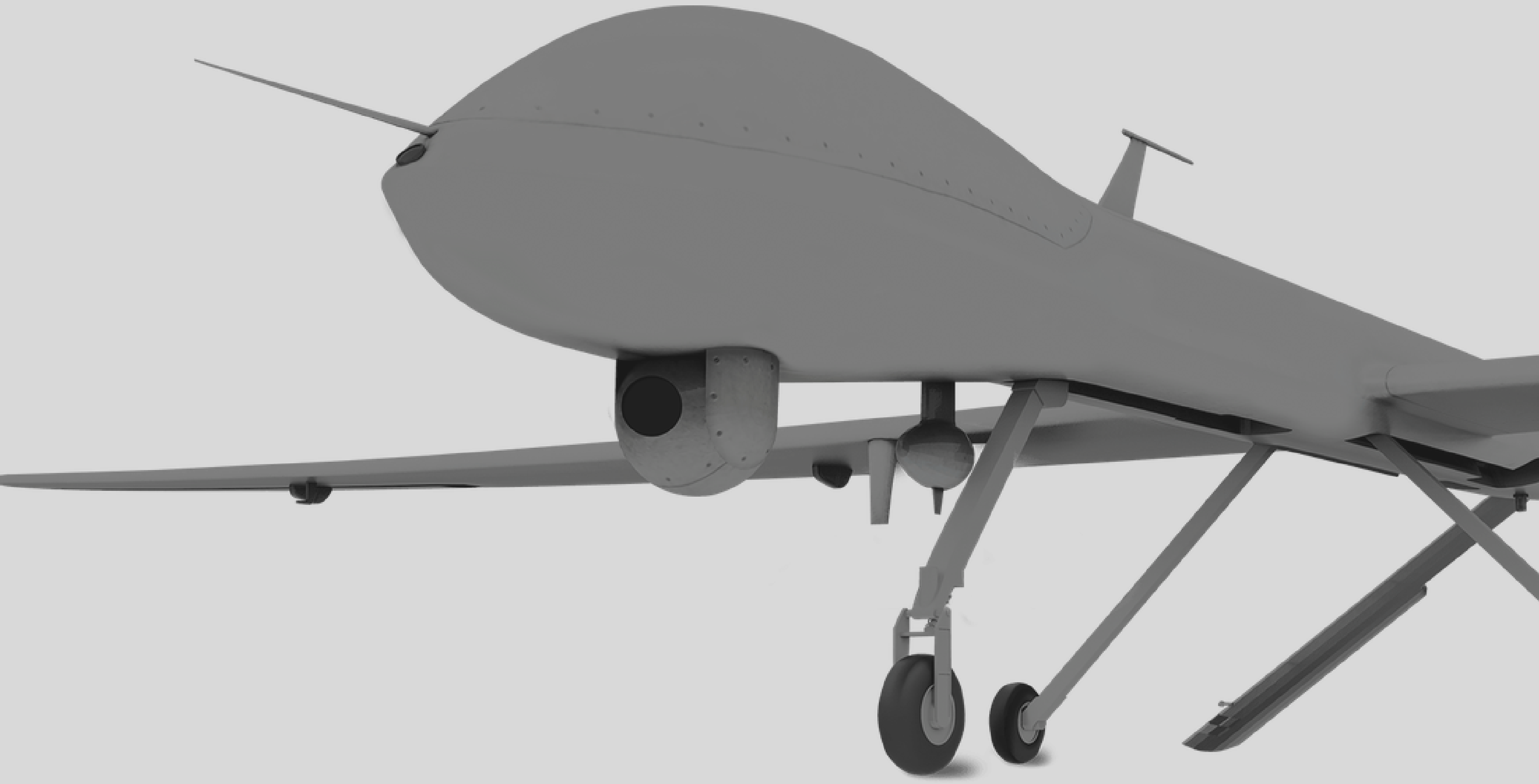
LOCATING RESPONSIBILITY IN AN AUTONOMOUS MILITARY TECHNOLOGY

A CASE STUDY OF THE AGS GLOBAL HAWK



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TECHNO-ANTHROPOLOGY MASTER THESIS

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Dansk Resumé

Dette speciale undersøger autonome teknologier i en militær kontekst. Formålet er at opnå en dybere indsigt i teknologisk autonomi og rollen som dette koncept spiller, i fordelingen og forståelsen af ansvar. Vi har i foråret 2018 udført etnografisk feltarbejde vedrørende forskere, og andre interessenter inden for det militærteknologiske fagområde. Ved hjælp af interviews, uformelle samtaler, observationer og litteratursøgning, har vi dannet os et indblik i den nuværende kontrovers om autonome teknologier. Vi har fokuseret på casen vedrørende Global Hawk dronerne, som de bliver brugt af NATO AGS. Global Hawk dronen er udviklet af det amerikanske militær i samarbejde med Northrop Grumman. Dronen har et massivt vingefang, en række af avancerede sensorer og er i stand til at udføre langvarige og langtrækkende rekonoceringsmissioner. Aktør-netværks teorien (ANT) og postfænomenologien har været de styrende teoretiske redskaber gennem dette speciale. Vi har brugt ANT til bedre at forstå det netværk der samles omkring skabelsen, indkøbet og brugen af Global Hawk dronen, samt hvor ansvar findes i dette netværk. Postfænomenologien har hjulpet os til at forstå hvordan autonome teknologier påvirker deres brugere og hvilke konsekvenser dette har. Som supplerende teoretisk ramme, har vi inddraget Ibo van de Poels; Problem of many hands. Denne teori har hjulpet vores forståelse af besværlighederne ved at identificere ansvar i et netværk der består af mange aktører.

Det amerikanske militær, NATO, de italienske luftfartsmyndigheder, Sigonella basen, piloten, data analytikeren, sensorerne, satellitter og mange andre aktører er blevet identificeret. Herfra har vi opnået en forståelse af den normative måde at fordele ansvar på i militæret. Personer er ansvarlige for deres direkte opgave og lederen af en given mission er ansvarlig for denne. Vores indsigt i NATO AGS netværket og de autonome teknologiers indflydelser lader os vurdere at det kan være hensigtsfuldt at se nærmere på hvem der er skyld i fejl når man snakker ansvar for disse. Altså at der er et skel mellem at placere ansvar og være ansvarlig for et uheld. For at Global Hawk dronen kan fungere som autonom til tider, ser det ud til at kræve et stort og stabilt netværk. Eftersom alle de involverede teknologier påvirker deres menneskelige brugere, gør dette placeringen af ansvar endnu mere besværligt.

Vi har fundet brugen af ANT og postfænomenologi som nyttige værktøjer til at undersøge ansvar og autonomi i en militær kontekst. Vi foreslår yderligere casestudier på området, med samme teorier. Derudover ville inklusionen af etiske teorier til vurdering af argumentation være fordelagtigt.

Abstract

This master thesis explores autonomous technologies in a military context, with the focus of understanding how technological autonomy can change the way we place and understand responsibility. Through fieldwork structured around the use of Actor-Network Theory and postphenomenology, we have examined the Global Hawk drone used by NATO AGS, for military reconnaissance and intelligence gathering. The fieldwork found that the military places responsibility based on a strict structure, where a person is accountable for their designated task and a commander is responsible for the specific operation. We will challenge this structure, by scrutinising the mediations and influences of the Global Hawk to better understand how it impacts each actor involved in its use. The effects of the autonomous mediations of the technology will be discussed through the perspective of *the problem of many hands,* as the framework for placing and following responsibility in the network. The research methodology has been a network-centric approach to following autonomy and responsibility, as it came to light when scrutinising the Global Hawk. We establish the Global Hawk as a strong technology, with a morally sound design. We have found that a highly advanced automated technology can make use of autonomous functions, even if there is a human in control. For future discussions of technological autonomy in a military context, we encourage an understanding of technological autonomy as process based, and for more case-based studies to be performed on autonomous technologies.

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Introduction

Technologies change many processes of our daily lives. They impact our approach to mundane and extraordinary tasks alike. The military has begun development on weapon systems utilising autonomy, enabled by the advancements of automatic technologies. The development has begun without a proper framework for understanding what autonomy is, what it does and how it impacts responsibility. We will explore these themes in our master thesis. Our goal is to participate in creating a better understanding of autonomy and responsibility, as well as proposing a theoretical framework for creating greater clarity in the doings and impacts of autonomous military technologies.

The technological advancements have a possibility of changing how war is waged, and has been the subject of both critique and justification of its use. We do not wish to assume the role of judge, and a final verdict on whether autonomous military technologies are 'good or evil' will not be the focus of this thesis. Our work is meant as a contribution to identify where and how autonomous technologies clash with human actors and responsibility, in an otherwise strict military regime.

Before we can truly begin, we need to consider the current understanding of autonomy in the public sphere of today.

In the recent years autonomous technologies have gained traction within the scientific communities.

Scientists and engineers from various fields have different perspectives on the dilemmas and possibilities, that such technological advancements will carry forward.

Autonomous technologies are perhaps most famous in the public domain as self-driving cars, which might be a household technology sooner than later. This technological development has carried numerous discussions on design, responsibility and ethics of technology. Ethicists, philosophers, software developers and engineers have all debated the implications of autonomous vehicles; who should be responsible and how autonomous vehicles will fit into a larger network with manual vehicles.

Autonomy has been attributed to the human condition for a long time. Autonomy has been closely linked with free will. It relates to the ability to make judgement calls based on the knowledge available through experience and the world we perceive (Dworkin 1988:6). Human autonomy is still a subject for debate and that makes it no small wonder that technological autonomy is even harder to define. Scientists have discussed and called for several different frameworks for understanding and working with autonomous technologies now and in the future (Noorman and Johnson 2014).

Views on autonomy and responsibility

In the current literature we find four viewpoints on autonomy and responsibility. We find these specific arguments interesting to behold and have in mind when working with these concepts.

1) Rob Sparrow (2007), argues in his book "*Killer Robots*", that the responsibility of wrongful doings of autonomous weapons does not fall on humans, but rather on the autonomous technology itself. He suggests that autonomous technologies themselves can be responsible. This framework for responsibility is made possible by Sparrows understanding of the technologies becoming truly autonomous, and that humans no longer can act as safety measures, due to the processing power and rapid self-learning of the technology. Sparrow's suggestion is controversial, and calls for a ban on autonomous technologies, because it is impossible and therefore unethical to place responsibility for the actions of these '*killer robots*'.

2) Thomas Hellström (2012) argues in: "*On the moral responsibility of military robots*" that we must develop tools and understandings for identifying levels of autonomy within weapon systems. He argues for the responsibility and blame to be placed upon the robot itself. Hellström's view is more moderate than that of Sparrow, where Hellström acknowledges different levels of autonomy. The framework for placing blame suggests that Hellström is concerned with the obligation to deal with problems that may occur in the future, and being capable of doing it now. As such, responsibility is not only placed upon the artefacts in the future, but it is also the responsibility of stakeholders, scientists and decisions-makers to solve the issues before they arise.

3) Gordana Dodig-Crnkovic and Daniel Persson (2008), states that humans and technology should share the responsibility. The complexity of the autonomy will not allow the designer to address all possible future scenarios of action. Therefore, a framework for placing responsibility on both human and technology is needed. Methods are needed for ensuring that most feasible security risks are handled prior to the use of the autonomous technology. Dodic-Crnkovic and Persson, involves the human actors in the responsibility again. They recognise that autonomous technologies can act in multiple ways in many scenarios, and the designers are absolved of some responsibility regarding situations that are not possible to expect. They employ a more moderate view of autonomous technologies, than both Hellström and Sparrow, where the designers can control the technology, at least to some extent.

4) Samir Chopra and Laurence F. White (2011), calls for an approach that places responsibility solely on designers and producers to foster an ethical development of autonomous technologies. Here we find the least techno-centric suggestion of placing responsibility. Humans will be in enough control of the autonomous technologies to control them and expect the different patterns of action. Their argumentations involve the efficacy to produce the desired results from the technology.

These are some of the diverse solutions to placing responsibility of autonomous technologies. There are different expectations of what autonomous technologies will be capable of, and to what extent humans will be able to control them. These expectations to capabilities creates a barrier for defining autonomy, since the same word is supporting different connotations.

Our exploration of literature on autonomous technologies, has led us to focus on the understanding of autonomy that the field and our informants introduce. This approach has shown itself to be useful when discussing the future needs and issues of responsibility with intricate technologies in high-stake situations, such as war. An important aspect of this discussion, is that while scholars are occupied with responsibility regarding technology, designers and decision-makers. Through our informants we have come to understand the normative approach to responsibility in the military, where the commander holds the full responsibility of military action. The analysis will amongst other things concern itself with this normative military responsibility and the expanded views on responsibility introduced by the field.

Autonomous technologies can be described in three stages (Scharre 2016).
First; we have automatic technologies. These perform a function based on pre-programming and are not capable of performing an action without the full assistance of a human actor. Automatic technologies are not defined as autonomous, but as advanced technologies that begin to approach technological autonomy.

Second; semi-autonomous technologies can perform actions and duties without the necessity of a human. These systems are designed in such a way that a human must always approve all actions - the technology has more autonomy of the execution, but not the action itself.

Third; true-autonomy is as the name entails, technologies that perform and act without the need for a human. They can adapt and learn and are built upon a strong artificial intelligence. These technologies are not in use in the military today, but are actively being developed (ibid.). True-autonomous technologies are the future perspective of warfare that both frightens and excites different actors.

Another concept that is important to understand for this context, is the element of human control. Being '*in, on or out of the loop'* is a prevalent technological perspective on the human interaction with technologies that can be said to be autonomous. This defines the human influence in various degrees of control (Scharre 2016; Schaub Jr. & Kristoffersen 2017).

In the loop means that a human actor needs to approve certain actions of the machine, and it cannot function without direct human interaction.

Being *on the loop* means that a human actor is surveilling the actions of the machine at all times and have the tools to stop or change the actions of the machine if necessary.

To be *out of the loop* means that the human actor is in no control or contact with the machine, and that it is truly autonomous.

Autonomous technology is not a straight forward subject. A technology can be automatic in its output, but utilise autonomous processes to reach that output.

Some technologies can have autonomous capabilities when coupled with other technologies, but not as a stand-alone product. Autonomous technologies are often described as complex. The function of the technology and the broad range of networks the technologies can influence both contribute to the complex image. When we address autonomous technologies as complex, we refer to the functions and doings of the system. As a technology gains the capability to analyse and act upon this analysis, it can be difficult for a human to control and understand every part of the decision loop.

“As autonomous weapons increase in complexity, however, it may be more difficult for human operators to fully understand the boundaries of their behaviour and accurately predict under what conditions failures might occur, even if they are unlikely.”
- (Scharre 2016).

This master thesis is concerned with autonomous technologies in a military context, this does not always mean weapons, and rather than weapons, the analysis will take root in a semi-autonomous military technology for intelligence gathering.

The military context

Autonomous weapon systems are already quite the controversy, with both Elon Musk and Stephen Hawking taking an early stand against the technology ("AI Open Letter - Future Of Life Institute" 2018). At the start of April 2018, 50 of the world’s leading scientists on AI and robotics decided to collectively boycott the South Korean university; Korea Advanced Institute of Science and Technology (KAIST), for cooperating with the South Korean weapons manufacturer Hanwha (McGhie and Nyvold 2018). Hanwha is known for producing cluster bombs, which are banned in more than 120 countries. Therefore, the cooperation between KAIST and Hanwha to produce autonomous weapon systems was a controversy in the scientific world.

Toby Walsh from The University of New South Wales in Sydney, who began the boycott, argues that while autonomous weapon systems are a great danger, artificial intelligence in military technologies can still take on a beneficial shape - such as minesweeper robots (The Engineer 2018).

Differentiating between beneficial and harmful autonomous military applications can be a difficult task (McGhie and Nyvold 2018). Some technologies can act autonomously in a military context with no lethal tasks. This could be surveillance and intelligence gathering, but it could also be target identification, which coupled with a lethal response, could be seen as an autonomous weapons platform with lethal force.

If autonomous weapon systems ever see the light of day, then a matter of responsibility is needed. Who is responsible for mistakes, the military commander, the designers, the data analysts, the state or someone else entirely? Is it possible to hold one person accountable for the mistakes of a system that has been classified as complex, self-controlling and unpredictable prior to its full engagement?

A common understanding of autonomy has not yet been reached. The future possibilities and ramifications have not yet been realised and are still disputed. The discussions on who should be responsible are still not coherent, with some advocating for a sole actor being responsible, others for groups and even some arguing for the autonomous technology to be held responsible. This is yet an area of great risk, uncertainty and in need of clearer structures and common understandings.

Problem Field

To better understand this area and all the intricacies of autonomy and responsibility we have studied a recent initiative in NATO that involves a technology, that is both in a military context and with autonomous capabilities.

Alliance Ground Surveillance (AGS) is a system that is meant to provide commanders in NATO with enhanced awareness of events on the ground. The AGS consists of 5 Global Hawk remotely piloted aircrafts, ground control stations and a command centre placed at the Naval Air Station Sigonella on the Italian island Sicily. The AGS is acquired by 15 of the 29 NATO countries and will operate on behalf of all allied countries, as the countries that do not participate in the acquisition will provide life-support or contribution in-kind. The focal point of the AGS is the fleet of unmanned aerial vehicles (UAV), the Global Hawks. These UAVs have the wingspan of an airbus and are able to carry a wide array of radars and other sensors. The Global Hawk can stay in the air for more than 30 hours at a time. This makes it able to cover vast areas when coupled with the multitude of sensors. The UAV can send near-real time imaging to the command centre, allowing more precise information and more timely action to be taken by military command (Alliance Ground Surveillance (AGS) 2016).

