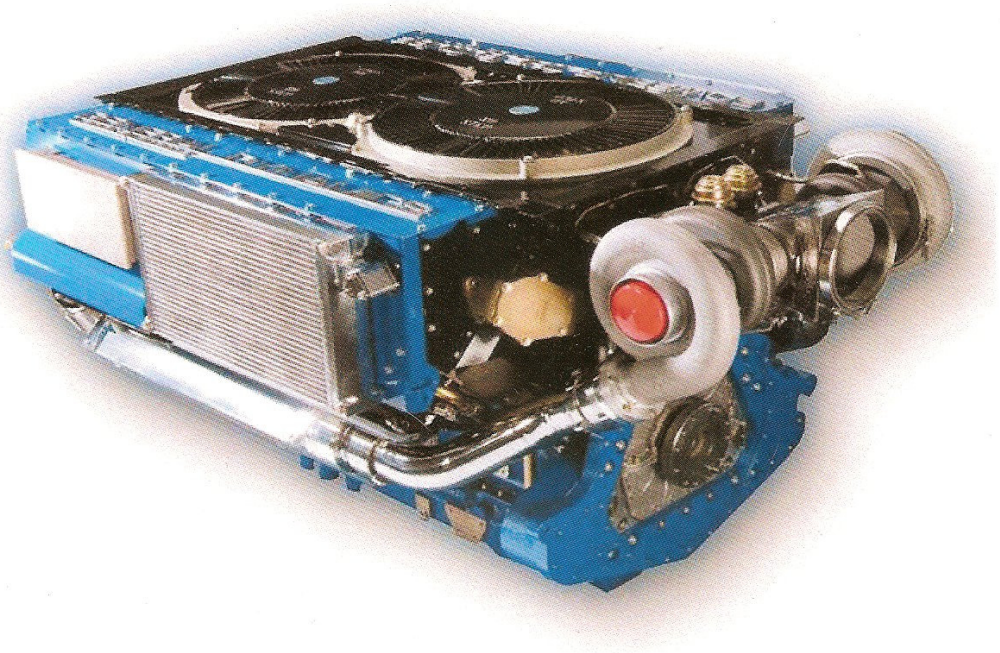
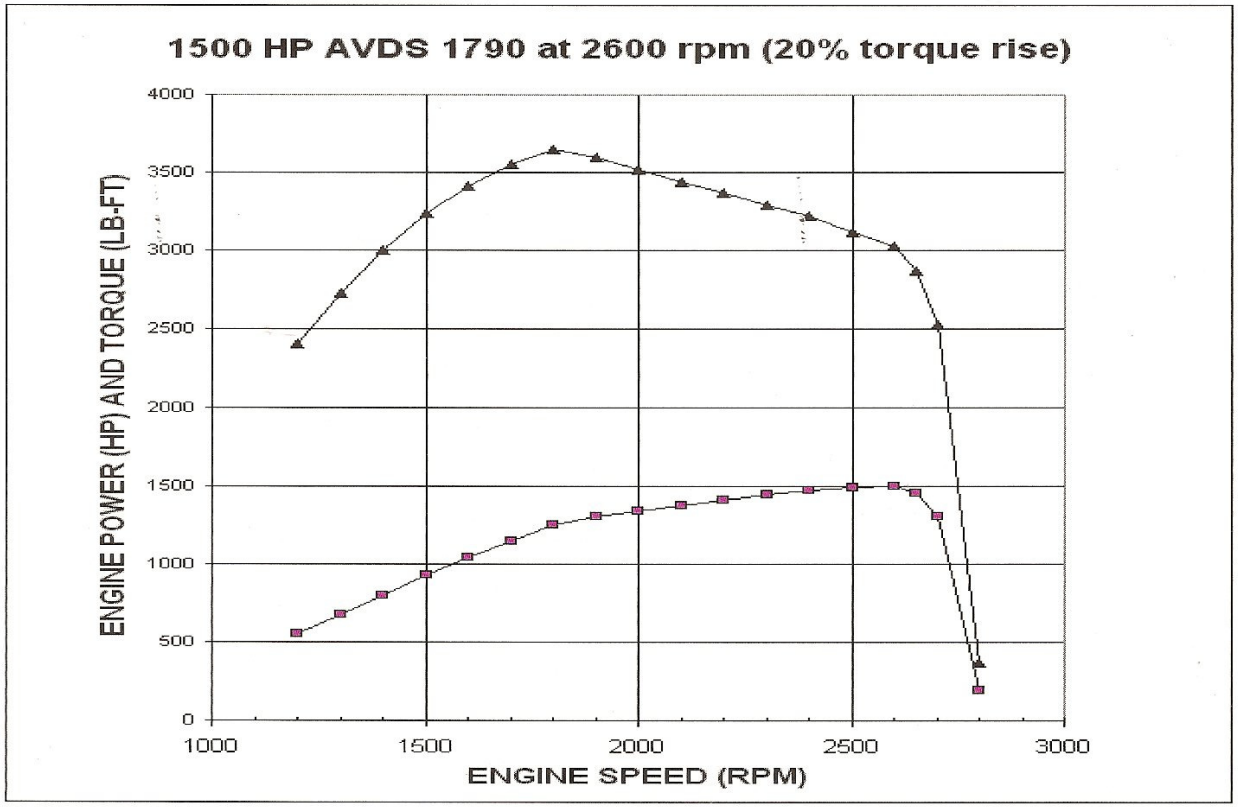
The AVDS-1790
1500
Horsepower Engine

