Well
Intervention Workshop
MED
20 September 2022

Preserving and Restoring Structural Integrity of Conductors & Well Casings

Bruce Trader
MADCON Corporation

Preserving & Restoring Structural Integrity of Conductors & Well Casings

Objective:

Structural integrity of the conductor and well casing are critical for the entire life cycle of the well – from drilling and completion to sidetracks and P & A and decommissioning.

This presentation will review the development and design of the Structural Composite Retrofit (SCR) Process. The SCR Process restores structural integrity and provides long term corrosion protection to severely corroded or damaged conductors and well casings (offshore & on land).

- Background
- Process Design Mandate
- Overview of Process
- Summary
- Projects

Preserving & Restoring Structural Integrity of Conductors & Well Casings

Background:

Twenty-two (22) years ago a major international oil & gas company requested a process be designed to restore full structural integrity and provide long term corrosion protection for conductors and surface casings.

After several years of production and less than optimal maintenance, the company had numerous conductors that had severe corrosion and required an immediate solution.

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Process Design Mandate:

- Restore original design capacity.
- Allow future work over and sidetracks to extend well life.
- Minimal to zero hot work.
- Long term corrosion protection – conductor & surface casing.
- Ease of installation in the splash zone.
- Meet regulatory compliance.
- No cofferdam required.
- Fit within existing conductor guides.
- Work from vessels or the platform and not require barge or rig.
- Eliminate future maintenance.

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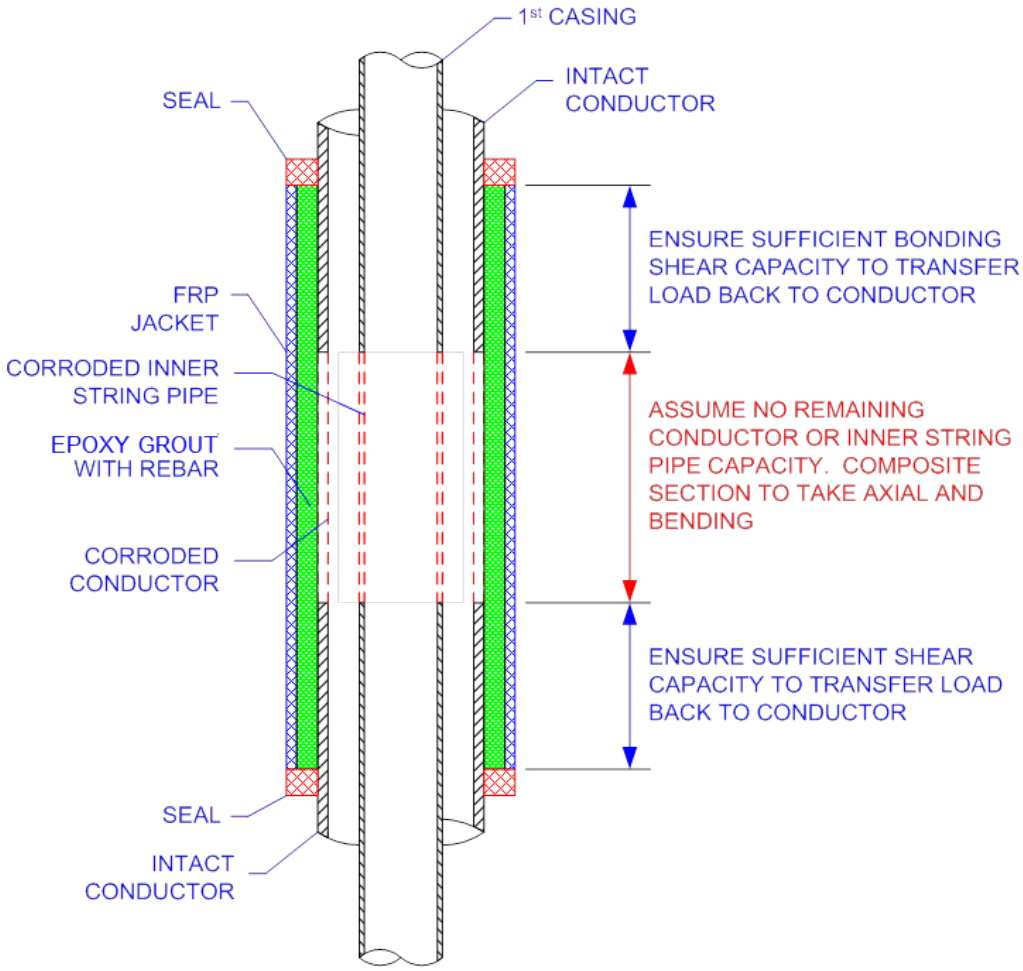
Overview of Process:

