

# IDE Master Graduation

## Project team, Procedural checks and personal Project brief

This document contains the agreements made between student and supervisory team about the student's IDE Master Graduation Project. This document can also include the involvement of an external organisation, however, it does not cover any legal employment relationship that the student and the client (might) agree upon. Next to that, this document facilitates the required procedural checks. In this document:

- The student defines the team, what he/she is going to do/deliver and how that will come about.
- SSC E&SA (Shared Service Center, Education & Student Affairs) reports on the student's registration and study progress.
- IDE's Board of Examiners confirms if the student is allowed to start the Graduation Project.

**USE ADOBE ACROBAT READER TO OPEN, EDIT AND SAVE THIS DOCUMENT**

Download again and reopen in case you tried other software, such as Preview (Mac) or a webbrowser

### STUDENT DATA & MASTER PROGRAMME

Save this form according the format "IDE Master Graduation Project Brief\_familyname\_firstname\_studentnumber\_dd-mm-yyyy". Complete all blue parts of the form and include the approved Project Brief in your Graduation Report as Appendix 1!

family name Remmerswaal 4849

initials J.B. given name Joost

student number

street & no.

zipcode & city

country

phone

email

Your master programme (only select the options that apply to you):

IDE master(s):  IPD  Dfl  SPD

2<sup>nd</sup> non-IDE master: \_\_\_\_\_

individual programme: - - (give date of approval)

honours programme:  Honours Programme Master

specialisation / annotation:  Medisign

Tech. in Sustainable Design

Entrepreneurship

### SUPERVISOR

Fill in the information and check the instructions on the right!

\*\* chair Dr. ir. Vegte, W.F. van der dept. / section: Internet of Things

\*\* mentor Ir. Klein, D dept. / section: Circular Product Design

2<sup>nd</sup> mentor Errico Garofalo

organisation: Thuisbaas

city: Zaandam country: Nederland

comments (optional)

Chair should request the IDE Board of Examiners for approval of a non-IDE mentor, including a motivation letter and c.v.

Second mentor only applies in case the assignment is hosted by an external organisation.

Ensure a heterogeneous team. In case you wish to include two team members from the same section, please explain why.

### Procedural Checks - IDE Master Graduation

#### APPROVAL PROJECT BRIEF

To be filled in by the chair of the supervisory team.

chair Dr. ir. Vegte, W.F. van der

date 15 - 03 - 2021

signature

Digitally signed by  
Wilfred van  
der Vegte  
Date:  
2021.03.15  
10:40:50  
+01'00'

#### CHECK STUDY PROGRESS

To be filled in by the SSC E&SA (Shared Service Center, Education & Student Affairs), after approval of the project brief by the Chair. The study progress will be checked for a 2nd time just before the green light meeting.

Master electives no. of EC accumulated in total: 30 EC

Of which, taking the conditional requirements into account, can be part of the exam programme 30 EC

List of electives obtained before the third semester without approval of the BoE

YES all 1<sup>st</sup> year master courses passed

NO missing 1<sup>st</sup> year master courses are:

name J. J. de Bruin

date 16 - 03 - 2021

signature

Digitally signed by J. J. de Bruin, SPA  
Date: 2021.03.16 11:30:40 +01'00'

#### FORMAL APPROVAL GRADUATION PROJECT

To be filled in by the Board of Examiners of IDE TU Delft. Please check the supervisory team and study the parts of the brief marked \*\*. Next, please assess, (dis)approve and sign this Project Brief, by using the criteria below.

- Does the project fit within the (MSc)-programme of the student (taking into account, if described, the activities done next to the obligatory MSc specific courses)?
- Is the level of the project challenging enough for a MSc IDE graduating student?
- Is the project expected to be doable within 100 working days/20 weeks ?
- Does the composition of the supervisory team comply with the regulations and fit the assignment ?

Content:  APPROVED  NOT APPROVED

Procedure:  APPROVED  NOT APPROVED

comments

name Monique von Morgen

date 29 - 03 - 2021

signature

**Proof-of- Concept for a new generation of heat pumps** project title

Please state the title of your graduation project (above) and the start date and end date (below). Keep the title compact and simple. Do not use abbreviations. The remainder of this document allows you to define and clarify your graduation project.

start date 01 - 03 - 2021 01 - 08 - 2021 end date

**INTRODUCTION \*\***

Please describe, the context of your project, and address the main stakeholders (interests) within this context in a concise yet complete manner. Who are involved, what do they value and how do they currently operate within the given context? What are the main opportunities and limitations you are currently aware of (cultural- and social norms, resources (time, money,...), technology, ...).

