



Proceedings of the 2019 Maritime Risk Symposium:

Understanding and Managing Risks to the Marine Transportation System
10th Annual Maritime Risk Symposium (MRS)



<https://www.sunymaritime.edu/MRS2019>

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Hosts of the Maritime Risk Symposium

- 2019 – Maritime College, State University of New York, Bronx NY
- 2018 - Oak Ridge National Laboratory, Oak Ridge Tennessee
- 2017 - The Center for Cyber Defense & Forensics at Tiffin University, Tiffin Ohio
- 2016 – Department of Homeland Security Center of Excellence: Coastal Resilience Center (CRC), the University of North Carolina at Chapel Hill
- 2015 – Department of Homeland Security Center of Excellence: Maritime Security Center (MSC), Stevens Institute of Technology
- 2013 – Department of Homeland Security Center of Excellence: Visual Analytics for Command, Control, and Interoperability Environments (VACCINE), Purdue University
- 2014 – Department of Homeland Security Center of Excellence: Center for Risk and Economic Analysis of Terrorism Events (CREATE), University of Southern California
- 2012 – Department of Homeland Security Center of Excellence: Center for Risk and Economic Analysis of Terrorism Events (CREATE), University of Southern California
- 2011 – Department of Homeland Security Center of Excellence: Command, Control, and Interoperability Center for Advanced Data Analysis, Rutgers University
- 2010 – Department of Homeland Security Center of Excellence: Center for Risk and Economic Analysis of Terrorism Events (CREATE), University of Southern California

The 2020 Maritime Risk Symposium will be held virtually at the Critical Infrastructure Resilience Institute at the University of Illinois,
<https://ciri.illinois.edu/events/11th-maritime-risk-symposium-2020>

Introduction

Written by:

Christine Spencer

SUNY Maritime College hosted the 10th Annual MRS 2019: Understanding and Managing Risks to the Marine Transportation System. The event brought together federal experts, government officials, industry professionals, researchers, students and educational institutions from across the country and around the world. Their purpose was to address how to better understand and manage risks posed to our current and future Maritime Transportation System (MTS).

MRS 2019 highlighted key risks, considered various approaches, and made recommendations on actions needed to promote a strong, secure, and efficient MTS in the future.

Major themes discussed include mariner competency, educational and training concerns, human element risks, technology as both a threat and tool, the need for collaboration, the state of the U.S. as a global maritime nation, detrimental effects of climate change, the harsh reality of global connectivity, sharing risk exposure and beyond.

Immediately following the symposium, the U.S. Coast Guard took advantage of the assembled experts to host a Project Evergreen workshop, a process the service uses to promote long term strategic planning by imagining various future scenarios and considering the implications for the MTS and other Coast Guard mission areas.

These Proceedings summarize all seven panels, the keynote speakers, and the Project Evergreen workshop.

Keynote Address

“Adapting to Meet the Challenges of a Growing Marine Transportation System”

By RADM Andrew Tiongson



RADM Andrew Tiongson’s address held a theme of remaining ready, relevant and responsive as well as consistently and strategically adapting to the growth occurring today. There is no doubt that we are in the midst of rapid growth in the areas of innovation and technology.

It is imperative that a balance be maintained of national security and economic prosperity while recognizing and reminding ourselves of the importance of the United States as a maritime nation. With 90% of global trade flowing by sea, as a nation we deserve a safe and dependable MTS that serves as the foundation of economic prosperity while maintaining national security.

RADM Tiongson outlined three areas of focus when analyzing the current and emerging risks to our MTS: the MTS is complex and growing; there are changes occurring in high latitudes and there are numerous emerging threats.

Point 1:

We are facing increasing growth in the maritime sector. Ships are bigger, cargos are larger in already stressed vessel traffic and port system. RADM Tiongson commented that the USCG Vessel Traffic Service (VTS) is stressed managing current vessel traffic levels of both government and civilian vessels. This is not accounting for the increase that is to come from larger volumes of traffic and emerging technological developments such as off shore wind energy. However, in the midst of change and development he stated “it is imperative we put full attention to maintain safety, security and stewardship of our waterways.”

Point 2:

RADM Tiongson highlighted that there are changes happening in high latitudes, including the increased vessel traffic in the North West Passage. The use of this route has come about due to rising temperatures and reduced ice coverage. There is a particular attraction to the use of this maritime route for tourism. However, beyond tourism there may also be emerging threats concerning drug and human trafficking. Therefore, in the midst of this change we must consider the additional strain that this places on the Coast Guard to perform rescue operations, security, pollution response and navigational safety operations in the Arctic.

Point 3:

There are new and emerging threats and we must address and mitigate these. RADM Tiongson outlined four dimensions of risk: Surface, Subsurface, Air and Cyber. These new and emerging threats are in all four dimensions and often combine the dimensions increasing safety and security risks exponentially. An example of an emerging threat is Unmanned Aerial Systems (UAS). These UAS devices not only pose a risk of being easily weaponized but have the ability to watch trade operations to collect delicate information critical to national security interests. The USCG is working on UAS counter capabilities that will allow for identification, tracking, control to kill the operation and prosecute the users. Of course, in addition to UAS devices there is a rising concern with cyber security in which RADM Tiongson stated that the USCG must expand their knowledge base to better understand cyber-attacks and how to be combat them.

Final point and Takeaway:

In the midst of rapid change, growth and innovation the focus should remain on how we can remain safe and effective in an already stressed system. We should also maintain an emphasis on training, development, education and action!

Panel #1: Navigation Risk on the MTS (Human Aspects)



Facilitator: Captain David Moskoﬀ (USMMA)

Captain Moskoﬀ reminded us that in midst of rapid growth across the maritime sector, various maritime accidents still impact ships and mariners around the world. “This is why we are here.”- Captain Moskoﬀ

Captain Scott Craig (Crowley) Panelist:

Captain Craig stated that an emerging threat to the MTS is the quality of the competency of mariners who are in service now and who will act as the leaders and support for the new wave of autonomous vessels and vessel operations of the future.

Captain Craig shared statistics of competency gaps and concerns with mariners currently in or seeking employment, and he addressed the concern that the current licensure scheme is not sufficient. Crowley uses a simulator assessment

study with partners such as Shell to test officer competency before they commit to a hire. They have found that 7% of otherwise qualified

applicants cannot be hired due to failed basic mariner requirements. Captain Craig expressed fear that other companies who operate within the global fleet who do not have these types of simulator testing processes are hiring unqualified mariners which poses an increased risk to our MTS.