- Engineering analysis
- Restore original design capacity

Repaired Capacity

- 780 kips or greater (3,470 kN) axial
- 8,196 kips-in (926 kNm) bending



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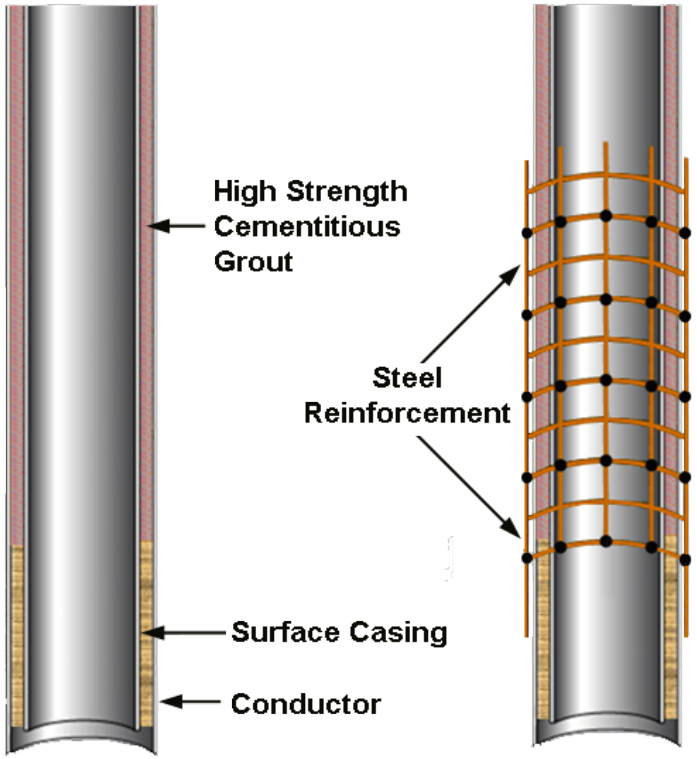
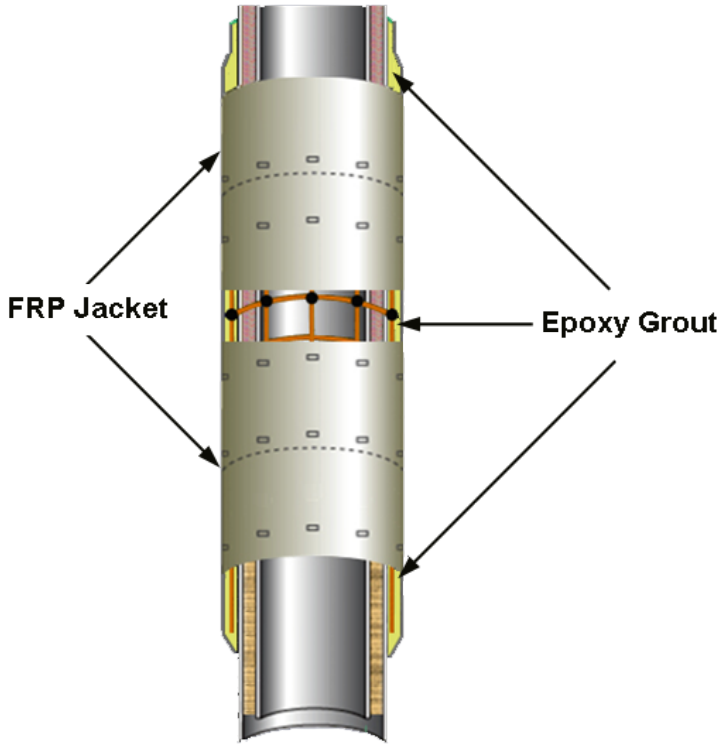
Overview of Process:

