Written Testimony of Mr. Charles Benton for a House Committee hearing on "Using New Ocean Technologies: Promoting Efficient Maritime Transportation and Improving Maritime Doman Awareness and Response Capability".

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2253 Rayburn House Office Building

Chairman Hunter and distinguished Members of the Committee,

Thank you for the opportunity to appear before you to testify on the subject of Small Vessel Safety and Security at this important hearing. I appreciate and welcome the Committee's continued focus on this subject.

Vessel tracking enables collision avoidance, makes more efficient use of our waterways possible, and enhances maritime security and response. The Automatic Identification System (AIS) developed in the 1970's is the primary vessel tracking capability for large ships. This capability has been extremely successful and is used in a broad range of operational settings, including high seas voyages, Vessel Tracking Systems, Maritime and Port Security, and Fleet Monitoring. However, the reality is that the costs and infrastructure of AIS result in less that 1% of all vessels on the water actually using it.

Background

There has been a long identified need to better support small vessel operations through enhanced identification and tracking capabilities. In 2010, the US government, through the Department of Homeland Security, issued a Small Vessel Security Strategy[1] that outlines many issues relating to this. . The overarching goals of the Small Vessel Security Strategy are to:

- Enhance maritime security and safety based on a coherent framework with a layered, innovative approach;
- Develop and leverage a strong partnership with the small vessel community and public and private sectors in order to enhance maritime domain awareness;
- Leverage technology to enhance the ability to detect, infer intent, and when necessary, interdict small vessels that pose a maritime security threat; and
- Enhance cooperation among international, federal, state, local, and tribal partners and the private sector (e.g., marinas, shipyards, small vessel and facility operators), and, in coordination with the Department of State and other relevant federal departments and agencies, international partners.

Other governments and maritime organizations worldwide have expressed similar goals, however AIS as it stands cannot meet this stated need.

[1] https://www.dhs.gov/small-vessel-security-strategy

AIS uses an identification system called the Maritime Mobile Service Identity (MMSI), which is a series of nine digits sent in digital form over a radio frequency channel in order to uniquely identify ship stations, ship earth stations, coast stations, coast earth stations, and group calls. These identities are formed in such a way that the identity or part thereof can be used by telephone and telex subscribers connected to the general telecommunications network to call ships automatically[2].

A significant issue is that the US has <999,999 total available numbers, and over 17 million recreational users. Clearly, the MMSI approach cannot be used to support large scale AIS like requirements. MMSI numbers are also associated with vessels, not radios (e.g. one vessel with many radios will use the same MMSI number for all radios), and are intended to be used to configure VHF devices including Digital Selective Calling (DSC) enabled VHF radios, and AIS transceivers, but not wireless computing devices such as smart phones or tablets.

Furthermore, the VHF based AIS transmission scheme has worked excellently within its intended operational settings. However, the AIS time slots and RF frequencies used are already near bandwidth saturation in busy ports… and simply can't sustain the traffic that adding the recreational community would bring. The simple fact is that if all recreational boaters start using AIS transceivers, the overall functionality of AIS would degrade to unacceptable levels in busy settings (where the greatest benefits of AIS like capabilities may be found).

AIS transmissions are also tailored to the original community they were designed to serve: large vessels. Many of the data fields that are supported in AIS Class A & B transmissions are irrelevant to recreational users: they do not carry cargo, describing length to the nearest meter is not practical for small runabouts, the types of vessel used for AIS A / B are not practical, and destination/ETA is often not practical.

Lastly, the original AIS approach was based upon an AIS transceiver being bolted to a specific vessel, and false IDs from "moving" radios are becoming a significant problem.

There is a clear need for a small vessel AIS capability. The existing MMSI and AIS standards are unable to meet this need; there is simply not enough identification numbers and not enough bandwidth in the existing standards. Furthermore, the operational environment for small vessels is rapidly becoming populated with general purpose computing devices, and high bandwidth digital communications networks. If small vessel AIS capabilities are to become commonplace, a new set of protocols, standards, and capabilities needs to be identified and implemented.