Captain Craig also highlighted research that indicates that officers who have not stood watch in 18-24 months have deteriorating watch standing, situational awareness, navigating and communication skillsets. His proposed solution is to close the skill gap with specialized classes, with frequent focused training, and annual testing requirements especially in cases of promotion.

James Scalli (Shell) Panelist:

James Scalli began by noting that Shell, is a company with 200 international vessels on time charter and 300 in the US (in addition to the operation of the Shell owned fleet). Shell is heavily invested in a safe MTS and is highly motivated to ensure safe navigation for their ships and others.

Scalli outline that in the midst of the rise of innovation, technology can be used to improve safety throughout the MTS by removing some of the human elements that are particularly dangerous. Scalli highlighted that the use of vacuum mooring systems, unmanned aerial vehicles (UAV) and remotely operated vehicles (ROV) can decrease safety concerns while bringing added value such as video and photo footage, while also decreasing environmental emissions. Scalli also highlighted the innovation taking place within Shell with a focus on barge engineering to promote mariner safety. There were 22 fatalities in the industry in 2017 and Shell is reviewing collapsible handrails and wire rails allowing mariners to clip onto the wire to prevent falls.

Captain Rob Jones (NTSB) Panelist:

Captain Jones stated that 70% of marine accidents are a result of the human element piece of our MTS. He highlighted recent major maritime disasters such as the Golden Ray RORO vessel that capsized in Georgia in September of 2019.

Captain Jones outlined three major points of focus for his presentation with a large emphasis of automation:

1. The role of pilots in autonomous ship operations.
2. Assessment of training and programming.
3. How automation will affect transportation and regulations. How to identify shortcomings ahead of time.

Within these points, Captain Jones highlighted the risks of more automated navigation tools onboard vessels today and how current mariners are less familiar with their onboard operations. In essence, with more autonomy comes less experienced helmsmen. This becomes of particular importance in difficult waterways such as the Houston ship channel. With autonomous ships arriving, the role of the pilot will become even more crucial in helping to handle vessels in restricted waterways. Captain Jones outlined the need to drill down and assess how autonomous operations may have contributed to an accident. Captain Jones is concerned with if, how and why the navigation rules of the road should change, how to identify autonomous ships, how to communicate with them, and how autonomous vessels can be expected to interpret subjective rules and practices, such as when a vessel is in extremis, and what constitutes prudent seamanship.

Takeaway:

Panel 1 highlighted that the human element that contributes to risks within the MTS is equally crucial in addressing those and other risks. We must ensure the competency of mariners in the midst of growing automation and technology. We must also anticipate and address how automation will pose additional risks to the MTS, in particular in waterways of extreme complexity. We must determine how automation can minimize the risks associated with human error without introducing new risks, all while enabling mariners to use their skills to increase safety.

Panel #2: Navigation Risk on the MTS (Technology)



Facilitator: Scott Brotemarkle (National Academies of Science)

Mr. Brotemarkle kicked off the panel by reminding us of the great promise and risk that technologies can pose to our MTS, such as risks to our vessel bridge systems and electronic navigational charts. He stated that these emerging technologies have many advantages, but also pose cyber risks and the potential for other unintended consequences.

Captain Elizabeth Kretovic (NOAA) Panelist:

Captain Kretovic outlined for the audience the Precision Navigation Program that NOAA is currently working on. In the context of the ever growing size of vessels and water getting deeper due to dredging, NOAA is “defining a process of collecting and integrating data to create more accurate navigational products and tools that support the mariner’s operational decision-making process” (<https://nauticalcharts.noaa.gov/learn/precision-navigation.html>).

In addition to underling the importance of the use of integrated data for a safer MTS, Captain Kretovic explained that NOAA is two months into a five-year plan of ending their paper chart program and moving completely to electronic navigational charts. Knowing that professional mariners and others may still prefer paper charts, Captain Kretovic stated that custom paper charts will still be available and that paper charts for historical purposes will also be available for download.

RADM James Watson (Ret. USCG/ American Bureau of Shipping (ABS))
Panelist:

RADM Watson's presentation outlined the developments in autonomous technology including the different levels of autonomy as outlined in the International Maritime Organization's (IMO) technical body, the Maritime Safety Committee's (MSC) regulatory scoping exercise. The different levels of autonomy outlined on the IMO website are as follows:

- Ship with automated processes and decision support: Seafarers are on board to operate and control shipboard systems and functions. Some operations may be automated.
- Remotely controlled ship with seafarers on board: The ship is controlled and operated from another location, but seafarers are on board.
- Remotely controlled ship without seafarers on board: The ship is controlled and operated from another location. There are no seafarers on board.
- Fully autonomous ship: The operating system of the ship is able to make decisions and determine actions by itself.

(<http://www.imo.org/en/MediaCentre/PressBriefings/Pages/o8-MSC-99-MASS-scoping.aspx>)

RADM Watson described the scoping exercise and ABS's development of their own responses to classifying autonomous vessels, of all levels, to highlight that both the IMO and ABS have had regulations and responses to autonomy in development for some time now and are diligently working to stay current and as far ahead of the innovation curve as possible.

RADM Watson stated that ongoing challenges will be: responding to the technology being developed and used for autonomous vessels, dealing with the human element in regards to safety of the MTS both in ongoing navigation challenges and the adaptation of new technology and the changing workforce, and

the regulatory frameworks that are still in development by the IMO and classification societies for autonomous shipping and cyber security.

At the end of RADM Watson's presentation he highlighted many recommendations for advancing autonomy. He suggested: government and industry development projects, testing and evaluation of subsystems and software, standard development committees and peer review opportunities, test sites and data collection centers (none in the US currently), open source software which can advance the confidence of new technology quicker and reduced regulations to encourage innovation and maintain national security and public outreach regarding safety and regulation acceptance to encourage investment so that technology will be better, safer, cheaper and therefore, successful.

Dr. Martha Grabowski (Le Moyne College/ Rennsselaer Polytechnic Institute) Panelist:

Dr. Grabowski outline her research using Wearable Augmented Reality Displays (WARD) which "present situated, real-time information visually, providing immediate access to information to support decision making."

(<https://www.sciencedirect.com/science/article/abs/pii/S000368701830766X>)

She conducted her research in a real-time physical simulator uncovering valuable knowledge on increasing situational awareness (SA) to improve operator performance. Among many findings, her research found that: "WARD users who used more closed-loop communication and information sharing showed improved threat avoidance, suggesting that operators can avoid accidents and failure through WARD use that promotes sharing and confirming information" (source above). Her findings in this research study regarding the operational impacts of the use of WARD gives the industry and others important information on improving safety for the seafarers who face daily situations which can result in dangerous or even catastrophic consequences.

