SAE 100 *Future look*

In celebration of SAE's Centennial in 2005, industry executives discuss the future of mobility technology.

What's downstream in turbine technology

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Gas turbine (GT) machines—aviation, industrial, and vehicular—are versatile and cost-effective machines used for the provision of electricity, mechanical load power, and propulsion. However, the machines continuously pose challenges to engineers who must design, construct, and operate reliable and efficient turbines that meet market needs while simultaneously respecting the environment. GT manufacturers, suppliers, and related scientific organizations must meld their technical services, expertise, and research facilities to meet the challenge facing the entire industry in the future.

For all engines in general, **Forecast** believes that R&D work will continue to focus on combustion, including flame sensors for GTs, more reliable and advanced low-NOx combustion systems, and new combustion systems for GTs; materials such as advanced long-life turbine blade coatings; turbomachinery, such as the further design of highly loaded stages and compressor aeromechanical design; and systems, including combined-cycle GTs with integrated low-temperature heat, and high-efficiency components for ICR-CHP (intercooled regenerative cyle, combined heat and power) GTs.

For aerospace engines, we foresee firing temperatures in excess of 2600°F in the near future. We expect increased use of "blisks" and new low-emissions combustors; new materials, such as titanium aluminides, replacing some Ni-based alloys; and advanced aerodynamics leading to lower blade counts for engines.

An overarching trend is the increasing globalization of engine R&D and production efforts. Cooperation in technology development programs and engine production work generally lowers risks and reduces costs for engine firms, as well as for governments sponsoring the programs or procuring the (military) engines

Recent high-elevation operations have taught the **U.S. Army** that an even more powerful engine will be needed aboard its Black Hawks in the future, and the Improved Turbine Engine Program (ITEP) is intended to address that need. A follow-on effort to the concluded Common Engine Program (CEP), ITEP constitutes the Army's attempt to develop a 3000-hp turboshaft for more powerful Black Hawks and AH-64 Apaches using a common powerplant.

In addition to a 50% increase in power, the program's goals include a 60% boost in lift and range ratio and a 20% reduction in costs. Any engine developed under the program would not be available before 2010, but could conceivably be installed in many of the Army's Black Hawks as part of the aforementioned re-engine drive.

Several major engine builders have been participating in CEP/ITEP and a number of other letter programs to lay the groundwork for the next generation of aviation turboshaft engines. (**GE** and **Pratt & Whitney** have teamed up for the effort.) Massive funding for gas turbine research has been authorized under the Versatile Affordable Advanced Turbine Engine (VAATE) umbrella, and much of that will be devoted to the development of more economical turboshaft engines. With lucrative government contracts (and civilian sales opportunities) at stake, some engine builders are also applying their own financial resources to the challenge of discovering more affordable turboshaft propulsion technology. The payoff could include a spot aboard a next-generation medium-lift transport helicopter such as **Sikorsky**'s proposed UH-60X. The performance requirements for such an aircraft, as yet, have not been finalized

For the new **Boeing** 7E7, both GE and **Rolls-Royce** are offering new evolutionary aviation turbofan engine designs: GE with the GEnx and Rolls-Royce with the Trent 1000. Further out for aerospace engines, we can look forward to revolutionary engine concepts. GE and Rolls-Royce are already working on hybrid engines that combine pulse detonation wave engine (PDWE) technology with conventional turbomachinery. AE

GEAE's GEnx for the Boeing 7E7

Rolls-Royce's Trent 1000