Activities of Smart Ship Application Platform 2 Project (SSAP2)

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Background

- Onboard and Shore IoT application services, which rely on ship onboard equipment data, have become much more expanding.
  - Weather routing
  - Optimum trim
  - Performance monitoring
  - Engine monitoring
  - Condition monitoring
  - Power plant energy management
  - Remote maintenance
Smart Ship and SSAP

- The concept of Smart Ship is to utilize Ship IoT application services to achieve optimum ship operation in terms of safety and energy efficiency.

- The target of SSAP (SSAP & SSAP2) projects is to support these Ship IoT application services in order to access ship equipment data easily and to enhance developing further application services for a better stage.
“Operation Technology (OT)” and “Information Technology (IT)” are to be bridged. The era of “transparency” in which user can access field data.

* PLC: Programmable Logic Controller
Coming IoT applications in marine industry

**Target**
- Prevent unpredicted downtime
- Reduce maintenance cost
- Energy efficiency in operation

**Measure**
- Condition monitoring
- Big data analysis
- Support service engineer
- Intelligent machinery
  - Self diagnostics

**Working style will be changed**
## IoT and Big data applications

<table>
<thead>
<tr>
<th>Role</th>
<th>Function</th>
<th>Example of IoT and Big data application</th>
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</table>
| **Ship owner**| Technical      | • Safety operation  
               |  management       | • Condition monitoring & maintenance  
               |                   | • Environmental regulation compliance  
               |                   | • Hull & propeller cleaning  
               |                   | • Retrofit & modification  
               | New building     | • Design optimization  |
| **Ship operator** | Operation     | • Energy saving operation  
               |                   | • Safe operation  
               |                   | • Schedule management  |
|               | Fleet planning | • Fleet allocation  
               |                   | • Service planning  
               |                   | • Chartering  |
| **Shipyard**  | In-service ship| • Ship performance analysis  |
|               | New building   | • Design optimization  |
| **Manufacturer** | Maintenance | • Remote monitoring & diagnosis  |
IoT application installation (now)

Similar data are sent to shore from each onboard software

To Shore

Onboard equipment
Cabling and interfacing one by one

Cabling and interfacing one by one

Similar data are sent to shore from each onboard software

ECDIS
VDR
Engine Data Logger
Ballast Control System

Onboard equipment

Cabling and interfacing one by one

Similar data are sent to shore from each onboard software

IoT application (onboard and shore)

Optimum Trim
Performance Monitoring
Weather Routing
Engine Monitoring
Remote Maintenance

Energy Efficient Autopilot
IoT application installation (future - SSAP2 target)

IoT application (onboard)

- Optimum Trim
- Performance Monitoring
- Weather Routing
- Engine Monitoring
- Remote Maintenance
- Energy Efficient Autopilot

Ship Equipment LAN for IoT Application

Shipboard data server

Router F/W

To Shore Open Platform (via satcom)

Onboard equipment

- ECDIS
- VDR
- Engine Data Logger
- Ballast Control System
Concept of Ship - Shore Open Platform

Ship IoT data platform
(Cooperation)

Application / services
(Competition)

Own application
Fleet management
Performance
3rd party application
Performance
Remote diagnostics
Condition monitoring
Fleet management

Ship – shore open platform

Onboard data server

Broadband

Data Center at shore

Ship LAN

Machinery & Equipment

Ship

VDR

Engine D/L

IAS

...
What are the benefits of such platform?

- Application providers can easily provide onboard and shore application software / services

- Equipment manufacturers can easily provide their services, such as remote maintenance
  - Ship owners can get remote maintenance supports directly from manufacturers

- Ship owners investment cost (CAPEX and OPEX) for onboard applications and shore services will be lower economized
  - More big data applications will be used

- Shipyards and equipment manufactures can collect data from running equipment
  - Better understanding for service performances

- Ship owners can manage/control ship data transmission to shore

- Standardized format and protocol will enhance application development
SSAP1 Project
(Smart Ship Application Platform 1 Project)

• Participants
  – Members: 27 organizations
  – Observers: 9 organizations

• Schedule

• Joint Industry Project supported by JSMEA + Class NK

• Achievements
  – Design specification of shipboard data server
  – Implementation of shipboard data server and trials on 2 domestic vessels
  – Ship – shore open platform design for ship IoT
  – Proposed 2 ISO NPs (ISO NP19847 / ISO NP19848)
Onboard trials in SSAP1 (2014)

RORO Ferry
SUNFLOWER SHIRETOKO

Crude-Oil Tanker
SHINKYOKUTO MARU
SSAP2 Project
(Smart Ship Application Platform 2 Project)

• Participants
  – Members: 38 organizations
  – Observers: 10 organizations

• Schedule
  – Aug. 2015 – Sep. 2017

• Joint Industry Project supported by JSMEA + Class NK

• Action items
  1. Promotion of SSAP2 concept
  2. System design and prototyping of SSAP2
  3. Standardization – ISO DIS19847/DIS19848
  4. Public relation
Organization of SSAP2 Project

SSAP2 all members
Members: 38 organizations
Observers: 10 organizations
Chairman:
  - Dr. Ando (MTI)
Secretary General:
  - Mr. Morono (Terasaki Electric)

Steering Committee
- Chairman
- Secretary General
- All leaders and sub-leaders

ISO Correspondence Team
(Working with JSTRA correspondence group)
Correspondence members:
  - Mr. Morono (Terasaki Electric)
  - Mr. Yamada (Uzushio Electric)
  - Dr. Ando (MTI)

Promotion Team
Leader:
  - Dr. Ando (MTI)
Sub-Leader:
  - Mr. Fujii (Diesel United)
  - Dr. Hiekata (U. of Tokyo)

