

CASE STUDY | OFFSHORE UK

Delivering Production Optimization via Perforating Solutions to UK Operators

Connex[®] Perforating

THE CHALLENGE

2009 - GEODynamics was contacted by a UK operator operating offshore UK to discuss an eline perforating intervention campaign. The customer was interested in both Razor & Connex[®] perforating technology but after technical meetings discussing both technologies the customer made the decision to proceed with the application of Connex[®] perforating technology to increase production from their well.

The customers goals were to:

- Overcome severe scale build up
- Perforate 4 existing intervals and 1 new zone
- Perforate 7" 29.00 ppf casing
- 4 existing intervals are below a 2.81" restriction in the 4 ½" 12.6 ppf tubing
- The new zone (6ft) is behind the 4 ½" tubing and 7" casing

THE SOLUTION

- Utilize Connex[®] perforating charges to achieve clean and clear perforation tunnels even in a hydrostatically balanced well
- Utilize a 2" 6 spf 60° Phased hollow steel carrier gun system to accommodate the 2.81" minimum restriction.
- Utilize a 2 7/8" 6 spf 60° Phased hollow steel carrier gun system to perforate zone above the 2.81" minimum restriction.

THE RESULTS

Total fluids production increased from 79 barrels a day to 1,935 barrels a day, an increase of two and a half times. This customer plans to utilize Connex[®] in future intervention programs.

PROJECT SUMMARY

Product Name

2" 2007 Connex[®] XDP
Part No: EC2-20A0722-RC

2 7/8" 2715 Connex[®] XDP
Part No: EC2-27A1522-RC

Both Guns 6 spf 60 Degree

Region

North Sea

Well Type

Deviated Oil Producer

Formation

Sandstone

Stages

65 stages

Depth

~10,950 Feet

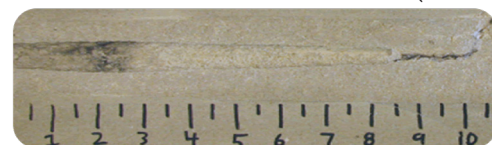
Tubing/Casing

Runs 1-4: 4 1/2" 12.6 PPF 13 Cr

Run 5: 4 1/2" 12.6 PPF 13 Cr &

7" 29.0 PPF L-80

Connex[®] CLEAN PERFORATION TUNNEL (OVERBALANCED)



CONVENTIONAL API 19-B CHARGE TUNNEL (OVERBALANCED)





CASE STUDY | OFFSHORE UK

Delivering Connex® Perforating Technology to North Sea Operators

Successful Perforating Design in Difficult Well

THE CHALLENGE

Dual casing strings, cement between the casings and in the annulus and near wellbore damage which was not being overcome by standard perforating protocol. Production had ceased due to the near wellbore damage mechanism and the well was providing a real challenge for the customer to recover the remaining reserves which were estimated at over 3 million barrels. The operator was left to consider what the options may be other than a full hydraulic fracture treatment. As is always the case the customer was looking for a cost effective solution to regain connectivity from the wellbore to the reservoir and gain access to those unproduced barrels.

The customers goals were to:

- Reduce cost via the use of slickline intervention only
- Optimally perforate dual cemented casing string of 4 ½" 15.1 ppf production casing and 7" 32.00 ppf drilling liner
- Overcome near wellbore damage mechanism
- Perforating accuracy on slickline

THE SOLUTION

- Utilize 3 1/8" 6 spf Connex® perforating charges to achieve clean and clear perforation tunnels and improve the entrance hole size in the outer casing string.
- Utilize a 2 7/8" StimGun assembly to treat the near wellbore area and overcome the near wellbore damage mechanism.
- Utilize GEODynamics GFire and GLog services to deliver on depth perforating services on slickline!

THE RESULTS

The customer had planned for a 150 bbl/day uplift in production prior to the well intervention, the improved perforating performance of the 3 1/8" Connex® gun system in the 4 ½" liner saw production improve by 1,100 bbls/ day. Needless to say the stimgun part of the operation was not required which further improved the economics of the intervention. Last but not least GEODynamics were able to perforate on depth on slickline due to our slickline perforating procedures.

PROJECT SUMMARY

Product Name

3 1/8" 3323 Connex® XDP
Part No: EC2-33A2322-RC

6 spf 60 Degree

Region

North Sea

Well Type

Deviated Oil Producer

Formation

Sandstone

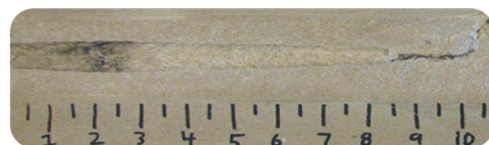
Depth

~13,200 Feet

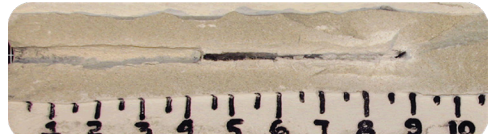
Tubing/Casing

4 1/2" 15.1 PPF 13 Cr &
7" 32.0 PPF L-80

Connex® CLEAN PERFORATION TUNNEL (OVERBALANCED)



