

The background image shows an offshore construction site. On the left, there is a prominent yellow metal structure, likely part of a crane or hoist system, with a red safety device attached. To the right, a tall, slender silver pole supports a navigation light. The scene is set against a clear blue sky and a vast blue sea. In the distance, a low-lying landmass is visible on the horizon, and a few small boats can be seen on the water.

Part A: OptiColor Project
Part B: Introduction to Offshore Construction

Achilleas Mina, S-Innovations Ltd
Dr. Harris Partaourides, RISE

About S-Innovations Ltd

- Established in 2016
- Development of innovative products
- Office & Prototyping Workshop at Paphos

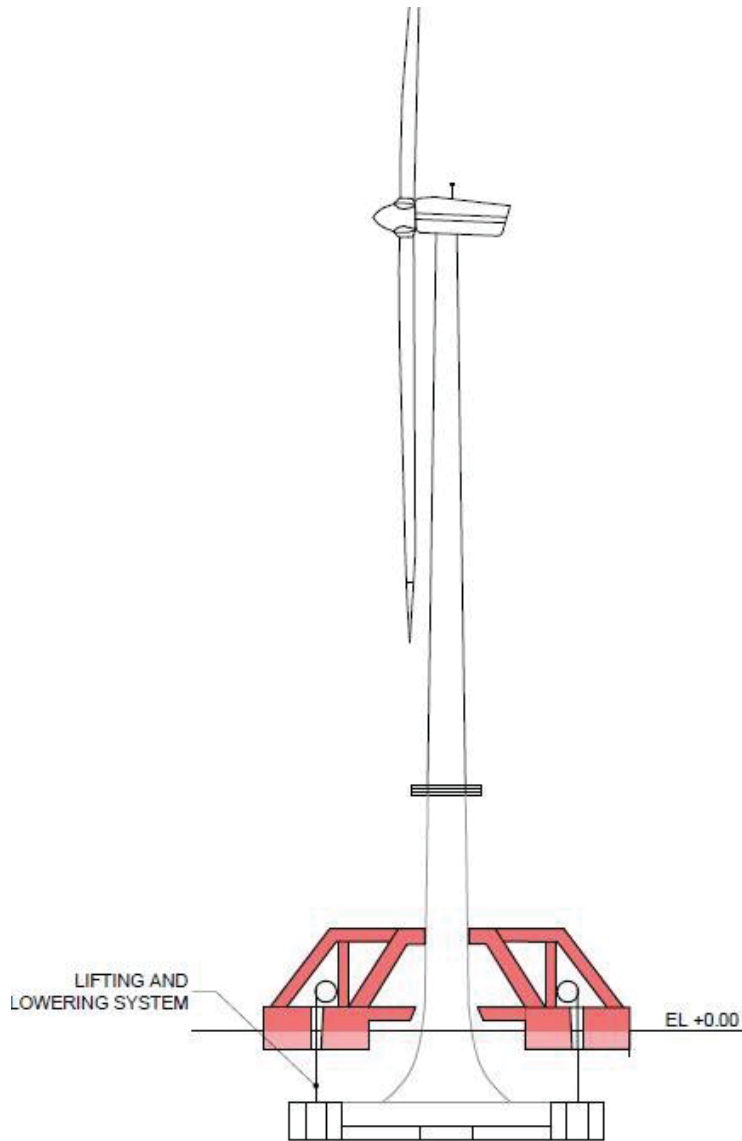
Technical Advisor Services

R&D activities are financed we have occasionally offered advisory services. Project planning and coordination, quality control services for offshore construction projects. (Huisman, Dolwin 3, Aberdeen Offshore Wind Farm).

Innovation Projects

2016, 2017, 2018: <https://innovationcyprus.com/innovation-ideas/>

2019: **OptiColor Project**, Our first project to be funded by the EU and the Republic of Cyprus.



1. **Accidents at Work**
2. OptiColor Project
3. Offshore Construction
4. Computer Vision

About this Presentation

1. Accidents at Work (2 min)
2. OptiColor project (12 min)
3. Introduction to Offshore Construction (15 min)

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1. Accidents at Work
2. **OptiColor Project**
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Διαρθρωτικά Ταμεία
της Ευρωπαϊκής Ένωσης στην Κύπρο

