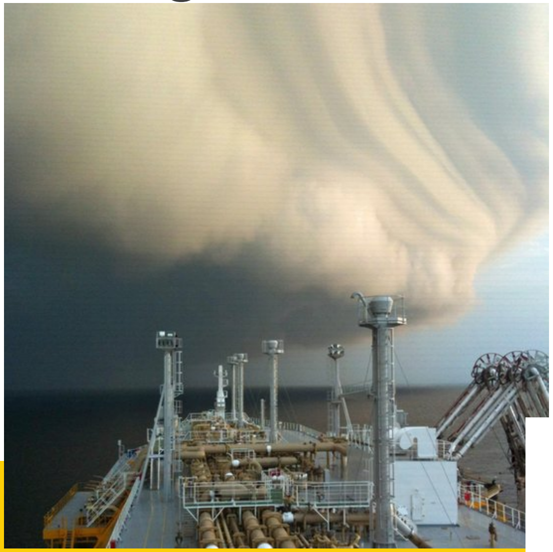
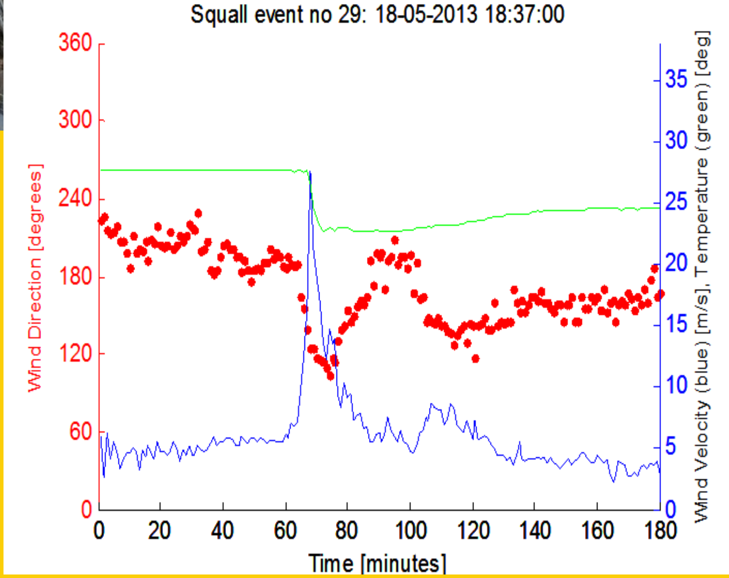
Metocean Engineering Master Class



Part I

Town and Gown
Petroleum Engineering Department,
Covenant University
Ota, Nigeria

Dr. Emmanuel Osalusi, CSci, CMarSci
Senior Metocean Engineer
The Shell Nigeria Exploration and Production Co.
Lagos, Nigeria



OUTLINE

1. Background
2. Introduction to Metocean Engineering
3. Metocean Considerations for Offshore Oil/Gas Development
4. Specifying the Offshore Environment
5. Metocean and its implications for offshore design and operations
    1. Impact on Design Criteria
    2. Impact on Operations
6. Q&A

QUALIFICATIONS

	Institution Attended
Academic Qualifications	**PhD** Petroleum Engineering (Institute of Petroleum Engineering, Heriot-Watt University, UK)
	MSc Applied Mathematics (University of Limpopo, South Africa
	PgDip, Mathematical Sciences, (African Institutes for Mathematical Sciences – www.aims.ac.za), University of Cape Town, South Africa
	BSc (Hons), Mathematical Sciences, Ondo State University (now Ekiti State University, Ado-Ekiti**),** Nigeria
Professional Qualifications	Lead Auditor /Auditor Course, Quality Management System (ISO 9001:2008)
	Member, The Institute of Marine Engineering, Science & Technology (*MIMarST - UK)* PRINCE2 – (Project Management - UK) Chartered Scientist (CSci), Science Council (UK), Chartered Marine Scientist (CMarSci), IMarEST (UK)

