The Role of Aegis in the USS Vincennes Tragedy: A Systemic Failure in Human-Technology Interaction

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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:

In 1988 in the midst of the Iran-Iraq War in the Persian Gulf, the United States fell responsible for the tragedy that led to almost 300 innocent lives lost. The USS Vincennes shot down what it thought to be a hostile F-14 which turned out to be an Iranian airliner traveling to Dubai. The decision to shoot down the aircraft was a mistake influenced by discrepancies between the crew and the AEGIS combat system, a fairly new technology which aided the US Navy in tracking potential threats (Encyclopedia Britannica, n.d.). The current understanding of this case is that the tragedy is mostly linked to human error and an unclear user interface (Vincze, 2020; Tingle, 2018). However, current scholars fail to address how it is the relationship between the humans and technology that failed the mission that day. The US military is one very large and complex team that requires proper integration of any new asset, whether its newly recruited personnel, weapons, or technology. Writers and military leaders must consider how the integration of technology into military operations fundamentally reshapes decision-making and alters trust dynamics, particularly in high stress combat environments. The current situation is flawed because it tends to view incidents such as the USS Vincennes as a failure of a single individual or technical malfunction, rather than recognizing the breakdown of a larger system of interconnected human, technological, and environmental factors. This narrow focus tends to overlook the complexities of modern military operations where issues often emerge from systematic weaknesses and not a singular point of failure. If we continue to see automated systems such as AEGIS as simply a tool and not an active decision maker in the military network, we fail to acknowledge the significant influence these systems have on human judgment and overall mission outcomes. The USS Vincennes incident reveals that failures in

modern military decision making cannot be solely attributed to human error or technological malfunction. It instead reflects a breakdown in the relationship between human operators and automated systems, driven by an imbalance of trust and flawed integration into the network. My analysis draws on Actor Network Theory (ANT), which argues that anything can be an actor of a network if it has any type of influence over the system (Cresswell, 2010). To support my conclusion, I draw heavily on the proceedings of the case and articles considering automation in a decision making environment.

Background:

The AEGIS is a system that was originally developed to defend US Navy ships against missile threats and aircraft during the Cold War. It was designed to track, identify, and engage multiple airborne threats simultaneously. Often described as the "shield" of the fleet, the system's name references the shield of Zeus in Greek mythology (Lockeed Martin, n.d.). The first AEGIS ship, the USS Ticonderoga was deployed in 1983 after two decades of research and development (O'Rourke, 2024). AEGIS represents a significant technological leap for the U.S. as ships are able to detect, track, and respond to threats faster than ever before (Lockeed Martin, n.d.).

In 1988, the Iran-Iraq War created an extremely dangerous environment in the Persian gulf as they attacked each others' oil tankers in the Persian Gulf. This became known as the Tanker War, which threatened global oil supplies and international shipping routes globally. The US launched Operation Earnest Will, a mission aiming to protect oil transport throughout the gulf. On July 3, the USS Vincennes was involved in several gunfights with Iranian vessels. At the same time, an Iranian airliner took off from Bandar-e Abbas in Iran and was headed towards Dubai. The USS Vincennes misidentified the aircraft for an F-14 fighter jet. After several

warning calls that went unanswered, the USS Vincennes fired two missiles that destroyed the aircraft and killed the 290 people onboard (Encyclopedia Britannica, n.d.).

Immediately following the event, initial reports described that the aircraft was heading straight towards the USS Vincennes and was not following a typical civilian aircraft flight path. However, three weeks later, investigations revealed that the airliner was following the proper flight path, was flying at a much slower rate than reported, and it was in fact ascending and not descending towards the USS Vincennes (Encyclopedia Britannica, n.d.). The AEGIS system played an integral part in the crew's decision making process, and the system's capabilities and role are questioned in this tragic accident.

Literature Review:

While several scholars have examined how autonomous systems like AEGIS can lead to tragic mistakes when humans overly rely on them, scholars have not yet adequately considered how the lack of trust between the crew and AEGIS system contributed to the outcome of the USS Vincennes incident. The first academic peer reviewed source, "The USS Vincennes Incident: A Case Study Involving Autonomous Weapon Systems," by Viola Vincze, argues that advanced automation can lead to catastrophic outcomes due to overreliance on technology. Vincze highlights that keeping humans in the decision loop works only if the crew is thoroughly trained and comfortable with using the technology in high pressure situations. Vincze emphasizes that the factor that contributed the most to the incident was human error, and that giving more freedom to the autonomous weapon could have potentially saved the lives of those on the airliner (Vincze, 2020).