NATO already employs several Airborne Early Warning & Control (AWACS) which scans the airspaces for aircrafts. The Global Hawk is an addition to this sensor network that spread it to ground-level as well.

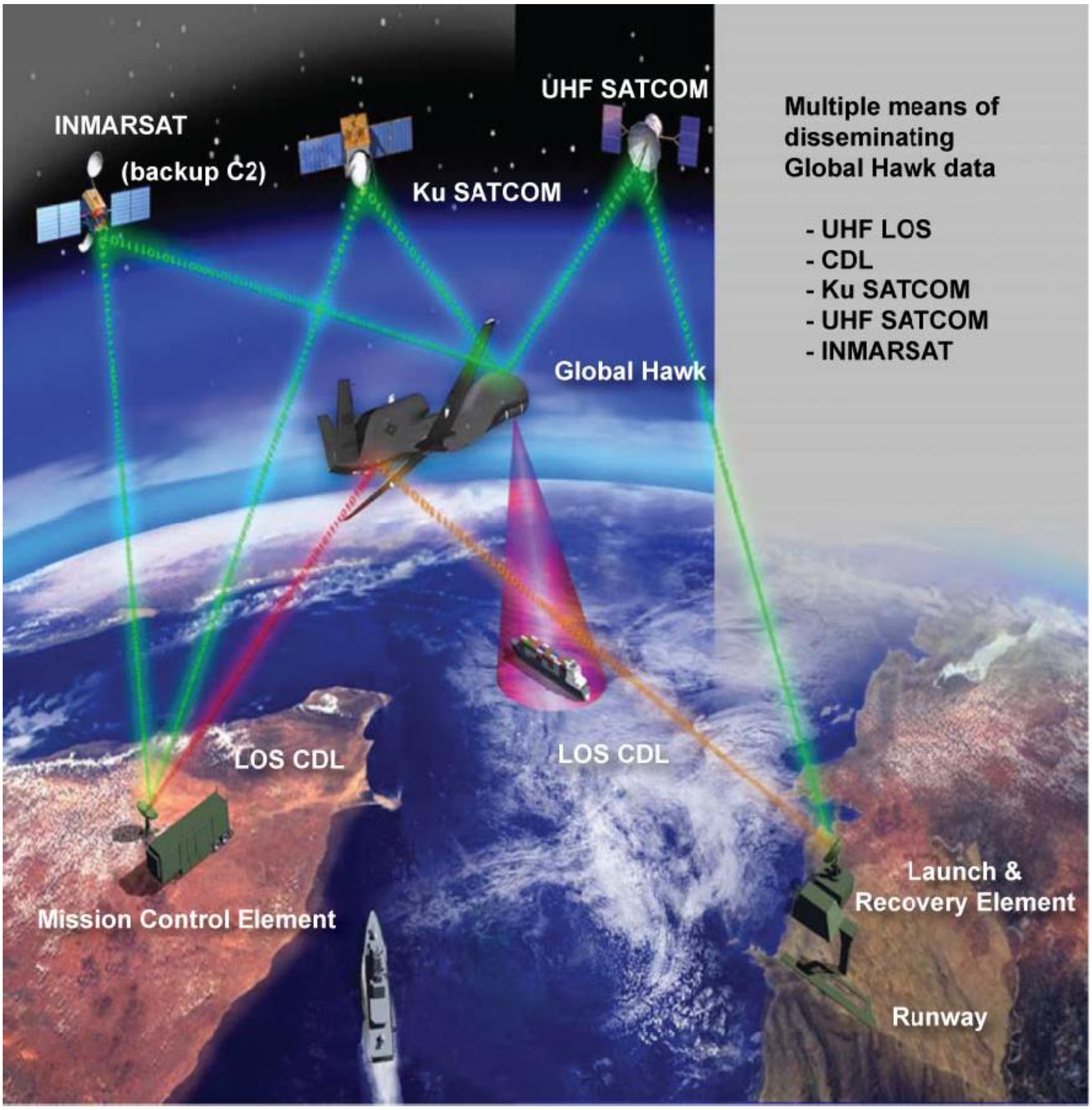

Figure 1: The Global Hawk's connection links

The Global Hawk is a highly advanced drone with autonomous functions used by a military network for prolonged missions of data collection, that will be used to determine targets of military action. The project is handled by a cooperation of many countries, with the same agenda of safety, but varying priorities in where to implement the UAVs.

Autonomous technologies are not clearly defined and as such they are hard to evaluate as an overall technological niche. In this case we will take a closer look at the Global Hawk to better understand technological autonomy and how this autonomy can impact the actors operating the drone, possibly shifting the placement of responsibility.

In the context of military use mistakes can lead to the death of innocents and this certainly raises the stakes. This is why the case of the Global Hawk is a problematic one.

We consider it of great importance to meet the case of the Global Hawk with an approach that reflects the intricacy and complexity of the technology and situation.

With the uncertainties surrounding technological autonomy and the placement of responsibility, we wish to explore the Global Hawk through a network-centred approach. First using actor-network theory to grasp the network, its constituting elements and the context of its origin and continued use. Afterwards we will scrutinise the mediations of the technology, to understand how it impacts the human actors and to identify where autonomy appears in the network. Our findings will later be discussed in relation to the allocation of responsibility, where we will bring forth our techno-anthropological suggestion of a framework for better understanding and working with the issues and benefits of an autonomous technology in a military context. We find that this is an important subject for futures to come, where a framework for understanding the doings and impacts of autonomous technologies and weapons must be clear.

This leads us to the following problem formulation:

> *"What constitutes the AGS Global Hawk system in the network of NATO? How does the inclusion of an autonomous technology impact the allocation of responsibility in its military use, as explored through a network-centric method of investigation?"*

The theoretical approach

The following chapter concerns the theoretical tools that will be applied to the field of autonomy and responsibility in a military context. We have explored some of the discussions on autonomous technologies and the themes involved in said discussion. Responsibility is high on the list and will be explored in order for us to better understand the influence of autonomy.

Technological autonomy is in itself a difficult subject, where the discussions of what it is as well as the consequences and benefits are still uncertain. We see humans and technologies as entangled matters, where each impact the other through agency. We find it necessary to explore these concepts through a network-centric approach in order to better understand what technological autonomy is and how it affects the responsibility of the actors in the network surrounding the technology.

It is important to approach the complicated matters of autonomy and responsibility with theoretical tools suited for the task. In order to do this the field will be analysed using postphenomenology and actor-network theory. We find that these theories lend themselves well to exploring networks, single actors and the workings of the technology. It allows us to better understand the broad concept of autonomy as well as how the morality and intentionality of artefacts can alter their perception. It also enables an exploration of how the actors address responsibility with the influence of technology and the degree to which the technology allows humans to act, understand and engage with the world.

We draw upon the differentiated perspectives of responsibility and autonomy in a socio-technical entanglement, and write this thesis in the spirit of constructivism, as understood by Bruno Latour for our theoretical foundation (Collin 2003). Latour's take on constructivism is one of the more controversial branches of constructivism. It draws on the ontological constructivism as well as epistemic constructivism.

Constructivism is a branch of scientific theory with a long and nuanced past. The ontological constructivism is opposed by the constructivist epistemology, which is more concerned with the social and human reality as constructions. It is a less controversial view on constructivism, and is spearheaded by scientists such as Foucault and Luhmann (ibid). While we find Latour's exploration of non-human actors a beneficial addition to our understanding of constructivism, we also find interesting and useful points from the work and understandings of Foucault. Foucault has a different perspective on knowledge. It is not true, as the normative imperative states and it is not a focus for scientific studies. Facts should rather be seen as what is accepted as knowledge by the scientific community. Foucault is not a classical constructivist, and might not accept such a label. His view on knowledge consisting of certain structures, and thus not being freely formed by reality or the representation of it, is a negative and critical examination of constructivism (Collin 2003). This view of how knowledge can be established is important for our discussions and understanding of what technological autonomy is, how it moves in the field of research and how the field relates it to responsibility. We do not call ourselves ontological or epistemic constructivists, since we are influenced by both branches with valuable understandings stemming from both.

Latour's perspective is based in a material-semiotic understanding, exploring the agency and intentionality of both humans and non-human actors (Lincoln & Guba 2000:170). Constructivism has had many iterations, from Karl Marx and the sociological macro perspective on economy and social class (Collin 2003). The strong programme of the Edinburgh-school by Bloor and Barnes, concerned with the social construction of scientific knowledge (ibid). All the way to Cetina Knorr, Steve Fuller and Bruno Latour who adopted the micro perspective from anthropology and ethnography, and changed their understanding of constructivism to regard answering the question of 'how' rather than 'why' in relation to scientific discoveries (ibid).

Latour distances himself further, from the constructivism of the strong programme, by attributing scientific victories to the mobilisation of actor-networks rather than being right - as seen in his example of Pasteur and Pouchet (ibid). The definition of artefacts as actors, and the consideration of their agency, is an important perspective for us to understand autonomous technologies. We consider it prudent to adopt this point of view, where being right is less important than the reasonings involved. It will be a key element for identifying and understanding the allocation of responsibility in networks containing autonomous technologies. This master thesis will not attempt to establish a universal truth on what technological autonomy is and how to understand responsibility in this context. This study is concerned with exemplifying and exploring how these aspects surface through a case study, as they can be seen as multiple, both constituted by the surrounding actors and the situation of the environment (Lincoln & Guba 2000:170). We will not pass judgment on the field but rather explore it and the different meanings that exists.

Keeping constructivism in mind, it is now time to explore a preliminary understanding of autonomy. We call it preliminary because the rest of the master thesis is concerned with fleshing out this concept in the images presented by the field.

Contrary to its name, an autonomous technology is not an isolated system devoid of human interaction. Several human actors; for development, quality control and translation of information, are needed for the systems to maintain a functioning state. The technology can be considered hard to understand in its entirety and there are calls for concern as to, whether human actors can 'keep up' with the technological development and control of autonomous technologies (Scharre, 2016).

We find a techno-anthropological approach to this matter a beneficial perspective for exploration of a complex and interdisciplinary field.

Autonomy

To create an overall framework for understanding responsibility in an autonomous technological construct, we find it prudent to first explore autonomy and responsibility one at a time. This section is meant to provide a basic insight into perspectives and thoughts that fluctuate in the ongoing discussions on autonomy.

We will not pass judgement on autonomy as a human attribute or concept, but rather try to understand the discourse that revolves around autonomy. This lends itself to more easily create a proper framework that allows for a scrutiny of technological autonomy and its applicability in modern military technology.

> *"It is apparent that, although not used just as a synonym for qualities that are usually approved of, "autonomy" is used in an exceedingly broad fashion. It is used sometimes as an equivalent of liberty [...], sometimes as equivalent to self-rule or sovereignty, sometimes as identical with freedom of the will. […] About the only features held constant from one author to another are that autonomy is a feature of persons and that it is a desirable quality to have."*
> *- (Dworkin 1988:6)*

Our understanding of autonomy takes from the compound work of '*The Theory and Practice of Autonomy*' by Gerald Dworkin. The concept of autonomy is characterised as an intricate thing. A trait or quality that can be understood in several different ways. Autonomy can be linked with; freedom, dignity, individuality, critical reflection and responsibility among others.

A common agreeance of authors on the subject is that autonomy is something that persons have and is considered positive to have. Dworkin argues that for a person to be morally autonomous, the moral principle must be their own. Freedom is also a trait that is associated with autonomy, and it is one of the traits that we find difficult to place on technology, since it will be programmed within certain limitations and scenarios.

However, we do also consider humans to be influenced by outside forces. Verbeek argues in "*The Morality of Things*" (2006), that technology already limits some human choices or at the very least, influences them. It is furthermore impossible to consider human autonomy to be based in total freedom, since we are all guided and influenced by the law (Verbeek 2006). With human autonomy being a disputed subject, even though it has been discussed for many years by a plethora of philosophers, it is no small wonder that technological autonomy is just as difficult to explore and understand.

Technological autonomy is structured more mechanically than human autonomy. As mentioned in the previous chapter, it can be understood to exist on a spectrum ranging from automated, automatic and semi-autonomous to true-autonomous systems. Different associations and expectations are presented with each category.

Defining a technology as "truly autonomous", equates such a technology with the conscient thought processes and acts of free will that represents the human condition to some degree.

The above criteria lead us to adopt the perspective on 'true technological autonomy' as a future technology perspective. The current use of the word 'autonomy' does not align with the connotations of the word used in human-centric, moral or ethical discussions.

In this thesis it becomes apparent that the concept of technological autonomy differs from the concept of human autonomy. The associations between the two shows itself in literature of autonomous technologies, yet we believe it to be beneficial to consider human autonomy and technological autonomy as separate concepts.

The future of technological autonomy is an interesting discussion, while true autonomy does not exist yet, we find that semi-autonomous and automatic technologies can encompass autonomous functions. It is the aim of this thesis to explore the autonomous functions of a semi-autonomous technology to understand how that technology impacts responsibility in a military context.

Responsibility

The discussions on the allocation of responsibility are grounded in the future expectations of whether true autonomy will be achieved, and what autonomous systems will be capable of in the future.

Allocating responsibility to humans acting autonomously without pressure can be an issue in itself, as explored by Ibo van de Poel (van de Poel et al. 2011; Doorn and van de Poel 2011). He argues for the *problem of many hands* in the context of ethics and responsibility in institutions. The focus of van de Poel is on moral responsibility and not the responsibility that is a stable of organisational rules or law. Five different 'senses of responsibility' are introduced by van de Poel and we find these interesting in our further scrutiny of responsibility as it appears in the context of autonomous military technologies.

The five senses of responsibility are divided into backward-looking responsibility and forward-looking responsibility. The difference between these are that backward-looking responsibility focuses on an action that has already taken place and forward-looking responsibility concerns possible future outcomes. The first and arguably most prominent of the backward-looking responsibilities is responsibility-as-blameworthiness. This sense is the reaction of blaming someone for an action. The other backward-looking senses of responsibility are; responsibility-as-accountability and responsibility-as-liability. Accountability is to be understood as the need to take responsibility for one's actions and their outcomes while liability is the moral obligation to try to remedy one's mistakes, in the form of payment or other restitutions.

The two forward-looking senses of responsibility are; responsibility-as-obligation and responsibility-as-virtue. Obligation here is to be understood as the need to think ahead and make sure that the actions taken now are done in a desirable way, to reach a desirable outcome. Responsibility-as-virtue holds true to its name and can be understood as a personal trait of someone who is responsible and takes responsibility for their actions, as well as understanding the possible future consequences.

Ibo van de Poel reminds us that the different senses of responsibility are not mutually exclusive, but all stems from the same notion of responsibility (ibid.). The reason why we find the categories useful, is to distinguish between the nuances of responsibility as the concept is used or touched upon by the various actors in our field of study.

Sense of responsibility	**Function of attributing responsibility**
<u>Backward-looking</u>	
Responsibility-as-blameworthiness	Retribution
Responsibility-as-accountability	Maintaining moral community
Responsibility-as-liability	Justice to victims
<u>Forward-looking</u>	
Responsibility-as-obligation	Efficacy
Responsibility-as-virtue	Due care to others

Figure 2: Ibo van de Poel's overview of responsibility (van de Poel et al. 2011)

Another useful concept for working with responsibility is the 'Problem of many hands'.

The problem of many hands states that in large networks, such as institutions and companies, responsibility can be difficult to assign due to the many actors involved in a process (ibid). Especially responsibility-as-blameworthiness is brought forth as hard to place in the large networks. This correlates well with our perspective on the field of autonomous technologies and the current discussions on the allocation of responsibility. We see how concerns often pertain to the placement of blame for actions performed or enabled by autonomous technologies. Because of this we find it beneficial to include van de Poel's conditions for responsibility, as some or all of these conditions are required to reasonably place responsibility-as-blameworthiness on a given actor. Capacity, causality, knowledge, freedom and wrong-doing are the five conditions for responsibility (van de Poel et al. 2011; Doorn and van de Poel 2011). The first condition concerns the capacity to act responsibly. Ibo van de Poel refers to the example of children and the mentally disabled as groups of people that are argued to be without the capacity of acting in a responsible manner. Machines are mentioned as actors where this condition is argued to apply, something that is exemplified in the debate on autonomous technologies.

The second condition focuses on causality. Has the actor actually caused the blameworthy incident? This is a criterion that often weighs heavily in discussions of responsibility, as people are reluctant to place blame on someone who has not actually caused the undesired result.

The third condition deals with knowledge. Here the actor must have prior knowledge of the possible results of their actions to be deemed blameworthy. Engineers are mentioned as an example of problematic actors regarding this condition. It can be said to be required of engineers to predict what advanced technologies are capable of. At the same time, it becomes increasingly difficult the more complex technology is involved.

The fourth condition pertains to the freedom of the actor. Here we must determine if the actor has been forced to perform the action by compulsion in any way.

The fifth condition revolves around the wrong-doing itself. To be blameworthy of an action, the action itself must be considered wrong. At this point we enter a borderland of ethical discussions. There are several ethical perspectives on what constitutes wrongdoings; utilitarian, deontological and virtue ethics to mention some. The main thing to remember when evaluating if you can allocate responsibility-as-blameworthiness is if it can be argued that the action performed was wrong, not depending on what ethical point of view this judgement belongs to (ibid.).

