

“the Safer, **the Smarter**”

Digital Innovation on Trust

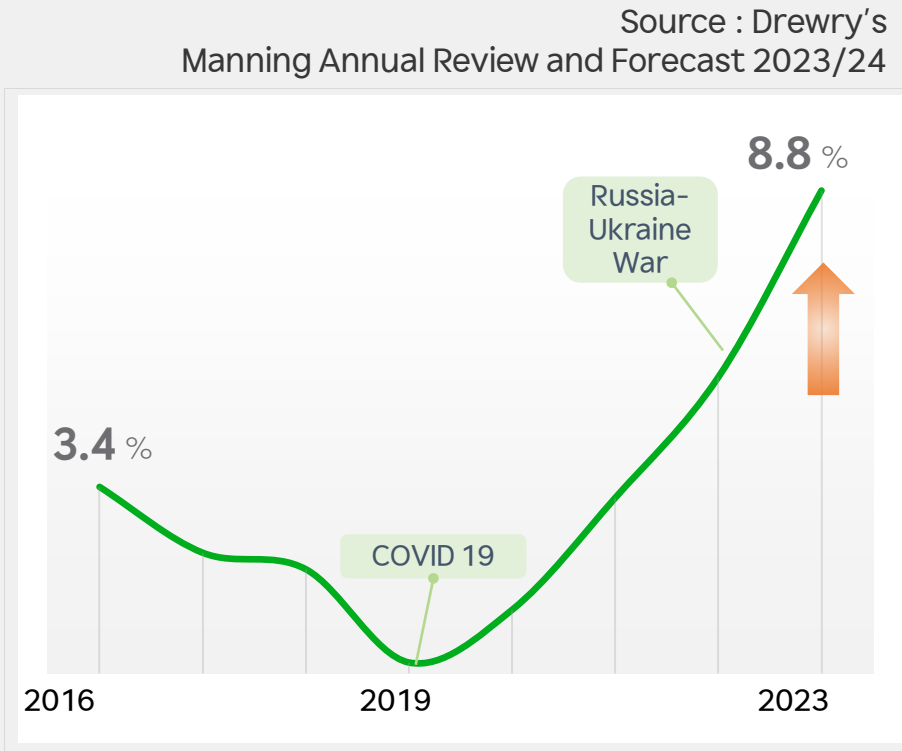
신뢰를 위한 디지털 혁신, 디지털트윈

HyeonSook Yoon

Senior Researcher, Ph.D.

Digital Research Lab / Advanced Research Center
HD Korea Shipbuilding & Offshore Engineering

Ship Officer Shortage, Highest Ever in 17 Years...



Supply shortfall about Double Increase compared to just a year ago

“ The maritime manpower shortage is becoming a worldwide phenomenon.

Additionally, **Alternative fuel & New functionalities** will be introduced continuously to what is **already highly complex systems**.



Can smart systems & AI be the solution?



Are these new technologies reliable?

Era of the Software Defined Mobility



1st Gen. Navigation
Road map + GPS



2nd Gen. Navigation
Centralized information



Next Gen. Cockpit
Safe & Efficient management

Empirical Judgment of Human Resources



Centralized & Automated Operation with AI



Integrated Navigation



Navigation Assistance



Integrated Bridge

IMO's Definition of IBS

- An **integrated bridge system (IBS)** is defined as a combination of systems ... to allow **centralized** access ..., with the aim of increasing **safe** and **efficient** ships management.

'Centralization'

Workstyle reform

'Safety'

Mitigation of Risk

'Efficiency'

Crew Assistant

HD's Progress for Software Defined Vessel



HiNAS CONTROL (Navigation Assistant)



- Autonomous navigation with panoramic AR
- Collision avoidance

HD HYUNDAI ISS (Integrated Smart-ship Solution)



- Voyage monitoring / Route optimization / CII estimation

HiCONiS IAS (Integrated Automation System)



- Integrated automation system of E/R machinery and cargo handling system

HD Hyundai is ready to centralize the control software of gas carriers and gas fueled ships as **total solution provider**

Autonomous Pioneer



World's 1st Transoceanic Voyage with **HiNAS** control

SK Shipping **180K LNGC**
"PRISM COURAGE"



May 1 ~ June 2, 2022

Smart-ship Initiator



Renewed **Cloud-Based** Next-Generation ISS

LNG DF Container
"Hull No.3351"



Sep 7 ~ Sep 11, 2024

Automation Self-Provider



Completed LNG Carrier Gas Trial with **HiCONiS IAS**

CoolCo **174K LNGC**
"Hull No.8196"



