



**SONATS**

Europe Technologies group

**TO INCREASE THE  
FATIGUE LIFE OF  
WELDED  
ASSEMBLIES**

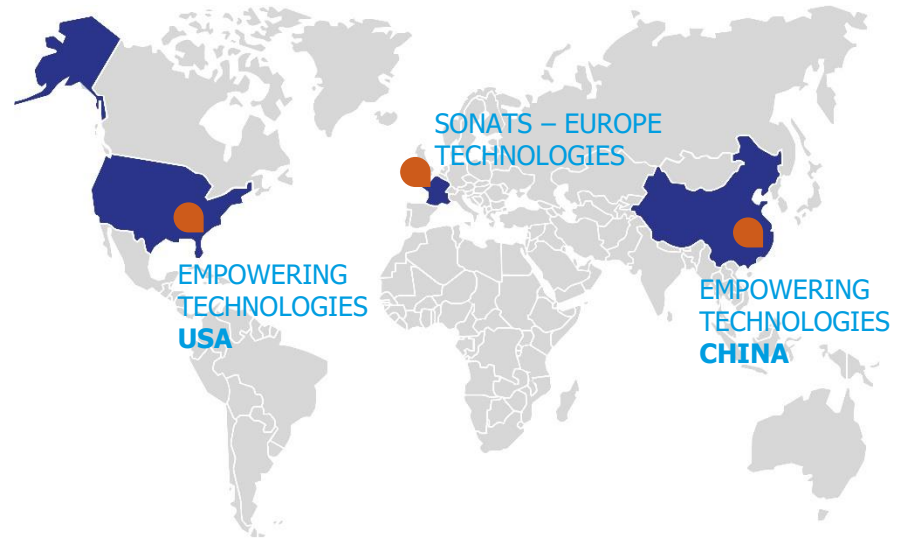
# SONATS & international sites

Specialist in impact surface treatment solutions since 1991



**Technical expertise and material  
characterization laboratory**

**Process development, equipment design,  
manufacture and service of shot peening,  
straightening and UIT**



# Our technologies



## Ultrasonic Peening

Shot Peening (USP)



Needle Straightening/Forming (UNS/UNF)



Ultrasonic Treatment/ Needle Peening (UIT/UNP)