The Tree is a new take on heat pumps. instead of using fans it uses the venturi effect to allocate enough air for the pump to work. This negates the use of conventionally used fans and has several advantages:

1. The turbine to create the venturi effect can be isolated and therefore the system can be easily sound proofed.
2. Since the need for fans is gone the system can be much smaller making it perfect for homes that do not have space for regular green energy options.
3. The system can be fully electric, making it a great alternative for the currently used gas alternatives.

Stakeholders

Errico Garofalo:

The inventor of the Tree, hopes to see proof of concept and a fully functioning prototype. His motivation for creating the Tree has always been based in sustainable energy solutions. Since this is the core of the product sustainability has to stay one of the main pillars of this project.

Joost Remmerswaal:

The design student, a critically thinking builder that loves to help work on sustainable solutions for the future. Hopes to give the Tree the boost towards production it needs and deserves.

Wilfred van der Vegte (Chair):

Interested in the further development of the product. specifically the IoT possibilities that can emerge from new user scenarios around home heat management.

David Klein (Mentor):

Is a concept developer whose mission it is to stimulate sustainability. Through this project he hopes to forge a fruitful collaboration between IDE and Urgenda.

Prospective heat pump owners: The presumption is they are interested in a low cost green energy solution for their homes. This ofcourse has to be validated through user testing. However the assumption that most people like to save their money on energy is not to far fetched.

Opportunities

Since the tree can be produced for a modest price and is relatively small it can be implemented in a broader target group than other sustainability options. For instance people that are not willing to invest in their current living situation. Or people that don't have acces to the parts of their building to instal other sustainability solutions (e.g. solar panels on the roof).

The new design also gives way for embodiment flexibility. The large white airconditioning boxes on buildings could be replaced by something that you'd actually want to put on the side of your house.

After the initial proof of concept and designing of the product the implementation of a smart system for the design can be implemented. Giving the user more ownership and connection towards their energy system.

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introduction (continued): space for images