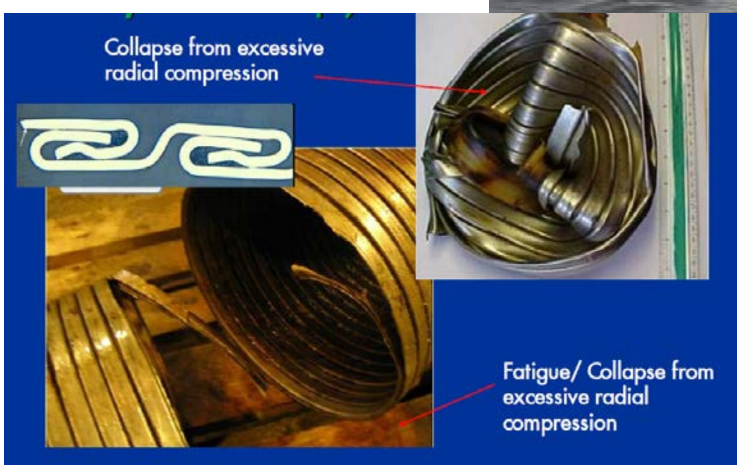
CAREER PATH

Year	Institution Attended
1997 - 2000	**Computer Officer/QA&QC officer,** SPIE Enertrans S.A., Nigeria. Shell/Total/NNPC LNG contract, Bonny Island, Rivers State.
2000 - 2001	**Document Control Officer,** Titan Engineers & Constructors, Nigeria. Shell/Total/NNPC LNG contract, Bonny Island, Rivers State.
2001 - 2002	**Administrative Officer/Document Control Officer,** Hyundai Heavy Industries, Nigeria, Shell/Total/NNPC LNG contract, Bonny Island, Rivers State.
2006	**Research Associate,** International Centre for Theoretical Physics (ICTP), Italy (CNR-ITAE).
2006 - 2009	**Research Associate,** Heriot-Watt University, Edinburgh.
2009 - 2010	**Numerical Hydrodynamic Engineer,** Total Gas & Power Ltd., London
2010 - 2011	**Senior Oceanographer,** Partrac Ltd., Glasgow
2011 - 2013	**Senior Global Analyst, GE Oil & Gas, Newcastle, UK**
2013 ongoing	**Senior Metocean Engineer, SHELL, Nigeria**

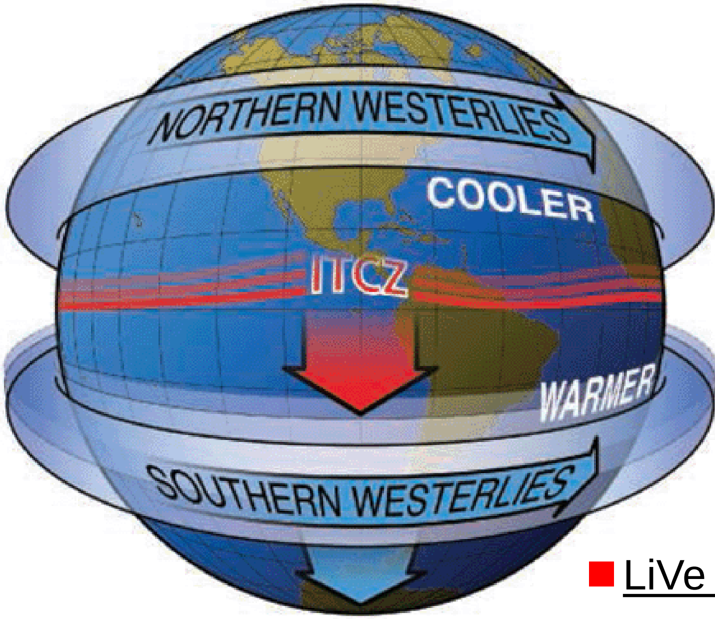
Peer Reviewed Publications

1) E. Osalusi, J. Side, R. Harris. Structure of turbulent flow in EMECs tidal energy test site, Int. Comm. Heat and Mass Transfer, 36, 5,422-431, (2009)
2) E. Osalusi, J. Side, R. Harris. Reynolds stress and turbulence estimates in bottom boundary layer of Fall of Warness, Int. Comm. Heat and Mass Transfer, 36, 5, 412-421, (2009)
3) E. Osalusi, J. Side, R. Harris. Thermo-Diffusion and Diffusion-Thermo effects on combined heat and mass transfer of a steady MHD convective and slip flow due to a rotating disk with viscous dissipation and Ohmic heating, , Int. Comm. Heat and Mass Transfer , 35, 908-915 (USA), (2008)
4) E. Osalusi, J. Side, R. Harris. Ohmic heating and viscous dissipation effects on unsteady hydromagnetic flow and heat transfer over a porous rotating disk with variable properties, hall and ion-slip currents, Far East Journal of Applied Mathematics, In press, (2008) etc
5) *(17 – Fluid Mechanics, 2 on Oceanic Turbulence)*


