

**University of Plymouth  
School of Engineering**



# **Civil Engineering / Diving and Underwater Technology**

**Tony Tapp**

*atapp@plymouth.ac.uk*

# Framework for Diver Training

## Faculty of Technology:

- *Three Schools in the Faculty: Engineering; Mathematics and Statistics; Computing, Communications and Electronics.*

## School of Engineering (SoE) – made up of three study areas:

- *Civil, Structural and Coastal Engineering.*
- *Mechanical, Marine and Materials Engineering.*
- *Environmental Building and Sustainable Construction.*

## Each study area in SoE offers a range of courses:

- *Post Graduate – MEng (Hons) or MSc.*
- *Undergraduate – BEng (Hons), BSc (Hons) or HND.*

## **SoE Academic Courses which offer “Diving”:**

- *MEng (Hons) Civil Engineering.*
- *MEng (Hons) Civil and Coastal Engineering.*
- *BEng (Hons) Civil Engineering.*
- *BEng (Hons) Civil and Coastal Engineering.*
- *BSc (Hons) Civil Engineering.*
- *BSc (Hons) Civil and Coastal Engineering.*
- *BSc (Hons) Civil Engineering and Computer Aided Design.*
- *HND Civil Engineering.*
- *BEng (Hons) Marine Technology.*
- *BSc (Hons) Marine and Composites Technology.*
- *BSc (Hons) Marine Sports Technology.*

**Each Academic Course is made up of a combination of a number of “Subject Modules”.**

**Each Subject Module carries a value of 10, 20 or 30 credits.**

**Each study year on an Academic Course contains Subject Modules worth a combined total of 120 credits.**

- *MEng (Hons) courses = 4 years = 480 credits.*
- *BEng/BSc (Hons) courses = 3 years = 360 credits.*
- *HND courses = 2 years = 240 credits.*

**The Subject Module offered in “Diving and Underwater Technology” is a 20 credit module, studied in Year 2.**

**“Diving and Underwater Technology” is an optional module.**

## **Question:** Why teach “Diving and Underwater Technology” to Civil Engineering students?

- *Lots of Civil Engineering jobs involve works around water (docks, harbours, jetties, sea defences, bridges, rivers, canals, water supply).*
- *Some jobs underwater require specialist Civil Engineering knowledge (survey, setting-out, construction, inspection).*
- *Why employ two people (a Diver underwater; a Civil Engineer topside) when a single person with the right skills combination could do both jobs? – hence avoiding communication and interpretation mistakes.*

**Diving is a high risk activity, so there are regulations from the Health and Safety Executive (HSE) to control the risks.**

**Diving at Work Regulations 1997 - these regulations apply to everyone involved in a working dive.**

# **“Diving and Underwater Technology”**

## **Module Aims:**

- *To gain theoretical and practical knowledge and skills necessary to carry out underwater inspections in a competent and safe manner.*

## **Learning objectives:**

- *To be able to carry out underwater structural inspections, and to have a knowledge of construction methods, defects and defect detection for steel, concrete and timber structures.*
- *To be able to plan underwater inspections so that they can be carried out in a safe and competent manner and in compliance with HSE regulations.*
- *To be able to produce a competent engineering report for a client.*

## **Class size:**

- *Maximum of 16 students per group; 2 groups each year.*

**All diving operations are undertaken by students who are “under training”, using SCUBA equipment.**

**Indicative syllabus:**

- *Dimensional surveys - methods and accuracy; survey control; recording and reporting techniques.*
- *Structural forms – wharves; quays; sheet pile walls; locks and lock gates; caissons; sluices; temporary works.*
- *Concrete – mixes and materials; defect inspection and reporting; deterioration mechanisms; NDT; repair methods.*
- *Steel – terminology; identification of structural sections, piles and pipes; defects; corrosion; ALWC; NDT; welds and weld inspection.*
- *Timber – inspection and reporting.*
- *Fasteners – nuts and bolts; identification and reporting.*
- *Photography and CCTV methods.*
- *Instrumentation – ADCP/AWAC.*

## **We don't do:**

- *Surface Supplied diving.*
- *Nitrox / Mixed Gas / Saturation diving.*
- *Welding.*
- *Cutting.*
- *Explosives and demolition.*
- *“Advanced” NDT – eg crack detection.*
- *ROV pilot.*

