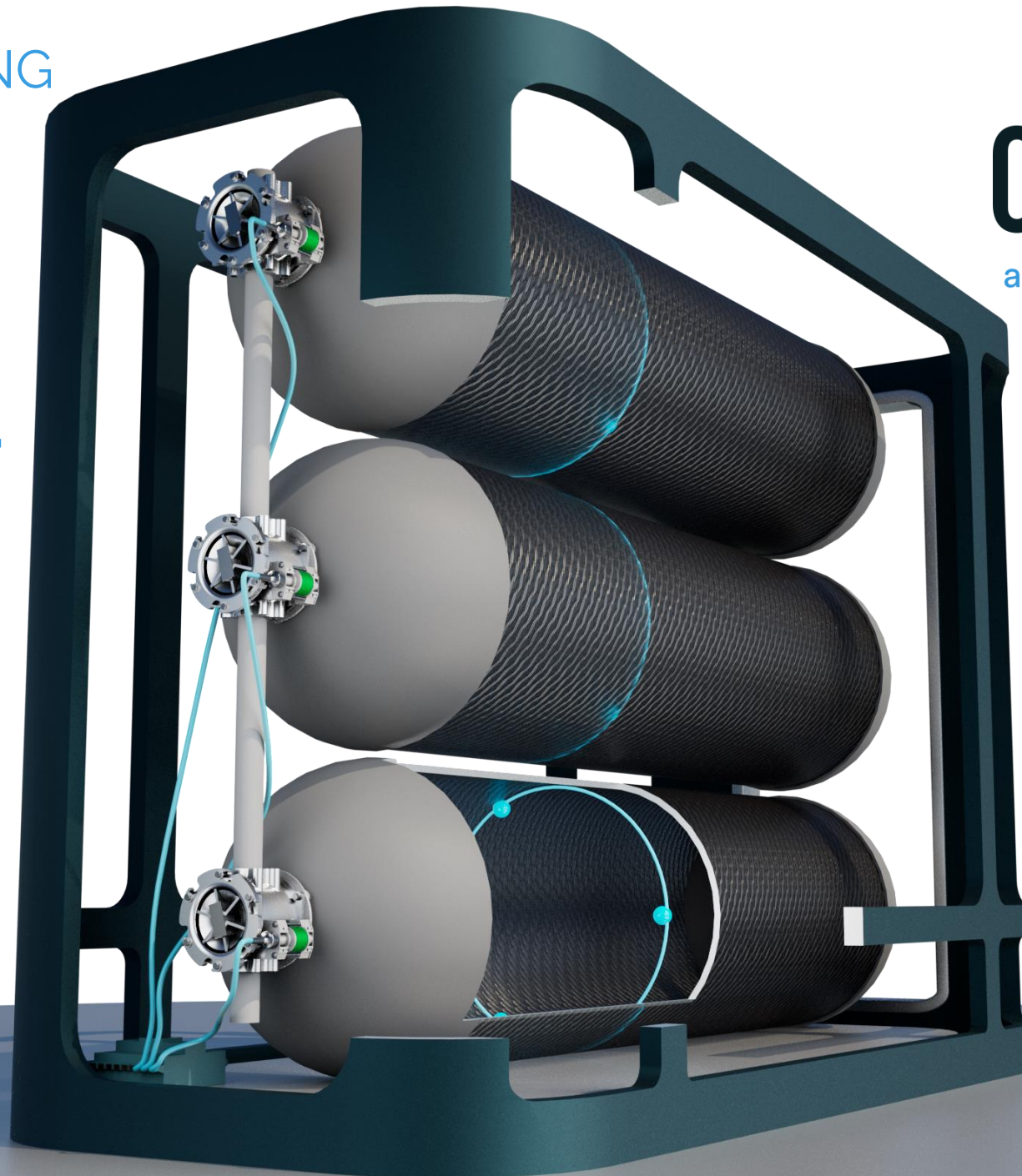


FIBER OPTIC SENSING
FOR
**SAFE,
CONNECTED
AND
INTELLIGENT**
COMPOSITES
STRUCTURES



COM&SENS
adding value by sensing

SHM FRANCE
MARCH 14th 2023

COM&SENS MAKES SENSE !

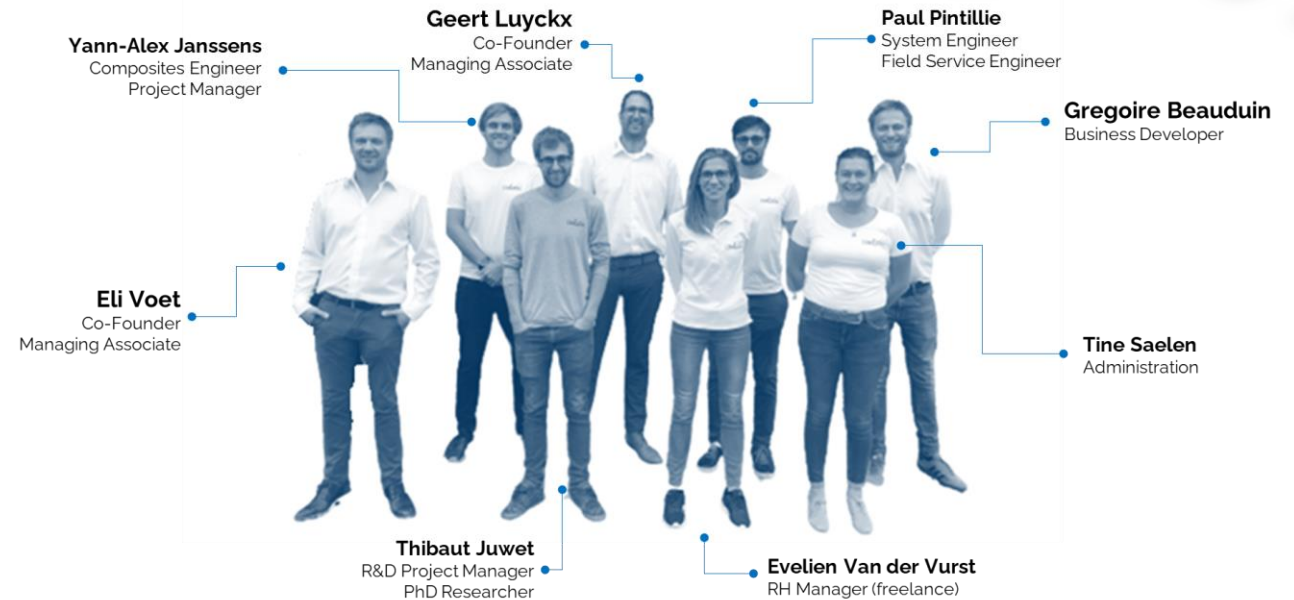
Com&Sens stands for Composites & Sensing



Proud Technology Spin-off
Ghent University Material Science and Engineering



FOUNDED IN 2012 BY GEERT LUYCKX & ELI VOET



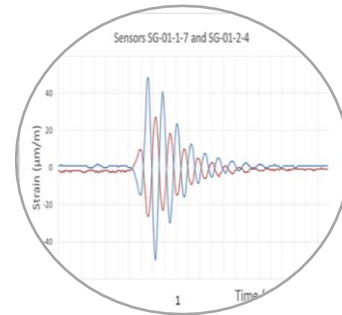
MARKET - CONTEXT

INDUSTRIES OF THE FUTURE NEED DATA, COMPOSITES & H₂ STORAGE



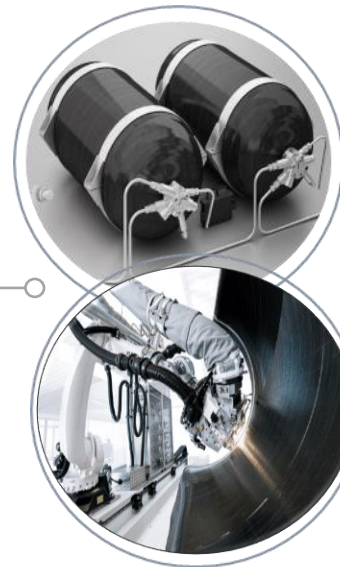
Need for (Sensor) Data.

- Industrial Internet of Things
- Machine Learning
- Industrial AI
- Structural Health Monitoring
- Predictive Maintenance
- Digital Twins



Need for Composites

to reach Zero Emission goals



- Hydrogen supply chain
- Automotive
- Aerospace
- Space
- Marine
- Rail
- Renewables

PROBLEM

H₂ COMPOSITES PRESSURE VESSELS STORAGE & DISTRIBUTION SYSTEMS

DESIGNERS & MANUFACTURERS

- **Trade-off cost vs risks in design, certification & MAIT**
- Process variability restraining ramp up
- **Development cost** & time (speed to market)
- Safety Factors & Certifications **costs**