The second academic peer reviewed source by Anthony Tingle argues that human misjudgement and inadequate understanding of AEGIS was central to the incident and that the

human actor was the primary actor that failed. He cites how AEGIS performed as designed, but the crew misinterpreted its data due to stress. Tingle quotes Vincennes's antiair-warfare officer, who unknowingly reported inaccurate information about Flight 655 to the captain, "data to me doesn't mean anything because I reacted to people that I thought that . . . I knew that I had operated with that were reliable . . . and when they reported at short range they had a decreasing altitude, increasing speed, I had no reason to doubt them." This quote emphasizes the necessary trust between the crew, but also highlights how the root of the problem was between the AEGIS system and the crew member who was responsible for interpreting AEGIS. Tingle argues that this misinterpretation is the central cause of the incident. This argument is incomplete as it fails to acknowledge that while there was a misinterpretation of the technology, the root of the issue is the fact that there is a lack of trust between the technology and the person actor. Examples of unclear communication between the system and the user was how the crew misinterpreted the aircraft to be descending even though the system indicated that it was ascending. A target that is supposedly moving towards the crew versus away from the crew will be treated in a much more hostile way. Just as the crew trusts each other, the crew needs to trust and understand the technological actor in order to perform effectively (Tingle, 2018).

These arguments relate to each other because they point out the human error that caused the crew to misinterpret the airliner for an enemy jet. While these arguments point out some of the human and technological actors that led to the tragedy, there is still a need to consider how unmanned systems must make up for their lack of capacity for interpersonal trust by being extremely clear when communicating with the human actor. While previous research on the incident focuses heavily on human error, my argument tackles how technology interacts with

human actors and the importance of clarity in human-machine interactions, especially in military scenarios.

Conceptual Framework:

My analysis of the Vincennes case draws on the Actor Network Theory framework, which allows me to examine how the actors failed to work together in order to properly conduct military operations in the Persian Gulf. Actor Network theory is a framework primarily developed by sociologists such as Michel Callon in the 1980s. It argues that anything can be an actor of a network if it has any type of influence over the system (Cresswell, 2010). This framework explains how engineers build and maintain actor-networks. While the engineer is the network builder, the network itself is composed of various actors including human and non-human actors. Non-human actors involve social, technical, natural, conceptual, and environmental actors. Translation is the process of how actors communicate and shape each other's behavior within a system. According to Callon, there are four stages of Translation: problematization, interessement, enrollment, and mobilization. Problematization involves the network builders identifying the problem and then actors needed to solve it. Interessement is how external actors are brought in and influenced to adopt roles that align with how the problem was framed. Enrollment is how actors accept and perform those roles. Finally, mobilization is when the focal actor successfully aligns themselves with other actors, leading them to work together in support of a shared objective (Callon, 1984). Overall, translation refers to the process of forming and maintaining relationships among diverse actors within a network. Drawing on Actor Network Theory, in the analysis that follows I begin by evaluating the importance of clear communication between the AEGIS system and the crew to avoid costly mistakes. Then, I

discuss how trust between these actors must be managed effectively to balance over reliance and skepticism.

Analysis I: Miscommunication in Human-Technology Interaction

The USS Vincennes incident resulted from a breakdown in the relationship between operators and the AEGIS Combat system, driven by misinterpretation of accurate data. This highlights the need to critically analyze actor-network in military operations, ensuring that both technological systems communicate clearly and that human operators maintain a balanced, calibrated trust in these systems. The USS Vincennes faced an especially demanding situation, actively engaging in a gunfight when the tragedy occured (Lynch, 2020). Iranian threats of an attack on "the Great Satan" during the 4th of July weekend heightened the crew's alertness, and the ship was concurrently engaged with two Iranian gunboats. A critical factor that led the captain to decide to engage with the airliner was the fact that he was informed that the aircraft was descending towards Vincennes – a potential sign of attack. While AEGIS correctly identified that it was ascending after takeoff, the tactical information coordinator (TIC) misinterpreted the data and called out that the aircraft's altitude was decreasing at 1,000 feet per mile. This discrepancy highlights a critical breakdown in the system's network. Although the AEGIS provided accurate data, the human interpretation distorted its meaning. Worried that the aircraft would launch a missile at them, the captain only had so much time. Concerned about the potential for a missile strike, the captain made a rapid decision based on this faulty interpretation (Friedman, 1989). The misinterpretation shows how easily a single misread data point can trigger a chain of irreversible damage in high-stake military operations.

