Creating a Nuclear Navy: A Social Analysis

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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

On a cold January morning in 1954, the sleek hull of a boat slid down the drydock of Electric Boat's Groton shipyard, and slipped into the frigid waters. Her keel was laid only three years prior and now the *USS Nautilus*, the first nuclear powered seagoing-vessel steamed down the Thames River, out into the open sea (Duncan, 1990, p. 13).

For the US Navy, this was a major accomplishment, marking a milestone in developing the nuclear triad, and bringing a new actor into the US's competition with its Soviet rival. This momentous occasion was a surprise, for such a technology was beyond the capabilities of any other nation of the time (Wilson, 2015, p. 3-4). Far surpassing the simple diesel-boat submarines of years prior, it begs the question of, how did this happen? How were nuclear-capable, and nuclear powered ships brought into the US Navy?

Commonly referred to as the creation of a "nuclear navy", the *Nautilus* was part of a push to "nuclearize" the US Navy. An effort to introduce nuclear propulsion to naval vessels, this coalesced as the Naval Nuclear Propulsion Program (NNPP). This thesis hopes to answer *"How did social attitudes allow for the creation of a nuclear navy in the United States?"*.

To answer this, my research paper looks beyond the narrative histories presented already written about NNPP. Simply telling *what* happened, these are mere chronologies. Rather than just documenting the NNPP, I seek to understand *why* such a program could exist. What social processes allowed for it to coalesce, continue, and succeed?

Contemporary Relevance

This research has relevant consequences as NNPP represented a shift from a fossil-fuel driven technology to a non fossil-fuel technology. This has implications in other industries, showing how seemingly insurmountable technological obstacles are surmountable given the right social forces. In light of advanced climate change, similar efforts are made to develop renewable energies — the focus of my technical project — to supplant a fossil-fuel economy. By analyzing the NNPP as a case study of energy transition, lessons are learnt as to how to transition from fossil fuels to renewables.

Methodology

Since I seek to understand how societal values and influences impacted the NNPP's development, I use several frameworks developed by the field of Science, Technology and Society (STS). First is the social construction of technology (SCOT) framework. SCOT analysis requires that I view the development of a technology as multidirectional stages, where design decisions are made not as simply improvements of previous iterations. Instead, they represent only one path among many. Further, any iteration made considers both technological and social desires (Bjiker, 2012, p. 22).

When considering NNPP, different classes of nuclear-submarines are the nodes within SCOT. Further, SCOT can look at the social patterns affecting each design choice. Particularly, how do attitudes towards nuclear energy influence the nature of nuclear propulsion and the technology altogether? How might cultural contexts impact NNPP's adoption and vice-versa?

Another STS framework informing my analysis is actor-network theory (ANT). This is where technologies, their artifacts (physical "things" resulting from technological advancement),

and relevant human actors (individuals and groups who impact the technology) exist in an ever-shifting relationship with one another, forming networks of "action" upon each other. To examine them, I will identify key actors and determine how they interact to help, or hinder the NNPP. Certain ships such the *USS Nautilus* and the *USS Thresher* represent particular actors which influence public perception of the technology (The Navy, 2003).

ANT and SCOT analyses then syncretize, providing a look at the social conditions allowing for NNPP's adoption. While SCOT examines how attitudes towards aspects of the technology might bolster, or diminish enthusiasm for NNPP, ANT contextualizes these attitudes. It assigns them to specific groups and individuals, considering them instrumental towards steps in the development process.

Throughout my paper I use several sources. These were sourced from academic journals and books. First, Duncan's work provides the canonical Navy interpretation of the NNPP, giving a general overview and narrative history. The thesis from Wilson overviews the propaganda program surrounding NNPP, while psychological, and sociological studies provide attitudinal information about particular actors and demographics. Finally, periodicals serve as primary sources outlining the cultural discussion around nuclear submarines at the time.

The Change: Creating the NNPP, A Narrative

The Nautilus

In 1946, the Navy sent representatives to Oak Ridge National Labs (ORNL) to learn about new nuclear technologies. They did this to gauge the viability of nuclear reactors for shipboard service. A motley crew of civilians and naval officers, they were ostensibly under the Atomic Energy Commission's oversight. Given how young nuclear science was, however, they

had virtual free rein (Duncan, 1990. p.12). Thus, from the start, a certain Hyman Rickover maneuvered until he came to lead the group. It was with his instigation that naval propulsion became a major topic (Duncan, 1990, p.13).