We find van de Poel’s views very similar to our own and we are inspired by his perspective on responsibility, both from the five senses of responsibility and the corresponding conditions.

From these conditions stated above we obtain an arsenal to better identify responsibility and evaluate how clear the responsibility-as-blameworthiness is in the specific case.

While van de Poel, does not explicitly argue for the intentionality and morality of artefacts in these constructs, we find that the overarching thoughts of large networks and many actors can be combined with the thoughts of postphenomenology to include non-human actors and understand their agency and doings. We find it interesting to examine how and if autonomous technologies can alter the weight of the criteria and whether it can reshape the allocation and type of responsibility attributed to the wrong-doing of an actor.

Combining ANT & Postphenomenology

We have chosen to identify and work with both autonomy and responsibility through their emergence in the network of the AGS Global Hawk. Our theoretical framework is constituted by actor-network theory (ANT) by Bruno Latour and postphenomenology by Don Ihde and the further work of Peter-Paul Verbeek.

We will first explain our approach and understanding towards ANT, highlighting the strengths and weaknesses of the theory. Afterwards we will dive into postphenomenology and how this theory can supplement ANT.

Actor-Network Theory with its material semiotic focus, allows attributing agency to objects on equal terms with human actors and lends itself in a suitable way to explore autonomous technologies (Salk, Latour & Woolgar 2013). By focusing on what relations that constitute each actor in a wider network, ANT brings agency in the network into focus. We consider this a useful addition to the debate on autonomous technologies. It becomes a useful tool to open the network and identify the actors that constitute it, especially when studying the entanglements of complicated technologies. ANT will be the initial theory for exploration, diving into how the different actors impact each other and with its material-semiotic focus we will scrutinise both humans and technology on equal terms.

Michel Callon's four moments of translations is not a key theoretical term for our analysis, since the negotiations of the network has largely been hidden, but it has been a big part of how we understand the stabilisation of the network into its current form.

The four moments of; *problematisation, interessement, enrolment* and *mobilisation* will therefore not feature as an analytical tool, but as a foundation for our understanding of networks and ANT as theory Callon 1984).

ANT, has like the actor-networks it explores changed through negotiations between several actors working with the theory, criticizing it and expanding upon it. This has led to a branch of ANT, known as post-ANT.
Post-ANT is brought forth as an answer to much of the critique that ANT has garnered over the years. For being too weak a theory, for being more method than theory and for focusing on the power in the networks (Gad and Jensen 2007). However, one of the key differences presented with post-ANT, is the view on networks. From a post-ANT perspective, networks are seen as unstable, temporal even. Dissolving and re-emerging being a part of what networks do. The modularity of the Global Hawk Drone is a prime example of why viewing networks as temporal is an important understanding for this project.
Another critique of ANT is brought forth by Anna Tsing in her lecture called *'Alien vs. Predator' (2008).* She criticizes Callon and a general idea in ANT to disregard context. We have found that for this project that context is of importance, and by combining ANT with postphenomenology we achieve the wanted context.

To supplement ANT and the material semiotic focus of the theory we draw upon postphenomenology. This theory encompasses the same ideals of world views, in a theoretical collaboration of material semiotic constructivism. Latour and Verbeek have both worked with the moralisation of technology and as such we find these views to be of a similar kind (Verbeek 2006; Latour 2013). There are certain differences that are important to point out. ANT's notion of generalised asymmetry, challenges certain aspects of postphenomenology, such as the hermeneutic relation between objects and humans. The mediations and influences of the technology would be impossible to explain from a postphenomenological standpoint if grounded in a generalised asymmetry. We abandon this idea of ANT and move towards the perspective of postphenomenology, with technology having agency when interacting with humans, but only in the capacity of which it was designed.

ANT focuses on the broad negotiations of a network constituted by human and non-human actors. The strength of postphenomenology lies in uncovering the mediations between humans and technologies through the theoretical tools of *relations*, *points of contact* and *influence*. The relations of *embodiment, alterity, hermeneutics* and *background* are ways to categorise the role technology plays in the human-world relationships, allowing the human actor to interpret the world in ways otherwise impossible.

The points of contact categorise the different types of connections between user and product, which appear in the human-technology-world relationships. These pertain to physical, cognitive and contextual understandings, called: *to the hand, before the eye, above the head* and *behind the back*. Finally, we identify the *influences* on human behaviour that is facilitated by the technology and attributed with either a weak or strong force and an apparent or hidden appearance. These influences are categorised as: Strong and apparent - called *coercive.* Weak and apparent - called *persuasive.* Strong and hidden - called *decisive.* As well as the weak and hidden - called *seductive* (Verbeek 2015).

The postphenomenological approach enables us to better understand the intentionality's of both humans and technology. This can highlight the morality of the technology as created by the designers, and the subjective choices of the humans operating and understanding the world through the technologies (Verbeek 2016). In the context of the problem of many hands, it can be beneficial when analysing responsibility in the network.

"[...] the actions of human beings who are dealing with technologies are always mediated. This implies that the explicit moralizations of technology only comes down to accepting the responsibility given with the insight that technologies inevitably mediate human interpretations and actions. If technologies are always mediating human-world relationships, it seems wise to anticipate this mediation and give it a desirable form, rather than rejecting the whole idea of a "moralization of technology."
- (Verbeek 2006).

The ethics and morality of technology has been a disputed subject as highlighted by Verbeek in "The Morality of Things" (2006). We carry the same understanding of technological entanglement, which calls for an analytical approach that takes into consideration this mediation and its consequences. With technologies encompassing morality and ethics, they can also impact moral choices of human actors depending on the mediations and forces of influence. It is an important perspective to understand the shape of responsibility in the context of autonomous technologies. This highlights the necessity for the discussion of ethics and morality of things, rather than disregarding it due to the intertwined relations of humans and technology.

This master thesis showcases how ANT and postphenomenology together, can provide the groundwork for identifying constituting parts of a network, as well as scrutinising the mediations and influences between human and technology. Combining the two theories allows us to see the network in its full context and zoom in on the relations between actors.
Using ANT and postphenomenology together is possible due to a shared ontological fundament and both of them having a common focus simplifying the complex and multiple. The outcome will rely on the ability for this theoretical apparatus to reveal the complexities of advanced military technologies and explain them in an orderly and comprehensible fashion. Both postphenomenology and ANT are strong theories for discovering and describing

intricate networks and negotiations between human and non-human actors. Neither of the theories are well equipped for understanding and exploring responsibility. With the inclusion of van de Poel's problem of many hands we wish to both highlight the doings of the networks, the understandings of autonomy and the possible constructions of responsibility. We find that van de Poel's theory for responsibility can be incorporated into the ANT and postphenomenological approach. ANT and postphenomenology has extensive tools to explore and understand intangible subjects in networks, such as morality, influence, concepts and knowledge. We have found these three theories to supplement enhance each other as well as eliminate weaknesses.

Methodology

When venturing into the field, it is important for the ethnographer to be reflected on how to approach it, and what the outcomes of the chosen method could be.

Before our fieldwork began we conducted a literature review to better understand our field and the knowledge that existed within. This was both to be more informed of our informants, to be able to connect with them on an academic level and to make sure our fieldwork would focus on the important matters at hand from the beginning. Through the following chapter, we will highlight the path we have taken to the final project design; our literature review and our meetings with the field. The chapter will show our method for approaching the field and the reflections we have done.

The ethnographer's path

This master thesis is located in a field of study that is new to us. A thorough literature search was necessary in order to grasp the layout of the field, how it has been explored and how we can contribute.

It was important for our literature search to begin broad and slowly narrow down as new knowledge and information came to light (Rienecker, Stray Jørgensen and Skov 2011).

We began exploring what the field of military technologies is made of and how, as well as which scientists engage in this field of study.

The first discoveries of the field, was that most of the research regarding autonomous military technologies, was conducted by scientists from the field of political science. The primary engagements being, judicial and political aspects and dilemmas of autonomous military technologies.

This discovery led to our initial problem formulation, which concerned the politics of autonomous weapons. This focused the scope of the literature search (ibid.). The aim became to explore whether other academic works had adopted our perspective on military technologies as not just being born from political and judicial decisions, but also actively shaping these decisions from a position of attributed agency. To ensure that this perspective on technology could perform an adequate analytical role, we began researching branches of theories that could enable us to perform this analytical perspective. Actor-network theory and Postphenomenology, seemed from experience to be the most beneficial for our perspective on the field of study. The theoretical literature search concerned itself with exploring how these theories can cooperate, deal with morality, ethics and politics and whether they had been used in the same academic context before. While researching the field from a more theoretical perspective, we came across a research paper, that approached the field from the same vantage point of actor-network theory and postphenomenology, however it still concerned itself more with the judicial and political argumentations. This led us to contact the author, Katrine Nørgaard who holds a Ph.D. in anthropology and is a scientist at the Royal Danish Defence College at the Institute for Leadership and Organisation.

Access to the field

Beginning our journey as techno-anthropologists into the field of autonomous military technologies, we expected it to be a difficult task to gain access to military personnel.

We contacted various people of academic involvement in the studies of military technologies, from the academic papers and journals that we had found in our initial research. Many of these academic publications were made by, or in cooperation with, the Centre for Military Studies (CMS) under the faculty of Political Studies at Copenhagen University, a picture of key people to contact quickly formed. Besides the researchers of the CMS our list included researchers of various civic companies or clusters, as well as the Royal Danish Defence College (RDDC).

During our process it was Katrine Nørgaard, a member of RDDC that caught our attention in a response to an email, inviting us in for a talk at Svanemøllen barracks, in the middle of February.

Katrine is a Ph.D., from an anthropological background, with a career at the RDDC.

It turned out that our interest in an alternative perspective on this particular field of study, aligned with Katrine's agenda. An exchange of academic literature, project writings and ideas on the area was agreed upon, and Katrine informed us of an upcoming military technology workshop, concerning a particular use of a specific autonomous system. The Global Hawk drone.
We were given access to the workshop itself and Katrine established interviews with participating experts on the day of the workshop.

Refining the search

After meeting the field, but before the workshop, the scope of the thesis became more apparent and fundamentally sound.
Since political and judicial aspects were a dominant scope of research in the field, we concluded that we could not steer clear of it, and that it would be an interesting and beneficial aspect to include. We did however wish to explore these aspects through a techno-anthropological vantage point, rooted in a theoretical foundation of actor-network theory and postphenomenology. This led to searching for more theoretical texts on the subject of ethics and politics. An interesting finding that we had seen before gaining access to the field, was the definitions of the word; "autonomy", where no standardised definition existed. Rather the word was debated and understood, depending on the scientists' expectations for what the future of autonomous military technologies would entail. This inquiry was reciprocated by the field, and the research of the future of autonomous weapon systems became primus motor for exploring autonomy and responsibility in this context.

We later found that the meaning of the word autonomy did not quite hold our interest, and we instead decided to work with autonomy, from the perspective of the field and our informants.
It is a basic premise of techno-anthropological fieldwork that the informants of the field are some of the most knowledgeable individuals pertaining their own actions and jobs. During our interview with SNE, a Danish pilot stationed with NATO AGS at the Naval Air Station Sigonella, we found responsibility to be a

much more important and interesting subject. We chose to explore responsibility in the context of autonomous technologies used by the AGS. The further we got into our research and writing process, the more apparent it became that judicial and political matters were not as important to our research as many others who studied the field. What came to hold our interest was exploring technological autonomy and how it impacts responsibility. The thesis therefore ended up focusing on how responsibility is placed in a military structure, whether it is a beneficial method and how autonomy can challenge that.

Our corpus of academic texts has been created by our own interest and wonder and later qualified by experts within the field, who has led us to these prominent scientific understandings. We have dived into the literature through the snowball method, searching for texts, getting an understanding for the field and narrowing the scope of the search. This continued until the literature became as relevant as possible and until the same argumentations, theoretical and methodological approaches started to circulate (Rienecker, Stray Jørgensen and Skov 2011).

Observations

As previously mentioned, we were invited to join a workshop on military technologies, this was an opportunity to dive into the field and observe the negotiations and actions of the different actors present. When observing, it is important for the ethnographer to be aware of the surroundings and reflected about the effect that is exuded upon the field from the presence of the ethnographer. We had discussions prior to the fieldwork on how we wanted to engage with the field. There are two dominant approaches to observing, called being either '*fully observing*' or '*fully participating*' (Hammersley and Atkinson 1995). These two methods, can be seen as two opposite ends in a spectrum of observation. Being *fully observing* allows the ethnographer to physically disconnect from the field and view the actions and negotiations in as natural a state as possible. Being *fully participating* means that the ethnographer actively takes part in the doings of the field, and tries to learn by taking on responsibility and exploring the lives of the actors from their point of view.

There are pros and cons to both methods, and the ethnographer is not locked into either role, but is able to move on the spectrum between these two ends.
When conducting the fieldwork as *fully observing,* the actors will not be affected by the presence of an outsider, they will act naturally. However, actions can be hard to understand, and the reasons behind those actions can become entirely invisible.
On the contrary, when the ethnographer enters the field as *fully participating,* the actors are very much aware of the presence of an outsider, and can act differently than normal, due to being "monitored"'. The benefit of entering the field *fully participating,* is that the ethnographer can ask inquiring questions during the observation and through this gain knowledge about the reasons behind certain actions, traditions or rituals - one could say that being *fully participating* transforms part of the observations into informal interview situations (Hammersley and Atkinson 1995).
The workshop was carried out as an informal discussion based around two presentations. This format meant that we found it most beneficial to engage the field as *fully participating,* joining the discussions and asking questions. Our observational work for this master thesis has been informal, e.g. the workshop as well as our meetings with the Royal Danish Defence College all took place over a cup of coffee. This has made it easier for us to embed in the field and become part of the language and the understandings. An aspect that came quite naturally, since the field was interested in an approach based in actor-network theory and postphenomenology, two theoretical approaches that we had already considered as the foundation for our thesis. Questions can be raised as to whether we can be fully participating when we have not observed the Global Hawk in operation. Here we find that according to the limitations of our field, where it has been impossible to observe the Global Hawk, we have been as participating as we have been able.

During the workshop our observational strategy was informed by our theoretical and analytical perspective. We tried to explore the relations between the technology and human actors whenever possible.

While the workshop did not physically include any of these military technologies, the presentations and discussions about them formed the basis of knowledge needed. Before, during and after the workshop there were plenty of opportunities to explore these themes, as most of the participants remained on location beyond the scope of the workshop.

Interviews

Where observations give us a descriptive insight into part of the field, the interview is greatly enhanced by the combined knowledge of both literary study and observation on the subject.

Each interview is different, and to generate as much knowledge as possible from the interview, a basic understanding of our informant and the field was needed. A main theme in our interviews at the military technology workshop at RDDC, was the Global Hawk technology, which was a central connecting factor between our informants.

We made the Global Hawk a focal point in our interview with our informants, to start out with something familiar and expected in the context.

The use of interview guides made the interviews more manageable for us, and more streamlined and coherent for our informants. These documents contained a line of questions that helped guide us through the interview process. As we performed '*semi-structured interviews*' the guides contained important questions and themes that we would like to cover and explore during each interview. We could more follow the narrative of the informant, allowing them to go slightly off-course on personal anecdotes and along interesting themes that might not have been considered in the original creation of the interview guide. This enabled the field to guide our knowledge generation (Kvale & Brinkmann 2009).

As stated above, this specific form of interview allows the narrative to be a driving factor. It requires the interviewer to be well versed in the craft of performing interviews, as it takes experience and a reflective perspective to discern what is a useable narrative (ibid).

During interviews culturally-defined terms appear. These can be either in meaning or vocabulary specific to our field of study, as used by the actors involved. Further work with the native inhabitants of the military and scientific cultures, were made easier through these emic expressions. The experts we encountered in our field were used to a common selection of field-specific lingo, which made this practice all the more important.

Our interviews were focused on a critical evaluation of the technology, to understand the flaws it may have had. This proved to be a beneficial approach, since the Global Hawk operation is classified information and without a critical approach we would not have gained much knowledge on the matter. This also meant that we had to be vary not to annoy the field, and it was as such a balancing act of getting the right information without appearing too aggressive. This was helped by the use of the semi-structured interview method, where our informants were able to decide some interesting narratives, where we could choose to explore them further if necessary.

Anonymity

We have not anonymised any informants in this master thesis, they are rooted in the field and we consider them to be experts, and their reputation is part of their credibility.

We have met other actors from the field, who were not important for the overall context of our findings, and have therefore chosen not to mention them. They have been helpful in understanding the field, but have not been quoted or explained through our empirical data.

Ethnographic data handling

When conducting fieldwork, it is important that the ethnographer is reflected on how the field is affected, not just in terms of the empirical data generation, but also regarding the ethical manoeuvring in the field. For our project, we have tried to uphold ourselves to a high standard when in the field, wanting to not poison the field, create divides between actors and to ensure that we would be welcome later if necessary. In general terms this meant being respectful and accommodating of our informants wishes. Since much information from our field was classified, this also meant being respectful towards their wishes on what we could include and what not to include in our project. All interviews were in Danish, and quotes for the thesis have been translated into English. In the appendix the original Danish quotes can be found, as well as the English translations. All quotes used have been sent to the specific informant 10 days before the hand-in deadline, to allow our informants to approve the quotes and the translations.

Creating fieldnotes

Empirical knowledge generated from fieldwork is very important to structure, in order for the ethnographer to use that information later. To record this knowledge, we used several methods.

