Yakski: An Electric Waterjet Propulsion System (Technical Report)

> Florida Manatee Conservation (STS Research Paper)

A Thesis Prospectus Submitted to the

Faculty of the School of Engineering and Applied Science University of Virginia • Charlottesville, Virginia

In Partial Fulfillment of the Requirements of the Degree Bachelor of Science, School of Engineering

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On my honor as a University Student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments

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Introduction:

The first manatee was discovered in 1741 (Mantees and How They Live, 2019), 75 years before the first proposed propeller design achieved its patent (The Inventors of Propellers, 2019). As with many areas on Earth, the bodies of water in the Central Florida area have been homes to millions of different marine species for long before the humans inhabited it. One of the most affected animals in this region is the manatee. Manatees are naturally slow-moving mammals that tend to graze just under the water level. This leaves them at great risk to be involved in boat collisions and being lacerated by motor propellers. Due to this, on an average, about 130 manatees are killed each year and of the remaining, 85 percent have a distinguishable laceration scar (Mantees and How They Live, 2019). This is over seven times the number that the FWC estimate of deaths that will affect the existence of the species (Florida Manatee, 2019). As a result, all species of manatees are considered endangered species and they are protected under the federal laws of the Endangered Species Act and the Marine Mammal Protection Act, as well as the Florida Manatee Sanctuary Act (Manatee Conservation, 2019). The Florida Fish and Wildlife Conservation Commission (FWC) has main authority in creating the protection laws for this species but many other research and conservation groups in this community. Due to the interest in protection of this Florida native species, there is high potential for an Actor Network Theory. The main missing piece from having a successful network is the lack of enrollment from actors from the boating community. If the conservationists, scientists, and engineers could all form a network, then a community could be created that is safe for the manatees and pleasing for the boating community.

Actor Network Theory and Manatee Conservation Research:

The Actor Network Theory (ANT), starting in the late 1980s, is a sociological approach to the way that groups from different scientific fields and nature connect around a specific topic, creating a "network". Each of these groups or species are designated an actor and are given equal responsibility to the success of the network. The main goal of this theory is to eliminate the





precedented facts and assumptions about the subject but follow how the actors work together and make fact off of their observations. This process of the actors connecting and creating is known as "Translation" (Rodger, Moore, & Newsome, 2009). The steps of Translation can be seen in Figure 1. From this, a network can be built.

For most networks, they are able to get established, but struggle to maintain the full enrollment of all the actors (Rodger, Moore, & Newsome, 2009). As soon as one actor falls out the network is incomplete and dissolves. The Actor Network Theory, although it requires constant involvement, the benefits can have a major effect on the designated community.

As stated, a main pillar of the ANT is that all actors are on an equal scale, but looking at past successful wildlife actor networks, one of the most, if not the most crucial member is the actor that connects all of the others together. For the Wildlife Tourism Network in Australia it was the scientific colleagues that conducted their research. This community of scientists were not only responsible for conducting the research and tracking the penguin actors, but they had a major influence on the network's alliance with the Australian National Antarctic Research Expeditions (ANARE) Strategic Plans and the Antarctic Science Advisory Committee (ASAC). Without the scientific colleagues the Strategic Committee didn't find importance for the network. With the lost of the alliance to the ANARE and the ASAC the network lost its influence to change regulations (Rodger, Moore, & Newsome, 2009). For the possible network for the manatees, this major influencer would be the Florida Fish and Wildlife Conversation Commission (FWC). Summarized by their mission, the FWC's purpose is the "Managing fish and wildlife resources for their long-term well-being and the benefit of people". They are main connection between wildlife and humans for the whole state of Florida. The FWC manages and protects over 1275 species of animals between land and water wildlife (FWC Overview, 2019). They play a major role in how humans interact with Florida wildlife, making sure that people can continue to participate in hunting, fishing, and boating without putting these species at risk. This includes strategic planning and implementing laws and regulations, such as licenses, hunting season dates, and boating speed zones. Specifically effecting manatees, the FWC provides the "Boater's Guide to Living with Florida Manatees", "Protecting Native Wildlife - Manatees", and "Waterway signs" handbooks (Information for Boaters and PWC Operators, 2019). These contain the rules that are enforced by the Coast Guard and the Florida's Sherriff Police Department. The FWC is also responsible for research and tracking of their species. They have multiple conservation groups that focus on each species or group of similar species to follow their population numbers, leading causes of deaths etc. For manatees alone, they have three different organizations (Manatee Research, 2019). Since the FWC's influence is so widespread, they would qualify as a base actor for the network to be built off of. With the help of the FWC,

alliances could be built between scientific researchers, policy makers, law officials, and manatees themselves.

The next connection that would be made is to the scientific researchers and organizations that will follow the manatees. The manatee is will be the most important non-human actor. Because of that, one of the actors must include a group of specie researchers. The specie researchers would be necessary to track and observe the same group of manatees. In order for the manatees to be a qualifying actor, it must be the same ones, so that research is consistent. One current possible actor is the MOTE Manatee Research Program (MRP) out of Sarasota, Florida. It is one of the three mentioned organizations under the FWC that studies manatee behavior, population, and distribution throughout the state of Florida (Manatee Research, 2019). The MOTE MRP qualifies as an active actor since the research is ongoing and relevant to Manatee conservation network.

Another influential actor to the network would be the people who are majorly responsible for enforcing the rules on the water, the Coast Guard. This branch of the military has a diverse array of responsibilities that cover anything that may take place on the country's waters. The Coast Guard is throughout the country but are heavily present off the coasts of Florida due to the vast amount of waterway and close vicinity to foreign countries. Due to this, the Coast Guard, along with local police departments, are the main enforcers of the marine laws and regulations. They have two different divisions that support this effort, Ports & Waterway Security and Marine Environmental Protection. Ensuring that the recreational boaters are following the waterway laws, such as controlling speed in Manatee Zones, falls under their Waterway Security. Maintaining the marine ecosystem and the human-wildlife interaction is part of the Coast Guard's Marine Environmental Protection mission (USCG: A Multi-Mission Force, 2019).

