~~LETTER~~ REPORT

OF THE

DEFENSE SCIENCE BOARD

TASK FORCE

ON

TRACKED VEHICLE INDUSTRIAL BASE

APRIL 1994

Office of the Under Secretary of Defense for Acquisition
Washington, D.C. 20301-3140

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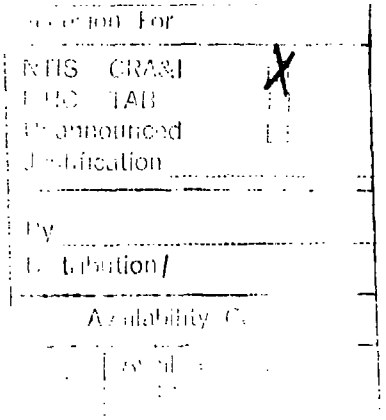

OFFICE OF THE SECRETARY OF DEFENSE
WASHINGTON, D.C. 20301-3140

DEFENSE SCIENCE
BOARD

MEMORANDUM FOR UNDER SECRETARY OF DEFENSE (ACQUISITION AND TECHNOLOGY)

SUBJECT: Report of the Defense Science Board Task Force on Tracked Vehicle Industrial Base

I am pleased to forward this final report of the Defense Science Board Task Force on the Tracked Vehicle Industrial Base The Task Force, chaired by Dr. Jacques Gansler, was chartered to assess the viability of the tracked vehicle industrial base and to propose a definitive plan of action to address any shortfalls.

This report provides input to the Department in three areas: tracked vehicle industrial base planning in a period of minimal production; preservation of key engineering skills and facilities for tank engines; and guidelines for use in future industrial base decision processes.

I concur in the Task Force's findings and recommendations and fully endorse their proposed course of action.

Paul G. Kaminski
Chairman

OFFICE OF THE SECRETARY OF DEFENSE
WASHINGTON, D.C. 20301-3140

DEFENSE SCIENCE
BOARD

5 May 1994

Dear Mr. Chairman:

I am pleased to submit to you the final report of the Defense Science Board (DSB) Task Force on the Tracked Vehicle Industrial Base.

This Task Force was charged with assessing the viability of the US tracked vehicle industrial base, given current Department plans, and to propose a definitive plan of action to address any short falls (along with cost estimates). The Task Force was also requested to examine the public and private base for tracked vehicles (with emphasis on tank engines) and to consider options regarding the retention of the Stratford Army Engine Plant (SAEP).

The Task Force gathered information through a series of briefings by government and industry personnel with expertise and extensive knowledge of the military and industrial aspects of the above issues. We also visited SAEP to observe, first-hand, the Textron Lycoming operation at that plant and to receive on site briefings from Textron regarding the facility.

Our assessment is that current DoD plans at the vehicle level appear to provide minimal industrial base support in the near term; however, we see major issues in the near term with regard to tracked vehicle engines and transmissions and we see reason for significant concern regarding long term systems engineering support.

The Task Force recommends that the Army assess the current program and strengthen the development and funding of a three-part armored force modernization R&D Program: M1 and M2/3 upgrades; next generation tracked combat vehicles (systems engineering); and a technology base insertion program. We also recommend that the Army develop (with Marine Corps support) a long-term (to 2010) tracked vehicle master plan by 1 December 1994, based on recommendations above, currently planned programs (e.g., AFAS/FARV and AAAV) and including an integrated industrial base plan that maximizes use of flexible manufacturing, dual and multi-use facilities, and existing capabilities. And in order to achieve a state-of-the-art, responsive, affordable and flexible, defense industrial base, planning should begin now to maximize the potential for dual-use of facilities, production equipment, and personnel to meet the specialized needs of both military and civilian customers.

Focusing on the tank engine and SAEP, we concluded that the Army must maintain support engineering and critical sole source spare parts and logistics capability at Textron as well as retaining access to Textron's unique knowledge and capabilities and company-owned proprietary processes. We formulated three options for SAEP:

A: Current Baseline - retain a minimal SAEP; provide current engineering and parts funding streams.

B: Current Baseline Plus - retain a downsized SAEP; somewhat increase support engineering; provide current funding streams; transfer some maintenance work from Anniston to SAEP; share in the cost of plant downsizing; and provide engineering funding for an evolutionary engine upgrade program.

C: Do not plan to retain SAEP - obtain engineering and parts from an alternate source and absorb the program transient and other significant one-time costs.

We recommend that Option B be pursued as a reasonable hedge for "risk reduction" in the near-term and as a step toward a potential long-term solution. This option adds cost of approximately $9M per year for engineering support and one-time downsizing costs of $6M, and assumes $20M per year of overhaul work is transferred from Anniston to Stratford. As part of this option, we would also propose to develop dual-use lease arrangements for key elements of the industrial base and that DoD release the $17M authorized and designated for long lead time orders.

