



Qualification of Phosphoric Acid Anodizing Structural bonding application on Aluminium

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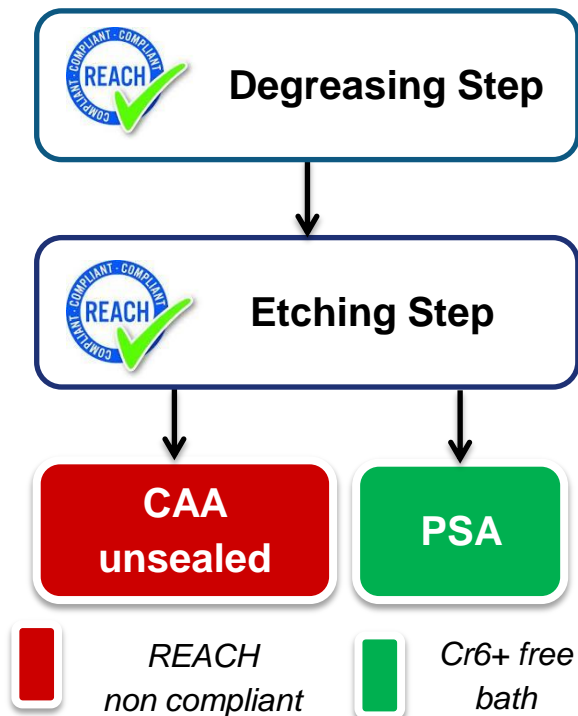
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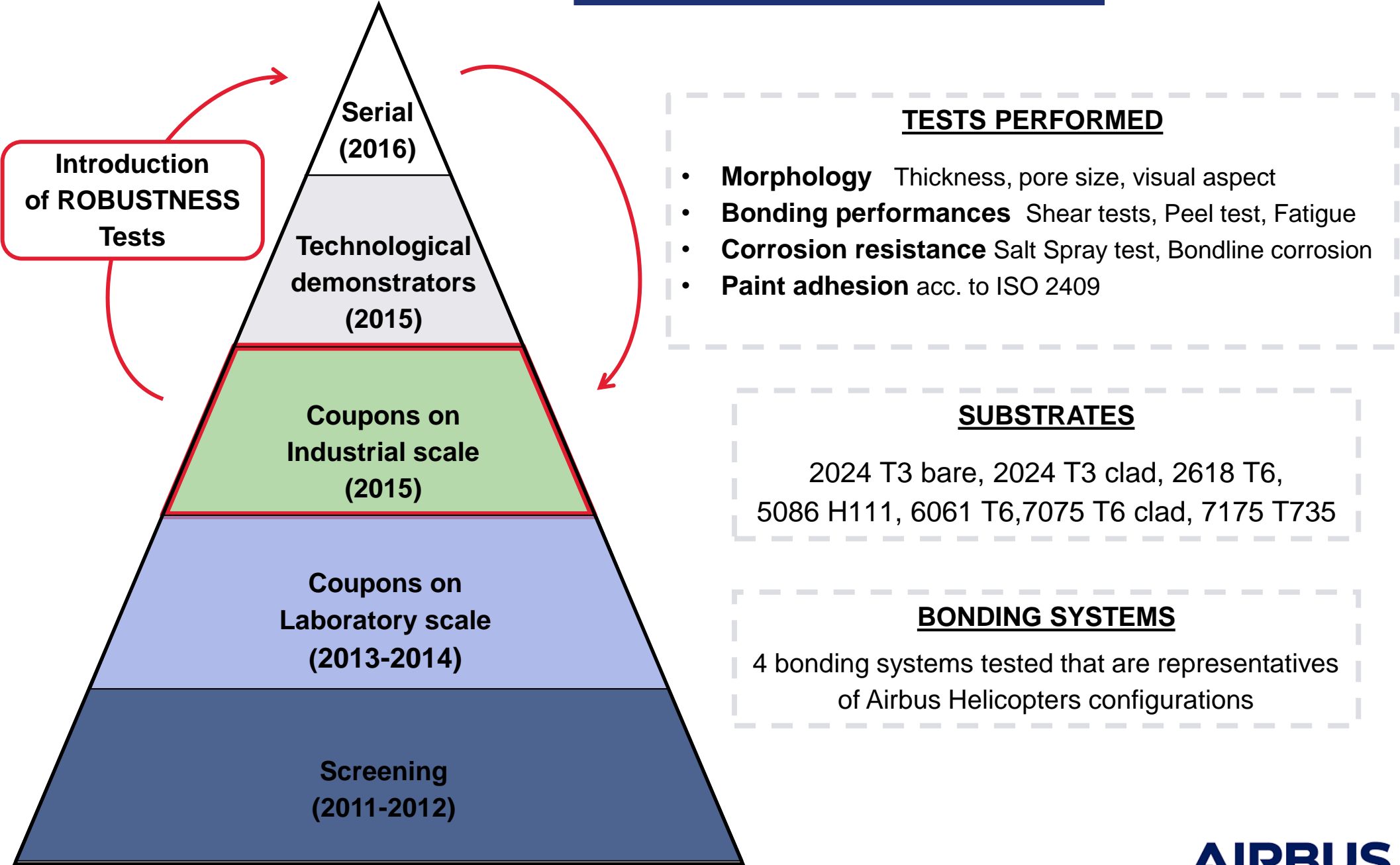
Aluminium 21, 2nd to 5th October 2017, MOSCOW

