

## Update:

# The Abrams-Crusader Common Engine

## Help Is on the Way

During the last few years, many have heard about our new tank engine, and some were even fortunate enough to see and touch one at the 2001 Armor Conference.

More than likely, you are asking, "When will I get one in my tank?" This update will provide you some insight concerning the Abrams-Crusader Common Engine (ACCE) program.

The AGT-1500 turbine engine was instrumental in making our Abrams tank the world's best; but it's getting tired and, unfortunately, more expensive to use and maintain. Designed in the late 1960s, the Army employed over 12,000 of these engines, but production ended in 1992, and since then, we have relied on overhauled engines. Many engines have been overhauled more than once. In fact, our "new" M1A2 SEP and M1A1 AIM (Abrams Integrated Management) tanks come from the factory with overhauled engines.

When the Army overhauls an AGT-1500, we cannot afford to replace all the components. Therefore, we intensify the focus on the replacement of the high-failure items, but the wear on the remaining components can result in overhauled engines that fail to achieve the durability of a new engine. With each subsequent overhaul, we lose more life and reliability. Where a new AGT-1500 engine delivered approximately 1,000 hours between depot maintenance events, it currently completes, on average, less than 500 hours. Unlike aircraft turbine engines, which are routinely upgraded over the aircraft's life to improve performance, our ground-based AGT-1500 has not had significant improvements.

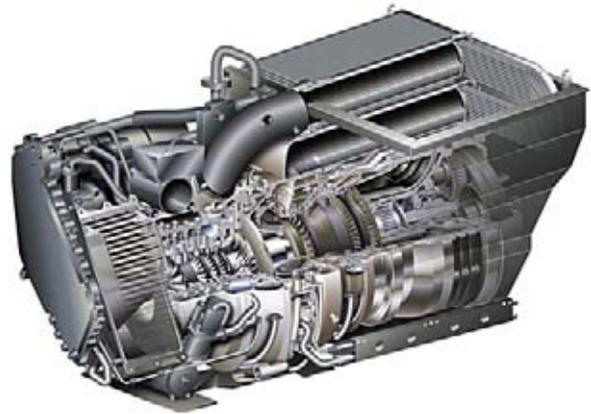
Maintaining the AGT-1500 engines eats up over 60 percent of the Abrams' Operational and Support (O&S) costs; it is the Army's most expensive ground system to operate. In 1999, the Project Manager Abrams office surveyed industry to see what could be done to

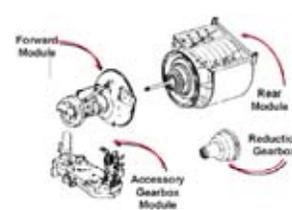
reduce engine O&S costs. They found that there were significant advances in engine technology since the AGT-1500 was developed in the 1960s. The team concluded that by replacing the AGT-1500 with another engine, the Army could expect a four-fold increase in reliability and at least a 35 percent reduction in fuel consumption without sacrificing current performance. Based on these realities, the Army could save billions of dollars over the projected life of our tanks by simply replacing the AGT-1500.

In the same period, the Crusader artillery system also required an engine with similar performance. In order to reduce maintenance and support burdens on the combined arms team, and enjoy economies of scale, senior lead-

ers directed that a common engine be acquired for both the Abrams tank and the Crusader artillery system.

On 8 March 2000, industry was officially asked for proposals. The type of engine was not specified, only that it operate on JP8, that it fit in both engine compartments, that it does not degrade current tank performance, and that it significantly reduces O&S costs. Upon contract award during the summer of 2000, a short 3½-year engine development and integration effort began. To realize these savings more quickly, development time was held to a minimum. A side-by-side comparison of the AGT-1500 and LV100 is shown below.



AGT-1500	ACCE/LV100
	
<ul style="list-style-type: none"><li>• Designed for 4-Level Maintenance (transitioning to 2-Level FY03 - FY05)</li><li>• 1960's technology</li><li>• Last new U.S. engine produced in 1992</li><li>• Higher fuel consumption</li><li>• Higher # of parts<ul style="list-style-type: none"><li>– No built-in data collection</li></ul></li><li>• Manual PTS/IGV adjustments (difficult)</li><li>• Common failures: Seals, recuperator, FOD ingestion (turbine nozzle &amp; blade), bearing failures due to coking</li><li>• Decay: Overhaul Cost ↑; Reliability ↓; Washout Rate ↑</li></ul>	<ul style="list-style-type: none"><li>• Designed for 2-Level Maintenance</li><li>• 1990's technology</li><li>• Production begins 2003 (04 deliveries)</li><li>• 30% reduction in fuel consumption</li><li>• 43% fewer parts</li><li>• Up to 6 X better reliability</li><li>• Electronic data collection (DMM)</li><li>• Self-adjusting PTS/IGV</li><li>• Seal improvements</li><li>• Recuperator improvements</li><li>• Reduced air requirements (V Packs)</li><li>• Applicable to Abrams M1A2 SEP, M1A1 AIM (pending), Crusader and possibly other heavy combat vehicles</li></ul>

