DYNAMIC POSITIONING CONFERENCE
October 13-14, 2015

TRAINING AND COMPETENCY

Optimizing DP Operations
DP Operator Controlability Enhancement Through Adaptive Maritime Automation

Hans van den Broek
TNO Earth, Life and Social Sciences

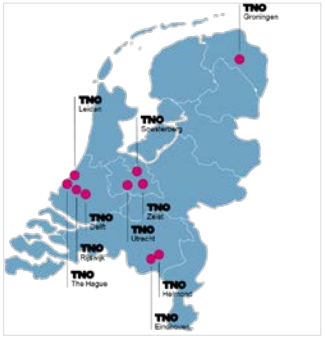
OPTIMIZING DP OPERATIONS

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

TNO innovation for life

TNO

ABOUT TNO

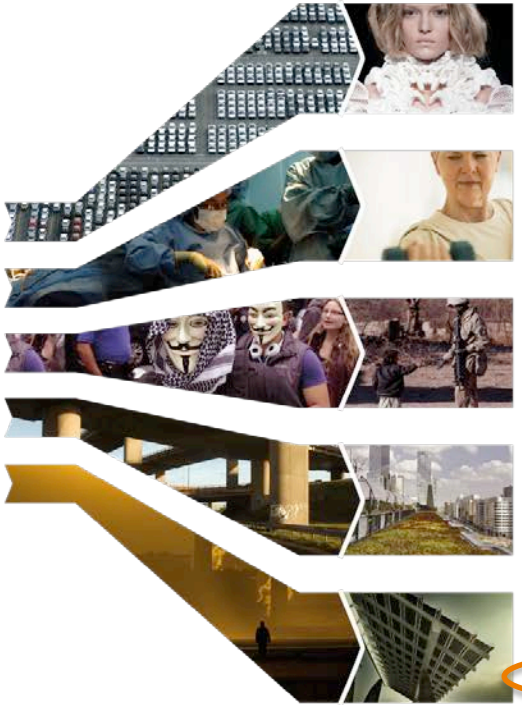


- Independent R&D Organization
- Founded by Dutch Law in 1932
- 3000 professionals
- Applied Research
  - Technical Sciences
  - Earth, Life and Social Sciences

Human Factors
Human Centred Design

- Extensive Research facilities
  - Concept Development and Experimentation (CD&E)

TNO DOMAINS



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

HEALTHY LIVING
- FOOD & NUTRITION
- PREDICTIVE HEALTH TECHNOLOGIES
- PREVENTION, WORK & HEALTH

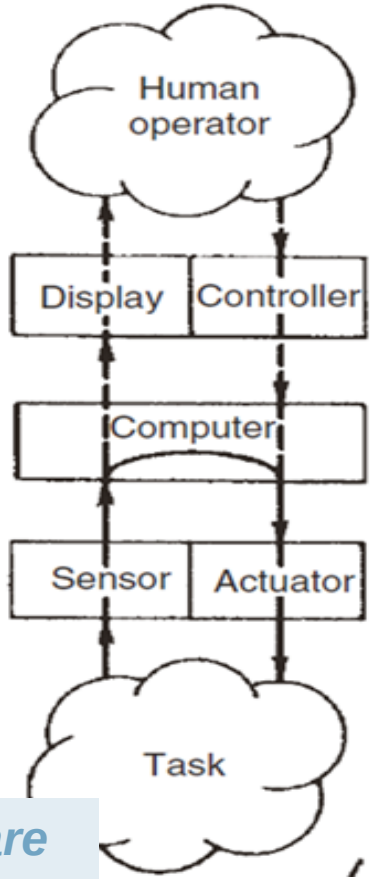
DEFENCE, SAFETY & SECURITY
- MISSIONS & OPERATIONS
- FORCE PROTECTION
- INFORMATION SUPERIORITY
- HUMAN EFFECTIVENESS
- CYBER SECURITY & RESILIENCE
- NATIONAL SECURITY & CRISIS MANAGEMENT