- Precision Cementitious Grouting- Surface Casing to Conductor
- Precision Epoxy Grouting- Conductor to FRP Jacket





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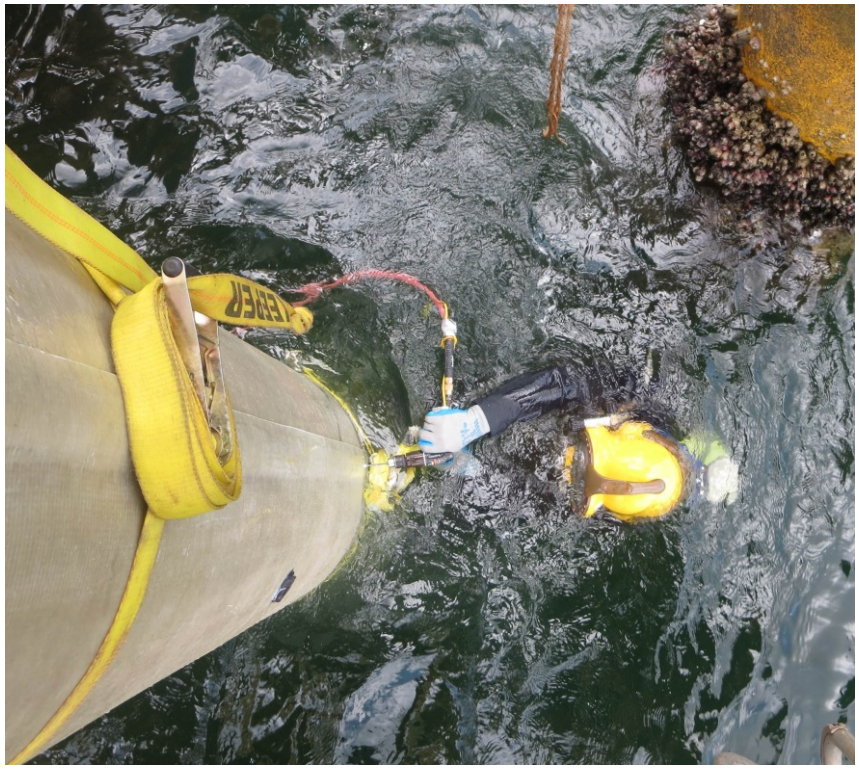
Overview of Process:

- Lightweight materials - composites
- Easily installed in splash zone



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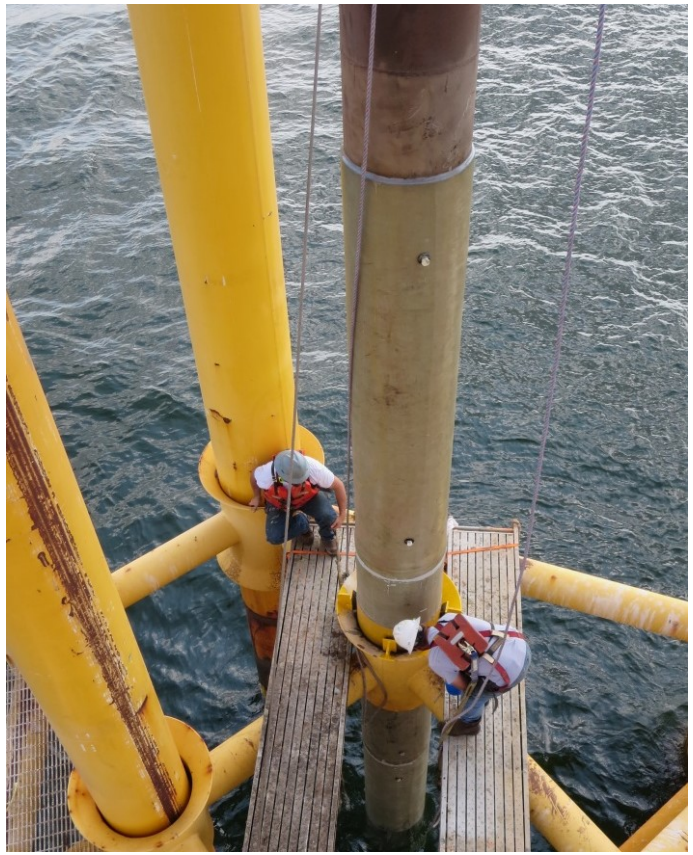
Overview of Process:

- Fit within existing guides
- Minimal or zero hot work



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Overview of Process:

- Work from vessels or the platform
- Does not require barge or rig

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Overview of Process:

- Long term corrosion protection
- Eliminate future maintenance

May 1994
(Initial Installation)

October 2016
(22 Years After Installation)
Now 27 years & counting.

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Summary:

Twenty-two (22) years ago a major international oil & gas company requested a process be designed to restore full structural integrity and provide long term corrosion protection for conductors and surface casings.

- ✓ Design mandate was achieved.
- ✓ To date, the SCR Process has been used to restore original design capacity and provide long term corrosion protection on hundreds of wells.
- ✓ Over forty of these repairs were to provide full structural restoration of collapsed wells.

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Case Study:

- Operator planned sidetrack
- Heavy external corrosion / wall loss.
- Work performed from platform.
- Total repair 23 meters. (-)3 to (+)20 well head.
- Full structural restoration plus long term corrosion protection.
- Project duration 5 days utilizing 8-man crew.

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Case Study:

- Heavy external corrosion / wall loss / perforations.
- Work performed from platform.
- Total repair 23 meters. (-)3 to (+)20 well head.
- Full structural restoration plus long term corrosion protection.
- Project duration 9 days utilizing 8-man crew.

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Case Study:

- Parted Conductor.
- Work performed from platform.
- Total repair 23 meters. (-)3 to (+)20 well head.
- Full structural restoration plus long term corrosion protection.
- Project duration 10 days utilizing 8-man crew.

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Case Study:

- Collapsed Well.
- Prior inspections reported no abnormal operating conditions.
- MADCON inspection identified well had collapsed.

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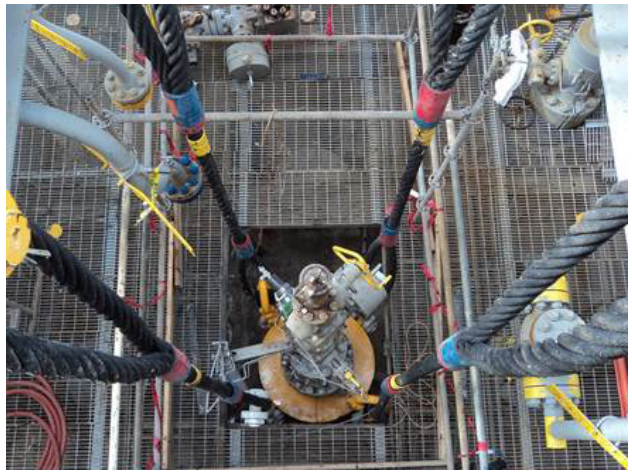