OPERATORS, OWNERS, OEM, USERS

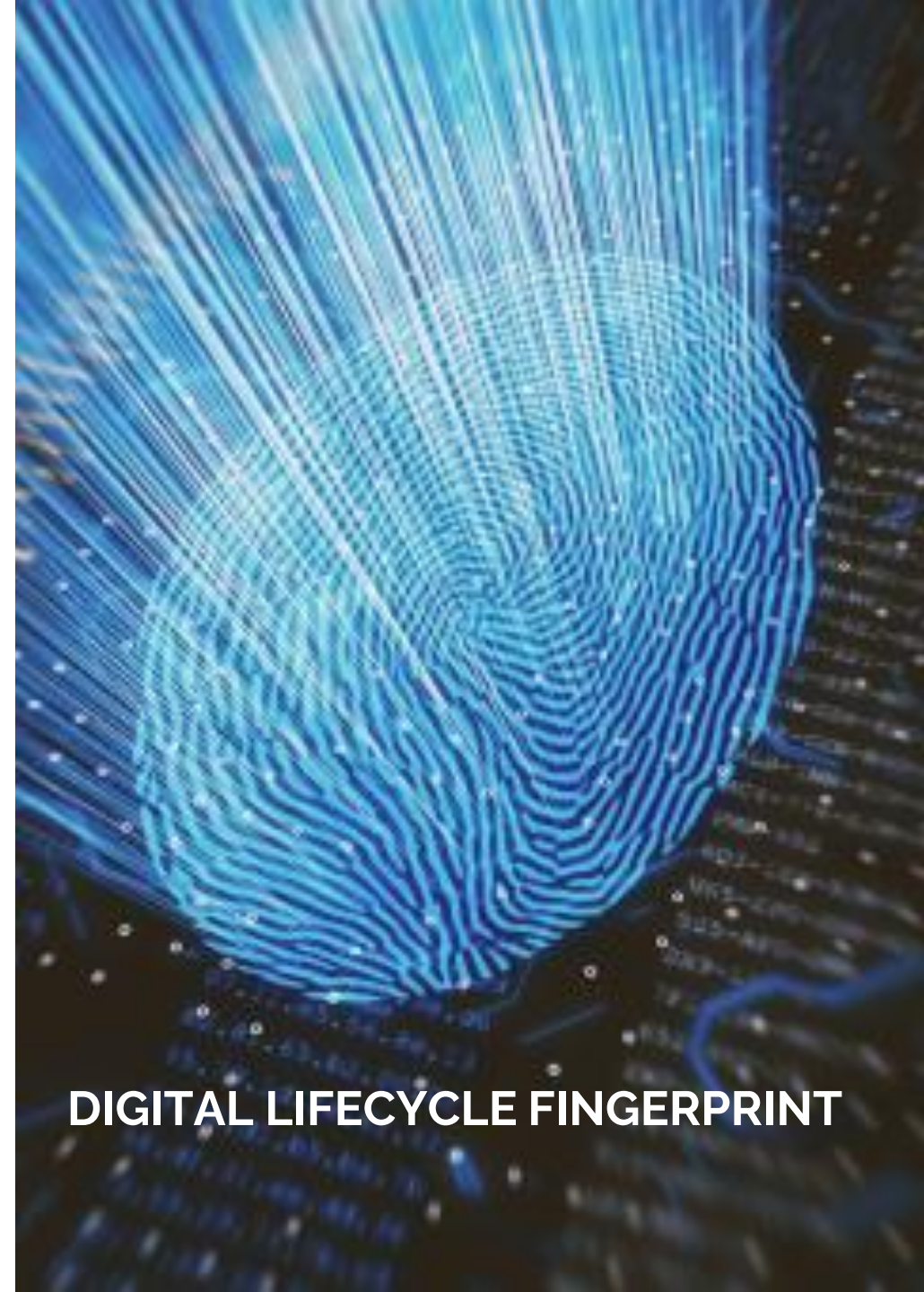
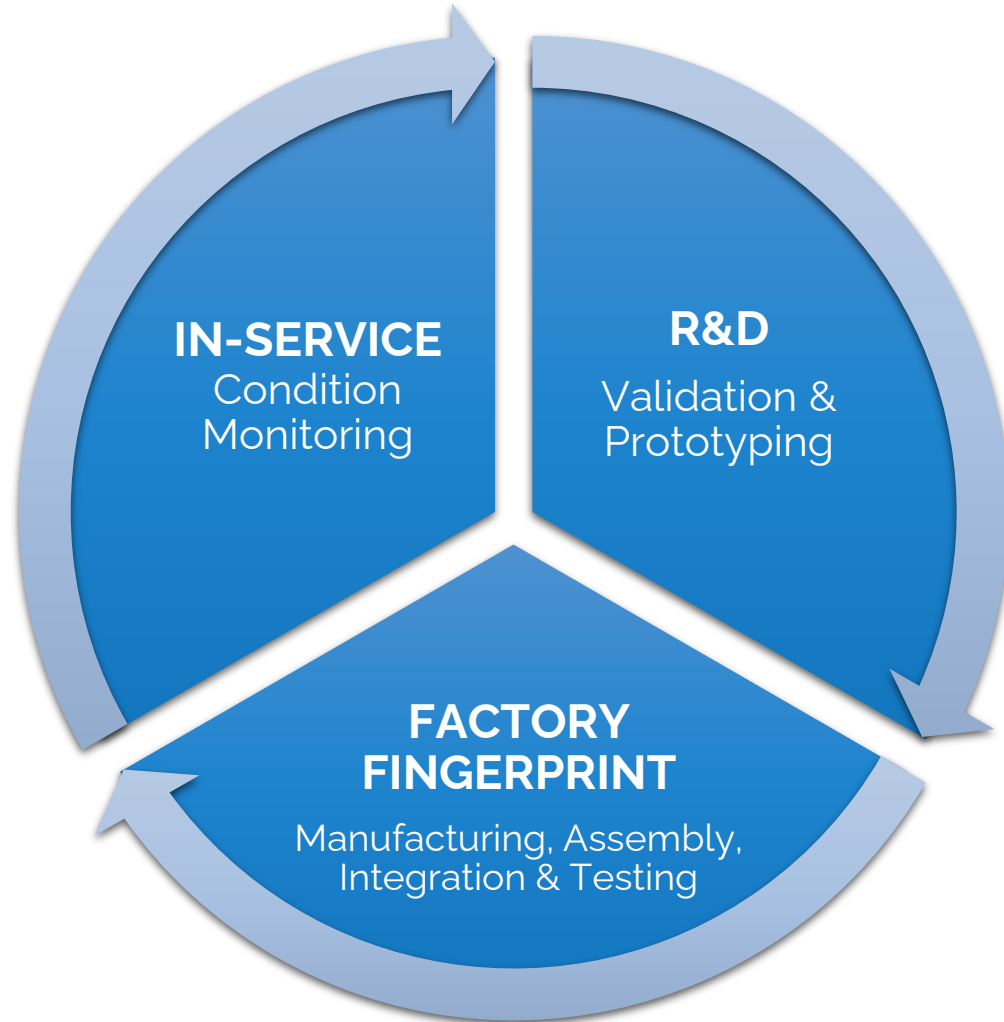
- **No Traceability & part history**
- Safety rely on standards, Impact of failure
- No failure prediction or damage detection tools
- **High (re)certification costs & downtime**
- No Reusability diagnostic tool



NO MORE FINGERS CROSSED

SOLUTION

FIBER OPTIC SENSORS GENERATING
LIFECYCLE DATA INSIGHTS



DIGITAL LIFECYCLE FINGERPRINT

SOLUTION

FIBER OPTIC SENSORS GENERATING LIFECYCLE DATA INSIGHTS

DESIGNERS & MANUFACTURERS

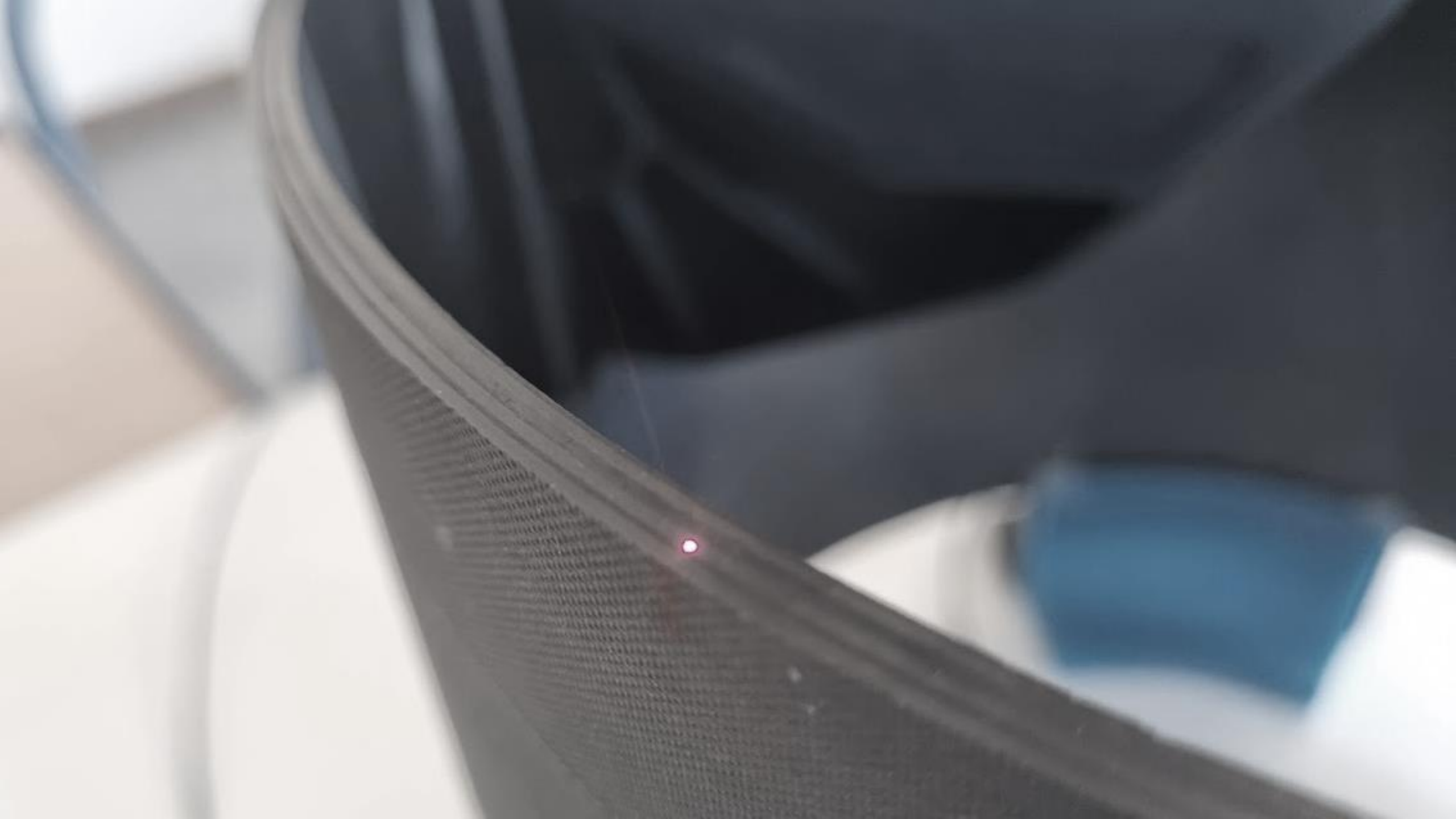
- **Optimize** designs with in-situ & service life data
- **Digitize** process & quality control parameters
- **Lower safety factors**
- Increase process **performance** (less trials & errors)