LITRE
CENTS PER


Collapse from excessive
radial compression
Fatigue/ Collapse from
excessive radial
compression

Aviation: Turbulent wind - Squalls



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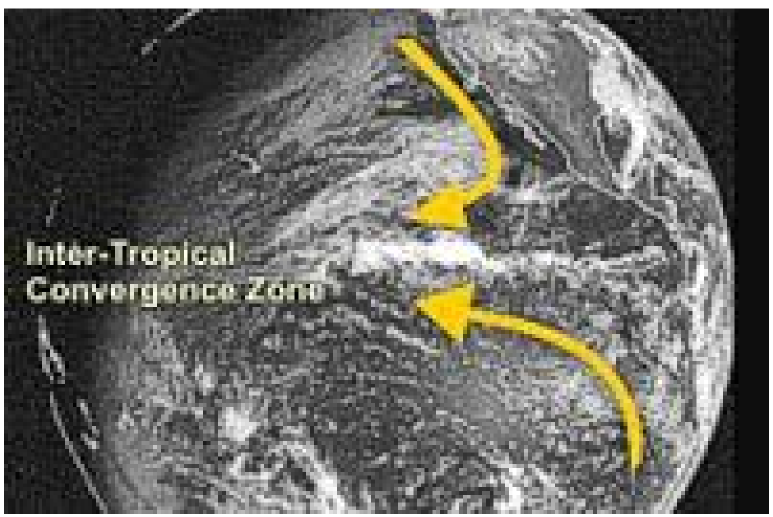
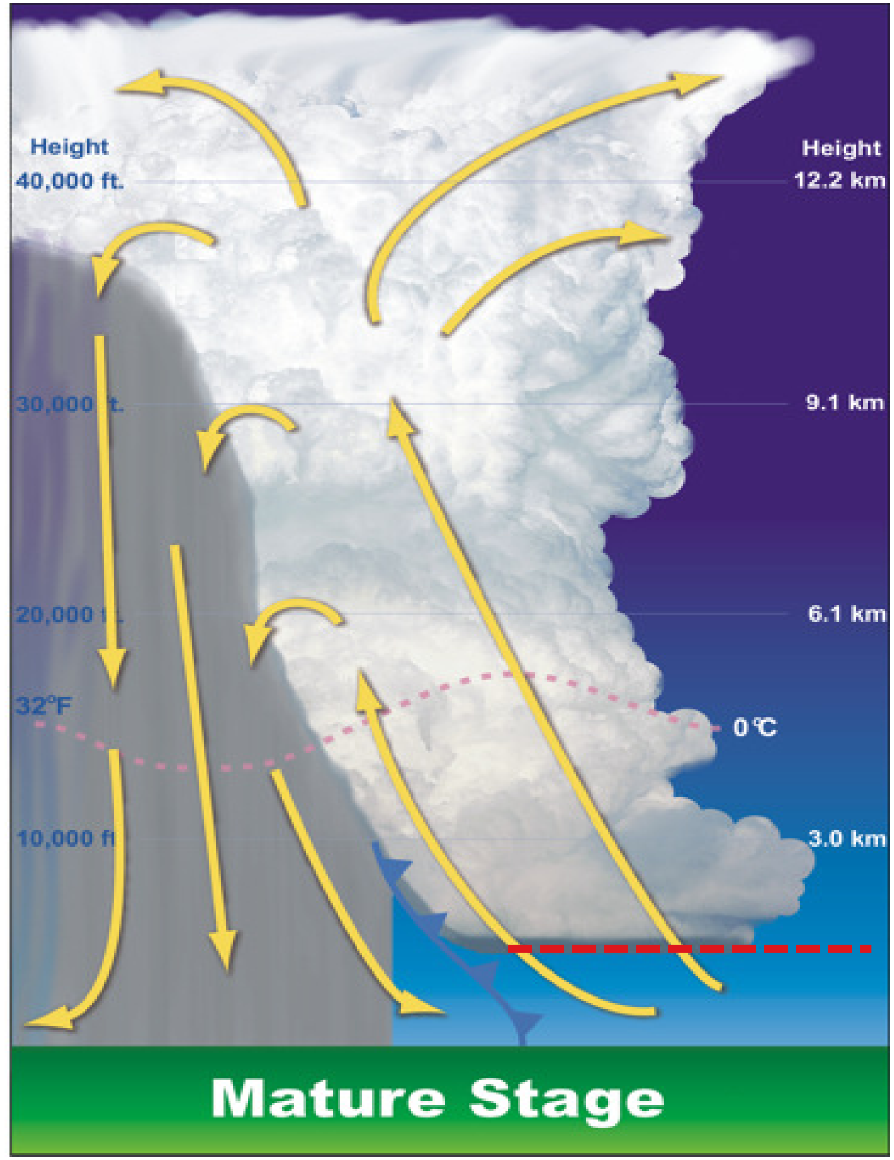
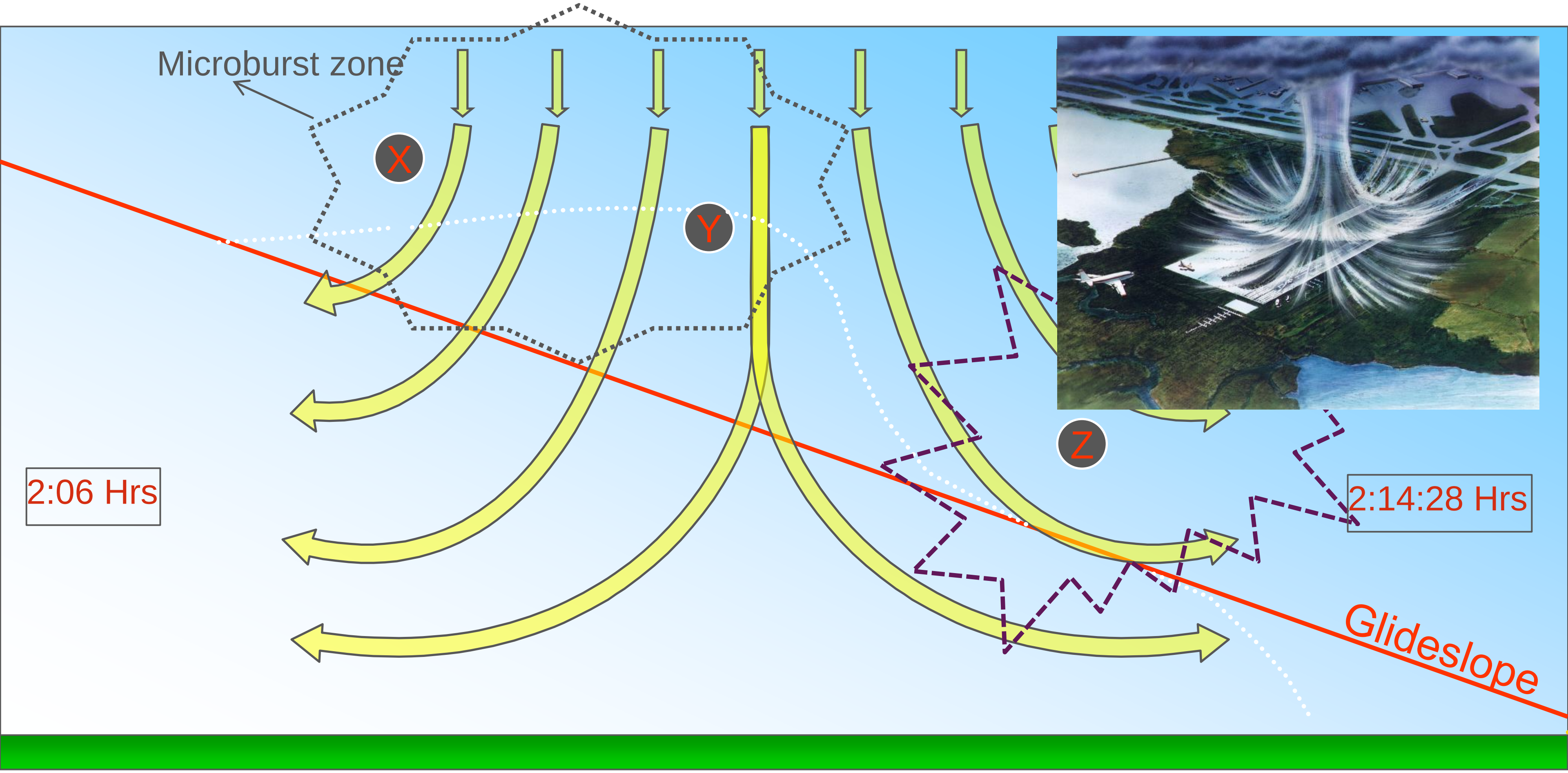






The aircraft encounters point X, where it enters the microburst zone, and a headwind causes it to rise above the normal glideslope. At the center of the microburst, point Y, there is a downdraft causing the aircraft to sink. The aircraft now enters the most dangerous zone, point Z, where a sudden tailwind causes the aircraft to lose airspeed and potentially crash.

