

Project Proposal

Active / Passive Acoustic SHM System for Impact Detection (APASHI)

"General Aviation and European Air Transport System Third Call FP7"
WARSAW, Institute of Aviation

Contact:

Dr. Ernst Semerad

AMAT- Aerospace & Advanced Composites

2444 Seibersdorf | Austria

T +43(0) 50550-3322 | M +43(0) 664 6207690

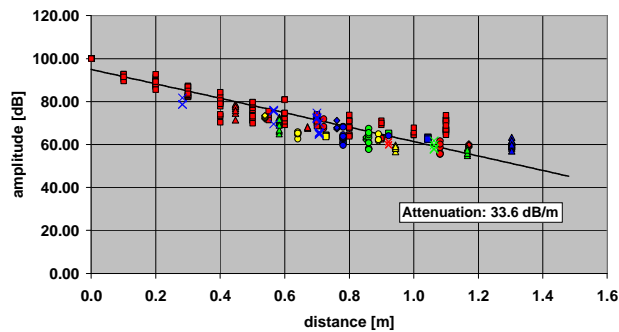
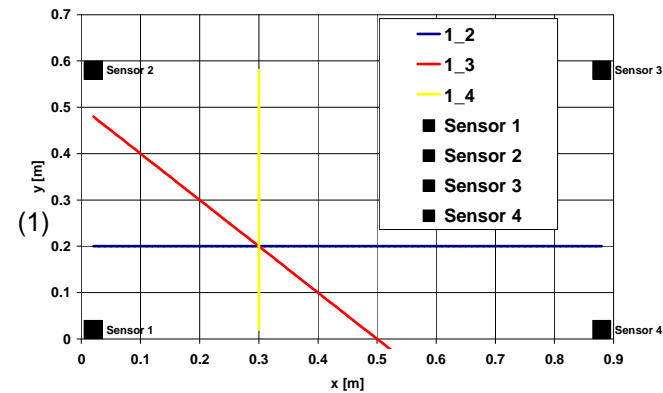
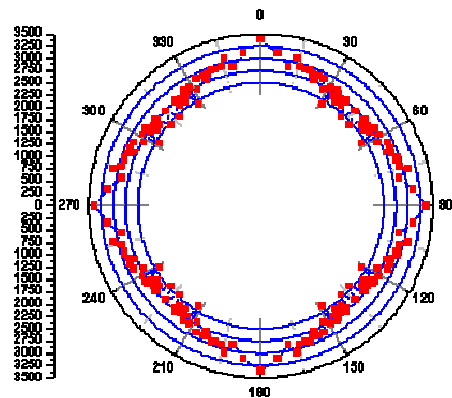
ernst.semerad@ait.ac.at

Background from CESAR Project

- **New Orthotropic Location / Damping Algorithm for Acoustic Emission**
- **Direct Impact damage detection by Acoustic Emission**
- **Impact Damage Quantification by Acoustic Emission on Demand Algorithm**
- **Assessment of cheaper sensor for AE Applications**

Background from CESAR Project

- New Orthotropic Location / Damping Algorithm for Acoustic Emission



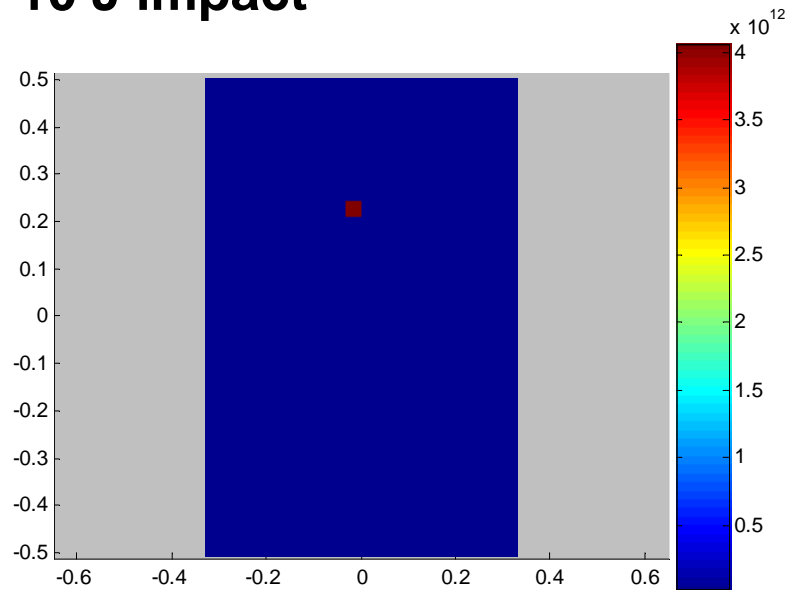
$$\text{signal_strenght} = \int_0^{t=\text{duration}} |V(t)| dt$$