A pressurized-water reactor emerged as the reactor-plant of choice. Meanwhile, all non-reactor components would remain *identical* to their diesel-boat counterpart, ensuring the submarine tested the viability of a reactor rather than of the hull (Wortman. 2022, p. 96). Researchers then ensured this reactor went aboard submarines rather than surface ships, as the secrecy in submarine programs gave them more unilateral authority. With this support from nuclear scientists, resources were secured, and soon, came the *USS Nautilus* (Duncan, 1990, p.16).

The Thresher

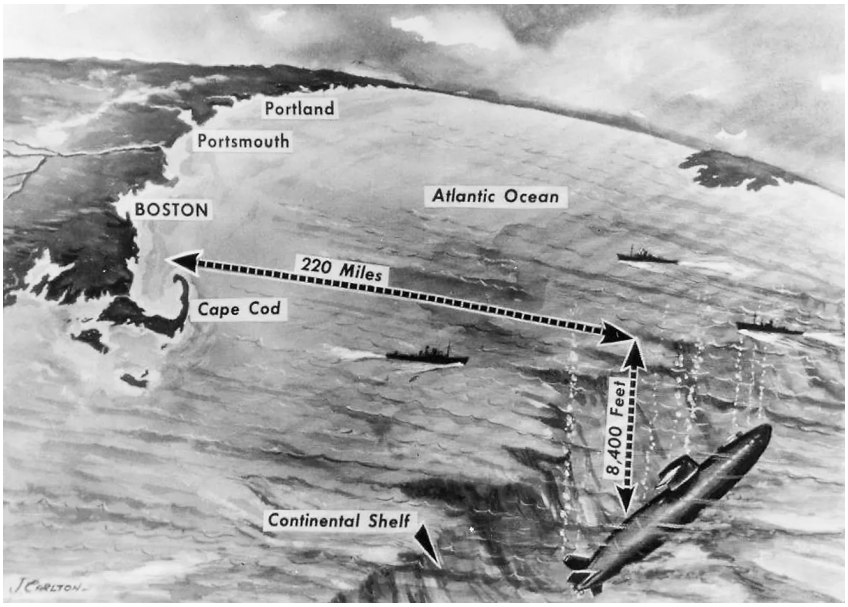
With *Nautilus'* success, Rickover's ambition seems to have borne fruit. The Navy thus alloted the program additional funding, while giving Rickover substantial oversight over new classes of boats. The submarine force grew to encompass the likes of the *Skipjack*, and the *Tullibee* — classes of boats which innovated in hull design, then sonar placement respectively (Duncan, 1990, pp. 18-23). It was to be the *Thresher,* however, which made history.

On the morning of April 9th, 1963, the *Thresher*, a new class of submarine steamed off the coast of Maine, hailed as the pride of the Navy. Able to dive deeper and more quietly than previous variants, the *Thresher* was to usher in a new generation of submarines. Inside was a full complement of weapons comparable to *Skipjack*'s, while at its heart lay the state-of-the-art electric drive, quieter than any mechanical transmission (Duncan, 1990, p. 19). Its inaugural test was to dive to test depth.

The dive proceeded smoothly. Submerging far below the continental shelf, it descended in increments of 100 feet. But then, came the transmission: “Experiencing minor difficulties…attempting to blow” (Wortman, 1996, p. 186). A flurry of frantic transmissions went down to *Thresher*, but responses came sparse. A garbled cry— “8400 feet” — and then silence. Thresher was lost, its 129 sailors crushed to death.

This tragedy exposed several challenges. First, it uncovered systemic issues within the NNPP. Particularly, shipbuilders were operating in a non-competitive industry; high start-up capital and arcane techniques meant that Newport News Shipbuilding, Groton Shipyard, and other shipbuilders held a virtual monopoly (Duncan, 1990, p. 49). As such, there was no incentive for proper workmanship, allowing for shoddy work and unsafe submarines.

In time, however, these concerns resolved themselves. Legislators demanded the creation of the SUBSAFE program, overhauling submarine design and enacting stringent regulations on submarine manufacture (Herald, 2018). What more, this program prevented any dive to test-depth until a boat had met all SUBSAFE certifications. Through the implementation of SUBSAFE, a new standard of practice predominated in the shipyards making the post-Thresher submarine force safer than ever.



