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**ReFaMo Oy**

**Ground-breaking technology to  
monitor real-time fatigue**

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# Steel Fatigue causes big problems

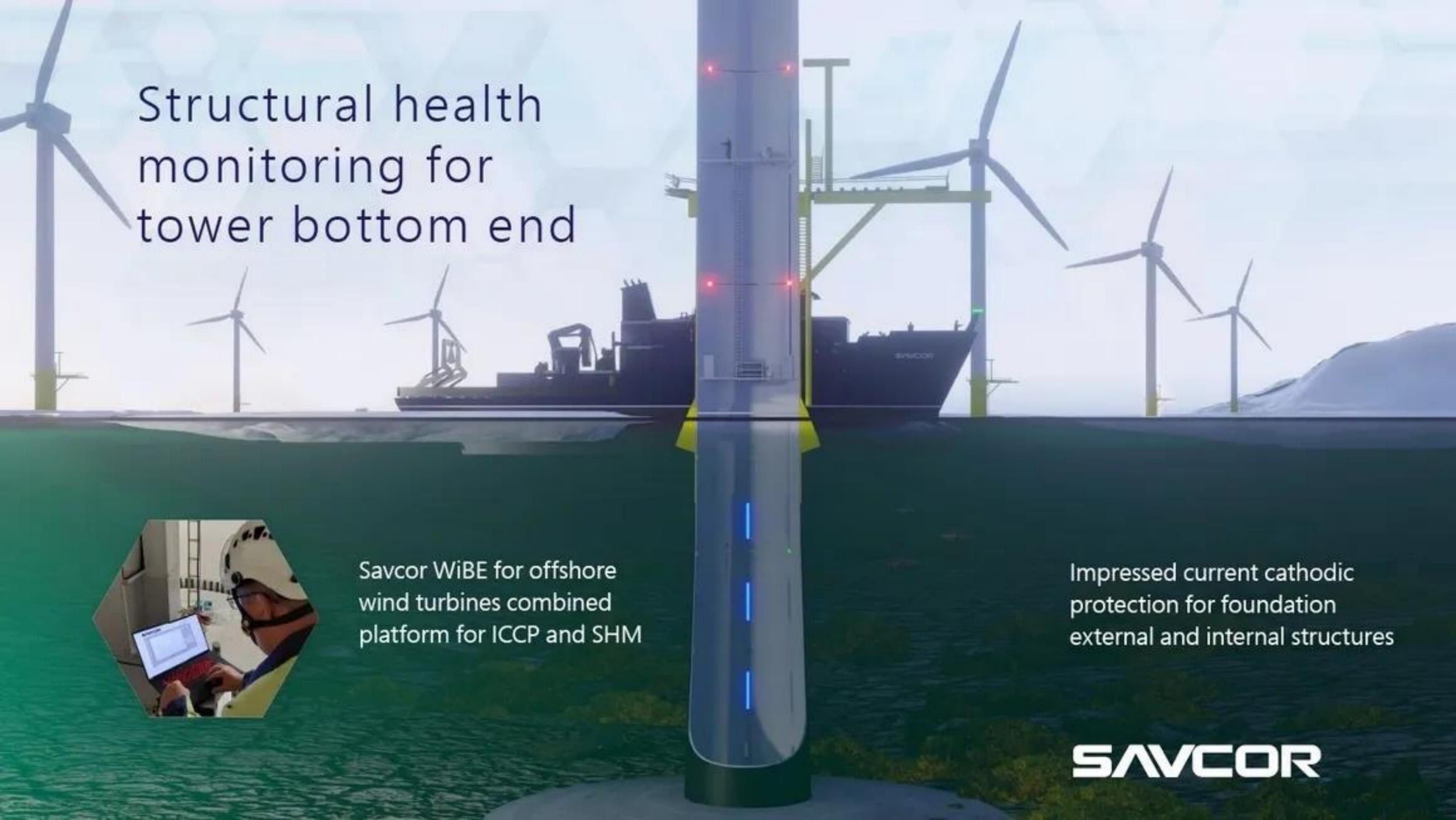
- Unexpected fatigue failures in mechanical structures cause undesirable breaks in production and human safety concerns
- From a design viewpoint, structural integrity is handled by making worst-case assumptions for load conditions, and safe-side estimations for service life
- Unnecessary over-dimensioning of structural components and unexpected failures are both unwanted issues.