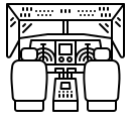
Aug 28 ~ Sep 14, 2024

Toward Centralized Management

Integrated Navigation



Centralized Access of Navigation, Automation & Smart-ship



Short-term: Integrated Navigation System

AI-INS

- Multifunctional display combination for safe & convenient navigation



Centralization (with IAS & ISS)

Mid-term: Centralization of INS, IAS & ISS*

Smart Bridge

* INS: Integrated Navigation System
 IAS: Integrated Automation System
 ISS: Integrated Smart ship Solution

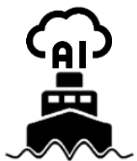
- Portal of on board information including the wheel house, engine & cargo control room, etc.
- Intuitive and easy access to all information on board with advanced visualization technologies.



Beyond "Centralization" to "Autonomy"



Centralized & Automated Operation with AI & Digital Twin



Long-term: Unified Bridge Control with AI

Digital Bridge & ROC (Remote Operation Center)

- Under development -



Yes, Digitalization will improve the work style of seafarers.

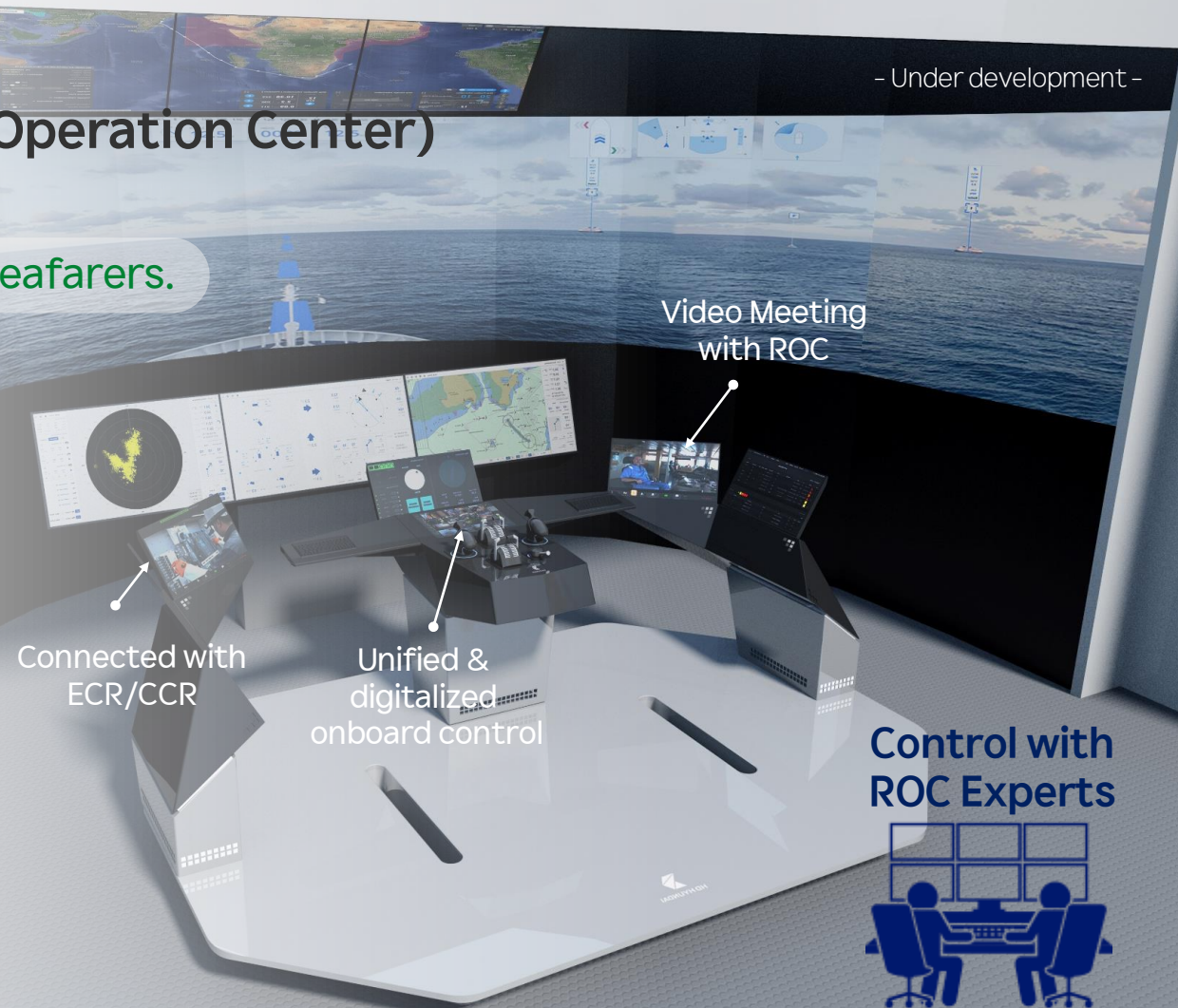
“ I believe moving to a more comprehensive digital paradigm will also help to **address the current dwindling pool** of skilled seafarers.