The Wreck of the Thresher (Herald, 2018)

The George Washington

As lessons were learnt from the *Thresher*, the existential threat posed by the Soviets mounted. The *Thresher* disaster only increased societal angst. To counter the perceived Soviet threat, came the modern nuclear submarine. Up to this point, nuclear submarines simply had nuclear reactors, allowing indefinitely long submersion. They were *not* nuclear-*armed*, only holding conventional warheads. The *George Washingto*n class changed this and its story is replete with propaganda, business interests, and the machinations of a certain discoverer of plutonium.

Analysis of the Change

Propaganda and Periodicals

The story of *George Washington* begins with understanding the relationship between the media and NNPP. As much as public opinion held sway over NNPP, so did advocates of nuclear propulsion influence the public. To do so, they relied on propaganda: media and information publicized to influence the media's consumers. In the cut-throat world of political maneuvering, public support was instrumental to secure and maintain funding, especially in a program as risky as NNPP. And so, the Navy and its contractors turned to periodicals — magazines which saw broad readership — to disseminate a curated image of the nascent submarine force. Periodicals like *The Saturday Evening Post*, *National Geographic*, and most importantly, *Life* were conscripted in this publicity campaign (Wilson, 2015, p. 1). While secrecy veiled much information about the program, this gave it a mystique capitalized on in the American imagination. Releasing only tidbits of information, the Navy lauded the scientific achievements of early submarines as futuristic and daring. Hearkening to the explorers of old, the *Skate* figured prominently in a 1959 edition of *Life*, which compared its passage through the ice-cap to finding the Northwest Passage (Wilson, 2015, p. 9).

USS Skate dramatically breaches the North Pole ice-cap ("Skate", 1959)

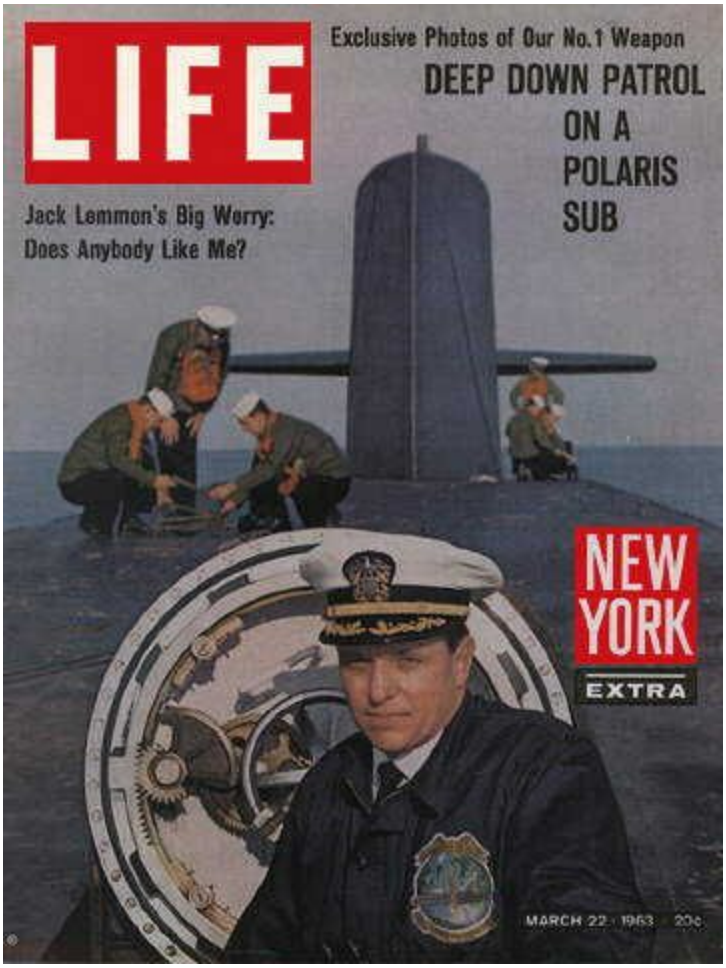
One submarine, the *Triton* even charted a path modeled after Magellan's circumnavigation of the globe. A "carnival-like" atmosphere abounded, despite the secretive nature of the submarine's mission. *Life* magazine's subsequent 1960 edition consisted of "stunning [periscope] photographs" — a novelty that captivated mid-century American audiences (Wilson, 2015, p. 12).