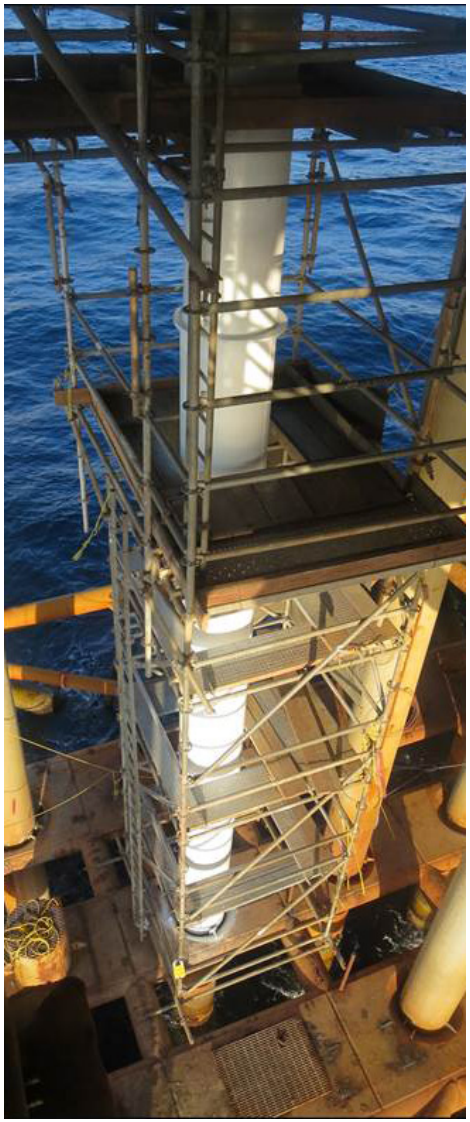

Case Study:

- Designed / Engineered lifting mechanism that did not require rig or barge.
- Total repair 23 meters. (-)3 to (+)20 well head.
- Full structural restoration.
- Project duration 12 days utilizing 8-man crew.

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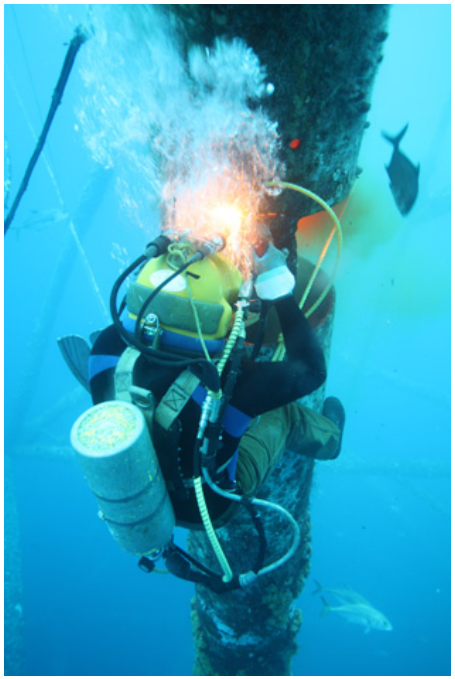

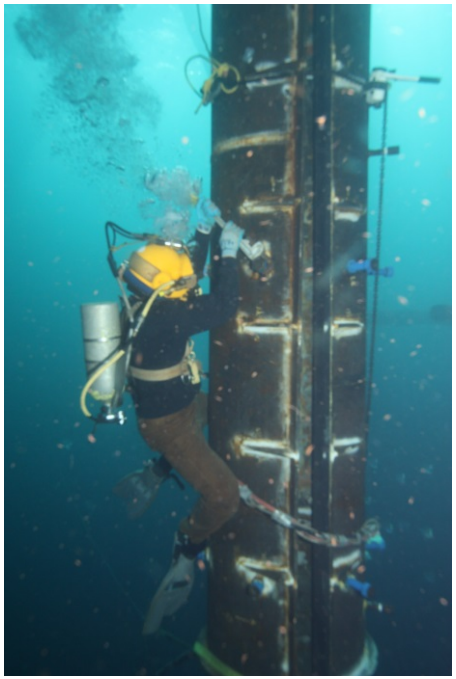

Case Study:

- Sub Sea Parted Conductor.
- Grouted Conductor to SC Annulus.
- MADCON Structural Bonded Clamp.
- (-)25 to (-)20 meters.
- Full structural restoration.
- Project duration 11 days utilizing 8-man crew.

