PERRIS: Also one in England. Thank you.

His paper -- this is a tongue twister, so I'll have to read this one. Application of Very Low Frequency Extended Line of Sight Technology for AIS Systems.

And with that, I'd like to turn it over to Mr. Braithwaite.

MR. BRAITHWAITE: Thank you, Bob. Good morning everybody. First, I think I'm obligated to tell everybody what AIRINC means, because I go through this every place I go. It originally stood for Aeronautical Radio Incorporated. We are owned by the airlines and we are the communications company for the air transport industry. And now you can remember that acronym, kind of an acronym of acronyms now.

The good news is that I'm not going to be technical this morning. I originally started to do this paper on some spread spectrum technology, but I realized as I get into this, the issues, the concept of the system were much more important. And so today what I want to do is really bring, bring up the issue of all of the features that we've been discussing for, for the various ports throughout the United States and try to divide the system into two pieces.

What I'm really recommending here is that we take a look at the safety issues as part of the Coast Guard VTS, and leave all of the other enhancements to port productivity to the business of running the port and let the stakeholders in each of the ports effectively wind up operating an information system similar to the LA/LB Marine Exchange on a profit making basis this time, where the cost of deploying that system can be borne by the users on a fee basis. So that's what I'm going to get into a little bit today. The first slide, please.

In my paper I talked about the vision of what this country is going to look like in the year 2020, and I honestly believe that we're going to see information technology by the year 2020 of an order far beyond our imagination right now. The only question I have is how we're going to get there and how long it will take.

When I talked about the VTS just for the safety of the ports, I think it's a much cleaner issue. It's something that the Coast Guard can operate, they can get funded from Congress, it's a clean issue. And when I talked about a Port Information Management System, it leaves the capability of how that is developed and deployed up to each of the individual ports. PIMS in itself can be a public/private partnership. It doesn't have to just be the pilot organizations, the port authority, the marine exchanges. We can bring in commercial partners and venture capital. There is a source of funding that we can provide that would allow this business to be developed. It can be profitable, and I think that there is enough stakeholders in each of the ports that we can come up with a type of vision that's needed.

There's a couple of problems. Problem number one is Automatic Identification Systems needs international acceptance. We've talked about all kinds of systems that we can use, but we must remember that ports have to, have to supply information and get information from ships of the world.

These international ships are required to carry GMDSS radio equipment next year if they don't already have it on-board right now. And the easiest transition for that ship is to modify that equipment so that it can handle digital selective calling in the method that's going to be hopefully approved by IMO in 18 months and



that is ITU recommendation 825. And I won't get into the details of that, that gets pretty complicated.

But essentially there's several modes of operation of digital selecting calling radio that would allow both poled position reports from ships in a broadcast method of each ship broadcasting on a time slot basis of what he's got.

And that can also contain information on not only just position, but course and speed and a lot of the other safety enhancements that I see coming out of the recommendations of both the Marine Board and the New Orleans committees on the lower Mississippi.

I think it will meet all the basic scenarios for safety with the VHF marine band. And that's the one that's internationally accepted right now. And although we have some problems in this country with lack of frequency allocations because we gave a lot away to the railroads years ago, I think we can still work around that with some narrow banding and some other concepts.

But it does give a cost effective approach to the ship owner, and it allows interfaces to a



lot of on-board systems. You can connect into an integrated bridge system, connect into the on-board GPS, get heading information, speed information, et cetera.

The second problem, and probably a little stickier problem, is the need for efficient port operations. The DSC concept right now as recommended by ITU in that 825 recommendation really doesn't have enough data right, enough band with enough speed to give us all the things that we've seen talked about here and all the things that we've seen coming out of the lower Mississippi River recommendation in particular.

I don't think that's a Coast Guard responsibility either. I think that a lot of those enhancements to the information system, the AIS system, can be taken care of by the port stakeholders themselves. I personally don't think Congress is going to fund it. I don't think they are going to go beyond the safety issue. If they do, then we all get real lucky. I just don't think we should count on that.

The port stakeholders can run this as a business, but they need a champion in each of the ports. Somebody like the LA Marine Exchange that



stood up and took the lead and worked the problem both at the state and federal level.

One of the things that I wanted to bring up was the concept of ISTEA, and I know a lot of you aren't familiar with this, but for five years Congress has been funding the Intermodal Surface Transportation Efficiency Act. It's coming up for renewal for another six years worth of funding, going to be about a billion and a half dollars in it, the last one had over a billion.

That money has been used to develop national architecture for highways, and particularly communication systems for information traveler, travel information systems. The railroads are getting money out of it, the Commuter Rail Subways Transit Organization, metropolitan areas are getting funds and grants out of this stuff. Marine is not getting anything.

I think there is every reason to expect that we could put in for grant money with DOT, make a very cogent argument that we are a very strong part of the intermodal operation of this country, and see if we can get some deployments to do this PIMS thing, which is precisely what Congress wants. They want public-private partnerships.



They want to seed the money into the local, state and local level, and then they want to be able to step aside, get out of the way and let it be run as a profit-making business. That's why ISTEA was created.

There's also state infrastructure banks that have been created out of Congress that provides funding in very attractive rates and sometimes grants. There's private firms that can put up money. Typically the federal grants are at 80/20 match, 80 percent comes out of the federal, you have to come up with 20 percent locally.

Companies can step up and say, you know, we put a million dollars or more of research and development together, and we want credit for that as part of our matching funds and that has been a settled argument.

To do a, to do an effective PIMS we've got some challenges ahead of us if we're going to do this. We need to, we need to recognize that technology is changing rapidly and it's one of the reasons I'm saying let's draw a box around the Coast Guard responsibility, freeze it and get on with our life, because the other technology is changing so fast we'll chase it for another ten



years like we have now if we don't do that.

The protocols need to be established so we can have some standardization in communications. There's already a national transportation communications interface protocol been developed for highway and train work. We may be able to adopt that, provide us with both the messaging format and the interchange.

Wireless technology. Ships are old. We have to have wireless technology to be able to reach the ships. And there is so much going on in that, and I talk about so many forms of that in my paper, one of which is coming up on the next slide.

We need a network architecture that is going to be flexible enough to be adapted to each of the individual ports. We know that all of the ports are different. No two ports are identical, but we have to have an architecture that can be adapted to that.

We have to identify the data sources and the data users. This is how we're going to make some money. The information that has to be for sale comes from a variety of sources, weather information, tide and current reports, berthing



assignments, pilot assignments, tug assignments, anchorages. I always admired the Singapore folks. They want 90 percent of their berths occupied all of the time and they're striving hard to get there. That's a pretty efficient operation.

And the data users, the people who are willing to buy the information. We can even look at cable subscriptions for information. Next slide please.

The maritime net that, one of the things I want to talk about is the possibility of a protected spread spectrum frequency. We don't know if we can achieve this, but we are looking at 5.6 gigahertz spread spectrum frequency. And if we can get it with enough band width, we may be able to get the data rates that we need to run a wireless network. IEEE is now approved.

802.11, which is the wireless network standards, this is something that may serve a port area where everybody can effectively think that they're tied in on an Internet cable.