As the submarines grew more advanced, the periodicals then launched a new propaganda campaign to justify increasing submarine lethality. From the *Skate*, until the *Triton*, NNPP and, the media campaign of the periodicals focused solely on nuclear *propulsion*, and the novelty of reactor plants. Soon, however, that would not be enough. A 1960 edition of *The Saturday Evening Post* featured the impassioned fears of a Hanson Baldwin. Lamenting the robust USSR shipbuilding industry, Baldwin foretells of a future where the US Navy is outstripped by the Soviets whose fleet already surpassed the old WWII *Kriegsmarine* foe (Wilson, 2015, pp.

14-15). The defense industry piled high onto the wave of apocalyptic sentiment. With the launching of the *Sputnik*, the American public renewed their fears that their ideological foe was gaining the edge. It was this fear that *Life* editors exploited when advocating for incorporating nuclear warheads into nuclear submarines. *Life* editors insisted that if America dallied, then the "Reds" would be the first to develop submarine-launched ballistic missiles (SLBMs) (Wilson, 2015, p. 18). Depicting the American continent as but an island surrounded by open-sea, it was only a matter of time that Soviet subs encircled the States (Wilson, 2015, p. 6). And so, to counter this threat, the US must develop SLBMs first and develop a new class of submarines to launch them.

This push towards SLBMs came as the introduction of a new technological actor: the *Polaris* missiles. Vaunted as indispensable, their development allowed for the conception of the nuclear-armed *George Washington* class of subs. In a 1960 edition of *Life*, Lockheed Corporation (now Lockheed Martin) ran a full-page advertisement, claiming that its *Polaris* missile heralded a "new age of Western defense" (Lockheed Corporation, 1960, p. 63). *Life* even appealed to the general public asking that they contact legislators to support a bill putting "$2.3 billion for research into the oceans", touting SLBMs as the "best" form of deterrence (Wilson, 2015, pp. 20-21). Articles and ads steadily swayed American public opinion to the necessity of the *Polaris* program and nuclear deterrence became synonymous with nuclear submarines.

Ad supporting the Polaris Program (Lockheed Corporation, 1960, p. 63)



America's "No. 1 Weapon", the Polaris Sub (Life, 1963, March 22)

This relationship between business and defense came not only from defense contractors. Domestic-energy providers, eager to expand nuclear energy into the mainstream, sought to develop the technology using Department of Defense (DoD) funds. This is apparent from how Glenn Seaborg, discoverer of plutonium and Atomic Energy Commission Chairman, wanted to, in his words, "bring industry into atomic energy" (Duncan, 1990, p. 116). Further, as NNPP enjoyed more successes, Rickover was entrusted with developing civilian nuclear infrastructure, with the Shippingport Power Plant converting shipboard reactors into civilian reactors (Wortman, 2022, p. 141). President Eisenhower championed this as "Atoms for Peace", a new era in the nuclear age (Wortman, 2022, p. 143). Thus, civilian nuclear energy proponents used the NNPP to

further general nuclear engineering research, advancing the field for civilian infrastructure. This symbiosis between civilian legislators and Naval leadership thus provided the motivation and funding for the nuclear venture. Without this support, NNPP could not have sustained for so long.

Thus, one finds that Naval leadership, government figures, and business interests actively conditioned public opinion itself in pursuit of the NNPP, as actors in their own rights. *Their* general advocacy for NNPP led them to condition public opinion itself, creating a social circumstance favorable to nuclear development. And so, the relationship between public and public servants was not unilateral acquiescence, but was rather, a bilateral tension between public apprehension of the "nuclear", and government insistence on arms development. When combined with business interests, support for the NNPP ultimately won.

