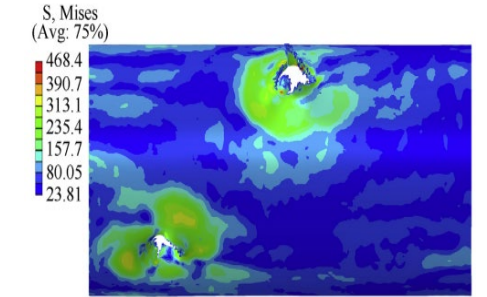
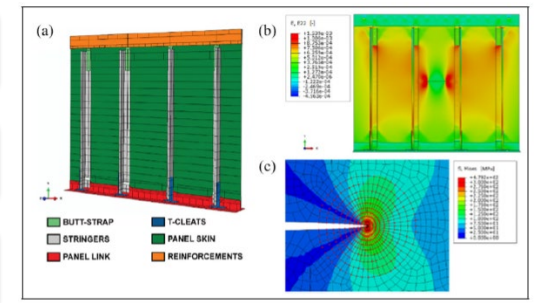
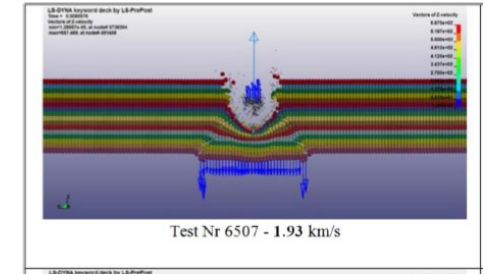
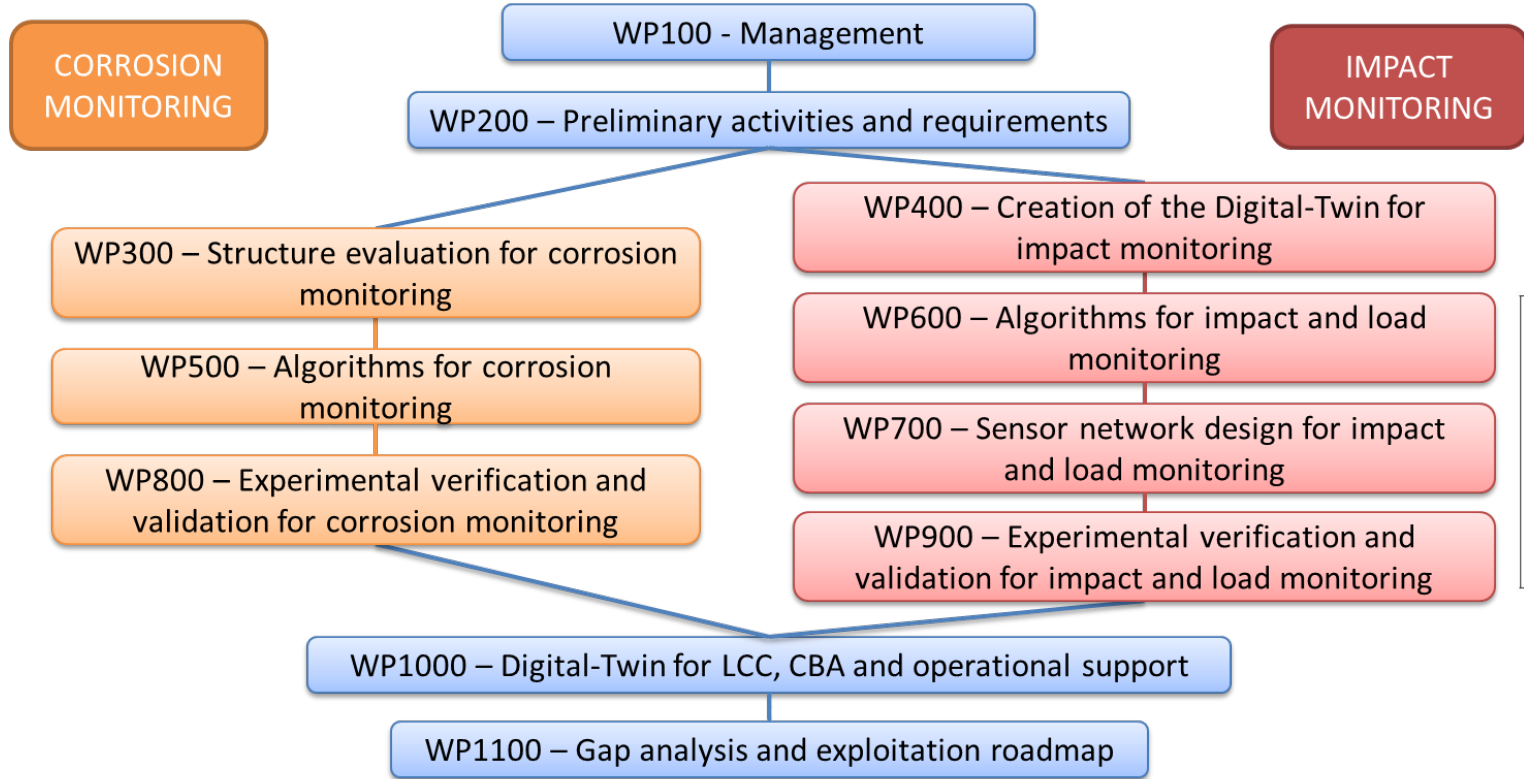
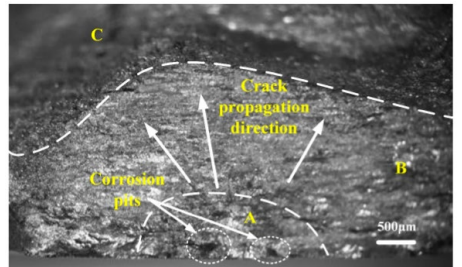
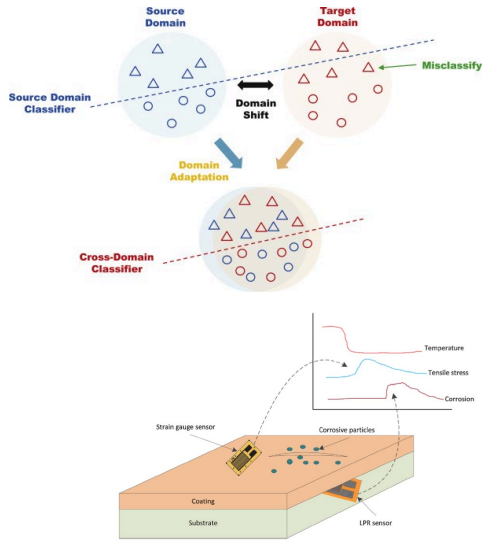


