



Explosives as an Alternative Cutting Technique

Presented by David Lindsay MIExpE

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About SPEX – The Group

SPEX is comprised of two in-house businesses. Each business can operate either independently or in conjunction with the other, depending on the requirements of the specific project.

By combining these businesses, SPEX is able to accelerate project delivery, minimising our clients' time and cost.

SPEX's partners and customers have full access to our multi-disciplinary expertise and resources.



The Aim

- Essentially, our aim is to raise the profile of explosive cutting technology and the significant benefits that can be gained from their use.
- We want to engage with organisations and individuals and be given the opportunity discuss explosives technology and to clarify any misconceptions that may exist regarding the use of explosives during decommissioning activities.
- We are happy to be challenged and appreciate that the use of explosives may be a controversial subject for some.



Collision Effect Severance Charges

Collision Effect Charges

- Available in a range of sizes to suit common casing or pile sizes
- Normally Liquid filled
- Quick to prepare on site
- Simultaneous charges can be initiated at the same time
- Not uncommon to complete a Wellhead Severance and recovery operation within 4 – 6hrs.



Explosive Wellhead Severance

- Wellhead Severance using explosives is a method that has been extensively used since the earliest days of oil and gas exploration.
- It is a tried, tested and proven technique that has been used successfully for the removal of individual wellheads or to complete multi well, multi operator vessel based well abandonment campaigns.



Collision Effect Charges – Structural removal

- This flare platform was located offshore Nigeria in approximately 32m of water.
- The flare platform was a tripod structure piled through each jacket leg. Pile diameter was 30 inches OD with 1-inch wall thickness.
- The structure was located extremely close to a series of oil and gas pipelines. The closest pipeline was 12 3/4-inches OD (oil filled), and 15.75m from the nearest pile. The closest gas-filled pipeline was located 31m from the nearest pile.



Collision Effect Charges – Structural removal

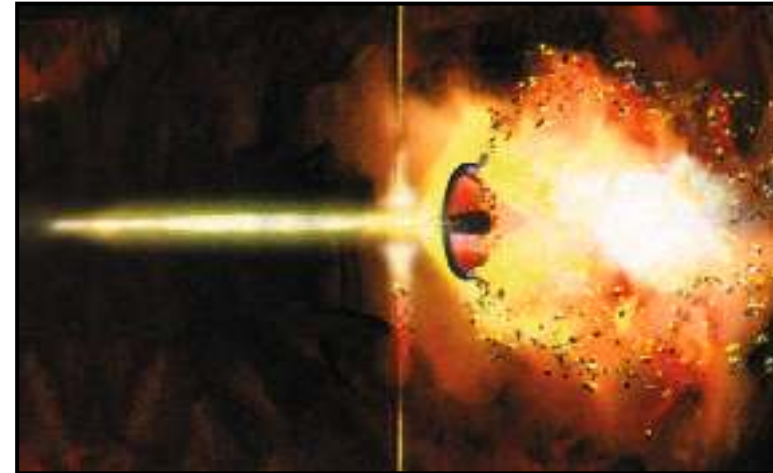


Shaped Charges



Shaped Charge Technology

- Jet tip velocities can reach 10KM/s @ 40 μ s
- Acceleration rate 25 million g
- If the event could be prolonged to last 1.5 sec's it would reach the speed of light
- Pressure created on the surface of the target is 10 Million Bar/Atmospheres
- Jet behaves like a fluid but x-ray diffraction has shown it remains solid
- Temperatures of 450 °C have been recorded (melting temp for copper is 1,085 °C)
- Performance effected by, cone angle, liner material, stand off (air gap) from target.



Shaped Charge Technology

- Can be either pre formed or hand filled with Plastic Explosives on site
- Designed to fit specific targets
- Can be fitted externally or internally
- Can be deployed by divers or ROV
- Multiple charges can be initiated at the same time
- Typically contain less explosives than collision effect charges
- Produces a much neater cut than collision effect charges





Historical Decommissioning Projects

Emerald Field

- The Emerald field development was located in the UK Sector of the northern North Sea, in approximately 150 m of water.
- The field was abandoned after economic production could not be sustained.
- Explosives services were employed to assist in the removal of the associated facilities. These were comprised of:
 - Eight mooring piles
 - Six mooring chains
 - Sixteen subsea wellheads
 - Four riser bases
 - Eight riser buoyancy tanks
 - Tripod mooring system (TMS)



Maureen Alpha Wellhead Template Removal

- After the removal of the Maureen Alpha platform, the wellhead template remained in situ and was to be removed in sections.
- This involved cutting a vast series of tubulars ranging from 10 inches OD to 80 inches.
- 77 outside circular explosive shaped charges were deployed
- Up to 8 Charges were deployed at a time.
- The template was cut into eight separate sections each weighing 65 tonnes each and recovered using the vessel crane.



