SUT, MASTS and the D’Arcy Thomson Forum present:

 The 10th Anniversary Special of the Salvage, Decommissioning & Wreck Removal Workshop

Thursday 10th November 2022 (Auditorium A)

**Navigating the Blue Economy through the Climate Emergency:**

**How do we achieve joined up thinking and improved decision making?**

***Welcome - Karen Seath, Chair, SUT Salvage, Decom & Wreck Removal Committee***

A walk through 10 years

* North sea very different regulatory environment
* Key area of interest is impact of manmade infrastructure on the marine environment, impact of removal
	+ They have become part of the marine environment, removing infrastructure has become a debate
* In 2018 SUT introduced the topic of explosives for decommissioning
	+ Very interesting panel - marine scientists, explosive experts
* Showcasing and discussing technology is a focus, simulation and visualisation have come to the floor
* Circular economy
	+ Topic that was started in 2018/2019
	+ Highly challenging because key driver is economics
* Climate change
	+ Understanding GHG emissions
	+ Thinking about use of materials

**Session 1: Energy infrastructure Use and impact: The need for better decision making?**

The energy 'transition' - are we going from the frying pan into the fire? Is it time to rethink policy?

**Chair: Petra Harsanyi, Marine Station Manager, St Abbs Marine Station**

***Abigail Davies, PhD Student, National Decommissioning Centre/University of Aberdeen: The Energy ‘transition’: Out of the frying pan, into the fire?***

* Graphs of major GG
	+ CO2 increasing from 1970s
	+ Methane is 8x more impactful as a GG than CO2
		- We have increased the rate of change
		- Causes impactful short term warming
		- Stays in the atmosphere as a maximum of 12 years, but can cause sig impacts in that time
	+ We have collectively reduced CFC’s
* 7% of GG emissions comes from burning of fossil fuels
* Need to look at energy mix and demand
* Coal has reduced, petrol and natural gas have not sig reduced
	+ Natural gas is methane, tends to leak in both upstream and downstream part of the system
* Sectors responsible for GG emissions
	+ Domestic is a large part of GG emissions in UK
	+ Personal responsibility to decarbonize
	+ We talk about academia and industry, ignore personal responsibility and impact
* Are we really transitioning?
	+ Used to produce all natural gas in UK, can control upstream and downstream emissions
		- Started importing from Russia and Norway, less trustworthy
			* 15% of Russian gas leaks
	+ Need to look in gross of renewables
		- During transition has increased 5.9%, offshore wind only 3
	+ Prediction that we will produce over 500 tons this year, not including imports and aviation
	+ We have offshored our emissions - imported products
		- Not included in the graphs
		- Makes our emissions much higher
* Are we greenwashing?
* We don’t have good data reporting or carbon accounting
	+ UK is very bad
	+ Different government sectors use different methods to calculate emissions, not comparable
	+ Emissions are 3x higher than reported when including upstream and downstream emissions
* Carbon capture and storage
	+ Dodgy
	+ Problems with leaking
	+ This data doesn’t come from the operators
	+ No storage so far that can actually store more than 40% of what it takes in
* Offshore vs onshore
	+ Onshore higher, but offshore is harder to calculate and measure so it is underreported
* Materials
	+ How we use and reuse materials (circular economy)
	+ Steel easy to recycle
	+ 60% of recycled steel goes to electric arc furnace, we can’t control where that goes
	+ Hard to pin down emissions with transport
	+ Can look at how we assign emissions to materials
		- Methodology is standardised, linear
		- Two options at end of life
			* Recycle assumes goes to electric arc furnace - false
			* Bin - materials are lost - false
		- We include IOP without understanding exact pathway of materials
			* Material value
				+ Energy carbon value
			* Product value
				+ Energy and carbon to create final product
			* Retention model
				+ How to retain the value within the material and product