CONVENTIONAL API 19-B CHARGE TUNNEL (OVERBALANCED)





CASE STUDY | OFFSHORE UK

DELIVERING INJECTOR WELL RESULTS VIA ELINE AND ELIMINATING UNDERBALANCED TCP

Connex® Injector Well Perforating

THE CHALLENGE

2010 - GEODynamics was contacted by an international operator operating offshore UK to discuss perforating options available from GEODynamics for injector well perforating. The clients previous injector wells struggled to meet the required injection rates with several perforating options already utilized. On previous perforating operations it was noted that the wells did not take any fluid at the time of perforating, this highlighted a near wellbore problem that conventional perforating means were not able to overcome.

The customers goals were to:

- Observe losses at the time of perforating
- Eliminate the need for underbalance TCP operations and the associated rig time.
- Eliminate the need for Dynamic Underbalance and the additional eline runs required.
- Perforate overbalance on eline
- Meet their injection target

THE SOLUTION

- Utilize Connex® perforating charges to achieve clean and clear perforation tunnels even in a hydrostatically overbalanced well
- Utilize a 4 1/2" 12 spf CONNEX® gun system based on iPerf analysis.
- Utilize customers eline service provider to deploy the gun system.

THE RESULTS

For the first time the customer observed fluid losses immediately upon perforating the casing. After running completion injection operations commenced with the customer achieving their required injection rates. Connex® gun systems are now used by the customer for both injector and producing wells.

PROJECT SUMMARY

Product Name

4 1/2" 3323 Connex® XDP
Part No: EC2-33A2322-RC
12 spf 45/135 Degree

Region

North Sea

Formation

Sandstone

Well Type

Deviated Injector

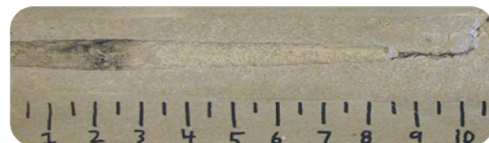
Depth

~10,100 Feet

Casing

7" 29.0 PPF 13cr

Connex® CLEAN PERFORATION TUNNEL (OVERBALANCED)



CONVENTIONAL API 19-B CHARGE TUNNEL (OVERBALANCED)





CASE STUDY | OFFSHORE UK

Delivering Production Optimization via Perforating Solutions to UK Operators

Connex® Perforating

THE CHALLENGE

2009 - GEODynamics was contacted by a UK operator operating offshore UK to discuss an inline perforating intervention campaign. The customer was interested in both Razor & Connex® perforating technology but after technical meetings discussing both technologies the customer made the decision to proceed with the application of Connex® perforating technology to increase production from their well.

The customers goals were to:

- Overcome severe scale build up
- Perforate 4 existing intervals and 1 new zone
- Perforate 7" 29.00 ppf casing
- 4 existing intervals are below a 2.81" restriction in the 4 ½" 12.6 ppf tubing
- The new zone (6ft) is behind the 4 ½" tubing and 7" casing

THE SOLUTION

- Utilize Connex® perforating charges to achieve clean and clear perforation tunnels even in a hydrostatically balanced well
- Utilize a 2" 6 spf 60° Phased hollow steel carrier gun system to accommodate the 2.81" minimum restriction.
- Utilize a 2 7/8" 6 spf 60° Phased hollow steel carrier gun system to perforate zone above the 2.81" minimum restriction.

THE RESULTS

Total fluids production increased from 79 barrels a day to 1,935 barrels a day, an increase of two and a half times. This customer plans to utilize Connex in future intervention programs.

PROJECT SUMMARY

Product Name

2" 2007 Connex® XDP
Part No: EC2-20A0722-RC
2 7/8" 2715 Connex® XDP
Part No: EC2-27A1522-RC

Both Guns 6 spf 60 Degree

Region

North Sea

Well Type

Deviated Oil Producer

Formation

Sandstone

Depth

~10,950 Feet

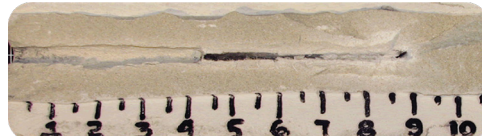
Tubing/Casing

Runs 1-4: 4 1/2" 12.6 PPF 13 Cr
Run 5: 4 1/2" 12.6 PPF 13 Cr
& 7" 29.0 PPF L-80

Connex® CLEAN PERFORATION TUNNEL (OVERBALANCED)



CONVENTIONAL API 19-B CHARGE TUNNEL (OVERBALANCED)





CASE STUDY | OFFSHORE UK

Delivering Production Optimization via Perforating Solutions to UK Operators

Connex® Successful in Multi Well Program

THE CHALLENGE

A North Sea operator has several wells in which the same intervals are re-perforated on a 12 to 18 month cycle, this is required due to a decline in production over the stated time frame. The client is very proactive in looking for new technology to increase production and decided that Connex® perforating technology was worth introducing to their operations to meet this goal. This was an excellent opportunity to compare Connex® against the perforating technologies that had been used previously.