Public Perception

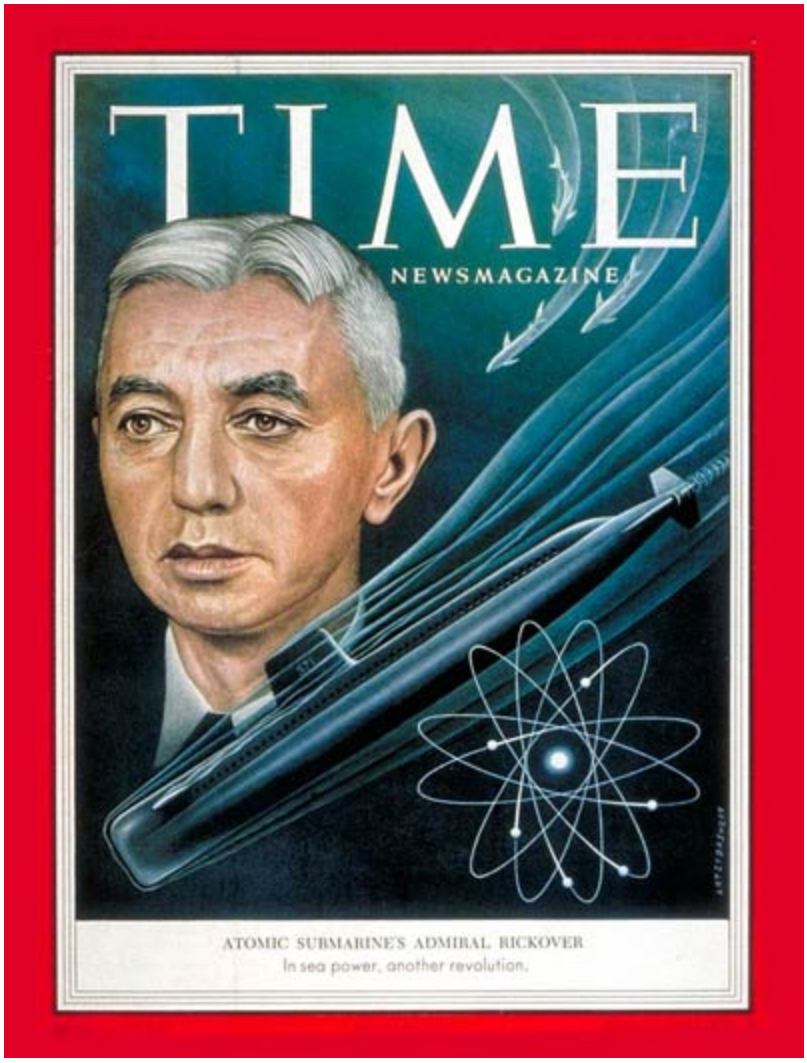
In all, the propaganda campaign launched by the military-industrial complex proved fruitful. For much of the NNPP, support for nuclear weapons remained high, being a majority opinion among Americans up through the 1960s (Baron, 2020, p. 2). By proxy, this support for nuclear weapons development also represented support for domestic nuclear energy, with the general public differentiating little between the two. What mattered most was proximity towards their own homes rather than existence of a program (Baron, 2020, pp. 4-5). Thus, support for nuclear programs such as NNPP did not drop until nuclear energy proved uneconomical due to newfound cheap natural gas (Baron, 2020, p. 2).

In this connection, one finds success for Glenn Seaborg and the Atomic Energy commission. As they linked together the naval reactor program with the domestic Shippingport

energy program, so the American public linked together military and domestic nuclear development.

Public Perception: Rickover, a Curious Legend

Throughout the propaganda campaigns released by the US Navy, a certain name pops up with stunning regularity: Hyman Rickover. A short and quick-tempered man, yet meticulous and technical, he is presented by the Navy as being an "obsessive overachiever", singularly focused on the nuclear submarine (Wilson, 2015, p. 7). Though perhaps one might discard this as simply mid-century historians quick to lionize a "Great Man" (a historiography fashionable at the time), the construction of his legend served many purposes. Particularly, he became a symbol, putting a face to the NNPP and garnering public support. The historiography of him reveals a two-fold purpose: in the early days, it deflected responsibility for NNPP from Naval leadership putting all potential risk upon one man. A brief spat between Congress and Rickover regarding his stalled promotion reveals his initial expendability for the Navy; he was simply a useful face for the program (Duncan, 1990. 14). As the program became more successful, however, Rickover's utility changed, becoming a figure that can be paraded to the American public as a plucky innovator (Wilson, 2015, p. 7). Thus, his legend became an instrument of propaganda, building a rapport between the NNPP and the American public, and ensuring the program's continuation.



The Admiral Hyman Rickover (Time, 1954 63(2))

A New Hierarchy

A primary factor in the implementation of NNPP was the dynamics of military hierarchy. As with any military organization, rank was the framework in which all sailors existed. From the lowliest midshipman, to the Navy Secretary himself, all had a clearly defined position and the accompanying relationships that entailed.

This structure was challenged with the advent of NNPP, where tension came from reconciling a pre-existing submarine force with the intricacies of operating a nuclear submarine.

