MEMO

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Company	:	-
Attention	:	-
From	:	Ed van Breugel
Department	:	Product Group Missiles
Copy	:	Click to enter copy.
Date	:	20-5-2022
Your reference	:	Traineeship or graduation
Our reference	:	F/DGS-2022-020 issue 1
Subject	:	**Design and filament winding of a pressure vessel**

Introduction and background

The Product Group Missiles of GKN Fokker focuses on the Engineering and Development of Defense application like subsonic and supersonic missile airframes and canisters/launching tubes with mainly fiber reinforced thermoset materials.
The Filament Winding (FW) process is the main automated production process for the composite missile airframes and canisters/launching tubes.

This filament winding experience is now applied in a Dutch Mobility Funded project (4 year):
- Aerospace cryogenic liquid hydrogen tank.
- Thermoplastic (AFP/welded) inner & (Filament Wound) thermoset outer tank.
- Consortium incl GKN Fokker, NLR, Toray, KVE, SAM-XL and TANIQ.
- R&D and Missiles team.
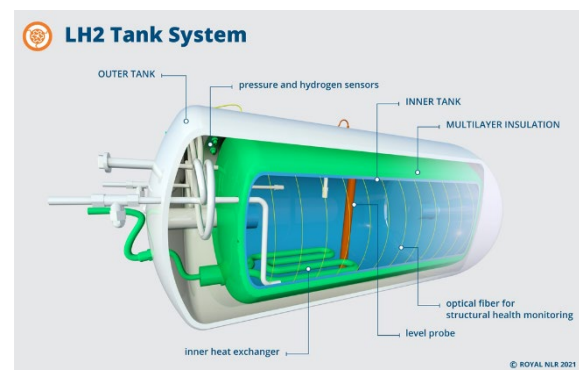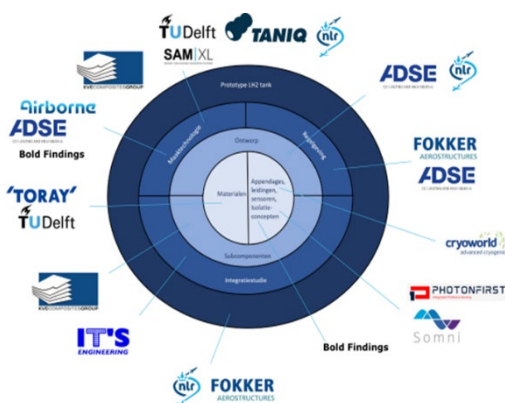
Objective

Knowledge has to be build-up for design and manufacture of specifically LH2 pressure vessels, and in this assignment only filament winding the outer tank with thermoset prepregs, which can be used as input for the total tank design, material/laminate testing and demonstrator manufacture.

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Tasks / Activities

The assignment tasks/activities comprise:

➢ Thoroughly define and describe the goal and deliverables of the assignment including its boundary conditions and limits.

