

# Automation of Damage Assessment (project FIXAR)

Automation-of-damage-assessment-using-augmented-reality, internship/graduation AE 3<sup>rd</sup>/4<sup>th</sup> year

---

Arnold Koetje, November 2019

## Summary

A Dutch consortium initiated by Inholland Composites recently started a 2-year research program to develop knowledge and technology for sustainable composites repair. For the upcoming internship- and graduation period starting February 2020, Inholland Composites Delft is looking for an aeronautical engineering student to perform research in the field of damage assessment of composites typically applied in the wind- and aerospace industries. Different types of inspection techniques will be considered including ultrasonic measurement using the recently acquired DolphiCam 2 inspection camera. The preferred candidate has an interest in using holographic visualization (i.e. using tablet or HoloLens) for damage assessment and therefore is curious in establishing the required software development environment for integration of ultrasonic testing and holographic imaging.

## Background

How can the aviation- and wind energy sector make composites repair economically viable by applying automated technologies? To answer this question, Inholland Composites, part of Inholland University of Applied Sciences, initiated a consortium with Dutch aviation- and wind energy SMEs, CompositesNL, and the Saxion and Amsterdam Universities of Applied Sciences. Starting in October 2019, they will embark on a 2-year applied research project FIXAR: **Future Improvements for Composites Sustainable Automated Repair**. (<http://projectfixar.nl>)



Figure 1 New applied research project FIXAR. An inholland/Saxion/HvA collaboration with Dutch aviation- and wind energy SMEs, and CompositesNL (ref: Inholland Composites)

Driven by a SiA Raak MKB grant, the research question is co-developed with Dutch windenergy- and aerospace companies SPECTO Aerospace, Fusion Engineering, KVE Composites, Colosso Engineering, Pontis Engineering, Schatmaker and Carbon Racing. These SMEs have signed up for project FIXAR as their interest has a close link to their businesses. To ensure knowledge dissemination within the Dutch Wind- and Aviation industry an advisory board has been established consisting of the Royal Netherlands Air Force, the KLM, Fokker GKN, the NLR, the TU Delft, Field lab Zephyros, the Hanze University of Applied Sciences and LM Windpower.

### Outline FIXAR research program

Both windenergy- and aerospace industry rely on lightweight structures using fiber reinforced polymers and have a significantly growing installed base around the world. Both industries share similar needs, but differ in maintenance requirements, processes and maturity stages. By combining forces, this consortium is looking for ways to share and simplify knowledge on composites repair to aim for innovations using automated solutions to break through the current state of the art, often locked in the certified procedures owned by the OEM's.

Four work packages will support answering the main research question and provide focus for the envisioned improvements for composites sustainable repairs:

- workpackage 1: benefits in automated repair solutions for (offshore) windfarms
- workpackage 2: repairability using thermoplastics
- workpackage 3: sustainable composites repair for aerospace
- **workpackage 4: Mixed Reality for inspection and validation of repaired composites**



Figure. 2. FIXAR, applying new ways of automation for repairing composites for the windenergy and aviation industry

(ref: Inholland Composites).

### Internship/graduation assignment description

For work package 4 of project FIXAR, Inholland Composites Delft is looking for an aeronautical engineering student to perform research in the field of damage assessment of composites typically applied in the wind- and aerospace industries. Different types of inspection techniques will be considered including ultrasonic measurement using the recently acquired DolphiCam 2 inspection camera. The preferred candidate has an interest in using holographic visualization (i.e. using tablet or HoloLens) for damage assessment and therefore is curious in establishing the required software development environment for integration of ultrasonic testing and holographic imaging.