The customers goals were to:

- Regain lost production
- Unable to apply static underbalance due to open perforations
- Low permeability reservoir
- Complete re-perforations as part of eline intervention campaign

THE SOLUTION

- Utilize 2 7/8" Connex® perforating charges to achieve clean and clear perforation tunnels even in a hydrostatically balanced or overbalanced environment.
- Introduce new top sub to allow maximum running flexibility with perforating gun systems. This sub allowed any gun to be run in any position in the event unforeseen circumstances forced a change in the perforating program.

THE RESULTS

Well 1 – Expected uplift:	100 bbls/day
Actual uplift:	250 bbls/day = 2.50X
Well 2 – Expected uplift:	100 bbls/day
Actual uplift:	275 bbls/day = 2.75X
Well 3 – Expected uplift:	100 bbls/day
Actual uplift:	276 bbls/day = 2.76X

*Note – expected uplift in production figure is customers estimation based on previous perforating of the zones in question.

PROJECT SUMMARY

Product Name

2 7/8" 2715 Connex® XDP
Part No: EC2-27A1522-RC
6 spf 60 Degree

Region

North Sea

Well Type

Deviated Oil Producer

Formation

Sandstone

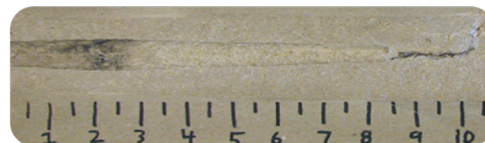
Depth

~25,700 Feet

Casing

Well 1 - 4 1/2" 12.6 PPF 13cr L-80
Well 2 - 5" 18.0 PPF L-80
Well 3 - 7" 26.0 PPF 13cr L-80

Connex® CLEAN PERFORATION TUNNEL (OVERBALANCED)



CONVENTIONAL API 19-B CHARGE TUNNEL (OVERBALANCED)





CASE STUDY | OFFSHORE UK

Bringing TCP Expertise to UK Onshore Operators in a Cost Efficient Manner

Tubing Conveyed Perforating

THE CHALLENGE

2008 - GEODynamics was contacted by an onshore operator in the UK to discuss a unique Tubing Conveyed Perforating application,

The customers goals were to:

- Perforate 6" open hole
- Run & Retrieve TCP gun through 2 7/8" 6.4 ppf tubing
- Use 3/4" sucker rods as the work string to safely deploy the TCP assembly into the open hole
- Utilize a crane in place of a rig
- Use a firing head suitable for the open hole application
- Propose a perforating method that would remove perforating tunnel crushed zone and present a clean tunnel conduit from reservoir to wellbore

THE SOLUTION

- Utilize Connex[®] perforating charges to achieve clean and clear perforation tunnels in a sub hydrostatic well
- Utilize a 2" 6 spf 60° Phased hollow steel carrier gun system to ensure safe retrieval through the 2 7/8" tubing
- Utilize an Electronic Memory Firing Head to overcome any issues presented by the open hole scenario
- Utilize the 3/4" sucker rods as proposed by customer to ensure job cost was kept to a minimum

THE RESULTS

The sucker rods and pump were pulled from the well, the TCP operation was executed as planned, the rods and pump were rerun and the well was put back on production in a single day.

PROJECT SUMMARY

Product Name

2" 2007 Connex[®] XDP Part
No: EC2-20A0722-RC

6 spf 60 Degree

Region

Onshore United Kingdom

Well Type

Horizontal Oil Producer

Formation

Sandstone

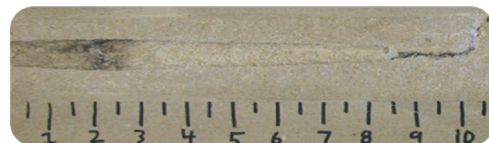
Depth

2,300 Feet

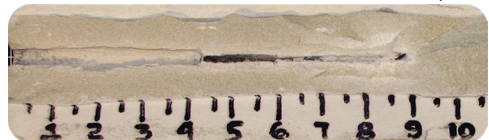
Tubing/Casing

Open Hole

Connex[®] CLEAN PERFORATION TUNNEL (OVERBALANCED)



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Both Guns 6 spf 60 Degree

Region

North Sea

Well Type

Deviated Oil Producer

Formation

Sandstone

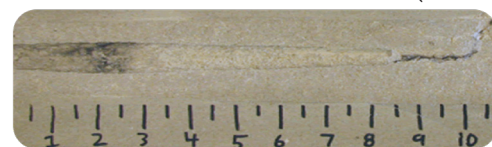
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Tubing/Casing

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7" 32.0 PPF L-80

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CONVENTIONAL API 19-B CHARGE TUNNEL (OVERBALANCED)