$$\text{signal_strenght}_{\text{corrected}} = \text{signal_strenght}_{\text{measured}} \cdot 10^{\frac{k_{\text{damping}} \cdot \text{Amplitude} \cdot d}{20}}$$

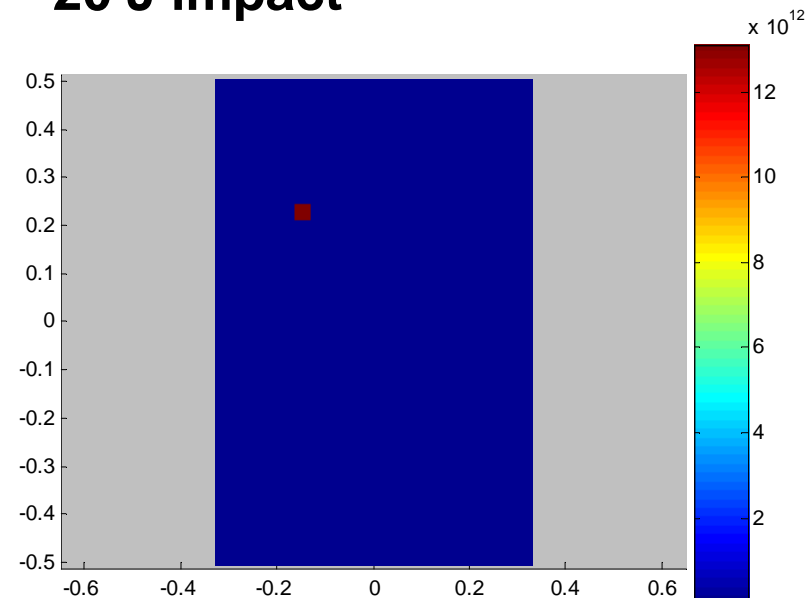
Background from CESAR Project