The ACCE/LV100 engine is designed to support a two-level maintenance concept: "Replace Forward and Fix in the Rear." The overall reduction of parts within the engine makes it more reliable, and the new engine is equipped with a Digital Memory Module (DMM), which is an electronic logbook and data repository capable of capturing critical usage data that is designed to increase service life of the engine. The DMM is updated at production and overhaul with the critical component serial numbers and previous hours/cycles. This is designed to assist in identifying overhaul task and fleet trends.

The table below shows some of the parts that were eliminated in the new LV100 engine as well as several improvements to reduce the maintainer's overall task load. The operator, the maintainer, and the logistician supporting the unit will all realize benefits from the new LV100 tank engine. One projected benefit is the increase in the Mean Time Between Failure (MTBF) from the current <500 hrs to 1600 hrs. Another benefit comes from the engine layout: many of the Line Replaceable Units (LRUs) are grouped on the top right side of the engine for ease in removal and repairs.

The GE/Honeywell Team is working toward a May 2002 deadline, when they anticipate that the first engine will be ready for tests. All indications from the Program Management Reviews are that the program is on schedule. After personally experiencing several "out-



of-the-can" engine failures while at the Combat Maneuver Training Center in Hohenfels, Germany, this program is particularly impressive to me. It is also exciting because it is crucial to sustaining our Abrams force and most of you will be around to reap its benefits.

Starting in 2004, approximately 200 M1A2 SEPs will come off the production line with the new GE/Honeywell LV100 tank engine. The PM/TSM Abrams offices are working to include the new tank engine in the Abrams Integrated Management (AIM) overhaul process at Anniston Army Depot for the M1A1 tank and also to implement a field retrofit program for a significant portion of the Abrams fleet. The following is a rudimentary schedule, as we know it today:

- **May 02:** First Engine To Test
- **Dec 02:** Abrams test engines received

- **Jan 04:** First Abrams engine to production
- **Jan 05:** First Unit Equipped

Many of us frequently experience the woes of the AGT-1500 and wish for an immediate replacement. Since that is not going to happen overnight, we must continue to perform aggressive Preventive Maintenance Checks and Services (PMCS) to help reduce the number of engine repairs/failures and sustain the overall life of the engine. It will be some time before many of you see the new tank engine, which means you will keep receiving the rebuilt engines mentioned earlier. I am not claiming that routine PMCS will fix all engine troubles; nevertheless, it will aid in preventing some of engine failures experienced due to lack of maintenance. Leverage what you already know about the AGT-1500 and use it to your advantage.

## LV100-5 Addresses Top 10 AGT-1500 Problems

### AGT-1500 Field Issues

- No.5 Seal leakage
- No.7 Seal leakage
- No.10 Seal leakage
- Inlet screen sealing
  - RTV impedes maintenance
  - Inlet screen interferes with plenum seal
- Fuel pump seal leakage
- Oil Filter Clogged Switch fails
- VIGV/PTS adjustment requires shim
- Must drain 17 qts to remove oil tank
- No. 4 Oil Feed Line damage during starter replacement
- PT Speed Pick-up change-out requires transmission removal

### LV100-5 Design Features

- ✓ Seal eliminated
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- ✓ Redesigned to eliminate failure modes
- ✓ Visible inlet interface
- ✓ Screen location eliminates need for RTV seal
- ✓ Screen integral with inlet housing inboard of seal
- ✓ Pump redesigned to aerospace standards
- ✓ Pressure sensor replaces low-reliability microswitch
- ✓ Actuators are self-adjusting
- ✓ Considering design options
- ✓ Starter relocated to be more accessible, higher reliable starter incorporated, - 40 lbs. lighter
- ✓ Speed Pick-ups relocated to allow ease of removal

## References

COL Donald Kotchman, Abrams Tank Systems ACCE/AGT-1500 comparison briefing, Warren, MI, 2001

MAJ Randy Munn, Abrams Tank Engine Update (information paper), Warren, MI, 9 September 1999

COL James Moran, Abrams Modernization: "Keeping the Best Ahead of the Rest," *Army AL&T*, January-February 2001

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