Using our STRESSONIC® technology to peen with

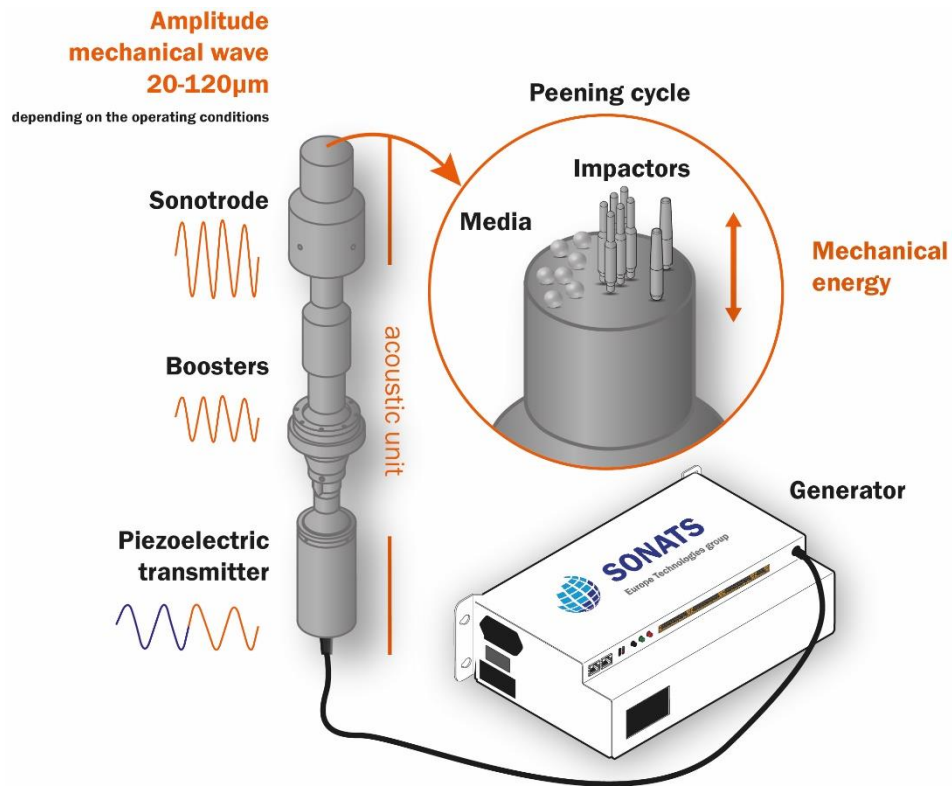
Balls

20 to 50 needles

1 to 7 needles



# STRESSONIC® Technologie

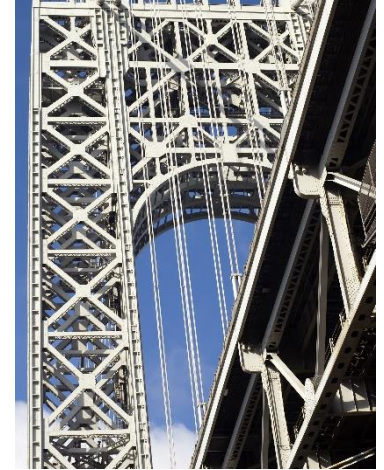


# The UIT – HFMI

process is  
applied to  
**welded  
steel  
assemblies**



**UIT : Ultrasonic Impact Treatment**  
**HFMI : High Frequency Mechanical Impact**



# Introduction to fatigue

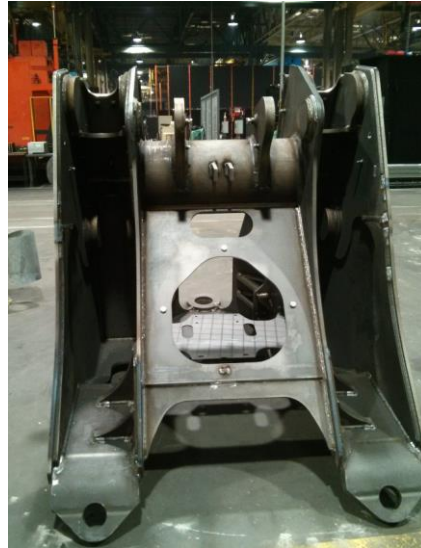


Fatigue of a part or structure is the damage caused by **repeated cyclic stresses**.

Each stress introduces a small defect to the part, and the accumulation of defects leads to the failure of the part or structure.

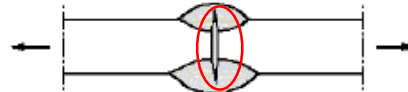
Fatigue cracking can be divided into 2 stages:

- **The initiation of cracks**
- **The propagation of cracks**

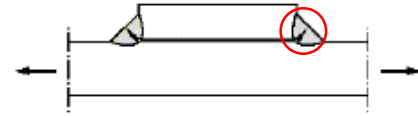


# Fatigue cracks

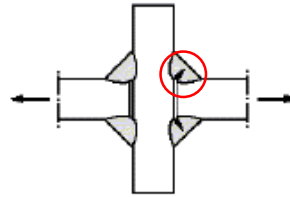
Eligible cases of cracking



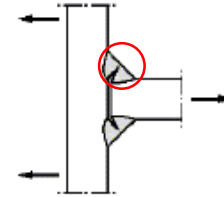
(a)



(b)



(c)



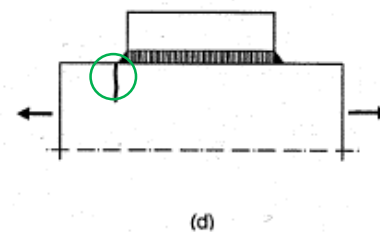
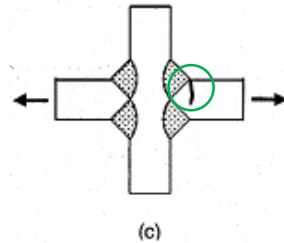
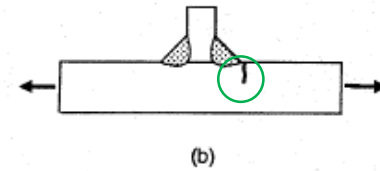
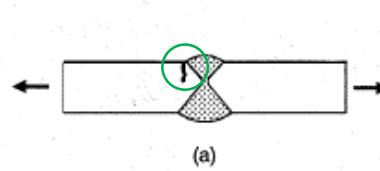
(d)