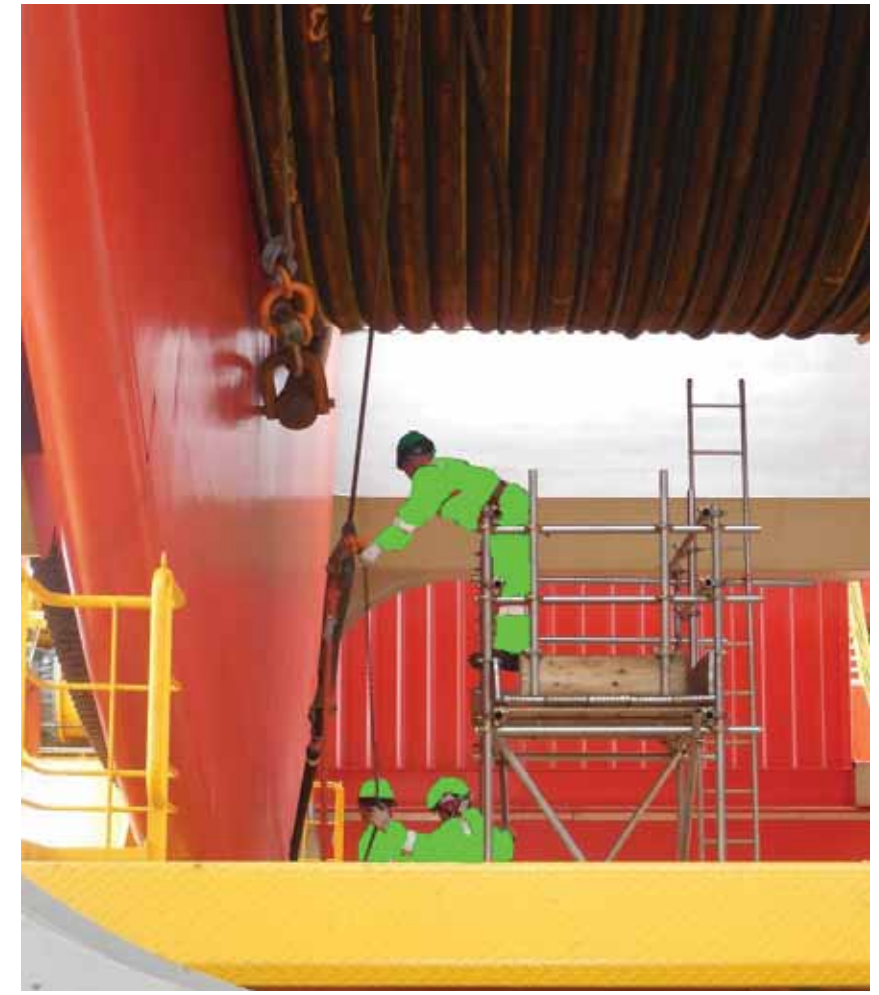


Ευρωπαϊκή Ένωση
Ευρωπαϊκό Ταμείο
Περιφερειακής Ανάπτυξης

OptiColor Project - Problem to solve

Safety color is not always the optimal. In some cases the result is the opposite.
Camouflage.

A method for determining which high-visibility color makes workers more conspicuous.



1. Accidents at Work
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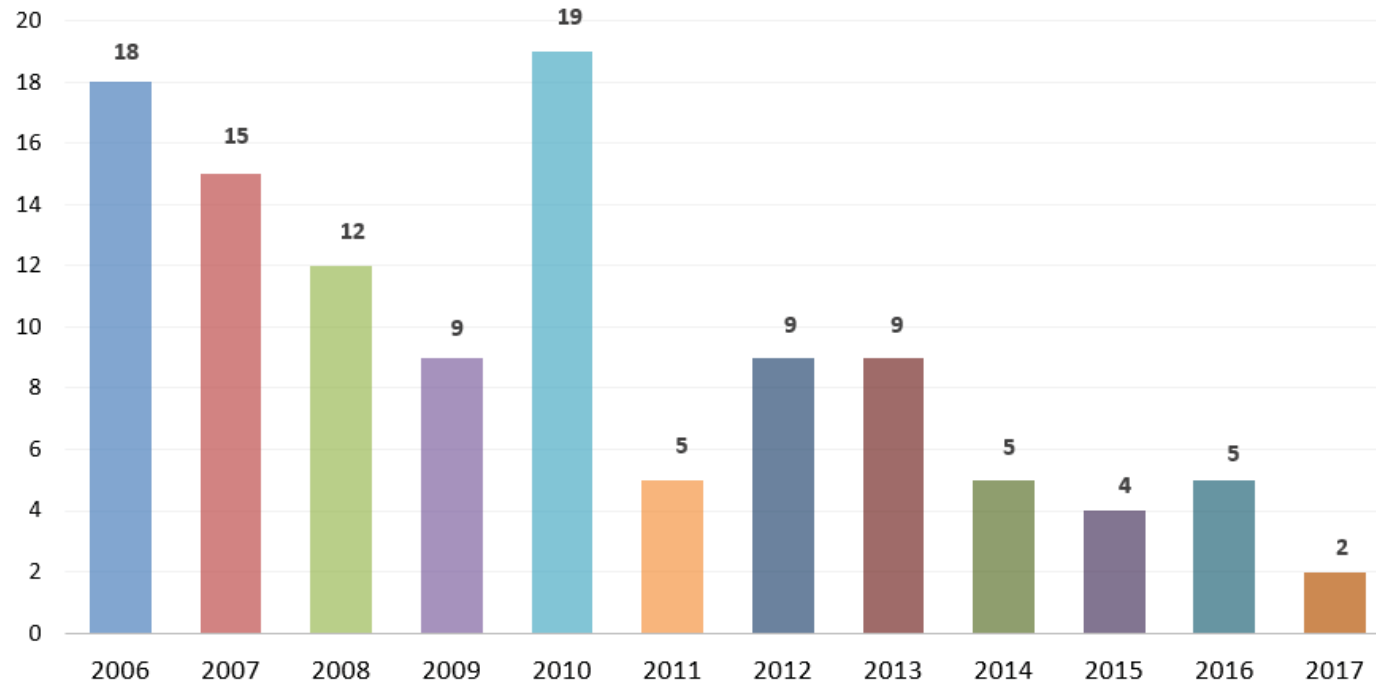
Why conspicuity is important?

Cyprus 10-year average:

≈ 2000 accidents at work /year
 ≈ 9.5 fatal accidents/year

Europe EU28, year 2015

≈ 3,212,000 accidents
 ≈ 3880 fatal accidents at work



Accident definition: Results to at least 4 days of absence

Global Cost (ILO), Work related accidents and illnesses, 4 % GDP, \$1.25 trillion

EU-OSHA(1:6) (Accidents : Illness), Accidents => 0.6 % ΑΕΠ

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Personal Protective Equipment (PPE)