There is new connections that we can give them to a broader worldwide Internet, and new web cast technology has now come about where each



individual subscriber can get precisely the information that they want in real time, updated all the time.

These are the new technologies that I don't think we need to throw on the Coast Guard and say this has to be part of VTS. It's a business and we can run it that way. And the last slide, please.

The thing that has to happen is we have to make a business case. It's the only way we're going to get the type of solution that managements and any organization will sign up to go forward with. It will be similar to what the Marine Exchange in LA/Long Beach does, they will be selling information.

We need a market analysis prior to any investments that we ask people to make. We need cost models. We need to automate as much of the services as we can to keep those costs down. You can't staff this with a lot of people and expect to make any money at it.

Cash flow is the most important aspect of any new business. More businesses go bankrupt because they get behind in that cash flow and they can't make their payroll. We have to be



able to stay in the black at all times, and that's what a good business case does for you.

This information for fee stuff really is a small fee for a very large customer base. And if I asked an Internet, a cable subscriber to pay a dollar for a month to get all of the marine information on the port that they wanted, that's not asking a great deal on the cable subscription. But if you had half a million users, that's a lot of money.

The last thing I guess I wanted to make for a point on this is that port efficiency really is a winning situation for everybody. The ship owner wins, the port authorities win, the Coast Guard and the federal government win. I can't see any losers on this.

And I know we're not going to have questions until about an hour and a half from now and you probably all forgot what I said anyhow, so I want to throw one question out to the audience and hopefully I can get some response when we come back for questions and that is, does anybody see any reason why this concept won't work?

Thank you for your time.

(Applause.)



MR. PERRIS: Mr. Sitsma?

MR. SITSMA: Thank you, Bob.

My paper this morning is going to look at specific applications of ASI or AIS. And I'm going to try to stay light on technology, and just be a little more heavy on specific applications.

A little bit of background on our company. We were established in 1975. We're located in Seattle, Washington. And MCC is basically a systems integrator and functions as a prime contractor for deploying turnkey communication systems for the purpose of data gathering and data dissemination, which essentially is an AIS network.

We use two types of technology, both VHF meteor burst communications, which may be a new term to some of you, and extended line of sight technology. And these two operate seamlessly with one another and have been used successfully in deploying a number of AIS-type networks. Next slide, please.

Just briefly on technology, meteor burst communications makes use of billions of micrometeors that enter the atmosphere daily.



They vaporize, they burn up, they leave a trail for about a quarter of a second, and that is used as a transmission medium for VHF radio signals. Gives us a range of approximately 2,000 kilometers. And this is a channel that's very noisy, it's intermittent, it's a difficult one to reliably communicate on, so our company has been developing very robust and adapting protocols over the past few decades to successfully use this transmission medium.

As I mentioned, this has a long-range effect. But it also has a very good extended line of sight range. It's difficult to see this. Right in this area here, we get a good range of about 75 to 100 miles by ground wave, a refraction of the low VHF signal around the curvature of the earth.  Those elements, combined with the protocols that we have, gives us a very good, robust VHF technology.  Next slide, please.

Principle features of which are, this is a system that will operate on one frequency in the low VHF band.  As I mentioned, ranges go up to 100 miles on extended line of sight.  And we use a protocol that combines both CSMA and time division multiple access, and we get a channel



efficiency and utilization of about 90 percent. That's about all the depth I'll go into on the technology.  I'd encourage you to take time to read our paper and we go into a little more detail at that point.

Typical AIS network is comprised of transponders on board vessels, one or more base stations, and then, of course, the control center where the, where the data finally is transmitted to.

The base stations -- generally if there is a land line available, they will tie directly into a control center.  If not, they will function as a repeater station, operating into the nearest base station and then to a control center. The transponders on board the ships, as you can see we provide both ship-to-ship and ship-to-shore communications.

The way the system operates when it, when a vessel approaches or enters into an AIS network, it will operate in the CMSA mode, carrier sense mode, multiple access mode, establish communication with its nearest neighbor. If it's outside of a base station range, it will automatically communicate with the nearest vessel



and there will actually be groups of vessels that will form their own subnetwork of communicating with one another. If one of those vessels comes in contact with the base station, then it functions as the repeater station for that group, and all vessels can communicate then into the control center. Next slide, please.

Briefly show you what's, what equipment goes into a base station. See there, it's two elements, primarily. There's the transponder, which is the same unit that's used on board the vessel, so we just use one radio throughout the network, and then one antenna, which can be a, as you can see, either a folded I pole or just a ten-foot whip. Those are the basic elements of the base station. Can operate off either AC power or solar panel if that's not available.

It's completely automated, unattended, and if there is not a land line available, then it can function as a repeater station -- next slide, please -- which then can communicate directly into the nearest base station. They're very light weight and small base stations. They're rapidly deployed in times of emergency or, or if the network needs to be extended periodically for



maybe a community of vessels and aircraft that may be responding to an incident, a portable repeater station can be set up very quickly.

The transponder assembly on board the vessel. Next slide, please. This unit right here, it's about the size of about a sheet of paper and about an inch and a half thick, and then a ten-foot antenna here on the vessel. Those are the basic components.

Other items that could be added -- well, generally are added, are differential GPS or GPS laptop computer for two-way messaging. And automatic position reporting then is provided from seconds to minutes, and this is a programmable feature, either on board the vessel -- it can also be programed from the control center, transferred to the operator on the, on the ship. It can also be dynamically adjusted, depending on its proximity to other vessels in its neighborhood.

And as you can see, we provide the vessel ID, speed over ground, et cetera. Next slide, please.

So an AIS network is truly multipurpose. It can be used for vessel-to-vessel communications,



vessel-to-shore. Yesterday we talked quite a bit about AIS navigation and environmental monitoring. That's very easily embedded into an AIS network. That information gathered into the control center and then again disseminated out into the vessels of the network. And transponders have been placed on, as you can see, the ships, aircraft, helicopters and so forth.

So, at this time I'd like to look at four specific systems that have been deployed, just give you an idea of the elements that go into a system and some of the features.

The first system is the resource management system. This was deployed several years ago by the Department of Forestry, Ministry of Forests in British Columbia. They respond to incidences each year, approximately 3,000 wild fires, and so their objectives were very similar to the maritime industry. They wanted to eliminate the congestion on voice channels and they wanted to ensure that there was safe and efficient operation of all of their aircraft and helicopters, and they wanted this to be not burdensome to the pilot.

So the network that was deployed was an AIS



network providing update positioning every 30 seconds, two-way messaging with full end-to-end acknowledgment. That's a rather large network. They operate approximately 250 transponders on various aircraft and vehicles. And this provides coverage throughout the province of British Columbia and also the coastal areas.

Now, the architecture of this system, as I mentioned, consists of about 30 base stations, and that provides complete communications throughout British Columbia. And kind of to put that in perspective, you can put almost six Louisianas into the province of British Columbia. So just with a third of the base stations we have complete coverage, including the coastal areas.

Now, as you can see here, the various vehicles and aircrafts communicate directly to a base station, or if they're out of range of a base station, they go to the nearest neighbor and then into a base station into the Victoria control center where the dispatchers have maps that with icons they show all of the, where the resources are located. So when a fire breaks out or there is an incident, they immediately determine the nearest resource and dispatch that



resource to take care of that, that fire.