# SAMAS 2: Structural Health and Ballistic Impact Monitoring and Prognosis on a Military Helicopter

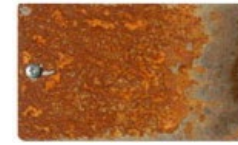


T_MAX	0.1	0.11	0.14	0.18	0.23	0.28	0.34	0.41	0.48	0.56	0.64	0.73	0.82	0.91
T_MIN	0.1	0.09	0.07	0.11	0.16	0.22	0.29	0.37	0.47	0.57	0.68	0.77	0.87	0.96
T_AVE	0.1	0.09	0.1	0.12	0.14	0.17	0.21	0.25	0.31	0.37	0.44	0.51	0.59	0.67
RH_MAX	0.4	0.48	0.52	0.58	0.64	0.71	0.78	0.85	0.92	0.98	1.0	1.0	1.0	1.0
RH_AVE	0.47	0.52	0.56	0.61	0.66	0.71	0.76	0.81	0.86	0.91	0.95	0.98	1.0	1.0
SUNSHINE	0.11	0.14	0.18	0.23	0.28	0.34	0.41	0.48	0.56	0.64	0.73	0.82	0.91	1.0
TOW	0.2	0.25	0.3	0.36	0.42	0.49	0.56	0.64	0.71	0.78	0.85	0.92	0.98	1.0
PRECIP	0.04	0.04	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
WIND_MAX	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
WIND_AVE	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
SOLAR	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
UV	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
CHLORIDE	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
SO <sub>2</sub>	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04



Collaboration: EU consortium (Leonardo SpA, CNR, etc.)

