NMEA 2000
Standard for Serial-Data Networking of Marine Electronic Devices

METS 2011
November 15, 2011
Amsterdam, Netherlands
Steve Spitzer-Technical Director NMEA
NMEA 2000

Who is NMEA?

How was NMEA 2000 developed

What is NMEA 2000?

What are the benefits of NMEA 2000?

What is the future of NMEA 2000?

Questions?

Property of NMEA Do not copy or redistributed with NMEA permission
57-year old global non-profit marine industry membership-driven organization

- 600 members worldwide, 40 countries represented
- Manufacturers, Trade
- Dealers, Shipyards
- Boat Builders
- Government Administrations
- Industry Associations
Positive international reputation built on:

- Openness
- Listening
- Discussion
- Collaboration
- Consensus
- Direct input from our members and from other interested parties
Digital Electronic Interfaces since 1980

- NMEA 0183 (IEC 61162-1)
  - Single Talker/Multiple Listener
- NMEA 0183 HS (IEC 61162-2)
- NMEA 2000 (IEC 61162-3)
  - “Open” Industry Network

NMEA 0400 Installation Standard

- First Published in 1994
- Globally Recognized
Collaboration with Global & U.S. Trade Associations

- ABYC, ANSI
- BMEA
- IALA, ICOMIA
- IEC, IMO, ISO
- MEIPA, NMMA
- RTCM, SAE
- U.S.C.G.
Dedicated to serve worldwide marine electronics industry interest

- Promote the safe interconnection and interchangeability of equipment
- Minimize misunderstanding and confusion between manufacturers
- Provide educational training
- Accredited Standards Developer
- Publisher of Marine Electronics Journal
Continuing Education and Professional Advancement

- Marine Electronics Installer (MEI)
- Advanced Marine Electronics Installer (AMEI)
- Certified Marine Electronics Technician (CMET)
- NMEA 2000®

More than 1200 Trained Worldwide
NMEA 2000
What is It?

NMEA 2000
is
Based on
Controller Area Network (CAN)
NMEA 2000
What is It?

• CAN was developed by Robert Bosch in 1983
  • CAN is designed for real-time requirements and with its a high-integrity serial data communications bus for real-time applications
  • Is more cost efficient than any other serial bus system including RS232 and TCP/IP
  • More effective than TCP/IP connection when it comes to short reaction times, timely error detection, quick error recovery and error repair.
  • Excellent error detection and fault confinement capabilities
  • Has the ability to function in difficult atmospheric & electrical environments
NMEA 2000
What is It?

- Adopted by Society of Automotive Engineers (SAE) in 1986
- High Safety and Reliable Industries
  - Automotive, Agriculture, Industrial, Medical Engineering, Robotic, Transportation
- Method to Exchange Data between Multiple Manufacturers’ Equipment Simultaneously
- Suitable for Mission Critical Data (GPS, Heading)
- Simple, Scalable, Configurable
“Open” Marine Networking Interface Standard

- NMEA 2000 Standards Committee established in 1994
- Multi-national marine electronics committee under NMEA guidance
- 5 years in development
- 2001 commercially viable in U.S.
- Adopted as the International Standard for SOLAS (IEC 61162-3)
NMEA 2000
How was it Developed?

Members
• Academia - Kansas and Oklahoma State,
• Networking and Computer Industry
• Marine Electronic Companies,
• U.S. Coast Guard Research & Development

Beta tested 18 months under NMEA guidance
• U.S. Coast Guard
• Marine Electronics Manufacturers
  • Furuno USA, JRC, Litton Marine, Navionics, Northstar, Raymarine,
    Simrad, Teleflex, Trimble, Wood Freeman
• CAN Manufacturers
  • Kvaser, Vector Can Tech

Today more than 100 companies worldwide
Europe, Asia, Australia
New Zealand, U.S.
All categories of electronics and electrical are represented
NMEA 2000
What is It?

9 Documents Comprise the NMEA 2000 Standard

- Main Document
- Appendix A (Application Layer)
- Appendix B (Database of Messages)
- Appendix C Certification Criteria and Test Methods)
- Appendix D (Application Notes)
- Appendix E ISO 11783-3 Data Link Layer
- Appendix F ISO 11783-5 Network Management
- Appendix G ISO 11898 Controller Area Network
- Appendix H Third Party Gateway
NMEA 2000
What is It?