1 – Context : CAA Unsealed replacement

- **CAA Unsealed** concerned by European environmental regulation REACH as contains Hexavalent chromium (Cr6+).
- At Airbus Helicopters, CAA unsealed is used on Aluminium Alloys for structural Bonding applications.
- Substitute : **Phosphoric Sulfuric Anodising (PSA)**, an electrolycal treatment , without Cr6+.



2 – Technical requirements and qualification approach



3- Tests on coupons at Laboratory scale

Screening

Laboratory scale

Industrial Scale

Technological demonstrator

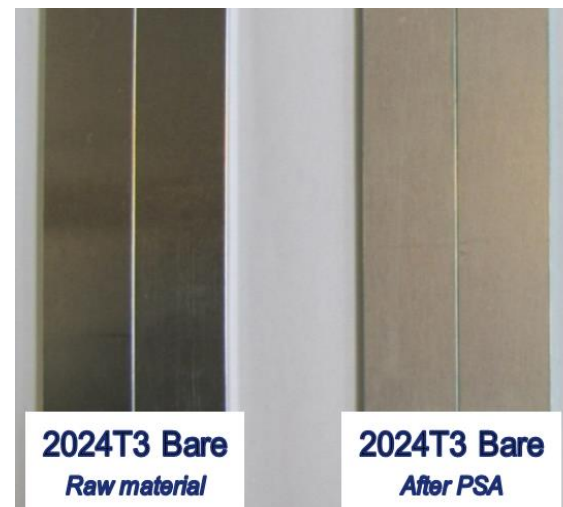
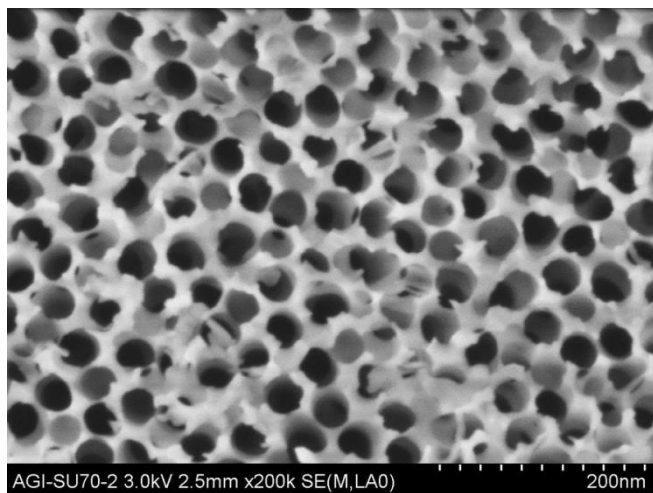
Serial

Goal

To perform different tests at lab scale in order to find the good nominal range with parameters that satisfy the AH technical requirements on different aluminum alloys

Visual aspect and morphology

- PSA oxyde layer is porous and has thickness lower than thickness of CAA unsealed layer.
- Thickness depends on Aluminium Alloys treated.
- PSA oxyde layer is **visible to the naked eye**.