System Design & Prototyping Team
Leader:
  - Mr. Moritani (ClassNK)
Sub-Leader:
  - Mr. Nakano (JRCS)
  - Mr. Ikeda (ClassNK)

Standardization Team
Leader:
  - Mr. Morono (Terasaki Electric)
Sub-Leader:
  - Mr. Yamada (Uzushio Electric)
  - Mr. Hara (Furuno Electric)

Public Relations Team
Currently PR function is a part of steering committee

Ship Data Center
(ClassNK)
JSMEA
Ship Life Cycle Study Group

Japan Ship Machinery and Equipment Association
New ISO regarding Ship IoT

- **ISO/DIS19847** - Shipboard data servers to share field data on the sea
  - Specifications of ship onboard data server
- **ISO/DIS19848** - Standard data for machinery and equipment part of ship
  - Specifications of dictionary and format
ISO DIS 19847
Shipboard data servers to share field data on the sea

- Requirements for shipboard data servers to collect and share field data

**Shipboard data server**

**Input Data**
- IEC61162-1/2 Sentence data
- ISO/CD 19848 Format data
- File based on ISO/CD 19848

**Input Function**
- Data Streaming
- Data Stored

**Data Streaming**

**Output Function**
- Streaming Transport service
- Request-Response Transport service
- File Transport service

**Output Data**
- IEC61162-450
- ISO/CD 19848 Format data
- File based on ISO/CD 19848
ISO DIS 19848

- **Standardized ID of sensors, common data model & format**

- **ID of sensors**
  - **URL** compliant naming scheme
  - Dictionaries (*informative*)
    - JSMEA
    - DNV-GL

- **Data model**
  - Data channel list (meta data)
  - Time series data (data)

- **Data format**
  - **XML** with schema definition
  - **JSON** (*informative*)
  - **CSV** (*informative*)
Policy of standardization

- Corroborate and harmonize with
  - Existing standards
    - IEC61162-450/460 (Digital Interface – Part 450 Multiple taker and multiple listeners – Ethernet interconnection)
    - ISO16425 (Guidelines for the installation of ship communication networks for shipboard equipment and systems)
  - New proposed standards
    - IHO S-100series
    - IEC BAM (Bridge alert management – Operational and performance requirements, methods of testing and required test results)
  - Associated projects / Organization
    - e-Navigation (IALA)
    - SMART-Navigation (Korea)
    - IEC etc.,
  - Cyber security discussions
Process for ISO (ISO 19847, ISO 19848) *

- ISO PWI 19847/19848 were accepted as NP in Aug. 2015

- 2 CDs were accepted as DIS in Nov. 2016

- 2 DISs will be distributed for comment and voting to the members of ISO/TC8/SC6 in June. 2017

*NP: New work item Proposal, WD: Working Draft
*CD: Committee Draft, DIS: Draft International Standard
Ship Data Center at Shore

**Class NK “Ship Data Center”**
**DNV-GL “Veracity”**
- Ship data center provides a platform to access ship IoT data safely, easily and reasonably. With the platform, utilizations of ship IoT data at shore will become much easier and it will enhance development and operation of ship IoT application services.
Each software or system has its specific data format. SDC convert them to the standardized ISO format.

API with access control provides ship IoT data to application services.
## Roadmap regarding digitalization toward 2020

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<tbody>
<tr>
<td><strong>Application</strong>&lt;br&gt; R&amp;D projects (e.g. i-Shipping in Japan and autonomous ships in Europe)</td>
<td></td>
<td></td>
<td>R&amp;D projects (Navigation, engine, hull, cargo, operation and etc.)</td>
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<tr>
<td>PHM*1 services &amp; products (Machinery &amp; equipment)</td>
<td></td>
<td></td>
<td>Condition monitoring and PHM for main engine, machineries and equipment.</td>
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<tr>
<td>IT and IoT utilization in fleet operation</td>
<td></td>
<td>Integration of ship with shore operation system. Optimization, automation and simulation technologies.</td>
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<tr>
<td><strong>Platform</strong>&lt;br&gt; Ship IoT standardization (ISO CD 19847/19848) and other ISOs</td>
<td>ISO 19847/19848</td>
<td>(FDIS)</td>
<td>Smart Ship related ISOs?</td>
<td></td>
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<tr>
<td>Ship data center</td>
<td></td>
<td></td>
<td></td>
<td>Trials &amp; Operation</td>
<td></td>
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<tr>
<td><strong>Regulatory</strong>&lt;br&gt; Cyber security</td>
<td>BIMCO guideline, IMO MSC guideline, Class guideline ↔ IACS Cyber Security Panel</td>
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<tr>
<td>MRV *2</td>
<td></td>
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<td>IMO MRV</td>
<td>EU MRV</td>
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<tr>
<td>e-Navigation and autonomous ship regulations</td>
<td>Model development</td>
<td>Standardization</td>
<td>Implementation</td>
<td>Operation</td>
<td>Several autonomous ship projects in Norway, Finland and in other nations</td>
</tr>
</tbody>
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*1 PHM: Prognostics and Health Monitoring, *2 MRV: Monitoring Reporting and Verification
Summary

• JSMEA, Class NK, 38 member organizations and 10 observers are working together for SSAP2 (Smart Ship Application Platform 2) Project

• The aim of SSAP2 Project is to design and to implement an open platform for supporting Ship IoT service development and operation

• SSAP2 follows up ISO DIS 19847/ 19848 standardization process

• Ship Data Center is a platform for shore side Ship IoT applications. SSAP2 works closely with Ship Data Center to achieve the open platform concept.
Thank you very much for your attention

For further information, please contact

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JSMEA, Japan Ship Machinery and Equipment Association
http://www.jsmea.or.jp/ssap

Ship Data Center(Class NK)
http://www.shipdatacenter.com