The crew's perception of threat was intensified by Iranian rhetoric referring to the U.S. as "the Great Satan" during the 4th of July weekend. The high-stress environment, fueled by

escalating Iranian threats and ongoing engagement with Iranian gunboats, left little time for thoughtful decision making and contributed to cognitive overload within the crew. The ambiguous interpretation of the AEGIS system's outputs became a significant factor in the fateful decision. This mistake emphasizes the importance of clarity when it comes to having technological actors involved in the decision making process, especially in warfare. There is a large amount of data processing and guidance that comes from these machines, and it is imperative that they are able to communicate their findings accurately. Engineers, as network creators, must understand the environment their technology is going to be used in. While it is created in a lower stress environment, it is used in the highest of stakes environments. While the AEGIS system may appear intuitive in development and training settings, its usability must be reevaluated for high-pressure, real world scenarios where time and clarity are critical. In warfighting networks, the clarity of machine communication must be matched by an operational environment that supports careful human reasoning.

However, the burden of responsibility does not rely solely on the technology or its creators. In military operations, training and composure under pressure are essential expectations. Once a network is built, strengthening the relationships between human and non-human actors becomes imperative. The USS Vincennes operated in a loud and chaotic environment, where communication was discouraged and high stress led to operational errors . Reports describe the Commanding Officer yelling at the crew, further undermining effective collaboration and heightening the sense of urgency and confusion. Another key piece of information that led to the accident is the operator who manually entered a military IFF code for the civilian airliner. IFF stands for Identification Friend of Foe (Walker, 2018). This action identified the passenger flight into a perceived threat, a severe misclassification. This illustrates

how the human-machine relationship in the network was not only fragile but actively contributed to the fatal error.

This incident demonstrates how the network failed the overall mission. The network, encompassing the military training system, the crew, and the AEGIS Combat System, broke down under stress, leading to poor communication and costly mistakes. The chaotic environment, such as the Commanding Officer raising his temper, weakened the relationships limiting effective collaboration. A comparison with the USS Bunker Hill during Desert Storm highlights the critical role of the environment in actor-network functionality. Despite operating under similar high-stakes conditions and identical AEGIS training, the Bunker Hill remained a calm, collaborative atmosphere. Crew members were encouraged to cross-check decisions and engage in open communication, leading to zero incidents despite processing nearly 1000 aircraft movements per day (Walker, 2018). The contrast underscores how leadership and environment, rather than technological limitations or inadequate training, were pivotal in determining network success.

The USS Vincennes tragedy demonstrates that technological accuracy alone cannot prevent failures in complex military networks. Effective decision-making in high-stakes environments requires not only clear communication from technological systems but also a balanced level of trust from human operators. As the comparison with the USS Bunker Hill reveals, leadership, crew dynamics, and environmental factors are essential for ensuring operational success. Future advancements in military technology must account for these human and environmental variables to foster resilient and reliable actor-networks in warfare.

