PRECISION MARINE NAVIGATION
STAKEHOLDER and PARTNER WORKSHOP
30. SEPT. 2020

GRAPHICS by ANTHONY WEEKS
www.thepublicfistener.com

REAR ADMIRAL SHEPARD M. SMITH
DIRECTOR, OFFICE of COAST SURVEY, NOS, NOAA

"I HAVE SEEN A LOT of CHANGES in NAVIGATION AT SEA."

"WE'VE HAD GOOD ENGAGEMENT!"
- WE HAVE A LIST SERVE and BLOG for our STAKEHOLDERS, as well as a NEWSLETTER.
- WE HAVE BEEN REACHING out to FEDERAL PARTNERS too.

... and WE HAVE INCLUDED END USER VOICES!

WHAT IS "PRECISION MARINE NAVIGATION"?
"the ABILITY of a VESSEL to SAFELY and EFFICIENTLY NAVIGATE within the US EEZ and OPERATE in close proximity to the SEAFLOOR, BRIDGES, NARROW CHANNELS, or other MARINE HAZARDS..."

WHAT ARE THE PROJECT GOALS?
DEVELOP a PROTOTYPE DATA PROCESSING and DISSEMINATION to INGEST, PROCESS, and DISSEMINATE selected NOAA HYDROGRAPHIC, BATHYMETRIC, OCEANOGRAPHIC, and WEATHER in an INTERNATIONALLY RECOGNIZED, UNIFORM FORMAT (S-100).

DEV OPS
CLOUD COMPUTING
OPEN SOURCE SOFTWARE

PAPER CHARTS PROVIDED INFO... ... BUT NOT DYNAMICALLY.

NOW... WE ARE ABLE TO COLLECT and DISSEMINATE DATA in HOURS... not DAYS ... or YEARS...

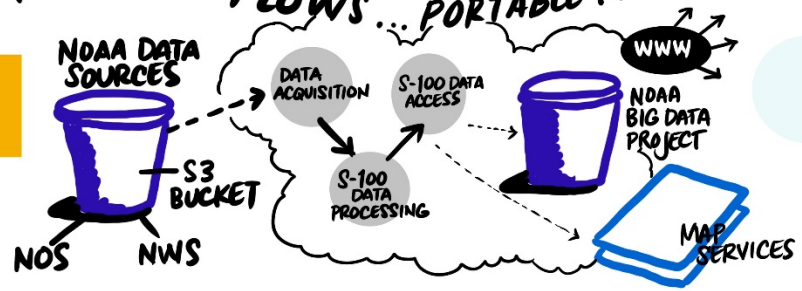
- SHORELINE CHANGES
- CHANNEL CONDITIONS
- OCEANOGRAPHIC TABLES (TIDE, CURRENT)

"WE HAVE INTERNATIONAL PARTNERS"

WHAT IS THE NEXT GENERATION of NAVIGATION SERVICES?
STANDARDS... DEVICES... INFORMATION FLOWS... PORTABLE PILOT UNITS

USE LESS REGULATED SERVICES as a SPRINGBOARD for DEVELOPING the NEXT GENERATION of NAVIGATION SERVICES.

A SCHEMATIC of PROTOTYPE on AWS...
BUILT on an INTEROPERABLE, MULTI-USE FRAMEWORK.



S-100 PROVIDES the FRAMEWORK for PRECISION MARINE NAVIGATION!
- DATA can be DOWN-LOADED even in LOW BAND-WIDTH ENVIRONMENT
- OPTIMIZED for WEB MAPPING SERVICES
- AUTOMATICALLY GENERATES TILES of FORECAST GUIDANCE of SURFACE WATER CURRENTS for the NEXT 3 DAYS (4x DAY)

PRECISION MARINE NAVIGATION

STAKEHOLDER WORKSHOP
30. SEPT. 2020

LAURA REAR MCLAUGHLIN

"We support the NATION'S ECONOMY and SAFEGUARD COASTAL COMMUNITIES with OCEANOGRAPHIC INFORMATION accessible by ANYONE, at ANY TIME, from ANY PLACE..."