# SAMAS 2: Corrosion Monitoring



Setup of requirement and target objectives

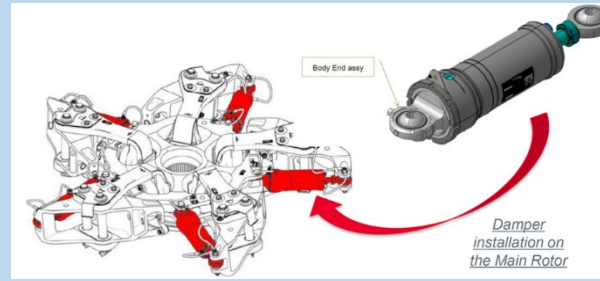
Structure identification for corrosion prediction

Models and algorithms for corrosion rate prediction

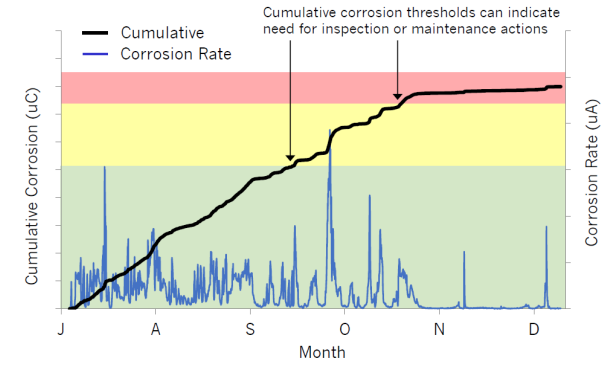
Two helicopter's components provided by LHD have been selected for this task:



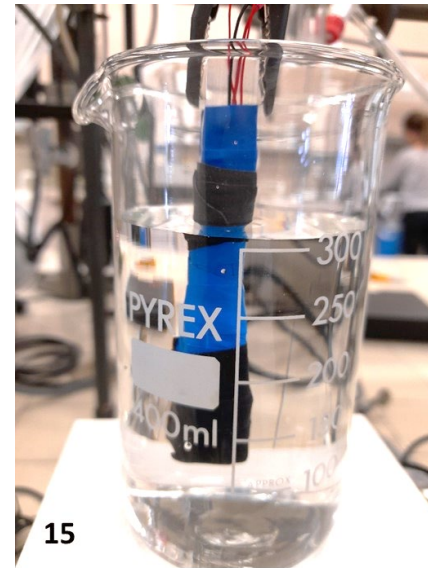
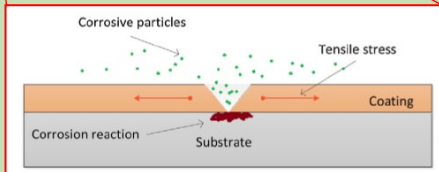
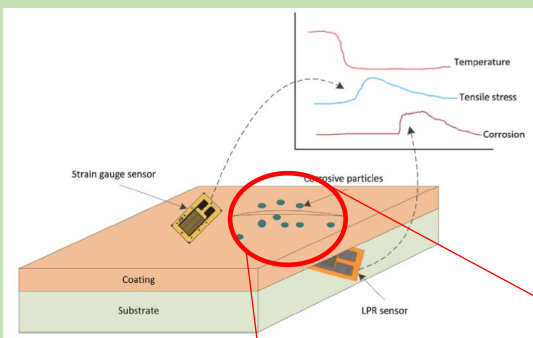
Tail Gear Box Case