3- Tests on coupons at Laboratory scale

Screening

Laboratory scale

Industrial Scale

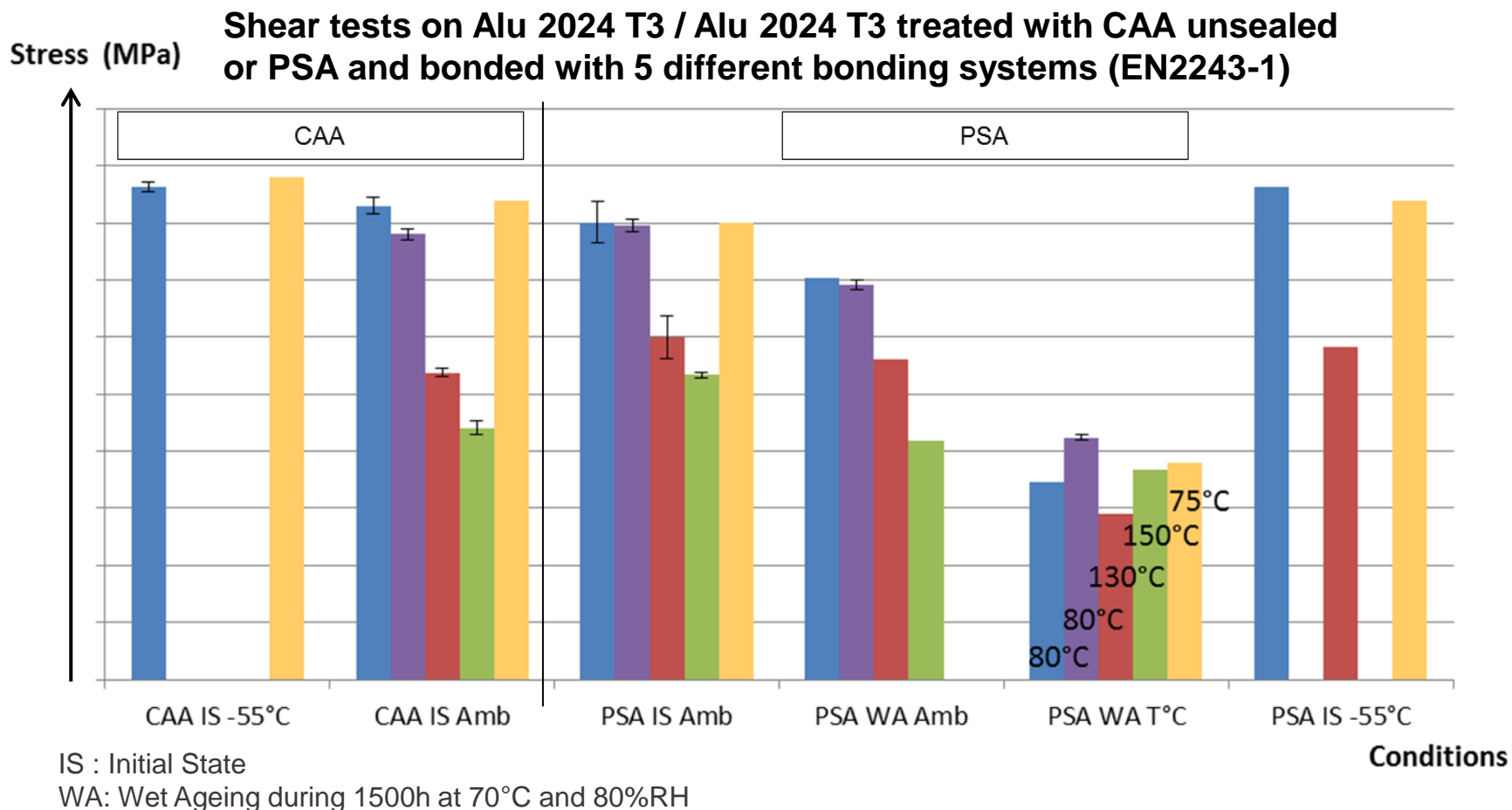
Technological demonstrator

Serial

Goal

To perform different tests at lab scale in order to find the good nominal range with parameters that satisfy the AH technical requirements on different aluminum alloys

Bonding performances on PSA



Conclusion : PSA at least equivalent to CAA unsealed

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4- Tests on coupons at Industrial scale