- Direct Impact damage detection by Acoustic Emission – large GFRP panels

10 J impact



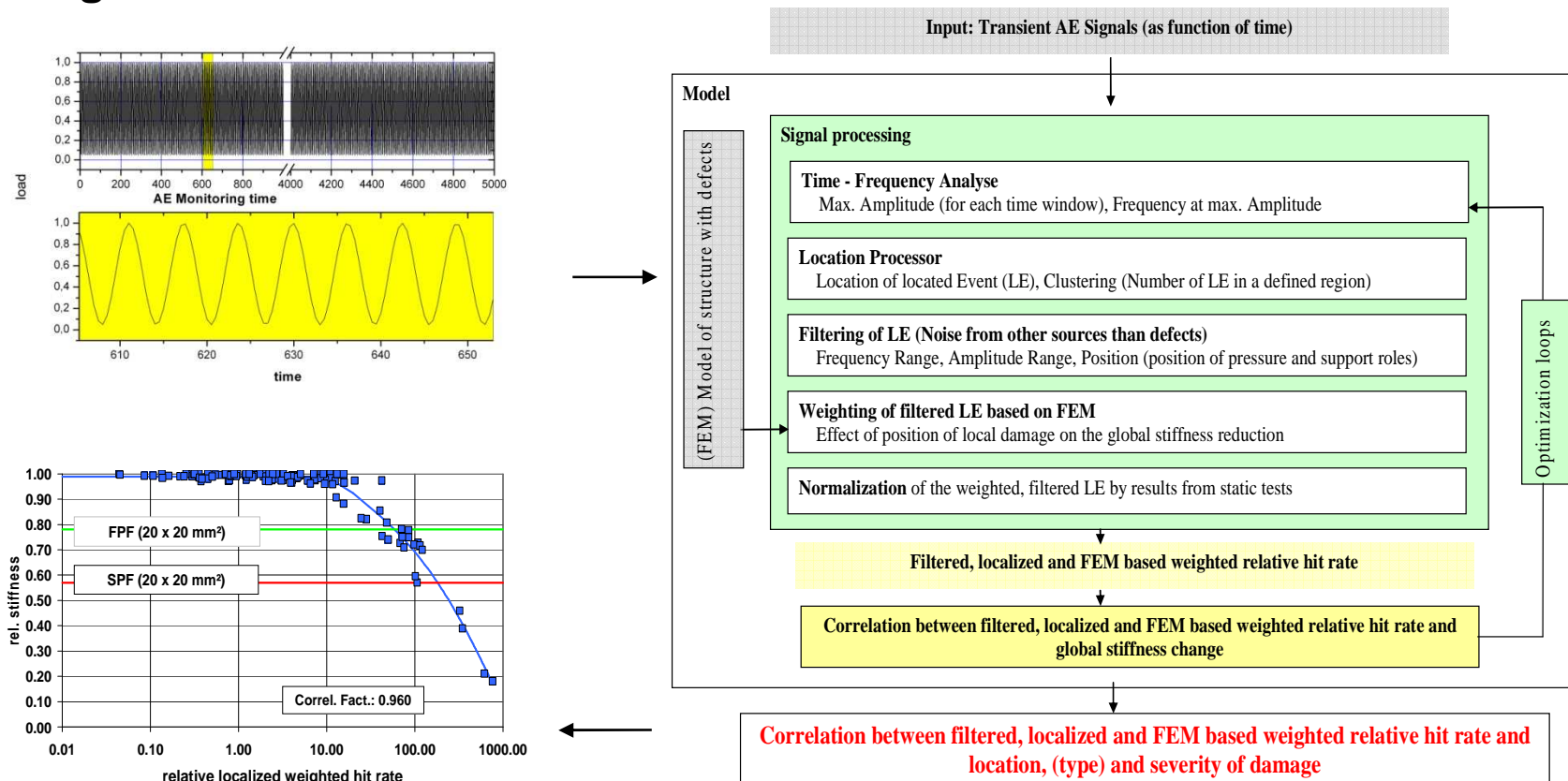
20 J impact



- Location accuracy: +/- 3 mm /
- Linear correlation between Impact Energy and recalculated AE energy