During interviews and observations, we always made sure to have one person write field notes. This was mainly in the form of *jotted notes,* where the field notes are structured around a few keywords, that will help the ethnographer recall the situation at a later date (Emerson, Fretz & Shaw 1995:20). It is important that jotted notes are reflected upon and that details and thick descriptions are added as soon as possible after the fieldwork is concluded. The more time that passes between adding details and the fieldwork, the bigger the risk is of corrupting the field notes. Certain situations, details or elements can be forgotten or the ethnographer can falsely attribute two factors to the same causal claim.

Transcribing

We have recorded the interviews for data validity and to better recall all the information generated during the interview. The recordings have been transcribed through the method of *meaning condensation*, writing keywords and short passages of the themes and most important areas from the interview (Kvale and Brinkmann 2009). Quotes that are needed for the thesis are written out completely. The method of *meaning condensation* allows the researchers to relive the interview, and discuss key points to ensure that the most important details and narratives are present.

Network and mediations of the Global Hawk

The hawk is famous for its remarkable eyesight, its outstanding ability to locate prey on the ground from its position high up in the sky. This might have been part of the thoughts behind the naming of the remotely piloted aircraft (RPA), the Global Hawk. This RPA, UAV, or drone, is an aircraft with the wingspan of an airbus. There are no personnel on board but instead an assortment of sensors. The drone is designed to travel at great heights, for long durations and observe vast areas on the ground for military intelligence gathering.

For an aircraft to be able to perform this task it has taken a great deal of advanced automatization. The drone steers itself based on pre-planned instructions and is integrated into an expansive network of satellites, bases of operation and other military assets. The ability to operate globally might be where the first part of the name originates.

The capabilities of the Global Hawk are advanced in a manner that borders technological autonomy. A border that might be less distinct than one might think.

The “semi-autonomous” functions of the Global Hawk are what intrigues us. The discussion of autonomy and responsibility concerns vague and philosophical concepts. Concepts which we might better be able to comprehend and define when studied in a specific context. This is the reason we dive into this case of the Global Hawk. The UAV and its integration in NATO is a case that has the wanted military context. By bringing forth the actors involved in the requisition and use of the Global Hawk, we hope to better understand how responsibility appears in this network. We apply the theoretical terms of ANT to better open the network and the relations formed between actors, both technological and human. Postphenomenology is brought to use when we need to understand how the autonomous functions of the UAV change its users. Both of these aspects are then combined to further our understanding of how autonomy and responsibility are in this case of the Global Hawk.

This knowledge will afterwards be used in our discussion of what implications arise, when determining responsibility in a military network containing autonomous technologies.

Figure 3: The NATO Global Hawk

Before we begin our analysis of the Global Hawk, it is prudent to keep in mind that we base this thesis of literary and ethnographic data from a field that is highly classified. The military operations of the AGS at the Naval Air Station Sigonella are on behalf of NATO and thus a matter of international security. We have not been able to gain complete access to this field that is still under development. The Global Hawk is not cleared for flight and this is another reason why we take a closer look at the US Military and their history with the UAV, in order to better establish parallels to the new implementation of the Global Hawk in NATO.

NATO and the Global Hawk

To fully understand the implementation of the Global Hawk in NATO, we must first look at the context of its development and use in the American military before its later adoption into NATO.

During Operation Desert Storm in the early 90's, the US Military identified the need for UAVs that were able to locate mobile SCUD missiles.

These were difficult to find with conventional measures at the time. The requirements were to develop a high-altitude air vehicle with loitering capabilities and surveillance equipment for reconnaissance of target land areas. While Defence Advanced Research Projects Agency (DARPA) was responsible for the initial technological development, the Air Force was to take over the later phases of development.

The US Navy and Army were drawn into the development process to make sure that the UAV would meet more criteria as well as receive the necessary funding. This initiative led to both the DarkStar drone and the Global Hawk drone. The two separate drones were initially developed from the High-Altitude Endurance UAV Program and were designed to perform two specific functions.

The DarkStar was meant to carry a simple sensor array and perform missions of shorter distance and with less hours than the Global Hawk. We will not go further into details concerning this specific drone as the main focus of this thesis is the Global Hawk.

The Global Hawk was meant to carry several sensor suites, SAR and Electro-Optical/ Infrared included. The missions of the Global Hawk were to span extended periods of time and cover large geographical areas, both in distance and footprint compared to the DarkStar drone. The initial developmental efforts gathered several actors within the United States' military. The development project of the Global Hawk called for more than a single production company. Northrop Grumman was designated as the primary contractor for the development and production of the Global Hawk UAV. Northrop Grumman is a privately owned American engineering company that specialises in military technologies. Their task included the drone, ground control and support elements. Besides development and production, Northrop Grumman was to perform exercises, demonstrations and maintenance for an unspecified period of time.

To support this demanding task, Northrop Grumman sub-contracted the following companies:

Raytheon Systems (ground segment & sensors), Rolls-Royce (turbofan engine), Vought Aircraft (carbon-fiber wings) and L-3 Communications (communications system). These were not the only subcontractors involved in the process but the most important for the overall work.

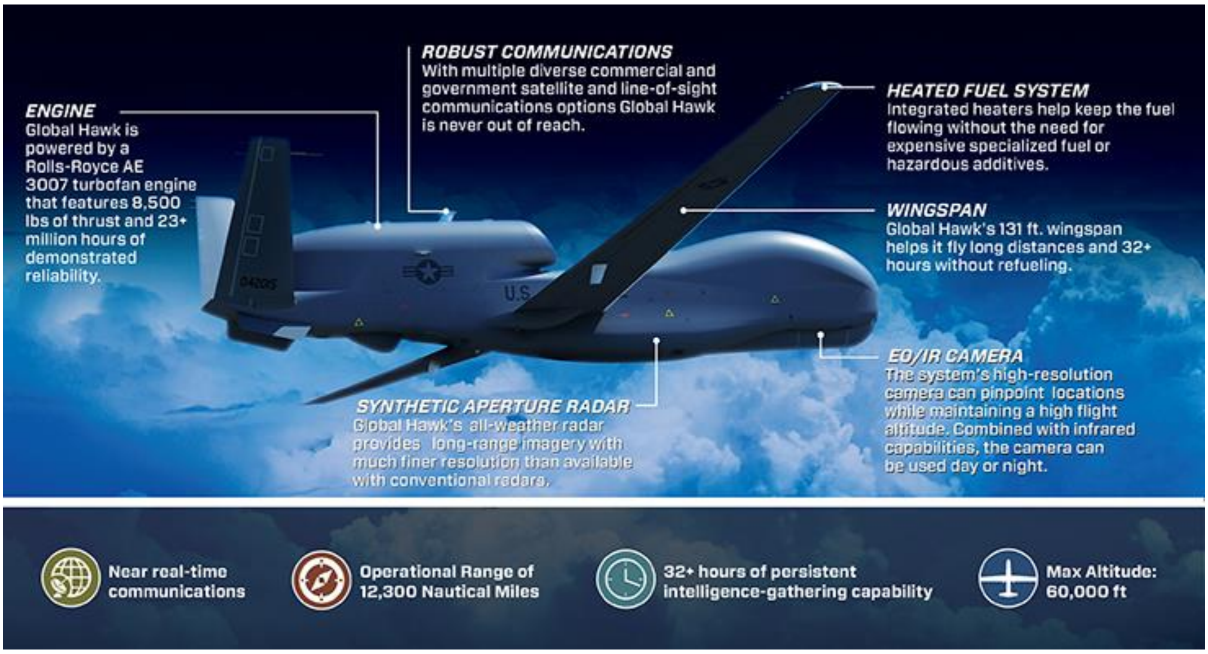

Figure 4: The Global Hawk's technical components

This specific combination of contractors enabled the construction of the Global Hawk, overcoming both aeronautical and sensor challenges. The development of the Global Hawk, is not just the work of one actor. It is a network of several contractors who each brings their part to the network, to create the Global Hawk.

During the initial production, and later during the continued development of the Global Hawk drone, the term “Blocks” were used to describe a given set of capabilities for a series of drones. As such the Block-10 Global Hawk varies in capabilities from the Block-20 Global Hawk and so forth. This term is used to further specify the abilities of a certain drone. NATO has acquired Block-40 drones, meaning there have been extensive testing of the Global Hawk concept by both Northrop Grumman and the American army, prior to the NATO acquisition.

The testing of the Global Hawk system was not done without mistakes and accidents.
As part of the test flight routines of the US military, a Global Hawk UAV was deployed from a Nevada air base and subsequently entered a downwards spiral and plummeted to its destruction. The error was possible because of a built-in system function that would initiate a self-destruct sequence. As there was no Global Hawk activated from the California air base, the “red button” was activated and the Global Hawk from Nevada initiated its self-destruct sequence. This was not the only mishap during testing, but one that shows how human error can lead to unforeseen accidents.

The terror attack on 9/11 created a political climate that prompted the deployment of the Global Hawk in military action. Operation Enduring Freedom was initiated November 11th, 2001 and lasted until September 28th, 2002. Global Hawk UAVs were utilised for more than 60 combat missions and 1,200 combat hours during the war on terror in south-west Asia.
The sensor-data from the UAV was fed to operations control in Saudi Arabia and from there spread out to combat commanders on the ground. This showed the flexibility of operations and an already expansive network during 2002. The drone was also employed with great success in Operation Iraqi Freedom in 2003.
Combat action was not without losses. Two Global Hawk UAVs were lost during combat missions.
Before NATO considered investing in the Global Hawk, it was a tried and true product for the American army. They had performed extensive tests and modifications based on the experiences from different wars. Northrop Grumman had gathered more than 20 years of experience with the Global Hawk, and thus it was not a huge risk or an unknown technology for NATO.

NATO, the North Atlantic Treaty Organisation, established as a means to create political and military safety for the member countries through the concept of collective defence. An attack on one member, is an attack on all members.

NATO furthermore uses diplomatic and military power to de-escalate international issues (nato.int n.d.).

There are 29 allied countries, of which Denmark is a member as well as the United States of America. The Global Hawk is paid for by 15 of the members, where England and France pay in-kind with military intelligence from their own platforms. Even though 15 countries have come together to fund this project, all 29 members will have full access to the Global Hawks, and are expected to fund the life support of the project (Alliance Ground Surveillance (AGS) 2016). The Global Hawks have become a way for some member countries to reach the guiding principle of contributing 2 pct. of their national GDP towards NATO. A principle that is not enforced, with many countries paying less and countries like the US, paying more than 3 pct. of their national GDP. The American President Donald Trump, criticized the fact that only five members contributed with 2 pct. or more of their GDP, in 2017 (Baker 2017). Luxembourg has for one chosen to equip the five Global Hawks with a specific sensor type, and contribute towards their 2 pct. in that manner.

Figure 5: The 15 AGS countries

The reason the US is important for the context of this case, is that they have 20 years of experience operating the Global Hawk. The US is the member country who contributes the most towards the defence budget, and even though all members in NATO are equal, the experience with the Global Hawk, has given the US the most positions in AGS. E.g. the general at the base is American, according to SNE. The US has gathered the strength to co-shape the network, and establish it in a fashion that suits their operational structure. At the moment, most training is done in cooperation with the United States as they have the most experience, with more than 150.000 logged flight hours with the Global Hawk ("RQ-4 Global Hawk Achieves Milestone C" 2015). The United States Military therefore becomes a central actor in the success of the NATO initiative, and can furthermore move the knowledge and function of the network to be more similar to theirs. The many different functions of the Global Hawk and the diverse and highly specialised operators, is an indicator of multiple black boxes existing within the network of the Global Hawk. Specialising the operators can be a way to open the black boxes and eliminate incommensurability within the network. A downside of this is the lack of transparency in the overall project.

As with many technologies, different actors co-create and sustain the technology. The Global Hawk drone is no different. The interesting aspect of the Global Hawk is that it has already been stabilised in the context of the American military. Moving it to NATO changes many protocols of operation and new negotiations must be made to stabilise the Global Hawk in an international network for military intelligence.

This is further problematised when the Global Hawk is proposed to assume different roles and different functions. SNE explained that beyond military intelligence gathering, it is also NATOs intention that it will help with humanitarian work, becoming an object for strategizing in the event of natural disasters and something else entirely if it enters into a military-scientific relation. From this we find that the Global Hawk is a *boundary object* (Star and Griesemer 1989). It is understood to be beneficial in a plethora of different situations, yet it is fluid and malleable enough to support all of these images of the technology. This makes the Global Hawk an *ideal boundary object,* where every social world can form understandings of the technology and communicate their needs across it through its modularity where the addition of different sensor packages can fine tune it for different jobs, the addition of reaper drones or the connection with search and rescue vehicles can substantially change the effect, image, use and outcome of the Global Hawk network (Bossen and Lauritzen 2007). Every new function of the Global Hawk will require new actors and social worlds to enter the network, which in turn will be subject to negotiations. With military technologies being a security political subject, these negotiations will require strict protocols for data management, cooperation and much more. Being a *boundary object*, is what allows the Global Hawk to exist in many different constellations because of its wide range of uses that spans several social worlds. It can furthermore become an actor for engagement between these worlds and help connect, humanitarian, scientific and civic regimes to the military regime in which it originally exists.

If we take a look at a person who can invoke the different regimes, the politician becomes an interesting actor.
The Global Hawk is a background relation for politicians and other disenfranchised actors. It exists, it works and a deeper understanding than that is rarely needed. It can be invoked in speeches if safety and security is a subject or if the value of human lives is discussed. As a boundary object it can be used by NATO officials to better link the civilian and military spheres, diminishing the negatives of the technology as can be seen when NATO and AGS members actively calls the Global Hawk an RPA, rather than a UAV.

> *"The Global Hawk is more automatic than autonomous, and that is a lesson we have learned. It has something to do with the way it flies and thinks."*
> *- Interview 03/04-2018, SNE [Translated]*

For these actors the Global Hawk can be described as an *above the head* point of contact in postphenomenological terms. It exists as a concept with meanings and values, mainly as a security and strategic device. NATO have made an effort in speaking of the Global Hawk as an RPA, rather than as a UAV. One reason for this, is that drones and autonomy in military technologies is heavily debated, and the term RPA, strictly underlines the fact that pilots and human actors are involved in the operation of the drone, in contrast to a UAV, that could fly autonomously. This is despite the fact that Northrop Grumman, the inventors of the Global Hawk, has classified it as an autonomous system ("Autonomous Systems" 2018).

The AGS Network

In the above chapter we have followed the journey of the Global Hawk UAV in a NATO context. The network which constitutes AGS can be seen grow and expand, for each actor identified. This expansion brings more than the supporting capabilities of each actor, who has an agenda and motivation that helps NATO consolidate them in the network. In the following chapter we will scrutinise each actor, to see if their relation is vital to the existence of the AGS and the performance of the Global Hawk UAV. In the actor-network it is paramount for our investigation to identify the appearance of responsibility, as it is placed upon or moved between actors. Here we only put responsibility forward when explicitly shown, performed or discussed by actors in the field.

The US Military plays a pivotal role as the purveyors of the Global Hawk system. The US Military successfully established the original network, that led to the design and production of the first Global Hawks. For this endeavour the private American engineering company Northrop Grumman, and their subcontractors, were necessary.
On a technical level the Global hawk drone is supported by Northrop Grumman, the company who invented the drone, their engineers and their know-how. They have supplied the United States with Global Hawks, both for military and scientific use, for the better part of 20 years.

The know-how and technical capabilities need to be moved to a NATO context as well, where the organisational constitution is a considerably larger network. There are high requirements for the capabilities of the Global Hawk, in part due to the military operations performed by the US in the Middle-East in recent time. This will require cooperation and the establishment of common goals between Northrop Grumman, NATO, the 29 member countries and the values of each country.

Since Northrop Grumman has continued the production and development of the Global Hawks and their associated control segments and operational equipment, they still carry an essential part of the technical responsibility. Here we consider responsibility for the functionality of the drone, its associated equipment and the design process both past and future. Not its use.

This can be understood as responsibility-as-obligation, and thus pertains to a more forward-looking sense of responsibility. The engineering company is responsible for the design they create and produce.

NATO is the actor that put forth the agenda of enabling the Global Hawk in a context outside the US Military. In this case NATO will be represented in a simplified form as we recognise that NATO in itself is a massively entangled network. The 29 members work towards common goals, but still have different national agendas. Here we see how NATO organises the AGS and achieves their goal by bringing the necessary actors into the network. NATO as an actor possess considerable means to reach their goals, supported by the 29 allied countries and their military institutions. With such great power in the network, comes an equally great responsibility. Each allied country in NATO has a responsibility to care for the interests of their population. This is a balancing act between facilitating security politics that protect their citizens and employing ethical solutions. This can be seen as responsibility-as-obligation, in a different way than Northrop Grumman. Here the allied countries are responsible in a political sense and not an engineering one.

Organisational structure of Naval Air Station Sigonella

Figure 6: The Naval Air Station Sigonella

The Naval Air Station Sigonella, located on the Italian island Sicily, has been a forward operating base for non-Italian military operations, even before the AGS was established. Danish fighter aircrafts were deployed from the base during the conflict in Libya in 2011 (www.Fmn.dk, "Danske Fly Indsat I Libyen" 2011). The air base is a hub for military operations in the Middle-East and provides housing for the AGS.