Already the Navy had a core of diesel-boat officers, many having seen wartime service years prior, and many more being trained in the diesel-boat submarine force. With the advent of nuclear propulsion, however, the expertise of diesel-boat officers came into question and the relationship between Navy leadership and the seemingly "out-dated" diesel-boat officers defined the early years of NNPP.

Particularly the tragedy of the *Thresher* renewed scrutiny of Admiral Rickover's unilateral command over the submarine force's officer class. Having advocated heavily for NNPP, Rickover amassed for himself final responsibility for nuclear propulsion and final say in recruiting officers for his fleet of boats. In this, he undertook radical change. He assumed that the technological divide between nuclear and diesel propulsion was so large as to render anyone trained aboard a diesel-boat incapable of learning the intricacies of nuclear plants. Thus, competent officers from the old diesel-boat navy were rejected in favor of newer recruits. Vice Admiral Smedberg declared that this rejection of the old officers from the nuclear navy stripped proven experience from it, putting overbearing responsibility on the small core of nuclear trained officers (Duncan, 1990, p. 86). This then was a factor which led to the sinking of the *Thresher*, where technical perfection in the design of the boat gave little protection for an inexperienced crew.

This episode reveals the new dynamics in the submarine force. While prior, one would have seen the strict rigidity of military hierarchy, where rank and experience defined career advancement, in this new submarine force, this was upended. Given the luxury of a direct channel to the Navy Secretary, Rickover organized his office as he saw fit. Every man, civilian or enlisted, was hand-picked by the Admiral and thrown into a rankless environment. In the NNPP program office, Rickover enforced a despotic egalitarianism, where only competency in nuclear

propulsion gave chance for promotion (Duncan, 1990, p. 6). On its face, this seemed a good system, ensuring a meritocracy unburdened by cumbersome hierarchy. But in translating this workplace ethos to the submarine, it shorn away competency beneath the waves, leaving *Thresher* in the hands of untried officers. Thus, Smedberg argued that in attempting to form a new officer corps, Rickover inadvertently sacrificed the crew of the *Thresher*.

Still, to lay the blame of this disaster solely on Rickover ignores the larger issues plaguing the navy and shipbuilding during this era. Particularly, shipyards had operated non-competitively for decades since the Second World War. High start-up capital, and arcane techniques meant that Newport New Shipbuilding, Groton Shipyard, and other shipbuilders held a virtual monopoly (Duncan, 1990, p. 49). To this there was no incentive for proper workmanship allowing for shoddy work and unsafe submarines. Further, while Rickover's draconian exclusion of diesel-boat officers from his nuclear force brought tragedy, it was not without cause. In examining the mental aptitude of submariners, the Navy concluded a clear correlation between the transition from diesel-boats to nuclear submarines and a spike in psychiatric incidents. From 56 incidents per 126,160 manpatrols, to 20 per 1000, a spike of over 400% in incidents-per-manpatrol occurred just 10 years after the *Nautilus's* launching (Weybrew, 1979, p. 188). Further psychiatric studies showed a requirement for more stringent mental aptitude for officers compared to subordinates (Weybrew, 1979, p. 191). Thus, a correlation existed between the transition from diesel-boats to nuclear submarines and the introduction of new stressors and mental challenges. While not absolving Rickover, it supports his assertion that the mental fortitude, and skill-set needed on a nuclear sub exceeded that of a diesel-boat. With this in mind, the Navy, still reliant on Rickover allowed him to retain his tight-fisted oversight of NNPP, and his system of personal officer selection remained.

A Failed System

The *Thresher* laid bare the shortcomings of naval construction. During the deposition of the shipyards, much was said of the personal power of Rickover and the laxity of the shipbuilders. But much should also be said of the technological limitations of the time. Did *Thresher* fail because it was impossible for the time?

To this, I say yes. Only the micro-managerial style of Rickover gave the motive force to push through this technology (Oliver, 2014). Thus, the *Thresher* revealed a systemic problem. While Rickover deflected blame by lamenting shipyard malpractice, *Thresher* was already doomed from its conception (Duncan, 1990, p. 85). Throughout the creations of the *Nautilus*, *Tullibee*, and *Skipjack*, Rickover's personal attention went into each boat, sieving out any mistakes before completion. As the NNPP proved successful, and the Navy demanded ever greater numbers of boats, the ability of the Admiral to tend to his creations diminished. By the time *Thresher* came into production, Rickover was juggling the maintenance of an existing 26 nuclear submarines, with 30 more under construction, alongside newer reactor plants (Duncan, 1990, p. 71). Clearly he could only show minimal attention to the *Thresher*. Thus, a system built upon the attentions of one man in that moment, failed.