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Case Study:

- Land Based Collapsed Well.
- Hidden corrosion just below ground interface.
- MADCON Structural Bonded Clamp.
- Full structural restoration.
- Project duration 2 days with 4-man crew

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Case Study:

- Five Year Maintenance & Repair Contract.
- Land Based Wells for U.S. Strategic Petroleum Reserve (Operator: Fluor Federal Petroleum Operations)
- Exposed Casing In Concrete Sump Creates Hot Spot For Corrosion.
- MADCON SCR Process For Corrosion Protection And Casing Reinforcement.

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Case Study:

- When operator excavated to perform maintenance on valves; extreme corrosion was discovered.
- Due diligence emergency strengthening of high temperature well.
- Four-man crew; 3 days on site. Total cost: $100,000 USD
- Immediate cost savings to customer: $750,000 USD

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Case Study:
- Parted Conductor.
- Grouted Conductor to SC Annulus.
- MADCON SCR Process Type 4 Bonded Sleeve Employed for Structural Repair

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Case Study:

- Parted Conductors.
- MADCON SCR Process Type 4 Bonded Sleeve Employed for Structural Repair

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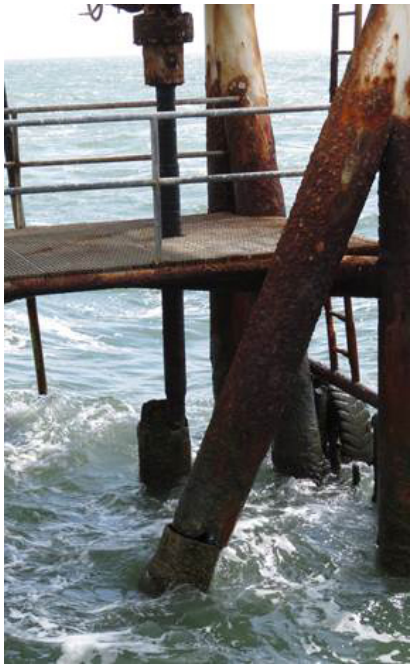

Case Study:

- Parted Conductor.
- Corroded / missing section surface casing.
- Production casing reinforced with carbon fiber.
- MADCON SCR Process Type 4 Bonded Sleeve Employed for Structural Repair

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Case Study:

- Surface casing leaking.
- Installed carbon fiber to reinforce SC and stop leak.
- MADCON SCR Process Type 4 Bonded Sleeve

Employed for Structural Repair & Long-Term Corrosion Protection

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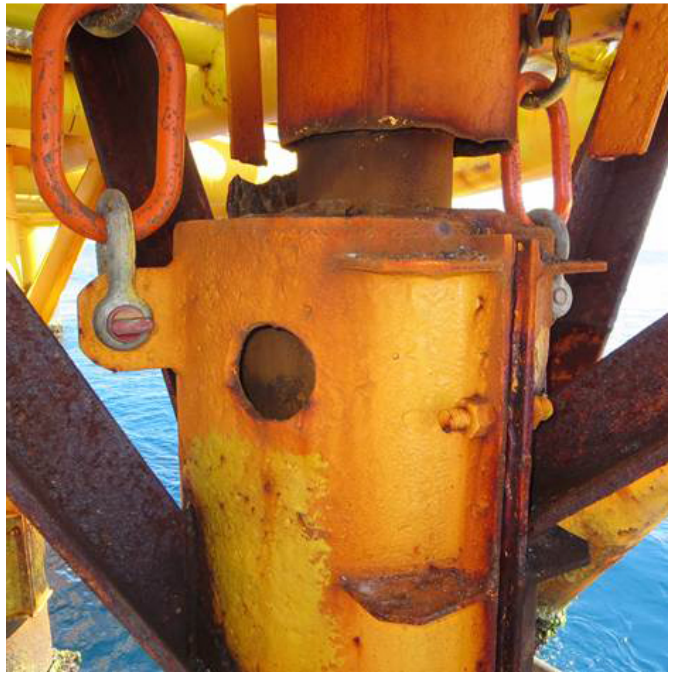