Dr. Grabowski also outlined her work with the USCG to integrate archival and real time accident, incident, weather, AIS and environmental data. She combined 10 years of data with current real time data to produce a decision support system that provides an informational heat map that highlights risks on the lower Mississippi river on any given day.

After discussing her research, she highlighted that unexpected risks can result from integrating large amounts of data, as the integrations can mask data

inaccuracies and incompleteness. To address this problem, Dr. Grabowski's research team developed a machine learning approach that highlighted and eventually could automatically repair large scale integrated safety data sets. These advanced analytical approaches are important as the network of systems that comprise marine transportation are increasingly interdependent, requiring different tools and techniques to identify waterway and vessel risk.

Mr. Vivek Barve (North American Region/ Kongsberg Maritime INC)
Panelist:

Mr. Barve presented on autonomy and encouraged inter-industry collaboration due to the large amount of innovation occurring outside of the maritime industry. Mr. Barve stated that Kongsberg has been involved in remote and autonomous operations for 20 years now with both military and civilian applications. He highlighted many of the projects that Kongsberg has been involved in including the world's first autonomous and fully electric container vessel, *YARA*, which will conduct operations in 2020.

Mr. Barve listed various forms of technology that is available today such as sensors that: improve SA (critical to collision avoidance), detect and track obstacles on course, work with electric charts and augmented reality for increased safety, visibility and information for the crew.

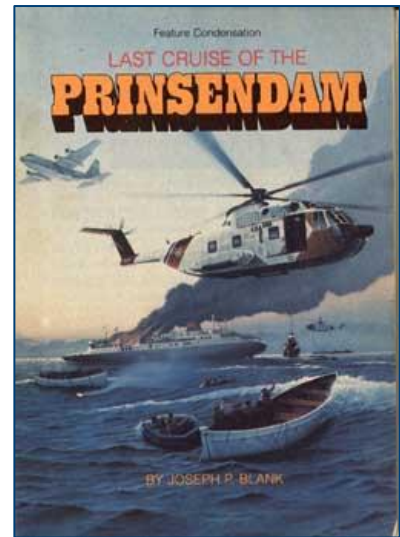
Takeaway:

Panel 2 highlighted the importance of collaboration, integrated data (as well as its inherent risks), and technology to improve safety and information within the human element of shipping. The panel also highlighted the long history of autonomous vessels, the different levels of automation of these vessels and the regulatory responses that are currently occurring and emerging from the IMO and classification societies to ensure the safety of these developing operations. Following the panel, the audience discussion highlighted the need for maritime colleges to adapt to the technological and innovative environment of today and the industry partnerships with these colleges needed to better prepare future mariners to thrive and perform competently in this new reality they will face.

Lunch Keynote Speaker: Honorable Judge Ingram



Judge Ingram presented on the fire and sinking of the MS Prinsendam, a Holland American cruise ship built in 1973. After outlining the rich historical event he highlighted the great collaboration that took place in various subsects of the maritime industry such as the USCG, commercial vessels and maritime lawyers. He stated that the event was one of the most successful rescues by the Coast Guard. Out of hundreds on board (mostly elderly passengers) there were no casualties or serious injuries.



Takeaway:

After the celebration of a successful collaboration it seemed to act as a reminder for us now that even though we are all in a time of change, uncertainty, development and innovation we as an industry have historically come together and fulfilled a successful mission as a whole. Just as we tackled the fire of Prinsendam, we will tackle the risks that this new reality in our global world will pose to our MTS.

Panel #3: Maritime Cyber Risk



Facilitator Lieutenant Commander Sarah Brennan (USCG)

Mr. Dan Meidenbauer (JHAPL) Panelist:

Mr. Meidenbauer began his presentation by highlighting the great dangers that cyber threats can cause to critical infrastructure and other systems that our adversaries are targeting. Mr. Meidenbauer stated that a way to combat such risks is by using technology to improve our situational awareness of potentially dangerous pieces of our operating system networks. Also, technology can automate response actions to immediately stop attacks before damage is brought upon our systems. He stated that it is very important that we raise our Operation Technology (OT) systems to match the level of development of our Information Technology (IT) systems.

Cynthia Hudson (HudsonAnalytix) Panelist:

Ms. Hudson encouraged audience members and beyond to take a holistic approach to maritime cyber risk management and proactive pre breach

preparation. The goal is to assess the risk and how to manage it to better get our hands around cyber threats and the risks they pose.

Ms. Hudson encouraged organizations to take a serious inventory of the threats they face and how those risks can be insurable. She outlined what coverage is available today. She stated that although coverage is limited and there are no current enforced regulations pertaining to cyber security, companies should invest in cyber capability development and adhere to cyber security best practices in order to be ready to transfer the risk to insurance when it is developed and comply to regulations when they are enforced.

Ms. Hudson informed the audience of the NIST/IMO cyber security frameworks taking affect in 2020 and she detailed recommendations on how companies can posture against cyber threats. She again encouraged organizations to immediately begin looking at and measuring where they are vulnerable and where they make others vulnerable. In today's world, businesses and organizations are more interlinked than ever. Therefore, companies are at a greater risk of unknowingly exposing outside organizations (outsourced groups, government, industry partners and other companies).

She encourages organizations to see cyber risks as affecting the entire value chain from shareholders to customers and beyond. Recognize the financial risks and whose money is at stake.

Ms. Hudson explained that we must analyze and measure our organization's cyber risk to see where we are vulnerable, who we are exposing, how we are using our resources to address the threats we face and assess the cost of what we are risking when we do not address our risks effectively.

John Wolf (Morgan Stanley) Panelist:

Mr. Wolf explained to the audience, from an outside maritime industry perspective, how important cyber resilient practice is. After a detrimental event in the banking industry where hundreds of millions have been lost due to a payment-based cyber-attacks, Morgan Stanley has adopted strict policies and processes to combat cyber threats. These include layers of detective and preventative controls as well as planned companywide phishing campaigns, where re-training is provided for those who click on the fake links as well as other disciplinary actions for repeat offenders. Mr. Wolf reminded the maritime industry that investors have billions of dollars in the maritime sector and when companies are negligent, they put their investors at risk as well.

Boriana Farrar (American P&I Club) Panelist:

Ms. Farrar began her presentation with the current climate in the maritime industry in regards to cyber security. She pointed out the guidelines that are currently available such as the IMO maritime cyber risk management guidelines and guidelines put forth by organizations such as INTERTANKO. She explained that just as P&I clubs advise owners on how to combat cyber risks, these guidelines are there to provide their own advice. She also reminded the audience that the maritime industry can be one that is reactive versus proactive. Therefore, in a time of no enforced cyber regulations it is important for organizations to take the advice provided by industry guidelines in order to stay ahead.