With respect to the overall tracked vehicle base, we feel that the Army needs to maintain a "critical mass" of support engineering and logistics capability at Textron for an extended period (even when there is no production). The Army must plan and fund this effort.

Finally, the Task Force developed a proposed approach for use by the Department in making industrial base decisions, such as in the tracked vehicle case. We have outlined in our report, guidelines for use by OSD in these future decisions.

On behalf of the Task Force, thank you for the opportunity to constructively review this most important aspect of our military industrial base.

Sincerely,

Final Report of the
Defense Science Board Task Force on Tracked Vehicle Industrial Base

The charge to the Defense Science Board (DSB) Task Force on Tracked Vehicle Industrial Base was to assess the viability of this sector of the U.S. defense industry (private and public), given current Department plans, and to propose a definitive plan of action to address any shortfalls (along with cost estimates), for DoD and Congressional review. The USD (A&T) charge explicity requested that the investigation focus on the tank engine area; and the Director, Tactical Warfare Programs, requested that the group consider options that do and do not plan to retain the Stratford Army Engine Plant (SAEP) -- and provide the best course of action under either case. The members of the Task Force selected for this effort are shown in Figure 1.

The Task Force received the following briefings: Textron Lycoming Overview; Current and Future Tank Industrial Base Plans (TACOM); Armor Programs (SARDA); Engines for Rotary Wing Air Vehicles (SARDA); Cummins Engine Company (Diesel Engine Overview); Aviation Perspectives (ATCOM); Status of DSB Task Force on Depots; General Electric (Overview of GE Aircraft and Ground Vehicle Engines); United Defense (Industrial Base Perspectives); GD Land Systems (Industrial Base Perspectives); Combat Vehicle Propulsion Systems Overview; Future Tank Threat (AFSTC); GD Land Systems (Tank Industrial Base); AGT 1500 Engine Story (TACOM), Commercial Use of Government Equipment (PM M1A1); Depot Core Competency (AMC); AGT 1500 Engine Overhaul Results (PM M1A1); Advanced Field Artillery System Engine Requirements (PM AFAS/FARV); Advanced Amphibious Assault Vehicle Engine Requirements (PM AAA); Detroit Diesel (Diesel Engine Overview), ACT 1500 Engine Evaluation (PM M1A1), AGT 1500 Industrial Base (TACOM), and Army Position on Tank Engine Industrial Base (DSA(PP&P)).

In summary, the Task Force assessment of the tracked vehicle industrial base is as follows:

- Current plans at the vehicle level appear to minimally provide industrial base coverage in the near term.
- Major near term issues appear in the tank engine area.
- Significant concern exists about long term systems engineering support, at both the vehicle and subsystems level.

The Army has formulated a near-term approach to maintaining the tracked vehicle industrial base within available resources. The task force believes that with some reprogramming of these resources, particulary in the tank engine area, the base can be maintained in the near-term. However, a concern of the Task Force is the unclear nature of future tracked vehicle systems evolution and, thus, of the future needs and plans for the associated industrial base. For example, as currently envisioned, decisions regarding a next-generation main battle tank will not be made until the early 21st century. The potential discontinuity in production associated with such timing, particularly given the dramatic drop in investment that is planned over the next several years, makes the maintenance of the tracked vehicle industrial base very difficult. Decisions on the base are also

complicated by the current split of effort between public (e.g., depots) and private organizations. This split causes concern over maintaining "critical mass" -- especially in the overall engineering area and on selected critical parts.

Figure 1
Task Force Membership and Government Advisors

Chairman:	
Dr. Jacques Gansler*	TASC
Members:	
Ms. Joan Habermann*	Logistics Management Institute
LTG John Woodmansee*, USA, Ret	Perot Systems Corp.
MG Oscar Decker, USA, Ret	Private Consultant
Mr. Gordon England*	Lockheed Fort Worth Company
Mr. Lee Kapor	Private Consultant
Dr. Ernest Petrick	Private Consultant
Dr. Percy Pierre*	Michigan State University
Mr. Adolph Quilici	Private Consultant
Independent DSB Reviewers	
Dr. Kent Bowen*	Harvard Business School
Mr. Art Johnson*	Loral
Executive Secretary	
Mr. Charles Sieber	Tactical Warfare Programs, OUSD (A&T)
DSB Secretariat Representative	
Lt Col John Dertzbaugh	DSB
OSD:	
Mr. Frank Kendall	OUSD(A&T)
Mr. Roy Willis	PDUSD Logistics
Dr. Don Dix	DDR&E
Mr. Tim Bright	PA&E/Land Forces
Mr. Skipp Hayes	Comptroller/Investment
Mr. Mark Shaeffer	OASD(ES)/IEQ
Mr Dick Roemer	CAIG
Joint Staff:	
COL Jim Ethechury	J-8
Army:	
Mr. Steve Linke	OASA(RDA)
Mr. Henry Morrow	ATCOM
TACOM:	
MG James Monroe, USA	TACOM
Mr. Prince Young, Jr.	TACOM
Ms. Terri Wyckoff	TACOM