# Increased running time - Improved efficiency

- The potential of ReFaMo is identified as a more accurate knowledge of the life of the masts and thus the production time of windmills and a possible extension of lifecycle
- Industry in significant growth. Parks are set up in demanding conditions and it is important to identify how the conditions affect the mast and what the actual lifespan of the mast is under different conditions
- ReFaMo's 4R SW Solution will increase value of Savcor's monitoring system.



# Structural health monitoring for tower bottom end



Savcor WiBE for offshore wind turbines combined platform for ICCP and SHM

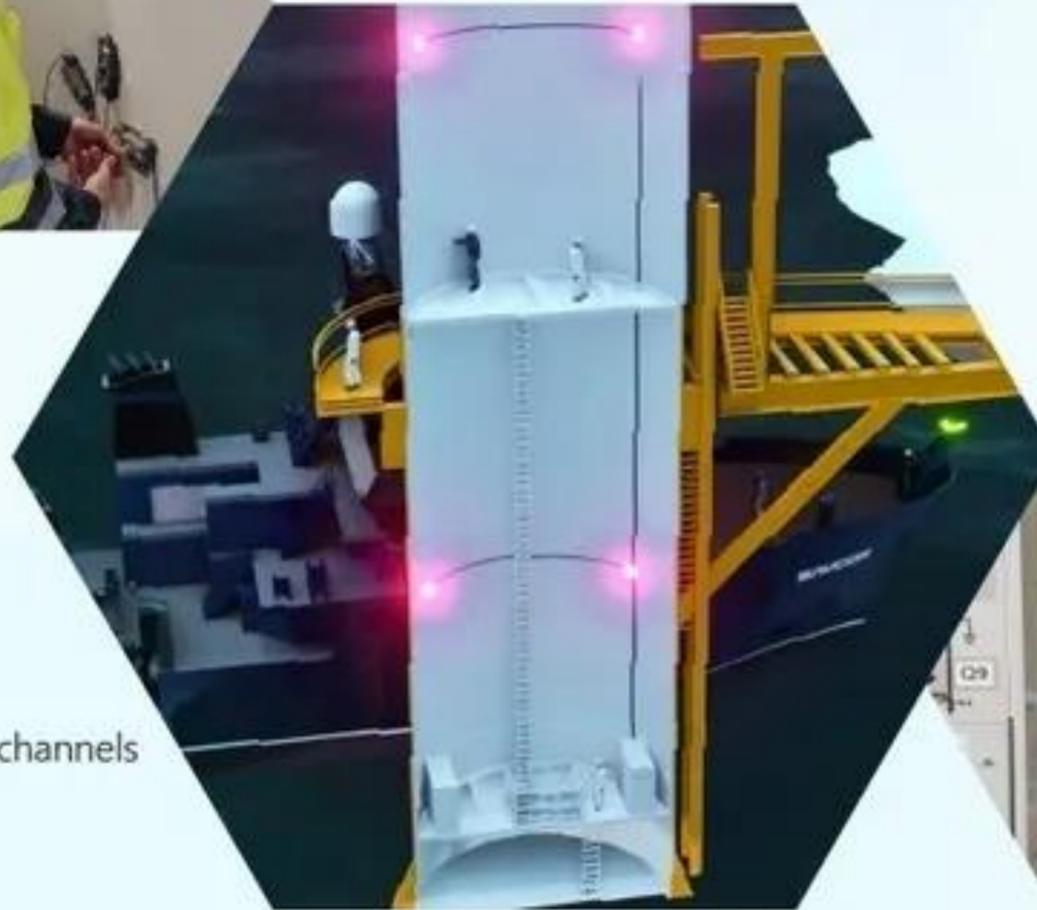
Impressed current cathodic protection for foundation external and internal structures