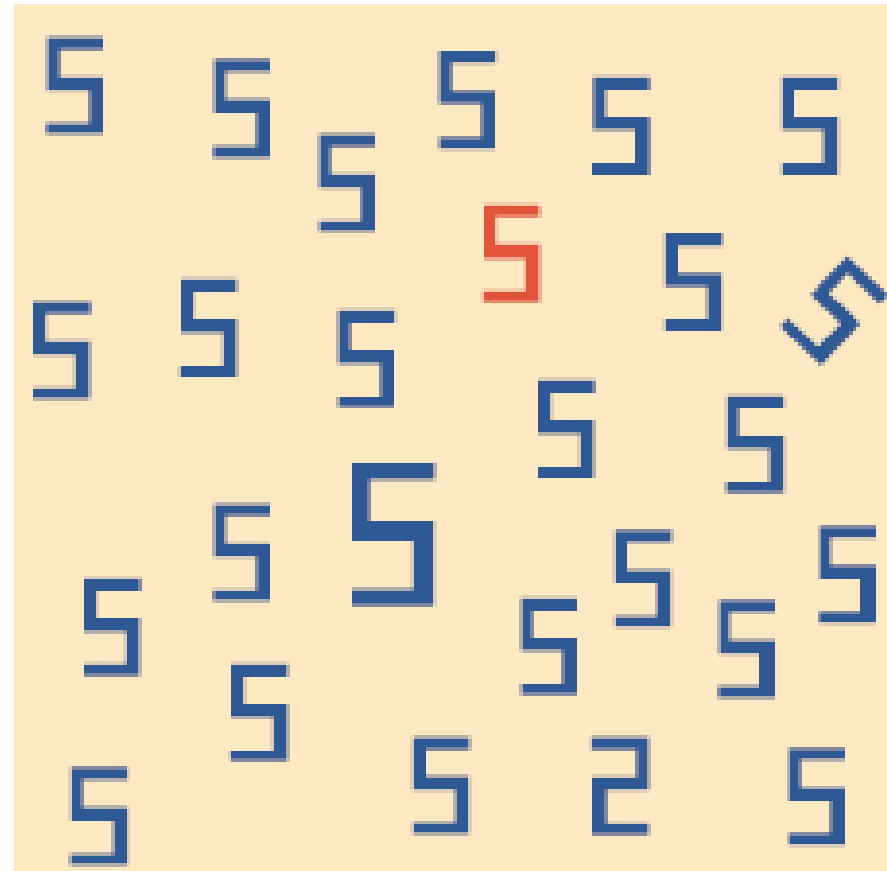
Minimum PPE for a construction site

High-Visibility Clothing

We use high-visibility clothing to be easily noticeable (**conspicuous**) to other workers or adjacent traffic. **Being conspicuous, reduces the number of situations where people are not seen and accidents happen.**

1. Accidents at Work
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Fundamental knowledge: Visual Search and Attention



The four main attributes affecting visual search and attention.

1. Colour
2. Motion
3. Orientation
4. Size

To make a worker more conspicuous we can only change the color

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Fundamental knowledge

Lahrmann et al (2018) performed a year-long randomized controlled trial to investigate the effect of yellow jackets on cyclist accidents. The investigation involved:

- 3400 volunteer cyclists wearing yellow jackets
- 3400 without yellow jackets.

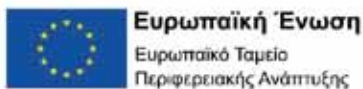
The research showed a **55% lower accident** rate between cyclists and motor vehicles for the group wearing the yellow HSVA.



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Arbitrary Choice of Color



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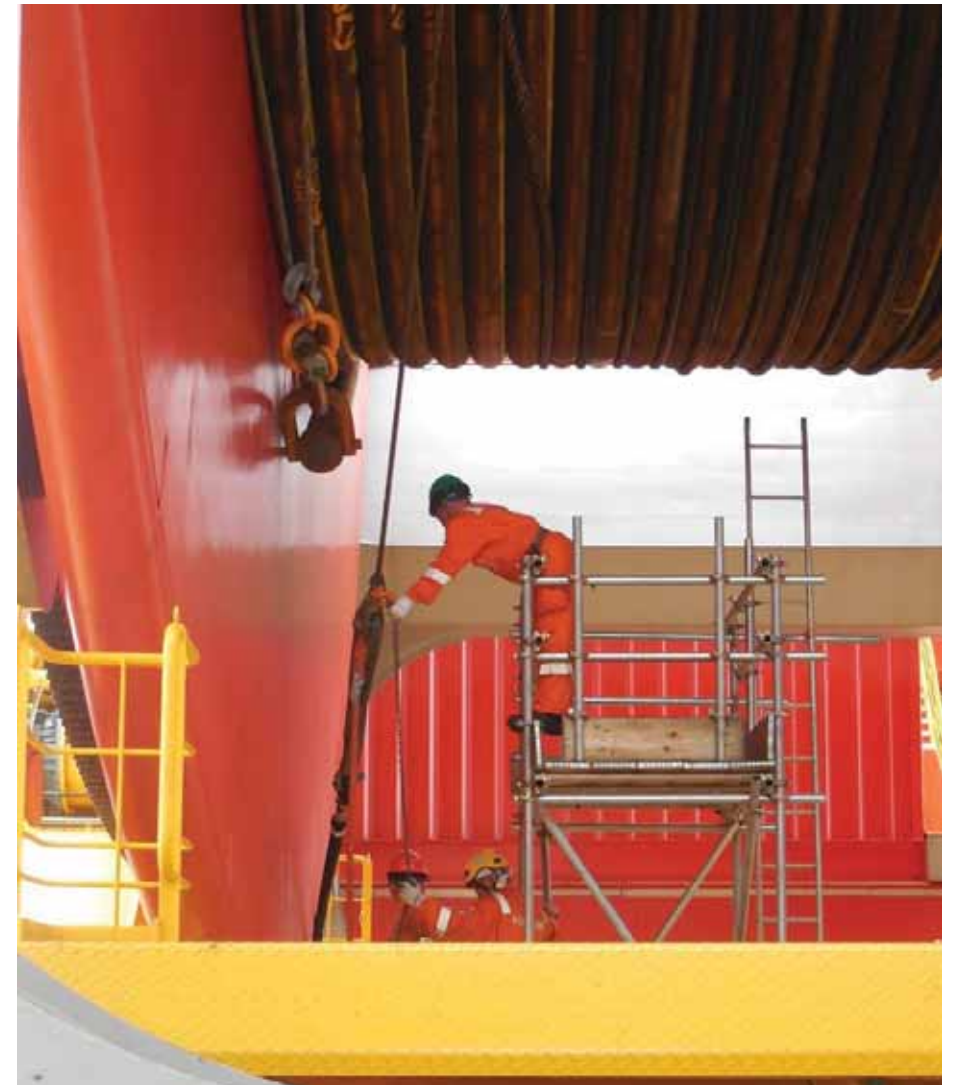
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16 12:

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OptiColor Project



- 6-month project.
- Co-funded by S-Innovations Ltd (40%) and Cyprus Research Promotion Foundation (60%). Program Call: Proof of Concept.