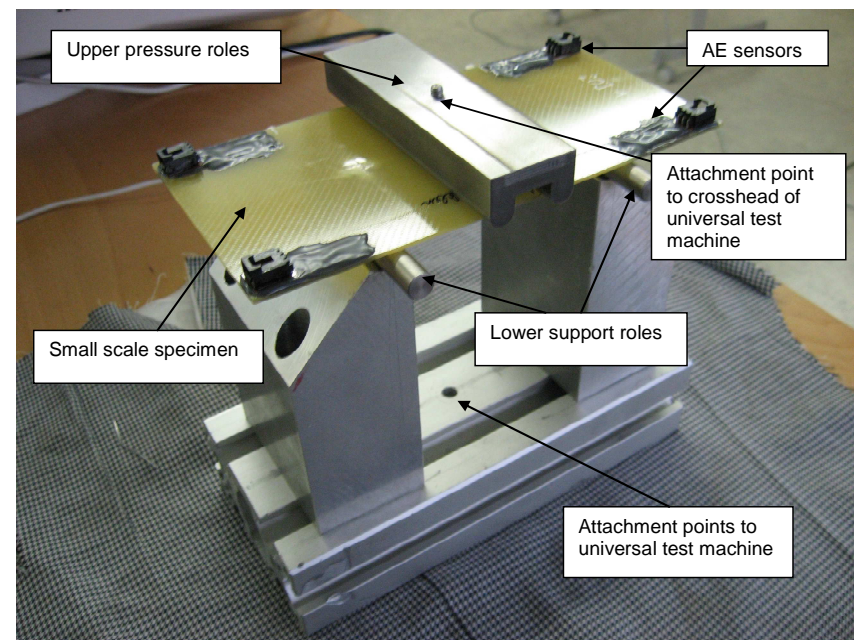
Background from CESAR Project

Impact Damage Quantification by Acoustic Emission on Demand Algorithm



Background from CESAR Project

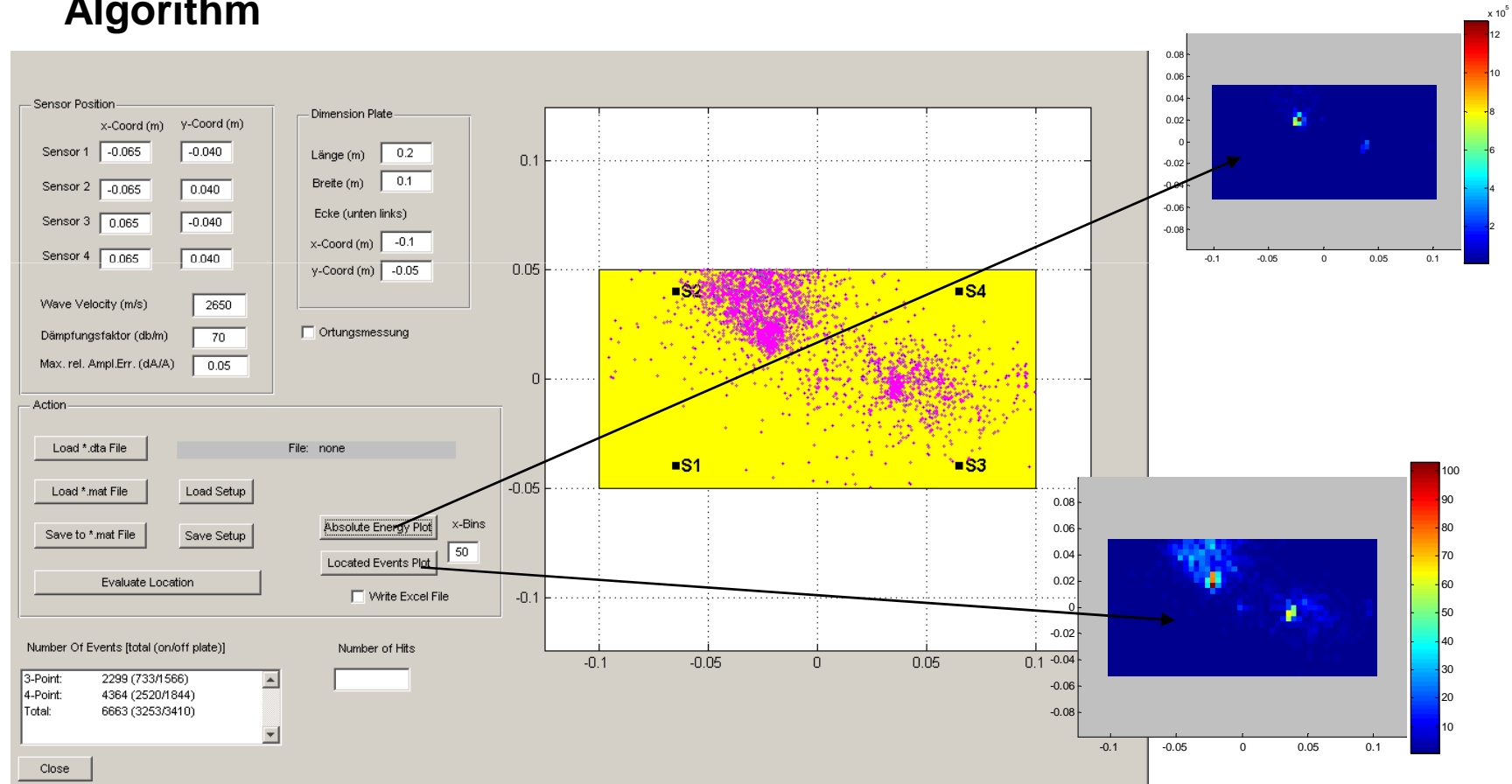
- **Impact Damage Quantification by Acoustic Emission on Demand Algorithm**