Can map pathways at end of life

Assign a value to the pathways

* + - * + Recycling takes more energy
		- Is we dispose we lose all value, recycle we lose 50% of value
			* If we reuse but move it, reuse in situ we lose zero value
	+ Can end up with over 100,000 tons of CO2 for decommissioning steel jacket

***Steve Hall, Policy & Technology Consultant: Current global marine policies – Time to rethink?***

* Silos
	+ We treat fisheries different from oils and gas - there should be EIAs
		- Legacy activities, get away with things
* No shortage of global marine regulation
	+ Not joined up
	+ Many in EEZ concerning human economic activities of various kinds
	+ Handled by different orgs, disjoined, no communication between them
* Many different strands of scientific data needed to inform policy
	+ Need smart and well qualified people, equipment to get this data - expensive
* Ocean is low priority compared to terrestrial
	+ Don’t wait for international legislation to make things happen
	+ We don’t know what’s in the deep sea
* ABNJ’s are still the wild west
	+ Who’s going to enforce it?
* Leadership
	+ UNESCO is UN body on ocean matters
	+ Is it though?
	+ No clear leading body on ocean issues - no person sitting at UN to be spokesman/woman
	+ All the orgs argue they have the remit from the UN to be in charge of ocean matters
* Marine autonomous technology isn’t new
	+ Torpedo, converted jet ski with transmitter, explosives, etc
	+ Laws have been made, but they’ve not been updated to new technology
	+ What happens if you hit the wrong target?
		- How did you discern your target
* How will lab grown fish change the fishing industry in 20 years? Emerging technologies have ability to completely transform the environment for the better
* Sea level rise? What does that do to industry (oil and gas platforms)? More powerful storms?
* Ocean needs a seat at the UN! An ocean body in the UN

***Lee Hanlon, CEO, CessCon Decom: The circular economy challenge for onshore decommissioning of offshore infrastructure***

* Circular economy is core of values
	+ Need to engage with operators early
	+ Need to see what can be used and removed
* Over 99% of the materials are reused and recycled
* The end of life for one thing should be the beginning for something else
	+ Remanufactured, resold, returned to supply chain
	+ Easier said than done
* Challenges
	+ Removed two platforms
	+ Can be done in 90 minutes
	+ Transported to the barge, barge moored
	+ Assess the structure for what can be reused
* Top town dismantle methodology
	+ Lift 2 tons per day
* Every piece is identified and quantified
* Pulldown
	+ Looked at explosives, stayed away from it
	+ Controlled pulldown instead
* What are the real impacts, challenges?
	+ Complex in planning, cost, risk
	+ It can be costly to remove it
* Pump resale is 10% of new pump - small revenue
* Scrap steel (per ton) is same price as the resale pump
* So what’s the point? Why go through all the hassle when you can get scrap material for the same price?
	+ Main challenge and barrier to circular economy

***Charlotte Stamper, Energy Infrastructure Lead, European Metal Recycling: A virtuous circle? Opportunities for a circular offshore renewables sector***