OPERATORS, OWNERS, OEM, USERS

- **Enable digital traceability & part history**
- Prevent failure & detect damage (increase safety)
- Enable predictive maintenance
- **Enable continuous certification**
- Enable fatigue Monitoring



DIGITAL LIFECYCLE FINGERPRINT



FIBER BRAGG GRATINGS

TECHNOLOGY WITH NO COMPROMISES



- **POINT SENSOR** (semi-distributed)
- **ABSOLUTE** sensor properties
- **STRAIN + TEMPERATURE**
- **EMBEDDING**
- **MULTIPLEXING**

Simultaneous read-out:

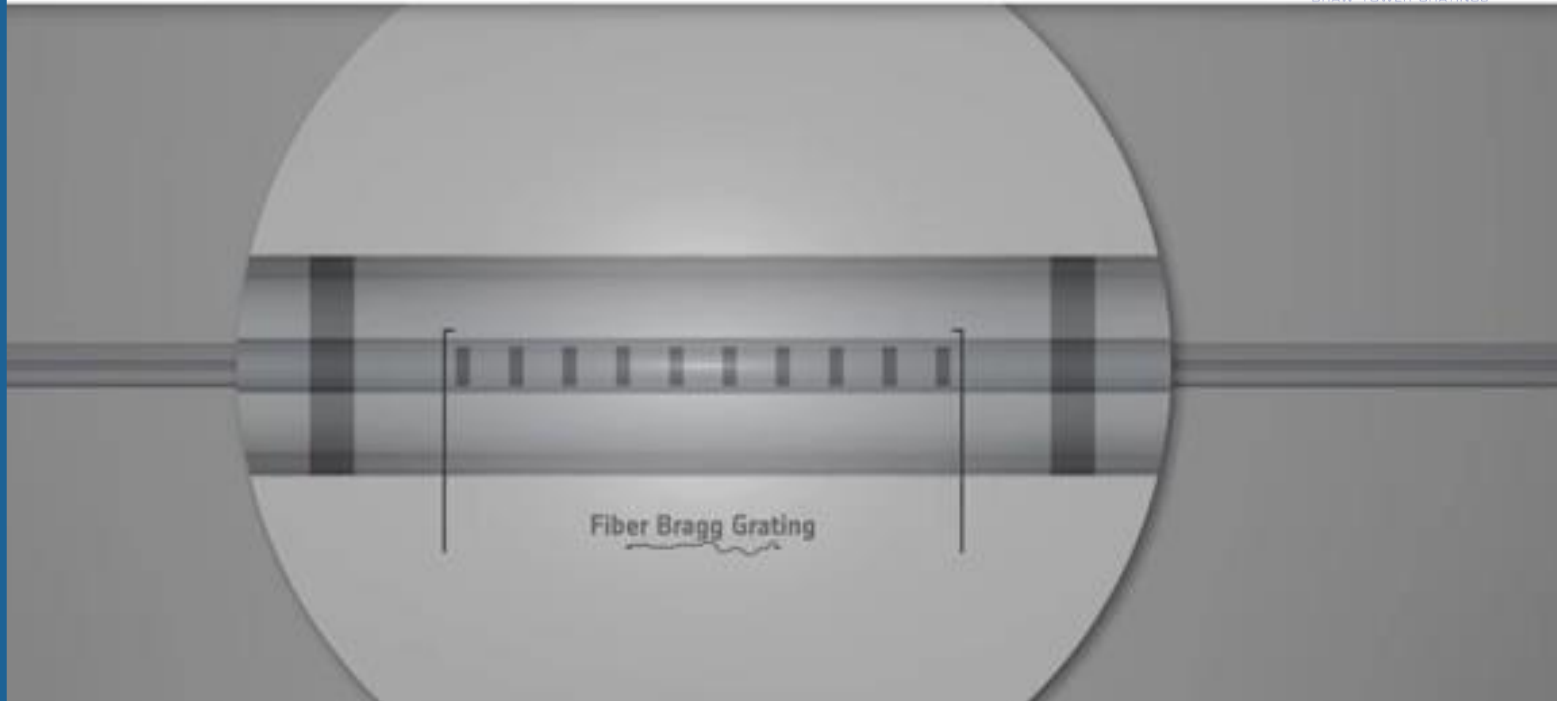
1 fiber : 20 to 40 sensors!

Extensive sensor network:

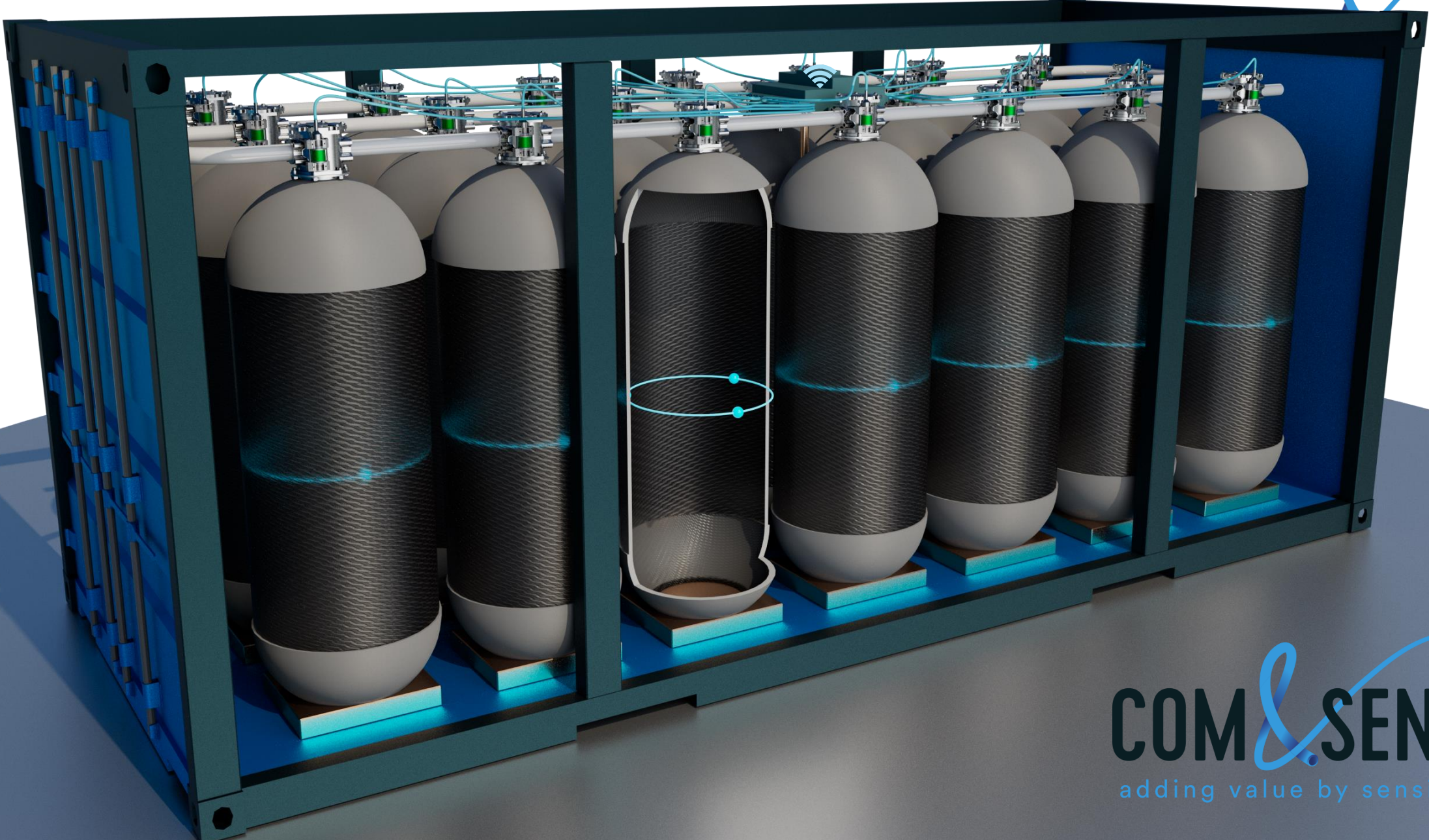
1, 4, 8 & 16 channels

Up to 300 – 400 FBGs/system

PROUD OFFICIAL DTG SOLUTION PARTNER OF **FBGS**
DRAW TOWER GRATINGS



COM&SENS MAKES SENSE



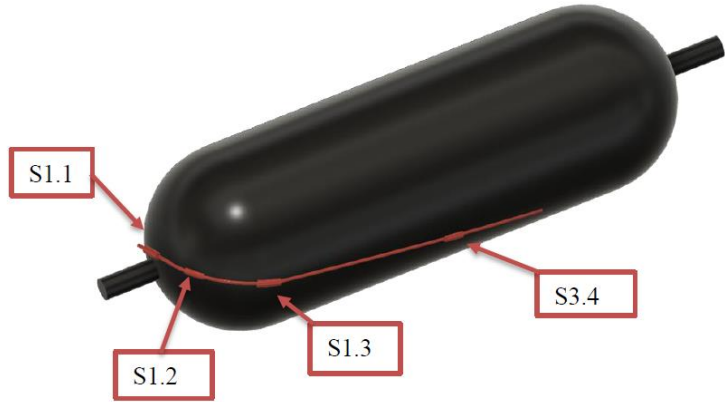
COM&SENS
adding value by sensing

INTERLAMINATE INSIGHTS

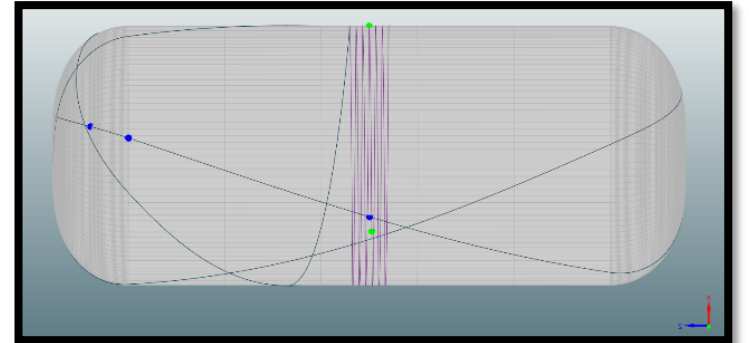
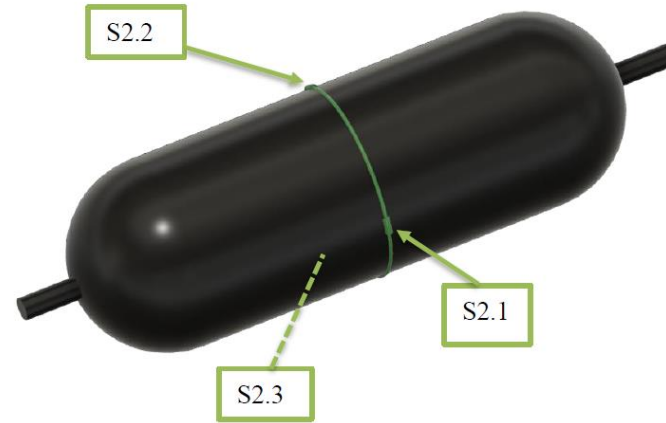
MULTIPLEXED SENSOR CONFIGURATION