... , it's about using **digital tools to take up the slack** when there simply aren't enough of them.

Yarden Gross, CEO at Orca AI

Source : SAFETY4SEA (2023.6.25)

'Digitalization of the bridge: A boon or a bane for seafarers?'





“Reliability”



Are these new technologies reliable?

To trust a technology, we need evidence that it works in all kinds of conditions, and that it is safe.

In harsh marine environments, verification tests are **challenging and sometimes impossible**.

How can we safely mitigate the risk of SW errors?

Commissioning at Virtual World

Digital Twin
1010001010
110101

LIMITATION ; Commissioning

Crucial part of the process, but...

- Lately carried out in shipbuilding process
- Up to 70% of **delays related with errors** in control SW (Reinhart and Wunsch, 2007)
- **Unable to test under harsh situations**



ADVANCED TECH. ; HILS*

* Hardware-in-the-Loop Simulation

Hardware

Actual **Digital Systems** installed on ship



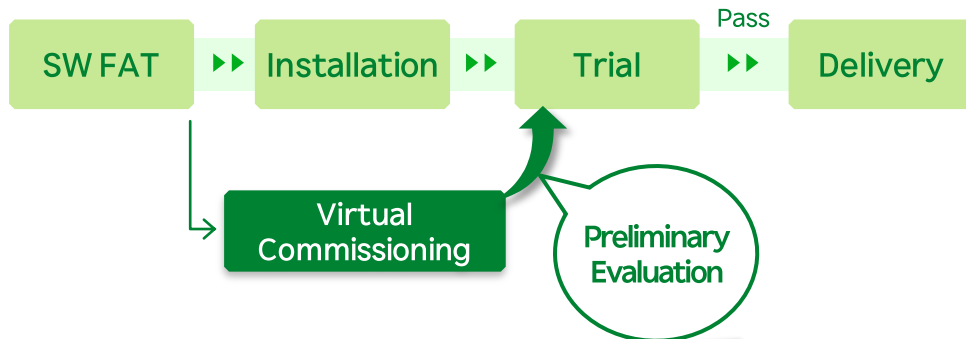
Simulation

Real-time operational **Digital Twin Model**



Pre-validation at Virtual Ship

To Eliminate **SW Risk** & Improve **SW Quality**



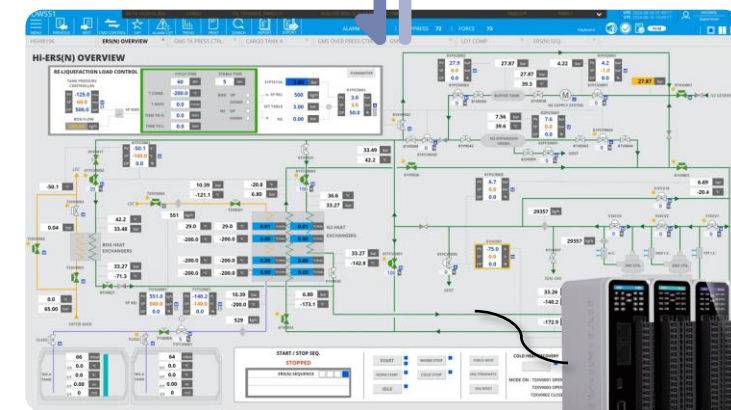
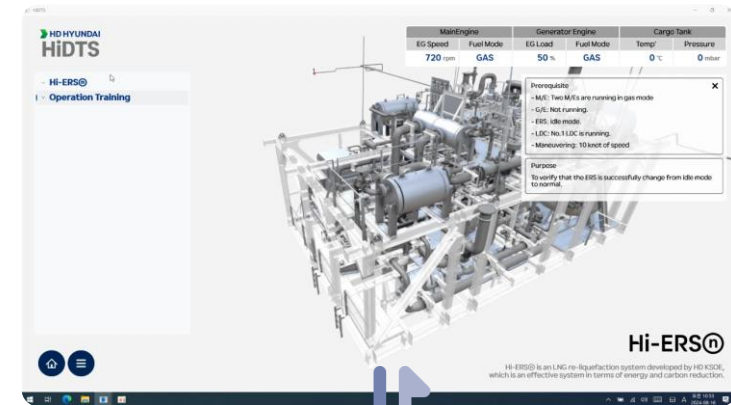
“ **Virtual Commissioning** can give owners some benefits such as **protecting their asset**, **monitoring the progress of test** and **reducing time** to solve and find problems that could happen during the onboard test.