* What is in a wind turbine?
	+ Where does the steel come from and what happens at the end of life?
	+ Blades are fibreglass
	+ Some very valuable materials
		- Copper, nickel, cobalt, rare earth elements in magnets
		- Minor amount but important
	+ Offshore is more complex
		- Emerging technology is floating turbines
		- This will take over offshore wind
			* Can go deep
			* Huge max potential
* Offshore market
	+ We need 4x increase in wind by end of the decade to accomplish goal
	+ At Least 4,000 turbines in north sea by 2030
	+ We need 150,000 turbines globally by 2050
	+ Huge market!!
* Things we need to think about today when we implement offshore wind for circularity in the future
	+ Onshore wind decommissioning happening already - we need to learn from that
		- We don’t know how to do it well
		- No one considered taking them down when they were made
	+ Cannot recycle fibreglass from the blades
		- How can we recover materials from offshore turbines?
	+ We have a chance to get things right
* At the start of investment in ports and manufacturing in Scotland
	+ Huge of investment
	+ Wind turbines are replicable
		- Should be an opportunity for UK supply chain to do serial manufacturing
		- Need to couple decommissioning with next generation infrastructure when designing our ports
		- Cannot rely on other people to manufacture them - the world is an unpredictable place
			* Do we want tore ly on China to get the rare earth elements needed to build them?
* Offshore wind farms need substations
	+ A lot of the same infrastructure as offshore oil and gas is used for offshore wind
	+ What strategies and policies do we need for successful reuse?
* Workforce
	+ We need to help people transition
	+ Massive skills gaps on offshore wind, but skills are present in oil and gas
		- Needs to be transferability
		- Need to transition while retaining key knowledge and skills from offshore oil and gas
* It will be difficult to keep supply up with demand of some of the materials and rare metals needed
	+ If we can embed circularity we can retain materials
	+ Need to plan now for our material needs in the future

***Discussion/Q&A***

* Is the potential for a circular economy there so we don’t need to procure more rare metals? What evidence do we need? Do we have enough of the rare earth elements?
	+ We should be eliminating these metals from our technology in the future, redesign
	+ Try to avoid deep sea mining at all costs
	+ Should we all assume that we can have electric vehicles? We don’t have the resources to replace all vehicles with electric vehicles currently
		- They are still a drain
		- Need to reframe the discussion
		- The right design and the right policy should be enough to procure the elements we have
		- There is a lack of design for the reuse and recycling
	+ With the pace we need to implement wind turbines do we have the time to figure this out?
		- The renewable has reduced its cost, the focus is not about it’s sustainable growth
		- The onus is on the renewable sector now
		- Take time now to discern where the emissions are and avoid it in the future
	+ How are the new platforms designed to allow for decommissioning?
		- Nothing has changed
		- Some parts easier to remove, method and sequence has not changed
* In terms of making the seabed safe for fishing (snagging), what measures are being taken during decommissioning?
	+ Clean seabed is ideal
	+ Still conversation about leaving materials that are part of the marine ecosystem
* How has the design of wind turbines changed over the last 30 years?
* There’s been many stop/starts with transitioning to renewables
	+ Pace needs to be faster
	+ Still talking about starting
	+ Can we think more long-term? We have a small carbon budget left to use. Can we think about 100 years into the future?
	+ There is a system change needed (public transport) but we still think in terms of just replacing our current structures, taboo subject
	+ We could build things that are built to last longer
	+ Things need to be local, need to be accessible to sustainability
* Where does the recycled material go?
	+ Sell steel to EMR
	+ Steel is global commodity, will be exported to places that will pay the most
		- Needs to be more local
		- Economic reasons that’s not happening

**Session 2: The Marine Ecosystem – do we properly explain the intrinsic need for protection?**

What changes have to be made to promote prevention rather than cure? Have we changed our view on the value of biodiversity following the Dasgupta Review?

***Chair: Nigel James, Master Mariner / Director, Waves Group - Opening: Prevention rather than cure? A Master Mariner’s perspective***

* What are we protecting it for? What are we protecting it from?
* Need to think differently
	+ Lessons learned
	+ New technology
* Container-stack collapses
	+ Even one or two stack collapses is a big job
		- Each one is the side of a truck
		- Example holds 7,000 containers, lost over 1,800 over the side, rest scattered on deck
		- Is there something we can do to mitigate these losses?
			* Mitigation of synchronous rolling and parametric rolling
				+ Reason for stack collapses
			* Want something easy to understand, can put on a piece of paper
			* Produced chart for each vessel based on vessel metrics and wave factors
* Fire on container ships
	+ Nitric acid leak on board
		- Ports wouldn’t accept it, has to go around with this nitric acid leak
		- Situation got out of control
		- Vessel caught fire and sank
	+ We carry everything on container vessels
		- Every dangerous substance - acids, explosives
		- Things end up in the sea - plastic nurdles
		- Wildlife severely affected
	+ Thermal sensors are required to be carried for firemen
		- Ships are required, most don’t carry them
		- Smaller than mobile phone, half the price
		- Allows you to find the fire
* Prevention rather than cure on ships