CO-OPS is the AUTHORITATIVE SOURCE for ACCURATE, RELIABLE, and TIMELY INFORMATION...

- TIDES
- WATER LEVELS
- CURRENTS
- OTHER OCEANOGRAPHIC INFORMATION

NWLON: National Water Level observation Network

PORTS: Physical oceanographic Real Time System

OFS: Operational Forecast System

MAPS and CHARTS

SAFE, EFFICIENT NAVIGATION

COASTAL RESILIENCE and PLANNING

PRODUCTS:

- Coastal Inundation Dashboard
- Sea Level Trends
- Tsunami Warning
- Tidal Datums Calculator

DARREN WRIGHT

THE NATIONAL WEATHER SERVICE IS MADE UP of 11 PROGRAMS:

- Aviation Weather
- Climate
- Fire Weather
- Hydrology
- Marine and Coastal
- Tsunami
- Public Weather
- Severe Weather
- Space Weather
- Tropical
- Winter

NWS MARINE PRODUCTS:

- Marine Text Forecasts and Products
- Marine Graphic Forecasts and Products
- Satellite and Radar Imagery
- Ice Analysis, Forecasts, and Iceberg Reports
- Computer Generated Model Guidance
- Foreign Marine Forecasts
- Marine Climatological Information

PRECISION MARINE NAVIGATION
STAKEHOLDER WORKSHOP
30. SEPT. 2020

CANADIAN HYDROGRAPHIC SERVICE : THE FULL VALUE CHAIN

- LOUIS MALTAIS
- KAREN HART
- HANS CHRISTOFFER LAURITZEN
- MIKE MONTESANO
- MARK HAYDEN
- PASCAL RHEAUME

- **DOES THE GATEWAY INCLUDE ALASKA and HAWAII ?**

  Not currently.

- **3-D WORK ?**

  We are using multiple layers and using 3-D to generate a 2-D forecast.

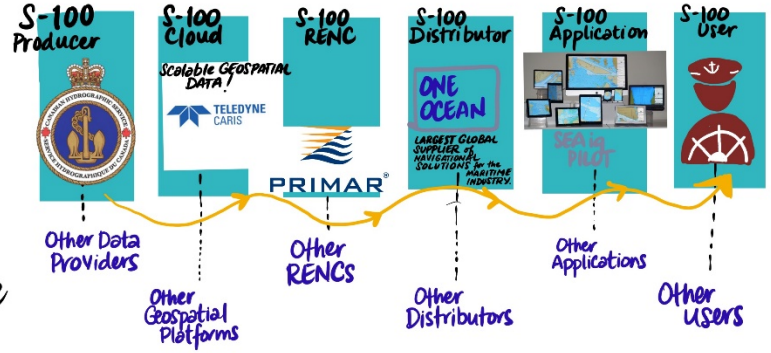
  The 3-D files are available (4.5 m depth) in a different bucket.

- **INTEROPERABILITY...**

  We are working on metric charts to align with international standards for contouring

  — Needs to go through IMO process...

The S-100 VALUE CHAIN...



— **SEAMLESS...** from SURVEY to BRIDGE

— **REAL-TIME DATA TRANSMISSION...**

— **AUTOMATED and TIMELY UPDATES...**

— **PREPARING for E-NAVIGATION and the FUTURE of AUTONOMOUS SHIPPING**

— **FULL 4 DIMENSION SERVICE**

PRECISION MARINE NAVIGATION
STAKEHOLDER WORKSHOP
30. SEPT. 2020

S-128

SPATIAL DATA RESOLUTION?
- Points of interest...
- Resolution scales with underlying chart scale...
- TUNE Resolution for DIFFERENT COMMUNITIES...
- Depends on USER.
- Value increases if you can pick out specific reference points.
- Highest available resolution... Where should we provide it?

"THE CATALOG of CATALOGS"
"You need it to understand LATENCY and UPDATES to DATA SETS."

"You need it also for DISCOVERABILITY and REGISTRATION of SERVICES around the world."