A more powerful version of the AVDS-1790 series V-12 air-cooled engine has recently been added to the engine family – 1500 horsepower. It shares the same construction as other engines in the family and the air-cooled system. New for the 1500 horsepower engine is the electronic common rail fuel system, wastegated turbochargers and cooling system. New valve train components allow rating the engine at higher rpm. The engine produces 1500 horsepower at 2600 rpm, and 3635 lb.-ft. at 1800 rpm for a 20% torque rise (See chart on next page).

Other features have been added, such as relocated aftercoolers, and new intake manifolds which make the engine more compact than the 1050 and 1200 horsepower versions of the family. The air-cooled engine is very modular, making integration into different chassis and with different transmissions an easy task. Preliminary design work has been performed, identifying the integration scope in an Abrams vehicle.

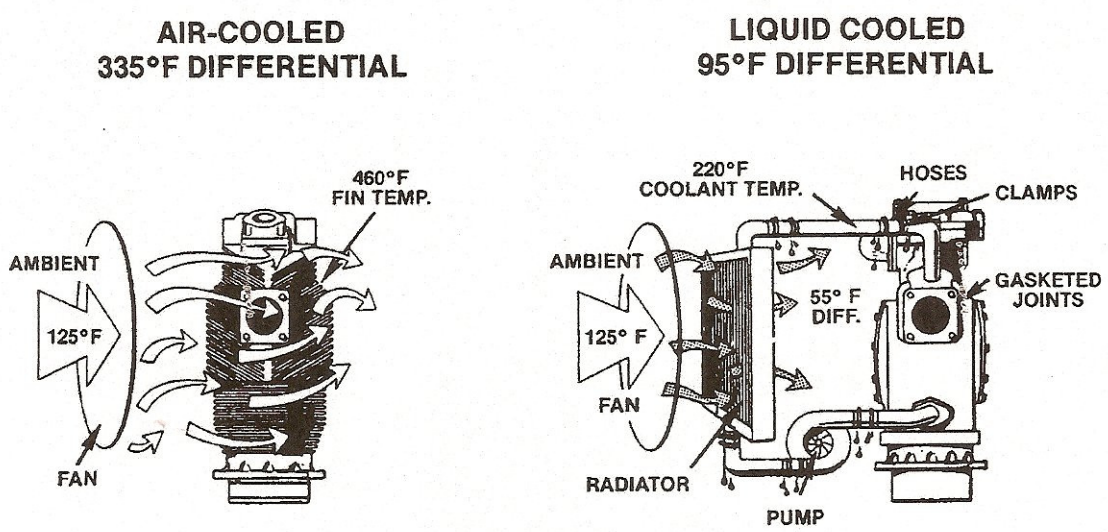
The 1500 horsepower engine was introduced by General Dynamics in October 2004 at the Association of the United States Army convention in Washington, D.C. At that time the engine had completed its demonstration test phase. All performance parameters have been met as shown below.





The AVDS-1790 family of engines consists of the following power levels: 750, 900, 950, 1050, 1200 and 1500 horsepower. These engines are currently in use in many countries in M60 series tanks and derivative vehicles, M88A1 Retriever, M88A2 HERCULES, Merkava Mark I, II and III, and modernized Centurion vehicles. The logistic support system is in place worldwide and overhaul / maintenance depots actively support the engine series in many countries. GDLS provides a parts support base, offers training and modernization programs for sustaining the engine series for many years in the future.