## **We are limited by:**

- *What the Health and Safety Executive (HSE) will allow us to do with students who are “under training”.*
- *The high cost of specialist equipment.*
- *The need to maintain an appropriate balance within an Academic Course – we offer courses in Civil Engineering or Marine Technology which include an element of Diving – **NOT the other way around.***

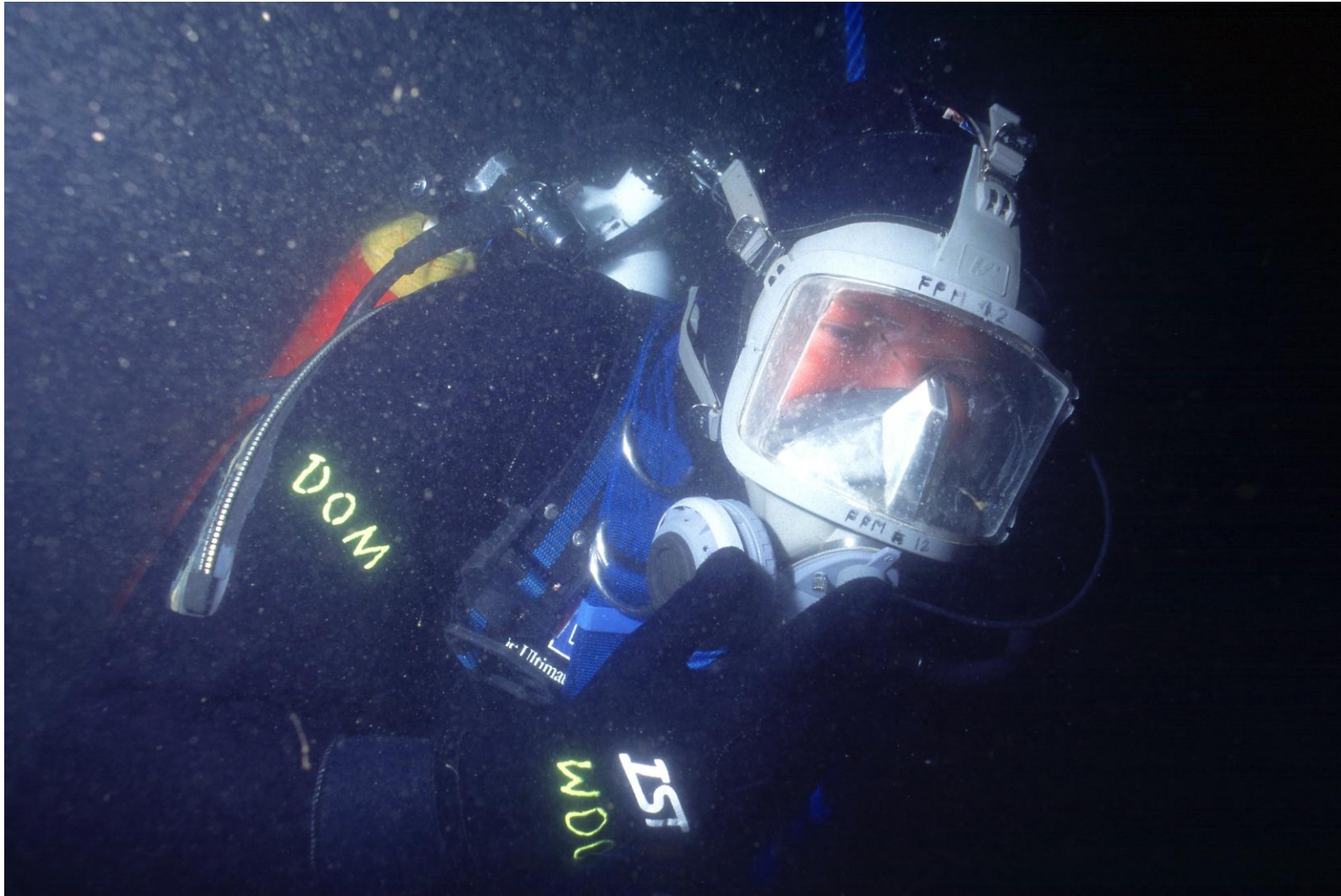




Typical diving operation,  
with supervisor (staff),  
tenders and divers  
(students) and standby  
diver (staff).

Task: survey of a  
marina wave screen –  
timber, steel and in-situ  
concrete.

A diver wearing an AGA Positive Pressure full face mask.