URBANISATION
- MOBILITY & LOGISTICS
- ENVIRONMENT & SUSTAINABILITY
- BUILDINGS & INFRASTRUCTURES
- SMART CITIES

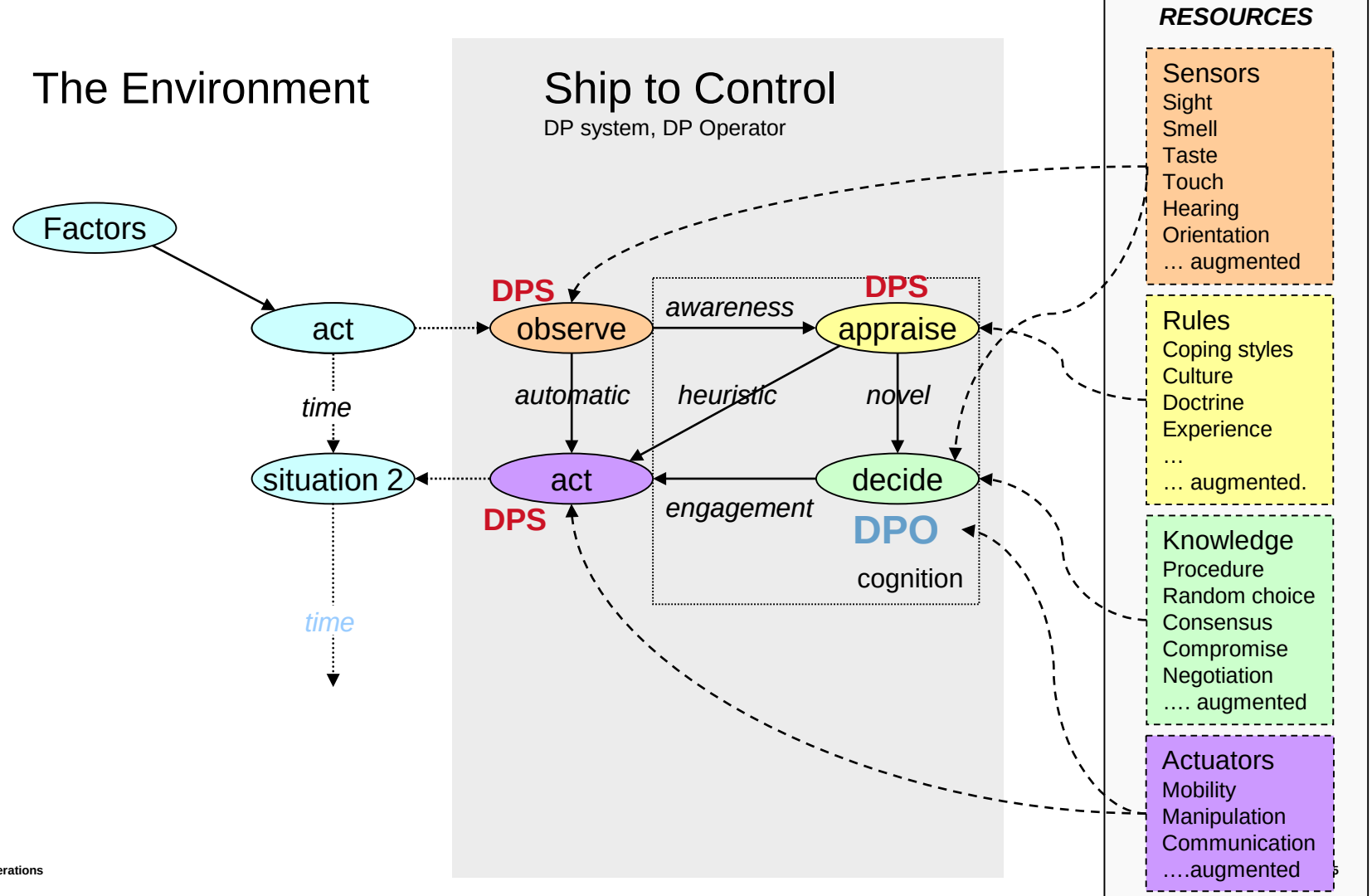
ENERGY
- SUSTAINABLE ENERGY
- GEO ENERGY
- GEOLOGICAL SURVEY OF THE NETHERLANDS
- MARITIME & OFFSHORE

ENHANCING CONTROLLABILITY

DP OPERATORS EXERCISE SUPERVISORY CONTROL

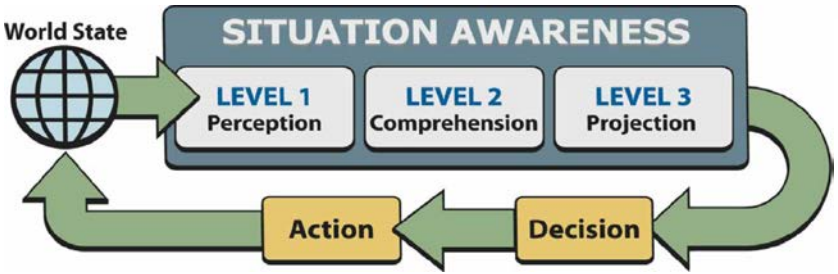


IMCA: 30% of out of position incidents *are* Human Factors related


The Environment
Ship to Control
DP system, DP Operator
RESOURCES
Factors
act
time
situation 2
time
DPS
observe
awareness
DPS
appraise
automatic
heuristic
novel
act
DPS
engagement
decide
DPO
cognition
Sensors
Sight
Smell
Taste
Touch
Hearing
Orientation
… augmented
Rules
Coping styles
Culture
Doctrine
Experience
…
… augmented.
Knowledge
Procedure
Random choice
Consensus
Compromise
Negotiation
…. augmented
Actuators
Mobility
Manipulation
Communication
….augmented