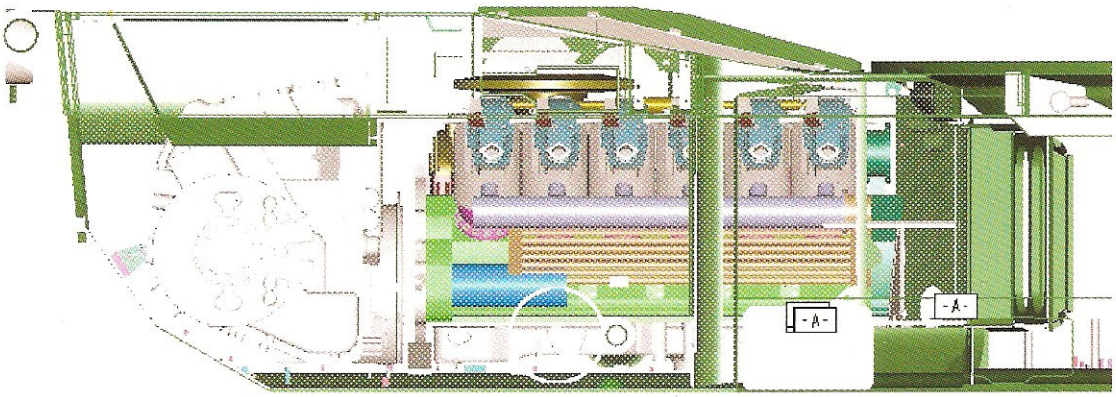
The 1500 horsepower engine, like its other family members, is air-cooled. This is optimum for operation in the extreme environment of battle tanks because it is more efficient, has fewer parts and is more robust than liquid cooling. The illustration below shows the difference in efficiency by comparing the temperature differentials of the two systems. The airflow required for cooling is proportional to the temperature differential across the cooling systems. In the liquid-cooled systems the differential is limited by the boiling point of the coolant. The boiling point is about 212° F, but with increased pressure in the system, the boiling point increased to 220° F or slightly higher. Both systems require airflow, but because of the higher differential, air-cooling is more efficient. This higher efficiency translates into smaller cooling system volume, lower weight and fewer parts, which also means lower maintenance and higher cooling system reliability.



Air-cooling is More Efficient

Another major advantage is the robustness of the air-cooled system. On the battlefield, if battle damage occurs, it may damage some fins on one of the air-cooled cylinders, but the cooling of the other 11 is still intact. With the liquid-cooled system, the radiator is closest to the grills, therefore susceptible to any incoming debris which can puncture the radiator. When this occurs, the coolant escapes, the boiling point goes down and the usual result is lots of steam and catastrophic engine failure.

Initial installation studies show that the 1790, 1500 horsepower engine can be integrated into the Abrams vehicle without changing core components of the engine. There are two options for the integration process. One is a tee configuration with a modified existing transmission and a hybrid suspension. The other is a new transmission that allows a transverse mounting of the engine. This approach does not require suspension modification. The first option is shown below. Both options can be accomplished without cutting and welding of the hull, and the final drive is retained.



1500 H.P. 1790 and X-1100-5 Power Pack

When compared to other diesels, the AVDS-1790 offers the same great performance and the following advantages:

- Commonality of parts, operation and maintenance procedures with other 1790 family engines
- Worldwide active support base
- Lowest acquisition cost
- Easy maintenance, air-cooled design
- Uncomplicated, modular construction
- Ease of integration as evidenced by the numerous vehicles it powers

When compared to the turbine, the AVDS-1790, 1500 horsepower engine has all the above advantages plus a huge advantage in acquisition and operating / support costs. This is supported by the U.S. Army's ACCE (Abrams Crusader Common Engine) program conducted five years ago. This study compared the O & S (Operating & Support) costs for the Abrams with the AGT-1500 turbine and a diesel. Fleet size was 2700 vehicles operating for 184 hours per year for 30 years. The O & S cost savings for the diesel is $5.259 billion with fuel at $1.02 per gallon. This cost reduction does not reflect the true cost of transporting the fuel to the fleet.

In 2001, The Defense Science Board published a report of their findings on More Capable Warfighting Through Reduced Fuel Burden. The Board concluded that the true cost of fuel when transported to a battle zone is $17.50 per gallon. When this fuel cost is entered in the ACCE scenario, the diesel O & S cost savings for the diesel is $8.027 billion.

When all factors are considered, i.e., cost, supportability / performance, the AVDS-1790, 1500 horsepower engine is the best choice to power your heavy, high-performing, military vehicle.