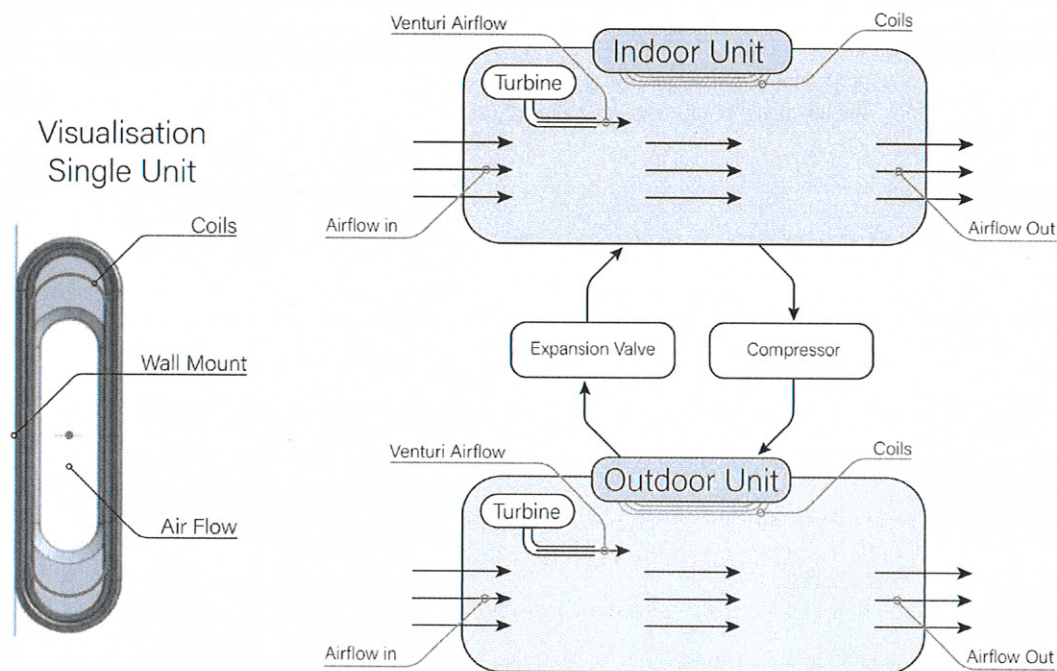


image / figure 1: The original design of the Tree/ Schematic

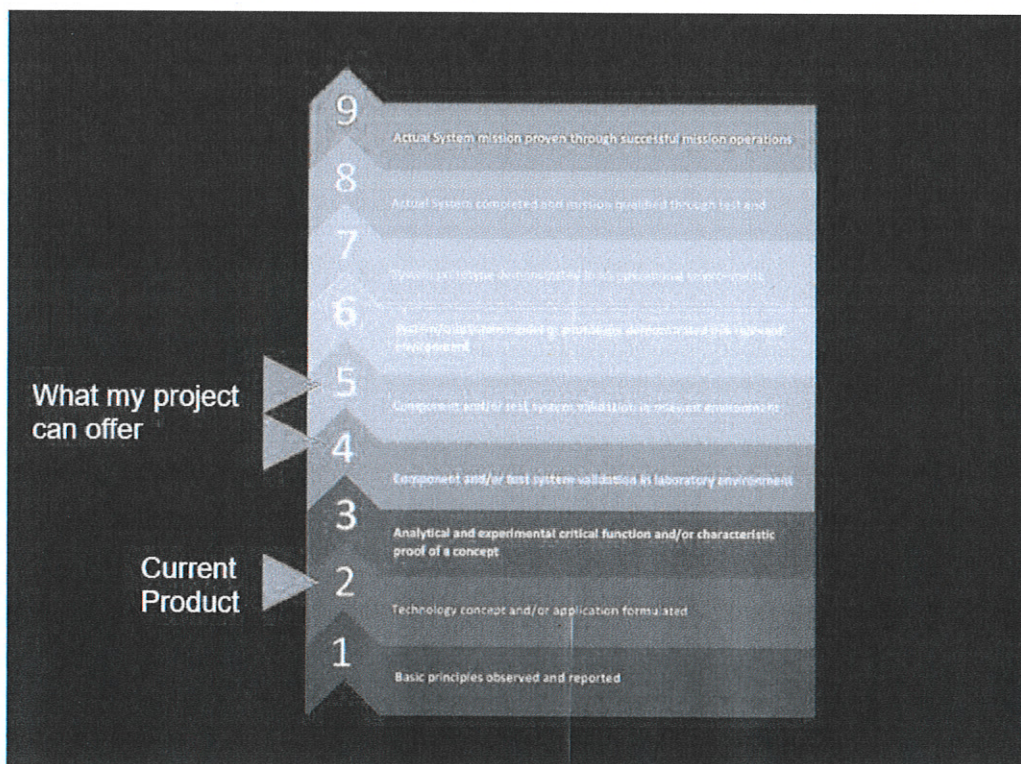


image / figure 2: Technology Readiness Level (TRL)

**PROBLEM DEFINITION \*\***

Limit and define the scope and solution space of your project to one that is manageable within one Master Graduation Project of 30 EC (= 20 full time weeks or 100 working days) and clearly indicate what issue(s) should be addressed in this project.

The current TRL of the product is 2. The basic principles have been observed and an applications has been found and formulated. The next steps in the process are the proof of concept and the validation of the concept in a laboratory setting. This project will be focused on fulfilling this part of the TRL. The requirement for the "completion" of this project will therefore be a working prototype or several working prototypes to validate the working principle. The main variables that need to be found are:

1. The turbine: does it work as well as currently used fans?
2. The airflow: can the venturi effect be exploited?
3. The efficiency: Will this product hold up to the currently available heat pump market?

Of course the context can not be disregarded and therefore the prototype will be validated using user tests and interviews. This will be in collaboration with Thuisbaas to ensure enough people, but more importantly, the correct target group is reached. The main added benefit for this product is the smaller size and sound reduction compared to current solutions. The way this is accomplished with the new product will therefore be tested.

**ASSIGNMENT \*\***

State in 2 or 3 sentences what you are going to research, design, create and / or generate, that will solve (part of) the issue(s) pointed out in "problem definition". Then illustrate this assignment by indicating what kind of solution you expect and / or aim to deliver, for instance: a product, a product-service combination, a strategy illustrated through product or product-service combination ideas, ... . In case of a Specialisation and/or Annotation, make sure the assignment reflects this/these.

The redesign of this product will be done in the follow stages: \_\_\_\_\_

1. The scientific principle will be tested for its validity. \_\_\_\_\_
2. This knowledge will be used to redesign the current product. \_\_\_\_\_
3. Validating the redesign. \_\_\_\_\_

1. The scientific principle (7 weeks)

The first step of this project is to establish a working principle for the heat pump. This will include but is not limited to the airflow, the turbine, the Coefficient of Performance (COP), the noise level and the fabrication.

2. Redesigning the product. (7 weeks)

Most of the current product is based in visualization. The biggest hurdle to overcome will therefore be the internal structure of the product. This will be the focus of the redesign.