***James Herbert, Secretary General, International Salvage Union: Lloyd’s Open Form and the role of the marine salvage industry in the preservation of marine ecosystems***

* Marine salvage is practice of going to aid of vessels in distress
	+ Usually done on commercial basis
* Very small numbers of large players able to operate globally
	+ More regional operators
	+ One port or one part of the world operators
* ISU does about 200 salvage operations a year, $500 million gross income
* The commercial industry is the difference between a casualty and a catastrophe
	+ Calling in marine salvage should be first priority, not last resort
* Salvage vessels keep ports open and industry alive
	+ Suez canal example
* Policy
	+ IMO
	+ Council of Lloyds
	+ No cure no pay
		- If they aren’t successful with the salvage they don’t get paid, based on value of the cargo and vessel
	+ Contract is Lloyds Open Form (LOF) for 100 years
	+ Article 13 of salvage convention determines the price of the salvage
	+ Article 14 awards
		- Special awards for situations where vessel is not saved, but time and resources were put into trying to save it
		- Did not work well
		- SCOPIC regime introduced
			* Salvals can invoke clause to get some time and money for the job even if not successful
	+ Damage to the environment is paid for by P&I clubs
		- Invoke Lloyds open form because it is an immediate response
* ESG approach beginning to be taken seriously
	+ Enables harmful substances to be carried at sea?
* Graph showing the substances involved in cases they have
	+ Shows why we need the salvage industry to prevent these substances going into the sea

***Mike Elliott, Chair in Estuarine & Coastal Sciences, University of Hull: The value of biodiversity – A scientist’s perspective***

* We have a link between the ecological and societal services and benefits
* Within the context of oil and gas
	+ Decision levels we go through to determine where the environmental effects are coming from
	+ How do they affect the biodiversity
	+ Every activity is a detailed part of decommissioning
* We need to value how pressure are changing the biodiversity, and the effort we go through to prevent them
	+ How is the marine ecosystem functioning changing
		- How are our benefits changing
	+ Protecting ecosystem services misses the point
		- We need to consider what is the ecosystem doing that’s important
* Framework for how we value that and how we communicate that value
	+ How do we value ecology?
	+ How do we value the effects on biodiversity?
* In the light of petrol
	+ If the marine ecosystem is functioning we get ecosystem services
		- Fish
		- Fish gives us birds
	+ We build boats to catch the fish, we put in human capital
	+ We build restaurants, we find value in it
* We can value the ecology part
	+ We have socioecology valuation - ecosystem services
	+ Socioeconomic valuation
	+ How do we value these different parts
* How we value the ecology doesn’t relate to money
	+ What is the fragility and irreplaceability of a habitat
	+ Vulnerable and sensitive? To what?
	+ Ecological valuation is important, but we are not valuing in monetary terms
* Socio Ecological valuation
	+ Starts linking ecological valuation to what we want from the environment
	+ Anthropocentric view but most people think this way
	+ How do we value the ecosystem services?
* Socioeconomic value
	+ Where politicians take notice
* We often stop at the monetary, material, tangible valuation and ignore either values
* The way we think about biodiversity needs to build in natural and economic valuation
* Can have good economy without good ecology, but it won’t be sustainable
* Natural capital
	+ Didn’t come out of the environment monetary came out of the treasury
	+ Are we protecting natural capital for the benefit of the economy or the planet?
	+ Now it’s used in regulations
	+ What assets do we have in the sea, what are the flows and the benefits
	+ Ecologists now use economic terms - assets and flows
* Now we indicators for all of these aspects
	+ Natural capital accounting
	+ Matrix approach
		- How do we measure our biodiversity, how do we link to ED, how do we link to societal values
* Ecologists and economists want things to happen different
	+ How do we merge them
	+ Different currency for each, on either side of the equation
* Horizon Europe is developing these methods

