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Fuel from Thoughts

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University of Dayton Research Institute and Air Force researchers at Wright-Patterson Air Force Base have ramped up production of a new research fuel formula, as well as a fuel derived from seed oils, and now have enough fuel to move from lab testing to testing in engines and auxiliary power systems.

The journal *Industrial and Engineering Chemistry Research* published an article about the work on the fuel formula led by Heinz Robota, Ohio Research Scholar in alternative fuels and the Research Institute's alternative fuels synthesis group leader.

"My goals are to supply the Air Force with ready-to-test fuel compositions developed in our lab that are unlike commercial fuels; understand the chemistry and chemical engineering issues related to production of these fuels; and be able to provide further assistance as the Air Force tests the samples," Robota said.

This is a very early step in the process. It's not the group's goal to invent commercial fuels or ways of making them, according to Robota. His group's job is to develop fuel samples with certain properties the Air Force can use to broaden its understanding of the composition of alternative fuels and how different compositions influence their practical in-use properties.

In addition to making research fuels, Robota's group is working with the Air Force to further advance alternative fuels by working with commercial partners to make testable quantities of fuel using the Air Force Research Laboratory's Assured Aerospace Fuels Research Facility Sample Preparation Unit.

Robota's group is currently in the middle of such an undertaking with a commercial partner, converting 1,750 gallons of a renewable crude to roughly 500 gallons of what is expected to be a true renewable fuel. When completed, the fuel will be delivered to a major engine manufacturer for testing on a full-scale engine stand.

While the development of the research fuel has given Robota's group a confidence boost, he cautions they have to find fuels that do more than burn. After initial rounds of engine testing, further tests will examine burn rate, emissions, how the fuel interacts with engine parts and how the fuel performs at high altitudes.

"Fuels are highly engineered components," Robota said. "But it is important to have perspective on how petroleum-based fuels evolved. We have 60 years of research in that area. Biofuels is a fairly young industry, and we need time for research and development. There is no substitute for experience and history."

In addition to University of Dayton Research Institute staff, students are also part of the experience. Robota's group, which performs nearly \$4 million of research annually, includes one graduate student and four undergraduate students.

"It is a vehicle for training students in the awareness of science and its practical use — how what they do in the lab affects the end user," Robota said.

Throughout the Research Institute, scientists are conducting fuels research that will deliver benefits to the end user.

While Robota's group is working on a totally alternative fuel, others at the Research Institute have helped develop a 50/50 blend of conventional and synthetic jet fuel for use in military and commercial aircraft through the Commercial Aviation Alternative Fuels Initiative. It is the first aviation biofuel approved by the American Society for Testing and Materials.

Another Research Institute group is looking into using algae and coal as alternative fuel sources.

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