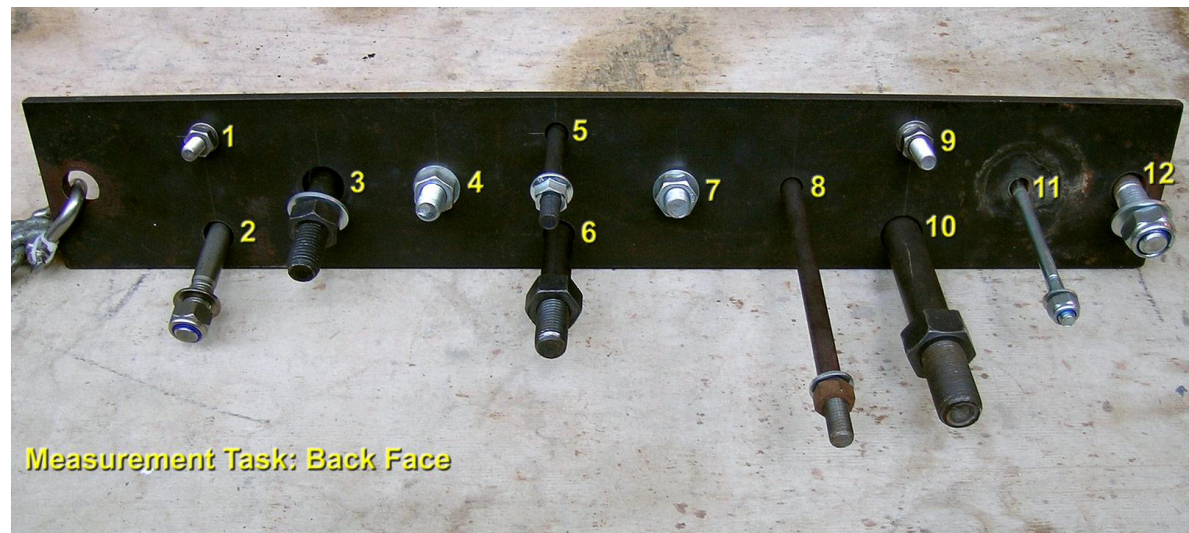
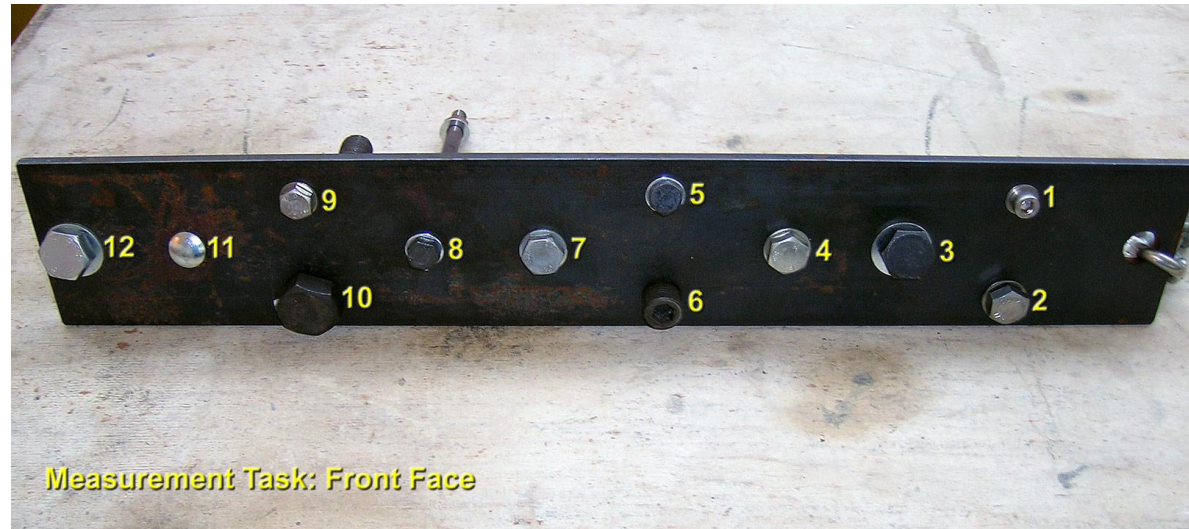
A diver wearing an AGA Neutral Pressure Full Face Mask, fitted with a through-water voice communications system; the comms system allows an in-water instructor to give guidance to the student on the correct operation of the video camera equipment.



Measurement task on a fabricated steel plate sample; survey to be carried out using a Cygnus Ultrasonic Thickness Gauge, and a vernier.