**Not Applicable**

# Fatigue cracks

Eligible cases of cracking



**Applicable**

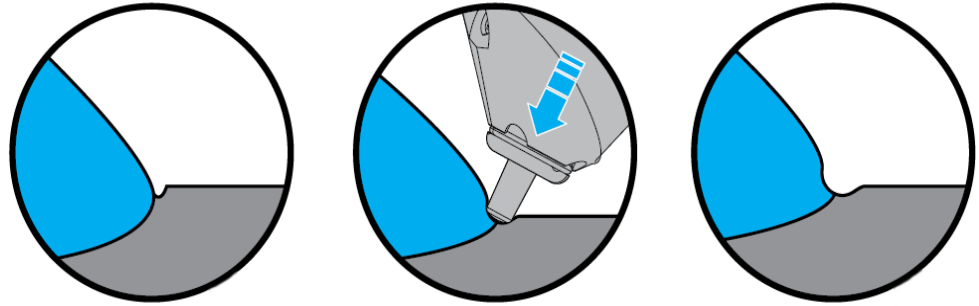


# UIT - HFMI

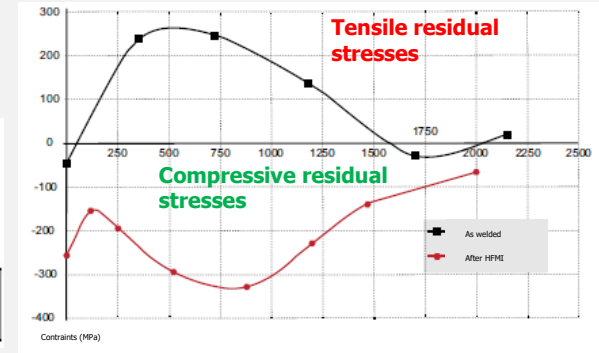
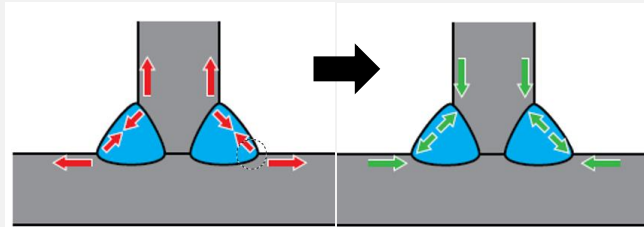
## The effects?



## Weld toe geometry modification



## Conversion of residual stresses from tension to compression



Before peening



After peening



# UIT - HFMI

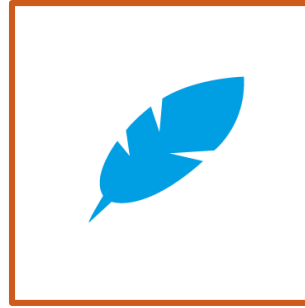
## Why should I use it?



**To increase the fatigue life**



**To increase the fatigue limit**



**To reduce the weight**



**To reduce or compensate the distortions induced by the welding**



**To improve stress corrosion resistance**



**Recommended by the International Institute of Welding**

# UIT - HFMI

## When should I use it?



1

In the design calculations

4

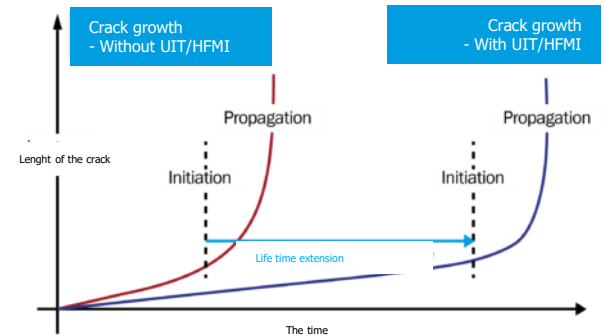
To extend the fatigue life of service parts

2

On new parts production

3

For maintenance and repair



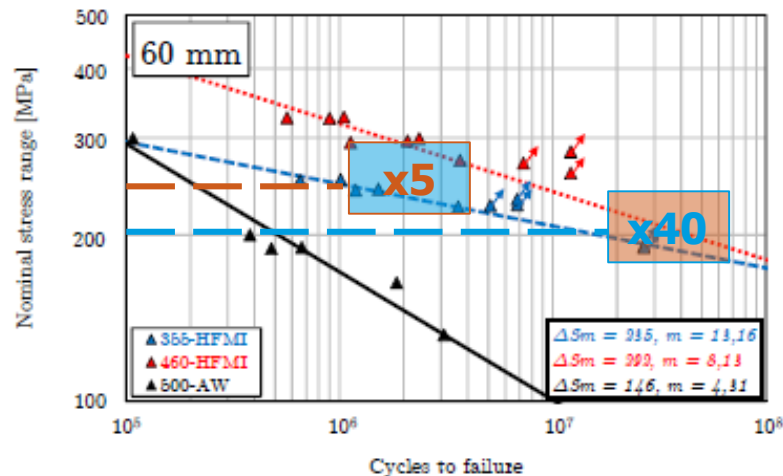
# UIT - HFMI

## Studies and Recommendations



### Fatigue life time increase

The effectiveness of the process has been demonstrated in numerous international research studies.