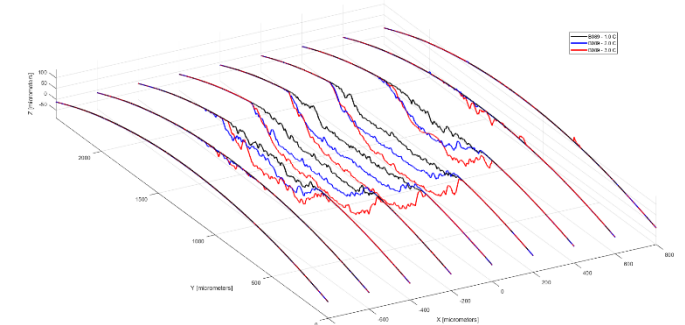
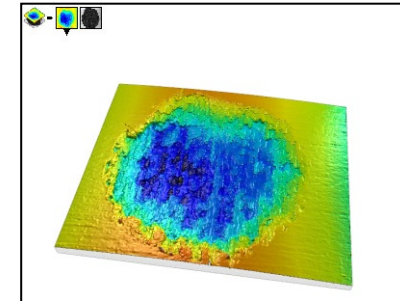
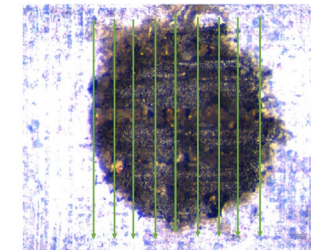
Main Rotor Body-End Damper



Experimental verification



15



# Project: SAMAS 2

## TITLE: Data-based monitoring for corrosion identification in helicopters

- **RESEARCH BACKGROUND:** In the framework of SAMAS 2, various corrosion (natural, artificial, accelerated) tests are currently performed on representative structures (i.e., coupons, laminas) and realistic structures. However, the usage of data is not a straightforward task, and thus data processing becomes a highly important tool for identification of corrosion damage. Data-based methods can be exploited for diagnostic purposes. Another interesting field to be explored is the post-corrosion fatigue phenomenon, where the corrosion damage is scaled up due to cyclic loading.
- **RESEARCH ACTIVITIES:** Signal processing, data analysis, algorithms development for detection and quantification (AI)

**METHODOLOGY:** Programming, experimental

**DURATION:** 9 months

### CONTACTS:

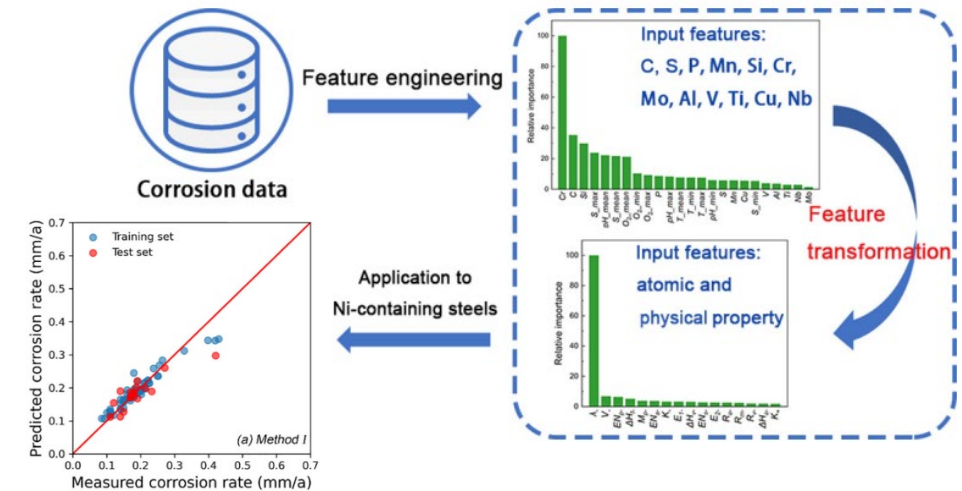
[claudio.sbarufatti@polimi.it](mailto:claudio.sbarufatti@polimi.it)

[vasiliki.panagiotopoulou@polimi.it](mailto:vasiliki.panagiotopoulou@polimi.it)

[marco.giglio@polimi.it](mailto:marco.giglio@polimi.it)