***Moya Crawford, Managing Director, D’Arcy Thompson Simulator Centre and Deep Tek: Where we are with the Hazardous and Noxious Substances (HNS) Convention – How does this fit in with the opening up of the NE Passage?***

* When we talk about the passage of noxious substances we need to talk about fuel
	+ Bunker oil, refined hydrocarbon
* Offshore floating wind will be subject of salvage
* No one mentions nuclear, taboo subject because not a part of Scottish gov policy
	+ Not allowed to discuss nuclear as part of energy mix despite the low carbon footprint
	+ Need to question it
* What will our benchmark be to start salvage before the damage?
* In the example
	+ Trawler on shallow rocks by Norway, Svalbard
	+ Salvage contractor went out (January, dark and cold in Arctic)
		- Went with high power ice breaker
		- First removed pollutants, used young naval recruits
	+ Successful salvage mission
	+ Lots of negotiation, really wanted to remove all pollution
	+ Wanted to get best methodology for the wreck removal
		- Survey data (drones, ROV)
	+ Two seasons to remove the wreck
		- Had to be cut up
		- Manage ice flow, make sure work is safe, unpredictable weather

***Discussion/Q&A***

* Case history of natural accounting that shows a different outcome from commercial accounting?
	+ Been used in a few countries, not been used properly on the marine system
	+ Been used more on terrestrial systems
	+ Not sure if it will work on the marine area
	+ LOF allows salvage industry to get reward for protecting marine environment
		- Creates space for a discussion of the natural capital
		- Need to put the expertise back in this industry
		- How with natural capital accounting methodology how can we take that back into the marine salvage industry?
			* Biodiversity accounting, biodiversity credits would be a mechanism
	+ How to include the larger impact of biodiversity loss within accounting
		- The effects are larger reaching than just where the event happens
	+ Society needs to put pressure on ship owners to use professional salvage operators
* Natural capital versus natural real estate?
	+ Real estate is just part of capital
	+ We talk about social, economic capital and we want to bring all these together to ask how we can value a system in ways other than just GDP
	+ Fish are natural capital, not real estate
* In terms of getting the salvage operator in requires a lot of resources
	+ Open question about whether the industry can respond globally
	+ Big issue for the Arctic - Russian ICU suspended, so now there is not a member of the NE passage to respond there
	+ The industry is under threat therefore the environment is under threat
* James was at the IMO yesterday
	+ Session of the maritime safety committee
	+ Pleased to see that large part of member state delegates stayed for the talk about marine salvage, and a range of the NGOs, seem to take it seriously
	+ We think about states that are well organised for marine casualties, but the majority are not organised around it and need consultants

**Session 3: Exploration and Removal of Wrecks and Offshore Structure: Technology and Data**

We take you to the depths to explore the latest expedition to the Titanic; discuss what elements of 'legacy wrecks are environmental hazards; and share how state of the art visualisation and simulation can inform responsible decision making.

***Chair: Andy Matkin, Commercial Manager (Environmental Services), Fugro***

***Murray Roberts, Professor of Applied Marine Biology & Ecology, University of Edinburgh: Exploring the Titanic – the 2022 expedition***