# Agricultural machinery



## Applications

Loader/tractor attachment parts, ploughs

## Objectives

To move critical fatigue areas to easy design areas

To provide lifetime warranty

## Test Results

- ▶ Validated fatigue lifetime at scale 1
- ▶ Failures observed outside the weld area and heat affected zone



	Welded	After UIT/HFMI
Lifetime	5 years	17,5 years
Increase lifetime		x 3.5

# Handling and transport

## Applications

Lifting arms, Chassis, Trailers, Tippers, Earth movers, buckets

## Issues

Premature cracking on highly stressed weld toes

## Results

- ▶ Improved fatigue life (e.g. 200,000 cycles to 5 million on lifting arms)
- ▶ Increased component strength without changing the design



# Industrial equipments



## Applications

Storage tanks, Pressure vessels  
Crushers, Mixer shafts

## Issues

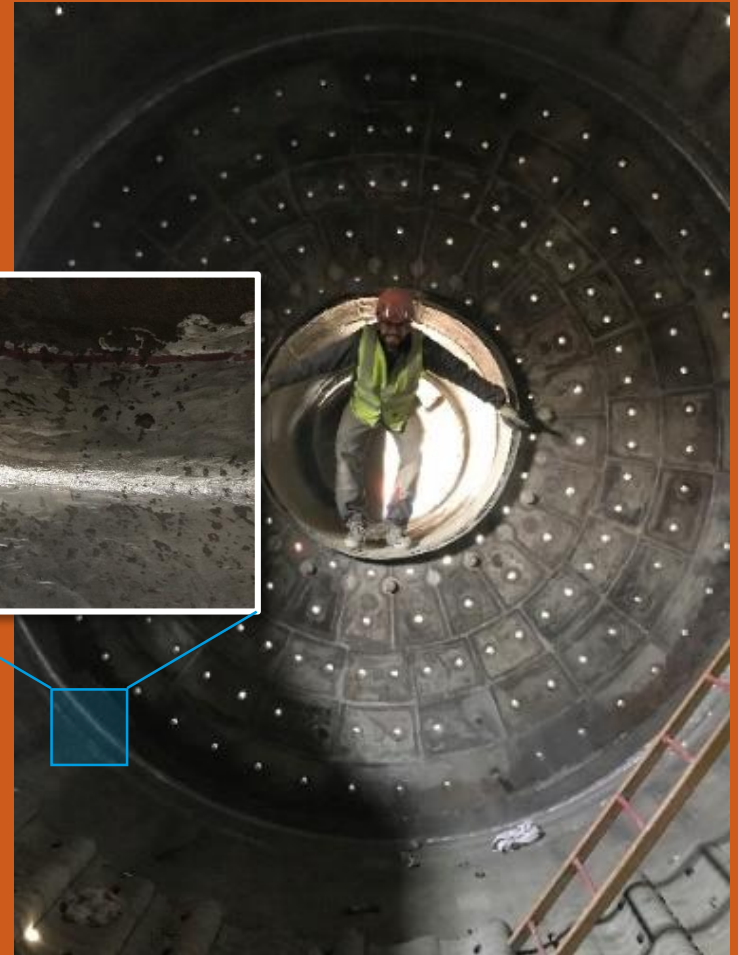
Equipment near the end of its estimated life (In service)

Strong design constraints (weight, pressure...) (New part)

Risk of Stress Corrosion Cracking on weld toe and heat Affected Zone

## Results

- ▶ Extended fatigue life (Repair)
- ▶ Increased fatigue limit (New Equipment)
- ▶ Improved design
- ▶ Improvement of stress corrosion resistance (SCC)



# Infrastructures

## Applications

Bridges (around 100 projects in France, Europe and the USA) including the George Washington Bridge, New York city

## Issues

Fatigue cracking after decades of service  
End of life for some welded joints

## Results

- ▶ Remain in service after repair of already cracked welds
- ▶ or after direct UIT on non-cracked welds
- ▶ Lifetime considered infinite (validated by fatigue tests)



SONATS equipment test on beams scale 1  
**AASHTO Recommendations (USA)**





# Naval / Marine



## Applications

Aluminum or steel structures  
New or under repair ships

## Issues

Increasing safety coefficients  
Cracking in highly stressed areas (engine, propulsion and exhaust areas)  
Hydrogen embrittlement