Then there are a number of work stations connected to the control center in Victoria as well, so it's a client-server system, the server located in Victoria with a complete database on all of their resources. Next slide.

Now, there are, a number of their base stations provide coverage along the coastal areas. And so for the past several years there have been a number of vessels that have been equipped with transponders and are part of that network. And the type of vessels tracked, super ferries, tugs, hovercrafts, sea buses. You can see all of them listed there on the lower left-hand portion of the slide. Sailboats, swift shore rays, and also on rigid hull inflatable boats.

And this over the past several years then has allowed the various types of AIS technologies to be tested and to be evaluated, such as moving map displays -- those are provided on board the ships and also some of the aircraft -- and ship-to-shore and ship-to-ship communications and so forth. Okay. Next slide.

Other system that I want to briefly touch on



is the system that's being deployed in the state of Michigan. This is a terrestrial system, but still a lot of the elements are certainly applicable to a maritime situation. This is for law enforcement. And the network consists of about 20 base stations throughout lower and upper peninsulas of Michigan providing coverage also over much of the Great Lakes region. Next slide.

And this is essentially a data gathering and dissemination network. As you can see, there's, up to 350 vehicles will be assigned to that system. There will be vehicle-to-vehicle communications as well as vehicle-to-base station and into the control center in Lancing, Michigan. So all of the information from these vehicles, position reports, two-way messaging and so forth, differential GPS is all communicated to the central station in Lancing, and then disseminated to up to 28 district offices throughout the state of Michigan.

And the next slide shows the transponder assembly that's on a, on a vehicle. Again, automatic position reports and here are the update rate on position as a function of the speed of the vehicle. This is all done



automatically. Two-way messaging, emergency communications as well, panic button in the vehicle. The driver also has a key chain, so if he is up to a quarter of a mile from the vehicle, he can automatically send an emergency message into the central headquarters in Lancing.

And then all of this, those events are monitored in the vehicle, automatically, so it's not burdensome at all to the driver. And there is a mobile data terminal that is mounted on the dash, a two-line display for scrolling, up to 120 preprogrammed messages. So if there's a message he wishes to send, he can just scroll through it, hit the send button. So it's very easy to implement for the, for the operator.

Also, using GPS we have market drops so that if there are road hazards or accidents that can be reported, that can be entered by a push of a button and taken care of. Okay. Next slide.

The system or project we're just working on now is, we call it PACMAR AIS. And this is really the development and assessment of an AIS system in Canada. This is a six-month test and evaluation. And again, this is a joint government and industry project sponsored by the



VC Chamber of Fishing, VC pilots and the Canadian Coast Guard.

And here you can see we're making use of some of the coastal networks base stations that are part of the British Columbia Ministry of

Forest network. There are six additional stations being installed, so there is continuous coverage from Vancouver to Prince Rupert.

There will be portable transponders that will be used by pilots. There will be 20 vessels equipped with, pre-equipped with antennas so the pilots can come on board and quickly hook up their portable units. There also will be fully portable units.

We have several of them here today, and so we're very anxious for you folks to take a look at that, because we would like to have your feedback because we really want to address the needs of the pilots.

This is, as I mentioned, a system that will run for about six months. It will start in May and go through October. And some of the objectives on this system are shown on the next slide. These are all detailed in our paper, so that's probably the best place for you to review



these.

But primarily three areas, evaluation of technical parameters, coverage interference, capacity and so forth. And then the operational assessment, viability of carry-on portable units. And then how, then to address how does AIS integrate and work into a total VTS operation.

Final network I'd like for you to take a look at is the International Tug of Opportunity System.

The purpose of this network is to provide emergency response to disabled oil tankers in the Puget Sound area, Straits of Wandefuka and along the Olympic Coast Marine Sanctuary. And the purpose again is to prevent groundings and to protect the marine environment. This system is scheduled to come on-line late this summer. It will consist of approximately 100 tugs. May we have the next slide, please?

It will be automatic positioning, information available on 100 tugs. Control or the master station will be located in the Marine Exchange in Seattle, Washington. And monitoring stations will be set up at the Coast Guard, both in Vancouver for the Canadian Coast Guard and in



Seattle for the U.S. Coast Guard. And there will be a visual read out of ID, tug location, course and speed. And if there is an incident, the nearest tug would be located within a matter of seconds and procedures can then begin as far as dispatching the nearest available and capable tug.

The next slide shows you briefly what the network architecture is going to be. This is very detailed, but primarily all of the base stations, there will be four that will be interconnected through what we call a frame relay cloud or EXDOP-25 network. This will interconnect the control center in Kent, Washington, also the Marine Exchange in Seattle, and the Coast Guard facilities in Seattle and Vancouver. So this is a client-server network. This is discussed further in the paper, and I'll encourage you to read that. Next slide.

To conclude here, we have a VHF extended line of sight network. There are many applications that can be brought into that network. You can see them all here. Just next one to highlight there is the port environmental monitoring tides, currents, aids to navigation



and so forth.

So in conclusion, certainly VHF extended line of sight is one of the most capable AIS technologies. It makes very efficient use of the spectrum, uses single channel. Efficiencies on the channel approach 90 percent of the protocols used. And the equipment is available, it's off-the-shelf. Nationwide frequencies are available. And it's a proven technology and it works.

So thank you for this opportunity to speak.

(Applause.)

MR. STRONG: I'd like to thank you for two interesting papers and I'm sure there will be time for questions here when we get through this particular discussion.

One of the things I want to do just before we break for coffee while you're all here and in mass, is to thank the United States Coast Guard for its significant participation. This is the first time this year that we've ever done this at RTCM, and having all of the Coast Guard being able to be with us and speak in a single day like yesterday and some of today. We particularly would like to thank Lieutenant Commander Frank



Elfring, Steve Nearing and Joyce Burton who I know worked very hard with the planning committee to put all of this together, and we very much appreciate it.

And I also just wanted to really extend my thanks to Admiral North for being able to spend as much time as he did with us. That is a very busy job that he has and we appreciate that.

The other thing I wanted to do just before we take the coffee break, if you'll direct your eyes to your right over here and you see the banner of Radio Technical Commission for Maritime Services, you'll notice that it says since 1947. If you do a quick subtraction, you will note that this is our 50th anniversary. I think I am the first person to mention that since this assembly proceeding started.

I think that's pretty significant. And while we choose not to have a large celebration, there was suggestions of golf tournaments and fishing tournaments. But nonetheless, if you think of what's happened to the technologies that are associated with our business over 50 years, it's astounding to see the changes that have taken place, that are taking place.

I don't know, is Bill Adams in the room? I figured he wouldn't be. But there's been a lot of people in positions of leadership in this organization. I've been privileged in the last two years of working with RTCM, but Bill Adams has been a faithful president for the last number of years, and I just think he does a wonderful job. He is a very humble man and he'd be very upset and will be when he hears that I said this today.

But on our 50th anniversary as an organization, I thank you for your support. And I would urge you when you see Bill to shake his hand and say thank you for being our president, thank you for all of the hard work of working behind the scenes. He works very, very hard. He is a task master to make sure that everything goes right. But you-all appreciate that because things are orderly and -- but just go up and say thank you, Bill, for being our president. And don't tell him who told you to do that.