**SAVCOR**

# WiBE structural health monitoring

## Key features:

- Structural monitoring using fiber optic sensors
- New generation fiber optic data acquisition
- Immunity against EMI and lightning strikes
- Plug-n-play commissioning
- Typical minimum setup includes 2\*acceleration, 4\*strain (temperature compensated), 1\*inclination
- Information of tower bottom lifecycle incidents
- Real-time fatigue monitoring to optimize lifetime extension
- Advanced self diagnostics and alarming functions
- Automatic reporting
- Monitoring helps to improve maintenance and inspection planning
- Optional ICCP system to external/internal foundation channels
- Connection to local SCADA system
- Remote monitoring
- Intuitive graphical user interface with 3D modelling



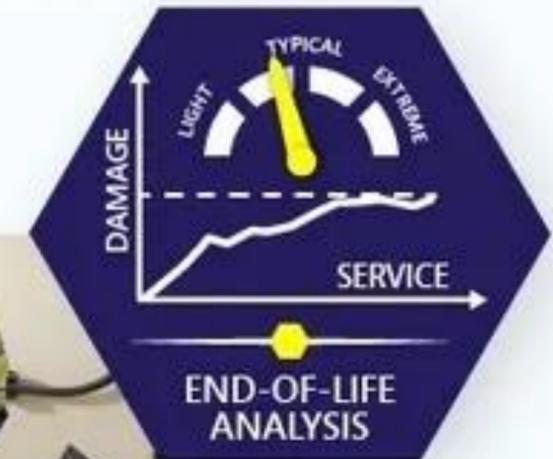
## Sensor specifications:

### Fiber optic sensors

Strain	<0.5%, accuracy $\pm 2000\mu\epsilon$
Accelerometer	1000 pm/g accuracy, $\pm 5g$
Inclinometer	0.1° accuracy, $\pm 5^\circ$
Temperature	$\pm 0.3\%$ , -40 - +65°C
Wavelength range	1525-1575 nm