Helical



Circular

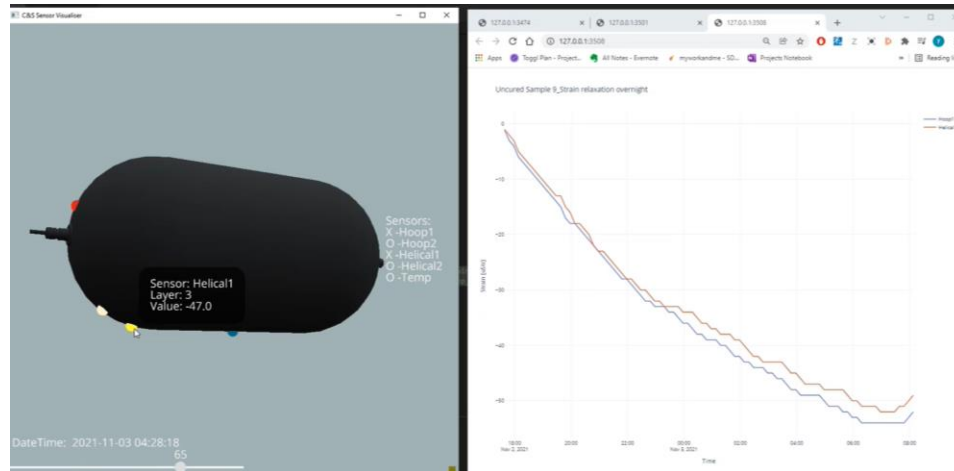


COMPOSITES PRESSURE VESSELS

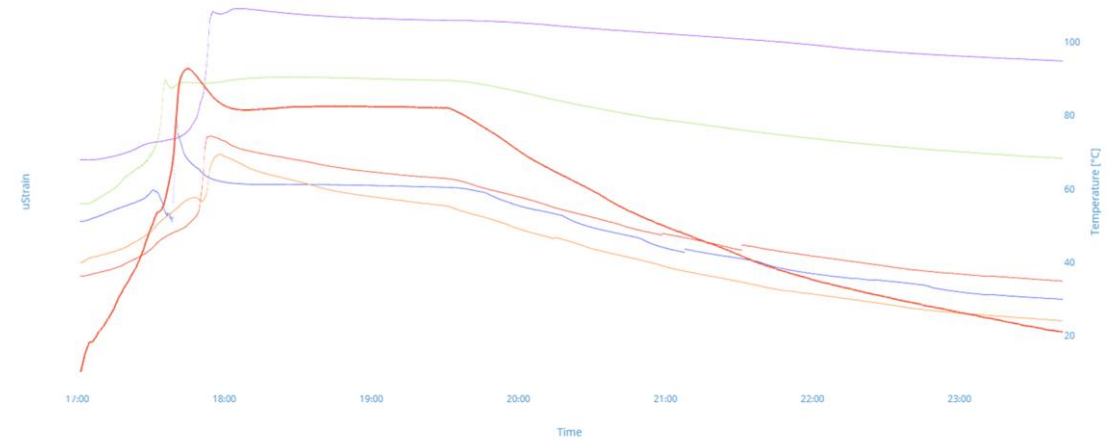
REPORTS SCREENSHOTS



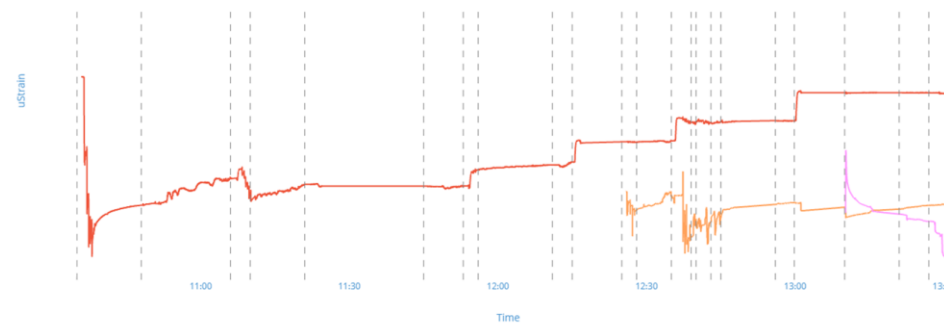
Reporting Tool



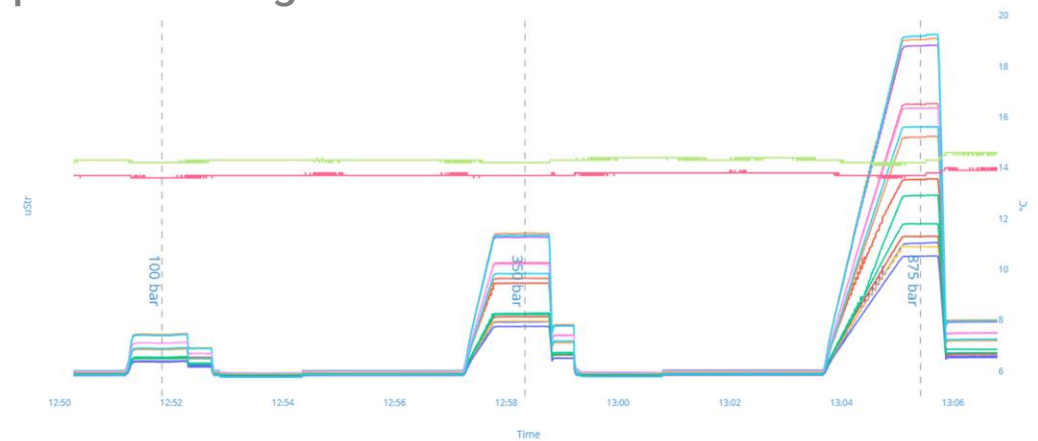
Curing



Filament Winding



Expansion Testing

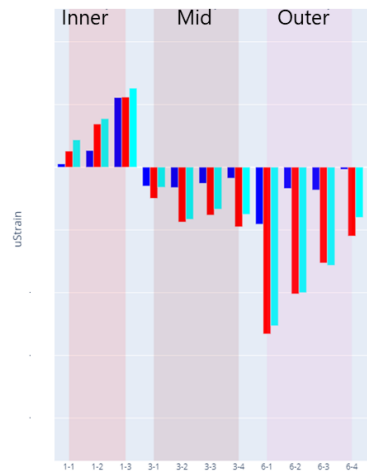


COPV PROCESS MONITORING

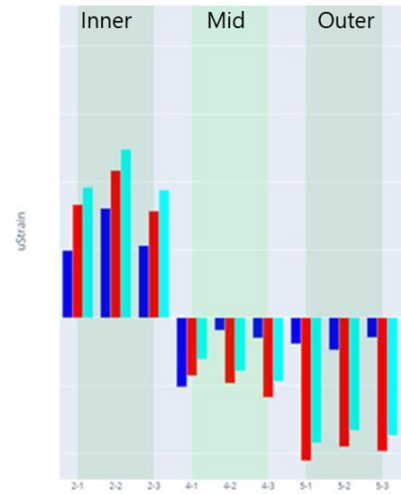
BEFORE VS AFTER: WINDING, CURING, EXPANSION TEST



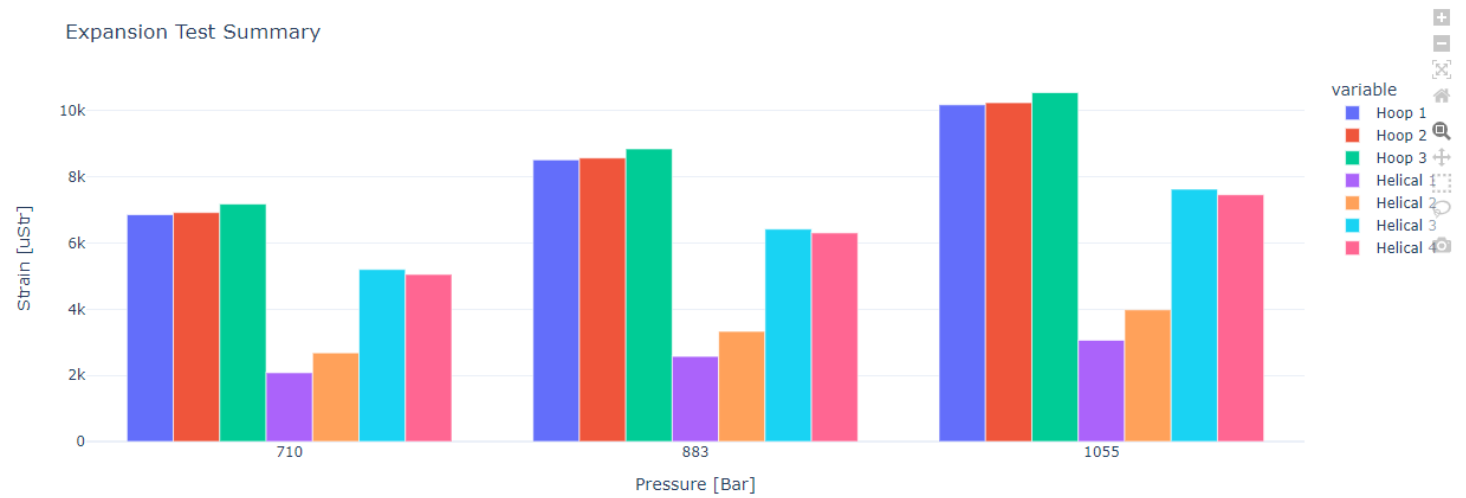
HELICALS



HOOPS



Expansion Test Summary

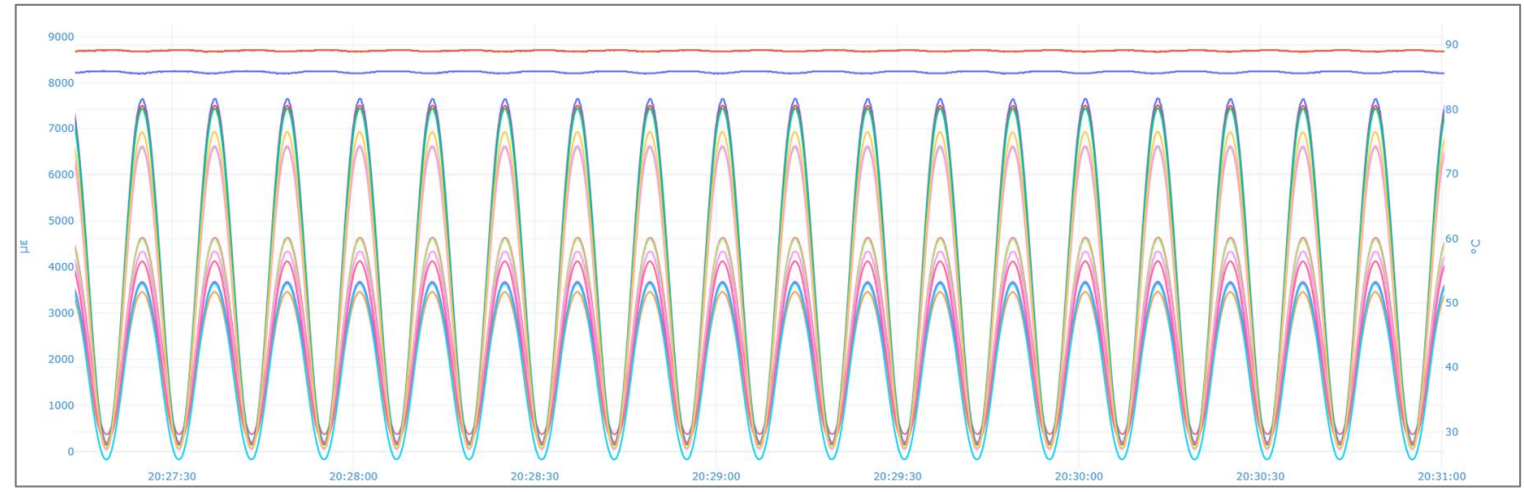


SMART COMPOSITES PRESSURE VESSELS

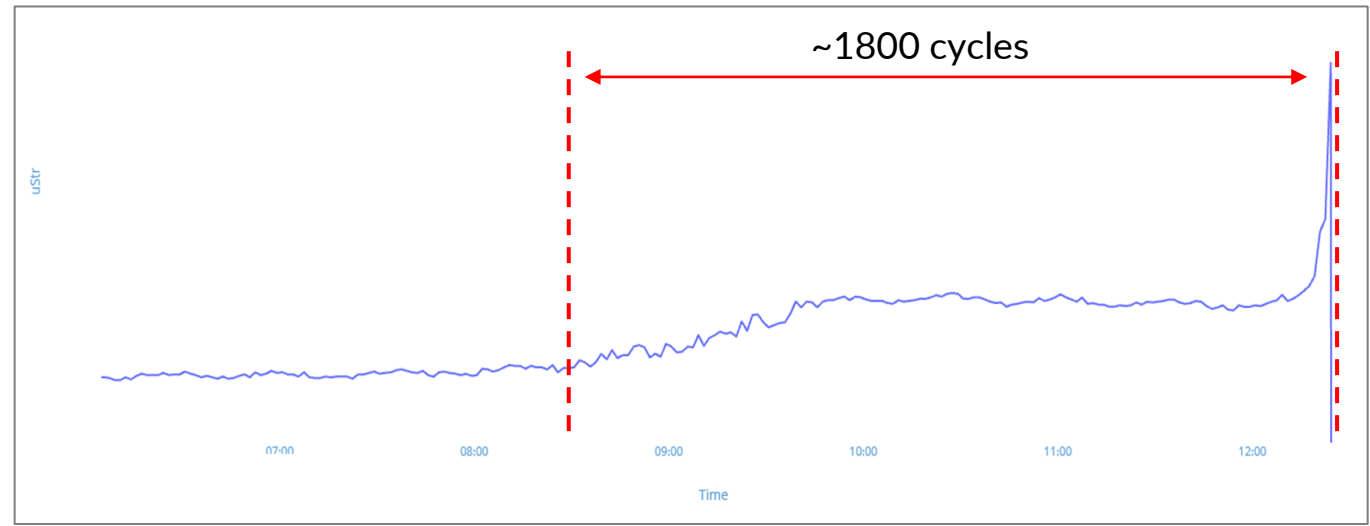
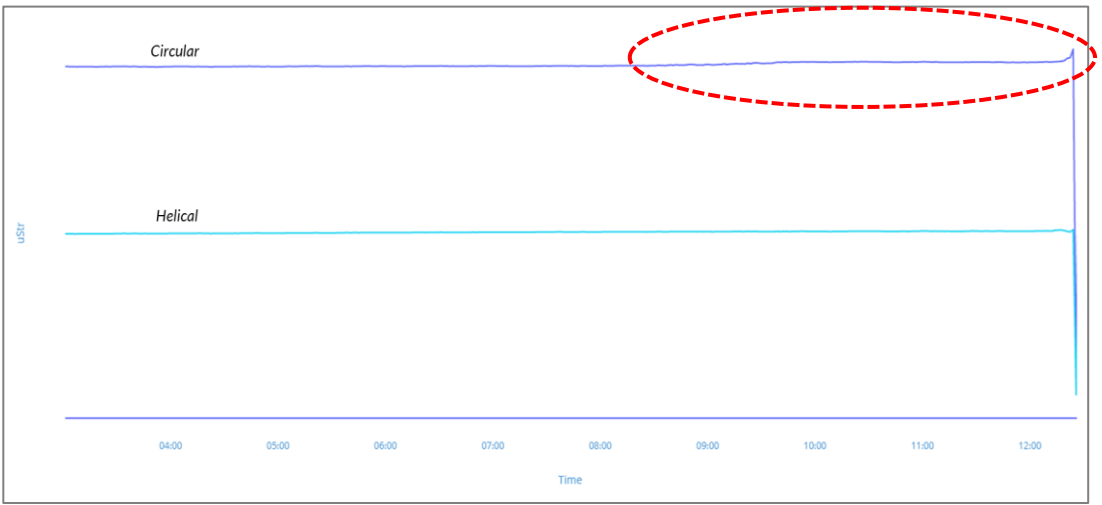


REPORTS SCREENSHOTS

Pressure Cycling strain amplitude Hoops vs Helicals



Pressure Cycling strain amplitude until failure



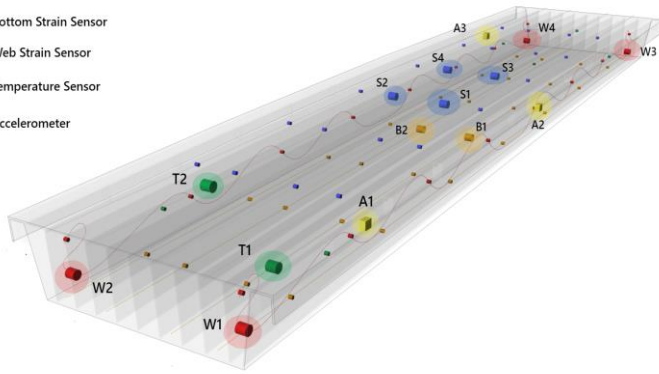
REFERENCES

SMART CIRCULAR BRIDGE



Sensor Config

- Deck Strain Sensor
- Bottom Strain Sensor
- Web Strain Sensor
- Temperature Sensor
- Accelerometer