3. Validating the redesign. (7 weeks)

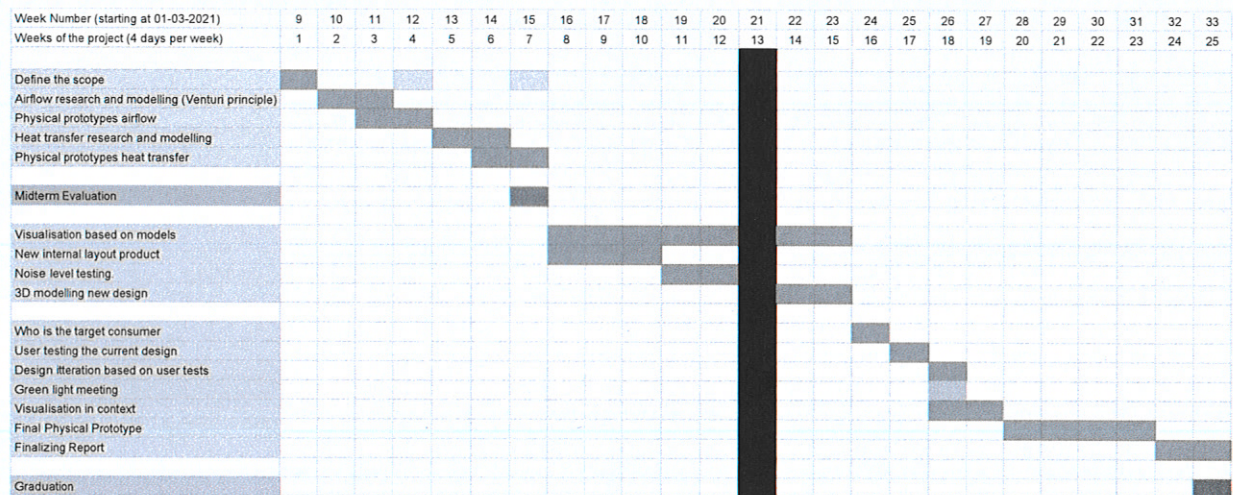
The final step for this project will be the validation of the product. Does it work as intended? Can it compete with the current market? do people want it? these are the kind of questions that will be asked here.

**PLANNING AND APPROACH \*\***

Include a Gantt Chart (replace the example below - more examples can be found in Manual 2) that shows the different phases of your project, deliverables you have in mind, meetings, and how you plan to spend your time. Please note that all activities should fit within the given net time of 30 EC = 20 full time weeks or 100 working days, and your planning should include a kick-off meeting, mid-term meeting, green light meeting and graduation ceremony. Illustrate your Gantt Chart by, for instance, explaining your approach, and please indicate periods of part-time activities and/or periods of not spending time on your graduation project, if any, for instance because of holidays or parallel activities.

start date 1 - 3 - 2021

1 - 8 - 2021 end date



As stated before this project will be divided in 3 stages: The scientific principle, Redesigning the product and Validating the redesign. Every stage will be roughly 7 weeks. The work weeks will be 4 days and therefore the full project will take 5 weeks extra capping at 25 weeks instead of 20.

Of course this planning is open to changes if the need for them arises.

### MOTIVATION AND PERSONAL AMBITIONS

Explain why you set up this project, what competences you want to prove and learn. For example: acquired competences from your MSc programme, the elective semester, extra-curricular activities (etc.) and point out the competences you have yet developed. Optionally, describe which personal learning ambitions you explicitly want to address in this project, on top of the learning objectives of the Graduation Project, such as: in depth knowledge a on specific subject, broadening your competences or experimenting with a specific tool and/or methodology, ... . Stick to no more than five ambitions.

I set up this project because i want to start helping out in the world. My whole life has been about improving myself. As many students these days the main part of my life has been studying since basically my birth. This project is the perfect opportunity to start contributing to the world in a positive way. Especially since if this project is a success it will contribute to solving the global environmental crisis.

In both my bachelor and my master I've used a lot of different modeling tools. But they were always used on a surface level of competence. In this project I want to dive in to one of those modeling tools to become an expert so I have at least one or maybe more tools in my repertoire for physics based modeling. This project will be great for this study goal since its essence lies within the current and future heat pump technology.

Furthermore the way Errico Garofalo approaches this project is in line with this point of view. His work for Thuisbaas is based in creating a better and greener world for humanity and his children. This will hopefully create a setting in which I can create a product that will not be fully focused on making money. This is how I would like to approach all of my projects because money is definitely not a main objective for me as a designer.

I would consider myself a physical prototype focused designer. This is also something I want to bring to this project as an expertise. Hopefully the project will go smoothly, creating enough space and time for implementing this strength.

### FINAL COMMENTS

In case your project brief needs final comments, please add any information you think is relevant.

