M9 ARMORED COMBAT EARTHMOVER (ACE)

Performance Plan and Agreement
December 20, 2002

The M9 Armored Combat Earthmover (ACE) is a highly mobile, armored, combat earthmover capable of supporting forces in both offensive and defensive operations. It performs critical combat engineer tasks such as digging hull defilade fighting positions for guns, tanks and other battlefield systems to increase their survivability. The ACE breaches berms, prepares anti-tank ditches, prepares combat roads, removes roadblocks and prepares access routes at water obstacles.

On September 28, 2001 the Vice Chief of Staff of the Army (VCSA) approved the Recapitalization Program for the ACE. The three initiatives of this program are:

a. Full recapitalization of 374 ACEs. This number constitutes the entire fleet of 533 ACEs, less 52 newer ACEs in the Counterattack Corps and 107 ACEs in Europe.

b. Application of a thicker hull bottom on all 533 ACEs at a depot or an equivalent facility.

c. Installation of System Identification Plan (SIP) Phase Four enhancements to all 533 vehicles.

The Business Process Improvement Directorate (BPI), using specific metrics identified in this Performance Plan and Agreement (PPA), will evaluate success of the Recapitalization Program. The ACE Recapitalization Program will use existing data sources and on-site U.S. Army Materiel Systems Analysis Activity (AMSAA) data collectors to track components and systems to determine if they are performing to expectations. Automatic Identification Technology (AIT) will be incorporated as it becomes available.

INITIATIVE ONE: Full Recapitalization

The ACE Recapitalization Program consists of rebuilding the vehicle chassis and overhauling all major components. In the process, the vehicle will be returned to near-zero hour condition and brought to the latest production configuration.

Rebuild will involve the following:

a. Complete teardown to bare hull.

b. Apply any SIP One, SIP Two, and SIP Three items not already installed.

c. Replace or repair damaged items.

d. Mandatory replacement of wear items such as all hoses and seals.

e. Parts upgrades. Items such as accumulators, heaters, road wheels, road arms, and final drive breathers will be replaced with newer configurations.

f. Installation of actuator rings at number two and number three station is (number one station is applied during SIP One).

The following major components will be torn down and completely overhauled:

Component	Standard
Accumulator, actuator	National Maintenance Work Requirements (NMWR)
Accumulator, main hydraulic	NMWR
Actuators, corner and intermediate	NMWR
Cylinder assembly, ejector	NMWR
Ejector	NMWR
Engine	NMWR
Final drive	NMWR
Pump, main hydraulic	NMWR
Steering unit assembly	NMWR
Transfer case	NMWR
Transmission	NMWR
Winch, 35K pound	NMWR

Three metrics will be tracked:

a. Reduce fleet age.

b. Reduce annual O&S costs.

c. Analyze component usage and replacement data. Applicable components are:

National Stock Number (NSN)	Item	Serial Numbered?
3040-01-434-8048	Accumulator, actuator	No
2590-01-170-5026	Accumulator, main	No
4810-01-337-8962	Actuator, corner	Yes
4810-01-337-8963	Actuator, intermediate	Yes
3040-01-187-0571	Cylinder assembly, ejector	No
2590-01-217-3263	Ejector	No
2815-01-399-6801	Engine	Yes
2520-01-455-4722	Final drive	No
4320-01-408-4789	Pump, main hydraulic	No
2530-01-337-8961	Steer unit assembly	Yes
2520-01-171-0027	Transfer case	No
2520-01-339-4716	Transmission	Yes
2590-01-440-8736	Winch, 35K pound	Yes

For each component, the metric is the same. Increase average Mean Time Between Replacement (MTBR). The preferred metric would be to increase average Mean Time Between Failure (MTBF) since MTBR does not capture component failures that are fixed through repair. However, determining baseline MTBF for ACE components would require on-site sample data collection, and there is no such program in place. Baseline and future MTBR can be derived from Operating and Support Management Information System (OSMIS). Since NSNs remain the same before and after recapitalization, OSMIS data will not differentiate between non-recapitalized and recapitalized components. The best way to accurately capture the required data is through on-site AMSAA data collection and AIT. Therefore, the above components are the primary candidates to receive contact memory buttons (CMBs).

The performance tracking metric is to increase annual MTBR (in hours) of each component, as measured by AMSAA Sample Data Collection (SDC) OSMIS, by the percent shown in the table below. The baseline is the average of the MTBR for each component during Fiscal Years 2000-2001, (FY 00-01), as measured by OSMIS. The target is derived by averaging the highest two years during FY98-01. Note that component replacement data may be skewed by such factors as depot procurements for overhaul, and by available funds for units in the field to buy and stock components independent of demand.