Screening

Laboratory scale

Industrial Scale

Technological demonstrator

Serial

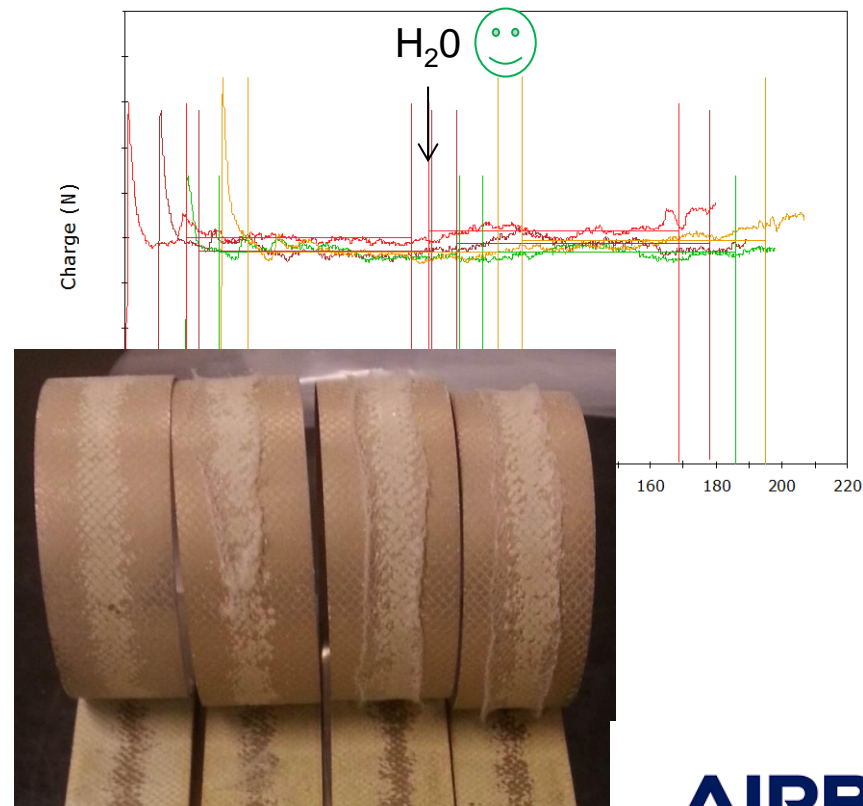
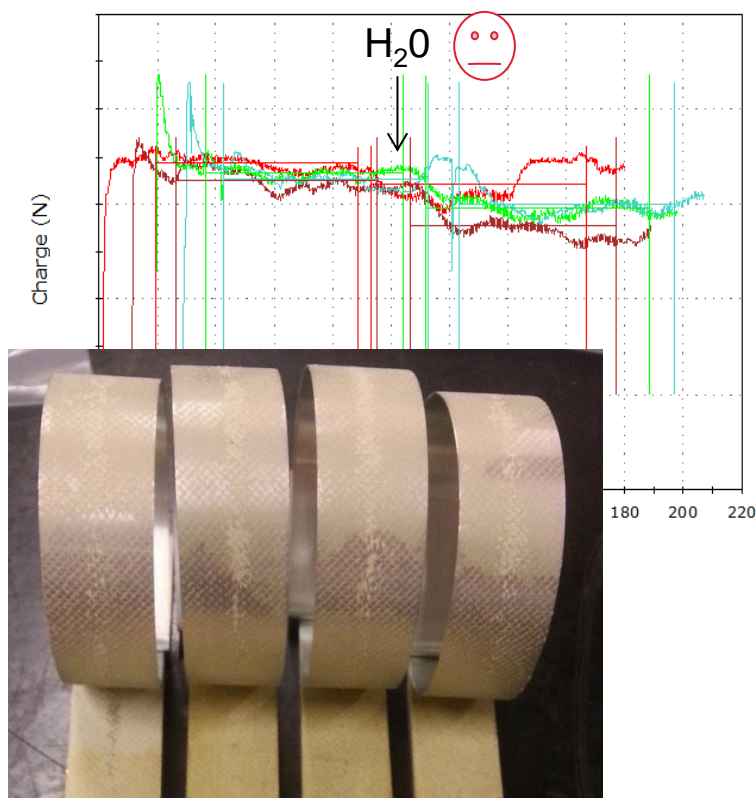
Goal

To perform different tests at industrial scale to verify reproducibility and compliance of results within the qualified parameters.

