LETSGLOBAL
life extension of technical structures

Fatigue Life Improvement for Offshore Applications
3-Day Technical Training Course

DAY 1 — Fundamentals of Fatigue in Offshore Structures

1. Introduction to Fatigue in Marine and Offshore Environments
- Offshore loading conditions: waves, wind, currents, vortex shedding
- Fatigue in welded joints and critical details
- Failure modes in jackets, topsides, FPSOs, risers, moorings, subsea components
- Corrosion and marine growth influence

2. Stress Concentration and Welded Joint Behavior
- Stress concentration factors in offshore structures
- Residual stresses from welding
- S–N curves and material behavior
- Environmental effects: seawater corrosion, cathodic protection, coatings

3. Standards and Design Frameworks
- DNV, API, ISO, IIW fatigue design rules
- Detail classification and fatigue categories
- Integrity management and inspection requirements

4. Case Studies — Fatigue Failures
- Examples of offshore structural cracking
- Root-cause analysis and lessons learned

DAY 2 — Fatigue Life Improvement Techniques & Ultrasonic Peening

1. Overview of Fatigue Life Improvement Methods
- Weld toe grinding, TIG dressing, shot peening, hammer peening
- Ultrasonic Impact Treatment (Ultrasonic Peening)

2. Ultrasonic Peening Treatment (UPT): Principles & Science
- Ultrasonic vibration and impact fundamentals
- Residual stress modification and compressive layer formation
- Weld toe geometry improvement and microstructure refinement
- Benefits in offshore environments

3. Application Procedures
- Equipment and operation
- New welds vs. existing welds
- Accessibility challenges
- Safety, QA/QC, documentation

4. Qualification & Certification
- IIW and DNV requirements
- Demonstrating improvement using measurements
- Integration into Life Extension Plans

5. Practical Demonstration
- Simulated or live demonstration of ultrasonic peening
- Hands-on practice

DAY 3 — Engineering Assessment, Life Extension & Carbon Footprint Impact

1. Engineering Assessment for Life Extension
- Fitness-for-Service concepts
- Fracture mechanics and crack growth modeling
- Remaining Useful Life (RUL) calculation
- Updated S–N curves after UPT

2. Structural Integrity Management (SIM)
- Inspection planning before/after UPT
- NDT and monitoring systems
- Long-term effectiveness evaluation

3. Carbon Footprint Reduction Through Life Extension
- Delaying structural replacement
- Emissions savings from extending asset life
- ESG alignment

4. Practical Examples & Case Studies
- Offshore wind monopiles, FPSO decks, jack-up legs, tubular joints
- Quantified fatigue improvements (3×–10×)
- Cost–benefit and risk-based decision making

5. Group Exercise / Workshop
- Evaluate welded detail with loading history
- Perform fatigue life calculation before and after UPT
- Propose life-extension strategy and carbon savings