Project Objective

Formulate a generally applicable methodology for determining the optimal safety color for a particular worksite i.e. determine the color that contrast the most to the work environment → Personnel becomes more conspicuous.

Image Analysis

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High Visibility Colors – Color Contrast

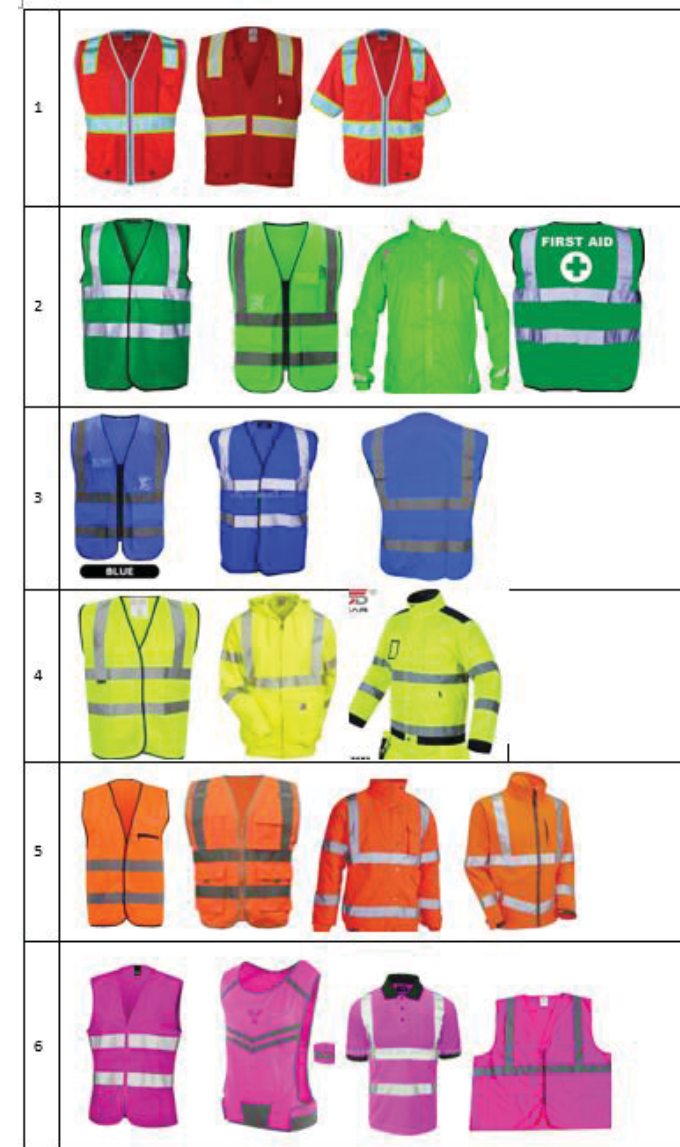
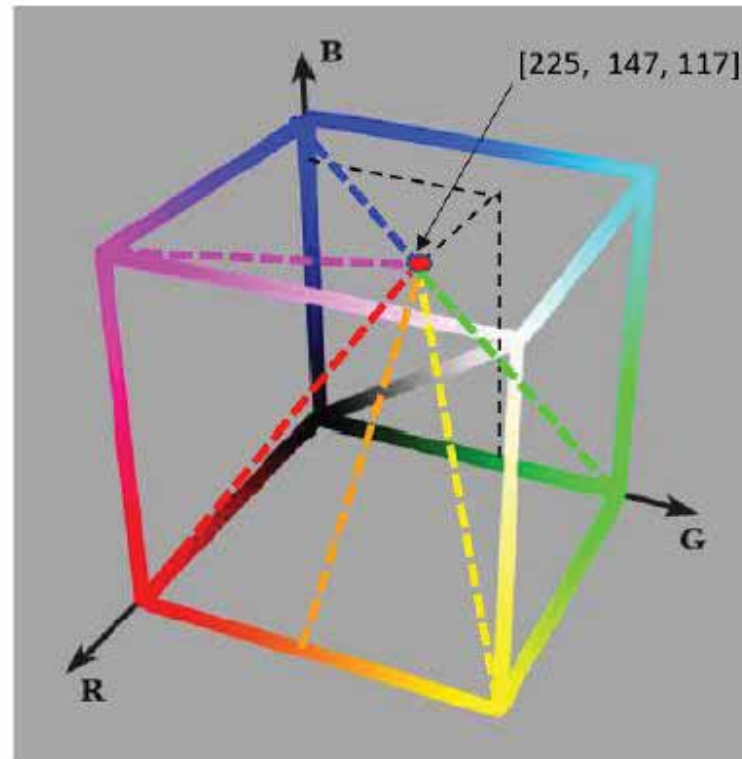
ISO EN 20471:2013 - High visibility clothing

Standards for Safety Apparel specify only three colors:

