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DoD SBIR / STTR
DETAILS - Topics Search Results

Proposals Accepted: May 26, 2011 - June 29, 2011
Program: SBIR
Topic Number: N112-096 (Navy)
Title: On Demand Oil Supply
Research & Technical Areas: Air Platform

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Questions may also be submitted through this website (see below).

Acquisition Program: F-35, Joint Strike Fighter

Objective: Develop and validate a reliable and automatic on demand oil supply system.

Description: State-of-the-art oil pumps in aero-engines such as the JSF's F-135, deliver a volumetric flow rate proportional to the rotor speed of the high-pressure engine core, which drives the pump via shafts and gear systems In aircraft & engines such as the F-35 & F-135 where the fuel and oil systems are used to cool a variety of engine and airframe systems, the undesirable oil heating accumulates and reduces the fuel's heat-sink reserve at critical flight conditions. Maximum flow rates are set to meet requirements at maximum engine power settings. At power (speeds) less than maximum, the oil flow exceeds system requirements and as a result, parasitic losses generate additional heat due to the fact that the system circulates more oil than necessary. For some engine architectures, cruise and idle operation are critical and Thermal Management System (TMS) sizing conditions at which a reduction of these parasitic losses is crucially important in developing a light weight engine system. Pumps that are capable of varying oil flow rate independent of shaft speed may then be able to deliver oil according to the true requirements. System should be designed and constructed for at least minimum engine service life which is 4000 +/-10 Engine Flight Hours (EFH), and minimum of 2 times the inspection Interval. The goal is to design a system that does not exceed the current pump weight of 27 pound with oil. A new system developed for a more optimized control depending on engine needs or variables could be in the form of direct-drive - variable displacement systems, variable speed – constant displacement systems, or combinations of these approaches. Additional considerations are the need for an automated feedback control system to adjust the oil pump output conditions over the entire operational envelop and total mission duration to insure proper lubrication system operating performance and system level reliability. Weight and durability will be critical factors in the design of an automatic on demand oil supply system with a not to exceed oil flow rate of 30 gl per minute. To achieve optimum integration potential it is advised that the SBIR contractor contact and work closely with an engine manufacturer. The Navy is not solely seeking an electrical solution. However, if one is proposed, the electrical power requirements should be defined using an electrical power source that meets the requirements of MIL-STD-704. An innovative solution is desired and all options will be considered.

PHASE I: Determine feasibility of developing an on demand oil pump supply system. Include part power oil flow requirements and robustness analyses in the study.

PHASE II: Define and develop prototype test plan and test rig. Develop and demonstrate prototype capability.

PHASE III: Integration into an OEM development program, where demonstration of durability, accuracy, reliability and repeatability can be verified. PRIVATE SECTOR COMMERCIAL POTENTIAL/

DUAL-USE APPLICATIONS: Commercial aircraft gas turbine engine, rotorcraft engines, and ground based gas turbine power generation.

References:

1. Streifinger, H. (2010). Fuel/Oil Heat Management of Turbine Aero Engines – Future Requirements and Experience from the Past http://docs.google.com/viewer?a=v&q=cache:5QCuxofBpbAJ:ftp.rta.nato.int/public/PubFullText/RTO/MP/RTO-MP-AVT-178/MP-AVT-178-08.doc+RTO-MP-AVT-178-08&hl=en&gl=us&pid=bl&srcid=ADGEEShbaSOPUSyCnuKBO0w5VYOaLdY5z4WGjp2WCxZJPZqYrKJ51MmByojTKbMXjXH5kAoaT6126-0l_18z0gpT82ItHWMbPPr8Ri6HG19mqC4ZNgN0s15Ogg4oUXE28qnAzPqHzGn7&sig=AHIEtbQYrW5vUHIg3R7xLLfX4V6EPnlHQQ

2. Black, S. J. (1986). X-29 Fuel/Auxiliary Oil Systems Thermal Management. AIAA 860913, doi: 10.4271/860913

3. Streifinger, H. (1998). Fuel/Oil System Thermal Management in Aircraft Turbine Engines. RTO Applied Vehicle Technology Panel Symposium RTO MP-8, 12-1-12-10. http://ftp.rta.nato.int/public/PubFullText/RTO/MP/RTO-MP-008/$MP-008-12.pdf
4. MIL-STD-704. MILITARY STANDARD: ELECTRIC POWER, AIRCRAFT, CHARACTERISTICS AND UTILIZATION OF (06 OCT 1959). http://www.everyspec.com/MIL-STD/MIL-STD+(0700+-+0799)/MIL_STD_704_1080/

Keywords: oil; supply; oil pumps; volumetric flow rate; thermal management system; on-demand oil system

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