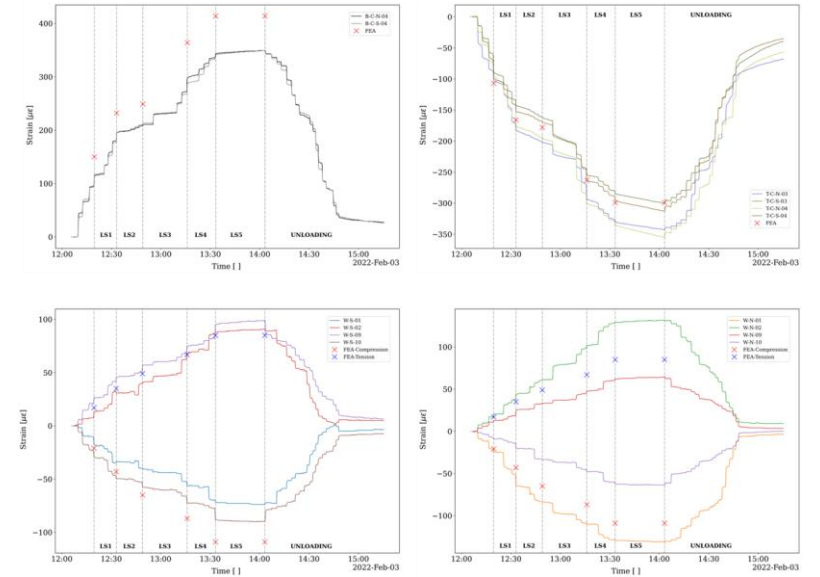


Infusion & Curing

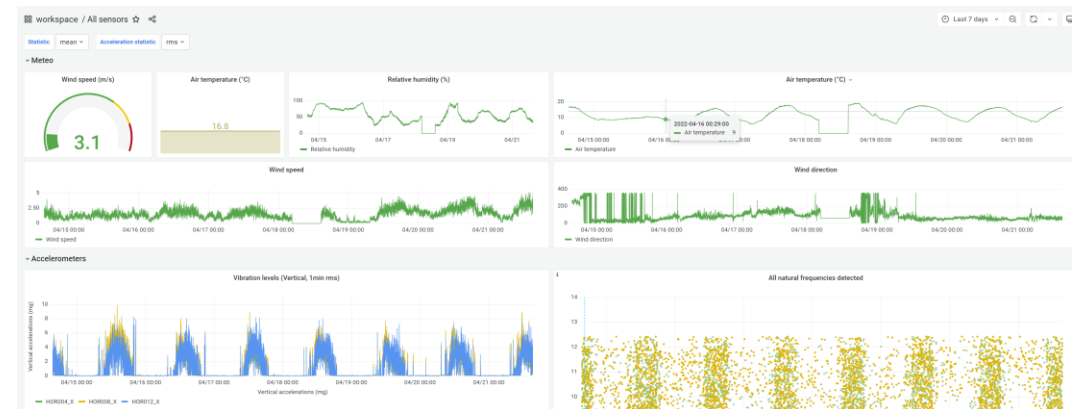
SCB_Almere-Curing



Acceptance Test



In Service



REFERENCES

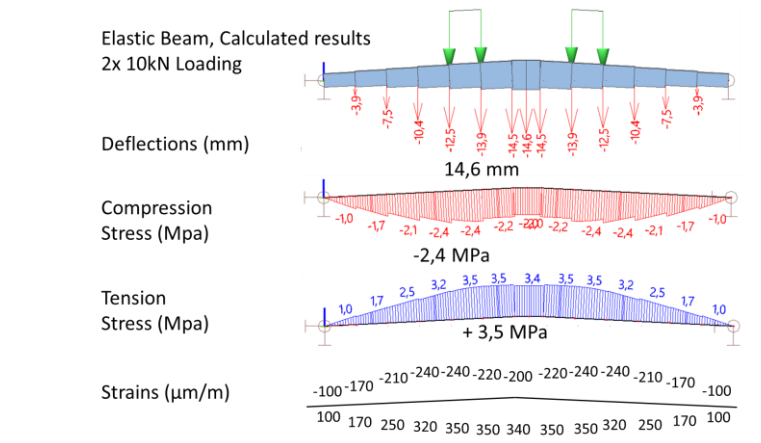
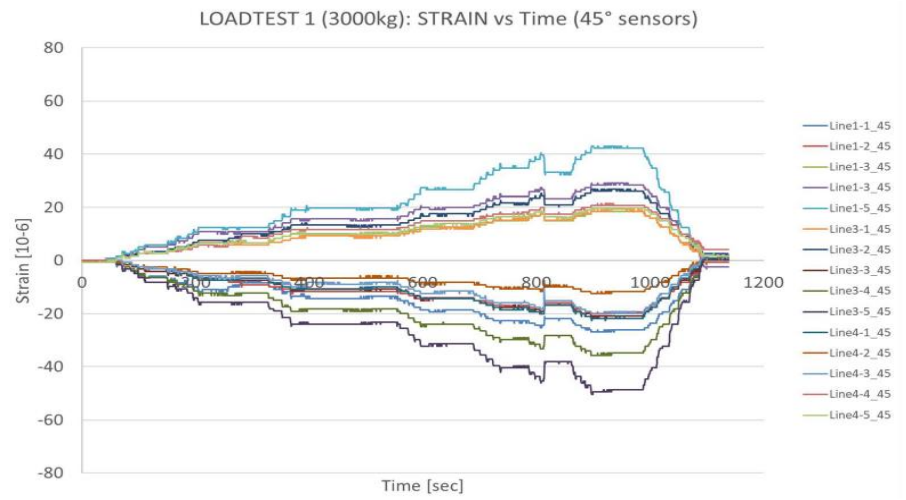
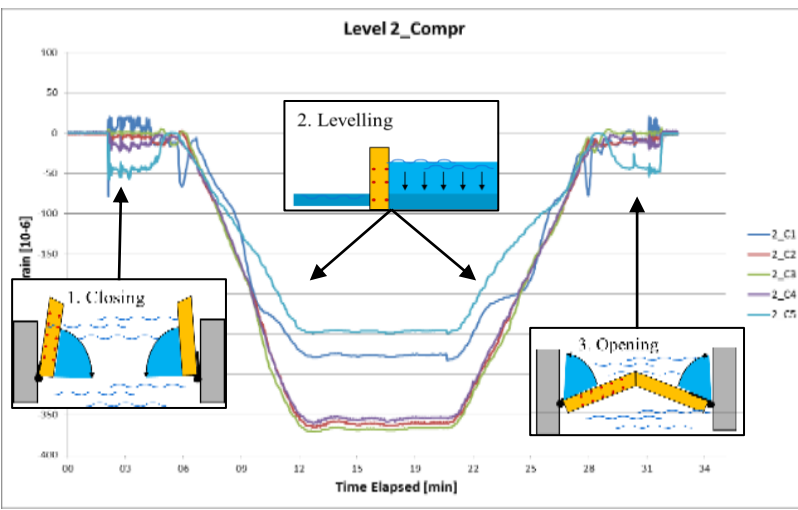
COMPOSITES STRUCTURES



COMPOSITES WATERLOCK

SUPER YACHT CARBON RUDDER

PEDESTRIAN COMPOSITES BRIDGE



REFERENCES

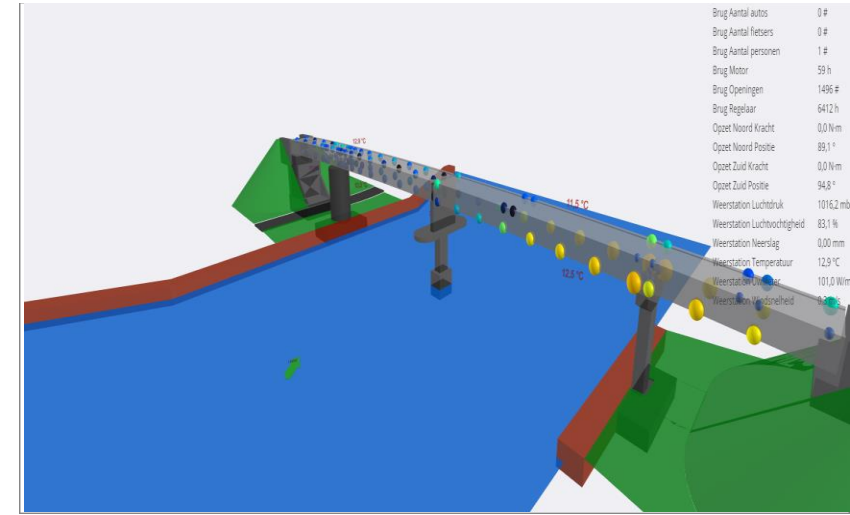
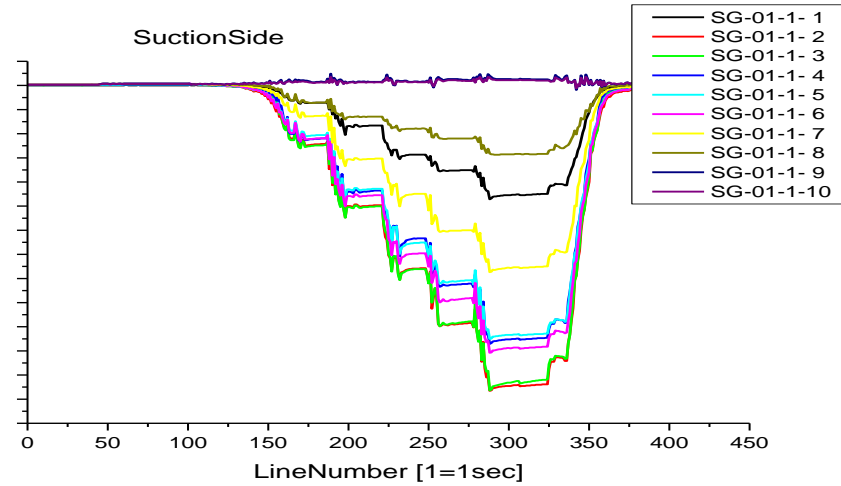
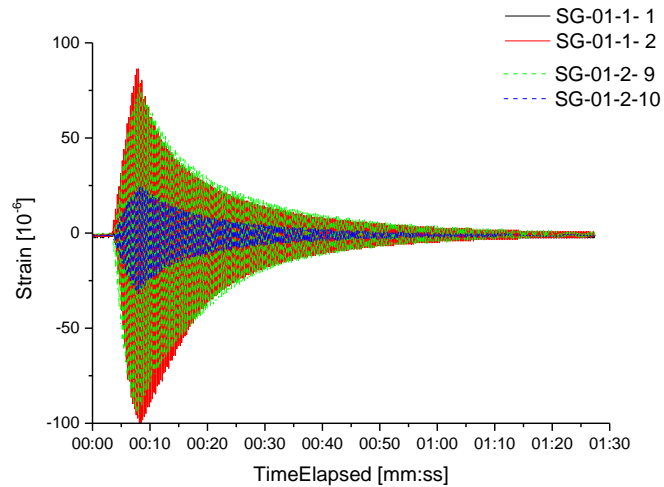
COMPOSITES STRUCTURES