- Fluorescent yellow
- Fluorescent orange
- Fluorescent red

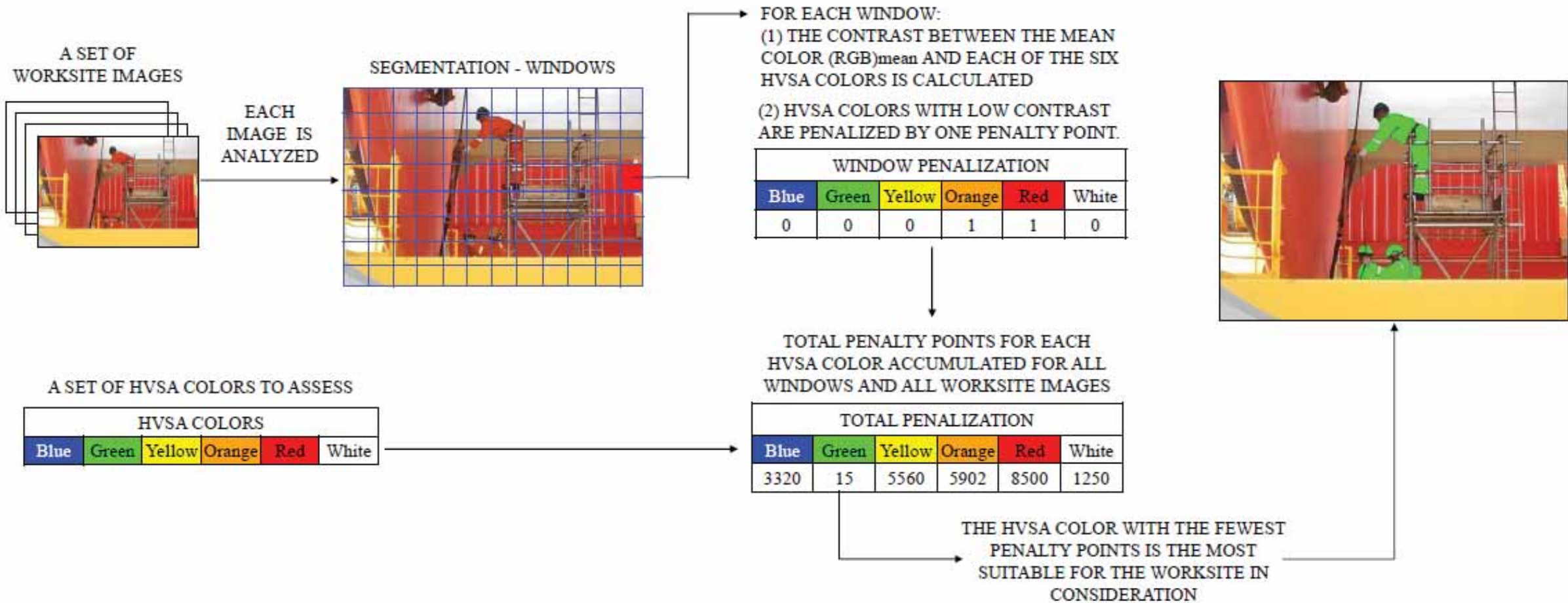


Restricts optimization



Our methodology for determining the optimal safety Color

GRAPHICAL ABSTRACT: Method for selecting optimal colors for high-visibility safety apparel (HVSA)



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Concept Validation

- 40 sets of test images.
- Each set having the original image and an edited version of the same image.



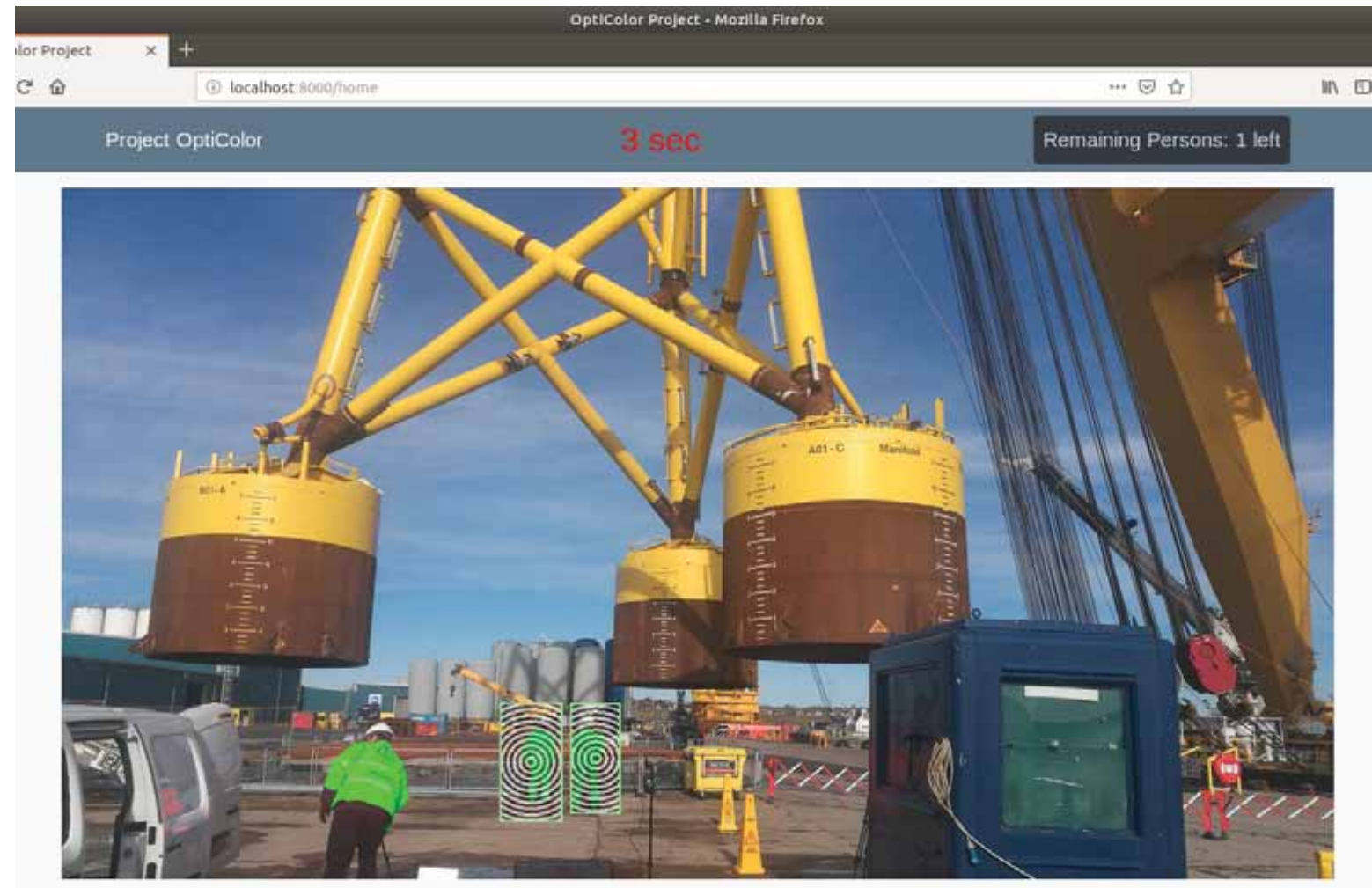
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Concept Validation

- Volunteers were presented with either the original or the edited version and asked to spot (click) personnel on worksite pictures.
- Measure the search time, i.e. the time needed to spot the people on the picture.