NSN	Item	FY00-01 Average MTBR (OSMIS)	Target MTBR	Percent Increase
30400-14-348-048	Accumulator, actuator	1,547	3,268	111.2
2590011705026	Accumulator, main hydraulic	19,952	26,594	33.3
4810013378962	Actuator,	1,993	2,653	33.1
4810013378963	Actuator, intermediate	4,034	5,305	31.5
3040011870571	Cylinder assembly, ejector	25,797	30,602	18.6
2590012173263	Ejector	103,002	90,369	0.0
2815013996801	Engine	3,564	8,666	143.2
2520014554722	Final drive	2,317	3,232	39.5
4320014084789	Pump, main hydraulic	9,919	15,146	52.7
2530013378961	Steering unit assembly	3,004	4,615	53.6
2520011710027	Transfer case	10,318	40,248	290.1
2520013394716	Transmission	2,860	4,845	69.4
2590014408736	Winch, 35K pound	125,309	153,430	22.4

The AMSAA will position data collectors to cover those units with recapitalized ACEs, and will track all maintenance activity on these vehicles. The BPI will coordinate with the Project Manager (PM) ACE and Anniston Army Depot to furnish CMBs or other AIT in time for installation on the FY03 Recapitalization Program (the FY02 program will not have such technology installed). The BPI will request funds for installation of the technology, and will ensure that field data collectors know when and how to collect relevant data.

INITIATIVE 2: Thicker Hull Bottom

The purpose of the thicker hull bottom program is to increase the durability of the hull. This project involves cutting out the existing 3/8-inch

thick hull bottom and welding in a new one-inch thick section. Also included is a rear steel skid plate and improved hull access plates.

The work must be done at depot or equivalent due to special fixtures and need for complete vehicle teardown and hull preparation.

The thicker hull bottom is already on 52 ACEs in the Counterattack Corps (installed during production) and it is being installed as part of an ongoing U.S. Army Europe (USAREUR) refurbishment program for their 107 ACEs. Thus, by applying the thicker hull bottom during full recapitalization of 374 vehicles, all 533 ACEs in the fleet will receive this improvement.

There is one metric associated with this initiative:

Improve Durability.

INITIATIVE 3: System Improvement Plan Phase Four (SIP Four)

The ACE SIP is a series of continuous improvements to the ACE. Primarily hardware oriented, the ACE SIP is Other Procurement Army (OPA) funded and applied in the field through block modifications. The SIP is designed to improve performance, durability, readiness and Manpower and Personnel Integration (MANPRINT) characteristics of the ACE. The SIP Four consists of the following projects:

a. Hydraulic diagnostic center. Consists of embedded transducers, manifolds, valves, a data bus, and a centralized digital multimeter and switch bank to let the maintainer conduct diagnostic tests.

b. Power pack removal improvements. Quick disconnects, relocated hose brackets, and replacement of a mounting bolt with a guide pin.

c. Steel apron with automatic blade folder. New apron is steel instead of aluminum, has a lower profile for improved visibility, incorporates a storage compartment, and includes an actuator to hydraulically fold and unfold the dozer blade.

d. Improved track tensioner. Hydraulic system replaces the current grease cylinders for adjusting track tension.

e. Improved final drive flanges. Ductile steel flanges replace the current brittle aluminum flanges.

f. Force XXI electronics preparation. Adds brackets for future Force XXI electronics packages such as Force XXI Battle Command Brigade and Below (FBCB2).

g. New crew cooling system. Chilled-liquid system without armor protection, versus existing chilled-air system with armor protection. Nuclear, Biological and Chemical (NBC) components requiring armor protection are moved into the armored operator's compartment.

h. Non-Halon fire extinguisher. Dry-powder system brings the ACE into compliance with Montreal Protocol for elimination of Halon.

i. New hatch mount. Uses components of the Bradley Fighting Vehicle hatch hinge and mounts to the radio box instead of the vision ring.

The thicker hull bottom is also a component of SIP Four. Unlike the other projects, however, it cannot be applied at Directorate of Logistics (DOL) or field units and it is primarily OMA funded.

Two metrics are associated with this initiative:

a. Enhance Vehicle Performance and Maintainability. This is a largely subjective metric, which is a part of another ACE program.

b. Analyze benefits of SIP Four Projects. The expected benefits of each of the SIP Four projects are shown below. Only some of the benefits are quantifiable, and in very few instances is there any realistic way to predict the extent of a benefit.

	Enhance Capability	*Improve R/M/S	Reduce Operation & Support (O&S) Costs	Extend service life
Hydraulic Diagnostic Center		X	X	
Power pack removal improvements		X		
Steel apron with automatic blade folder	X	X	X	
Improved track tensioner	X	X	X	
Improved final drive flanges		X	X	X
Force XXI electronics prep	X			
New crew cooling system	X	X	X	

Non-Halon fire extinguisher			X	
	Enhance Capability	*Improve R/M/S	Reduce Operation & Support (O&S) Costs	Extend service life
New hatch mount			X	X
Thicker hull bottom		X	X	X

* Reliability, Maintainability, and Supportability

Hydraulic Diagnostic Center.