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

Ship to Control

DP system, DP Operator, IOSS

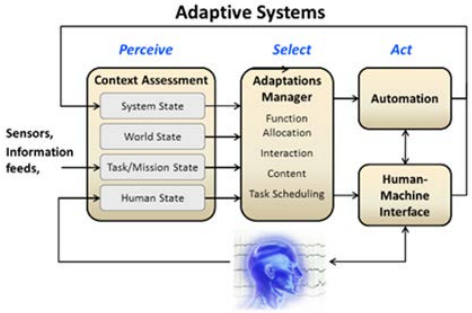
Factors

act

time

situation 2

Model based observability, predictability and directability



DPS

observe

awareness

DPS

appraise

automatic

heuristic

novel

act

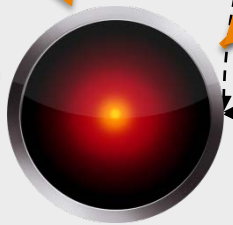
decide

DPS

engagement

DPO

cognition



IOSS

Intelligent operator support system

RESOURCES

Sensors
Sight
Smell
Taste
Touch
Hearing
Orientation
… augmented

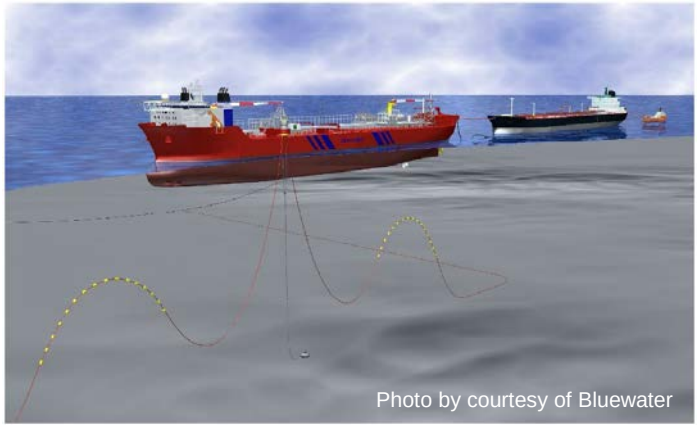
Rules
Coping styles
Culture
Doctrine
Experience
…
… augmented.

Knowledge
Procedure
Random choice
Consensus
Compromise
Negotiation
…. augmented

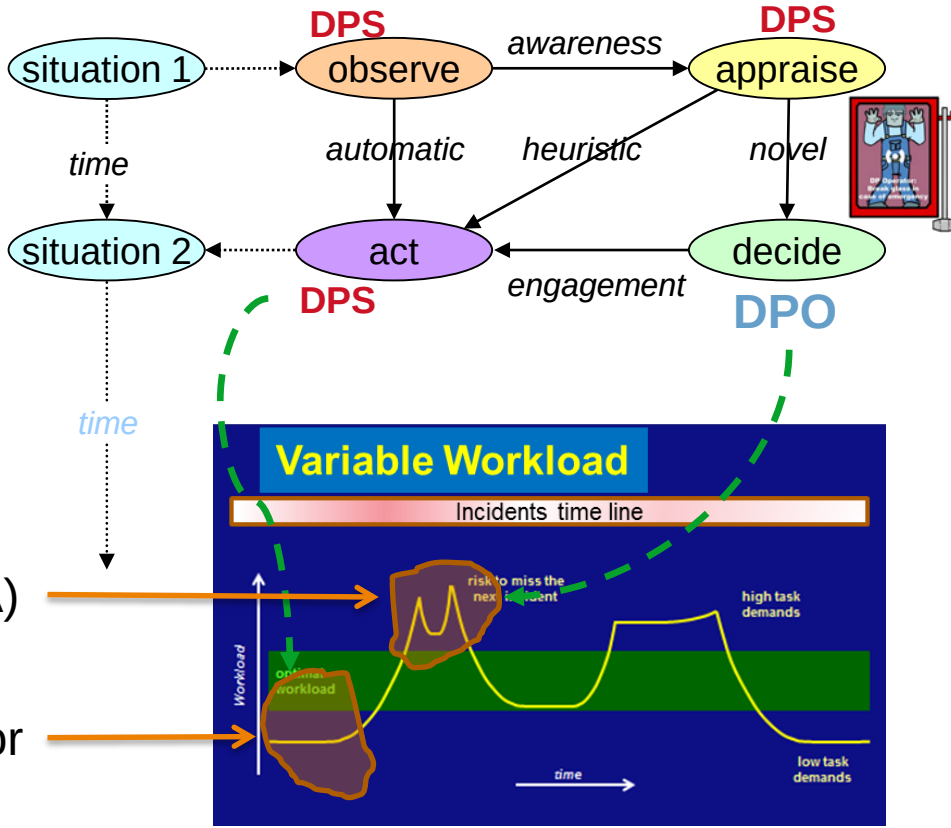
Actuators
Mobility
Manipulation
Communication
….augmented