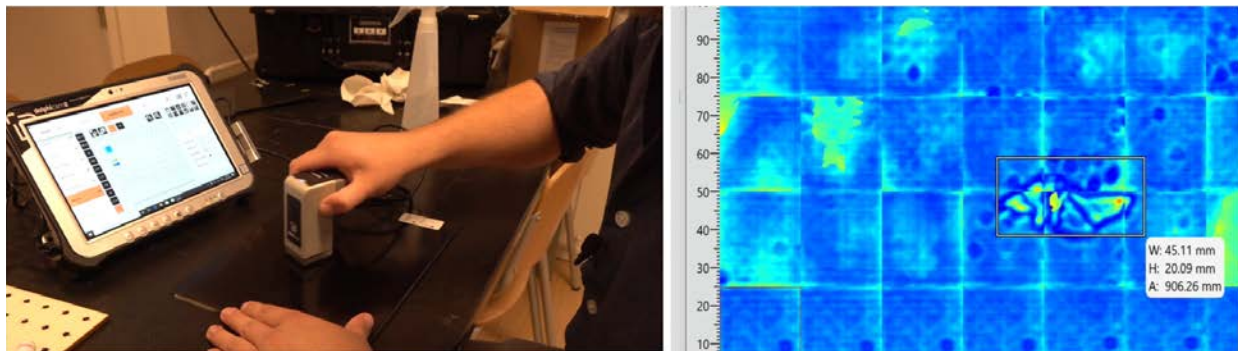


Figure 3 Ultrasonic scan at Inholland Composites with DolphiCam2

With the recent introduction of augmented reality, it would be feasible to integrate this in the validation process in such a way that the scanned surface of the (repaired) damage is visualised directly on the laminate using a tablet or a HoloLens. The ultimate goal is to integrate augmented reality in process of automation of damage assessment for lightweight structures using Non Destructive Testing (NDT) technologies.

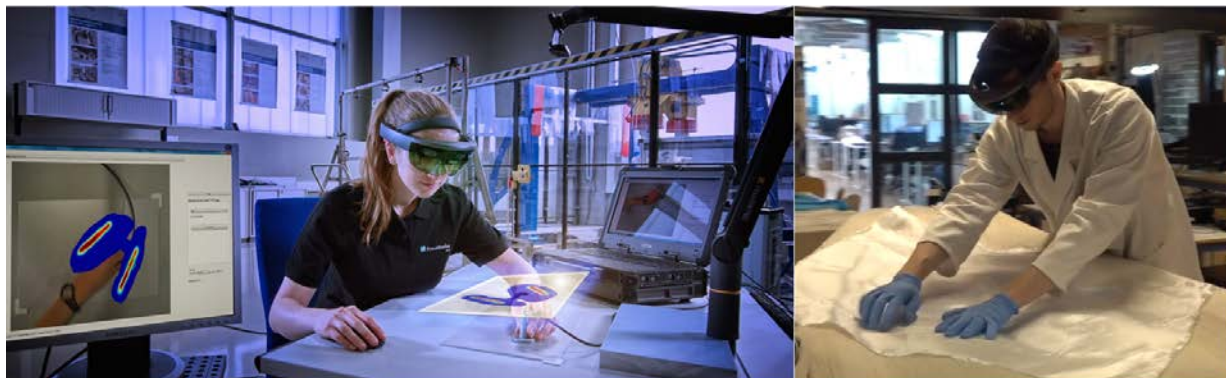


Figure 4 Fraunhofer IZFP (left) - Inholland Composites (right)

### Knowledge base

Inholland Composites performed several RAAK-MKB research projects (since 2014) including *Robocompo* (<http://robocompo.nl>) and *First-Time-Right* (<http://r1ght.nl>), together many SMEs with the aim to automate the vacuum infusion process and achieve first-time-right production. These projects provided a significant expansion in the knowledge base for Inholland where applying automation technologies have proven to be an attractive value proposition in composites engineering, production and validation. Several simulation- and training proof-of-concepts have been

developed using VR and AR resulting in successful demonstrators, which are currently available in the laboratory of Inholland Composites.

### **Activities**

This internship is a chance to improve your expertise in composite materials and its production methods. You will get familiar with Non Destructive Testing methodologies for damage assessment and have an opportunity to enhance your systems-engineering skills by combining NDT with holographic visualisation. Using the API from DolphiCam in combination with other software tools can be expected, allowing direct visualisation on the scanned surface using augmented reality.

### **Scope of work**

During all research activities within project FIXAR it is intended for the student to gain practical experience with composites. So, even if you're working on a 'theoretical' business-case, you will have to get your hands dirty in the lab. Thus, during design you will learn about manufacturing methods and materials. We are striving to create physical demonstrators in the design projects. Furthermore, a typical scope of work consists of these elements:

- Project plan, research questions, research method
- Literature study, research on sensing- and mixed reality technologies.
- Concept and detailed design
- Demonstrator
- Analysis of test results
- Communication and interaction with stakeholders, companies and experts.
- Communication through <http://projectfixar.nl> (status updates to consortium, video's)
- Technical report

### **Company information**

Inholland Composites, located at Inholland in Delft and Alkmaar, is a very well equipped, high-tech laboratory in the field of composite materials and structures. The focus is on fibre reinforced plastics which provide durable and lightweight solutions in a wide range of applications. Inholland Composites needs students from various technical departments and it's our mission to put theory into practice and provide students with up-to-date education, which connects to today's business. Visit <http://inhollandcomposites.nl> for more information.

Internship period: February / July 2020

Assignment Written by: Arnold Koetje

Checked by: J. de Kwant

Authorised by: Antoine Gerritse