The Naval Air Station Sigonella contains the ground control and support segments of the AGS. These segments combine with the Forward Support Units and the connected satellite network, to help maintain contact to the Global Hawk UAV. This is a technological network, mainly constituted by artefacts and engineers, with the goal of keeping connection to the Global Hawk and the data stream flowing.

The AGS facilities are designed with the expertise from Northrop Grumman, drawing upon the experiences of the American army. Due to the prior experience the United States have with the Global Hawk, they have a possibility of directing the operational network of the Global Hawk.

The United States is the country which contributes the most to the NATO defence budget. During the military technological laboratory held by the Royal Danish Defence College, SNE the Danish representative from NATO AGS

showed us, that the United States is also the country that holds the most positions within AGS. The United States have secured central roles in the AGS network and this provides them with a possibility for to expand their own military intelligence capabilities. Until NATO gets their first active Global Hawk at Sigonella, the US oversees educating pilots as well as all training exercises. The Global Hawks are expected to arrive at Sigonella in 2019, according to SNE.
Beyond the United States who carries a certain responsibility from their experience, the effort to setup the AGS core is also placed upon two subsidiaries of NATO.

> *"The NATO Alliance Ground Surveillance Management Organization (NAGSMO) and its executive body - NATO Alliance Ground Surveillance Management Agency (NAGSMA) - are responsible for the acquisition of the AGS Core capability on behalf of the 15 acquiring countries."*
> *- (Alliance Ground Surveillance (AGS) 2016).*

Getting access to the functions of NAGSMO and NAGSMA beyond their acquisition of the AGS Core capability, has not been possible. We therefore acknowledge them as actors in the network with a certain responsibility, but the focus will be on AGS, as a division and their locality at the Naval Air Station Sigonella.
This further expands the network and with 29 countries having to agree upon the terms of operation and setup, long negotiations between the allied countries are still in place.
When the systems are all completed, they need to be coordinated with NATO AWACS for a more complete surveillance and intelligence gathering, on both land, sea and air. The network constituting the Global hawk is a massive endeavour, involving a multitude of disciplines.

"We are currently writing our standard operating procedure, to find out who should task us, how we should get the tasks and who is allowed to present the tasks. Is it all 29 countries? Is it NATO as organisation and their intelligence unit who is responsible for tasking us? The entire flow of tasks and how to mold it together is something that is discussed right now. And how long should that take one might ask. To get a new unit incorporated into NATO's operational pattern is important because the tasks is so broad. From humanitarian efforts to flying over areas after a hurricane, and all the way to the more difficult intelligence gathering tasks, where we fly on the border to a country of interest. It's important to figure out who can present the tasks, how they should be carried out and who can prioritise the tasks? We only have five Global Hawks and it will be a couple of years before we reach full capacity." - Interview 03/04-2018, SNE [Translated]

As explained by SNE there are still uncertainties in the tasking and operation of the Global Hawk due to it still being in a test phase. The delegation of responsibility is still being questioned. Whether it will be the responsibility of NATO or if the different allied countries will be able to task the AGS as well, is still uncertain. SNE furthermore explains that a lot of the training and facilitation during the testing phase is conducted with American Global Hawks and personnel.

Certifying the Global Hawk drone

The Italian Civil Aviation Authority (ENAC) is currently treating the query for the Global Hawk UAV airworthiness certification. This is a necessary step for getting legal access to the European airspace with as few restrictions as possible. As such ENAC becomes an *Obligatory Passage Point* for AGS to become operational. Here we find that ENAC is responsible for reviewing and testing the aviation capabilities of the Global Hawk. This can be seen as a supervisory responsibility, where the engineering of the drone itself is examined.

The importance of ENAC stems from the Global Hawk's historical development phase. As explained previously the Global Hawk was never fully certified by the American authorities, and rather 'rubber stamped' through. This has put a lot of limitations on the American use of the drone, where they are only allowed to take off and land the drone during the night, severely limiting its flexibility, since it can no longer respond at any time.

Germany previously purchased a Global Hawk and named it Euro Hawk. The certification for its operation in European airspace was never granted and the drone was never used (Knight 2015). This explains why ENAC becomes a strong actor in this network, setting an *obligatory passage point* for the operation and airworthiness of the drone. The Global Hawk is further challenged on its regulation, because it crosses the airspace of many European countries. If it is surveilling Russia, the Arctic or the Middle-East, it has to travel along several sovereign airspaces, not all belonging to members of NATO.

> *"If we are talking about the Global Hawk platform as flying, then there's always someone responsible for the platform, and that will be the guy at the steering wheel. Then you could see it as a unit, if we are talking about airworthiness, then responsibility is placed with the commander, the American chief, the American general who's joining Sigonella in summer (2018). He is sitting with the 'red card' and says if the unit is allowed to take flight or not. He is airworthiness responsible, he's getting inputs from the Italian aviation authorities who tells him if he's airworthy or not, but if there are any problems, then he's the one left with the responsibility." - Interview 03/04-2018, SNE [Translated]*

The “normative military responsibility”

The Global Hawk UAV is at times put forth as an actor in itself, but one must keep in mind that the drone consists of many parts, from motor and wings, to sensor array and a satellite up-link module. There are 11 military personnel directly involved in the deployment of a single Global Hawk. Many more are in contact with it or benefitting from it in some way.

Through our interview with SNE at the military technological laboratory, we came across a structure for responsibility in the military, that also showed itself during a literature study (The New York Times 1863; Doty and Doty 2012).

We have chosen to call this allocation of responsibility: *“normative military responsibility*”.

The normative military responsibility is to always point out the person in charge. This person is trained to maintain an overview of the operation and handle any situation in a most professional manner. This is also explained by Lieutenant Colonel Joe Doty and Captain Chuck Doty:

> *“A commander can delegate authority but not responsibility. Authority refers to who is in charge, while responsibility refers to who is accountable.” - (Doty and Doty 2012).*

When addressing this perspective from the vantage point of Ibo van de Poel, we find that the normative military responsibility is based on responsibility-as-accountability. If we take the problem of many hands into consideration, the normative military responsibility is a method for circumventing this problem. Instead of having issues finding the actor to blame, the military will at all times have a structure in place with an identified accountable actor. Through this method the military has appointed a spokesperson for the network, who follows the mobilised responsibility.

ENAC, Northrop Grumman, the American military, NATO and many other actors are carrying responsibility for different tasks regarding the implementation of the Global Hawk. We still find that they are operating under the aforementioned normative militaristic responsibility, allocating responsibility-as-accountability onto the person in charge. This perspective of responsibility is something that we wish to explore by scrutinising the other actors operating the drone, trying to understand the responsibilities of the pilots, data analysts, designers and commanders. The normative responsibility in the military will become a subject for debate in the following chapter. We have chosen to explore this theme in the discussion, because the Global Hawk is still in a testing phase. As such no certainties towards delegation of responsibility, understanding of autonomy or such issues have solidified in the actor-network's negotiations yet.

The autonomous impact

We have found the Global Hawk to be multiple through an exploration of how responsibility moves in the network by investigating the different organisational actors above. '*Multiplicity*' is a term borrowed from Annemarie Mol (2007). Through this theoretical understanding of the Global Hawk we can gage its doings and what it *is* in the different perspectives of the actors. Each of the actors that we have found to constitute the implementation process, has their own perspective of what the Global Hawk is. As such they hold different responsibilities for its success. With this in mind, we will scrutinise the network to better understand the direct users of the Global Hawk.

From a military perspective it is a reconnaissance unit. If we zoom further in on the network and direct our attention to just one of the operators, we find several interesting notions of responsibility, autonomy and how these concepts clash.

Pilot

If we direct our attention to the pilot through a postphenomenological perspective, we find that the pilots will see the Global Hawk as an airplane that enables their presence to travel great distances. The Global Hawk is unmanned and remotely controlled by pilots on the ground, equipped with a mouse and a computer screen. Despite being a drone, which are usually flown by drone operators, the Global Hawk requires a trained pilot to control it. This is due to flying through commercial airspace when ascending and descending. Even though the practice of flying and manoeuvring the aircraft is changed substantially, dropping the normal control stick for a mouse and a flight input of data points in a program, it is still experienced pilots who fly the Global Hawk. An interesting point and perhaps a reason why regular pilots are still used for flying rather than trained programmers, is that many of the mediations between pilot and aircraft can be considered approximately the same. The primary relation between pilot and aircraft changes dramatically when you compare an onboard pilot to a remote pilot. We now wish to explore how the practice of piloting an aircraft changes, when the pilot is placed on the ground and the aircraft gains more autonomy. This is done to better understand where autonomy shows in the network and how it affects responsibility.

The feat of unmanned flight is made possible by the advanced automatization of the drone. While it sounds irresponsible to some and wondrous to others, it is certainly a change that impacts the relation between pilot and aircraft significantly. To better understand this new relation, we take a postphenomenological look at the pilot of the Global Hawk.

The pilots, whether remote or on the plane, are in an embodied mediation between the technology and themselves. Through this mediation they gain the ability to traverse great distances while flying. The big difference in embodiment between pilots on board and remote pilots is the physicality of the mediation. The onboard pilot assumes the aircraft, and merges with it to physically fly. The act of flying is for the onboard pilot an embodied mediation.

When the pilot pushes the flight stick down, the plane, and by extension the pilot, moves down with it. Flying is something that both plane and pilot *do*.

The remote pilot is embodied in a metaphorical sense. The pilot is grounded throughout the flight, while the perspective and the presence of the pilot is shifted 18 kilometres upwards. The remote pilot is detached from the feel of the plane and does not follow its movement in a physical sense. For the remote pilot, flying is something that he can make the plane *do*.

Flying the airplane remotely means that a lot of tactile feedback is lost. From the pressure of speed, the smell of the cockpit, the noises of the airplane and other such sensations that are unique to the onboard piloting. Instead the embodiment of the aircraft is lost and exchanged with another relation.

To control the remotely piloted aircraft the alterity mediation becomes the focus of function. The control mechanisms for remote pilots are interactions with a mouse and keyboard. The pilot types in flight points and directs movement of the UAV, while receiving feedback from the screen as output. For both types of pilot, the alterity mediation is a physical connection between the pilot and the flight controls. The output of this mediation is the same, however the experience of it differs.

The Global Hawk pilots rely much less on their flight controls, the routes of the drone are pre-planned in accordance with a mission statement, where every flight point is already known and automatically performed by the UAV. The pilots are present for emergencies or if divergence from the plan is needed. This is also an area where the Global Hawk's autonomous capabilities show. If necessary or during loss of connection with the drone, it will perform the alternative pre-planned route and is able to divert from the route based on a programmed decision tree. If the Global Hawk experiences certain elements through its sensors, it can take action based on the elements. For instance, it can take evasive action in the case of an attack, find the nearest allied airport for emergency landing or circle in place for a better view of a point of interest.

This also means that in the case of the remote pilot dedicating more control to the Global Hawk, the mediation between the two also change. The relation of the Global Hawk would change in the cases of loss of connection.

Here it would become a hermeneutic mediation because of the lack of in-the-moment control over the UAV. While the drone is out of view, its automatic pre-planned functions takes over. Making sure that it follows its designated route, and that it acts accordingly and predictably in the case of emergencies. Meaning if it encounters engine trouble it should automatically reroute and glide to the nearest designated emergency landing zone. The loss of connection is a possibility for us to explore some of the automatic functions, that are borderline autonomous.

> *"Losing connection is completely normal and not an emergency, a timer is set on the plane's instruments, you know the satellite coverage and for instance, if flying from Europe to USA, you could lose connection for two to three hours, where there is no satellite coverage. But we know that it is back in three hours, and then we can control it again. It can't be called an emergency just because we don't have contact with it. It's all planned."*
> *- Interview 03/04-2018, SNE [Translated]*

Michael Linden-Vørnle elaborated during a military technology workshop, that the loss of connection was problematised by the Pilot Industry Association. Here they questioned whether it was safe to employ a drone, when no human could interact with or supervise it. Michael Linden-Vørnle is an astrophysicist and Chief Advisor at DTU Space as well as a member of the International Civil Aviation Organisation (ICAO).

The following quote is from an interview with Michael Linden-Vørnle, about pilots, autonomy and predictability.

> *"If the pilot can't get in contact with the platform, then the plane should do something appropriate and it should be predictable. These are the kind of things we discuss in ICAO, almost till our heads turn blue. We have a workgroup that looks at human factors and the interaction with things. They came up with; automatic technologies are predictable, autonomous technologies are unpredictable. I asked them, a bit provocatively; "How do we rate the predictability of our pilots?" Pilots are also an autonomous system, pilots can also choose to fly into a mountainside, which we have seen unfortunate examples of. We know that the pilots have been chosen based on certain criteria, they have been trained in a specific way and continuously have their health checked. We expect that they act within a normal area, meaning they are predictable. But this is not always the case."*
>
> *- Interview 03/04-2018, Michael Linden-Vørnle [Translated]*

There should be no issue in a Global Hawk losing connection, as long as it is intended. The predictability of it needs to be trusted, just like the pilots are, despite accidents happening. SNE, as an experienced pilot, both onboard and remotely, sees no issue in losing connection to the drone, and has an understanding of the expected outcomes. If we zoom out from the drone in its autonomous capacity during loss of connection, and instead focus on the pilots again, we find that the postphenomenological relation between pilot and drone in this scenario becomes *hermeneutic*. While the *hermeneutic* relation is concerned with perceiving and understanding data, the lack of data can be just as telling in regards to where the drone is, and according to SNE, just as telling regarding what the drone will do.

The hermeneutic relation is not a mediation exclusive to the remote pilot, both types of pilots have to interpret data of different kinds. Whether it is air pressure, speed or warning lights for systems, a hermeneutic relation between the pilot and the different inscription devices occurs. For an unmanned aircraft this relation grows in importance for the pilot, since the hermeneutic relation and interpretation of received data becomes the eyes and ears of the pilot. As such it is a prevalent mediation for pilots who use several inscription devices to make phenomena tangible. The inscription devices available for the different types of pilots change the input of the mediation. A regular pilot has gauges and background relations that help the pilot interpret the situation at hand and respond correctly.

For a remote pilot the hermeneutic mediation is transferred entirely to computer screens with relevant data on otherwise intangible measures; such as positioning, wind pressure and speed. The connection between the pilot and the immediate surrounding airspace, is in a sense lost.

The mediating effect here is reshaping the practice of piloting. The pilots would at a glance look more like programmers than pilots, sitting in an office on the ground monitoring screens, interpreting data outputs and acting in accordance with command and data. It also means that the pilots need to develop new competencies through training to be able to pilot the Global Hawk. It is flying through some of the same mediations, but it is a physically disenfranchised action. The Global Hawk is the only drone in the world that requires a pilot with a flight certificate. This is because it needs to cross commercial airspace to reach its operating altitude of 18 kilometres. This is also the reason why pilots are educated in understanding data outputs and flying the drone, rather than using trained programmers.

In a manned aircraft pilots have their visual field of the outside, able to see, feel and understand how fast they are going. Experiencing the weather, rather than interpreting numbers on a screen.

There’s the noise from the engines and the wind resistance against the aircraft. The aircraft shakes and rumbles as it moves through the air.

For a remotely situated pilot all of these factors are readable through inscription devices, but does not encompass a physical connection with the outside. A pilot on board the aircraft is in embodiment and background relations. When both relations are removed from the control scheme, new ways of manoeuvring the airplane must take their place. This is why the loss of embodiment and background relations translate into a growth of importance for both the alterity and hermeneutics relation.

We have established the change in relation from a directly piloted aircraft and an unmanned one. It changes from an embodied relation to an alterity relation both as a result of a shift in control scheme, but also because of how data and an understanding of the situation is gained by the different pilots. The change in mediations for controlling the aircraft creates more room for automatic functions to take the place of the pilots, as can be seen when the pilots lose connection with the Global Hawk. With better technology, the translation of the embodiment and background relations into tangible numbers can make way for stronger data processing. This could create better autonomous flying capabilities of the drone, perhaps eliminating the need for pilots.

If we once more direct our attention to the exchange of a control stick in favour of the computer screen and mouse, the change in interaction between pilot and aircraft appears as distancing to the act of flying.
An onboard pilot has a point of contact *to the hand*. There is both a physical interaction when touching and using the control stick, as well as a bodily interaction when the control stick also moves the pilot.
The remote pilot loses this interaction and flying the Global Hawk is a *before the eye* point of contact. The airplane is understood, felt and flown through cognitive understanding and the interpretation of data. This change in point of contact highlights the reshaping of the pilot practice and shows that flying a Global Hawk is much more about interpreting data and making the drone *act*.
It is important to note, that the point of contact is not entirely dissimilar, pilots on board still have a point of contact *before the eye,* when interpreting data from

the displays and a remote pilot still interact with the mouse and keyboard *to the hand*. The importance of these points of contact, is that the pilot's control inputs changes dramatically, which further shows that pilots need reschooling and further education to use a Global Hawk drone. When point of contact for the Global Hawk is moved from *to the hand* to *before the eye*, it also widens the possibilities for the Global Hawk to act automatically through near-autonomous functions. The remote pilots do not have to engage with the drone at all times and can spend time controlling the actions of the Global Hawk, by interpreting the data instead. It opens the interaction space and can create a more flexible technology platform, where several actors can engage with it simultaneously, since they all need to approach it *before the eye,* rather than *to the hand.*

After having seen how the changes in relation between pilot and aircraft can be understood, it seems prudent to take a closer look at what forces that are behind this change, and how it affects the pilots. The design of the Global Hawk leaves no proper room for people to be on board the airplane during flight. This forces the pilots to be elsewhere while controlling the UAV. It is a coercive influence, both strong and apparent. Strong in the sense that it cannot be circumvented, since the unmanned part of the drone is designed into its use. It is apparent because of its direct nature, where no actor can be confused as to whether it is a UAV or an aircraft that allows a pilot to be on board. This also means that the drone forces certain constellations of actors through its design. In this case it leaves little room for other interpretations.