Ms. Farrar also explained what is currently covered within the realm of P&I insurance. Although clubs are still adapting to cyber risks the default rule in place is that if a risk would traditionally be covered and this risk has been caused by a cyber threat then it will be covered. Ms. Farrar included in her presentation that there is specific cyber insurance on the market today outside of the P&I scope.

Ms. Farrar highlighted cyber risk cases in her presentation that drew our attention to the harsh and expensive reality of cyber threats.

Takeaway:

It is time to take cyber security seriously. There are great risks that can cost billions of dollars and cause great threats to the safety and security of our MTS. All organizations need to analyze and measure where they are at risk and where they put others at risk. We must also bring OT systems to the level of development of IT systems and use technology to identify, combat and prevent further risk and damage to our organizations and systems. The banking industry has adapted many useful tools to enhance cyber resiliency that the maritime industry can use and learn from. There is cyber insurance on the market today and although P&I clubs do not directly cover cyber risks, they cover threats traditionally covered by P&I even if they are caused by cyber events.

Panel #4: Domestic Perspective on MTS and Risk



Facilitator RADM Pelkowski (USCG Ret./ SUNY Maritime College)

Thomas Creamer (USACE) Panelist:

Mr. Creamer spoke on the importance of maintaining existing navigation channels and using resources efficiently for dredging in the midst of rising vessel size and cargo shipment.

Buckley McAllister (President, McAllister Towing) Panelist:

Mr. McAllister highlighted that the major concerns of the MTS should be increasing vessel sizes, increased traffic marine and highway traffic, climate change resiliency, and limited shore side infrastructure to support maritime development. Mr. McAllister stated that the diminishing port infrastructure in New York and the inability to receive permits is top practical and immediate priority before thinking about larger issues such as climate change.

Dan Pastore (Port Authority NY/NJ) Panelist:

Mr. Pastore stated that the major concerns regarding the MTS are water capacity, security and climate change. The Port of NY/NJ serves 3,000 vessel per year, lots of cargo volume both on vessels and rail, 20,000 trucks are in the port per day and the pollution from vessels, cars and trucks is very high in the NY/NJ area. These are all major concerns that affect our security, overcapacity and environment.

CAPT Tama (COTP Sector NY) Panelist:

CAPT Tama named digitization, decarbonization, off shore wind growth, congestion, active shooters and UAS drones as the major concerns to the MTS domestically. However, in his presentation he focused on the three most important concerns in his eyes:

1. Cyber- there are no bounds to cyber threats it spans beyond domestic borders to the global supply chain.
2. Marine Planning- is of utmost importance when considering off shore wind growth, larger vessels, waterways, climate change and congestion.
3. Physical Security- with an emphasis on protecting against UAS.

Takeaway:

Panel 4 highlighted the major threats to our MTS today within our domestic borders and beyond. The panelists recommended major focus points such as critical maritime infrastructure (driven by policy and investment) needed to meet demand and national security standards.

Keynote Morning Speaker- RADM Mark Buzby “State of the MTS”



RADM Buzby began the address by expressing kind regards from US Secretary of Transportation, Elaine Chao. He stated that Ms. Chao believes in investing in and protecting the MTS and that the key focus of MARAD is safety for both the environment and transportation system.

RADM Buzby highlighted the importance of education and training for competent mariners to improve and ensure safety within our MTS in a time when there are all too many accidents despite modern technology and training levels. Within the realm of training, RADM Buzby emphasized putting focus on cyber training to mitigate risks within our reality of automated and electronic systems. He expressed being pleased to see SUNY Maritime College, Kings Point and the USCG Academy implementing cyber programs. RADM expressed MARAD's support and investment in maritime education and training to strengthen the MTS as a whole.

RADM Buzby spoke about the current state of the US fleet. He expressed great concern regarding the size of the fleet. He explained that although the Jones Act is

paramount, the cost of complying to US flag requirements are very costly and cause concern to a company's bottom line.

MARAD is working hard to educate other areas of the government about the importance of the MTS. In good news: there is new tonnage within the US fleet, MARAD is strengthening the tracking mechanism used today to increase visibility on cargo contracts awarded (to decrease cargo leakage and increase cargo available to US flagged ships) and the 2020 Maritime Security Program has been extended to 2025.

In regards to the Jones Act, it is very supported by Congress and this ensures support for 125 ship yards, 100 large ocean-going vessels, 1800 off shore vessels and 39,000 tug and support vessels all built and serviced by Americans. Working as a job machine, employing 650,000 Americans and giving the US 54 billion in economic output. RADM Buzby stressed the important of the Jones Act and how essential it is for national and economic security.

RADM Buzby also reported that there is strong development in petroleum, natural gas and off shore wind that will lead to new opportunities and new ship builds. He explained that as demand increases so will the amount of US flagged ships.

RADM Buzby also described the advances taking place to address the over capacity of road, rail and ports in NY/NJ area and the advances happening with NY harbor to grant new marine highways and make short sea shipping possible. He outlined the federal funding being given to port infrastructure (290 million) and port development. As well as, twelve bill grants (18 million) and ship yards (20 million.)

RADM Buzby also reported on the National Defense Reserve Fleet (NDRF) and its readiness, size, average age and current investments. The reality is that the fleet is old and needs to be recapitalized to be effective; new designs down the road should extend the service life of these vessels.

Final Remark and Takeaway:

The speed of innovation and change is making things speed up and we must embrace this and move forward accordingly and it takes the will to do so. Everyone must push ahead and remember that America is a maritime nation.

Panel #5: International Perspective



Facilitator: CAPT Todd Bonnar (CN)

**Jared Henry (President Chief Commercial Officer, Hapag-Lloyd USA)
Panelist:**

Mr. Henry stated that Hapag-Lloyd has had a US fleet since the 1900's. However, it has declined in the last 20 years due to the high cost to operate and the decrease in government cargos available to ship. In addition to these concerns, he expressed concern over the decrease government funding available and the shortage of US mariners to operate a US flag. In a global context, Mr. Henry highlighted that there is great competition for the US. He used the size of China's fleet and amount of port investments as an example.

Mr. Henry compared the US to China and believes there is great risk to our MTS due to the concerns he has raised. He suggested actions to mitigate these risks such as: an increase of enforcement of existing laws pertaining to cargo preference, extending the MSP to 2035 and eliminating the tax on overseas repairs.