Sensors



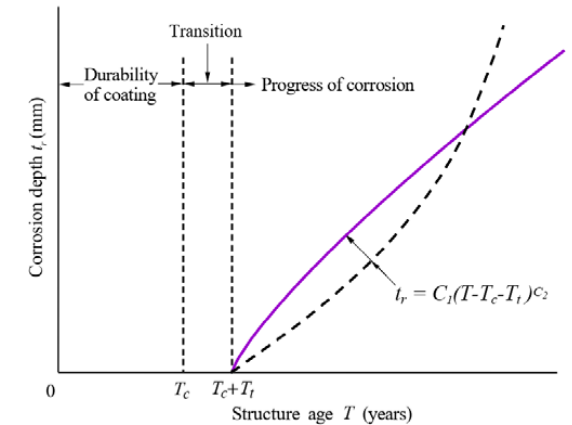


## TITLE: Model-based approaches for corrosion diagnosis and prognosis in helicopters

- **RESEARCH BACKGROUND:** In most applications, diagnosis and prognosis relying only on data-based methods is not feasible. Representative models of the actual structure must be applied in order to enforce the diagnostic capabilities of the proposed SHM tool for corrosion identification. Those models (i.e., analytical, empirical) should be able to link the environmental parameters, measured by sensors, with the estimated corrosion damage growth.
- **RESEARCH ACTIVITIES:** Signal processing, data analysis, algorithms development for detection and quantification (AI, Monte Carlo sampling, etc.)



Models



**METHODOLOGY:** Programming, experimental

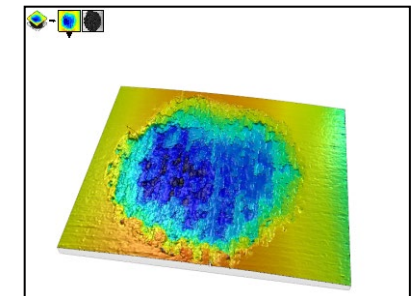
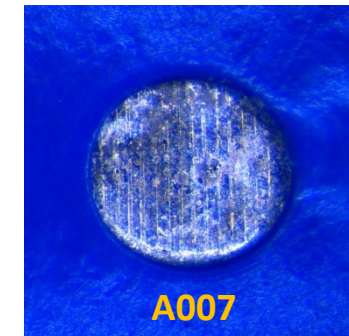
**DURATION:** 9 months

**CONTACTS:**

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[vasiliki.panagiotopoulou@polimi.it](mailto:vasiliki.panagiotopoulou@polimi.it)

[marco.giglio@polimi.it](mailto:marco.giglio@polimi.it)



# Project: SAMAS 2

## TITLE: Transfer Learning for corrosion rate prediction in helicopters

- **RESEARCH BACKGROUND:** SHM tools created based on data acquired from simple laboratory structures are not guaranteed that they will work if applied on actual structures. A new discipline of Deep Learning, named as Transfer Learning, exploits already obtained knowledge by transferring it to new, similar cases. Transfer Learning can be also implemented on fleet-level so to estimate and predict the corrosion rate at parts of interest.
- **RESEARCH ACTIVITIES:** Data analysis, population-based SHM, algorithms development

**METHODOLOGY:** Programming, experimental

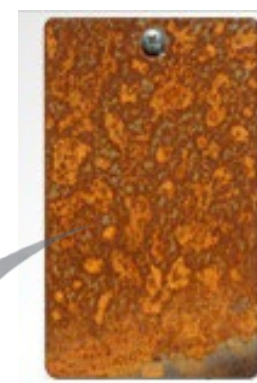
**DURATION:** 9 months

### CONTACTS:

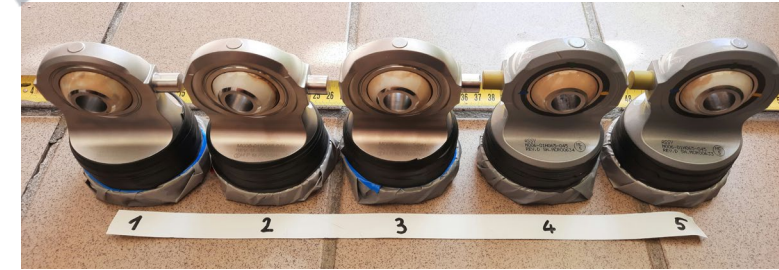
[claudio.sbarufatti@polimi.it](mailto:claudio.sbarufatti@polimi.it)

[vasiliki.panagiotopoulou@polimi.it](mailto:vasiliki.panagiotopoulou@polimi.it)

[marco.giglio@polimi.it](mailto:marco.giglio@polimi.it)



Lab structure



Actual structure



Helicopter 1



Helicopter 2