See you at 10:00.

(Brief recess.)

MR. STRONG: We'd like to get started with the second session, continuing on dealing with the issue of communication and transponder technology. Bob Perris will continue as moderator. The one correction to the record, I understand he also has a charting system on the canoe. Bob?

MR. PERRIS: Thank you. Thank you, Harry. Can we all take a seat, please, so we can get started? Take another minute to get started here. The theater lights are flashing.

Our next paper will be given by Mr. Ross Norsworthy. And Ross's paper will be titled ADS and DSC technology. Mr. Norsworthy is president of Ross Engineering. It's located here in Tampa. He is a graduate of the University of South Florida in Tampa and is a native of Tampa, Florida.

Mr. Ross Norsworthy.

MR. NORSWORTHY: Thanks, Bob.

I'm also an avid boater and fisherman, and once upon a time I was working in the avionics industry with Bendix, I was an engineering manager for Bendix Avionics in Ft. Lauderdale. And Ed King came to me one day from King Radio and said, hey, how would you like to go into the marine business? And I said, what do you want me to do? And he said, well, I want to start this marine company, King Marine. And he says, what you are going to do for the marine business is what you did in the aviation business, only design the integrated cockpit -- we designed the cockpit for the Boeing 757 and 767, which was an all glass cockpit. And he said, I want that same -- that's my vision for marine. And I said, okay. So now I can put my vocation and my avocation together and marry them together in one, so that's how we got into the marine business.

So we started King Marine in 1982 and then King Marine got bought and sold in that Allied Bendix thing, and we decided to do Ross Engineering because we were tired of corporate mergers. We didn't know who our boss was. In fact, the joke at King Marine was, the president said, if my boss calls in, take his name and number. So we did Ross Engineering because we got tired of trying to figure out who our new corporate owner was.

Okay. So we organized in 1986. We have a lot to say this morning and we're going to try to condense it into 15 minutes. First picture slide, please.

Try to get these right side up. This whole thing of AIS started with DSC. The IT recommendations provided for messaging, digital messaging within a radio, and IT recommendation 493 and 541 were adopted by the IMO and were put into the Safety Life at Sea Treaty. The idea was that you could push a button and get rescued because you would transmit your vessel ID and position. Next slide, picture slide.

We tried to sell DSC. We couldn't for a while because there were no mandates yet in force, so we decided to sell DSC on its merits. So we put scramblers in there and we put all kinds of poling stuff in there and the tuna fleet, fishing fleet started buying them. Next slide, please.

So we found that we could provide value to the fishermen by being able to track their boats, doing group callings, secure calling, and individual ship-to-ship calling. Next slide.

In 1992 we started installing a number of units on tuna boats. You'll see this tuna boat has a helicopter on its top, and there are other tuna boats in the area, and this is called a spotter plane. And so the task was to be able to communicate securely so that the other tuna boats didn't hear you, and so we scrambled and we tracked. Next slide.

This is a picture of the helicopter on top of the tuna boat. Next slide.

And on the tuna boat we integrated the Ross DSC500 with a Tremble GPS and a Furuno plotter, and Furuno radar. That was the first in 1992 that I know of, first integration of kind of an AIS kind of a system. Next, please.

Flip that one 90 degrees. That's upside down. Right side up. That's the integrated helicopter. You see the, that's a GPS, a Ross radio there and there's an Echo Tech plotter over to the side which you can't see. So they had an integrated bridge on the ship. Next, please.

This is an integrated radio base station. The next point in evolution was to integrate the AIS, the DSC operating system, the GMDSS emergency watch, and communications all in one radio site. There's two base stations, one directly behind the other. One is an eight channel and one is a six channel.

The one in front of you is a six-channel system, which contains all the transceivers, the DSC controllers, the AIS software, the DSC software, the communications software all in one cabinet. These were done under a subcontract with Lockheed Martin who had the prime contract with the Saudies for Ross Tenuric, Saudi Arabia. It's a totally integrated system all in one cabinet. Next slide.

That cabinet that we just saw takes two antennas to operate. We can put everything on one antenna, but it's going to take some racks like this. Here in Tampa on a radio tower down the street we have these two jug racks there. Now, that system -- our Tampa system has 14 working channels; 12 duplex and the others are simplex. And there is a combiner way of putting them all on one antenna, but it takes a lot of real estate. Next slide, please.

This is an example of an AIS work station. This is the one that we have in our shop and some other people in Canada and the United States have similar work stations. There's one of these in Los Angeles County. The Los Angeles County lifeguards under LA Fire Department just ordered a system of just -- we just delivered, they ordered it a year ago, we just delivered the complete infrastructure for them, and we have a high site on Black Jack Mountain on Catalina Island that has a reach from Point Conception to the Mexican border. It's a fully indicated DSC, AIS com system. That's an integrated tracking system. You see on the display the map, screen and all the vessels. Next, please.

In addition to tracking the vessels, we have all the vessel data on the right-hand side. Next slide.

We also have messaging. Our system facilitates shore-ship, ship-shore and ship-ship messaging through the work station. Next slide, please.

It's like flash e-mail. In addition to that, we have ports data. The system is connected to the port server in Tampa and we have all the ports data available to all the users. Next slide, please.

This box is an integration similar to -- in fact, some of these are actually on some of those -- there's 80 Valdez tankers that go in and out of Valdez, and that is an integration of an ASDSSE, automated shipboard dependence surveillance system equipment, with a DSC radio, a single-board computer, 12 channel GPS and a beacon receiver. Next slide, please.

The pilot said, well, it's not enough that big brother is watching me, we want to watch ourselves. So how can you give us something to look at? So we interfaced this to, in this illustration, a laptop PC which gives all the same facilities to the ship that are on the shore. Next slide, please.

And then they want portables. Bob Steiner had a lot to say yesterday about needs, needs, needs, and Captain Cropper from Tampa said, yeah, but we looked at some things and there are some things we want. So possibilities and needs are in a do loop that goes around and around. Hopefully we can find some exit point and draw a box around this thing, because the more you find that you see in possibilities, the more you define as needs.

And so we need some portable units. Why do we need portable units? Because in the interim while we're waiting for the mandates to come down and all the vessels to have the equipment installed on board, we need the carry aboards, so



the state licensed pilots carry these aboard.

Someone said, you can do this wireless? We need wireless. Again, possibility turns into need. And so we put enough battery capacity in this unit to last for 12 hours. We have a laptop PC, all the things, and it's totally wireless. The suitcase hangs on a rail on the fly bridge above the main bridge and the pilot has the laptop PC and there is a 2.4 Gig wireless serial link between the two. Next slide, please.

They said, oh, you can do it lighter. We need it lighter. Smaller, lighter. Not only do they want wireless now, they want it smaller, lighter. And so in our lab we have another suitcase. The black one to the right is a smaller, lighter version of the heavier, clunkier one to the left. Will somebody let me off the treadmill? Next slide, please.