* What does the titanic wreck have to do with marine colonisation
* What does it cost to dive the Titanic?
	+ “Mission specialists”
	+ $250,000 for one dive
* 2022 Titanic exploration
* Bringing scientists, explorers, deep sea enthusiasts
* Biodiversity on the Titanic
	+ No eDNA ever taken before
* Rare to see sites like the titanic wreck
	+ Building a time series
	+ Larval dispersal
* Role of the structure as an artificial reef?
	+ Working with archaeologists
	+ Information on how the deep ocean is acidifying
* Connectivity patterns different dependent on models, learning about validity of the models
* Went in sub to explore mystery wreck site near the Titanic
	+ Turned out to be rocky substrate
	+ Lots of life growing on it
* More rocks in the deep abyss than we thought
	+ Helps us to understand species dispersal across the abyssal ocean
* Need to id and quantify what we know, what is there, what grows on the Titanic, eDNA, water samples
	+ Cannot sample from Titanic!
* Make data available to the scientific community
	+ Need to be in public repositories

***Juha Flinkman, Finnish Environment Institute SYKE: Legacy wrecks as environmental hazards in the Northern Baltic Sea – Case Gulf of Finland***

(most explanation is on the slides)

* Lots of wrecks in Northern Baltic
	+ Popular trade route
* Gulf of Finland
	+ Lots of trade, lots of war
	+ Difficult to navigate
* Up till now it was no one person's responsibility to collect data on these wrecks
	+ Now it is the SYKE
* Two periods stand out - the world wars
* Environmental threats
* Most environmental wrecks are warships
	+ They don’t have to follow marine pollution conventions
	+ Careful methodology to operate wrecks
* Can find grey seals caught in trawl nets that died, they don’t decompose very fast in the deep sea
* UXOs and ghost netting, chemicals must be assessed - risk of the wreck to the environment
* Salvage must be carried out to remove these threats
	+ Pre salvage survey costs a lot of money, need to figure out how to do it or employ consultant company
* They’ve done all the easy wrecks, all that’s left are the more dangerous and deep wrecks, war graves
* Tools include archival reports, drawings how outlay of bumper tanks and damage to the ship, where the fuel and explosives might be

***Mark Lawrence, Lead – Digital Services, Waves Group: How state of the art Technology and Visualisation can help inform decision making***

(most explanation is on the slides)

* Risk assessment
	+ Trying to understand the likelihood of release of hydrocarbons and calculate overall risk of environmental impact
	+ Overall risk
* Data driven decision making
	+ Integrating and interpreting data, bringing datasets together generates situational awareness
	+ The context of it is to use that to develop proposals, communicate and determine cost to remedy the situation
	+ That allows the application of quantifying risk
* Approach to stages of intervention
	+ Want to find the lowest possible cost and risk per time to remove wrecks
* NBS to determine where hydrocarbons are
* Modelling the wreck to determine structure, damage, holes, and sample
* Found area of wreck that was leaking oil
	+ Oil spill determined

***Will Black, Decommissioning Project Manager, EnQuest on behalf of the Subsea Decommissioning Collaboration (SDC): A collaborative operator approach using innovative supply chain technologies***

* What is Subsea Decommissioning Collaboration
	+ Opportunity to share and be transparent about $1 billion and 15 years of work - huge scale
* Where did it all start?
	+ OGA went to operators to ask how to maximise recovery
	+ How can we optimise decommissioning in Eastern Shetland
	+ Scope increasing
	+ Only working group left from the initial initiative
* Opportunity in the scale, partnerships, transparency to supply chain
* Want to make it a sustainable solution, new technology
* Data is all online on NSTA website
* What have we done?
	+ Had to change mentality and go to supply chain
	+ Put forward the problem, opened portal for people to post ideas
	+ Categorise ideas
	+ Reviewed ideas
	+ Has 1 to 1 with every supply chain on their ideas
	+ Developed plan on that
* What does success look like on a high level?
	+ Willing to take risks to try something new, supply chain needs to understand that
	+ Need to consider emissions during decommissioning so they can be net zero
	+ Make clear they want to set up the supply chain during the whole journey
* How to inspire industry
	+ Webinars
	+ Meetings
	+ Getting out to supply chain
* Market responses
	+ Want to make sure that ideas stay to the company, not shared elsewhere
	+ Assess scoring criteria, how to move forward on that basis
		- Remove the subjective part
* Two screen workshops
* Have we got game changing ideas?
	+ No silver bullet
	+ Good initiatives and ideas, positive response about collaborative way of working
* Development plan
	+ How to take ideas to the next level - economic level