PART1: Design of a filament wound pressure vessel
- Design of an outer tank with deep vacuum inside (stringers/ribs?).
- Extreme vacuum tightness, avoid microcracking.
- FokkerWind and/or TaniqWind interfacing with Abaqus.
- Domeshape optimization.
- Connection to the inner tank.
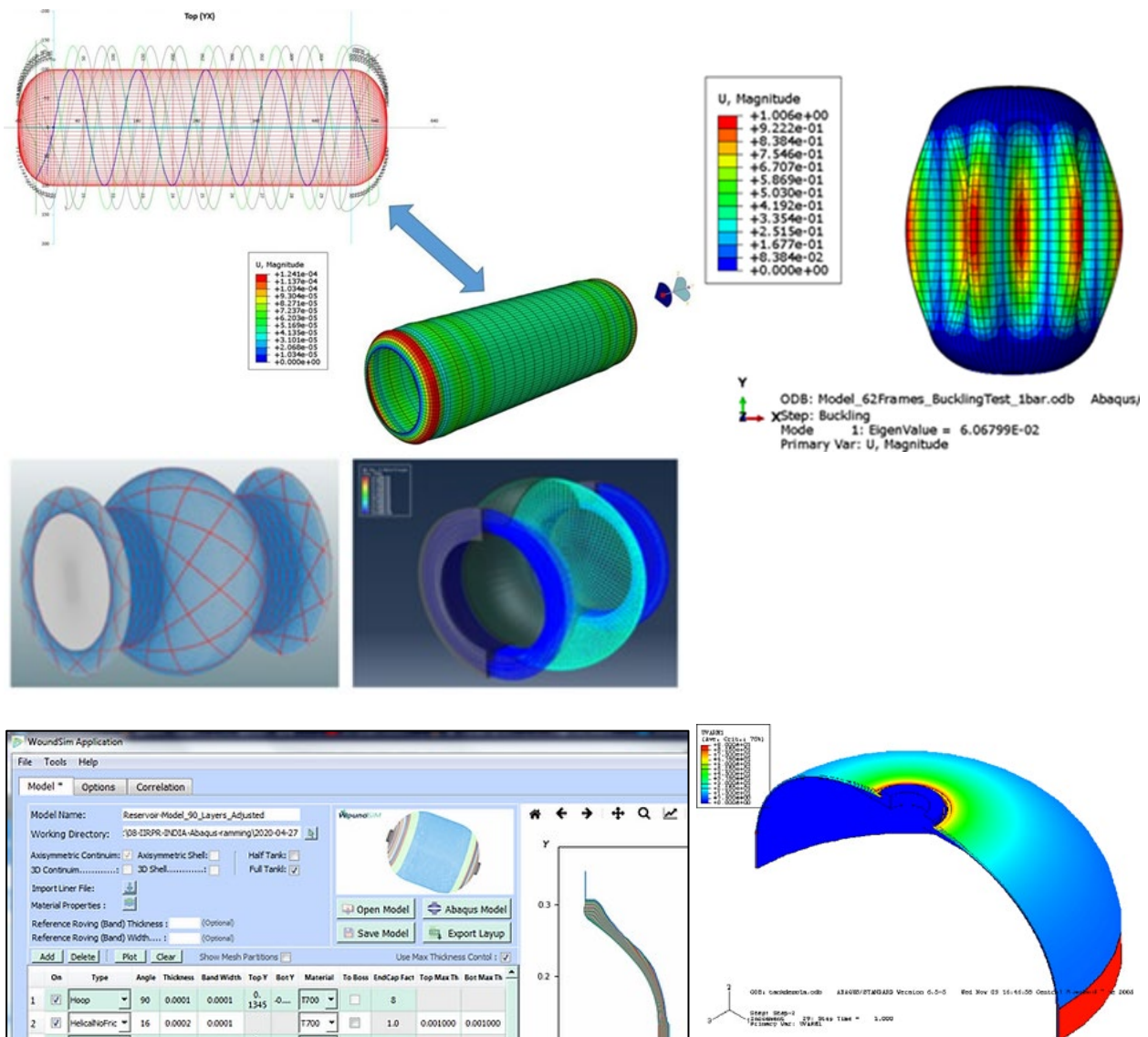
PART2: Filament winding of pressure vessel

- Winding pattern generation (FokkerWind and/or TaniqWind).
- Minimize thickness buildup at the poleopening.
- Optimize winding patterns/cross-overs.
- Manufacturing simulation (RobotStudio or RoboDK) and speed optimization.
- Verification (at Fokker, SAM-XL or TANIQ).
- Vacuum tightness with very homogeneous laminate.
- Guiding of (very) thin ply prepregs to avoid microcracking.
- Oven cured prepregs.