The automatic processes in the use of the Global Hawk UAV influences the user to interact less directly with the technological platform itself. This decisive influence makes sure that the pilots and technicians are focused on the feedback from the monitors, instead of micromanaging the automated processes. This is one of the main influences for reshaping the role of the pilot, from a manual flight controller, to understanding data, flight inputs and reacting and correcting the doings of the Global Hawk. The pilots are now more concerned with having a large overview of the processes, supervising the drone, making sure that each action it takes is correct. This has moved from the previous image of the pilot, concerned with the actual micromanagement of the drone.

Designing the ground control centre to look like a cockpit with the intent of making the crew think of it more like a plane, is a seductive influence to create a familiar environment. With the changed background relations as a result of transferring the pilot to the ground, the shape of the new 'office' can be a design method for keeping some of the pilot practice alive. It is a weak and hidden influence where the actors could easily rearrange the operation quarters, if better solutions are found.

Figure 7: NASAs Global Hawk command center (note, 'cockpit' in front, analysts in the 'cabine'

The Global Hawk is a multiple technology, this allowed NATO AGS to participate in the design of the Global Hawk, shaping some of the influences of the technology to a military context. The intent is to specialise and standardise the technology. Here it is important to note that the specifications for use have been designed to suit specific military standards. This helps explain the influences above, as they are intended. The responsibility of the pilots is not fully changed when operating the Global Hawk in contrast to a manned aircraft. This is in part because the Global Hawk has been designed for military operations.

If we look at the five criteria of responsibility; capacity, causality, knowledge, freedom and wrong-doing, we find that the pilot still encompasses these criteria. This could only change through a more autonomous technology, where the pilots surrender their own autonomy. In this case, causality, knowledge and freedom as criteria could be called into question, due to the mediations and influences of the technology. This will be explored in the discussing, due to its uncertain nature and the fact that the technology has not reached this point of autonomy yet.

We do however see, that the remote pilots of the Global Hawk, are responsible for supervising the drone, reacting and correcting any mistakes that it makes. Their role as pilots, are more concerned with data analysis than flying. With the already automatic and near-autonomous functions of the Global Hawk and the future implementation of machine-learning, the role of the pilots may change yet again, and their responsibility could change with them. These points will be brought up in the discussion, due to them still not being certain.

Data analyst

If we move our focus from the pilots to another operator of the Global Hawk, the data analyst becomes an interesting actor to examine. The analysts also negotiate with the Global Hawk, but they do it through data collection, interpretation and analysis rather than control.

> *"The Global Hawk is not just the five flying platforms, it's just as much the analysts and intelligence people on the ground who, can analyse the products we get. Right now, even though we haven't got the planes yet, the analysts are working with products from the US and actually also from Denmark and our Challenger planes"*
>
> *- Interview 03/04-2018, SNE [Translated]*

The analysts are equipped with valuable information and a link to what postphenomenology would deem an interpretation of the world. Through the actions of the Global Hawk it seems more like a sensor and information device than an airplane for the analyst. The primary function of the Global Hawk is to create data by scanning areas with specialised equipment. Synthetic aperture radar and infrared sensor systems are some of the systems that measure a specific part of the world, and mediates this to the data analyst. The data is sent from the drone to computer equipment that can display the information as images. The data analyst then analyses the received data and uses the knowledge to inform the military commanders of relevant points of interest. What constitutes relevant points of interest is often predefined by the mission statement and varies between geographical areas. The primary concern for the Global Hawk and the data analyst, is how the UAV and the surrounding system mediates the world to the person.

The role of the data analyst does not seem to be dependent on whether the aircraft is manned or not. They share a *before the eyes* point of contact with the drone pilot. What seems to be of importance, is the capabilities of the sensors and where they can be moved in the world.

The data analysts are impacted less by the change from airplane to drone. Their primary role is to analyse data, interpret it and communicate it outwards to commanders and NATO countries alike. This role does not change based on the vessel for delivering their data, it is still hermeneutic mediations that unfold the world for them and enable them to engage with the rest of the network. As explained with the pilots, the screens mediate knowledge of the world supplied by the Global Hawk, in this case it is from the different sensors, their readings, images and so forth. The Global Hawk works as an *inscription device,* turning otherwise faraway pictures of a country, into military intelligence. The analysts can then decipher this information and decision makers can later act upon it. The analysts receive pictures and knowledge otherwise hidden to them, by engaging with the data the Global Hawk supplies in this *hermeneutic relation*. With the Global Hawk acting as an inscription device and carrying several mediations of the world for the actors engaged with it, a question of intentionality and morality of the technology is also raised. Intentionality and morality in technology has been a subject for many scientists, here amongst Winner (1980) and Verbeek (2006). These aspects can be inscribed in the technology by the designers, based on what they believe is the correct output of data or control manuals. It is important to keep this notion in mind when dealing with a technology platform, such as the Global Hawk. It does not necessarily send impartial data to the analysts. Data can be inscribed with understandings, morality and intentionality of the designer, and as such these aspects of the technology can be further imbued by the analysts who impose their own values upon the data. This further underlines the importance of strong data practices that must move across and beyond sovereign borders for a streamlined code of conduct, to operate without incommensurability. This is further complicated, since the data can be used in a context where human lives are at stake. This is likely due to the military context. The images created by the inscription devices, can place responsibility on the designers. There is a forward-looking responsibility-as-obligation towards designing moral technologies that do not impose unethical choices upon the analysts. Here it is important to note, that warfare is a chaotic endeavour, and questions should be raised whether it is possible for designers to foresee all outcomes of their technology. In other words, it is not certain that the designers have the knowledge and capacity to shoulder this responsibility. Yet there is an understanding articulated by SNE, that mistakes will not happen.

It is important to note, as Michael Linden-Vørnle also has pointed out during an interview, that the Global Hawk is an Intelligence Security and Reconnaissance unit (ISR), in the same category as many other ISR units used by the military. The Global Hawk differs by having a more autonomous control scheme.

We now know that there is a translation process between the UAV sensors and the data analyst. The specific sensor package of the UAV is a directing factor. The sensor array determines what output is available, and as such is considered *coercive*, being both apparent and strong.

The Global Hawk is highly influential in determining what kind of data the analyst receives. The same technical specifications which controls how far, fast and for how long the UAV can be flown by the pilot, also controls how much data the analysts receive. This either opens or limits the places in the world where the Global Hawk can operate, as well as the duration and response time of such operations. It forces the operators of the drone to operate within these boundaries of use, this directly transfers to the data analyst. It is not possible to collect data via the Global Hawk from a place where the drone is not operating. In this manner the analyst is affected by a coercive influence. The drone is somewhat invisible to the analyst. Its design is only important through its capabilities and the drone becomes an actor that supplies the analysts with data, they would otherwise be incapable of getting. With the introduction of machine-learning, and the development of it on the Global Hawk, its capabilities as an *inscription device,* and the morality of the drone becomes even more important.

> *"There are some future possibilities in the Global Hawk, I would say. Where it actually makes use of machine-learning. Terma is developing this on the maritime sector, where it has self-learning and after it has identified the first 300 targets, we have operators who validates those targets. We can also look at tanks, which is something that is looked into a lot at the moment. If we take the C72 tank as example, it could identify that there are 37 C72 tanks in this area, and it can discern that through a certain algorithm that lights back on the radar. Then you validate those targets, and it gets a predictability of 86% likelihood that it's a tank, and then there is a 14% likelihood that it's a bus. Terma is developing this, and here we are talking more about autonomy regarding target recognition and there are some countries that would like that."*
> *- Interview 03/04-2018, SNE [Translated]*

With the possible future enhancement of recognition software and machine learning for the Global Hawk, the images and outputs it creates will be more coercive and decisive than they are now. This could create a change in the practice for the analyst akin to what we have seen with the pilots, where the human actors surrender some of their autonomy, in order for the technology to be empowered in its own analysis and doings. In this scenario of a smarter intelligence asset, the responsibility is moved further from the analyst and perhaps towards the technology itself, due to the decisions it can now make.

Commander

Now that we have explored the directly acting operators of the Global Hawk and how their role is reshaped through the platform, we would now like to take a further look into a more organisational actor: The commander on the ground.

Military officers, generals and decision makers, see the Global Hawk as a technology that provides intelligence and ultimately can save lives by streamlining war efforts and strategy.

The commander on the ground, who is in charge of the military operation has a different affiliation with the Global Hawk. The commander is not in direct contact with the drone like the pilots are. The commander is not directly dependant on the drone for work as the analysts are. For the commander the drone is a military asset, generating intelligence for the analysts, that the commander can use after it is translated for operation.

The commander on the ground has no direct contact with the Global Hawk. It is a conceptual relation, based in hermeneutic mediations from interpreting the data it supplies and comparing mission statements and their effect.

Due to the commander’s organisational and conceptual understanding of the Global Hawk, the commander requires knowledge of the different practices of operation. One issue, is that the Global Hawk as explained exists differently for the actors and there are functions that are hidden for external actors. This is what Latour has named a black box (1979).

Some black boxes stem from the educational background of the operators and they can be considered technical- as well as organisational.
Certain doings of the Global Hawk can be impossible to fully understand for some actors, due to their limited knowledge of the processes.
Exactly how the sensor array works and what it enables can be impossible to grasp as a pilot, yet it might be tacit knowledge for the engineering and analytics team. Such compartmentalisation helps to get an advanced technology to function, but makes it harder to comprehend the platform in its entirety.

The Global Hawk is linguistically defused by mentioning it only as a remotely piloted aircraft (RPA) rather than an unmanned aerial vehicle (UAV). It is described as always having a pilot in command, yet during flights over the Atlantic, communication with the drone will be lost. In these circumstances it is described as predictable rather than autonomous. It has the capability to change its course of action, based on a pre-programmed decision tree, which does not make it truly autonomous, but it is automatic in its decision making.
The reason for this discourse is partially due to the unfinished discussion on autonomy in technology and the conservative understanding that seems to be prevalent in some parts of the aviation field.

> *"It's not just about the military application, it's just as much about the civil application. If we have an autonomous infrastructure, consisting of things that can both drive, fly and sail. How do we integrate it into our existing infrastructure, including ourselves in an appropriate way, where it solves a lot of tasks in a better, more secure and more appropriate way, but doesn't create new risks or unnecessary risks?"*
> *- Interview 03/04-2018, Michael Linden-Vørnle [Translated]*

These are important perspectives and questions for the commander, since the drone affects the decisions made by the commander. The consideration of the autonomous infrastructure could be a beneficial future perspective, for the integration of moral and ethically sound technologies.

The Global Hawk is perceived by the military commander as *behind the back*. There is no direct contact with the drone itself, but it plays a factor in what decisions are made, and what decisions cannot be made. It impacts the choices of the commander in both a limiting and broadening way.

The influence on decision making shifts, depending on what the decision is. An example from the field is that the Global Hawk could detect that a certain road is not used at all. This could lead to a coercive influence on the decision making to not use that road, since it might be dangerous due to improvised explosive devices. The knowledge gained from the Global Hawk becomes part of its agency and morality in decision-making processes.

Another coercive influence that is common for all actors using the Global Hawk, is that they are limited by the distance the drone can travel and the area it can monitor. Considering the Global Hawk is remotely piloted, its design also opens the possibilities of more dangerous missions, since no human lives are at stake and only the material costs are an issue. The drone has an inbuilt self-destruct feature, where it spirals out of control and deletes all onboard data. Thus, destroying both data and sensor array in the process, further limiting the risks in an otherwise high-risk scenario.

> *"If we imagine that we are in Afghanistan, and it gets such a serious emergency that it can't make it to a landing area, which is quite unthinkable, but something could happen. Then it has a self-destruct mode, where it deletes all data, everything that could be of use and then it initiates a spiral dive where it self-destructs, and if it has the capacity for it, then it will do it on a pre-planned point."*
>
> *- Interview 03/04-2018, SNE [Translated]*

The Global Hawk is a technology that generates military intelligence which in turn can be used to specify the mission statement for the commander. It is a military asset in the same sense as tanks, troops and fighter aircrafts, although with a sole purpose of gathering intelligence as a strategic asset.
An interesting aspect of these influences, especially when explored in a military context, is the morality and safety of the Global Hawk. Seeing that the pilot is not physically placed in the aircraft, the pilot is out of harm's way during dangerous reconnaissance missions. With the Global Hawk capable of flying for 30 hours per flight, the pilots work in shifts and maintain the operation of the drone throughout, something that would be more demanding in a manned aircraft. By removing the pilots from the actual cockpit in the plane, the flexibility and the safety of the Global Hawk is seemingly increased.

The future of AGS

As explained earlier in the chapter, the AGS is not yet fully operational. Aviation licenses are still not in order, some parts of the Naval Air Station Sigonella are still under construction and the political decisions on where to fly the drones are still being weighed. Besides the administrative and legal matters that need to be concluded, the Technical University of Denmark (DTU) have made contact with the AGS to establish a cooperation between NATO and DTU.

How these matters are resolved will determine not only how responsibility will shift and be distributed within the AGS, but possibly also what new actors are involved in the future network of AGS.

The future tasking of the Global Hawk drones under AGS was a subject we first encountered in our interview with SNE and touched upon in the chapter above. The list of possible tasks the drone can be ordered to perform includes; surveillance of refugee movement, in order to aid humanitarian work, disaster help via flyovers of areas affected by natural disasters, as well as intelligence gathering pertaining to the security of allied countries. During our meetings with those involved in the AGS, we have been informed that even though the allied countries of NATO strives towards providing better security for all, there are certain areas of interest that are prioritised higher by some allies than by others. Some countries in the south of Europe seem to prioritise the surveillance of the Mediterranean area, with a focus on areas of conflict and the masses of refugees from the Middle East and Africa. The eastern allies seem intent on having better surveillance capabilities on the contented Crimea Peninsula and the surrounding areas, in order to be well informed on the movements of Russia in this area. Denmark is intent on deploying the Global Hawk to perform Arctic surveillance. Here the drone would be used to keep an eye on the drifting ice, ship traffic and help in protecting the areas that Denmark have access to, due to the special national connection Denmark has with Greenland and the Faroe Islands.

It becomes apparent that the tasks used as examples above already includes widely different areas of operation. Current procedure of creating guidelines for tasking the five Global Hawks will reveal how the network will come to appear at that time.

A matter pertaining the delegation of tasks, is the implementation of further cooperation with the scientific world. At this moment military surveillance data is often handed over to scientific institutions so that they might use it for research. Through communication with DTU Space and the Danish Acquisition and Logistics Organisation (FMI) of the Danish Ministry of Defence, we know that some of the data the military collects, is disseminated to relevant scientific organisations. Michael Linden-Vørnle spent a week at the Naval Air Station Sigonella as part of a negotiation to further the cooperation between the military and DTU. Both Linden-Vørnle and SNE, who was his point of contact in the AGS, seem hopeful for a mutually beneficial endeavour.

> *"There is a cooperation between DTU, NASA and NOAA amongst other organisations that would like to use the Global Hawk that NASA has. [...] We would like to use this (Red. NATO AGS) Global Hawk in the Arctic for various scientific projects. I have pointed out that there's a synergy between this and operative surveillance when there's flights with sensors already performed. It (the Global Hawk) can see things in real time or near-real time and these information's can be valuable in regards to surveillance of ship traffic as an example. Afterwards the data can be valuable to scientists and research projects they might have. This is the general thought. We have chosen to call it 'Multi-Use' as opposed to 'Dual-Use'. 'Dual-Use' is a technology that can be used both by the military and civilians. 'Multi-Use' is more akin to a platform where it doesn't matter if it is used by the military or civilians. It creates data and information that can serve multiple users depending on the time-perspective. This is what we would like to try out and also why we (Red. Michael and SNE) are meeting up. There can be some interesting perspectives in sharing data and experience in regard to the use of these large and very expensive platforms."*
>
> *- Interview 03/04-2018, Michael Linden-Vørnle [Translated]*

A way of handing such information over from the military to the scientific world usually concerns high quantities of images of certain areas of the world. Images made with specialised equipment, different radars and sensors that each help in extrapolating specific aspects of the surveilled area. An example could be satellite or drone footage of arctic areas, both sea and ice. This is used by the military to look for the movement of non-allied ships and placement of strategic assets. The scientific world can use it as part of oceanography studies or other relevant scientific areas. An important consideration in this exchange of data, is the fact that the military surveillance equipment is extremely expensive and to "reuse" it in this manner saves large amounts of money for the scientists. To ensure that no military secrets are compromised, it is a custom to delay the handover of data to make sure that it is no longer strategically relevant to foreign powers, or degrade the quality of the images to a point where they no longer show the unwanted material.

We find the future of the AGS interesting as it breaks new ground not only in a NATO military capacity, but also because of the possibilities of a closer cooperation between the military and scientific world. It does raise questions to the priorities of use the UAVs will be put under, though this remains to be seen from the tasking and possible inclusion of scientists in the network.

