Mr. William Voorhees

I am here to talk about the role of technology in enhancing energy security both over the near term and into the future. Thanks to the emphasis provided by Navy leadership, it has been much easier to get some traction on energy-related efforts in the science and technology arena.

As several speakers have noted, the Secretary of the Navy has set three energy-related goals for the Department. My presentation will describe the potential role of technology in supporting each of those three goals.

Mr. William Voorhees graduated from Lehigh University with a B.S. in mechanical engineering in 1985. He is currently the head of the Naval Air Systems Command (NAVAIR) Propulsion and Power Technology Office and is responsible for the planning, execution, development, demonstration, and transition of propulsion- and power-related technologies for all Navy and Marine Corps air vehicles, both present and future. He is also the Deputy Program Manager for the Variable Cycle Advanced Technology propulsion system demonstration effort. Mr. Voorhees's other duties include an active role on the NAVAIR Science and Technology Leadership Team, which guides the Naval Aviation Enterprise Science and Technology Strategic Planning efforts. Prior to his current position, he was the Air Vehicles Technology Team Lead and the Execution Co-Lead/Propulsion Team Lead for the RATTLRS flight demonstration program. With more than 25 years of experience in propulsion and power science and technology, he has also held the positions of Deputy Program Manager for the international X-31 VECTOR Flight Demonstration Program, Navy Lead for Fighter/Attack Demonstrator Engines, and Navy Lead for Propulsion Environmental Team and has participated in numerous other propulsion-related technical management and execution projects. He is a graduate of the Navy Senior Executive Management Development Program and has received the Meritorious Civilian Service Award.

We saw the F/A-18 Green Hornet; Rick just finished talking about that. While we want the alternate fuels to be drop-in, we also have to ensure that they provide the same performance and have the same safety and reliability that we get with our current fuels. As we go to even more exotic fuel formulations, we want to make sure that we have the technology in place to burn those fuels safely and reliably, as well as the ability to stretch the spec envelope to start making sure we can use fuels that are on the edge of what we would currently consider within spec today.

We are also using advanced materials in our latest aircraft designs, and we will continue to look at their use for future systems (Figure 1). Included in these are lightweight composites, which are key to getting weight out of the aircraft and achieving desired mission fuel burn reductions. In addition to the advanced materials, we are exploring things like low-drag coatings, which are paints you can put on an aircraft that reduce the drag, allowing you to be more efficient in cruise regimes of flight.

Figure 1. Use of Advanced Materials

Our emerging aircraft systems are also benefiting from advances in propulsion that were started prior to the establishment of Task Force Energy (Figure 2). In the past, however, most of these efficiency benefits were really secondary to the primary goal of the Advanced Development Program, which was usually the development of some new type of operational capability. In some cases, by developing that advanced capability, we have also been able to increase efficiency, and we are seeing the benefits of that today. As the Vice Chief of Naval Operations indicated this morning, as

efficiency becomes more important, we may see Key Performance Parameters (KPPs) or Key System Attributes (KSAs) emerge for future weapons procurements, which will put additional emphasis on things like specific fuel-reduction efforts.

Figure 2. The GE-38 Engine Will Provide Fuel Economy

We will hear more from our next speaker about how optimized simulator usage can reduce flying hours required to train our pilots. Technology can also contribute there by providing advanced modeling techniques, which make the simulation more realistic and more useful to the pilots.

Enhanced mission planning capabilities offer yet another way to improve both capability and efficiency. We want to help our future mission planners by asking: how do you fly the aircraft throughout the whole mission? How do you optimize the way you fly or operate the aircraft? Fairly simple changes can yield major reductions in fuel burn. We are also looking at how to model the aircraft as a system—not just the engine, but the whole electrical, thermal, and propulsion systems. How do you optimize aircraft operation over the entire flight regime and then take advantage of that in your missions?

We are also trying to identify the leap-ahead technologies that will be coming down the pipe for next-generation naval aircraft.

One of these is called variable-cycle engine technology. Basically, it allows you to adjust the bypass ratio of your jet engine appropriately to consume very little fuel while you are in cruise or to enable high specific thrust when you need it for combat maneuverability or takeoff. We are looking at the potential for reducing mission fuel burn by as much as 20% by utilizing variable-cycle technology (Figure 3). If you start looking at the fully integrated system—engine, propulsion, and thermal management—you can probably get another 10% efficiency on top of that. So we see this as a key enabler for the next generation of aircraft systems.

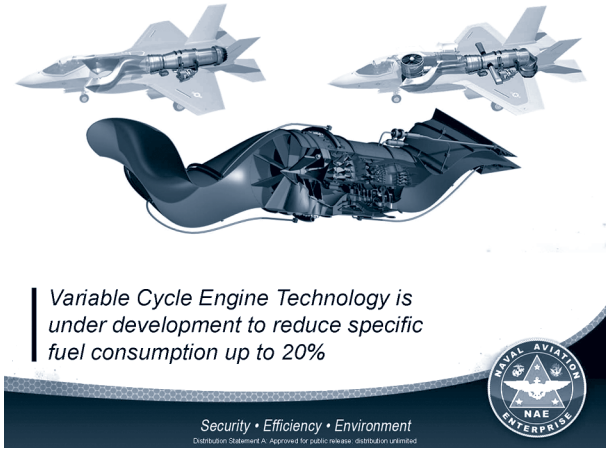

Figure 3. Variable-Cycle Engine Technology Could Reduce Specific Fuel Consumption up to 20%

Finally, we are building a roadmap that lays out the set of technologies that will both enable future capability for the Navy and reduce fuel burn. Some of these are described in the Naval Aviation Enterprise's Science and Technology Objectives. [1] With the increased interest from high-level leadership, we are getting traction on many of these ideas, so if we stick with it, I think there is a lot of opportunity for improvement.

REFERENCE

1. Naval Aviation Enterprise, *Science and Technology Objectives*, 2010, **http://www.public.navy.mil/airfor/nae/Documents/2010%20STO.pdf**.