Okay. And then on the laptop PC we see a turn. Somebody said, you know, could you draw us a constant radius turn? You know, we have this cross draft where when we're going to from weight point A, to weight point B, but we don't navigate weight points when we're in turns. It would be nice, too, if we could see the turn. Oh, you can



do that? All right. Possibility gives rise to need. We need a cross-track indicator that's good in a turn. So there we've drawn in the turn, a constant radius turn, and we give them cross track against the next turn. Can you tell us how far we are until the next turn? Possibility gives rise to need.

On the right-hand side of the screen in blue we have a countdown to the next event. Can you give us closing information on the nearest ship? Yes, we can. The message box on the right gives you all the closing information on the ship or the ship you clicked on. Feet off the centerline to the left in red. Red or green? Yes, red or green. We need that. Cross-track indicator on the right, we need that. We need to see that. Okay. Next slide, please. And we need to see our ship's actual size. We do that, too.

Can you message back and forth? We need flash e-mail back and forth. Yes, we can. So we installed flash e-mail.

We need ports data on the ship because we need to know what the tide situation is so that we can plan where we're going to be and when we're going to be. There's ports data. Next



slide, please.

Okay. We finished with the pictures, now for the words. I've given you a paper today -- and my time is going fast. The paper today has too many pages, so we're not going to read all the slides. Put the first one up for us, Tom, the first message slide.

That just tells you something about the company, something about our involvement in the international arenas. We volunteered into the ITU working parties a few years ago because we felt there was a need for us to understand what was going on and maybe participate a little bit. And we've also volunteered into the IMO NAV-43 process and we'll be going to London in July to help the United States and the rest of the world figure out what we're going to do. We are a pioneer in digital selective calling and automated independence surveillance. Next slide.

This is a summary of our contributions to U.S. government sponsored projects. Next slide, please. You can look at those later. That is just some advertisement, but it's true.

Our customers are Army, Navy, Coast Guard, Canadian Coast Guard, Lockheed Martin and a bunch



of other ones. We are currently the standard on all Army, U.S. Army watercraft, and our population in the Navy is increasing rapidly as well. Coast Guard is going out for procurement of DSC radios, I hope we win. Hope somebody good wins anyway. Next slide, please.

What are the requirements of DSC? There are a list of requirements if you care to look at them. I think there are now six ITU recommendations that reference DSC or are DSC.

The little radio became an integrated multi-mode shipboard radio system which has all the feature capabilities in it. It's very programmable. The Ross DSC-500A gives a date with a laptop PC and it can be anything you want it to be. It's infinitely programmable and it has menu selections and stuff on it. Has all the standard interfaces to other shipboard equipment and shore-side equipment. Next slide, please.

There's the combined radio cabinet with

everything in it, and we can do it on one antenna as well as two. This is a summary of what is in those integrated radio cabinets. Next slide, please.

The Ross DSC implementation provides



electronic charts, accepts standard vector charts. Also interfaces to ECDIS, using a standard IUC1162 interface. It gives you the wide area waterway of all ships positions on screen at actual size with an active default to minimum size, so a ship never goes below a minimum size so you can see it. Closing information on the closest other ship, all ships data as per the recommendations is available. Complete shore-side watch-standing capability. Flash e-mail messaging available to all stations. Ship-ship, ship-shore, shore-ship and groups of ships selectively. Access to the public switched telephone network for internet and intranet access -- there is your open architecture guys -- for access to weather maps and ports data. Facilities fixed installations on ships. Portable wireless units for pilot carry aboards. Expansion capability for other sensors and ship's computers and a complete shore-side multi-mode communication system. Next slide, please.

Why DSC? What are the advantages of DSC for AIS applications? Well, we have a globally dedicated frequency channel for calling, for access, for identification, channel switching,



and distress management, Channel 70. It's globally available, it's a good gateway. Alleviates the need for globally dedicated AIS frequency channels, which is a stumbling block internationally. We have not been able to solve that problem. It alleviates it. DSC solves the problems, alleviates the need for a dedicated AIS infrastructure since AIS can easily be integrated within the GMDSS. That's one to think about.

All GMDSS ships have DSC. All shore stations must have, by the implementation treaty, deadlines. We keep a constant DSC watch on all stations, provides a gateway access to all shore stations and all ship stations for controlling other radio base systems such as AIS. Has approved ITU recommendations. The only AIS recommendations currently that are approved are DSC ones. It has an IMO mandated international treaty status. It is the only international standard for AIS and so forth. Can readily be amended and maintained within the working parties. Has an internationally approved standard interface for IEC for integrated ship site.

So what more does it need? Well, it needs a



standardized broadcast mode for ship-ship operations outside shore station coverage. Already has provisions in the recommendations, but there is no documented standard procedure for a broadcast mode for DSC.

The second thing it lacks -- I'm running out of time -- is a higher capacity to handle more ships with less time latency. Thanks to our competitors, they've introduced proprietary technologies which in some ways are better and faster. And so DSC in order to not be outclassed and to survive, needs something. Next slide, please.

There's a new draft standard, an IMO VTS draft standard which needs to be approved in order to expedite the establishment of AIS. In order to bring this together, we need to expedite the standard.

I appreciate what Admiral North had to say yesterday. We need to expedite that. We can't wait forever. We need to bring it home. And here is a plan for doing it.

Number one, IMO must can finalize a requirement for AIS using the IALA, VTS draft as a baseline. It's a good baseline, minimal



tweaking, and it can be the IMO standard, functional standard.

Step two, IMO NAV can liaison with ITU working party 8-C a request that the working party, A, approve a technical recommendation that meets this standard; B, add a broadcast mode to DSC which is an approved recommendation which would -- well, along with any other necessary modifications, which would be minimal, that would meet this standard, what is the broadcast mode.

Thirdly, draft a new proposed broadcast mode for DSC to be added to REC-825. Could be metered communications, could be 4-S, could be a lot of things. Here is a draft liaison statement which tells the ITU or working party what to do. How to get there from here. It's a generic statement, but it recognizes that DSC has some benefits. Next slide, please.

I'm already over time, so I'm going to go quickly here. What I've done is I've drafted here for your consideration a DSC broadcast mode utilizing a structured TDMA technique. It's a tabularized method for achieving the performance index levels that other proprietary systems also do.



This paper is for your consideration. You can go through it in detail at your own leisure. The interested student will readily understand it, but it takes a while to go through it.

The intellectual property rights problems in the ITU are numerous. And in order to meet them, we have three choices. You cannot approve an ITU recommendation unless, A, the patent holder waives his rights for the purposes of the recommendation, and thus it is freely available to all parties; or, B, the patent holder doesn't waive his rights but agrees to negotiate on a nondiscriminatory basis with all parties, and the ITU leaves those negotiations up to those parties.

In view of all that, I said what if I come up with something and I want to give it to the public domain, I want to make it freely available. Well, the only safe passage mode, as I was told, was to file a patent application and then immediately tell the ITU that you waive your rights. So I did that.

Ross Engineering filed a provisional patent application last week with the U.S. Patent Office, and we transmitted a letter to the ITU



stating that this would be freely available to anyone who wants to implement a recommendation in accordance therewith. Solves the problems of capacity. It's easy to understand. It's organized. It's subject to base station control. And operates on 12-and-a-half and 25 kilohertz channels.

Thank you very much.