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



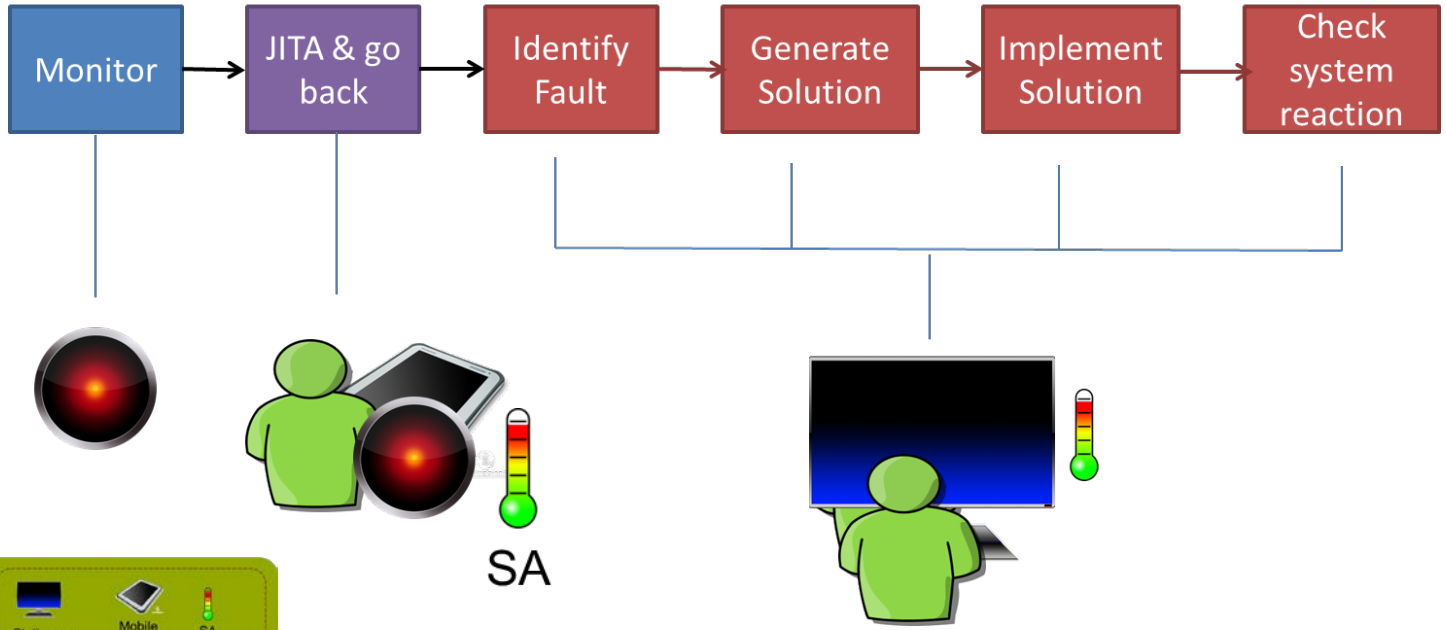
SUPPORT CONCEPT



Just in time situational awareness (JITSA)