Some Key Requirements

• Standardized messaging
• Data creation simplified
• Standard cables and connectors
• Proven, robust, safe
• Message prioritization (bit by bit arbitration)
• Scalable (252 addresses)
• Certification testing
• 250 Kbits/sec (50 times faster than 0183)
Cables / Connectors  Open DeviceNet Vendor Association (ODVA)

**Standardized Cables and Connectors**

- Meets UL Class 2, UL 1677 oil resistance and NEC CL2
- IP67 rated, 65 lb pull strength
- Keyed / threaded connectors
- Accepted by Lloyd’s Register
- Meets U.S.C.G. regulated vessel-wiring requirements
- Meets U.S.C.G. regulated vessel safety concerns
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What is It?

Physical Network Parts

- Backbone & Drop Cables
- Power Tees
- Tee Connectors
- Terminating Resistors-2

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NMEA 2000
What is It?
NMEA 2000
What is It?

NET-S
Power +

NET-C
Power -

NET-H
Data

NET-L
Data

Shield / Drain

Foil Shield

Braid Shield
NMEA 2000
What is It?

• Tee Connects each individual device to the backbone

FEMALE Backbone Connection

MALE Backbone Connection

FEMALE Drop Connection to Device
Both ends of the backbone are terminated. Network interfaces provide power for the device transceivers, so the backbone includes a pair for power and ground.
NMEA 2000
What are the Benefits?

• Ease of Install and Future Changes
  – Add and subtract products without network interruption

• Less Wire
  – NMEA 2000 single cable replaces wiring up to 50 NMEA 0183 interconnections

• Less Weight
  – Boat builder testimony (26 meter pleasure craft)
    • 1000 pounds less weight
    • 2 weeks faster to market

• Proven, Safe, Reliable
NMEA 2000
What are the Benefits?

Terminating Resistor is molded into the manufacturer’s connector

In-Line Terminating Resistor
Product Certification

• All NMEA 2000 products are certified
  • Behave in a known and predictable manner
  • Ensures safe and accurate communication
  • Over a 100 tests validated by NMEA
  • Expose any flaws or weaknesses in the protocol implementation
• Listing of certified products – www.nmea.org
• Beware of “Compatible” or “Works With”
NMEA 2000
What are the Benefits?

www.nmea.org

NMEA 2000 ®
STANDARD FOR SERIAL-DATA NETWORKING OF MARINE ELECTRONIC DEVICES

128267  Water Depth
Water depth relative to the transducer and offset of the measuring transducer. Positive offset numbers provide the distance from the transducer to the waterline.

<table>
<thead>
<tr>
<th>Field #</th>
<th>Field Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>SID</td>
</tr>
<tr>
<td>2</td>
<td>Water Depth, Transducer</td>
</tr>
<tr>
<td>3</td>
<td>Offset</td>
</tr>
<tr>
<td>4</td>
<td>Reserved Bits</td>
</tr>
</tbody>
</table>

128275  Distance Log
This PGN provides the cumulative voyage distance traveled since the last reset. The distance is tagged with the time and date of the distance measurement.

<table>
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</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Measurement Date</td>
</tr>
<tr>
<td>2</td>
<td>Measurement Time</td>
</tr>
<tr>
<td>3</td>
<td>Total Cumulative Distance</td>
</tr>
</tbody>
</table>
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What are the Benefits?
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Traditional
NMEA 2000
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Traditional

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What are the Benefits?

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What are the Benefits?

Traditional

NMEA 2000
NMEA 2000 Installation
NMEA 2000: What is the Future?

- **Alarms and Faults** – A set of tools for a suite of alarms and faults.
- **Power Generation** – Status and control of power generation devices, such as generators, alternators, inverters, hybrids, and shore power on ships.
- **Electrical Distribution** – Delivery of power on vessels; identifying loads, load sharing, and virtual breakers.
- **Audio Controls**
- **Galileo**
- **E-Navigation**
- **AIS Updates**

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