## Results

- ▶ Return to service
- ▶ Increased lifetime
- ▶ Limitation of SCC risk



# Power Generation



## Applications

Wind turbine nacelles, Masts

## Issues

Increasing the power of wind turbines without changing the nacelle design

## Results

- ▶ Increasing the fatigue limit of heavily loaded areas
- ▶ Validation of our client's production by the certification organization through the UIT Process



# UIT Equipment - **NOMAD**



Central Unit



## Benefits



Portable and lightweight



Speed of treatment  
(30 cm/min)



**Ultrasonic Technology**



Reduced maintenance downtime



Reduction of vibrations and RSI for users



Easy to use

# Laboratory expertise



Study and Analysis  
of materials



Residual stress  
measurements on  
customer site or in our  
laboratory before and after  
treatment

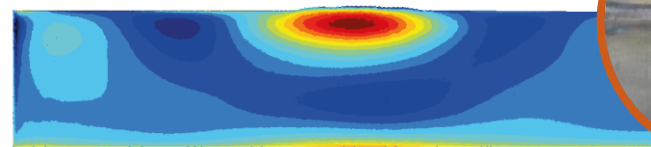


**Incremental  
drilling  
measurement**

**X-ray diffraction  
measurement**



**Measurement  
by contour  
method**



# UIT Equipment - **NOMAD**



## Flexible offerings



**Sales**



**Rental**



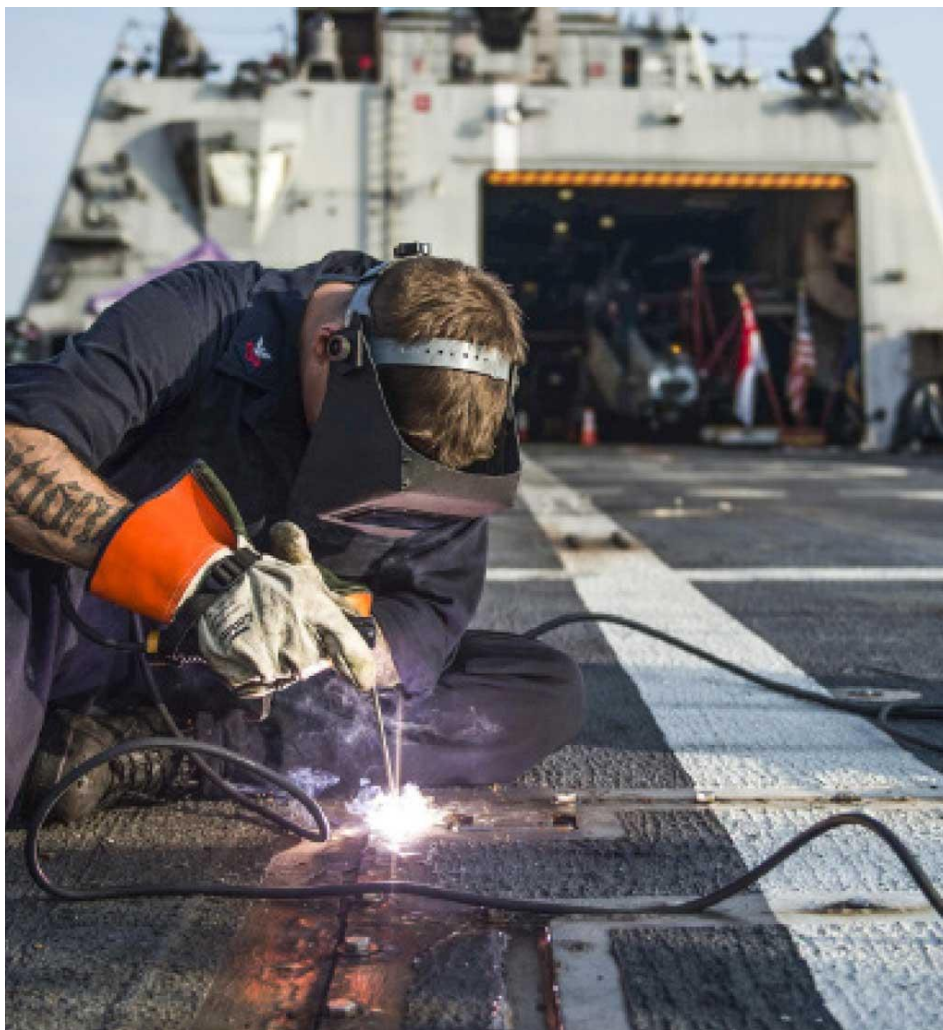
**Service**



**Quick availability of  
the equipment**



**On-site training with  
our technicians**



# Contacts

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