Analytical key points

By exploring the network of AGS, following responsibility and how the different actors can be said to hold tasks that only they can be responsible for, we have scrutinised the different types of operators. This is done in order to truly get an understanding of what their role in the network is. The postphenomenological perspective have enabled us to better see the relations between the Global Hawk and the operators, to map out where autonomy arise in the system at present, as well as where it could become a possibility in the future.

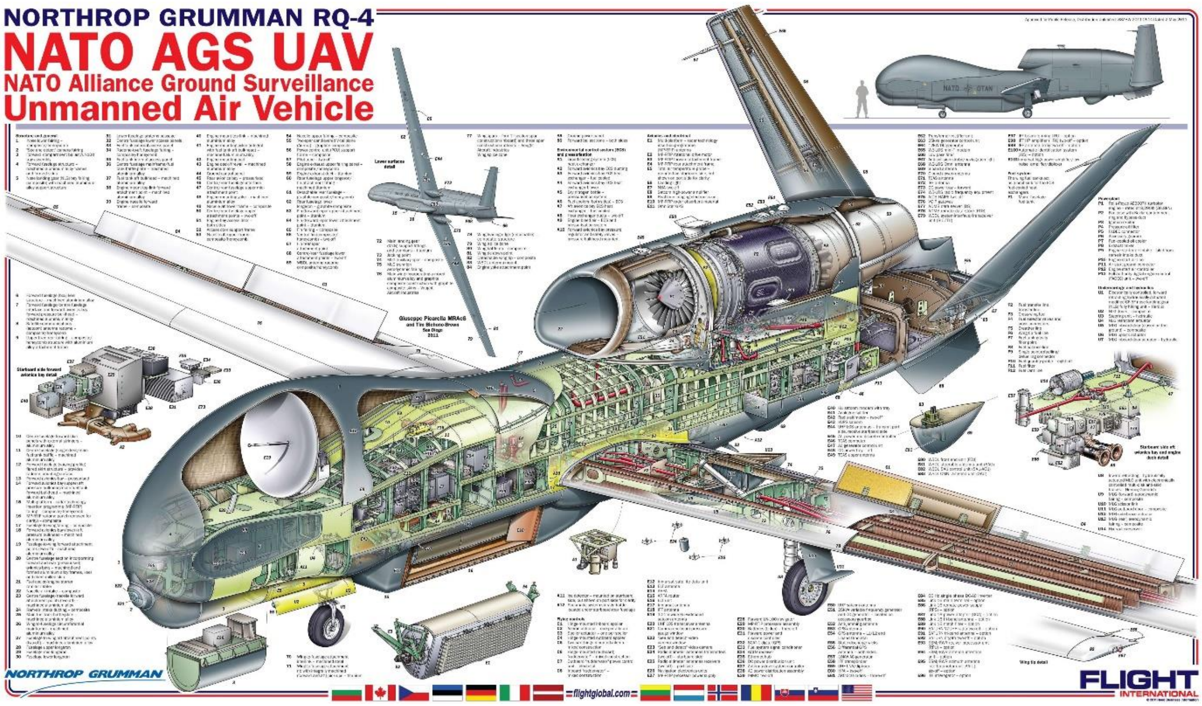

Figure 8: Crosscut of the Global Hawk

The Global Hawk UAV is facilitated through a network mainly composed by various actors within, or connected to NATO. It was designed and developed with a combined effort of the US Military and the contracted Northrop Grumman. The US Military supported the acquisition of the technology to a NATO context and AGS was the result. Situated on the Naval Air Station Sigonella in Italy, AGS will house the five Global Hawks, the control station and landing strip part of the Global Hawk system.

A massive network converges to enable the advanced capabilities of the Global Hawk. By itself it is an unmanned aerial vehicle with the wingspan of a large passenger airplane.

It has a sensor array, a massive engine and an aerodynamic hull that allows it to operate for extended durations. When combined with satellite up-link, the control segment, data analysts and data input from other surveillance sources, the Global Hawk becomes able to support tactical decisions of NATO at a whole new level. While not officially called autonomous by the AGS, the Global Hawk system functions effectively with little human interaction during operations. As such we can consider the Global Hawk "semi-autonomous" and suitable as a focal point for a further discussion, on the subject of how technological autonomy affects the placement of responsibility in a military context.

A common trait for all involved users of the drone, is that it allows the user to extend their presence to a great distance. The different roles have different interactions with the drone, enabling their functions where the UAV operates. This is beneficial for the pilot, who operates the aircraft without being physically present. This enables certain new aspects of military reconnaissance through the designed influences of the drone. With the operating crew secured on the ground, the drone can undertake more dangerous missions. The technology platform forces certain choices when operating the drone, as the user must use very specific tools and methods to utilise the UAV. This fits well into the military operations of the drone and the normative militaristic responsibility, explored earlier in the analysis. The drone is designed with a morality of safety and resilience regarding dangerous missions. It is equipped with automatic technological functionalities, to ensure that the operation can continue despite connection problems. While it is not fully autonomous, certain features show the capabilities it has in this category. It can fly without connection to the pilots, and still perform reliably. The pilots have slowly begun a transition towards supervisors of the drone, rather than conventional pilots.

The actors in the network that constitute the Global Hawk, do so in various ways. Actors contribute to make the intricate technology function, while others benefit from the data that the UAV generates, in some way, shape or form.

With such a wide network necessary to function at full capability, responsibility for each of these moving parts becomes hard to fully grasp.

Despite the normative militaristic way of placing responsibility on the commander in charge, the process of enabling the Global Hawk opens several considerations.
These considerations and points of interest in the analysis, will be brought forth and discussed in the coming chapter.

For the further discussion we are interested in exploring the militaristic normative responsibility. Understanding this concept in regards to the problem of many hands and how it works for delegating responsibility in a strict and disciplined institution.

With the possible future implementation of machine learning in the Global Hawk's analytical and operational process, we wish to discuss what this means for the pilots and data analysts. What happens when the human actors surrender parts of their autonomy and responsibilities to the technology. An interesting point of discussion will be; where will responsibility be situated in a future technological autonomous system? Will it change in a lethal context, in contrast to the strategic context of the Global Hawk? Beyond these points, a more autonomous system could reshape the pilots to a larger extent than what we have seen so far. A prominent avenue to explore is the impact of the technology on the roles of the operators.

If the Global Hawk gains the ability to conduct its own analysis, such as target recognition through machine learning, how will it then change the influential forces of the technology? Will actors be able to keep up with the advancements and understand the line of thinking, as employed by the technology and therefore still be able to control it? Or will the technology become too advanced for humans to contradict the analysis of the machine?

Responsible autonomy

The Global Hawk system has been studied, the actors in the network identified and the relations between human and technology opened and scrutinised. We have identified how autonomy appears in the Global Hawk case and what actors interact with responsibility. To further our comprehension, we will continue into a chapter where we discuss autonomy and responsibility in the context of our case.

This discussion is based on our findings from our analysis of the Global Hawk case and supplemented with relevant outside perspectives. Our initial focus in the chapter ahead comes from our problem formulation:

> "What constitutes the AGS Global Hawk system in the network of NATO? How does the inclusion of an autonomous technology impact the allocation of responsibility in its military use, as explored through a network-centric method of investigation?"

After having explored the constituting parts of the AGS Global Hawk system in the analysis, we are left with both new knowledge and questions. We will spend the coming pages improving our understanding of the 'impact of autonomous technology on the allocation of responsibility in its military use' as well as reflect on the revelations that relate to this question.

During the discussion, we will first debate the new questions that arose from our analysis surrounding the case. As we progress further into the chapter we will go into subjects that apply more generally to the field of autonomous military technologies. Throughout the discussion we will weigh benefits against drawbacks. This process is not aimed at judging the technologies as to what is correct and wrong, but rather identify what autonomy does and can do in the future, with a perspective of how this can change the weight and placement of responsibility in the network.

The area of technological autonomy is still under much debate, and true autonomy for technology has not yet been achieved. We wish to explore different scenarios to qualify the questions and considerations needed, for the future discussions of autonomy in technological systems. After this we will elaborate on what we have learned and what questions we are left with.

The identified autonomy will through the discussion be subject to investigation, to better understand how highly automated technology can push, change or shape the responsibility in the network.

The Global Hawk is not a fully autonomous technology, as many of its parts are dependent on human interaction for them to work. It is important to note that technological autonomy does not need to be a 'package deal', and that advanced automation in cooperation with many other functions can act semi-autonomously. We have identified certain parts of the platform where technological autonomy is more prevalent, such as; flying during loss of contact, performing evasive action or reacting to points of interest.

Therefore, we find it beneficial to consider and evaluate the semi-autonomous functions through their processes, as their capabilities can be borderline autonomous in certain situations.

If we consider the possible future scenario of implementing machine-learning with the Global Hawk for target recognition, we find that many of the Global Hawk's functions will still require human actors to interact with it. The function of finding targets, improving upon that feature and creating an analysis from the data, will be doable through autonomous functions.

We have through the analysis established that AGS, adopts the normative militaristic responsibility and further elaborated on how this perspective is enacted. There is always one person in command, and that person is responsible. By investigating the different interactions between Global Hawk and human, we have found that certain operators can encompass responsibility in their own right.

The military sees responsibility as a strict structure, we wish to challenge this view through a network-centric perspective of responsibility guided by agency, to see what the benefits of a normative structure is, and what the issues are.

As explained in the analysis, the conditions for being responsible are interesting in the study of autonomous technology.

During this chapter we use this understanding to see if the advanced automation of the Global Hawk causes a change in these conditions of responsibility for the human users in the network.

The autonomous impact on the responsibility of the Global Hawk

With our definition of technological autonomy in place as specific functions rather than full systems, it is now time to take a further look into some of the functions we identified in the analysis, with a focus on how the influence of autonomy affects the responsibility of the actors.

The postphenomenological analysis of the physicalities of the Global Hawk showed that the lack of space and facilities in a Global Hawk UAV, is a coercive influence. It forces the pilot out of the plane in a very apparent manner. By removing the pilot, we argue that the pilot previously inherited the responsibility for his own safety, but this responsibility has now been designed into the drone as a morality of safety. Disenfranchising the pilot from the plane, has strong positive effects for safety, but it does come at a cost of embodied mediation. The pilot is in less direct control of the UAV and the primary function of the pilot becomes understanding the data of the drone. This also means that the pilot must share the responsibility of control with the drone itself, where it is allowed to fly on its own until the pilot finds the need to take back the control. However, if the drone is flying in an area without connection, then the pilot will be both physically and cognitively disenfranchised from the drone, and the drone becomes the sole pilot. In a sense its programming will be responsible for taking the correct actions, only deviating according to strict parameters and with the correct action.

In the intro of our thesis, we introduced the descriptive terminology used by parts of the field to categorise the human role in a network containing autonomous technologies. Being “in, on or out of the loop” considers where the human actor is placed in the relation with the autonomous technology (Scharre 2016; Schaub Jr. & Kristoffersen 2017). ‘In the loop’ means that the human actor takes active part and must approve all actions of the technology. If the human actor is on the loop, then the actor is still part of the network, but does not need to approve all actions, just monitor them and intervene if issues arise. Out of the loop, means that the human actor is no longer part of the network, and this is where true autonomy of technologies starts to take root according so some.

For the pilot, we argue that the human actor is on the loop, supervising the technology with the possibility of taking full control over the drone if needed - stepping “into the loop” so to say. During times with no connection to the drone, the pilot is moved out of the loop, and the programming of the drone must be trusted. As long as a human actor is on the loop, responsibility can be easy to identify. The controlling human, in this case the pilot, has the responsibility to monitor and supervise the drone. If the pilot is completely removed from the loop, the responsibility previously attributed to the pilot should by default also move or change.

The coercive influence of the drone that grounds the pilot, carries a morality of safety, but also dilutes the structure of responsibility in the network, making it harder to place. If we consider the problem of many hands, the more actors that are part of a system, the more difficult the allocation of responsibility will be. When technologies assume a place in this network, further questions and doubt towards responsibility should be raised.

One of these questions pertain to how actors can be held responsible. According to the normative military perspective, the person in charge is responsible. Here we notice how they use responsibility-as-accountability. The commander takes on the responsibility because they are duty-bound to do so according to military protocol. What other actors can be said to be responsible, in a situation where something goes wrong in the AGS Global Hawk network? Who is to blame?

Here we find that the responsibility in some cases could be allocated to Northrop Grumman. The designers who developed and programmed the drone. When considering allocating responsibility to the designers and developers, we also need to consider whether a designer can feasibly account for all possible scenarios during war time, as these are often chaotic. The knowledge condition for responsibility, is the criteria to understand whether the actor had the correct knowledge, acted upon the knowledge correctly or if the actor has the knowledge to prevent future errors. It is a hard criterion to fulfil in this scenario, especially with the amount of designers and engineers involved in the production of a Global Hawk drone. In the analysis we explored the postphenomenological effects when the Global Hawk is flying without connection to the pilot. The single influence of moving the pilot out of the plane, and maintaining flight capability during loss of connection, arguably forces the responsibility to be spread out in the surrounding network, shared between the drone, the designers, the pilot and the commander. If the drone makes a wrongful action when there is no contact with it, then one might ask: who is the responsible actor?

The designer should have programmed the drone better, but can all factors in a war time scenario be accounted for? Should the commander on the ground have launched the mission, knowing that the drone would lose connection to the pilot? Did the pilot surrender control too easily, could measures have been taken to prevent the drone from acting alone? These are just some of questions and doubts that arise, from a single influence changing the placement of the actor compared to the loop.

One aspect that needs to be kept in mind, is that moving the pilot to the ground is a very apparent influence, and as such consequences and questions should arise naturally. It is no surprise that this influence has been pushed upon the actor.

Another aspect of the postphenomenological influences that we have not explored in depth in the analysis are hidden influences. One reason for this is their hidden aspect, meaning that studying the hidden influences from afar can be increasingly difficult.

For a full analysis and discussion on this aspect we would need to observe the operation of the drone in person, which will be considered during the perspectivation. For now, the hidden influence that we have found is the arrangement of the ground control station, where it is setup as an airplane. The pilots are in the ‘cockpit’ with the analysts sitting behind them in the ‘cabine’. The implications for responsibility and the appearance of autonomy is not a factor that we can identify in this setup. Instead we find it important to point out that hidden influences carry certain risks in a military setup, especially if it is a result of autonomous technological functions. Machine learning could carry forward hidden influences. This could happen in the analysis of images or the presentation of data. A seductive influence, being weak and hidden, would nudge operators towards a certain action. This influence would be considered mild in outcome and should carry no risk. A possible example of this could be highlights on the images that the sensors produce, thus suggesting areas of interest for the analyst, who could explore the suggestion or discard it. In this scenario, the analyst would still remain on the loop and retain the autonomy to correct the technology. Strong and hidden influences, are decisive in nature and carry much more risk. These are influences where the machine could take action through autonomy, and the analyst would be pushed out of the loop. This could be a result of the analysis from the technology being too complicated for humans to properly comprehend. This is a worry that Paul Scharre and other scientists within AI and technological autonomy has brought forth as dangerous outcomes. We are however moving towards what is currently still science fiction in this scenario, but in a context of responsibility there would either be placed responsibility on the designers, both as blameworthiness, accountability and efficacy. This means that designers would be responsible for mistakes in the past and preventing future mistakes before they can happen. Yet again, we reach the question of whether this is a feasible requirement, however it might be a necessary one.

The prime question that arise is whether the morality of safety outweighs scenarios of misconduct by the drone. These stories are classified by NATO, and as such we have not had the opportunity to explore any malfunctions or consequences. The history of errors that we have brought forth so far regarding the Global Hawk, have been from evaluations of the early development phase. While Global Hawks have been shot down during missions, we have found no more information on this. The morality of safety is also the value of human lives in an allied context, and protecting soldiers will often be one of the largest concerns of the military.

From the discussion above, we see that the design of the Global Hawk system is done with a very specific intent and enabled by a strong network. The apparent influences of the UAV are intentional and part of what makes it able to perform as well as it does. The technological platform has restrictions for every beneficial feature, and these limitations are not of a nature that we would deem crippling. Far from it. We would consider the Global Hawk a strong technology with a specific design that houses few drawbacks. The design obviously influences the users but it does so in a responsible and apparent fashion.
Our view on the moral embedded in the design of the UAV, is without having performed an in-depth study that allows the revelation of hidden influences on the involved actors.
It now becomes obvious that there lies a responsibility with the military leaders who requisition the UAVs to ensure that they order technology that is designed with wanted influences on the soldiers that use it. This can be said to be a responsibility-as-obligation, as they must make sure that the technologies do not facilitate wrongdoings.

After studying the influences of the technology, we are left wondering if the normative military allocation of responsibility, can become counterproductive. Here it is specifically the efficacy of a problem solution process that might be endangered by the go-to placement of responsibility-as-accountability on the person in command. Even with follow-up investigation of any incident or mishap it distracts from the opportunity to improve a technological design, if the standard solution is to shift perspective to the person in charge. As limited as our insight into the military culture is we understand the need for hierarchical structures in a culture that is based on discipline. Responsibility-as-blameworthiness allows a different perspective for pinpointing the blame on specific actors or functions, and might be a desired perspective when it comes to correct a technology and avoid future mistakes. This thought is based on the notion that a leader in charge might not be involved in a certain mishap in any other way, than being in charge of an operation. This is not meant to replace the correct training in the application of autonomous or semi-autonomous technologies, but instead a consideration that we believe to be beneficial for the military to include.