- **Two impacts per panel: 5/ 10 / 15 / 20 J**

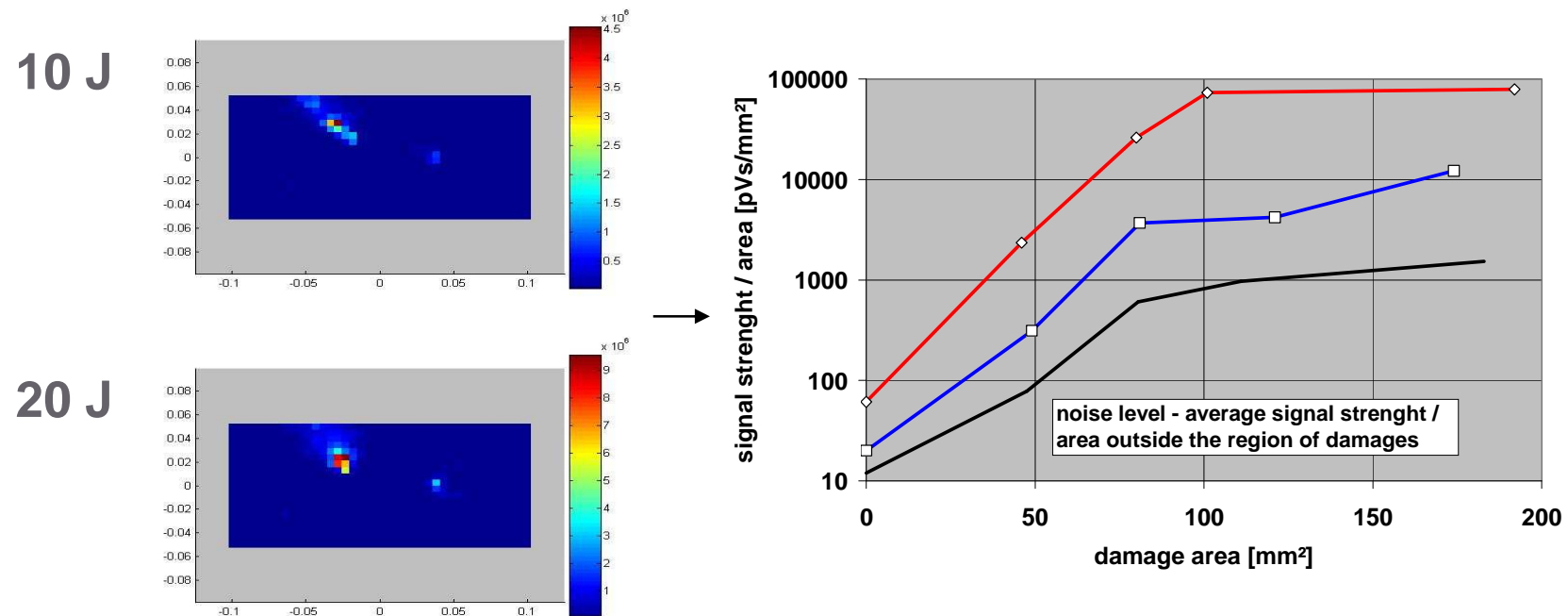
Background from CESAR Project

- Impact Damage Quantification by Acoustic Emission on Demand Algorithm



Background from CESAR Project

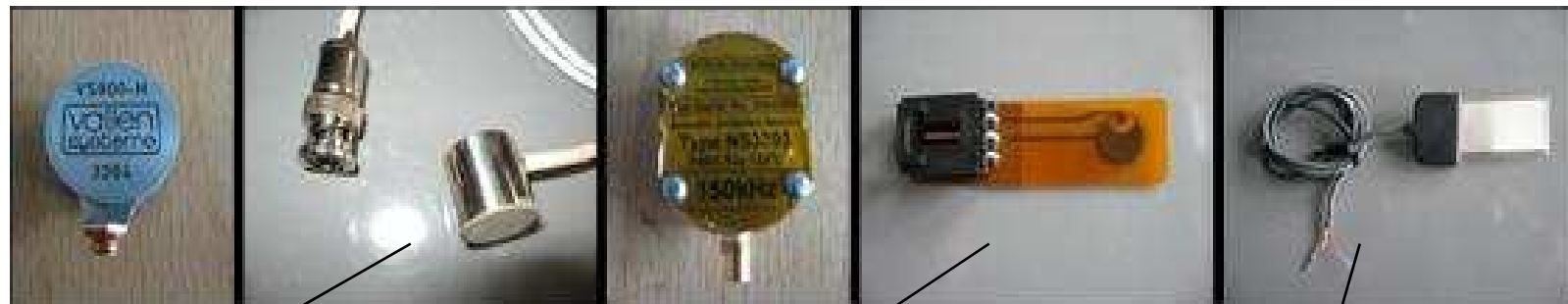
- Impact Damage Quantification by Acoustic Emission on Demand Algorithm



- Location accuracy: +/- 3 mm on 200 x 100 mm² GFRP plates
- Strong dependence on actual load history on the Quantification

Background from CESAR Project

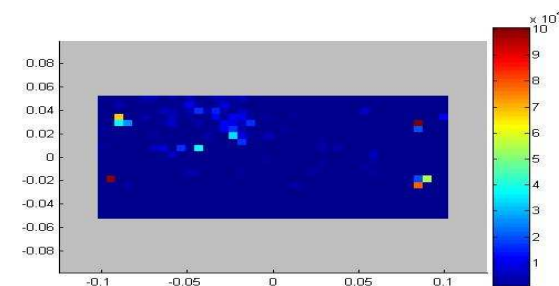
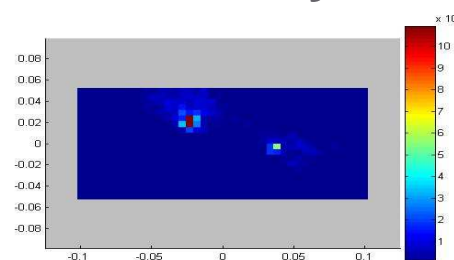
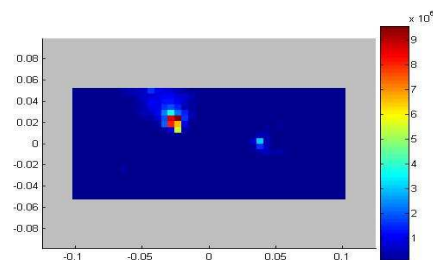
- Assessment of cheaper sensor for AE Applications



PAC

smart layer

PVDF



- Comparable results with conventional AE sensor and smart layer / currently unreasonable results with PVDF foil sensor

Project Idea

- **Development and Application of a Active / Passive Acoustic SHM System for Impact Damage Detection in primary composite structures using cheaper and easy to install or even embeddable sensors**

Proposed Project Steps

- **Identification of relevant types and sizes of damages for a prototype primary composite structure**
- **Analyses of the necessary actuator / sensor configuration**
- **Definition of the hardware / software requirements**
- **Development / Procurement of the necessary hardware**
- **Development of the damage quantification algorithm**
- **Verification of the system on simplified substructures and the final prototype structure under simulated real environmental conditions**

Reference 1



CESAR-Cost Effective Small AiRcraft

WP2 Task 2.4 SMART STRUCTURAL HEALTH MONITORING

Subtask 2.4.1 Systems Definition

Subtask 2.4.2 Systems Analysis

Subtask 2.4.3: Systems Design and Fabrication

Subtask 2.4.4: Systems Testing and Results Analysis

Partners: Aernnova, AIT (ARC), VZLU, Evektor, Merl, CIRA, Eurocopter, HAI, NLR, PZL, ILOT