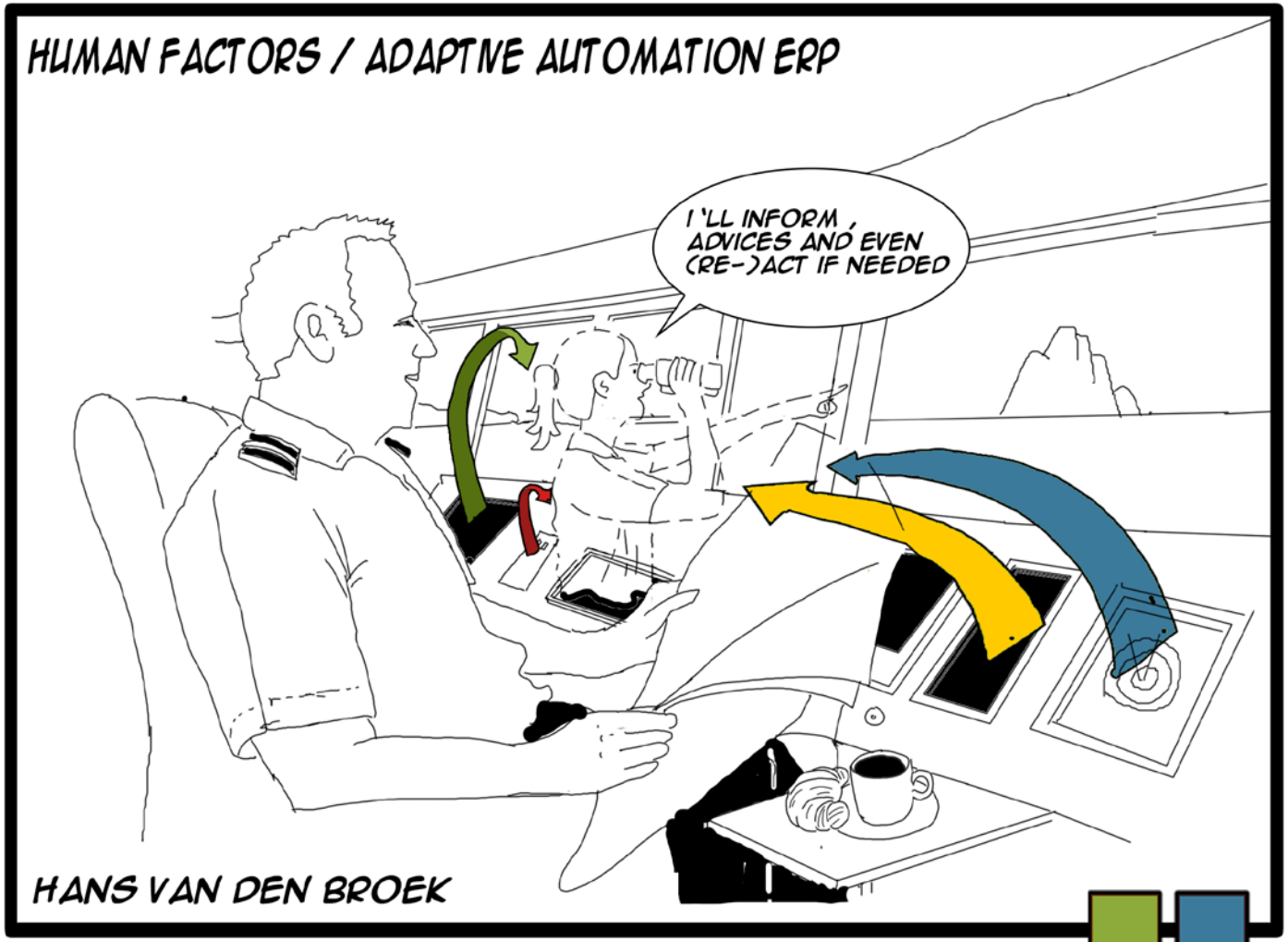
Roaming operator

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
I 'LL INFORM ,
ADVICES AND EVEN
(RE-)ACT IF NEEDED
HANS VAN DEN BROEK

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

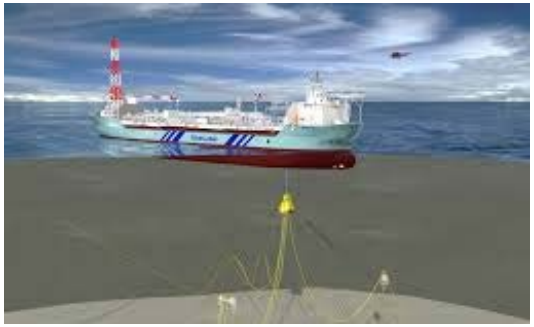
- DP simulation environment in TNO Human Factors Lab, i.e. bridge simulator

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

TOPSECTOR WATER

Netherlands Enterprise Agency

THANK YOU FOR YOUR ATTENTION

Contact information

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Photo’s by courtesy of DEME Group