Ken Krogman (Military Sealift Command) Panelist:

Mr. Krogman highlighted the importance of reconstituting operational skills for mariners to achieve mission success. Due to a resurgence in Great Power competition that has been largely absent in the maritime domain for over two decades, the maritime environment is a contested environment in which we cannot assume to have free rein. Skills such as sailing in formation, navigating without GPS, emission control (EMCON), darkening ship, and navigating a mine-swept channel, are crucial in mitigating risks posed to our combat logistics, Fleet support, and sealift ships. MSC has programs to train their afloat civilian mariner workforce and contract crews to recapture these essential capabilities.

Richard Hine, COO (ThayerMahan) Panelist:

The speaker encouraged the audience that in order to reduce risk in the MTS we must have superior domain awareness and use small companies to provide low cost solutions for the big issues present today. We can use small, inexpensive AI assets to make large assets safer and more effective.

Captain Robert Fay (Senior VP Maritime Operations International Registries INC) Panelist:

CAPT Fay outlined that his presentation focused on a cost perspective in terms of dealing with cyber threats. He stated that there are real and present dangers in regards to cyber security. In order to mitigate these risks, the solutions must be cost effective for companies to be incentivized to implement effective protections. Restrictive regulations should not be allowed to precede practical and appropriate solutions.

Takeaway:

There is great concern regarding the US flagged fleet size and ability to compete internationally. There is a push for government policy and investment. It is important that mariners be able to safely navigate when technology is not available. Cost is another major concern in regards to mitigating risks to the MTS. However, there are small assets and companies available to make large assets safer and more reliable.

Panel #6: Future Issues of Risk within the MTS



Facilitator: Dr. Henry Willis (RAND)

Dr. Willis aimed to address the risks that surprise us and how we prepare for these risks so that we can avoid surprise and plan as effectively as possible.

Daniel Maffei (FMC Commissioner) Panelist:

Mr. Maffei focused on global risks that pose threats to our entire MTS. These include:

- Lagging infrastructure
- Inland infrastructure in the US
- Infrastructure comparisons and global competition (China versus the US)
- Slow implementation of digitization and AI
- Data Analysis needed to increase supply chain effectiveness
- Large environmental uncertainty- rapid and severe weather
- Political issues- war, piracy, tariffs, Brexit, trade wars
- State subsidizing and protectionism that distorts transportation markets
- The major effects of subsidizing infrastructure in developing countries

He stated that systematic risks to the MTS are very difficult to anticipate and plan for but the best way to prepare is to issue systematic improvements.

RDML Sugimoto (USCG) Panelist:

RADM Sugimoto spoke of a multitude of risks being posed to our MTS and how they are increasing, posing new challenges and the USCG attempts to adapt and respond. The major risks to our MTS highlighted by his presentation were as follows:

- Maintaining National Security in an increasing environment of homegrown terrorism, UAS use (monitoring commercial operations and being weaponized).
- Congestion on waterways and how it is more difficult to maneuver around large vessels for USCG missions.
- Global warming causing water levels to rise and key infrastructure and logistic hubs needing to be moved and new infrastructure built.
- Recruitment and retention of human capital and in the midst of a changing workforce environment having the ability to maintain a legacy skillset and build a technological one as well.

RADM Sugimoto described that we are at a seminal moment in our MTS and reminded the audience of the US's unique features including our inland waterways that set it apart as a strong maritime nation in the midst of rising global competition.

Dr. Ty V. Wamsley (USACE) Panelist:

Dr. Wamsley named these as major future challenges to our MTS:

- Climate change and the water resource and increasing storm challenges it poses.
- Infrastructure and the capital needed to rework aging infrastructure in the midst of permits and compliance.
- R&D

Dr. Wamsley explained to the audience that R&D can be used to monitor and anticipate future risk. Collecting and analyzing data can optimize how to schedule dredging and use limited resources in effective ways and provide navigational advice (avoiding collisions) in flood and coastal risk management environments.

Dr. Wamsley is a strong believer in harnessing the value in mass amounts of data and integrating it in order to leverage AI and machine learning to better inform

those who are operating the system so that we can combat the risks of today and the future.

Jen Pederson (National Risk Management Center) Panelist:

Ms. Pederson's presentation focused on understanding the interdependencies between organizations to better understand interdependent risk. She focused on risk present today and rising risk in the future due to increasing interdependencies across sectors, supply chains and people leading to increasing risk exposure.

Ms. Pederson highlighted the importance of understanding risk, recognizing when organization expose others, and how our smart devices can detect threats and stop their functions immediately. She stated that as our technological awareness and ability rises, so does our adversaries and we must have systems that can respond to this reality. In regards to the identification of risks and combating cyber risk specifically, she spoke about the importance of raising our baseline and being able to identify the holes in our cyber portfolios. She stated that regardless of the amount of capital we spend to combat cyber risks if it can all be undermined by an employee thumb drive and we are unprepared then it is not an effective system. Ms. Pederson also highlighted the importance of training for our future mariners and mariners today to be able to work with technology, respond to threats and hold the balance of relying on their own eyes and ears in times of need.

Takeaway:

Panel 6 identified many rising threats in the future of the MTS including but not limited to geopolitical relations, climate change (effects on infrastructure and operations) and the new threats being posed by increasing interdependency between organizations. The panel also highlighted the need for effective training for mariners to thrive in this risk prone environment now and in the future.

Student Poster Contest Winners

Dr. David Nicol (Director DHS COE University of Illinois)

Announces Poster Winners!



This year was quite the competition yielding unexpected results. There was a three-way tie for the winner in the graduate student category and a traditional solo winner for the undergraduate research category. Below you will find the four winners and a bit about the focus of their research. Stevens Institute graduate research winner, Kevin Raleigh presented a poster titled "Hydrodynamics of Waystations for Autonomous Drone Charging" and it focused on the use of open ocean sensor platforms as charging stations for unmanned underwater vessels.

Rutgers University graduate research winner, Brandon Rogers presented "Frozen Frontier: Utilizing Geographic Information Systems to Improve Marine Safety in the Arctic." As his title indicates, Brandon researched how better mapping of the ever-changing geography of the Arctic, using Geographic Information Systems (GIS), would be a practical tool that could lower risk and increase the safety for sailors using the Northwest Passage.

SUNY Maritime graduate research winner, Christine Spencer's poster titled "The Future of Shipping" researched how global warming is affecting our MTS, society and global economy. She outlined recommendations to combat global warming and pave the way for decarbonization within the maritime industry. USCG Academy undergraduate research winner, Delaney Swift presented "Cyber Security in the Maritime Domain: A Holistic Approach." Her research identified the current gaps in maritime cyber security and Swift offered possible solution to address these gaps.