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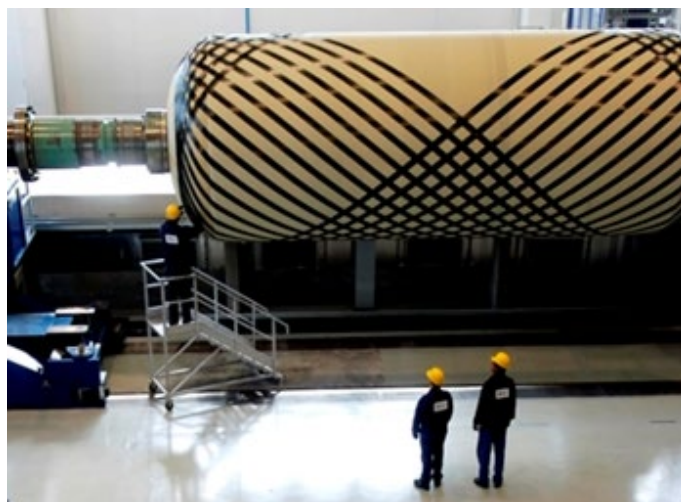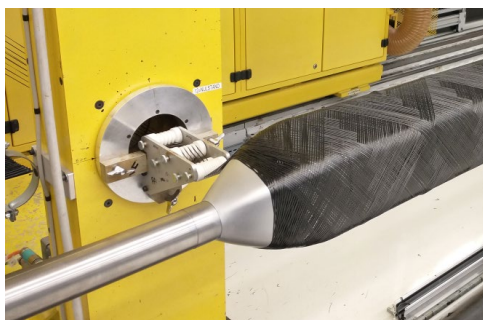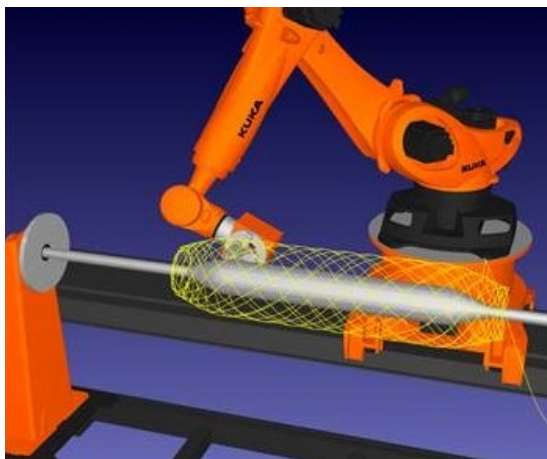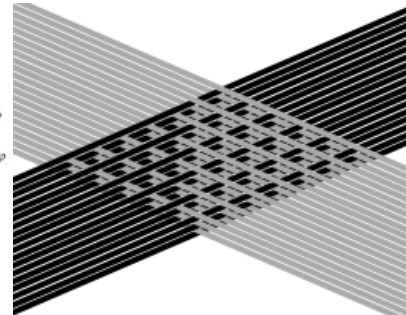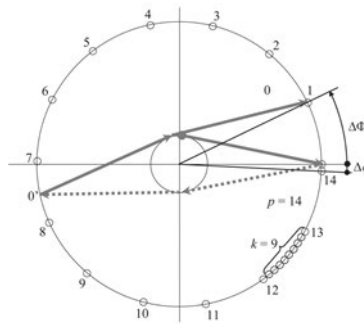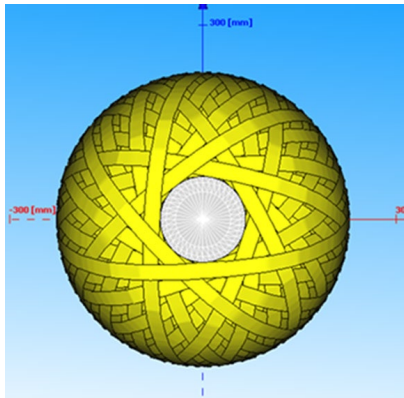
Deliverable

The goal and deliverable description for the assignment is to be delivered within the first month of the internship. The remaining tasks / activities shall be described in a technical report and to be delivered at the completion date of the internship.

Supervision

Internship supervision will be carried out by Ed van Breugel (primarily, filament winding) and Ariel Sarasih (design and stress analysis).

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