In the end, however, the implementation of SUBSAFE drew to a close the technical issues plaguing the *Thresher*. Improved safety standards, and allowance for improvised emergency protocols prevented further catastrophes (Wortman, 2022, p. 190). Through the tragedy of *Thresher* emerged a system capable of shouldering the burden of the submarine force, supplanting Rickover's micro-management, bringing about systemic change.

Analysis Conclusion

Thus, altogether, these changes syncretized, creating a seemingly impossible technology: submarine-based nuclear propulsion. We can interpret these social changes through STS frameworks. First, SCOT necessitates that technologies exist in a sympathetic cultural milieu. Thus, the propaganda campaigns — in all their fear-mongering and valorizing— presented not just the idea of a Soviet existential threat, but also primed the populace to think that nuclear submarines were *the* solution.

Then, ANT examined the actors who contributed to creating this sympathetic cultural milieu. By examining the trinity of governmental figures, defense contractors, and civilian energy, one finds 3 actors with vested interests in affecting the fourth actor: the American public. Only uniting the military-industrial complex *alongside civilian energy* did a concerted propaganda campaign occur. This coupled with the introduction of Lockheed's *Polaris* missiles, an actor in its own right, culminated in the push for nuclear-armed submarines, bringing about the *George Washington* class.

ANT then further explains why Rickover's new hierarchy caused such tragedy. Here, a singular actor — sailors — further divides into two sub-actors: the new nuclear-trained officer, and the diesel-boat officer. Rickover, as a particular actor, has outsized influence beyond a typical governmental figure. In this case, Rickover's enforced shift from nuclear-trained officers to diesel-boat officers assumed that the former bore the attributes of the latter, being but a diesel-boat officer who knew nuclear physics in addition to submarine operation. But this belied the diesel-boat officer's experience, thus conflicting with the technological actor: the *Thresher* itself. In this untested boat, the experience of the diesel-boat officer becomes paramount, and the *lack* of experience in the new officer class proved fatal.

Finally, as *Thresher*'s technical difficulties interacted with the officers who commanded her, so did the enormity of *Thresher's* development test Rickover's personal command. The complexity of the project acted upon the system, breaking it. This then presents an opportunity for SCOT to comment: as the system itself was predicated on the attention of a single actor, only the inclusion of the attentions of an expanded set of actors (through SUBSAFE which made shipbuilders more liable) ensured systemic safety.

Thus, ANT and SCOT give frameworks with which to interpret these events, with the social forces revealed wherein allowing for NNPP.

Conclusion

It was the atomic specter that loomed when shipboard nuclear propulsion was first presented as being possible. Doubtless this drove government leaders to pursue its implementation aboard submarines particularly. While this specter galvanized many to spurn nuclear arms, America had settled on its destructive potential. Deterrence policy ascended and the nuclear submarine was the greatest deterrent of all. But attributing existential dread as the sole reason making a seemingly impossible technology possible denies the greater forces at work.

While fear of the apocalyptic generated support, it could not have crystallized into a coherent and ultimately, successful nuclear propulsion program without the right social forces. From the tenuous interplay of naval officers and legislators, to calculated propaganda, to the reevaluation of military hierarchy, the NNPP amalgamated the social forces enveloping any technological program. In this, the NNPP deftly navigated the treacherous waters of public

opinion *and* government, and only through both did it prove successful. And so, it is this success which serves as a lesson to any other technology struggling to invent itself.

In this modern age, though nuclear threats linger, the multipolar geo-political order has proven sufficient to fend away the nuclear option. Thus, this threat wanes in the face of newer crises. Today, the Climate Crisis, rather than nuclear annihilation serves as our generation's threat. To combat it, we turn not to weapons and war, but to energy and the environment. And like the days of the NNPP, change will be wrought in part through new technologies. Though to change from fossil fuels to nuclear and renewables may seem impossible, I cannot help recall that the *Nautilus* too was once deemed impossible. But through the myriad social forces at play, it proved *possible.* And so, perhaps then, in our time climate change may itself fall to greener technologies.

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