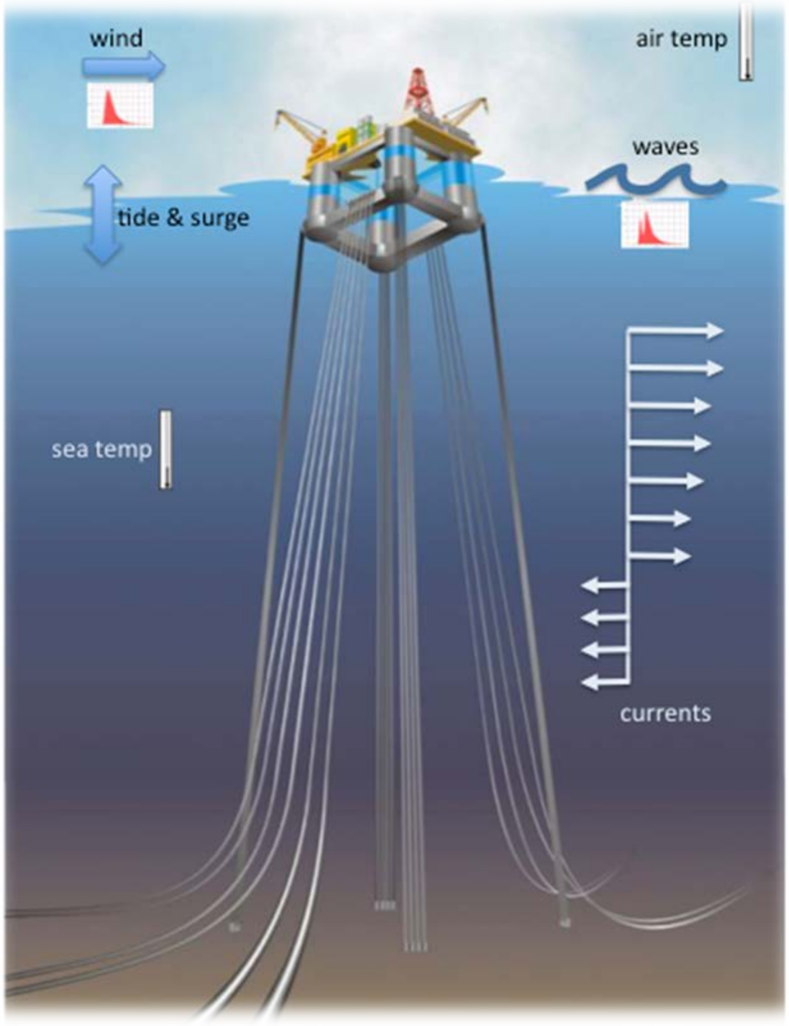
F-7-14-54 (AF477)

What is metocean

Metocean = Meteorological + Oceanographic

Abbreviation came in 40 years ago

Metocean is a discipline covering meteorology and physical oceanography, and is concerned with quantifying the impact and effect of weather and sea conditions on a wide range of activities in the onshore and offshore oil & gas and renewables – IMarEST / SUT



Definition of ‘metocean’

METOCEAN = METeorological and OCEANographic conditions

In Shell:

Metocean = assess impact of physical environment on our projects and operations

- to ensure consistent, safe and cost-effective design for offshore and onshore facilities
- to provide support to offshore/onshore operations

Metocean

Metocean = **meteorological** + **oceanographic**

Meteorological
- Winds
- Air temperature
- Air pressure
- Humidity
- Precipitation
- Superstructure icing
- Cloud cover/height
- Visibility
- Daylight hours
- Dust storms

\+

Oceanographic
- Waves
- Currents
- Sea temperature
- Salinity
- Tide and water level
- Storm surge
- Sea ice
- Sea Spray icing
- Icebergs
- Sediment transport