Case Study:

- Several costly, unsuccessful attempts to P & A.
- Removed multiple friction clamps that had been installed as prior repairs.
- Friction clamps create hot spot for cervice corrosion.
- Removed what was left of surface casing to access production casing.
- Multiple plies carbon fiber to reinforce production casing to hold 5,000 psi.
- MADCON SCR Process Type 4 Bonded Sleeve Employed for Structural Repair

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Case Study:

- 24” conductor corroded and separated
- Conductor guide corroded and missing
- Allowed conductor and 20 inch to bang around hitting horizontals
- Created cracks both sides of 20 inch

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Case Study:

- MADCON SCR Process Type 4 Bonded Sleeve Employed for Structural Repair
- New conductor guide frame installed

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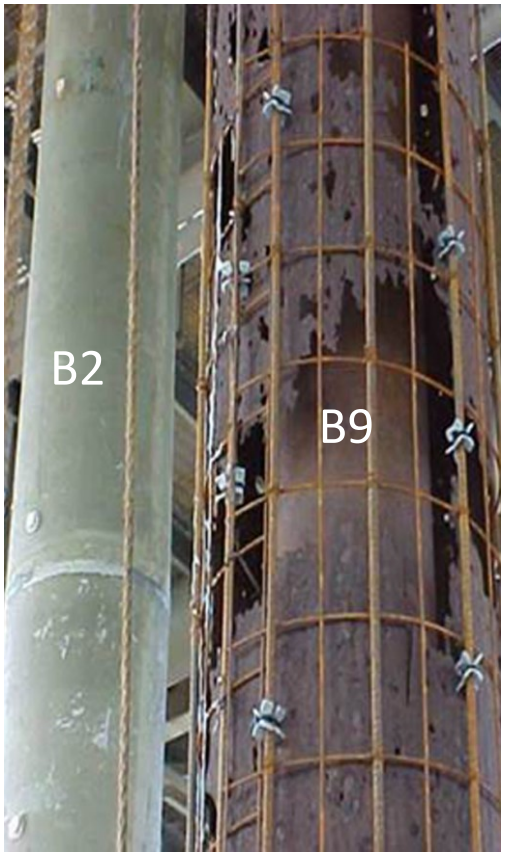