The military way of placing responsibility has its advantages. Allocating responsibility to the person in charge of an operation, is a simple solution to an otherwise complex problem. As explained it can become quite problematic to find out who, or what, is to blame when things go wrong. The normative militaristic perspective eliminates this complexity by pre-assigning the responsibility by referring to it in a manner pertaining to accountability.
A scenario could arise in the future use of the AGS Global Hawk. We might have the drone surveil an area and send data to an analyst. They then hand it over to the commander of the specific 11 people on duty. The images might indicate to the data analyst that a certain bridge has a high risk of being too dangerous for allied troops to pass. This information is handed over to a commander on the ground who leads their troops around the bridge, costing them precious time. They find out that because of the extra time used they missed a critical window in their operation, and lives were lost as a result. If they afterwards find out that the bridge in fact was not dangerous to cross, what happens then? This is also influenced by the chaotic nature of war. Sometimes a decision must be made, whether the information is enough. SNE explained how war time decisions are often a trade-off, of having the right information and having enough. With many moving pieces it can be difficult to investigate if a mistake was made

and who performed it. It can be beneficial to perform a deeper investigation into the network to look for the actor, who is to blame for the wrongdoing. We would be remiss not to mention that the NATO AGS would investigate such problematic actors, even as the responsibility is placed on the person in charge.

On the nature of autonomy

The apparent difference between autonomy for humans and autonomy for technology is another interesting aspect that has left us with wonder. It has showed itself both during research, literature studies and by meeting the field. We are aware that the discussion on this subject in the scientific and political world is ongoing and controversial.

Autonomy is the reason humans can be held both accountable and responsible, and if a human being does not possess autonomy, it can because they are still a child, or perhaps due to mental illness or things of that nature. For technology, autonomy is not as close linked with responsibility and accountability, one reason for this could be that punishment for machines seem to have little consequence, compared to punishing humans for their actions.

Technological autonomy is often mentioned as dangerous due to it being unpredictable, however if we consider Linden-Vørnle's quote from the analysis, then pilots and humans in general also carry the capacity to be unpredictable. The difference we see, is that humans are far easier to hold accountable. Just as technology can be programmed to act within certain parameters, humans are also both encouraged and forced to operate within the parameters of the law.

Technology is difficult to punish, and at best the designers can be held accountable for their development. We see technology as moral agents with the capability to affect human actors, through their mediations and influences. This means that technological autonomy should be taken into account when understanding responsibility. The more influencing a technology is, the more central its placement becomes in the calculation of responsibility. Especially when considering the conditions for responsibility, it becomes clear that while it is hard to argue that a machine has the capacity to act responsibly (without entering the field of highly advanced AI) or be free (since they are often programmed and restricted by humans), their inclusion in the network seem to be able to impact the conditions for other actors. An example of this can be seen in the information necessary to meet the knowledge condition. Here the actor is expected to know what the repercussions of their actions can be, in order to be responsible or blameworthy. In the case of a highly complex technology, this becomes increasingly difficult. As exemplified in the case of the Global Hawk.

A simple distinction that could be valuable for future discussions on the subject, is to speak of technological autonomy rather than simply calling it autonomy. The implications of technological and human autonomy seem to be vastly different, due to the perspective of responsibility. We find that technological autonomy should be seen in accordance with the network it is part of. As previously mentioned, a system or platform can also be automatic in its full picture, but still consist of several autonomous functions. The overall network of the technology, as well as the narrow network within the technology, is important to understand when making decisions on the morality and influence of the entire technological platform.

Considering the influences of technology. These are what determines the severity of the technological autonomous functions. If a technology is designed to nudge users towards morally sound choices, then the technology is part of the moral community as a helpful addition. Contrary, if it pushes humans towards unethical and amoral decisions the technology is a dangerous addition and should be scrutinised for improvement, or shut down. We find that humans can be responsible on their own and their responsibility can be identified based on their actions. Technology, on the other hand, is responsible through their associated network and can be called upon by reviewing the influences of the technology, when placing responsibility on the human.

'Multi-Use' in the network

With the specific influences of the Global Hawk explored, we have seen what the involved technology can do. During the analysis we briefly touched upon the proposed 'multi-use' of the Global Hawk. The term is coined by Michael Linden-Vørnle as a contrast to the existing 'dual-use'. Dual-use are technologies that can be used for military or civilian purposes. In the context of dual-use, it is binary. The technology is either used by the military sphere or the civilian sphere. Multi-use is an attempt to remove the binary function from the network, and have civic purposes for military technologies. This is proposed to be done by allowing scientists to gain access to the data, that the Global Hawk generates. This collaboration is still on the drawing board, and therefore no concrete examples can be found. We do however see benefits and issues with this collaboration, which is why we find it prudent to explore it here.

First, the implementation of a scientific use of the Global Hawk is very doable. The Global Hawk is used by NASA for scientific discovery in a non-AGS context. SNE furthermore elaborated in an interview, that the Global Hawk, without the constituting military network, is more of a scientific tool than a military intelligence tool. The modularity of the drone allows different sensors to be installed in the Global Hawk, although according to Linden-Vørnle, the sensors currently equipped are great for scientific work. The UAV would provide the same data, but analysed by a much larger group of actors in various scientific fields in, addition to the military analysts.

The inclusion of scientists raises interesting questions. Let us start by looking at what could happen if the scientists receive military intelligence through the supplied data.

This could either be a mistake on the military's part, by not being careful and detailed enough. Alternatively, it could be caused by cutting edge science, which might have new ways of interpreting the data that allows for a new analysis to be performed. The knowledge that was previously invisible to the military then becomes unearthed by the scientists.

Either reason for this will give the scientists access to data that they might not be privy to. It poses the question; how should the scientists handle such data?

If the data shows the movement of enemy troops, or has any implication towards human lives, then it could be difficult for scientists to act upon. Military strategy, including giving the order to take human lives, is something that few scientists are trained in. Extending this responsibility, albeit by proxy, from the military to the scientists further implicates the placement of responsibility and it may not be an area where scientists are even able to act informed and responsibly.

This is part of the reason why the exchange of data between military and civilian scientists is difficult.

The scientists might be placed in the hierarchical structure of the military, and for this to work, we believe that the normative military responsibility would need to be kept. The above issue can be circumvented by creating time locked data as is the way some military data is being handed over to scientists at the moment. For instance, military intelligence is only allowed to be used by scientists one year after it has been recorded. This greatly reduces the risk that scientists find data that the military should act upon. Whether the data is still relevant to the scientists after one year depends on the field of study. If this becomes the road ahead for the cooperation, we find it unproblematic and in fact having the military work more closely with the scientific world, could prove beneficial to both parties.

That being said, the future cooperation of military and civilian scientists could become less clear cut if additional actors were introduced to the Global Hawk network. Specific scientists that participate in the project of the AGS, will be involved in military actions in one way or another. By now the AGS is an information gathering operation and this aligns well with the investigative nature of relevant scientists. In the future, weapon systems could be introduced to the Global Hawk network. This would make the scientists work on data that is simultaneously used to target and deliver deadly ordinance to enemies of the NATO Alliance. This would open a new range of discussions on how responsibility moves in the network, though one dependant on a future scenario.

We have examined the Global Hawk with a critical perspective on its functions and outputs. We find the Global Hawk to be a solid and well-designed technology, with little to no dangerous hidden influences. This is why we estimate that it could encompass both scientists and military personnel simultaneously. The collaboration could furthermore be good publicity for the military, showing that semi-autonomous technologies are used in non-lethal manners and are used well. The inclusion of scientists could further the transparency of the military.

We have previously mentioned that NATO and the personnel in NATO have been taught and instructed to speak of the Global Hawk as a remotely piloted aircraft, rather than using the term; unmanned aerial vehicle, as the latter could pertain to autonomy. The Global Hawk, with a scientific collaboration could prove to be a strong foundation for opening this discussion on autonomy in military technologies and show that it is not all concerned with lethal measures. We find that a thorough discussion on the autonomy of military technologies could be beneficial if led by the military in collaboration with scientists from various disciplines such as, robotics, AI, law, political science, techno-anthropology and many other. Specially to further the correct technologies in the military regime through clarity and transparency.

However, while on the topic of transparency it also has the possibility to go the opposite way. It is not certain whether there will be more transparency in the military and their use of technology, or whether involving scientists in a project, that is first and foremost military, might lead to less transparency in the scientific work. If no time-delay or scrubbing of data is done and the scientists are included in analysing the data, they might be required to sign an agreement of secrecy for some of the work they do and the knowledge they create. While it might still be possible to perform valuable scientific work under a non-disclosure agreement, it could bring about a number of questions regarding validity and the future of scientific research, that we will not go further with here.

The above considerations are hopefully beneficial to keep in mind when contemplating the introduction of multi-use to the Global Hawk system.

In conclusion

The impact of autonomous technology on the allocation of responsibility

We have benefitted from applying ANT and Postphenomenology in analysing the specific technology of the AGS Global Hawk. We have taken a look at the autonomous capabilities of a technology in a case, instead of autonomy on a grander scale. This might be a valid method to nuance the discussion on autonomous technology in the political landscape. Providing case-based exemplification could help decision makers understand references better and be part of a foundation for a common terminology on the field.

The AGS Global Hawk is constituted by an expansive network of actors. These include, but are not limited to; NATO and the allied countries, Northrop Grumman, Naval Air Station Sigonella, the AGS, pilots, engineers, data analysts, operations commanders, commanders on the ground, the UAV itself and the onboard sensor suite. Each of these actors possess their own role in the network and interact with the Global Hawk in different ways.
The Global Hawk is highly automated and able to function autonomously in some cases. This is enabled by the extensive network of the AGS and the specific capabilities of flying on its own and reacting to certain inputs. These aspects are what we consider to constitute semi-autonomous processes. In these cases, a human can be considered to be 'on the loop' and thus still capable of affecting the actions of the UAV.
Human actors in the network of the Global Hawk are influenced by the technological actors. This becomes especially apparent when comparing the UAV pilot with the pilot of a manned aircraft. The influences of the technology change certain aspects of the operator roles in the network and make them behave in certain ways. The technological functions in the network that allows autonomous capabilities are examples of these influences.

This leads us to one of the more important realisations. Autonomous technology of the kind we have worked with, demands an expansive and dedicated network in order to function. Many different actors in the network are included with the purpose of making the Global Hawk operate as independently as possible. We might refer to the Global Hawk system as a technological platform and for ease of understanding compile the different parts of it under one umbrella. Fact is, there are many technologies that come together to form the platform and each might be fully understood only by some of the human actors that use it.
The Global Hawk is operated by several human actors and many more are involved in designing and facilitating its connection to the system, that enables its advanced capabilities. Identifying the responsible actor in the network, without adhering to the normative military method, becomes harder the more actors are involved. This becomes even more of an issue considering that we are not only investigating the human actors but also their non-human counterparts. As every technology involved in the system has an influence on the user, each technology should be considered when responsibility is placed. Not that the technology is the responsible actor, but because it might have played a part in the wrongdoing. Considering that the focus of our study has been a semi-autonomous technology, we find it even more beneficial to scrutinise the influences and mediations of future, fully autonomous technologies. We believe it can serve as control in the design phase, to limit dangerous and unnecessary risks.

The realisation that technological autonomy can be achieved with the combination of a network of technologies and human actors, might be useful in the further public, scientific and political debate on autonomous technologies. Especially autonomous weapons. The problem stems from the ability to achieve autonomous functions by combining technologies that might not be presumed autonomous in their own capacity, thus evading some legislative or restrictive measures.

If we presume that it takes a network of this complexity to facilitate an autonomous technology, then it stands to reason that the placement of responsibility is more difficult in such a network. This allow us to argue that the inclusion of autonomous technologies in general makes it harder to allocate responsibility in a network. The more actors involved, the harder it is for a person in charge to understand each part in depth. Each technological actor influences the human actors that use them in some way. Some influence in apparent ways, others in subtle and hidden ways. A strong and well-instructed design, that takes care to create wanted influences and exclude unwanted influences, might alleviate some of the strain on the placement of responsibility in the network. This effectively moves the responsibility onto the engineers and designers, a responsibility-as-obligation.

The consideration of 'multi-use' brings even more actors into an already vast network. It comes with considerable benefits for both the military and scientists involved, but makes it even harder to place responsibility-as-blameworthiness. This makes the normative military responsibility a viable solution in this particular case, as it ignores the intricacy of a network by placing responsibility-as-accountability on the person in charge.

To sum it up. Autonomous technologies make it harder to place responsibility in the networks that enable them. This is caused by the greater number of actors needed in such a network, and the fact that each technological part influences each human in contact with them. The problem can be met with a design that takes this knowledge into consideration.

There are still many questions left to be answered and a more comprehensive study should be launched with a primary research method of participatory observations at the Naval Air Station Sigonella. This method would allow a greater comprehension of the influences of the technology and is a method for making the hidden influences visible. There is furthermore still work to be done regarding a study of autonomous technologies from a network-centric approach.

As such we estimate that a further study of other autonomous military technologies, be it weapons or strategic assets, should be carried out under the same research design. It might use actor-network theory, postphenomenology and the problem of many hands to solidify and create a more structured techno-anthropological approach to autonomous military technologies. We believe this is a beneficial way forward, due to the strength ANT and postphenomenology has in scrutinising the network, by following responsibility and identifying technological autonomy as it presents itself. We have experienced this to be a strong research design in combination with the problem of many hands, to get a detailed view of the intricacies of the network, and have found that the concept of responsibility, while new in ANT and postphenomenology, fits well with already established intangible concepts such as; morality, strategy, negotiations and influences.

The road ahead

Over the past four months, we have learned that autonomous technologies in a military perspective is no small subject. For this master thesis we chose to focus on responsibility, autonomy and how they affect each other. With four months of research behind us, we have gained a greater understanding of technological autonomy, how it clashes with human autonomy and where responsibility fits in this construct of future possibilities. Yet, we are not certain that responsibility is where this research should begin. It is a massive subject and it is a truly important one for determining how and if autonomous technologies have a place in militaries around the world. The issue we have seen with the allocation of responsibility, is that we still find the understanding of technological autonomy to be lacklustre. Technological autonomy is seen as good-hearted if there is 'meaningful human control'. This term is used by developers, neutral actors and organisations against autonomous weapons (Human Rights Watch "Killer Robots And The Concept Of Meaningful Human Control" 2016).

Meaningful human control also means keeping the human in the loop and delegating the final word to the human actor. This does sound like a beneficial solution; however, one issue is that this definition is a contrast to what technological autonomy is. Because a human actor is in control, the argument is that the autonomy has been removed from the technology. However, we have found that technological autonomy should not be viewed from the final output of the technology, it should rather be viewed as process-focused autonomy in a larger network with a semi-autonomous or automatic output.

A big part of our thesis has concerned itself with identifying and understanding the influences of the technology. This is because we believe that it will be one of the most important ways to determine what technological autonomy does and how it can act as a moral agent.

For future work on this subject, close observation of the Global Hawk would be beneficial. Especially the hidden influences have been difficult for us to identify, without extensive observations of the practice at hand. Visiting the Naval Air

Station Sigonella on Sicily, would enable a more detailed analysis of how the Global Hawk affects the different actors. Access to the actors themselves could lead to better knowledge on how they think of the Global Hawk, and how they believe it influences them.

This might be difficult to gain access to, but would likely be highly beneficial. In the same category of getting more engrained in the field; interviews with designers to better grasp the design choices behind the Global Hawk, could grant better knowledge of how the influences were created. Whether they were planned or coincidental. This could be held up against the viewed mediations to better understand if it has been designed with morality in mind, or if improvements could be made.

During the exploration of this field we have encountered several arguments for or against the use of specific or general technologies. For a more evaluation-minded approach to the field, we believe it to be beneficial to include one or more ethical perspectives. An example of this could be the thoughts of Luc Boltanski and Laurent Thevenot as presented in “*On Justification: Economies of worth”*.

From here we would be able to draw upon a theoretical framework, that would allow us to index the different arguments in their respective categories. Boltanski and Thevenot argue that several “economies of worth” exist and overlaps in the same social spheres. Each of these “economies” have an internal evaluation system in place for determining the worth of a given endeavour. They identify six economies of worth in *“On Justification”*, each economy has specific values attached to it. These values would be possible to address in the formulation of our informants and the spokespersons of the field, to understand their argumentation and the values they invoke. Boltanski and Thevenot’s theoretical work would be a useful tool for understanding how autonomy is viewed and discussed, and could be a beneficial addition to scrutinising the political side of autonomous military technologies.

The use of this ethical theory would be to set up a framework for conflicting actor perspectives within the same “economy”.

In this way it should become easier to judge which of the conflicting perspectives that holds the most "worth" in the given economy.

It does not lend itself in the same way to arguments from different "economies", but in such a case points towards an argument for "the common good" and if this argument is made in unison, pushes towards a compromise of sorts.

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Figures and Pictures

Figure 1: http://www.nagsma.nato.int/pages/ags_general_information.aspx
Figure 2: van de Poel, Ibo, Jessica Nihlén Fahlquist, Neelke Doorn, Sjoerd Zwart, and Lambèr Royakkers. 2011. "The Problem Of Many Hands: Climate Change As An Example". Science And Engineering Ethics 18 (1): 49-67. doi:10.1007/s11948-011-9276-0.
Figure 3: https://www.nato.int/cps/en/natohq/news_120429.htm
Figure 4: http://www.northropgrumman.com/Capabilities/GlobalHawk/Pages/default.aspx
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