*Dr. Stanley Yoo
Digitalization Specialist, DNV*

- **Resolve root causes** through repeated simulations
- **Protecting the risk** of damaging real assets
- **Save time and cost** for onboard commissioning

Digital Twin Virtual Commissioning

Connected with Real Ship Automation System



HD Digital Convergence Center (DCC)



Virtual Commissioning Center

HD DCC



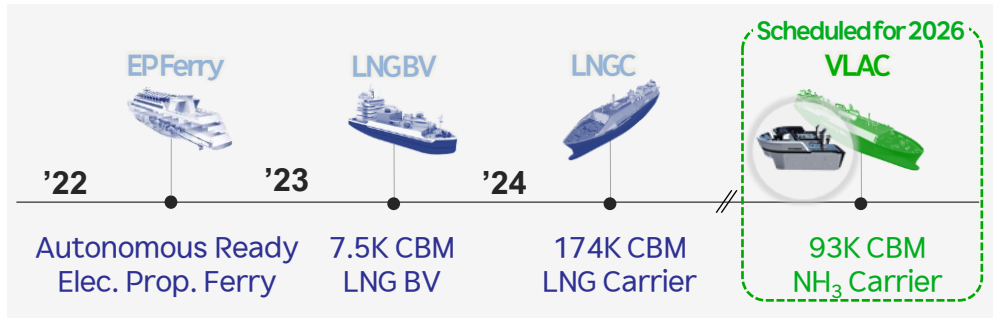
Smart Bridge



Since 2022,

HD DCC, Digital Convergence Center allows vessels to be digitally twinned.

3 virtual vessels are currently in operation.



Validation Ready for Digital Bridge

Our latest digital products – INS(w.HiNAS), IAS & ISS have been successfully validated & centralized to digital bridge on virtual LNG Carrier in DCC.



"Crew Assistance"

Digital Twin

Key technology for digital future.



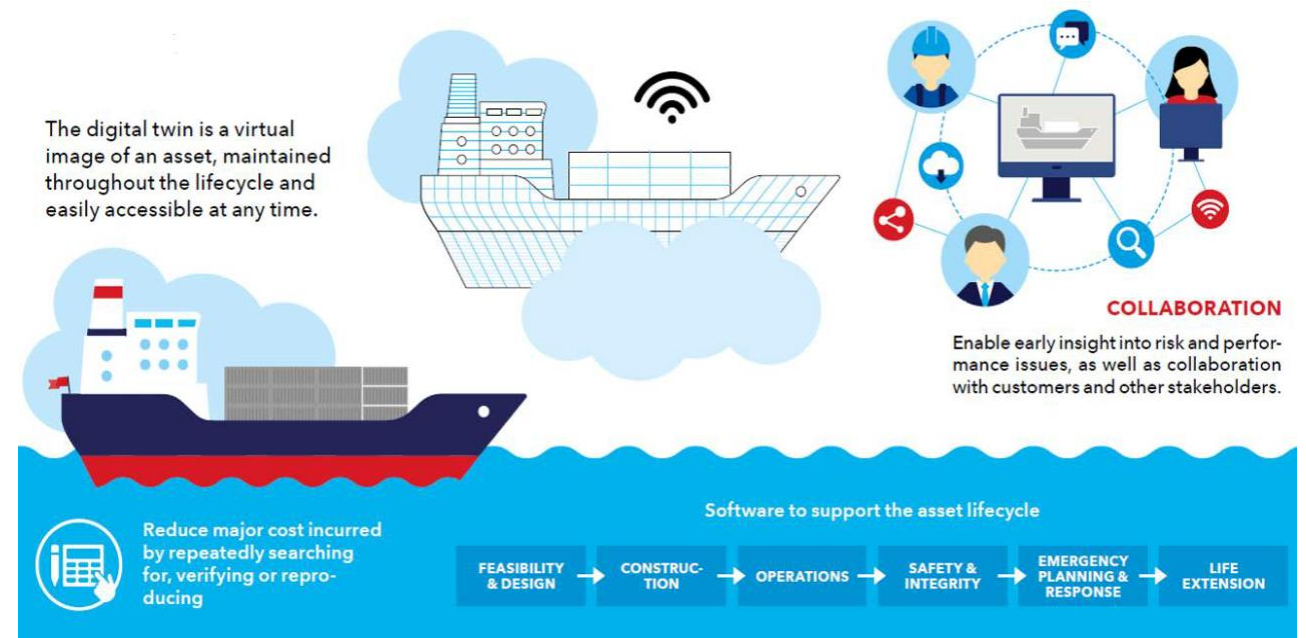
“ Digital twin can be used to **demonstrate, train and verify** the systems. This can give **large savings in operational costs** due to increased crew competence level and reduced manning.