# Fine Detail Measurement Task: Identifying fastening types and sizes.



Task: assembly of a pipe network using simple hand tools.

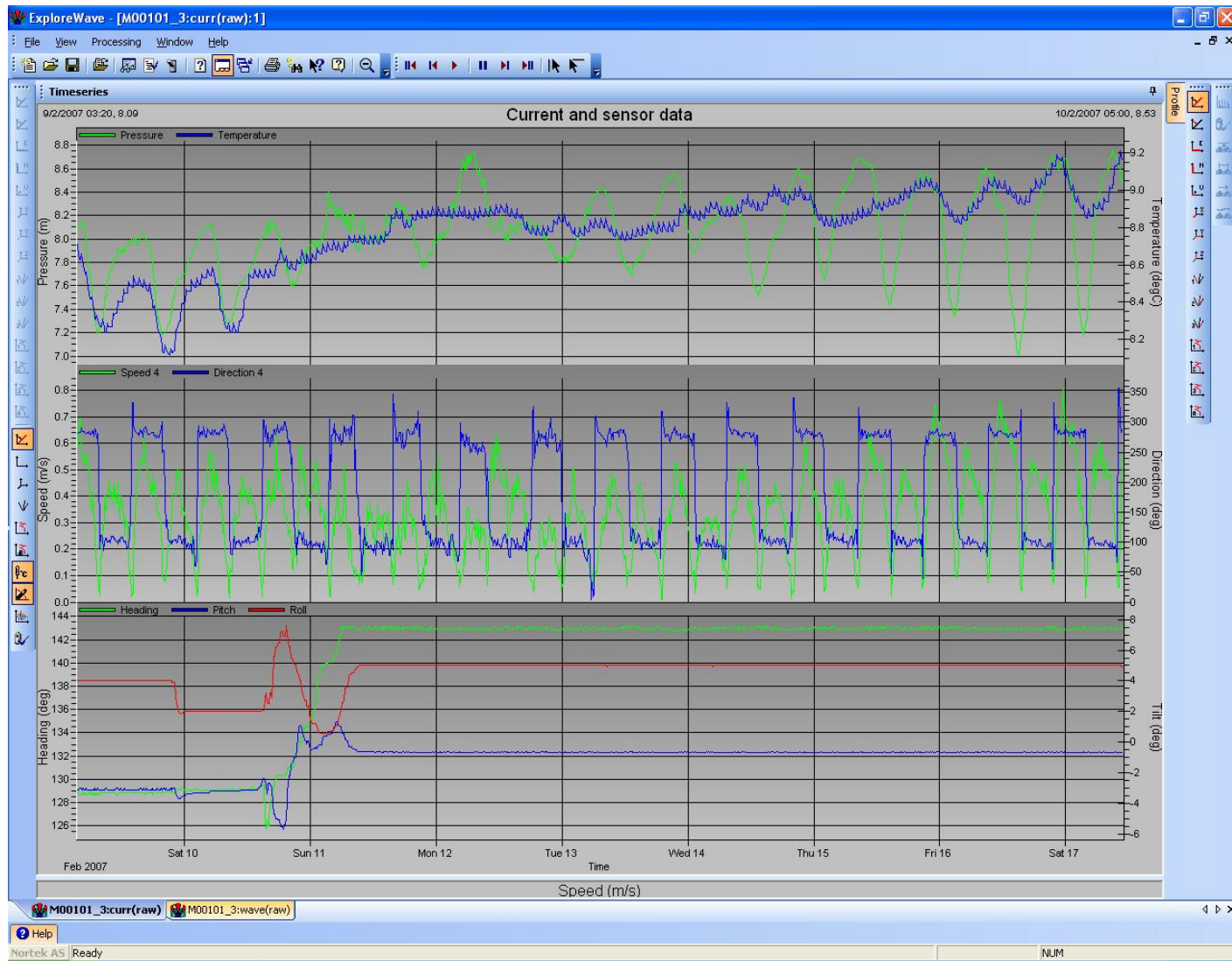




Configuration and deployment of coastal monitoring instrumentation – Nortek surface wave and current profiling system (AWAC).



# Sample output from AWAC – 10/02/07 to 17/02/07





Diving to support SoE Research:  
Collecting wave data at Alderney Breakwater.





Wave recorder on the seabed (with steel subframe buried in the sand), connected to an array of six pressure transducers. The system was used to measure incident and reflected waves.



After University: one of our Graduate Engineers at work in Canada.