***Discussion and Q&A***

* Opportunity to improve the EIA collaboratively? Collaboration in decommissioning?
	+ Collaboration easy in decommissioning because there’s no commercial gain
* Carbon accounting in plans?
	+ No, but want that to be part of the decision making
* Could deep sea tourism fund deep sea research?
	+ It already is!
	+ It’s great to see people dive deep sea coral reefs
	+ How can we make this an experience? How can the scientific community benefit?
* How is the data normalised to contractors understand what it says?
	+ Standard data on form that is posted on NSTA website
* Murray - will you go back to Titanic?
	+ Plan is to go back each year
	+ Cannot sample, highly controversial, but we need samples for science
		- Tension in that discussion
	+ There are people who are not super rich who will spend all their mortgage to dive the Titanic
* Mark - can you determine when an oil leak will happen in a wreck?
	+ Data is advancing very fast
	+ Depends on the scale of the damage hard to determine though
	+ Orientation of the wreck can be more structurally sound

**Session 4: Moving the Conversation on by Tackling Tough Topics**

Explosives and UXO's - we look at a changing story over time and new technologies for removal; and how the strength of partnership helps us address the long term negative impact of munitions and ordnance.

***Chair: Rachael Sinclair, Senior Scientist, SMRU Consulting***

**Part 1: Explosives and UXO’s – A changing story**

***Alison Brand, Managing Director, Manta Environmental: A look back, and how EDGAR (Explosives use in Decom, Guide for Assessment of Risk) enables the future***

* XCOM
	+ More interested in small explosions
* Current industry perception at first
	+ Explosives banned - too risky, need to be very tested, etc
* Relevant regulations
* Industry guidance
	+ Need to look at all the options - evidence and argument
* Explosives
	+ Economic benefits but use must be justified
* Use 10 values of adaptive management
* Underwater noisier
	+ Seismic, sonar, pipe laying, shipping
	+ Disrupt underwater communication from marine species
	+ Look at sounds SPLs and SELs
	+ Duration activity takes
	+ Strikes and cumulative - SEL
	+ Lower levels for longer durations might have similar effects of higher level sounds shorter duration
* What are we looking at?
	+ Burst of energy
	+ Short shock waves
	+ Waves reflected or refracted
* We need data for the model
	+ All projects are from the States
	+ Need a concept
		- Concept diagram
		- How many activities per event?
		- Species present? Densities? Acoustic impact criteria?
		- Potential impact → number of individuals impacted per species
	+ Model should be transparent and minimal input for the user
* Initial concept
	+ Found that the initial source level and sound pressure levels gave SPL peak
* User can see radius of impact, cetacean abundance
	+ Computes risk assessment for marine mammals
	+ Assessment for marine management units
	+ Build something that is built for purpose
		- A tool to see if it’s reasonable as first stop model
* Since building EDGAR
	+ Publications on sound pressure levels and sound exposure levels
	+ Impact?
		- 1,000 full text views in a year
	+ Models for seismic survey, impact piling

***Lisa Zardoni, Decommissioning Engineer, North Sea Transition Authority: Driving efficiencies with the right decom toolbox***

* Decommissioning strategy
	+ Target of 35% reduced decom cost by next year
	+ Objective to have it carried out in cost effective way
	+ 4 strategic areas
		- Planning for decom
		- Commercial transformation - decom executed at scale
		- Repurposing infrastructure
		- Work with industry to promote development and implementation of technologies
* The right toolbox is the one with the most tools
	+ Scope can be technical, commercial or regulatory
		- Can be proven technology or newly developed, or under development (need all in the toolbox)
	+ Accepting some inefficiencies, but choosing best for the job