WHAT FORECAST HORIZON for S-100 WEATHER FORECASTS and OCEAN MODEL FORECAST PRODUCTS DO YOU NEED to SUPPORT YOUR CUSTOMERS?
- 1-3 DAYS?
- 72 HOURS?

"WAVE HEIGHTS are PART of the WEATHER."

WHAT are the BARRIERS to S-100 IMPLEMENTATION?
- TRAINING
- POTENTIAL DISCONTINUITIES with S-100 products
  - US and CANADA...
- ABILITY to INCORPORATE into ECDIS with ship transit overlays.
- COMPLEX ISO-8211 FORMAT
- OPEN SOURCE LIBRARIES
- SPECIFIC IMPLEMENTATION ASSISTANCE
- WE HAVE DISTINCT USER GROUPS.
  - a SEGMENTATION STRATEGY: Products, Distribution, Use of Data

WHERE DO YOU WANT to SEE HIGH-RESOLUTION BATHYMETRY?
- INLETS
- DETROIT RIVER
- SHIPPING CHANNELS
- AT THE PORTS
- FISHING GROUNDS
- SHIPPING CHANNELS
- ANCHORAGES
- COASTAL AREAS
- PORT of PASCAGOULA

WHERE DO You MOST WANT to SEE HIGH-RESOLUTION SURFACE CURRENTS?
- HIGH NAVIGATIONAL RISK AREAS
- SHIPPING CHANNELS
- WITHIN/AROUND PORTS
- CONSTRAINED WATER WAYS
- NEAR OFF-SHORE PLATFORMS

PRECISION MARINE NAVIGATION
STAKEHOLDER and PARTNER WORKSHOP
30. SEPTEMBER. 2020

FEEDBACK SESSION:
SOFTWARE SYSTEMS and DISTRIBUTORS

ED WEAVER
GeoNavigation Technologies
- Visualize and Distribute S-100 Data Sets
- S-57 Support

PORT VOYAGER AWS TECHNOLOGY STACK
- .NET Core
- C#
  - using Amazon
  - using Amazon.S3

PROCESS
- NEED to USE:
  Amazon Resource Name (ARN) arn:aws:S3:::noaa-s111-pds
  AWS Region us-east-1
- CREATE the model Catalog Key → to get the appropriate metadata
- USE the object key to keep the file structure locally

CONNECTING STANDARDS COMMUNITIES

HOW WILL YOU USE S-100?
- IT'S ABOUT INTEROPERABILITY, not STOVEPIPES
- CREATING SOLUTIONS that WORK across the WORLD
- MULTIPLE DATA PRODUCTS

IMO is an ISSUE!
... but in S-100, we can provide things that we can't in S-57...

HIGHER LEVEL CATALOGUING.
- ONE LOCATION.
- ONE SOURCE.
- SUPER USEFUL to OEMs.
- DYNAMIC SELECTION and REFERENCING

S-129 used INLAND or primarily COASTAL?
Mostly COASTAL...

WHAT ARE THE CYBERSECURITY ISSUES with AWS, if any?
THERE are the ABILITIES for AUTHENTICATION SIGNATURES and ENCRYPTION.

MOVE toward S-101? When will there be a significant user base?

"WHEN DO WE LEAN IN from a USER PERSPECTIVE?"

WHAT SHOULD BE OUR S-100 DATA PRIORITIES?
WHAT WOULD YOU LIKE TO SEE INCORPORATED?
- AIR GAP and DENSITY
- ICE FORECAST GUIDANCE
- REAL TIME DATA
- ECAs?
- COMMUNITY EDITS, LOCAL INFORMATION
- AIS BASED HIGH TRAFFIC AREAS
- VTS Call-in Points

2024... APPLICATIONS S-57 and S-101 running AT THE SAME TIME.
2030... SUNSET of S-57
IT WILL BE UP TO THE OEMs to do CONVERSION.
ENABLING *interoperability*... and GETTING to FULL CAPABILITY.

IT'S IMPORTANT to HAVE INDUSTRY INVOLVEMENT!

WHAT ABOUT ACCESS to S-100 by RECREATIONAL USERS? A ROADMAP?

EACH USER WILL HAVE DIFFERENT NEEDS.