Smart Chart AIS – A Test Bed for Developing a Draft AIS-I Capability

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[2] http://en.wikipedia.org/wiki/Maritime_Mobile_Service_Identity

In 2010 the Department of Homeland Security S&T Directorate, Borders and Maritime Division issued a Small Business Innovation Research Program Topic looking for innovative new "Small Vessel Identification and Tracking Technologies". My company, Technology Systems Inc. responded with a proposal titled "Smart Chart AIS", and set forth the concept that since virtually all small vessel operators also had smart phones, a surrogate AIS capability could be developed that took advantage of these already present systems.

This resulted in development of the Smart Chart AIS app that is distributed for free to the public. Features in Smart Chart AIS include: NOAA charts, weather radar, cruising guide information, social network functionality, Augmented Reality capability, and most importantly, surrogate AIS capability for small vessels, referred to as AIS-i.

Full information on Smart Chart AIS can be found at www.smartchartais.com, including download links for the free iPhone and Android apps. Over 20,000 downloads of the Android version have occurred since its release in the summer of 2013. The iPhone release is expected to result in a 400%-500% increase in downloads, since the majority of recreational boat owners were early adopters, and thus ended up with iPhones when it was the only smart phone on the market.

A key aspect of this is a deliberate intent to achieve the critical mass required to make use of AIS-i a practical and beneficial undertaking for recreational boat users.

AIS-i

The term AIS is well known and conveys an immediate understanding of what the intended functionality is. As the Smart Chart AIS effort progressed, it became obvious that a national, and eventually international standard for wireless Internet based vessel tracking capability would be needed. Indeed, twenty years from now, "AIS" tracks from a range of sources will most likely be displayed on typical chart plotters, and "AIS functionality" over wireless networks is inevitable. The opportunity and challenge is how to shape and frame this capability so it is adopted in an optimized manner.

"AIS-i" does not claim to be AIS Class A or B, or to fulfill any of the FCC, USCG, or IMO (International Maritime Organization) regulations pertaining to those devices and their users. Likewise, the term originally used to describe this capability ("AIS Class E") was retired both to ensure that was not confused with AIS Class A & B, which are formal international standards, and due to Federal Communications Commission (FCC) concerns that any device using an "AIS Class" designation was by definition required to operate over VHF, which is clearly not the case for an Internet based protocol.

However, it is in industry's and government's interest that future wireless "AIS-like" capabilities be standardized, and eventually also be regulated or mandated in certain circumstances. It is expected that a standardized protocol that meets industry needs will be created using an open process, leading to establishment of a formal standard recognized by the IEC (International Electrotechnical Commission) or other similar organization. TSI is offering the SBIR funded "AIS-i" protocol to industry as a reference implementation,

essentially a starting point for this process. DHS is supportive of this thrust and the overall intent.

AIS-i Standards Development – Discussion

The long-term goal is to establish standards that will support tracking of small vessels over wireless networks. To be successful the end capability must be:

- Platform / Operating System (OS) agnostic
- Open to industry and end users
- Reliable, Predictable
- Enforceable (e.g. be managed by a governing body, not ad hoc)

Two examples that provide a template or framework for this are DNS (Domain Name Services) and AIS Class A/B.

DNS is a global, standards based capability that manages Internet domain name registration and routing. It meets all the criteria above. It is important to note that there are protocol standards involved, but also an architecture and framework in which services are provided to industry and end users by the Internet Corporation for Assigned Names and Numbers (ICANN), a non-profit organization. Readers are encouraged to review more about ICANN at http://en.wikipedia.org/wiki/ICANN, where a summary of how it came into being is presented, including the governmental rule-making processes involved, administrative and enforcement activities, the Governmental Advisory Committee (ICANN is a US non-profit, but serves a global function), funding, and so forth.

While DNS is far more encompassing than AIS-i, it is notable in they share some common attributes insofar as functional architecture. Specifically, it is a **SERVICE** which is provided, and that the SERVICE relies on certain **STANDARDS** as an element of implementation. Ultimately, an AIS-i SERVICE must be maintained, and users of the SERVICE will be required to observe certain technical STANDARDS.