Bonding performances on PSA

Realization of Dry/Wet Peeling test : test conditions following EN 2243-2. However, for the last 50% of the bondline length, injection of a wet agent on the disbonding location of the test coupon.

This test reveals increase of sensitivity of the surface treatment



4- Tests on coupons at Industrial scale

Screening

Laboratory scale

Industrial Scale

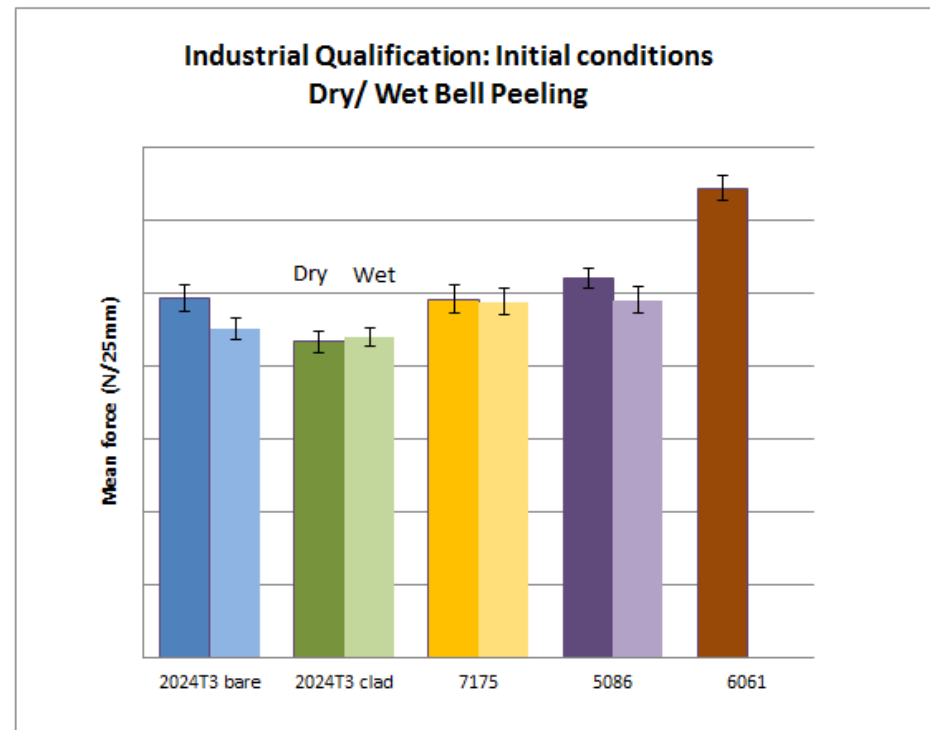
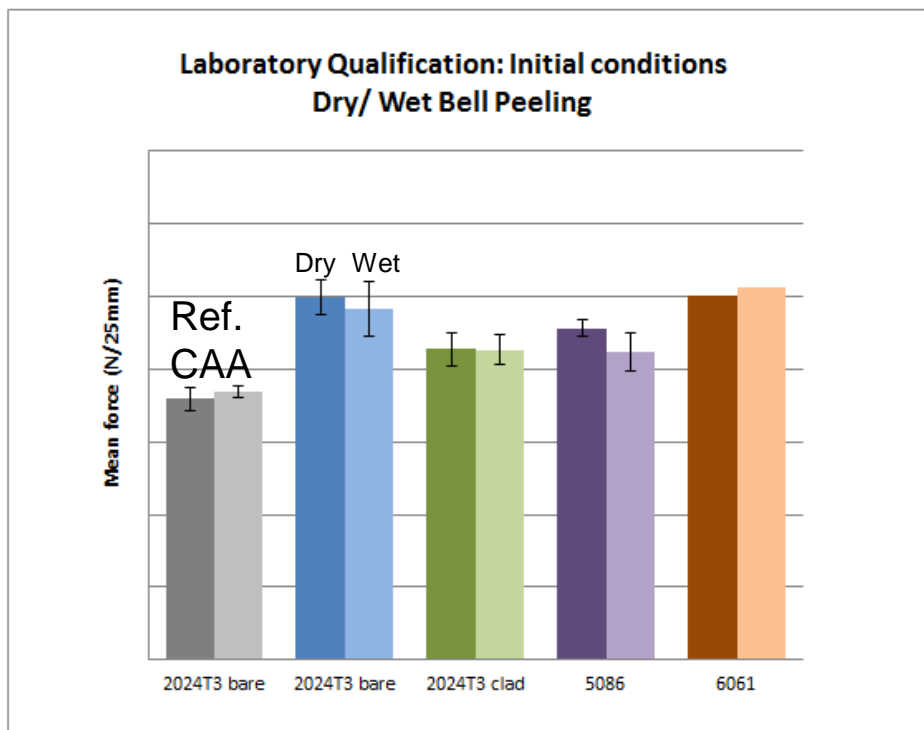
Technological demonstrator