***Richard Battrick, Managing Director, UXOcontrol: Regulatory framework for UXOs, scoping magnitude of problem, differences between explosives and UXOs***

* Help inform legal frameworks
	+ National frameworks give good informative work plans
	+ BREXIT will change UE regulations
* Transportation
	+ Still under EU frameworks for transportation
* International frameworks
* Best Practice
	+ Protocols when working on land
	+ Contamination from bombs in the wars
		- Sanitise the land to give back to the owners for use
	+ Same methods in the marine environment
* NOS
	+ Code of practice not taken up by industry
	+ Not UXO trained or qualified
	+ Most UXO practitioners come from the military
* Low and high explosives
	+ Low doesn’t detonate, burns quickly
	+ High does detonate
* Black powder
	+ Coarse grain is steady burn
	+ Fine great is quick burst
* Nitro-glycerine
	+ Waves go through the environment
* Changes based on environmental conditions
	+ Sea mines differ in dimensions, can ID
	+ Different types of mines
* Land mines
	+ Built at sea
* Torpedoes
	+ Ship torpedo weapon systems too
* Magnitude of the problem
	+ Historic ordinance is not accounted for
	+ Lots of contamination
		- Nuclear waste
		- 147,000 tons in 1947 dumped
		- Dumping sites all around the world
	+ Wrecks eroding, so are bombs
		- Collapsing and becoming unstable
		- Needs to be dealt with
		- Threat is not gone, practices allow for the dumping still
* Modern commercial challenges
	+ Subcontracted mechanism
	+ Use cheap equipment
	+ Take the risk on board
	+ Struggle to get people to engage
* Vessel management
	+ Challenge in the industry
	+ Vessel prices change, need to procure vessel in advance
	+ Different sensors, different metallic content
		- Important to understand what you’re dealing with
* Use Utility ROV System (UTROV)
	+ Need to remove obstacles – transfer and lift
* Weapon selection is a problem
	+ Need to understand the weapon system used for environment
	+ Need to have functional equipment
* Need to use doner charge, but don’t want that impact on the environment
	+ Plan for low order unless high is required
* Cobra
	+ Explosive charge directly on the items
	+ Don’t want it dispersed around the ocean floor, in propellers
* Analyse carbon footprint of the tools in the toolbox
* Equipment lifecycle
	+ Pinch Point with licensing framework, might be just for 24 hours
	+ What’s the environmental life cycle?

***Discussion/Q&A***

* Who pays for UXOs? Who decides which ones are used?
	+ Energy companies pays
	+ Third party consultant advises on UXO operator
* Are there parts of the EIA that are kept quiet?
	+ Distrust with explosive engineers from the military and industry
	+ If you own the survey data you can make decisions, generates trust
* Is the government trying to clean up historical dump grounds?
	+ There is a degree of ownership, but it’s not a priority

**Part 2: Driving topical discussion forward across the ‘Quadruple Helix’**

***Moya Crawford, President, SUT: The SUT Special Interest Groups, the strength of partnership, and looking forward***

* Need coherent policy that isn’t sectorally oriented but around water, the medium that sustains life
* How do assurance, insurance and finance affect what we do?
* We are the ones that must make the decisions, and cannot always look to the government. Their ability to affect change is limited
* Need to choose a number of subjects to move forward
* Big one is education and skills

***Dave Paterson, CEO, Marine Alliance for Science and Technology for Scotland (MASTS): Thoughts from the two workshops – Open discussion***

* MASTS promotes excellence in marine research but also supports government policy
* We are in Phase 3, where there is commitment of 80 partners to continue over the next 5 years but without gov funding
	+ Not strong enough in the T of MASTS, technology and business
* What are the real objectives of the work - how to project environment and economy
	+ Meetings like this bring together academics, government and industry
* Setting up networking tool called “Ocean Partnerships” with weeks and monthly meetings