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Validation showed a 35% reduction in the visual search time

	Average Search Time	Accuracy	Precision	Recall	F1 score
Original	7.65 s	0.920	0.934	0.981	0.956
Edited	5.01 s	0.969	0.971	0.998	0.984
Improvement	+ 34.57 %	+ 5.31 %	+ 3.93 %	+ 1.69 %	+ 2.90 %
p-value (<0.05)		0.0018	0.0054	0.0034	0.0021

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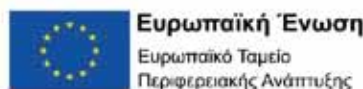
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Project achievements

1. Method developed. Implemented as Python/OpenCV algorithm that analyzes pictures from the work environment and determines the **optimal safety colour**.
2. The effectiveness of the developed methodology was experimentally validated (lab experiment with 50 volunteers)
3. Development of a simplified method. Color combination matrix to assist Safety Officers and other practitioners in selecting the optimal safety color.
4. Highlighted the need for updating the relevant standards EN ISO 20471:2013 or ANSI/ISEA 107-2015

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Find out more

Website: www.optimalsafetycolor.com

tycolor.com/work-package-1-project-management/

Optimal Safety Color

Home

WP1

WP2

WP3

WP4

WP5

Work Package 1: Project Management

Status: Ongoing

The objectives of WP1 are:

1. Keep the project on track with regards to scope, schedule and cost.
2. Handling communication with Research Promotion Foundation (RPF) and taking all necessary actions to comply with the obligations arising from the co-funding agreement.
3. Handling communication with RISE to coordinate the scope subcontracted to RISE as per the cooperation agreement.

Relevant Documents

1. Project Schedule (Gantt Chart)

2019-04-02: Opticolor Project Planning

2019-06-03: Opticolor Project Planning (revised)

2. Monthly Meetings – Agenda and MoM

April-Monthly-Meeting-MoM-2019-04-23 [Download](#)

May-Monthly-Meeting-MoM-2019-05-28 [Download](#)

3. Issues Log

Issues Log

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Ideal Long-term Outcome (Commercial)

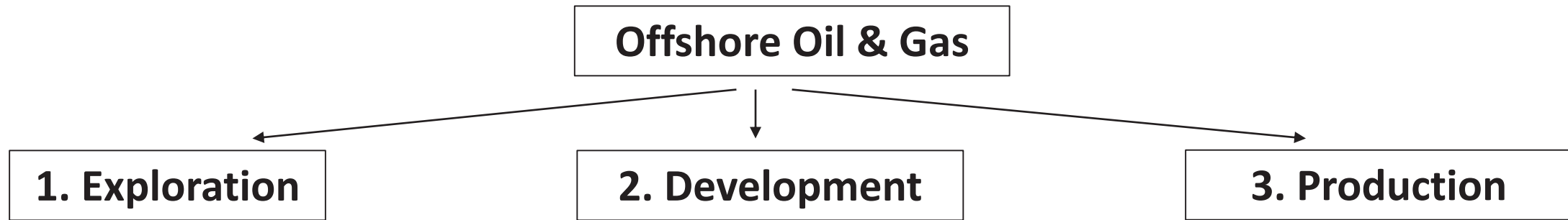
- 1) Having the knowhow and a proved concept we can proceed with the development of commercial SaaS application. The system will allow the user to upload the pictures from a specific work environment. A report will be produced suggesting the optimal color for consciousness.
- 2) Specialized Consulting Services. Specialized consulting services for determining optimal color schemes to enhance safety. Clients can be large construction companies, factories, shipyards, airport, ports, oil companies, shipping companies etc.

Part B

Offshore Construction



Offshore Construction in relation to Offshore Oil & Gas Sector



- Seismic Surveys
- Exploration Drilling (exploration wells)



- Development Drilling
- **Offshore Construction**



- Operation
- Maintenance

What is Offshore Construction?

The fabrication, transportation and installation of Offshore Structures
There are three stages: **(1) Fabrication** **(2) Transport** **(3) Installation**