MR. PERRIS: Our fourth paper will be given by Mr. Lars Holmstrom from GP&C Sweden. It's entitled, AIS/4-S Transponders, the European Experience and International Implementation.

Mr. Holmstrom is a graduate of the Royal Institute of Technology, Stockholm, Sweden, with a Master's Degree in electronics. Since 1963 he has been a licensed pilot and an officer in the Swedish Air Force Reserve. His current position is marketing director of GP&C Sweden. And he has been active since 1989 in the development and marketing of global positioning and communication systems within GP&C.

Mr. Holmstrom.

MR. HOLMSTROM: Thank you for inviting me to come and present the 4-S system. I have my president, Mr. Holcum Cabot (phonetic), here to



answer any possible questions.

When you consider a ship-to-ship and ship-to-shore system, the basic thing is to have a data link. A data link which can use the rate of spectrum in a very efficient way. And as far as we understand it, the time division model excess technique is the best, you can use one frequency and you can use it for very many participants.

But, you need an efficient way to synchronize the traffic. And one way to do that is to use the UTC time. The UTC time which is available from all GPS receivers with a very high interest. That leaves us a system with no master and no slave. That means you can use it anywhere in the world and you can have it in an extremely efficient way.

Then you need to have a way to organize the slots, the allocation of the slots. So that it will be no collisions between all of these participants in the system. And that we call the STDMA, self-organizing TDMA, and I will shortly tell you about that.

And the fourth very important thing to fulfill is if you have a congested traffic



situation, that means that you are approaching the maximum limit of this data link, then you must still be able to have safe transmissions of time critical messages. And I will also describe how that is done. Next picture, please.

The way to do this is that you have a transponder. We call this GP&C transponder, that stands for global positioning and communication. Of course, there is a GPS receiver to find your own position, but also for the timing I mentioned. The transmitter/receiver to the right is a VHF radio transmitter/receiver which is totally and fully automatically controlled by the computer according to a special program which is drawn extensively.

The transponder is contained in one unit, which is fully integrated and can then be used on ships and vehicles, but also by aircraft and base stations. The hardware is to most extent the same. Next picture, please.

There is, of course, a bracket which makes it possible for you to install it quickly and like most. Next, please.

Now, the GP&C transponder in its mobile unit is, of course, connected to the ECDIS display of



the ship, or it could be blind without any display. You see map display at the bottom.

If you do like to have communication over the horizon, then sat. com link is necessary and can be provided as an option. That means the ship in the middle of the ocean can report its voyage process every five hours, whatever you want, to the ship owners. Next picture, please.

This picture shows the base unit. The base unit, that is the unit at the GPS or along the Coast Guard. Please note that we here have a GPS receiver creating differential corrections. Differential corrections which will be transmitted from the base stations in certain intervals, to make accurate navigation possible for all travelers within the range of that station. This could be a very useful back-up to the yellow type of DGPS beacon receivers. And, of course, you connect the base unit to the DGPS map displays for various kinds. Next picture, please.

This might be the most important picture in my presentation. It shows the time frame which is one minute. The time frame is divided into 2,250 time slots. And the unique thing here is



that you listen with your receiver until your privately allocated time slot arrives, and then you make your transmission -- it is 26.6 miliseconds long -- and after that you continue to listen on the frequency. And that time spot is privately and said organized allocated in such a way that you get private time slots for yourself as often as is required. And you change within these 2,250 time slots all the time in a certain way so that there will be no blocking and that you can enter the system and leave the system in an orderly way without any risk of collision between the transmissions and the time slots.

What you see here is one time slot which contains the most popular message, that is of course the position message.  This is a device primarily designed to give very frequent position messages to everybody around you, to give everybody a good situation awareness, and tell everybody who is around you position and speed vector and a few other things.

The way to do this very accurate time slot division relies on the GPS time, which is used to synchronize data link.  That means that the guard



time between each transmission is very short and that gives this possibility.

In aviation applications, which is a little more advanced than what we have done in maritime applications, we do the double time slot with the division, and we use a little higher bit rate.  That is 9.6 kilobits per second.  Next picture, please.

Now, why do we do all this?  This is because we need high capacity.  This is a way of doing, using one frequency in one port.  You can have 300 ships at anchor reporting every three minutes, at the same time as 100 ships to make their position report every six seconds, and at the same time as 100 other ships does every 15 seconds, and ships maneuvering -- that means turning and changing their course -- 20 ships to meet every 30 seconds, and still there is time for the base station to transmit differential corrections to make accurate navigation possible. This is that capacity of the system if you use the time spots only once.

There are now means of using these time slot several times over so this can be doubled or three doubled if you have a close vicinity in a



harbor like Singapore or the straits, et cetera, but that I cannot explain at this moment, but that is multiple receivers along the coastline.

Here we see the coastal scenario, with a ship-to-ship and ship-to-shore system.  Please note VHF, VHF line of sight radio range.  That means that this ship, for instance, at the bottom will be heard by everybody around it but not directly from these base stations at the shore. That is the VTS station. There is another VTS station and we have a channel here. And these are remote stations to enlarge the coverage area.

Please also note that the standard VHF towers used for VHF communication can be used. These transponders are small, they use only five watts and are interconnected with telephone lines.

The system we have will not be disturbed by heavy rainfall like you have here in Florida or bridges or bends in the river, and, therefore, it is much more superior than radar. Especially when you consider that on the screen you will see your own ship's position on the ECDIS display, you will see other ships in the vicinity within radio range on the display including their



identity.

This identity means the possibility to direct report of that ship, either by voice or by text messages. They could be standard text messages, which could be shown in the language preferred on that other ship. Yesterday we heard some stories about language problems. So if you are a British ship and you want to speak to an Arabic ship, that ship can be displaying its text in Arabic and you just get the answer in English.

It also makes it possible for the silent VTS, that means everybody sees everybody, there is no need for position reports and a lot of chatting on the radio frequencies. It also is possible to have a VTS station here without radar at all. If there is no radar, if this is a small boat and you cannot afford a radar, you just buy yourself a transponder and a laptop and the people on the beach can see who is out there. Of course, that is that these ships do have transponders and are friendly, and if you are a law enforcement unit you have inscription, switch on the inscription, that means no one else but your completion will see you and you will see all the other civilians and this is the way for law



enforcement people to see each other and not be seen by others.

When you move along the coast line, there will be no problems with roaming. It is a seamless system. You will be in the center of a cell. It is a cellular system that way. And in each cell 2,250 time slots are available for position reports. In the systems we have in Sweden, Denmark, Norway, Germany and Finland, we use an update rate of once per second, because the system has such a tremendous capacity that we can afford that.

And in the paper I've given out, these test sites are shown and described, and it's a very ambitious one working in navigation where most of northern Europe is covered and south Europe is about to be covered and the south Atlantic will also be covered with the ATSB system. It is called the VDF Route 4.

Of course, recording of positions can be done on the time from VTS stations or any ship that makes the recording. And following up, after environmental and other things possible to follow and investigate.

There's another thing. If there is a radar



station on the shore and that radar station follows targets, it is very easy to make that radar station to make radar target road cuts. That means that the transponder on that VTS will transmit position reports from that base station, which includes all the track targets from that radar. So that you will have those targets shown on your screen even if they are not equipped with the GPS transponder or the transponder. I think we'll take the next picture, please.