Sea gem disaster : incident

- Originally: 5.6k ton steel barge
- Converted to rig by BP (1964)
- It consisted of 10 steel legs, (made it possible to raise the barge 15 m over the water surface, living quarters for a crew of 34 and a drilling tower with associated structures
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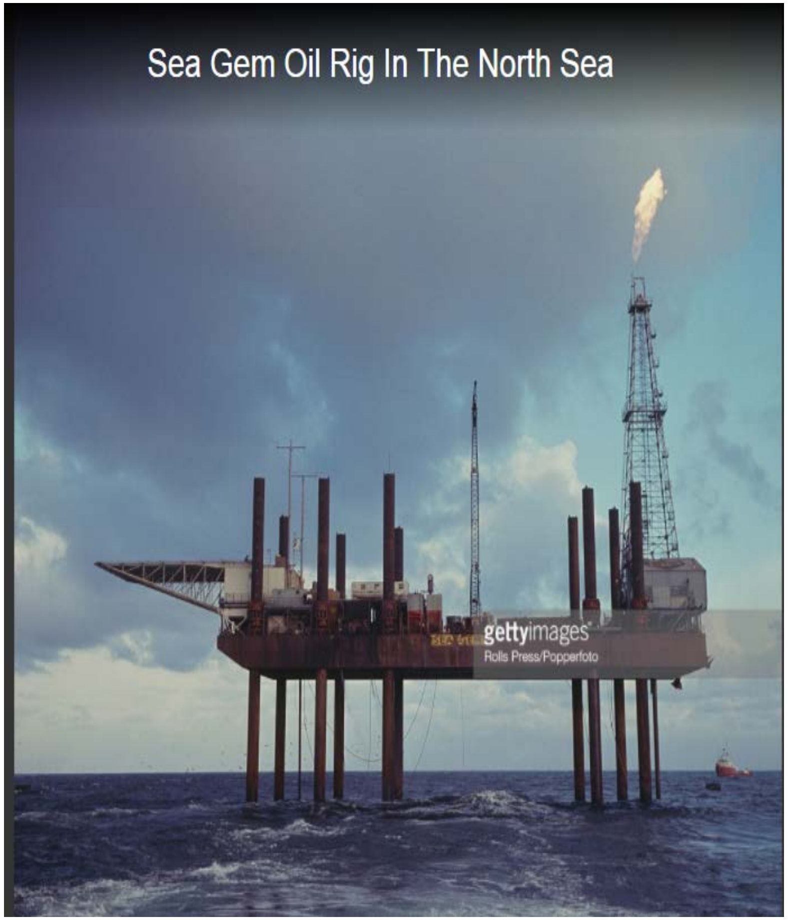


Sea gem disaster : accident

- On 27 December 1965, the rig was located approximately 67 kilometres (42 mi) off the coast of Lincolnshire.
- The crew were in the process of moving the rig to another site approximately 2 nautical miles (3.7 km; 2.3 mi) away. This process involved lowering the rig onto the surface of the water, in order to float it to the new site.
- When the rig was lowered, two of the legs crumpled and broke, causing the rig to capsize, with equipment and people sliding off and into the freezing cold of the North Sea at 1409 GMT.
- This inquiry concluded metal fatigue in part of the suspension system linking the hull to the legs was to blame for the collapse.

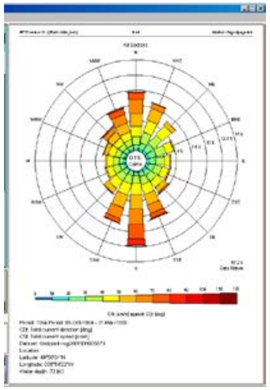
- 13 fatalities

Why metocean engineering?

The structural failure of the **Sea Gem rig** in December 1965 with the loss of thirteen lives was a wake-up call for improved understanding of the Southern North Sea environment. As the fledgling North Sea offshore industry moved into deeper and more exposed waters of the Northern North Sea demand for marine meteorological and oceanographic information grew leading to the emergence of **engineering meteorology and oceanography** as an important offshore industry discipline.