We anticipate a reduction in the time required to troubleshoot and diagnose the hydraulic system. Time savings accrue because critical test points are centralized and easy to access and because there will no longer be a need to disconnect lines, insert tees and gages, test, and reconnect. Reliability is improved because by not having to disconnect and reconnect lines. There is less likelihood of future leaks. The O&S costs may be reduced because with easier troubleshooting, there is less likelihood of needlessly replacing a serviceable component.

Power Pack Removal Improvements.

Use of quick disconnects instead of regular hose connections will help prevent oil spills and reduce the time to remove and replace the power pack. By relocating a bracket and replacing a difficult-to-reach mounting bolt with a guide pin, we further improve the maintainability. Time to remove and replace the power pack is well known and documented. This improvement can be similarly documented and thus verified.

Steel Apron with Automatic Blade Folder.

Capability is enhanced because the ACE operator can now fold the blade quickly from the operator's compartment while under armor protection. Maintainability is enhanced because sections that may break are now bolted on instead of welded, making repair and replacement much easier. The O&S costs are reduced because the steel apron costs less than the current aluminum apron and should need repair or replacement less often.

Improved Track Tensioner.

The operator can adjust track tension much quicker and easier, making it more likely that track will be properly adjusted. Track throws, usually associated with incorrect track tension, may be reduced, resulting in less maintenance, higher reliability, and fewer replacements of broken components.

Improved Final Drive Flanges.

New flanges should have better durability. Since the procurement cost is about the same, O&S costs should decrease. The current flanges appear to have a definite service life, as most have small cracks in the casting when examined at the depot. The new flanges, being more ductile, should have a longer service life.

Force XXI Electronics Preparation of Vehicles.

Vehicles will be prepared so units can quickly install FBCB2 and other Force XXI electronics that enhance communications.

New Crew Cooling System.

This chilled-liquid cooling system will be installed on 391 vehicles that currently do not have any type of air conditioning system. The enhanced capability will enable additional ACE operators to work more efficiently and for longer periods of time. The new system is much cheaper and more reliable. Also, the existing Microclimate Cooling System requires weekly servicing to ensure the seals remain moist; the new system does not need servicing for up to a year.

Non-Halon Fire Extinguisher.

The O&S costs should be reduced because Halon is becoming increasing difficult and expensive to procure.

New Hatch Mount.

This eliminates the tendency of an open hatch to pop off the primary catch (though still secured by the secondary catch). We may see lower replacement rates for the hatch pin and other hatch parts. This project also eliminates fatigue failures on the vision ring where the current hatch is supported.

Thicker Hull Bottom.

Hull bottom damage is the leading cause of vehicles being qualified for depot repair. The cost of repairing the existing bottom at the depot is

often more than the cost of installing the improved hull bottom and once repaired the vehicle is subject to the same damage again. A typical hull bottom repair done at General Support (GS) level will usually deadline the ACE for over four months, with no assurance that the hull will not incur the same damage again. With the thicker hull bottom, the ACE is more durable and not as likely to require hull bottom repair. Regarding the access plates, the new plates will be far easier for a mechanic to install than the existing configuration.

COORDINATION.

All signatories agree to the following:

a. This is a living document and is current as of August 20, 2002. Any changes to the PPA will be coordinated with all parties concerned.

b. The BPI, in coordination with all parties, will track results and provide tailored reports.

c. The recapitalized component performance metrics are established in this agreement.

d. The BPI will report tracking results to Army Senior Staff.

e. The PM, in coordination with all parties, will assist with metric development to be used in tracking execution.

f. The PM, in coordination with signatories, will supply data to the BPI.

g. The warfighters will ensure continued emphasis on accurate data reporting.

h. The warfighters will facilitate/authorize Headquarters, Department of the Army (HQDA) liaison visits when necessary.

i. The PM will provide updates to induction/distribution schedules, performance standards and baselines whenever necessary to the BPI.

j. The Deputy Assistant Secretary of the Army for Cost and Economics (DASA (CE)) will review cost and economic analysis of recapitalization efforts that have been validated and accepted by the Major Command (MACOM) and Major Subordinate Command cost analysis organizations and perform independent evaluations and analysis when applicable.

k. The AMSAA supports the ACE PM with data and data analysis using SDC for tracking replacement data of the top cost and readiness drivers. AMSAA is also identified as the independent evaluator for recapitalization performance.

AGREEMENT DATE: December 20, 2002

FORSCOM	Mr. James De Martini/s-October 15, 2002
DASA (Cost and Economics)	Mr. Joe Gordon/s-December 19, 2002
AMC	COL Moses Whitehurst Jr./s-September 23, 2002
PM CE/MHE	LTC Christopher Dozier/s-August 20, 2002
PM CMS	COL Michael K. Asada/s-September 4, 2002
PEO CS/CSS	BG Roger A. Nadeau/s-January 30, 2003
for ASA(ALT)	March 11, 2003