ADVANTAGES FOR THE U.S ARMY TO COLLABORATE WITH STATES TO DEVELOP MOLTEN SALT REACTOR TECHNOLOGY

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Military Realities

Today, the military faces several post-Cold War realities. First, the type of threat has changed. Second, regional conflicts are more probable than all-out war. Third, the United States will participate in joint and coalition operations that could take our forces anywhere in the world for undetermined periods of time. Finally, the U.S. military must operate on as lean a budget as is safe. So, as we consider future military energy sources, we foresee a more mobile military that must deploy rapidly and sustain itself indefinitely and economically anywhere in the world as part of a coalition force. We can gain great economies of scale through the development of advanced technology, and we can do more while costing the U.S. taxpayer less.

Synthetic Fuel

One way to minimize logistic challenges is for the military to produce fuel and potable water closer to the battle theater. Small nuclear power plants could be used to power a liquid transportation fuel synthesis process to manufacture synthetic fuels (gasoline, JP-5, diesel fuel, etc.) from such available elements as organic waste. The Naval Research Lab has been developing a system to produce synthetic fuels using carbon dioxide extracted from seawater. This work is headed up by Dr. Heather Willauer. Recently, Dr. Willauer demonstrated the feasibility of such a process at Technology Readiness Level TRL-7. https://www.youtube.com/watch?v=TOCepaqnCOc.

In November 1963, an Army study submitted to the Department of Defense (DOD) proposed employing a military compact reactor (MCR) as the power source for a nuclear-powered energy depot, which was being considered as a means of producing synthetic fuels in a combat zone for use in military vehicles. The energy depot was an attempt to solve the logistics problem of supplying fuel to military vehicles on the battlefield. While nuclear power could not supply energy directly to individual vehicles, the MCR could provide power to manufacture, under field conditions, a synthetic fuel as a substitute for conventional petroleum based fuels. The nuclear power plant would be combined with a fuel production system to turn readily available elements such as organic wastes into fuel, which then could be used as a substitute for gasoline or diesel fuel in vehicles. Currently, the latest generation of the Army's fuel production system is undergoing testing at Ft. Hunter Liggett in Monterey County, California.

Powering the Fuel Plant

Ideally, any power source (MCR) for a near battle-theater fuel synthesis plant would be small, lightweight, and readily accompany the army into the theater of operations. While the NRL is already developing the fuel synthesis plant, the power source for the plant itself should be considered. The Molten Salt Reactor (MSR) is a potential solution that offers a myriad of benefits for fuel synthesis in the theater of operations.

MSRs were developed and successfully ran for four years at the Oak Ridge National Lab (ORNL) in the late 1960s https://en.wikipedia.org/wiki/Molten-Salt_Reactor_Experiment. MSRs are an excellent technology to power a mobile fuel synthesis plant. MSRs are capable of generating the high temperature process heat needed, as well as being capable of powering a turbine for an electric power generation in a very small, ruggedized package. Moreover, due to the atmospheric pressure at which the core of a MSR operates, MSRs are a much safer, much less complex, and a more lightweight alternative to conventional light water reactors or the small liquid metal cooled reactor consider in the 1963 study. The benefits of the MSR reactor go well beyond this discussion, but the MSR does fit this application with near perfection.

MSRs were a little known, but very promising technology developed back in the 1960s for envisioned nuclear powered aircraft that never became a reality. Unlike many nuclear technologies, the MSR is a demonstrated technology. The MSRE (Molten Salt Reactor Experiment) ran for four years at Oak Ridge National Labs (ORNL) from 1965 through 1969 and demonstrated nearly all of the key aspects of this technology. Unfortunately R&D on MSRs ceased in the 1970's for political and economic reasons and the program was never restarted. As recently as 1996, MSRE documentation has been made available publicly by the USDOE and interest in MSRs have seen a significant resurgence in the private-sector. Several startups have been created in the United States as well as abroad, hoping to capitalize on the technology. Unfortunately, China has announced its intent to rapidly accelerate the commercialization of its own MSR program, which may squash the hopes of further developing this American technology in the United States. Troubling are China's own scientists publicly expounding on their eagerness that the MSRs capabilities be used for military applications.

Even more disheartening from an "American First" perspective, development in the United States has proven difficult due largely to the fact that no economic licensing pathway exists in the near future for anything other than Light Water Reactor (LWR) technology under the oversight of the USNRC. This is an enormous flaw in our regulatory structure that prevents States from rapidly developing new technologies in a manner consistent with nations with which the USNRC and USDOE has development and partner agreements with, such as China. (China has partnered with the USDOE to develop MSR technology in an agreement that puts "China First". https://www.technologyreview.com/s/542526/china-details-next-gen-nuclear-reactor-program/)

Why Partner with a State instead of China to Develop MSR Technology?

Branches of our military, such as the U.S. Army, could easily partner with States that have nuclear research and development programs to produce mutually beneficial technology, such as MSRs. Creating an oversight and regulation program for collaborative nuclear research and development ventures with States would allow branches of our military, such as the Navy, to pursue the benefits of MSR technology without the tremendous initial research costs. Why not let States leverage the private sector to bear those costs if they are willing?

Currently, Ohio State Representative Dick Stein is promoting legislation that creates a for-profit consortium and an Ohio State regulatory body that will allow the construction of research-sized MSRs for medical isotope production. (As a by-product of energy production, MSRs produce a critical radioisotope, Molybdenum-99, which currently has

no fully domestic source.) Medical isotope production from a MSR research reactor would be a lucrative endeavor. Normally, a commercial endeavor such as this is not allowable in the research and development stages of new reactor design types under USNRC rules. The U.S. Army could become a consortia partner by signing a collaborative agreement that allows the State of Ohio to develop nuclear technology under the authority of the U.S. Army and under their oversight and under their regulations. This would be preferable to anti-capitalism research and development killing regulations of the USNRC. Technology developed by this consortium could then be commercialized and militarized by the U.S. Army, saving taxpayers billions of dollars.

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