The Automatic Identification System (Classes A & B) utilizes standards for on the water operations, but does not require services during these operations. However, there still is a SERVICE element to AIS Class A/B, the issuance and maintenance of Maritime Mobile Service Identification (MMSI) numbers. The range and format of MMSI numbers has been dictated by the standards bodies involved, but the issuance of numbers is a service provided by a range of international organizations, government and non-government (e.g. USCG, BoatUS, etc.). AIS-i Vessel IDs will also need to be issued, thus the existing AIS Class A/B example can provide a template for certain aspects of AIS-i moving forward.

AIS-i (Developmental) Overview

AIS-i is a reference implementation that provides a working template for an envisioned international AIS-i standard and service. This reference implementation has not been rigorously peer reviewed, and it is expected that improvements can be identified and

implemented. Often there are numerous ways a protocol or standard can be implemented, with multiple "right" answers being present. Rather than dwell on choosing between a range of equally viable options, it is more productive to declare a particular solution or approach as the preferred implementation and move forward. That has been the approach to date, but TSI will now offer these draft protocols and standards to industry for comment and review.

It should be noted that TSI just established AIS-i as a fully independent function, separating it from the application environment it was originally developed within, Smart Chart AIS. Within the next few months it is expected that the AIS-i Services will be used by TSI's Smart Chart AIS client app and additional applications from other companies.

AIS-i Service

The AIS-i approach is covered under US Patent 7,805,146, issued September 28, 2010, entitled Cell Phone PDA/GPS Communication Network with AIS. The AIS-i technology covered in the patent contributes toward the realization of the common goal by providing a framework under which a single network protocol can be developed and introduced to industry rather than the alternative of numerous competing protocols that prevents the development of a true national standard from emerging. The patent holder (AGIS, Inc of Jupiter, Florida) has indicated to DHS "assurance that a license to such essential patent claim(s) will be made available to applicants desiring to utilize the license for the purpose of implementing the standard, under reasonable terms and conditions".

The intent is that a new organization will be formed and offer the services and data embodying AIS-i. Details of operational business model to support operations have not yet been identified. It should be noted that TSI has reserved the domain names AIS-i.net and AIS-i.com to support this future development.

AIS-I Outreach and Next Steps

A recent conference was convened at the California Maritime Academy, titled "e-Navigation Underway". The initial definition for e-Navigation was formulated by the International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) as:

> The harmonized collection, integration, exchange, presentation and analysis of marine information onboard and ashore by electronic means to enhance berth to berth navigation and related services for safety and security at sea and protection of the marine environment.

This conference was part of an international initiative that is coordinating international and national governmental developments and plans, and formulating specific recommendations regarding e-Navigation implementation and development. The e-Navigation initiative is being led by the UN's International Maritime Organization (IMO) with significant related efforts being performed by the Norwegian Coastal Administration,

Swedish Maritime Administration, and the Danish Maritime Safety Administration. The United States is benefitting from these partner efforts, but generally has not taken a leadership role in e-Navigation to date.

I presented a paper titled "AIS-i – Supporting the Recreational Boating Community over Wireless Internet", which was enthusiastically received. Attendees included senior government and industry personnel from around the world. This led to an invitation by the Radio Technical Commission for Maritime Services (or RTCM) to make a presentation at their annual technical meeting. RTCM is an international body that creates standards and documentation that are referenced by the International Electronics Commission and the UN's International Maritime Organization in establishing and sometimes mandating performance standards.

An outcome of the meeting was a unanimous committee vote to have two Special Committees evaluate and report on having AIS-i formally reviewed and incorporated into the international standards process. This is the first step in a multi-year process leading to AIS-i protocols being adopted industry wide on a global basis.

The protocols and service that have emerged from this project are gaining national and international recognition as an appropriate and clearly needed solution that will enhance maritime safety and security. The project is rapidly transitioning from an R&D phase to a transitional phase in which standards will be finalized and formally adopted by the leading standards and regulatory bodies in the maritime domain. Additional work is being considered that addresses extension of this architecture to support Arctic maritime operations. Continued support for these efforts will ensure that Homeland Security interests are addressed and that the US will provide the leadership needed to enhance the safety and security of the 99% of the maritime community that small vessels represent.

Thank you again for your interest and focus on this important subject.

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