What LEVEL of DATA UNCERTAINTY are you COMFORTABLE with? How should the UNCERTAINTY be Communicated?

- LOW CLUTTER for NAVIGATION; an AREA · WINDOW HEAT MAP
- UNCERTAINTY at the same STANDARD, and pertaining to other ports GLOBALLY.
- A GRAPHICAL DISPLAY of FORECAST ERROR
- MARINER should not have to CRUNCH NUMBERS during ROUTE MONITORING
- SPATIAL and TIME DEPENDENT UNCERTAINTY
- MULTIPLE UNCERTAINTIES, GRID AVERAGE, NOW, 12/24/48, etc.
- A BEST ESTIMATE? AN OPTIMISTIC OUTPUT FILE? CONSERVATIVE?

FOR S-104 WATER LEVEL FORECAST GUIDANCE from the FORECAST MODELS, DO YOU NEED the WATER LEVEL referred to MLLW or Some other DATUM?

- Canada is LLWLT/LNT and other neighboring countries are LAT...
- Same as the tidal datum in the underlying charts.
- Navigational and non-navigational?
- Whatever datum the soundings are on... (MLLW, MHHW)
- Same as the s102/s101 being covered ...

WHAT ARE YOUR EXPECTATIONS of NOAA SUPPORT when problems occur with S-100?

- Provision of backup delivery channels
- Fast correction and quick updates

WHAT CAPABILITIES WOULD NOAA NEED IN ORDER TO PROVIDE 24/7 SUPPORT?

WHAT'S THE RESPONSE TIME to Resolution?

RESOLUTION · WORK AROUND · REAL TIME SUPPORT

HIGH AVAILABILITY and 24/7 SUPPORT!

WEATHER INFORMATION will NEED 24/7 SUPPORT!

PROBLEMS may be OUTSIDE NOAA but they will still NEED DATA.

REGIONAL CONTACTS?

FEEDBACK Session

30 SEPTEMBER 2020

END USERS

What Sort of DATA do you NEED to CAPITALIZE on PMN for TRIP PLANNING?

- IMPROVED PASSING ZONES in RESTRICTED WATERS
- RECOGNIZE STORM SURGE EFFECTS
- HIGH-RESOLUTION BATHYMETRY
- TIDAL PREDICTIONS, TIDE STATIONS REAL TIME
- TIDAL STREAMS FORECASTS
- CHART DATA CATALOG, WATER LEVEL FORECASTS, WIND, WIND-WAVE, and SWELL TRAIN
- ROUTE PLANNING for DYNAMIC UNDER KEEL CLEARANCE ISSUES

HOW WILL YOU USE THIS DATA to IMPROVE TRIP PLANNING and ROUTE OPTIMIZATION?

"THE BANDWIDTH ISSUE IS REAL!"

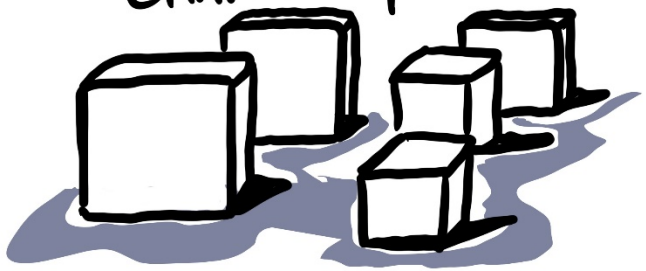
PLUG and PLAY!

S-100 and NOAA's PRECISION NAVIGATION SERVICES

THE IHO BUILDING BLOCKS:

A data framework for the development of NEXT GENERATION ELECTRONIC NAVIGATIONAL CHARTING products

GLOBAL CONSISTENCY! ...when you READ, INGEST, DISPLAY, or UPDATE.