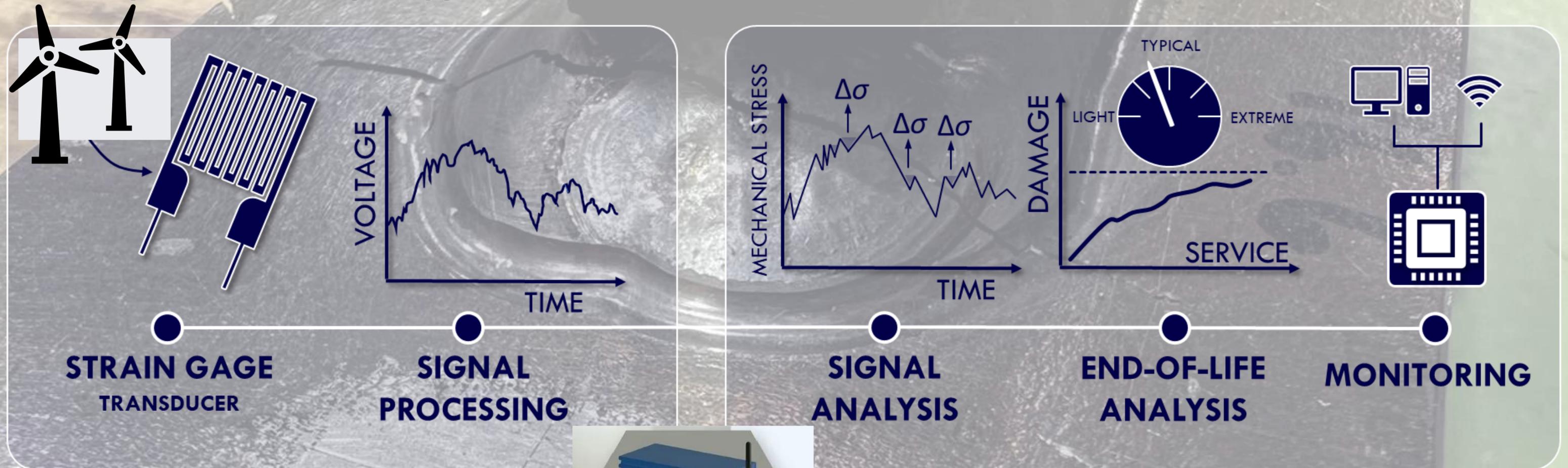
### Control unit

Material	Painted stainless steel
Dimensions	400*600*300
Dimensions w/ICCP	600*800*300
IP classification	IP66



# Patented method for real-time fatigue monitoring

ReFaMo provides a unique approach to solving the issues related to fatigue structural health monitoring



## HARDWARE

### SAVCOR:

- Turning analyzed fatigue data into real time operating condition of an asset
- No competitors in the field of combined measurement and analysis of load histories



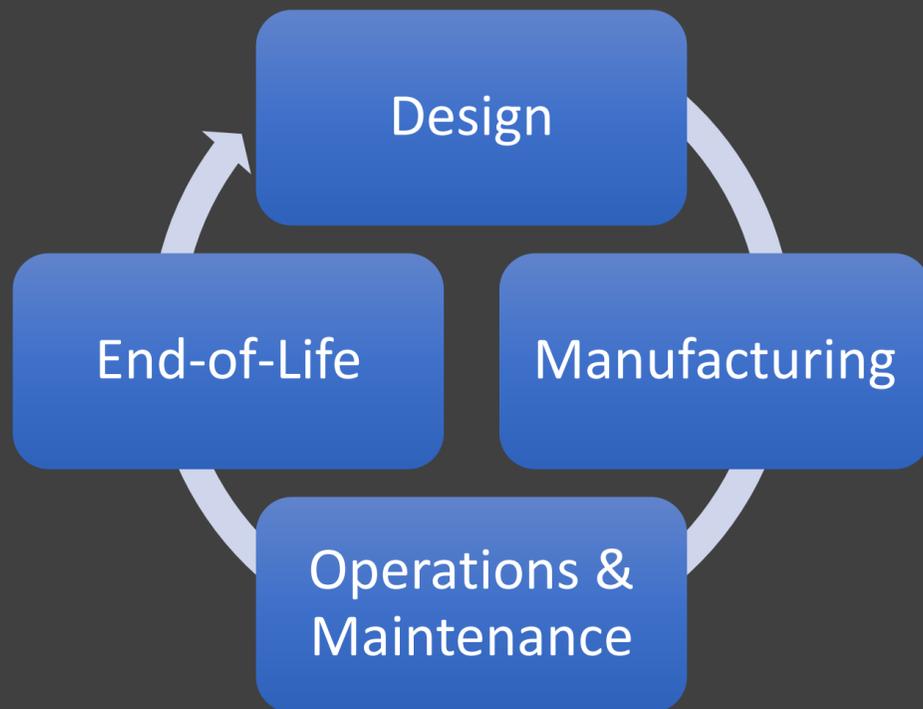
**SAVCOR**

## SOFTWARE

### Partly SAVCOR, analytics ReFaMo:

- A 4R software solution that communicates directly to the end user
- Intellectual property based on decades of metal fatigue research

# ReFaMo BENEFITS



**Life cycle management of structural components**



**Optimal operation of structural applications**



**Verification of design loads**



**Design data for new constructions**



**Minimized need for engineering**