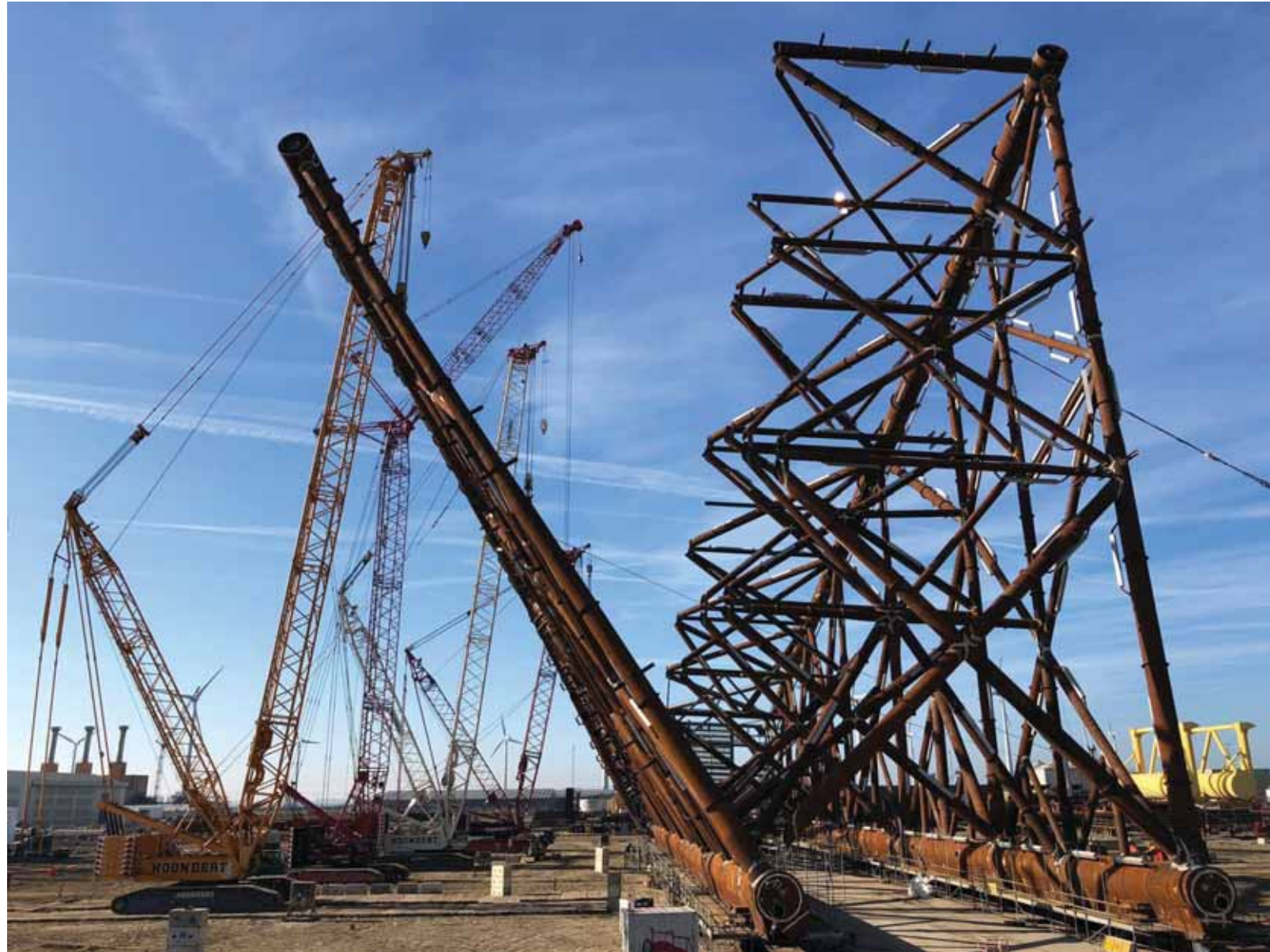


Example 1: Jacket/Tower

1. Fabrication

2. Transport

3. Installation



Example 1: Jacket/Tower

1. Fabrication

2. Transport

3. Installation



Example 1: Jacket/Tower

1. Fabrication

2. Transport

3. Installation



Example 2: Topside facilities

1. Fabrication

2. Transport

3. Installation



Example 2: Topside facilities

1. Fabrication

2. Transport

3. Installation



Example 2: Topside facilities

1. Fabrication
2. Transport
- 3. Installation**



Example 3: Pipeline

1. Fabrication

2. Transport

3. Installation



Example 3: Pipeline

1. Fabrication

2. Transport

3. Installation



Example 3: Pipeline

1. Fabrication

2. Transport

3. Installation



Offshore Contractors

Hired by Oil and Gas companies (Shell, BP, Exxon Mobil, Chevron, Total, etc.) to execute a project

EPCI = Engineering, Procurement, Construction and Installation

Operator will only do the FEED

Major Offshore Contractors

T&I – Heavy Lift

- Heerema
- SEIPEM
- Allseas
- Boskalis

Pipelaying & Subsea

- Technip
- SEIPEM
- Subsea7
- Allseas
- McDermott

Offshore Wind

- DEME
- Van Oord
- Boskalis
- Jan De Nul

HEEREMA - SLEIPNIR – Leviathan Topsides



Lifting Capacity
20'000 tons
Boeing 737 loaded = 80 tons
 $20000/80=250$

Allseas - PIONEERING SPIRIT – Brent Delta Topsides Decommissioning



Length: 382m
Breadth: 124m
Lifting Capacity: 48,000 t
Displacement: 1,000,000 t

Displacement (660,000 t)



Boskalis - Vanguard

Semi-submersible heavy transport vessel (SSHTVs)



Boskalis - Vanguard – Aasta Hansteen Float off



SUBSEA7 - SCANDI AFRICA – Subsea Construction Vessel - Reel Lay

Skandi Africa

A state-of-the-art deepwater construction support vessel

- ▶ Length: 160.9 m
- ▶ Speed: 12 - 16 knots
- ▶ Accommodation: 140 people
- ▶ DP3 and ICE-1B class notation for harsh environments
- ▶ 900 Te AHC main crane, 150 Te AHC knuckle-boom crane
- ▶ Large 2,700m² main deck and 3,500 Te under deck carousel
- ▶ 2 XLX ROV systems capable of operating to 4,000 m
- ▶ 650 Te Tilttable Lay System Tower (TLS) for flexible lay operations – product diameter from 50 to 630 mm

900 Te

Main Crane
Capacity

650 Te

Tilttable Lay System
onboard vessel



Swire - PACIFIC ORCA – Jack-up – Wind turbine Installation





Working in Offshore Construction

- **Office Based:** Project Engineers, Installation Engineers, Marine Engineers
- **Offshore Based:** Field Engineer, Construction Superintendent, QA/QC Personnel

How a Student can enter into Offshore Construction?

1. Internship Programs – Graduation Project (Thesis) ([example1](#))
2. Start at a Steel Fabricator or Shipyard (Huisman, Smulders, IHC)
3. Start at a onshore T&I Contractor ([Mammoet](#), [ALE](#), [Sarens](#))
4. Start as Welding or Coating inspector ([CWI](#), [CSWIP](#), [NACE](#) etc.)
5. Innovative Thesis Project related to Offshore Construction.

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Innovation Ideas (Offshore Construction and Computer Vision)

- Computer vision has not entered Oil & Gas yet – Great potential
- Computer Vision APIs – Google (GCP), Microsoft (Azure), Amazon (AWS), waiting for developers to develop.
- Offshore: Limited Internet Bandwidth
- Offshore Industry:
High R&D Expenditure



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1. POB Monitoring

POB (Persons on Board) Solutions

Weekly Mustering Drill

- Muster List
- Magnetic Cards
- Bracelets

Waiting for everybody....