- S-100 DISCOVERY METADATA
  - RESTRICTIONS OCCUR at the PRODUCT SPEC LEVEL.
  - NOT EVERY SPECIFICATION uses EVERY FIELD.
  - metadata about
    - OVERALL EXCHANGE CATALOGUE
    - INDIVIDUAL DATASETS
    - SUPPORT FILES
- HYDROSPATIAL INFORMATION REGISTRY:
  - → A Collection of HARMONIZED INFORMATION divided into a Series of
  - REGISTERS
    - FEATURE CONCEPT DICTIONARIES — Hydro, IALA, WMO, IEC
      - DESCRIBES the CONTENT of a DATA PRODUCT
      - Ties in SPATIAL PRIMITIVES (Point, Curve, Surface)
    - PORTRAYAL REGISTERS
      - PORTRAYAL FUNCTIONS that MAP the FEATURES to SYMBOL
      - ↳ Machine Readable Set of Symbols and Portrayal Rules
      - LUA, XSLT → NAVIGATION SYSTEMS MUST IMPLEMENT BOTH!

STANDARDS are the BUILDING BLOCKS to PRECISION NAVIGATION!

FEEDBACK Session

30 SEPT 2020

END USERS

HOW IMPORTANT is the ROBUSTNESS of RELIABILITY in DATA and DELIVERY METHOD?

CRITICAL and SIGNIFICANT.

- Consistency over time is important.
- Needs the same reliability as the data set it is representing.

HOW should we CALCULATE the WATER LEVEL TREND of the MODEL FORECAST GUIDANCE for INCLUSION in the future S-104/HDF5 files?

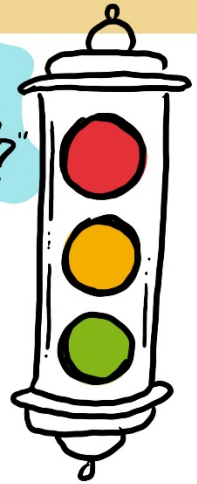
- VARIABLE by REGION
- DIFFERENCE between ACTUAL WATER LEVEL and ASTRONOMICAL FORECAST LEVEL
- A MODELED TREND?

WHAT LEVEL of DATA UNCERTAINTY are you COMFORTABLE with?

MAKE the DATA UNCERTAINTY SIMPLE and CLEAR!

... as well as GLOBALLY CONSISTENT

"LIKE a TRAFFIC LIGHT?"



- HOW does it vary by the FORECAST HOUR?
- WHERE does uncertainty increase with TIME?
- DEPENDS on SPECIFIC DATA...

WHAT SUPPORT do you NEED from NOAA for S-100 OPERATIONAL PRODUCTS?

- Training videos
- Online primer
- Notifications when outages, delays occur
- APIs
- Point of Contact
- Simplified user training and information
- Library of open source integration tools
- Help with finding all the catalogs/support files for the specifications

PRECISION MARINE NAVIGATION

1 OCTOBER 2020

FEDERAL PARTNERSHIP

Heather Gilbert
Denise la Due

AN INLAND STANDARD for FEATURES not found in MARITIME WATERS.

- **IENC** — INLAND ELECTRONIC NAVIGATIONAL CHARTS
- **IEHG** — INLAND ENC HARMONIZATION GROUP
- **PARTNERING**
  - NOAA:
    - Coordination
    - Data Sharing
  - CATZOC ASSESSMENT
  - eHYDRO ENTERPRISE WEBSITE
- eHYDRO JOINT METADATA PROJECT
- AIS AIDS to NAVIGATION

ARMY GEOSPATIAL CENTER — AGC — US ARMY CORPS OF ENGINEERS

U.S. COMMITTEE ON THE MARINE TRANSPORTATION SYSTEM — CMTS

- SYSTEM PERFORMANCE
- SAFETY
- SECURITY
- ENERGY INNOVATION
- INFRASTRUCTURE INVESTMENT

WE ARE ABOUT INTERAGENCY COORDINATION...

... and OUTREACH/ ENGAGEMENT.