This is the typical maritime position report. Every position report shows identity, and then comes position, speed, course of a ground heading and time span, rate of turn is also included. Next picture.

This is the maritime vessel data report. That occurs rather seldom, once every three or five or six minutes, depending on how you set it. Here comes the ship's total complete name. The type of ship as defined in the DSC protocols, and the dimensions of the ship. Please note that the GPS antenna position is also shown. That is necessary when you display the ships as seen from above on your screen, so that you will have a true picture of your own ship and other ships.



So, for instance, navigating in a harbor in close to zero visibility, you will see if you are clear or not.

And of course you can also signal a few

other things like destination and, of course, text messages. Text messages is the directed calls for certain ships or broadcast to every ship. Next picture, please.

This is the typical update rate which has been suggested in the ELIMO standards which has been submitted and is being under discussion. Please note that the designed cruising speed is used here, and that means there is 12 seconds between each update in the first instance here, but if this ship starts to turn, as described by the turn, it shall be computed, to get every four seconds. And a quick fast ship, the high speed ships, they do it every second or every third second. There is just talk about to make that compulsory in Sweden, they get some very high speed catamarans running close to the bank and there has been some accidents. Next page, please.

This is just a sum up. This is a global data link. It works on a single frequency. It



is a two-way VHF data link. It is autonomous. That means there is no master and there is no slave. It is not depending on the Coast Guard or on VTS stations. Works in the middle of the ocean or it works in the middle of the busiest harbor. It works in broadcast mode, 2,250 time slots. And, of course, each time slot can be reused on either side of the horizon, that way it can be global and theoretically. You can have one single frequency in the whole world, if you can organize it, which is another problem.

These are the basic needs for safe passage. See your own position and other's position. All weather, day and night. Even in this squalls. Chart information certainly. Speed of ground, course of ground heading and identity. Messages, broadcast and directed messages. Monitoring from VTS effective in open seas as well as in busy harbors.

And this is the ship-to-ship and ship-to-shore 4-S system, provides a baseline for information exchange. It's off-the-shelf technology as described in my paper. Exercises simplicity, fulfills the outcry for silent VTS, and puts the driver in the driver's seat. Yet,



provides a conduit for control, positions for the future.

Ladies and gentlemen, thank you for your attention.

MR. PERRIS: Our final paper will be given by Mr. Bert Tepper. Mr. Tepper is with the Canadian Coast Guard where he is the chief of surveillance systems. Mr. Tepper's paper is entitled AIS in Canada, and Mr. Tepper has recently tested two AIS systems, and we are very interested in his report.

Mr. Tepper.

MR. TEPPER: Okay. Good. Well, in the next 15 minutes I'm supposed to tell you the experience that Canada has with automatic identification and what the Canadian Coast Guard has done in order to test available systems.

You have heard the three previous speakers talking about the AIS sea mode, AIS broadcast mode and also Don Sitsma talked about his ELOS system. And I'm sort of happy to inform you that we have experience with all of these three systems in one fashion or another.

In order to prepare this talk I thought the best way is to order it according to chronology.



In 1993 we started out with a very simple VHF, ELOS system, which you heard about this morning. And contrary to what has been said before, we were really driven by need. We didn't ask for possibilities, we came out with a need, and our need was the tracking of fish factories in the neighborhood of Tofino, and I'm going to say a few more things when I get to that specific item.

Then in 1994 the Canadian Coast Guard in 1992 started to experiment with differential GPS, and consequently since every AIS needs a position advice, needs differential GPS or GPS, we thought it natural that we get our feet wet, so to speak, with a basic R and D project that would evaluate AIS.

At that point in time, 1994, the only system we knew about was the AIS/DSC system. And we put one in Tofino, because we had no money, and so our system configuration had to be simple and we relied for targets to be the taps anchor that originate from the Port of Valdez.

But at the same time, 1995, '96, all of a sudden something happened and we had the so-called AIS Pilot Project, and I will say quite a bit about that, because I'm sure that you're quite interested in what we feel is the output from that particular project.

In 1996 having a DSC air system in Tofino, we said let's try it for the fish factory testing instead of the VHF ELOS system, and you see the reason for that.

In 1997, which is this year, as Don Sitsma already described, we are also going to do a major test out on the west coast using the MCC system. Now let's start into it.

The period of 1993, '95, the problem was how to track clusters of fish factory vessels off the VGS Tofino. The problem there is closely bunched factory vessels, the radar and S-band radar which we have out there does not have sufficient resolution together with the tracking capability to at all times track the ships, their names and their positions. And our VTS operators demanded something that would assist them in this task. And the system that was suggested at that time was the VHF, ELOS system which we at that time rented from Spacial Information Systems, a company in Alberta.

The equipment was very simple, self-contained, no networks, nothing. One base station at Tofino VTS center and about 15 ship transponders were deployed during each fishing season. And we did that during '93, '94 and '95, during those shipping seasons. The application was very simple, monitoring of fish factory vessels during these three seasons.

The equipment that we used looked roughly like that. You will recognize the box that Don Sitsma described this morning to your left, and at that time we did not have differential VTS, we used the simple receiver and the corresponding antenna.

Needless to say, the operators like the system very much and we're quite happy because it did reduce their work load. In '94, '96, as I said before, we said we should get some experience with this new technology of AIS. The Canadian Coast Guard recognized that AIS has the potential to significantly improve the operation and the technical things around VTS, the provision of VTS services, and we wanted to, so to speak, get our feet wet in the start with a small little process.

Our test set up was operational in 1995 to begin. In order to save the costs, and that has been quite a bit of hampering us in a manner of fashions, because these setups are not cheap, so we have one shore station at Tofino. We will have one ASDSSE model, the 12,500, and we monitored the TAP tankers.

Now, during 1995, '96, the evaluation program developed a lot of development work and I leave that until I discuss the AIS pilot project, because those two periods started now to overlap.

I do a little bit of a jump into 1996 because I said before the tracking of fish factory vessels is still a problem, and this time the lease contract for the three years had run out and we have a small little AIS, DSC project going, and so we said let's use it to try to track the fish factories. So we had some 12 simple AIS, DSC transponders together with the ADS-500A from Ross Engineering and the associated AIS software. Again the system was used to track fish factory vessels.

The way it looked, this is how our display screen in Tofino looked like. These are -- there is one particular incident in time when the fish factory vessels are clustered around. If you want to select any one particular vessel, you move the cursor on it, it turns red and you can see on the right-hand side the, the description relating to that particular radio. And we selected one of our test radios in this particular time, also one screen tells you all the vessels that are in the vicinity.

Now I come to our AIS pilot project. 1995, '96, the AIS pilot project. During last year's RTCM meeting, I described what we have planned, how we set the system up, and how we were going to plan to test it. At that time we were not having completed our test, therefore we did not have any feedback on that material.

So just to review very briefly, the AIS system that we use for that purpose, that pilot project, was in the cities of Quebec and the cities of Montreal. Here is Montreal, here is Quebec.