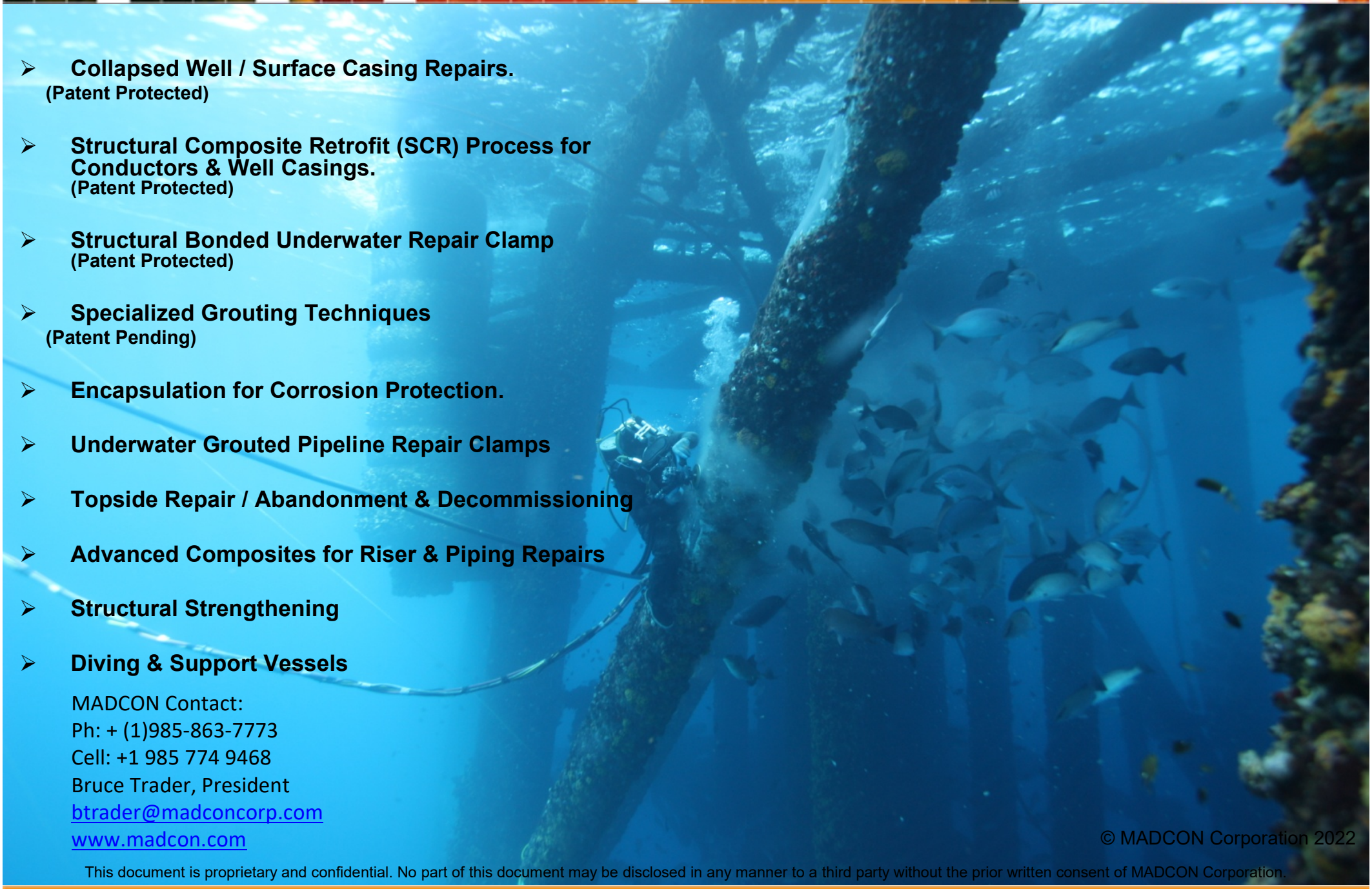


B-2 and B-9 Conductor
Structural Restoration
May 2000

Same Conductors (B-2 & B-9) September 2019.

22 Years & Counting

MADCON CORPORATION



- **Collapsed Well / Surface Casing Repairs.**
  (Patent Protected)
- **Structural Composite Retrofit (SCR) Process for Conductors & Well Casings.**
  (Patent Protected)
- **Structural Bonded Underwater Repair Clamp**
  (Patent Protected)
- **Specialized Grouting Techniques**
  (Patent Pending)
- **Encapsulation for Corrosion Protection.**
- **Underwater Grouted Pipeline Repair Clamps**
- **Topside Repair / Abandonment & Decommissioning**
- **Advanced Composites for Riser & Piping Repairs**
- **Structural Strengthening**
- **Diving & Support Vessels**

MADCON Contact:
Ph: + (1)985-863-7773
Cell: +1 985 774 9468
Bruce Trader, President
btrader@madconcorp.com
www.madcon.com