ESTABLISHED in 2004 as part of the US OCEAN ACTION PLAN

- A Cabinet-level interagency committee
- Assesses MTS adequacy
- Promotes MTS integration with other modes of transportation
- Coordinates and makes recommendations related to MTS federal policy

NATIONAL NAVIGATION STRATEGIC ACTION PLAN / 2021-2026

- SHARE DATA
- REFLECT ADVANCES in the MTS and the WORLD of e-NAVIGATION
- LAYS OUT the LINKAGE of the PLAN to the INTERNATIONAL e-NAVIGATION efforts of IHO, IMO, and other bodies

QUESTIONS and FEEDBACK

1 OCTOBER 2020

- DOES EUROPE USE THE IENC INLAND STANDARD?
  Yes. They were one of the early developers.
- CAN USACE PROVIDE ALL IENC DATA as ONE COMBINED FILE for DOWNLOAD?
  Yes! There is the option on the charts download page.
- IS IT POSSIBLE TO HAVE ONE SINGLE UPDATE RELEASE of NAVAIDS?
  It would be POSSIBLE... but it's not the most PRACTICAL given our updating processes.
- A UNIFIED EFFORT for STANDARDIZATION of REAL TIME OBSERVATIONS?
  A CLEARINGHOUSE for NAVIGATIONAL DATA, without the distinction between NOAA and everyone else.
- JOINT METADATA PROJECT? Could it be a ~~gatekeeper~~ for bringing in data from other places?
- WILL USACE make REAL-TIME WATER LEVEL OBSERVATION DATA available for rivers in S-104 format?
- NEAR REAL TIME DATA for the GREAT LAKES?
  Continued coordination between NOAA and USACE.
- HOW DO YOU DISTRIBUTE IENCs to the END USERS/VESSELS?
  - We use distributors...
    ...and we also have built out the infrastructure for a standardized catalog discovery system
  - We will be bringing users into our one-stop shop... but we are babystepping our way there.

AT NOAA...
WE DO HAVE PROCESSES for INGESTING DATA from other SOURCES...
...and ASSESSING IT for QUALITY... and VALIDATING IT.

- PLANS for USCG to provide AID to NAVIGATION information in a format other than USCG Light List such as an online database available to the public?
- Plans to update IENC so it will match with satellite images?

  Reach out to Denise LaDue, if you find errors in the data.

WHAT IS INTEGRAL for your NAVIGATION CUSTOMERS that we need to include LINKS to from our MARINE NAVIGATION WEBSITE?

- High-resolution bathymetry
- Real-time observations
- Water levels
- Currents
- Tides
- Link to CO-OPS home page
- Marine events, safety zones
- Navigation warnings
- marine weather warnings

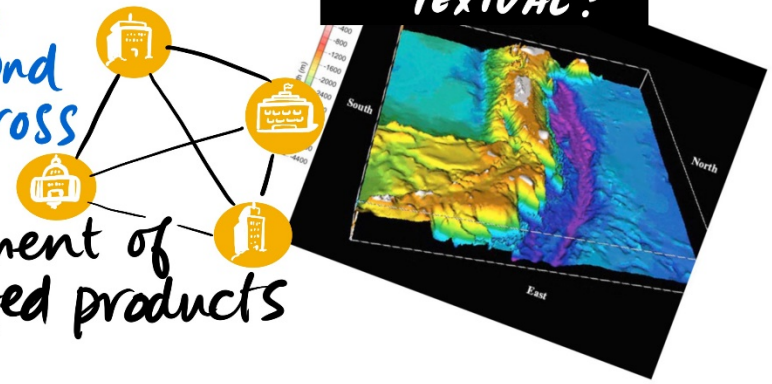
A navigation website that includes navigation products

USABILITY in 1-2 CLICKS!

WHAT KIND of "BATHYMETRY" would be MOST HELPFUL?

"WHAT CAN I PUT INTO MY PPU?"

VISUAL? TEXTUAL?



HOW SHOULD WE STAY ENGAGED and COORDINATE across AGENCIES?

- Support development of IHO S-100 related products and standards
- Local harbor safety committees are a good source of information

FEEDBACK and DISCUSSION

1 OCTOBER 2020

TARGETED ENGAGEMENT with US MARITIME ACADEMY STUDENTS?

Many of them will be end users in the near term.

CONSIDER REACHING OUT TO THE NMC...

USE and ADOPTION of S-100 PRODUCTS will require a COMPREHENSIVE TRAINING and EDUCATION EFFORT!

