Optimizing DP Operations
DP Operator Controlability Enhancement Through Adaptive Maritime Automation

Hans van den Broek
TNO Earth, Life and Social Sciences
OPTIMIZING DP OPERATIONS

DP Operator Controlability Enhancement Through Adaptive Maritime Automation | Hans van den Broek
ABOUT TNO

- Independent R&D Organization
- Founded by Dutch Law in 1932
- 3000 professionals
- Applied Research
  - Technical Sciences
  - Earth, Life and Social Sciences
- Extensive Research facilities
  - Concept Development and Experimentation (CD&E)
TNO DOMAINS

INDUSTRY

HEALTHY LIVING

DEFENCE, SAFETY & SECURITY

URBANISATION

ENERGY

FLEXIBLE & FREE-FORM PRODUCTS
SPACE & SCIENTIFIC INSTRUMENTATION
SUSTAINABLE CHEMICAL INDUSTRY
SEMICONDUCTOR EQUIPMENT
NETWORKED INFORMATION

FOOD & NUTRITION
PREDICTIVE HEALTH TECHNOLOGIES
PREVENTION, WORK & HEALTH

MISSIONS & OPERATIONS
FORCE PROTECTION
INFORMATION SUPERIORITY
HUMAN EFFECTIVENESS
CYBER SECURITY & RESILIENCE
NATIONAL SECURITY & CRISIS MANAGEMENT

MOBILITY & LOGISTICS
ENVIRONMENT & SUSTAINABILITY
BUILDINGS & INFRASTRUCTURES
SMART CITIES

SUSTAINABLE ENERGY
GEO ENERGY
GEOLGICAL SURVEY OF THE NETHERLANDS
MARITIME & OFFSHORE
ENHANCING CONTROLLABILITY
DP OPERATORS EXERCISE
SUPERVISORY CONTROL

IMCA: 30% of out of position incidents are Human Factors related
The Environment

Ship to Control
DP system, DP Operator

Factors
act
situation 2
time

DPS
observe
automatic

DPS
appraise
heuristic
novel

DPS
act

DPO
decide
engagement
cognition

RESOURCES

Sensors
Sight
Smell
Taste
Touch
Hearing
Orientation
Orientation
... augmented

Rules
Coping styles
Culture
Doctrine
Experience
... augmented.

Knowledge
Procedure
Random choice
Consensus
Compromise
Negotiation
Negotiation
... augmented

Actuators
Mobility
Manipulation
Communication
Communication
... augmented

Optimizing DP Operations
THE IRONY OF AUTOMATION

- In highly automated environments, the role of the operator is crucial to solve problems that are out of scope for the system.
- These are cognitive demanding situations and require a high situational awareness.
- Out-of-the-loop performance problem and limited attention span (30 min)
  - Loss of Situational Awareness
  - Cognitive lockup
The Environment

Factors

Model based observability, predictability and directability

Intelligent operator support system

Ship to Control
DP system, DP Operator, IOSS

Factors

DPS

act

observe

appraise

decide

DPS

awareness

heuristic

novel

DPS

engagement

cognition

DPO

IOSS

Optimizing DP Operations

RESOURCES

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Optimizing DP Operations
2015 FPSO USE CASE

Stationary DP
- Operator SA over DP System
- Focus on position keeping
- 24/7 Supervision
- Under work load
- Vigilance problem
- 99% DPS controlled operation
- Very little practice with incidents
SUPPORT CONCEPT

Just in time situational awareness (JITSA)

Roaming operator
ROAMING AND JUST IN TIME SITUATIONAL AWARENESS
IN SUMMARY: IOSS HAS TREE FUNCTIONS

› Ecological interface
  › Presenting information in a intuitive and comprehensive way
  › Just in Time Situational Awareness support

› Advisory system
  › Interact as a team player

› Adaptive Automaton
  › Task allocation scheme
HUMAN FACTORS / ADAPTIVE AUTOMATION ERP

HANS VAN DEN BROEK

I’ll inform, advice and even (re-)act if needed
2016: HUMAN IN THE LOOP TESTING (CD&E)

DP Operator support concepts 2015

› Identify essential operator capabilities (skills, knowledge, competences)
› Relevant human state estimators (Situational Awareness)
› Imtech DP simulator software
› OASYS integrated development environment to build support systems that reason with real time and historical data and events

Human in the loop experimentation 2016

› DP simulation environment in TNO Human Factors Lab, i.e. bridge simulator
TNO EARLY RESEARCH PROGRAM (ERP): ADAPTIVE AUTOMATION

- 2015 - 2018
- 1,25 mEUR per year
- Knowledge innovation and breakthroughs
- Application in Industry

Maritime
- Dynamic Positioning

Automotive
- Truck platooning
- Personalized Adaptive Cruise-control
SA IN VARIOUS DP OPERATIONS

Stationary DP:
- Operator SA over DPS (one-on-one)
- Supervisor, Vigilance problem
- Low workload
- Focus on operator support
- Instant situational awareness
- Condition based monitoring

DP Tracking:
- Operator SA over DPS
- Multi actor involvement and coordination.
- Bridge team
- Focus on team cooperation
- Instant shared SA
- Shared decision making

Multiple DP Vessels:
- Operator SA over DPS
- Bridge team (within ship)
- Between ship coordination
- Focus on alignment of manoeuvring and lift operation
- Multiple systems coordination
JIP DPO-NEXT
PLEASE JOIN OUR PROJECT!

Industrial Stakeholders

- DP Operators
- DP Vessel Owners
- DP system suppliers
- ROV operators

ERP+JIP 7mEUR value
Project costs: EUR 500-1000k
25% subsidy
75% industry funded
Participation fee: 50kEUR

Netherlands Enterprise Agency
THANK YOU FOR YOUR ATTENTION

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