Serial

Goal

To perform different tests at industrial scale to verify reproducibility and compliance of results within the qualified parameters.

Bonding performances on PSA



Conclusions: Results are compliant and reproducible at industrial scale

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5- Tests on coupons at Industrial scale – Robustness tests

Screening

Laboratory scale

Industrial Scale

Technological demonstrator

Serial

Goal

To perform different tests at industrial scale **out of the qualified limits** in order to verify influence of these parameters on bonding performances.

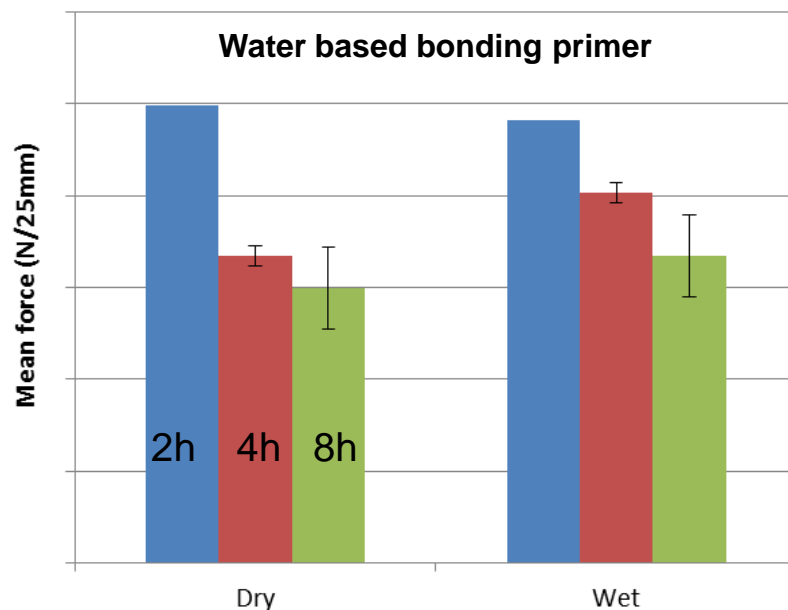
- **To identify Key-Characteristics of the process**

Influences chosen from lessons learnt of Airbus Operations qualification and recurrent non-conformity on CAA unsealed

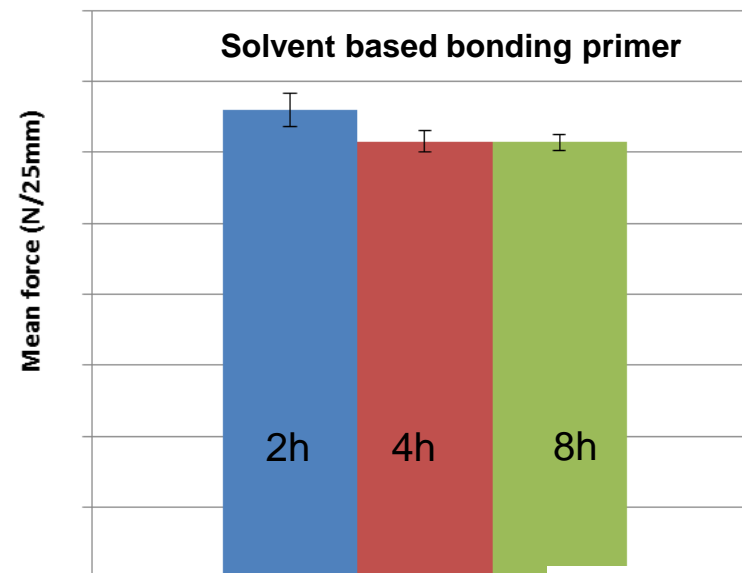
- **Exemple of Peeling tests results on the influence of open-time**

Open-time : time between end of last rinsing after PSA and bonding primer application (first layer).

