



NAVIGATION TECHNOLOGY CURRENT STATE, FUTURE POSSIBILITIES, GAPS AND BARRIERS

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Introduction of Massachusetts Maritime Academy

- Celebrating 125 years of navigation and engineering education for the marine transportation industry
- Certain diversifications of educational options have expanded offerings
- 1,500 cadets in the Regiment and opting for seven different major fields of study
- Two graduate level management options
- 600 cadets complete one 60-day sea term annually

The state maritime academies are stressed financially because of extended sea days for the training ships and additional instructors and staff needed to keep up with new training and documentation requirements in the classroom and laboratory.

While engineering cadets have to accrue 180 days only – the deck cadets have to gather 360 days – usually through convoluted equivalencies including more days at sea, factoring sea days on training ships, use of simulators and credit for in port watch keeping and shipboard maintenance.
(MMA raw sea days count at 216. 156 are factored at 1.5 equaling 234, added to it is 60 days commercial shipping totally 294 directly from sea going experience.)



Current state of navigation efforts at MMA

- MMA is not a research institution – we are an educational and training institution
- Our core mission is keeping current in new technologies and processes as required
- Bogged down with archaic and unpopular navigation and operational systems
- Example – the use of celestial navigation
 - Today's practicing mariners rarely, if ever, take a celestial site for position fixing
 - One-third of the navigational training at the SMAs focus on this navigation to be prepared for rigorous assessments and examination.
- Cadet navigation training:
 - Celestial navigation (10 credits*)
 - Coastal navigation (8 credits*)
 - Electronic navigation (8 credits*)
 - STCW (6 credits), specific navigation equipment and procedures (15 credits)



Current state of navigation efforts at MMA (cont.)

- MMA operates a fleet of training vessels – but primary use relies in the 13,800 GT Training Ship KENNEDY, and the 112 GT Training Vessel RANGER.
KENNEDY is fully equipped with the oceangoing commercial ship navigation equipment
RANGER is outfitted handsomely with navigation equipment that simulates that of the bigger ships.

Navigation/communications Training Aids

360-degree Full Mission Bridge Simulator
240-degree part-ship Simulator
Radar/ARPA Simulator
Electronic Navigation Simulator
GMDSS Simulator



Current state of navigation efforts at MMA (cont.)

- One element of today's ship operations where cadet interaction lacks is off-shore communications
- AIS, LRIT, GMDSS MF/HF, and Sat-C are used – but nothing with internet connectivity
- The ship provides a store and forward email service through Iridium Satellite, but not 24-7 connectivity. Iridium service provider offers this option – it is only dedicated to the Master for critical needs such as eNOAD and medical references.

This fact is highlighted because internet connectivity is the essence of e-Navigation, and obviously a hinge pin to the future of navigation.



Baseline Topics for Discussion....just so you know my position

- Integration of observations and predictions of environmental conditions
 - Technology focused – one-window approach
Still ties the mariner to a computer screen and takes attention from the bridge-windows.
Application of this level of technology demands another mate on the bridge
- Development of eLORAN
 - Critically important. Satellites systems are fragile and unprotected
- Government responsibility for PNT data, or industry
 - Transit Sat Nav, Loran-C, Omega, and GPS – where has America's mission gone?
- The future of non-physical ATONs, such as virtual buoys
 - No opposed to this for offshore navigation
- E-Navigation training
 - Another training requirement? We must ensure that the training architecture is established before the requirements are published.



What processes, policies, procedures is MMA developing for e-Navigation implementation?

- Because MMA is not a research institution, there is actually no development
- Cadets are trained to state of the art technology, and encouraged to learn more
- Curriculum will be modified and/or enhanced so as to meet regulatory dictates
- Training ship equipment will be updated by the owner as required to meet regulatory dictates
- Individual SMAs would encourage private sector installation aboard training ships – but SMAs cannot afford the outright purchase.



What are the challenges to implementation of e-Navigation?

- All maritime academies would be greatly challenged by adding the necessary curriculum without reductions in other elements.
- Cost is a real consideration for e-Navigation, namely the 24/7 connections via satellites while their training ships are at-sea.
- Coastal vessels could accomplish this with cellular connection, but no more than about 10 miles offshore.
- Ship's officers as presently educated and trained are sorely deficient in dealing with modern electronic trouble shooting.
- Recently enacted training requirements for management level engineering officers included no specific elements on skills that understand what makes a radar or ECDIS tick, especially the networking of them.
- MMA actually added an IT network employee to the ship's at-sea staffing, essentially to deal with onboard intranet and email service.
- Deck officers, or a resurrected Radio Electronics Officer, are needed aboard underway ships. The initial vision will likely be an endorsement for Deck Officers.



What vulnerabilities due to over-reliance on GPS, and how is this discussed at MMA?

Although performing at very high reliability, GPS can fail. Satellite damaged by space debris, or cyber-hacking of the timing signals.

- Redundant equipment on board KENNEDY and RANGER satisfies individual receiver failure.
- When at-sea the Bridge Watch Officers and Training Officers will frequently deny GPS/ECDIS display information from cadets. During these periods they must rely upon DR navigation and celestial observations.
- When coasting or making landfall, cadets are required to use observations of ATONs, radar navigation, and fathometer observations.



What e-Navigation products most useful, what is still needed

- The connectivity of the AIS with ARPA and ECDIS has proven to be the most useful product.
- ECDIS capability to use AIS frequency for text messaging still needs universal acceptance at-sea.
- In a lesser degree the course tracking function of the Steering Systems is demonstrated for educational purposes, but the use of it is fundamentally inconsistent with the required training.



What are consequences of implementing e-Navigation?

Recently a Massachusetts state regulator challenged the need for marine pilots for ships entering and leaving port. This demonstrates a potential consequence. Automotous automobile software engineers claim the computer does a better job than drivers.

- A fully harmonized e-Navigation system will take years, and even then not all vessels navigating in the coastal plan or deep-sea will be so equipped.
- Conflict between government regulators and private sector manufacturers will ensure a confusing market of equipment.
- GPS signal failure, cyber-hacking, locked up computers and hardware failure, communication interruptions can render the e-Navigation nearly useless
- Finally, when at the ships have it – will the smaller vessel operators?



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What roles does USA have to do to ensure e-Navigation is implemented correctly

- The USA is a consistent participant in the IMO on all levels from sub-committees, working groups, correspondence groups, technical writing and full committees.
- With this participation comes the responsibility to buy-in to the implementation plan.
- The US Coast Guard must work ahead of implementation to establish appropriate training and certification processes.
- Also the expertise of masters and mates in the application of the technology aboard ships – from access to information, to ergonomic design.
- Class societies can help by working on standardization of equipment.



What roles does the Marine Board have in identified gaps and challenges?

The Marine Board provides open dialogue for all stakeholders in the maritime industry and produces relevant research reports.



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