Argument II: Dangers of Overreliance in Military Decision-Making

The USS Vincennes incident highlights how an imbalance of trust– whether through an over reliance or under-reliance on technology can lead to catastrophic outcomes. While the AEGIS system functioned correctly, the human operators' misinterpretation of accurate data underscores the importance of fostering a critical yet balanced relationship with technology in military decision making. Overreliance on technology can lead to complacency. Despite the AEGIS system functioning correctly, the crew placed too much trust in their interpretation of the system's outputs. Automation bias is the phenomenon of the human tendency to over-trust automated systems, even when evidence suggests otherwise (Hoffman, 2024). It is a phenomenon that spans multiple fields and is especially studied in medicine, aviation, and finance. An example of a study done in the aviation industry investigates professional pilots in cockpit simulators. It found that more than half of them disregarded information when automated systems failed to alert them or made dangerous mistakes when these systems gave them incorrect information (Hoffman, 2024). Automation bias becomes increasingly more problematic the more responsibility we give to autonomous systems. In the USS Vincennes case, the crew failed to question their interpretation of the data from the AEGIS system despite indications that the situation warranted further verification (U.S Department of Defense, 1988). These indications include how the target was following a civilian aircraft pattern and their lack of visual confirmation. This shows significance because the crew failed to question the interpretation of AEGIS when most other signs indicated that the aircraft was not a hostile threat. Human perception of automated outputs, not the system's accuracy, drove the decision to engage. The failure was not technical, but sociotechnical. It emerged from how humans use and understood technology under stress.

The consequences of automation bias in military contexts extend beyond mere misinterpretation—they reflect a fundamental issue in how automated systems are integrated into decision-making structures. When operators are conditioned to trust automation implicitly, critical thinking and situational awareness can diminish, especially under high-pressure circumstances. This was evident on the USS Vincennes, where the crew's deference to perceived technological authority contributed to a catastrophic failure in judgment. In high-stakes military environments, this imbalance of trust can have deadly consequences. While automated systems like AEGIS are designed to enhance decision-making, they must be accompanied by training programs that emphasize the importance of human oversight and critical engagement. Operators should be trained not just to use these systems but to question and verify their outputs when necessary, fostering a balanced relationship between human intuition and technological guidance. Without this balance, even the most advanced systems can become liabilities rather than assets.

The USS Vincennes incident highlights how overreliance on technology, fueled by automation bias, can lead to catastrophic failures in military decision-making. However, it is important to recognize that this overreliance is a relatively recent challenge. Historically, warfare relied heavily on human intuition, direct observation, and deliberate decision-making (Krulak, 1999). Commanders depended on visual confirmation and experience, rather than automated outputs, to assess threats and determine appropriate actions. It was only with the rise of advanced automated systems like AEGIS that the dynamics of warfare fundamentally shifted. The introduction of automation not only increased the speed and efficiency of military operations but also introduced new risks, particularly the potential for cognitive complacency and misplaced trust in technology. Understanding how automation transformed the nature of military

decision-making is essential to grasping the full implications of incidents like the USS Vincennes tragedy.

Throughout a majority of history, military leaders relied on visual confirmation to make decisions. Ranging from medieval warfare till less than a century ago, decisions were made solely based on human interpretation and intuition. Commanders assessed battlefield conditions through direct observation, personal experience, and reports from scouts or subordinates. In ancient battles, leaders like Alexander the Great or Julius Caesar made tactical choices by visually evaluating enemy formations and troop movements. Similarly, during naval conflicts of the 18th and 19th centuries, admirals depended on lookout reports and visual signals to make critical strategic decisions in real time (Wasson, 2014).

In historical military operations, decision-making relied on human-to-human relationships built through trust, communication, and shared experience. These connections developed naturally over time, allowing leaders to make critical decisions based on intuition, collaboration, and mutual understanding. In the case of the USS Vincennes, the introduction of the AEGIS Combat System fundamentally altered the ship's actor-network by integrating a non-human decision-making element into this historically human-driven process. The tragedy illustrates a critical imbalance: had AEGIS not been part of the ship's network, the crew might have made different decisions, potentially avoiding the tragic outcome. Conversely, if AEGIS had acted entirely autonomously, without human intervention, the system's accurate data could have prevented the misinterpretation that led to the shootdown. This paradox highlights the need for a more nuanced integration of automated systems into human networks. Instead of viewing technology as a separate tool, automated systems should be treated as active participants within the network—just like human crew members. For technology to effectively complement human

judgment, it must be integrated in a way that encourages interaction, verification, and critical engagement—similar to how the crew collaborates with one another.

Conclusion:

The tragic incident involving the USS Vincennes demonstrates how failures in modern military decision making cannot be solely attributed to any one person or technology but must be understood as a breakdown in the relationship between human operators and automated systems. It is essential to recognize that automated systems are not just tools, they are integral actors within military decision networks. The USS Vincennes, as a system, could only become successful once it fostered a balanced, calibrated trust between humans and technology ensuring that automation enhances human judgement instead of undermining it.

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