LET'S HIT AS MANY USERS IN THE "USER PYRAMID" as we can!

SUMMARY

PRECISION MARINE NAVIGATION

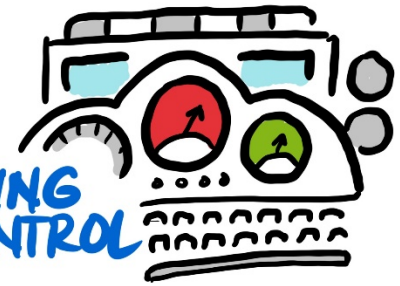
1 OCTOBER 2020

- AUTONOMOUS and HIGH-AUTOMATION SHIPPING:
  - HOW WILL WE "SERVE" THEM, EVEN THOUGH THEY AREN'T HUMAN USERS?
  - Consider THE INCREASING ROLE OF CONTROL CENTERS!

- EDUCATION, LICENSING, MANDATION:
  - "THESE THINGS NEED TO MOVE TOGETHER!"

HOW COULD WE IMPROVE ENGAGEMENT?

- REGULAR BLOG POSTS
- QUARTERLY EMAIL UPDATES
- CONGRESSIONAL BRIEFINGS
- LIST SERVE
- CONNECTIONS with TRAINING ACADEMIES



Could we leverage platforms like LINKED IN?

...FLEET OPS centers?

1 OCT 2020

NOAA

"BETTER FORECASTING"

REAL TIME DATA NEEDS VARY...

WE ARE ADDING NEW PORTS while GROWING EXISTING PORT SYSTEMS.

NOCMP
National Operational Coastal Modeling Program
14 Operational Forecast Systems!

RECAPITALIZATION of EXISTING STATIONS and SENSORS
NEW TECHNOLOGY and INSTRUMENTATION
STRONGER OUTREACH and DATA ACCESS
WE ARE FOCUSED on IMPROVING DATA RELIABILITY and ACCESS.

FORMALIZE the PROTOTYPES... and then START to ENGAGE.

HOW DO WE PROVIDE UPDATED INFORMATION?

"BE ABLE to WARN for the FULL EVOLUTION of an EVENT."

PORTS
Physical Oceanographic Real Time System

NCOP
National Current Observation Program

HOW DO WE MODERNIZE MARITIME FORECASTS?

... and WHAT DID WE LEARN from the OCTOBER 1, 2015 EL FARO DISASTER?

HOW DO WE VALIDATE THIRD-PARTY INFO? — and INTEGRATE IT...

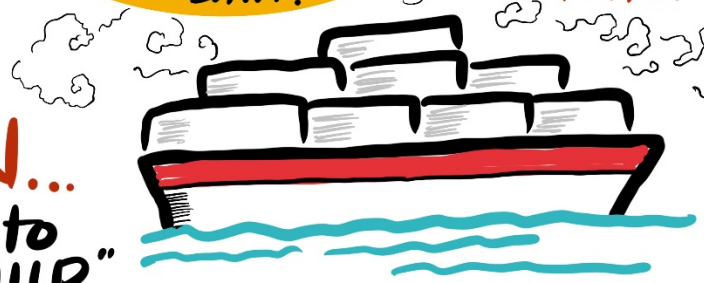
WHAT IS THE FUTURE of REAL-TIME OBSERVATIONS, PREDICTIONS, NOWCASTS/FORECASTS, and other GEOSPATIAL INFORMATION?

- INTEGRATED into ELECTRONIC CHARTING...
- STANDARDIZED...
- DISSEMINATION... "from the KAYAKER to the CONTAINER SHIP"
- TRAINING... and SIMULATION?

"WE CAN NO LONGER DESCRIBE the WEATHER USING TEXT!"

WHAT ARE THE BEST FORMATS for DISSEMINATING DATA?

HIGH-RESOLUTION GRAPHICAL DISPLAYS.



HOW DO WE FORMAT INFORMATION from a VARIETY of PORT SYSTEMS and GET IT OUT through AIS?

"OUR PRODUCTS NEED TO BE SEAMLESS!"