Computer Vision Solution

CCTV, Constant monitoring of crew location.



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2. Suspended Load Alarm



Camera: Boom Tip, Hook
Computer Vision Solution
Set safety circle - Sound Alarm



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3. Winch Winding Alarm



Winch camera

On a crane, serious damage can be caused by incorrect winding of a rope. The MDC3 can provide an optimum view of the winch in real time. Through monitoring of the winch, costly damage to the rope can be avoided and downtimes reduced.

Computer Vision Approach
CCTV, Constant monitoring of
winch winding
(5 or more winches per crane)



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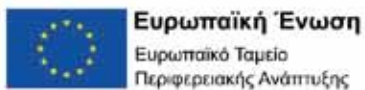
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4. Automatic Welding and welding inspection

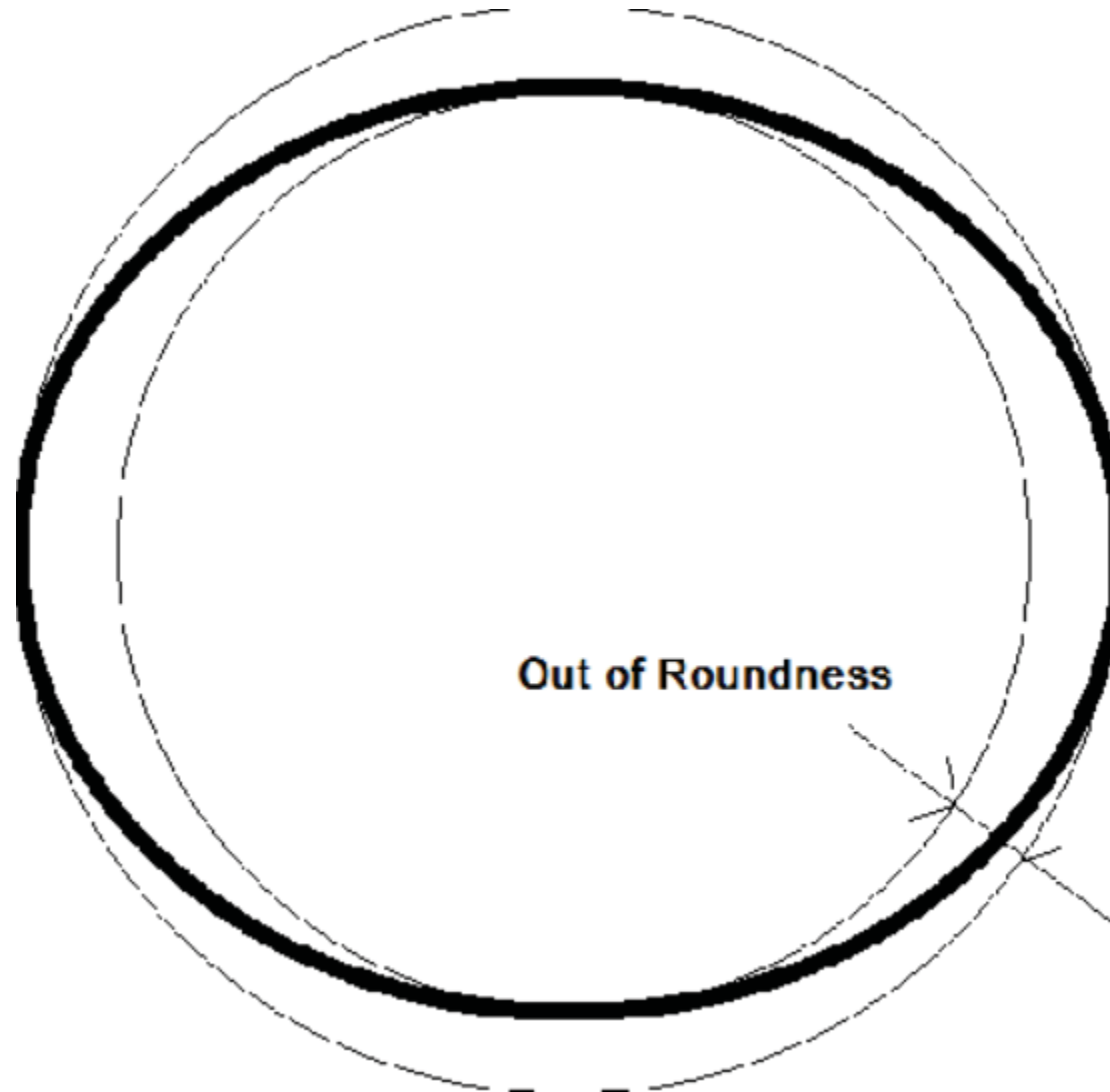


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5. Ovality Checks



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6. Subsea Work - ROV

<https://www.youtube.com/watch?v=b7lpXxkhse8>

The image shows a YouTube video player interface. The video content is a night-time scene of an offshore oil or gas platform under construction. A yellow ROV (Remotely Operated Vehicle) is visible in the upper right, with the name 'ROVCO' on its side. The ROV is positioned near a large, complex steel structure. The video player shows the channel name 'Rovco Subsea' with 19 subscribers. Below the channel name are navigation tabs for 'HOME', 'VIDEOS', 'PLAYLISTS', and 'CHANNELS'. The 'Uploads' section is active, showing a 'PLAY ALL' button. Three video thumbnails are visible: 'Rovco Company Overview' (1:31, 290 views), 'Rovco SubSLAM X1 Jacket Reconstruction' (2:12, 171 views), and 'Rovco T...' (165 views). A large, detailed inset image on the right side of the player shows a close-up of the ROV's mechanical arm and gripper, illuminated by a bright yellow light, working on a component of the steel structure.

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7. PPE Monitoring (Safety Officer)

<https://www.youtube.com/watch?v=pL-c00M2CnI>



Recognize hard hats, safety goggles, high visibility vests, protective boots and other required safety equipment. Recognize if workers are wearing protective harnesses when working height. PPE violation, it can notify site safety officer in real time. **(Agmis, Lithuania)**



Thank you!

Email
am@innovationcyprus.com