Keynote Lunch Speaker
RADM Alfutis, President, SUNY Maritime College
**“Educating the Future Maritime Workforce in a Sea of
Constant Disruptors and Change.”**



The Admiral's Speech:

Over the past day and a half, we have been discussing the risks to the marine transportation system. How should maritime education and training respond to the risks and disruptors the maritime industry is facing today?

As I consider how to best answer this question, I gain inspiration from one of Maritime College's past Superintendents, Captain James Harvey Tomb as he was facing a time of similar disruption in the maritime industry – the shift from sail to steam. When he became Superintendent, he had three goals he felt he had to accomplish in order to modernize what was then the New York State Nautical School. First, he wanted to elevate the stature of the school by renaming it the New York State Merchant Marine Academy. Second, he wanted a new training

ship, and replaced our second training ship, the Newport, with the first Empire State. Finally, he wanted to acquire a permanent shore base for the school, and 11 years after becoming the Superintendent, Fort Schuyler was dedicated as the new home of the New York State Merchant Marine Academy. As a result, Captain Tomb is credited as one of the most transformative leaders in our school's history, and I am inspired by his vision, leadership, and tenacity.

Today, I would like to introduce the idea that we are in a new age of accelerations that is driving the greatest changes in the maritime industry since those witnessed by Captain Tomb almost 100 years ago. In this age of accelerations, maritime colleges and academies must modernize in order to remain relevant. We need to change how we teach and prepare future mariners given not only the challenge of these changes but the rate of change they will be facing. We need to be more agile and nimble as institutions that produce more adaptable and resilient graduates.

We have been discussing the many risks and disruptors that are driving changes in the maritime industry. The integration of digital technologies into everyday life – digitalization – is reshaping every aspect of our lives and business. Risks and disruptors include: digitization and data analytics; systems integration and automation; cyber risks and resiliency; e-commerce; new technologies; and, environmental regulations.

The development and integration of sensor technologies, digital data, and smart systems will continue to accelerate. Just look at the how our automobiles have become mobile data vacuums that can track everything from the weight of the passengers, to what we listen, to whom we call, to diagnostic information. Along with these advances, data analytics by sophisticated computers and programs will enable the development of autonomous systems that are situationally aware, capable of making decisions and adept at learning.

As such, there is consensus that there will be a steady progression to autonomous systems for ships with the goal of autonomous ships in the future. This will mean a reduction in crew sizes and a shift where licensed mariners are required in order to operate ships safely in autonomous and manual modes.

Just like other industries where technology has eliminated jobs, the overall number of jobs for mariners could actually increase due to increased volumes of shipping traffic associated with an expected increase in world GDP. However, different skill sets and credentials will be associated with these new jobs. We need not fear automation. A Deloitte study of automation in the U.K. found that over a 15-year period 800,000 low-skilled jobs were eliminated as the result of AI and other automation technologies, while 3.5 million new jobs were created. These new jobs

paid on average nearly \$13,000 more per year than the ones that were lost. The study went on to conclude: “continued success will rest on the ability of businesses and organizations, educators and government to correctly anticipate future skills requirements and provide the right training and education.”

The ongoing transition from manual and automatic to autonomous systems over the next decade will result in increasingly complex systems. More integrated and complex systems will require cyber resiliency against malicious or inadvertent attacks for all sectors of the maritime industry including ship and terminal operations, brokering, chartering, protection and indemnity (P&I), ship registry and supply chain management. Part of the solution to providing security for complex systems includes block-chain technology. After the June 2017 cyberattack that cost Maersk as much as \$300 million and disrupted operations for 2 weeks, there was an accelerated interest in blockchain technology. IBM and AP Moller-Maersk set up a joint blockchain venture to make the company’s supply chain more efficient and secure.

Cyber threats and new technologies such as blockchain will drive the need for a digital maritime workforce having new certificates/credentials. In short, a more digital and tech savvy crew and maritime workforce will be required onboard and ashore.

Driven by environmental regulatory disruptors such as IMO 2020 and USCG Subchapter M, shipping will become greener and more fuel-efficient. According to DNV GL, “the growth in liquid natural gas (LNG) powered ships is expected to accelerate towards 2025.” In 2018, there were about 143 LNG powered ships in operation (excluding LNG carriers), and another 135 are under construction. Additionally, there are another 135 “LNG ready” ships in operation or on order. Recent developments in ship propulsion electrification, new battery storage technologies and hybrid-electric solutions on smaller vessels could be the harbinger for some degree of hybridization on larger vessels in the next decade. Sources estimate that by 2025 a majority of larger vessels could have some degree of hybridization.

But the real question is, how is this challenge of risks and disruptions caused by changing technologies and regulations facing the current and future generations of students and mariners different from that of previous generations? How are these changes any different from the shift from steam to diesel propulsion? Or the advent of containerization and its impact on global shipping? The maritime industry is, after all, an industry of innovation and change.

I believe New York Times columnist and best-selling author Thomas Friedman describes it best in his book *Thank You for Being Late: An Optimist's guide to Thriving in the Age of Accelerations*. Friedman says it is the dizzy pace of simultaneous and accelerating change in three different but interconnected realms: the market, Mother Nature, and Moore's law or technology. The market refers to globalization which is causing the world to be "hyper-connected" and interdependent. Mother Nature is climate change, biodiversity loss, and population growth. Moore's law states that the power of microchips will double every 24 months. The impact of these interconnected realms is that technological change is accelerating so fast that, unlike in the past, people, regulations, and educational institutions can no longer keep pace. We are now in what Friedman refers to as the "age of accelerations."

So, the various risks and disruptors I mentioned fall into one of these categories and ALL are going to be occurring at a faster rate. How should maritime colleges and academies respond to this sea of risks and disruptors? What are the implications of this new age of accelerations to maritime training and education? What competencies will be required of mariners in this new digital age? How can we keep up? Can we keep up? We need to change course.

First, our institutions must have processes in place that, through meaningful partnerships with the industries we serve, allow us to quickly design and deliver relevant programs. We have been familiar for decades with the term "just in time logistics". We must now adapt this same concept to our institutions and offer "just in time education and training."

For example, Google needed a course after they released basic algorithms for an open source program called TensorFlow in October 2015. Udacity, working directly with Google engineers, was able to develop and put online a course by January 2016. Friedman calls this "jump starting the curriculum." Traditional universities would find this nearly impossible under current academic structures.

While shared governance is essential, we must establish new processes that enable us to evolve, change, and deliver "just-in-time" programs and courses. We need to create non-traditional processes and new structures that will allow us to be become more agile and pro-active, such as Centers of Excellence, Institutes, Certificates and Micro-credentials, and Online Delivery.