Hutton TLP Wellhead Template and Foundation Removal

- Following the release and removal of the Hutton TLP, the wellhead template, wellheads, and tension leg foundation piles remained in situ and were to be removed in sections.
- This involved cutting a vast series of tubulars ranging from 16" OD to 72" OD.
- 54 outside circular explosive shaped charges and over 30 wellhead charges were used.
- Within the subsea template, there remained 27 wellheads and their associated casing strings.
- To minimize dive and vessel time, multiple charges were run per single initiation. Therefore, up to six wellheads could be recovered after each run.



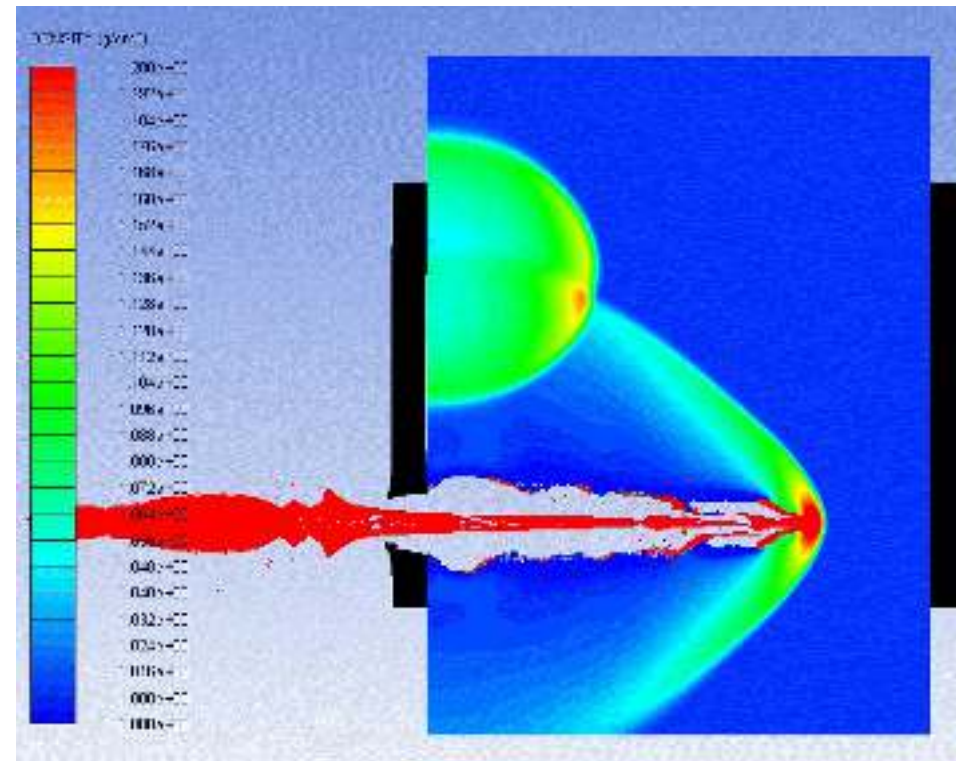


Innovation & Engineering

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Multi-disciplinary design and engineering team provides:

- Extensive capabilities including:
 - Advanced analysis (FEA and CFD)
 - Mechanical
 - Structural
 - Energetics
- Fully integrated draughting and 3D animation service
- Full project execution capability, including supply chain management
- 3D printing and modelling capabilities



Test Facilities

- Two secure sites located within 40 minutes of Aberdeen (54 acres and 5 acres)
- Fully licensed for explosive component manufacture, assembly and testing
- Wet and dry test capabilities
- Capability to fully instrument high-speed events with bespoke data acquisition tools
- Specialist high-speed camera to record test events
- Load-out area for crane deployment
- Equipment testing and commissioning
- Suitable for ROV and diving operations
- Perforating charge and high pressure test chambers



Crude Oil Storage Tank Removal

- Earlier this year SPEX were approached by a client about the feasibility of using shaped charges to assist with the removal of two large COS Tanks from one of their assets.
- Each tank measured approx 9m Dia and stood 90m tall.
- During the operation the load of each tanks would be suspended from the hooks of a HLV.
- There were initial concerns that the use of explosives could cause damage to the Platform legs, the suspension rigging, the HLV and the 2 WROV's that would be in the water at the time of the detonation.



Crude Oil Storage Tank Removal

- SPEX were able to demonstrate, through our modelling and simulation methods that we could design a charge capable of performing the necessary cuts with sufficiently small amounts of explosives that no additional damage to other assets would be caused.
- After designing the charges we did a live field trial to demonstrate the effectiveness of the charge design.
- Prior to going offshore we engaged with the appropriate environmental bodies.
- Last month the project was completed successfully.





Benefits of Using Explosives

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- Requires less personnel
- Minimal deck space
- Faster Mob and Demob times
- Multiple cuts can be achieved simultaneously
- Repeat cuts, if required, can be achieved in minimal time
- Deep water capability
- Less cost “Equipment, Personnel, Service, Vessel time”
- Potentially less environmental impact than non explosive cutting methods



Thank you.