Digital twin can **enhance efficiency** throughout the organization.

Source : Digital Twin Report for DMA (2018)
 'DNV Digital Twins for Blue Denmark'

Digital Twin to Support Vessels

The digital twin will enhance information management and collaboration.



Virtual Vessel to Cloud



World 1st Certified Cloud Digital Twin

HiDTS Cloud



Digital Convergence Center



STC

Simulation Trust Center



Easily Accessible
Cloud Digital Twin
(via DNV Veracity)



World 1st Cloud-based Digital Twin

On-site test for 174K LNGC
Virtual Commissioning(3-7 June 2024)

HiDTS HD Intelligent Digital Twin Ship

Connected Digital Twin

In June 2024, HD Hyundai & DNV performed **Remote Virtual Commissioning** using **HiDTS cloud**.

DNV 1864 SAFEGUARDING LIFE, PROPERTY AND THE ENVIRONMENT

“HiDTS can **reduce time** to solve and find problems that could happen during the onboard test.”

*Seung-hyeon Yoo
Digitalization Specialist, DNV*

* HiDTS: HD intelligent Digital Twin Ship, DDV-DT: Data Driven Verification Digital Twin

Efficiency

Crew assistance



Changing Asset Training



Tailor-made training solution

HiDTS OTS (Operator Training Solution)



World 1st DDV-DT AiP

Cloud Digital Twin for 174K LNG Carrier



World 1st Certified Cloud Digital Twin



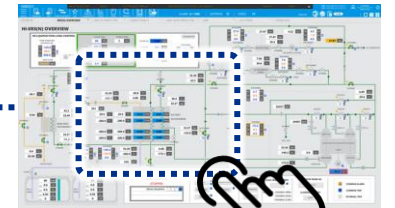
* HiDTS: HD intelligent Digital Twin Ship, DDV-DT: Data Driven Verification Digital Twin

Hands-on Experience in Virtual Environment

at Anytime, at Anywhere, for Various Scenarios



Same control interface as your vessel



Noise & Risk-free
 Virtual environmental training!
 Really helpful to understand the new systems of **My Vessel**

Changing Human-Asset Interactions



Centralized & Automated Operation with AI & Digital Twin - Under development -

“HiDTS Cloud will contribute to the realization of autonomous ship. It is a meaningful step forward for advanced future digital ship which surpass current smart ship.

Source : DNV-HD KSOE
World 1st DDV-DT AiP Ceremony at Gastech 2022



Certified Digital Twin Solution

HiDTS AMS (Asset Management Solution)

HD HYUNDAI MARINE SOLUTIONS

Current voyage information: 21°C, 8.07, LINC HYDROGEN DUAL FUELED CARRIER, 300K VLCC, 9845104 / 03000611

SHIP	PORT NAME	DISTANCE	PERIOD
001	ROTTERDAM PORT	26,107 KM	26.81 DAYS
002	LONG BEACH PORT	9708 KM	12.85 DAYS
003	SINGAPORE PORT	4608 KM	6.13 DAYS
004	HONG KONG PORT	3128 KM	2.81 DAYS
005	SHANGHAI PORT	880 KM	1.16 DAYS
006	INCHEON PORT	300 KM	0.35 DAYS

Expired parts A/S

ENERGY CHARGER: NO.1 / 71W LINC / H. PYEONGTAEK

DEPARTURE: 2024.07.15 | GRADE: A | BUILDER: HDHYUNDAI

- Under development -





Can smart systems & AI be the solution?



Are these new technologies reliable?

Yes, Digital twin is a key for digital future.



Digital Innovation on Trust

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the Smarter”**