The role of metocean in offshore industry

Provide optimal/suitable and innovative Metocean solutions and guidance for offshore/onshore projects:

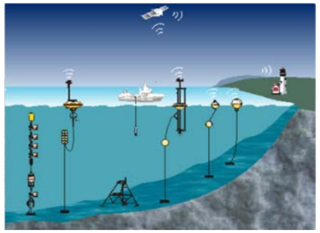


Extreme design criteria for ultimate strength

Fatigue criteria

Operational criteria for construction/tow/installation

Meteorological and oceanographic instrumentation and measure ns



Weather and ocean modeling and forecasting

Renewable ocean/wind energy

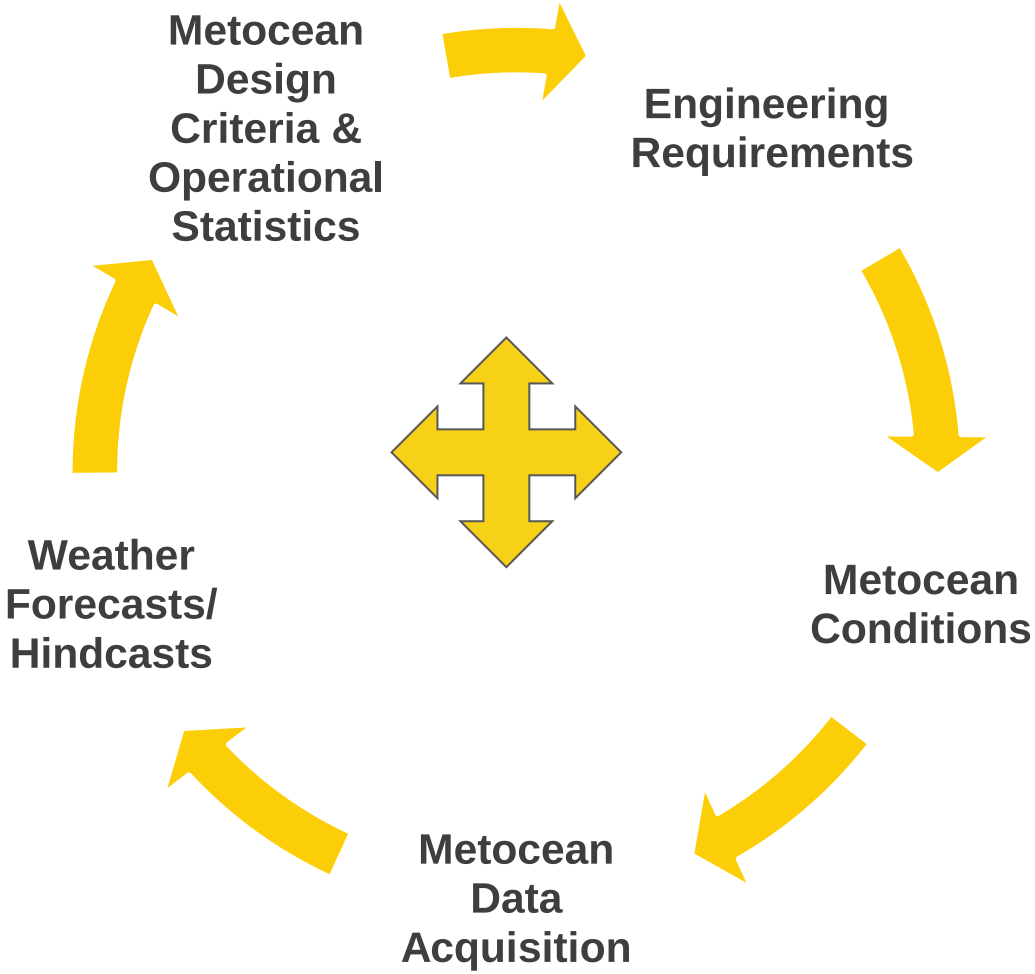
Ice management planning

Iceberg and sea ice tracking

Research/technology development

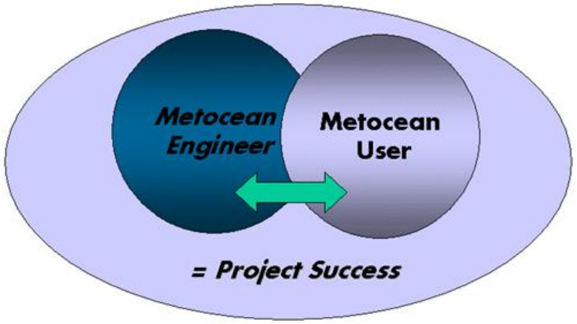
Industry/regulatory liaison

Metocean cycle



Challenges

- Cross-discipline awareness
- Early interaction
- Appropriate time & budget for deliverables



Closer working interaction adds more value


Q&A