WIND BLADES

TIDAL TURBINE BLADE

COMPOSITES BRIDGE



ESA 4000136778/21/NL/AR

SPACE COMPOSITES STRUCTURES (ASSEMBLY)

LIFE CYCLE MONITORING



European Space Agency

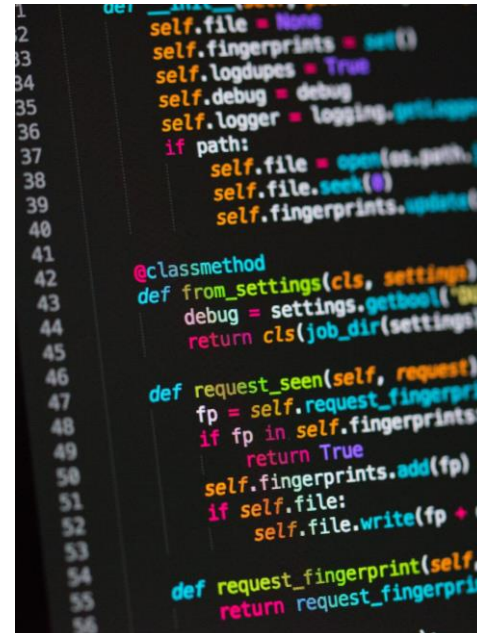
PRODUCTION
MONITORING -
MAIT

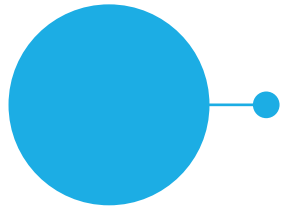


STORAGE -
TRANSPORT -
HANDLING



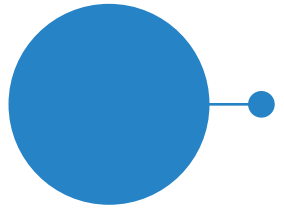
IN SERVICE
MONITORING





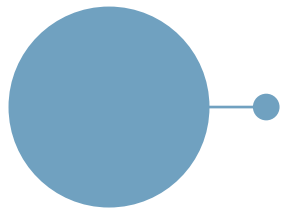
TEAM COMPOSITES EXPERTISE

COMBINATION OF ACADEMIC RESEARCH WITH INDUSTRIAL TRACK RECORD



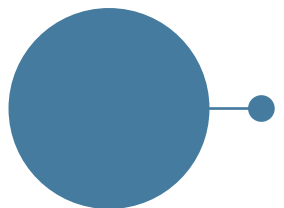
FBG EMBEDDING EXPERTISE

IN FILAMENT WINDING, AFP/ATL, (X)RTM, PREPREG, PULTRUSION, INFUSION, BRAIDING



FORERUNNER IP

GAME CHANGING PATENTED TECHNOLOGY
POST PROCESS RECONNECTION OF SENSORS

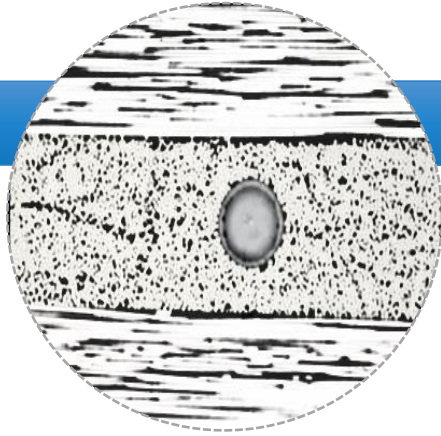


FILAMENT WINDING & AFP/ATL

FRONTRUNNING IN ROBUST & VERSATILE
METHODOLOGY FOR INDUSTRIALIZATION OF
SMART STRUCTURAL COMPOSITES

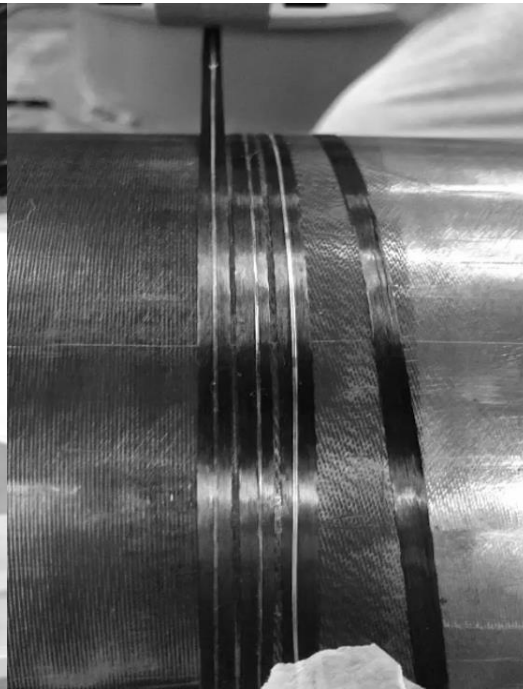
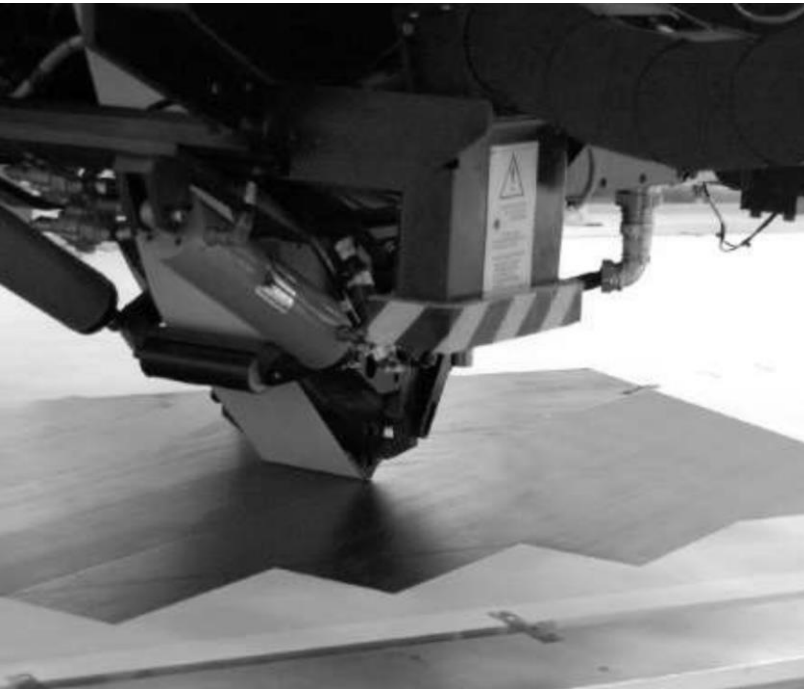
FORERUNNERS IN
SELF-SENSING
STRUCTURAL
COMPOSITES
INDUSTRIALIZATION

AUTOMATED EMBEDDING

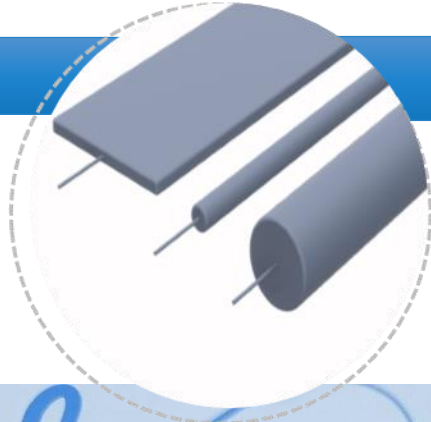


SENSOR EMBEDDING & CONNECTION TECHNOLOGIES FOR COMPOSITES

- Unrivalled track record & acknowledge expertise in the composites industry
- **Patented game-changing technologies (US 10466419)**
- R&D on automation & industrialization
- Supported by **ESA**, Vlaio, PhD & application **market leaders**



FIBER SENSING ROD (FSR)



SURFACE MOUNTING COMPOSITES REINFORCED SENSORS - FSR

- **Proven** robust and cost-efficient **methodology** for sensing on structures
- In-house **production capacity**
- **Versatility** in applications and environments