As an example, when the President of Southern New Hampshire University wanted their internet-based distance learning program, now known as SNHU Online, to be able to innovate more quickly, he established a completely new entity at a separate location outside the university's governance structure to allow SNHU

Online to be more nimble and agile and grow into the largest nonprofit provider of online higher education in the country.

We need to create new academic programs to respond to the rapid digitization of not just the maritime industry, but all the industries we support, including programs in coding, digital technologies and control systems, systems integration and automation, “smart building” technologies, and cyber safety and resiliency, just to name a few. We need to look at innovative uses of digital technologies such as augmented and virtual reality for maritime education and training. Digital data and technologies must be infused across all of our existing and new academic programs

In short, our institutions need to become more agile and pro-active. We can no longer afford to wait on regulatory agencies such as the Coast Guard or IMO to tell us what new skills we need to instill in our students, and react to their requirements. We must anticipate future trends in industry and the impacts of those trends on our programs.

In order to adopt this model, we will need to frequently scan the horizon, determine what DNV-GL refers to as “the most likely future,” and understand that while there will be significant uncertainties, we should be able to make decisions, and equally important assess them, based on current trends in a relatively short period.

Second, our students will need to become more adaptable and resilient. Changes in technology, the environment, the regulatory picture and globalization represent a more complex array of forces for our students to understand than ever before. Students can no longer assume that technical skills they acquire at our schools will serve the demands of a rapidly changing world. More than ever, students need to learn the flexibility, adaptability and resilience that will prepare them for changes to the maritime industry in which they will work and for many different jobs they are likely to hold. This means our institutions must graduate students who can adapt, retool, and re-learn throughout their careers.

We can only do this through a careful balance of education and training. Education provides the theoretical foundation and promotes intellectual and personal growth in areas such as: critical thinking and analysis; quantitative and scientific reasoning; information literacy; communication skills; leadership and ethics; appreciation for global civilizations and the natural world; and competency in a field of study. Training refers to skills and knowledge that relate to specific useful competencies. Training prepares students for a current job, while education prepares them for a career.

In short, we must integrate knowledge in a discipline (major), hands-on learning experiences, and adaptive skills from across a program of studies in liberal arts and STEM, such as

- Technological Competency
- Communication Skills
- Leadership and Teamwork
- Analytical and Critical Thinking
- Multi-Cultural Awareness and Respect

In this way, we will provide graduates not only immediate employability in a competitive career field but also the character, adaptability and ingenuity to succeed throughout their careers as the nature of the industry changes rapidly.

Finally, recognizing the maritime industry is a global industry there must be closer and more frequent collaboration between industry and maritime colleges and universities. Participating in government-industry committees and working groups, such as the Coast Guard Merchant Marine Personnel Advisory Committee, maintaining robust industry advisory boards, and hosting industry events on campus, such as the Maritime Risk Symposium, provide us with important opportunities for these collaborations. In addition, our students and faculty need to be more aware of the geo-political, international, and economic factors that drive the maritime industry. This will require increased opportunities for study abroad, international internships, and faculty exchanges.

When he was looking at the need for the New York State Nautical School to modernize, Captain Tomb once wrote, “American merchant marine literature is rich in the splendid exploits of our sailing vessels and decidedly scant in steam or motor, thereby creating a tendency to live too much in the past and to stick to obsolete training. Our marine schools have never been abreast of the times.” We are now facing similar challenges. There will be inertia internally and externally to these needed changes, however if we do not have the courage and tenacity of Captain Tombs to adapt to this age of accelerations, our greatest risk may be living in the past and becoming obsolete.

Panel #7: “Symposium Highlights & MTS Risk Management Research.”



Facilitator: RADM Fred Rosa (USCG Ret. / Johns Hopkins APL)

At the outset, RADM Rosa asked each of the panelists to address one or more of the four questions set forth below:

1. What are the most significant takeaways from the symposium in terms of their potential to inform MTS risk management activities?
2. What important aspects of the maritime risk management challenge were not discussed during the symposium, yet are essential to forging further progress in this area?
3. What significant risk management research questions emerged that warrant follow-up as we seek to stimulate and guide maritime risk research?
4. What research and/or other maritime risk activities are being undertaken at your institution?

RADM Alfultis (SUNY Maritime College)

RADM Alfultis viewed the key takeaways as: the proliferation of and increased reliance on networked systems; the risks inherent in many integrated shipboard operational systems; and the overall importance of data. His significant issues not addressed were: (1) the clear potential for pathogens to spread quickly through the MTS and threaten large populations; and (2) the various container threats that require constant balancing of security and economic efficiency.

With respect to research questions, RADM Alfultis emphasized the vital importance of studying human interaction with digital systems, particularly in terms of maintaining situational awareness of the actual maritime environment, and then he highlighted the potential of geospatial information technology as a tool for planning with respect to maritime infrastructure and waterways management.

RADM Alfultis also stressed the pressing need for a comprehensive evaluation of current requirements for mariners, asserting that the standards and examinations extant today are based on the 20th century environment and must be updated to reflect today's evolving 21st century realities. He specifically urged that the USCG and MARAD cannot continue to add mariner license requirements without “making room” for them by deleting obsolete requirements. In his view, continuing along this path poses significant risks to the MTS.

RADM Alfultis encouraged the audience to consider what new types of educational and training programs need to be developed and implemented in response to the many dramatic changes transforming the maritime environment. As examples, he cited: cyber dependency and related threats; offshore wind energy; LNG for bunkering, fuel and cargo; autonomous vessels; and new training ships and other assets designed to train for both routine operations and disaster response.

RADM Fossum (Texas A&M Maritime Academy)

RADM Fossum focused his opening remarks primarily on key MRS 2019 takeaways. His highlights included the following:

- There is a compelling need for research that enhances our knowledge of the 21st century maritime realm. As one example, a recent Crowley Maritime study found that 70% of marine accidents are due to human error. Other research findings raise significant concerns relating to the incidence of weakness in

basic mariner competencies and to disturbing cases of loss of critical situational awareness as a result of reliance on automation technology.

- Research such as that conducted by Crowley affords us a better understanding of today's maritime realities and corresponding action must be taken with respect to education, training, licensing, certification, periodic observation and testing, etc. The aviation industry has numerous lessons learned and useful practices related to maintaining crew and support team knowledge and professionalism that the maritime industry can tailor and adopt to promote greater safety and security throughout the MTS.
- New and emerging threats in maritime cybersecurity underscore the vital importance of mariners having systems – both cyber and physical – that are resilient and redundant
- There is an ongoing transition away from paper nautical charts. Other industries have adapted successfully, and the maritime industry must do so as well.