This diagram shows the configuration for both systems, the AIS/DSC system and the AIS broadcast system. The small little solid circles here show the location of the VHF transmitters and receivers relating to the AIS broadcast system. The dotted lines refer to the AIS broadcast system.

The different ranges are perhaps misleading. They are entirely related to the fact that some of the sites are very high and some of the other sites we use existing facilities. The corresponding information from either, from what Trois-risher, Sorrel and Montreal are all routed in the Montreal VTS stations, and the system here was routed in our Quebec station.

Now, the AIS broadcast system which we started in around the 1995, '96 was a very simple system. A lot of improvements have been made since then. But when we started out, we had this. We had autonomous mode of operation, with reporting rate was fixed at one second, the message capacity was about 40 characters, ship-to-shore, shore-to-ship and ship-to-ship direct.

Shore stations cannot function as a repeater, and we demonstrated that as well that when two ships are not in its region of coverage and they want to see each other on display screens, then the shore station can indeed serve as a repeater. And we demonstrated that in the area of Quebec. And we had a high performance display at that point in time that was furnished by the company.

Now, as far as the AIS DSC system is confirmed, we started also out with a basic configuration, Channel 70 poling, automatic access on Channel 70, but manually adjusted poling rate, partial working channel capability, we had some problems. And we had the GMDSS distress calling capability and a basic functionality as explained before.

Now, during this period a number of developments took place at Ross Engineering, and we worked very closely together as we already, Ross Engineering, Mr. Norsworthy, has explained the features that he has nowadays. But when we started out the entire test period from roughly December '95 to December '96, was a series of very interesting developments, and they were driven by our needs.

And sure enough, possibilities and needs sometimes chased each other, but one of the key things before we started on this pilot project was the requirement that ships can see other ships. Our marine industry who was a partner in this whole thing said, we are not interested in participating in any AIS trials unless you can demonstrate to us that we can see the ships. In fact, our surrounding neighbors.

In fact, it is quite interesting and I can't help but have a lot of interesting discussions, certainly with the U.S. Coast Guard I would like to discuss it sometime, our marine industry said we don't want VTS. Give us a system that allows us to see where the traffic is and we can operate independently. Those are the extremes.

Obviously VTS is there and VTS is there to stay, but nevertheless that was one of the key parameters that ships have to see each other. Message capability always to me is interesting. We have a ship-to-ship via rebroadcast, ship-to-shore and shore-to-ship. All of these things were developed in that period. The message capability, we started with something like 250 characters and increased us to 13K, the Canadian Coast Guard had tested to 5K only at this point in time.

The number of ship reports were increased. We started with 40 on a working channel and have it now increased to 250 ships per minute, or ship-to-ports per minute. And the variable reporting rates via specific speed groups have also been incorporated, something akin to what the broadcast system can do and that it can adjust its reporting rate as a function of the speed and operations of the vessel.

Continuing with the development, one of the key factors was the pass over from one sector to the next sector to the next sector from the next sector, and that caused quite a bit of problems in the beginning. In the beginning we did not have automatic hand over as the ship goes from one coverage sector to another coverage sector because the frequencies have to change and that is quite an interesting little problem.

But just before we finished our experiments in December of '96, for one trial, one ship, the problem was solved and we did indeed have seamless continuous coverage and have over from one sector to the other sector without VTS operator involvement.

Other things that were added was a remote monitor facility, remote power switching of shipboard transponders, range and bearing indications and base to ship, and a basic logging capability.

Now, what are our conclusions for the time



being? I call them preliminary conclusions because we still -- there are a lot of people involved, a lot of organizations. And they are at this point in time reviewing the final report. And consequently, I have extracted the key conclusions, the most interesting ones at this point in time, and within about two months we are going to have perhaps a more extensive set of conclusions. But as I said, there is a lot of organizations that have to give their blessings.

Well, let's run through them quickly. AIS is a valuable compliment to radar. Our radar operators have decided and have concluded that in those areas where radar already exists, AIS does have a specific role to play, it does provide an interesting addition to that. In areas where there is only a VHF zone, then AIS significantly improves VTS operations where we have only a VHF controlled zone.

Coast Guard operators and Canadian Coast Guard captains have responded positively to AIS, especially Canadian Coast Guard captains dealing with ice breakers have said that AIS in general -- either the DSC, VIST or the broadcast system can provide them with the necessary tools



to simplify their operation, especially if they are in close contact with ships that they are escorting through ice.

Could AIS replace radar?  That is still an open question.  The pilot project which I have described and is describing now, was specifically directed to see whether AIS can replace radar. Well, our conclusion is, yes, we can see the potential but we feel that every case where somebody considers the replacement of radar with AIS has to be very carefully studied.  It is not an across the board endorsement, AIS can replace radar.

To be fully effective AIS must be fully integrated with other positioning systems and displays.  In talking to one of our ice breaker captains, he particularly told me, look, it's great stuff, but I don't want to run from one bridge wing to the other bridge wing in order to integrate myself to various indicators and invent various tools; everything has to be integrated. AIS must provide true heading and not just course over ground. Some of our VTS operators have said that they want to see the orientation of the ship in the channel, not just where it is being



headed.

Continuing with our preliminary conclusions, the AIS, DSC capacity of 250 ships reports is insufficient for our volumes and something needs to be done and it has been recognized by our previous speakers, something has to be done in that area. For a river system AIS broadcast we feel is better suited that the AIS, DSC, because of its relative independence of the shore structure. The autonomous mode of AIS broadcast provides a potential anti collision capability and we are investigating precisely what are the parameters surrounding that issue in order to make it so. And twist, interestingly enough, our response by our river pilots; and unfortunately, we don't have a great statistical basis for that, but the one that we did acquaint with the system has been somewhat lukewarm. It deals with the question what they have to do with regard to their work load and so on and so forth. In particular, the size of the laptop is considered too small by some of the river pilots.

And the last two conclusions is the independence from shore facilities gives AIS broadcast a number of operational flexabilities.



And AIS communication channel, as has been said before, certainly by Tom Braithwaite in his thing, is simply not designed to handle large general data link capabilities and something else should be discovered.

So, where is my time?

MR. STRONG:  You're over.

MR. TEPPER:  I'm over.  Therefore I will drop.  I will just highlight this because Don Sitsma mentioned that under collaborative agreement it means the Canadian Coast Guard, the BC Chamber of Shipping, evaluate the VHF ELOS system together with British Columbia management system, during this period, '97 and we are very excited to find out what that system can do for us.

Thank you very much.

(Applause.)

MR. PERRIS:  Before I turn it over to Mr. Strong, I'd like to thank all five presenters for excellent briefings, unfortunately we've run out of time for any questions. Just one comment and threads I think tying this together, AIS is here, it's, it is off the shelf as you saw. I believe ship-to-ship direct, ship-to-shore,



shore-to-ship is a reality. It's not something that has to be invented. I do believe the discussion of protocols and frequency allocations, remains both here in the United States and internationally. I think it's something we can work on. And as Mr. Lemley and Admiral North said, the Coast Guard has to go out and do it.

So thank you very much.

MR. STRONG: Bob, thank you very much. And to all of your panelists and speakers, we appreciate it.

(Whereupon, the proceedings recessed at 11:00 A.M.)