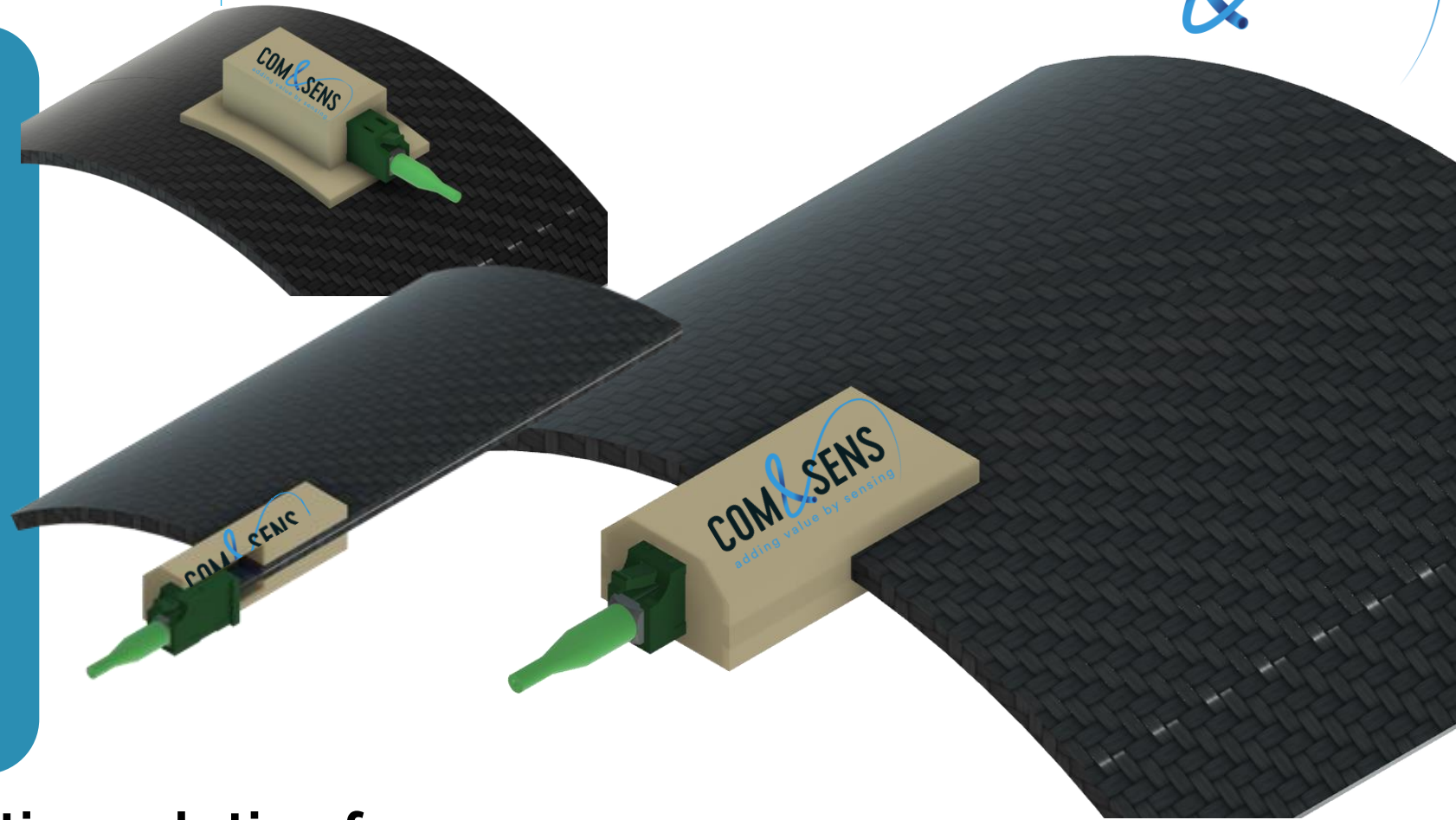


EDGE CONNECTION

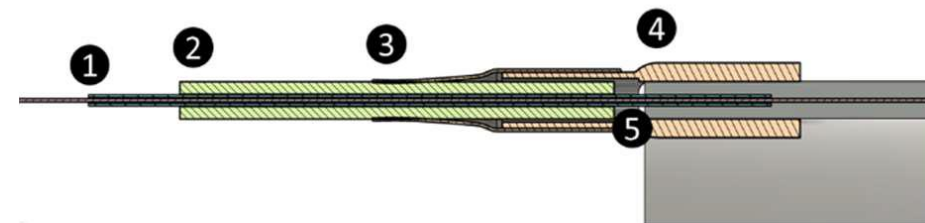
SMART COMPOSITES GAME CHANGER



REPAIRABILITY & CONNECTION
of embedded optical fibre
in **MACHINED**
composites
structures

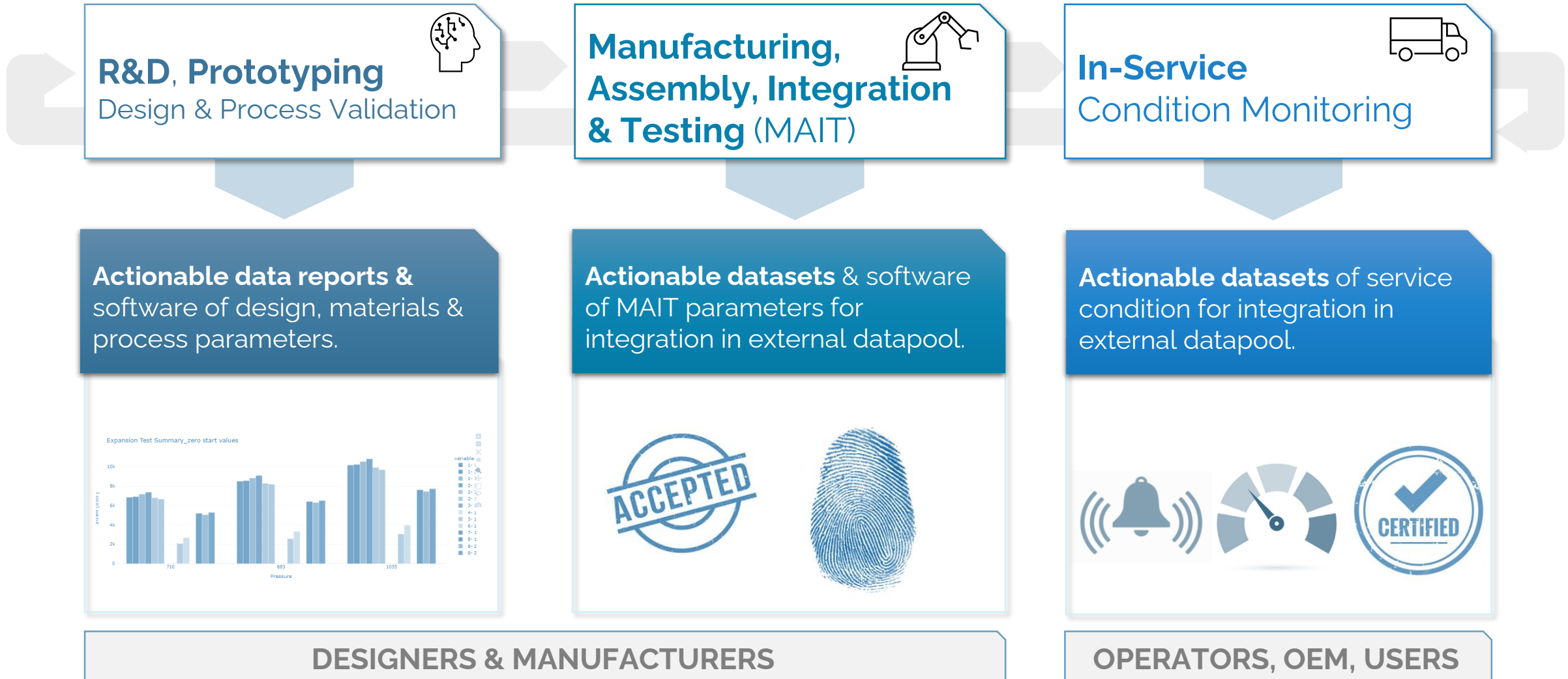


Fiber optic edge connection solution for embedded optical fibres in composite materials
non-intrusive connection featuring low optical-loss and fiber strain relief with standard FO pigtail.



OFFER

ADDING VALUE AT EACH STEP OF A **COMPOSITES STRUCTURE LIFECYCLE**

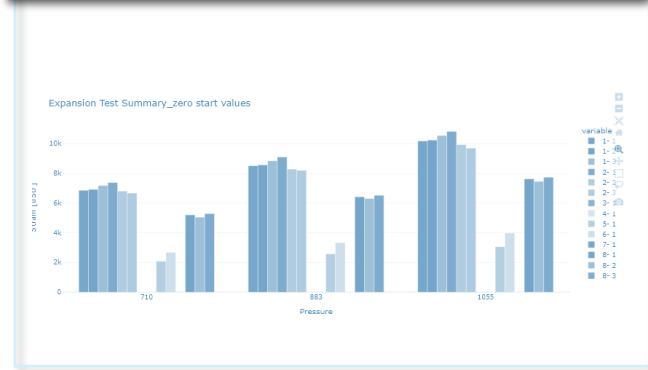


R&D, Prototyping
Design & Process Validation

Manufacturing, Assembly, Integration & Testing (MAIT)

In-Service
Condition Monitoring

Actionable data reports & software of design, materials & process parameters.



DESIGNERS & MANUFACTURERS

Actionable datasets & software of MAIT parameters for integration in external datapool.



Actionable datasets of service condition for integration in external datapool.



OPERATORS, OEM, USERS

COM&SENS

adding value by sensing

DIGITAL MANUFACTURING
&
STRUCTURAL HEALTH MONITORING
TECHNOLOGIES

ENABLING
SAFE, CONNECTED AND INTELLIGENT
COMPOSITES STRUCTURES

FOLLOW US ON 