Having the Coast Guard as part of the network will increase their knowledge of the dangers that manatees face and add importance to their job of protecting them. This will give the network its best chance of being successful and effective.

The researching actor is responsible for providing the data that supports laws and the enforcing actor implements the laws, so an obvious necessary actor would be the people who created and pass these laws. In 1953, under the Submerged Lands Act, *state waters*, were created. State waters are the region of water from zero miles off the coast, referred to as the baseline, to three nautical miles out. While this is federal law and stands for the East Coast of Florida, due to historical precedents, state waters extend out to nine nautical miles for the West Coast of Florida. Manatees are coastal shallow water creatures that reside in this state water region (Ocean Commission, 2019). This means that the Florida State legislature is responsible for developing the laws to protect the species and their habitat. This authority would qualify the Florida State legislature as an actor. Having the policy makers in direct contact with the researchers and have instant access to the necessary data that the policies should be based off of will lead to more impactful laws and regulations.

The goal of this proposed network is to conserve the Florida manatee species by opening a flow of communication between the manatees and their main predator, a boat propeller. For this to be effective, the last actor in the network must be from the marine engineering division. Having a member from the group that designs and produces these propellers allows a trading zone to be created. From this the engineers can communicate easily with the conservation researchers, working towards a product that satisfies both customers, the boaters and manatees. **Trading Zones in the Network:**

Trading Zones are described as "hubs" of communication between groups of different background knowledge, where a common language and understanding is developed. Initially, these "hubs" were constricted by location, creating a common language between people who were physically near each other. With the brink of the 21st century and its accompanying technology, these "hubs" were now able to be much larger and diverse. They are now able to connect people across the world, advancing the trading zones and improving their influence. These can be useful for efficiency when working with a wide variety of specialist towards a common goal. Using a common language eliminates the risk of miscommunication and ensures efficient and successful results (Gorman & Werhane, 2010). These are common in the science and technology fields. No one engineer or scientists can make an invention completely by themselves, so trading zones are used to integrate all different types of professions into a product. In the case of manatee conservation, a trading zone would be beneficial for the network of actors.

Florida boating is currently at an all-time high. According to a report produced by the Center for Biological Diversity in 2014, policymakers were rapid authorizing water-craft projects without properly analyzing them. These projects have increased the number and size of the boats that are sharing the water with manatees. With more boats in the water, the likeliness of a manatee having a collision or being lacerated by a propeller increases. As previously stated, the largest cause of manatee death is from collision. If the size of the boats increases, the number of manatees that do survive those collision will decrease. Along the same line of the thought, the bigger the propeller, the higher chances of death rather than laceration. Having policymakers in the network will keep the idea of manatee conservation relevant and with a trading zone they will

know how to correctly analyze a proposal before approving it (Florida Manatee, 2019). This will help to prevent the collision caused death rate of manatees.

Currently there is no open conversation between the engineers and scientists during the design process of propellers. There are certain constraints that exist on the design of the propeller due to the laws of nature and science, but if the engineers could work with the researchers, there could be potential for discovering an innovative, less harmful design. Jet skis, for example, utilize an impeller and suction of water to produce a jet stream of water that propels the vehicle forward. This a system that is far less harmful to the manatees than propellers because it eliminates the risk of being cut up by the metal blades. With an operable trading zone, the boat design engineers would be an active actor in the network.

A trading zone would also be effective with solving the issue of climate change on manatee's habitat. Since manatees are native to the warm waters around the coast of Florida, cold snaps caused by fluctuations in the temperature of sea water has become a fatal threat to the manatees. Climate change has been linked to the increased number of hurricanes and red-tide algal blooms (Florida Manatee, 2019). These natural disasters negatively affect manatees through the disruption of their habitat and physical harm to the sea level grazing manatees. With a trading zone, attention could be brought to the policymakers about climate change. If policymakers fully understand the scientific effects of climate change on manatees, they will be able to create appropriate and effective regulations to fight it.

Conclusion:

The Actor Network Theory proposes a way for a community to be built and have an influence on society. For the network to be existing, all actors mentioned must be active in their departments and dedicated to making an impact. For manatees, they were here long before humans and the

earth we live on is as much their home as it ours. Even though society today places humans on top of the food chain, all species and ecosystems are equally as crucial, thus should be treated as such. There is a compromise that includes manatees living in a safe environment while humans enjoy the fun of water recreation. A network would include all major players that have a hand in reaching that compromise. It will get all parties on the same page and allow them to put all their efforts toward reaching that goal, rather than wasting it with trying to work with the other groups. As a result, everyone will be able to live their best lives.

Plans for Further Research: (Author's Notes)

For my full thesis in the spring, there are many areas that I plan to further research and elaborate on. For each of the actors proposed I want to do further research into the work that they currently do for the Florida manatees. This includes policies already in place, work/programs that the FWC has in operation and ongoing research on the species. With respect to climate change specifically, I want to research the effect of previous policies on the marine life and analyze of they could be improved to have a more successful outcome. On the engineering side, I want to elaborate on the current design process of propellers and how the engineers could use a trading zone and the network to improve upon it. In reference to trading zones, I want to look further into their benefits with all actors including engineers, policymakers, and researchers (concerning climate change). Specifically, I want to analyze the influence of each actor and determine which actors need to trade with which to have the most successful outcome. In summary, I want to look further into all the ideas proposed and report a more extensive status of them.

Resources:

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