RADM McDonald (Massachusetts Maritime Academy)

RADM McDonald began by sharing his overall perception that there is increasing concern – both in the maritime realm and, at least to a certain extent, among the general public – about the many risks being posed to our MTS; the critical importance of safeguarding mariners; and the troubling uncertainties about where the United States is headed as a maritime nation. He offered that the primary driver for this elevated concern is a maritime world that is so very different, citing cyber threats, piracy, contested operating regions, tariff wars, the Brexit transition, and significant new and costly IMO requirements as leading examples.

Most of RADM McDonald's remaining opening remarks focused on various education and training issues, including the following:

- In addition to all of many other requirements, today's mariners must be educated on geopolitical and related issues impacting the regions through which they operate;
- Given the current "packed curricula" at maritime academies, the reluctance to remove obsolete requirements simply must end;
- More emphasis should be placed on exploring opportunities to collaborate in curriculum development and research (e.g., seeking industry advice on majors, and including more labor representation in initiatives like the MRS series); and
- There should be a significant ramp-up of training related to offshore wind energy operations, ideally implemented through extensive coordination of

the many stakeholders (not merely just within legacy and emerging stovepipes).

At the session drew to a close, RADM Rosa asked each of the panelists to briefly identify major challenges they encounter in their respective roles as leading maritime educators.

RADM Alfultis (SUNY Maritime College)

- Need for greater investment in maritime education
- Decline over time of NY state support for maritime education

RADM Fossum (Texas A&M Maritime Academy)

- Concur with respect to greater investment funding
- Recruiting and retaining students owing to higher debt loads
- Inadequate public understanding that the Jones Act is also about national security, not just jobs

RADM McDonald (Massachusetts Maritime Academy)

- Concur with respect to greater investment funding
- Under-appreciation of the important role of maritime colleges as social mobility mechanisms
- Legislative failures to take the contribution of the maritime industry to the broader economy adequately into account in funding decisions

Takeaway

Panel 7 highlighted the major themes gleaned from the symposium and also captured the executive perspective of key maritime educators charged with preparing the next generation of maritime leaders and other professionals. Of particular note, all three admirals concurred with the assessment that there is a compelling need for a fully comprehensive review of current mariner education and training requirements – and that the review must be premised in part on the necessity of a prioritization process enabling certain requirements to be eliminated or scaled back in order to make room for vital new requirements responding to 21st century realities.

Another common theme of importance was the recognition that today's maritime colleges must be proactive and innovative in terms of optimizing their overall educational approach to keep step with today's rapidly changing world. Not

surprisingly, forging tangible progress with respect to both of these major themes will require increased outreach to – and collaboration with – a wide range of diverse MTS stakeholders, including many in the broader public who may not realize that they are, in fact, key stakeholders owing to the many benefits they derive from the maritime contribution to U.S. national security and the economy.

Our nation's security and prosperity depend on the continued cooperation among maritime colleges, the maritime industry, government agencies, and other stakeholders to identify, and prepare for emerging risks.

Project Evergreen Workshop Report

Project Evergreen is a U.S. Coast Guard scenario-based strategic planning tool that was first employed more than two decades ago. The core of Project Evergreen is to develop a number of plausible future scenarios, each with various economic, geo-political, technical, and other conditions. These scenarios are suggestive of potential risk factors, as well as the skills, resources, capabilities, and other factors that would enable the Coast Guard to successfully achieve its mission in those conditions.



By way of clarification, the purpose of Project Evergreen is not to predict the future *per se*, but rather to enhance the Coast Guard's awareness of a range of possible maritime futures so as to better inform strategic-level policy, risk management, and resource decisions.

MRS 2019 provided an ideal set of maritime professionals to contribute to Project Evergreen during a workshop that was held at the conclusion of the Symposium. The participants reviewed four circa 2030 global scenarios and focused on unidentified or undervalued future MTS risks.

Four working groups were each assigned a different 2030 global scenario and then met separately for a facilitated discussion of the risk implications of their scenario. A brief synopsis of each group's key finding is set forth below:

Group #1

Given a scenario involving an ascendant China leveraging its economic power and rapidly advancing transformative technologies, Group #1 identified having sufficient trained maritime personnel in the work force as the most significant strategic threat to the MTS.

Group #2

Group #2 grappled with a 2030 scenario of major global economic growth, including new oil and gas pipelines in an Arctic region rendered much more accessible by global warming, coupled with an overall global environment under great stress, as evidenced by failing infrastructure, food insecurity, and population displacement. Group #2 found that the largest strategic threat to address in managing MTS-related risk is global warming.

Group #3

In its future world of increased flooding, changes in the workforce, capital inequality, and advanced technology, Group #3 assessed the inadequacy of

coordinated national and international maritime governance as the largest strategic risk to the MTS and the one that requires the most attention going forward.

Group #4

This 2030 scenario featured: both Russia and China with a strong global presence; the strength of the dollar eroded, as cryptocurrency and yen dominant in its place; and widespread HIV now drug-resistant. Confronted with these and other harsh realities, Group #4 concluded that disaster cycles caused by climate change are the biggest strategic threat to the MTS owing to significant resource strain and infrastructure damage.

Takeaway

Consideration of the four alternative 2030 scenarios reinforced the importance of accounting for a wide range of distinct yet often overlapping risks to the MTS as we seek to make the right strategic decisions now to prepare for the future. Each of the four groups developed useful insights that will contribute not only to avoiding or minimizing strategic surprise, but also to developing MTS resource allocation options with “common denominator” potential to prove advantageous in efficiently addressing multiple discrete risks in 2030 and beyond.

Workshop Closing Remarks by RADM Fred Rosa (USCG Ret. / Johns Hopkins APL)

RADM Rosa thanked all of the participants for their careful analysis of the 2030 scenarios. In his view, the Evergreen approach is challenging to implement well, but definitely worth the investment as illustrated by the way in which the MRS 2019 participants generated key insights that will help to inform today’s maritime leaders how best to posture the MTS for success in the face of the daunting challenges looming in a complex and uncertain future. He also offered that implementing the approach effectively entails significant collateral benefits, primarily by broadening the awareness of individual participants and promoting greater collaboration between and among the many MTS stakeholder stovepipes throughout the public and private sectors.

RADM Rosa concluded by expressing his confidence that the results of this and similar workshops in the continuing Evergreen series would prove of great value to Coast Guard and other senior maritime leaders in making critical upcoming MTS-related policy and resource decisions on behalf of the Nation.