Influence of Open time: end of Surface treatment and primer application - Dry/Wet peeling



Influence of Open time: end of Surface treatment and primer application - Dry peeling

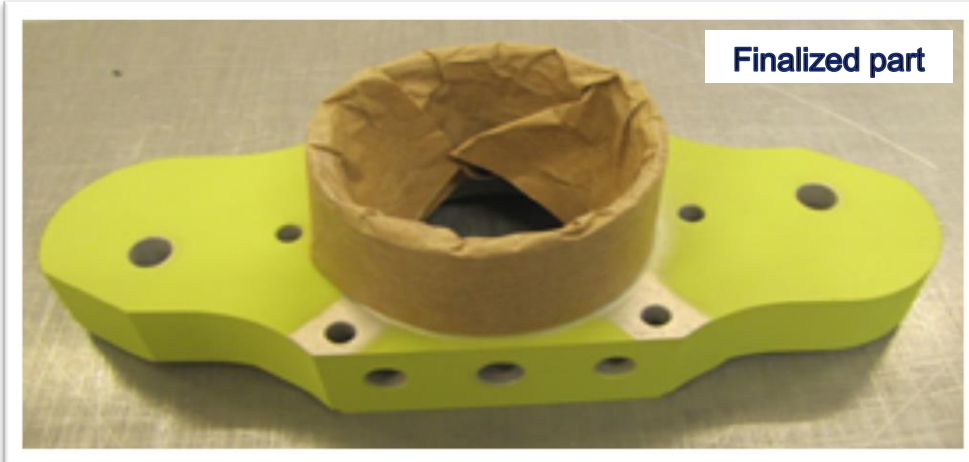


6- Tests on technological demonstrators

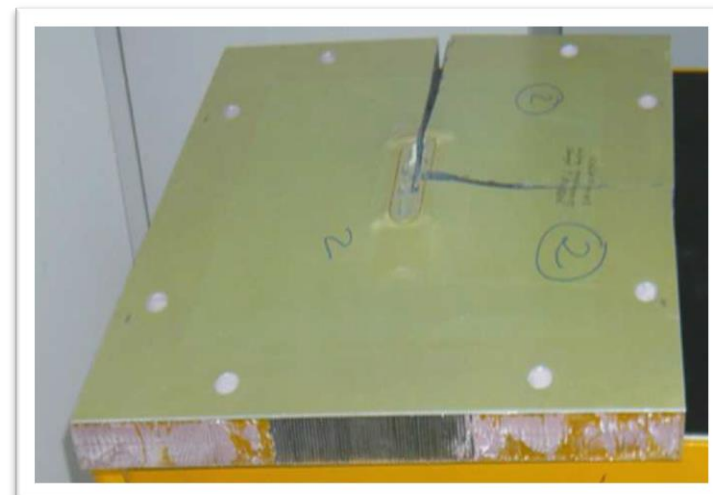


Goal

To perform treatment of parts in serial conditions, with realization of tests.



- ✓ **Morphology** 😊
Thickness, pore size, PSA layer Homogeneity
- ✓ **Bonding performances** 😊
Peel tests on follow-up coupons
- ✓ **Paint adhesion** 😊
acc. to ISO 2409
- ✓ **Robustness**
Influence of non compliant installation of part on production line
- ✓ **Successful test on part**



Conclusions



- **Equivalence of PSA to CAA unsealed demonstrated for bonding applications**
- New step through qualification process : **Robustness qualification**
 - ✓ Realization of mechanical tests out-of-the qualified limits at industrial scale
 - ✓ Key characteristics of PSA process identified
 - ✓ Involvement of Production workshops during this step
- Thanks to Robustness qualification, production workshop has a first experience of the process before serial treatments :
 - ✓ very positive returns from the two internal production workshops of Airbus Helicopters following serial introduction of PSA.
 - ✓ Following step is to implement PSA the supply chain.



Thank you for your attention

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