*DSB Member

Task Force Findings and Recommendations

I. Tracked Vehicles

Findings - Near Term:

1. Current near-term thrusts in armored force modernization appear appropriate, but are (embarrassingly) underfunded and stretched-out. These are: digitization of the battlefield; correcting the problems identified in Desert Storm; Advanced Field Artillery System (AFAS), Future Ammunition Supply Vehicle (FARV) and Armored Gun System (AGS) new starts; maintaining a strong technology base; and deployment of smart weapons.
2. Assuming the lease for commercial use of government tank transmission equipment at Allison is executed, the current (baseline) program minimally sustains the near-term industrial base, except for heavy vehicle (tank) engines.

Findings - Long Term:

1. The long-term health of armored force modernization is of serious concern. Future procurement budgets and R&D budgets don't provide for state-of-the-art equipment or a strong industrial base.
2. The Army's Armored Systems Modernization (ASM) effort and ARPA's advanced armored vehicle and armor/anti-armor programs were (properly) looking at the future, but were dropped, without future alternatives being analyzed and developed.
3. The Abrams (M1) tank and the Bradley (M2/3) fighting vehicle are the fielded systems through 2010+ and there are no replacements in planning or under development.
4. There is no long-term, integrated industrial base plan for the tracked vehicle industry. As now funded, it will be the (ad hoc) result of the separate funding of the projected M1A2 upgrades, AFAS/FARV and AAAV programs and the technology base projects. There is little advanced tracked vehicle system engineering being done.

Recommendations:

1. Army assess the current program and strengthen the development and funding of a three-part armored force modernization R&D Program, including: M1 and M2/3 upgrades; next generation tracked combat vehicles (systems engineering); and technology base insertion program.
2. Army to develop (with Marine Corps support) a long-term (to 2010) tracked vehicle master plan by 1 December 1994 based on recommendation 1 above, currently planned programs (e.g., AFAS/FARV and AAAV) and including an integrated industrial base plan that maximizes use of flexible manufacturing, dual and multi-use facilities, and existing capabilities.
3. OSD must establish guidelines for desired overall twenty-first century defense industrial base structure. Guidelines should address the following:

- When DoD is down to only one or two historic suppliers of a critical defense item (or capability) -- in either the private or public sector -- what metrics should be used to guide future actions (from base/plant closures through budget actions)?
- See Section III (below) for a discussion of this recommendation.

4. In order to achieve a state-of-the-art, responsive, affordable, and flexible, defense industrial base, planning should begin now to maximize dual-use of facilities, production equipment, and personnel to meet the specialized needs of both military and civilian customers. For this reason, the Task Force recommends that:
   -- Far more attractive dual-use leasing arrangements must be expeditiously established for commercial use of Government plant and equipment (e.g., at Textron for engines and at Allison for transmissions), and
   -- Acquisition reform must be aggressively pursued in order to make dual-use of facilities, equipment and personnel attractive to both government and industry through: making the procurement process less unique and less administratively burdensome; allowing use of commercial accounting standards; equitable sharing of overhead as the ratio of military and commercial work varies; and employment of other applicable commercial practices.

II. Tank Engines

Because of the near-term concern about the tank engine industrial base, the Task Force focused on this issue.

Findings:

1. The Army needs to maintain support engineering, critical sole-source spare parts, and logistics capability at Textron and retain access to Textron's unique knowledge and capabilities and company-owned proprietary processes.
2. The Stratford Army Engine Plant (SAEP), dual-use facility needs significant restructuring/down-sizing.
3. The long term viability of SAEP depends on Textron's commercial work. This commercial future is uncertain.
4. Dual-use lease procedures being worked at Allison Transmission facility are also required at Textron.
5. There is minimal and inconclusive data on the engine durability; however, it does indicate the need for continuing an engine durability improvement program, requiring Textron engineering support.
6. There are three options which should be considerd (with some possible variations) for the Stratford Army Engine Plant:

   OPTION A: Current Baseline (Plan to retain a minimal SAEP)
   - Current engineering and parts funding streams

OPTION B: Current Baseline Plus (Plan to retain downsized SAEP)

- Current engineering and parts funding streams
- Some maintenance work transferred from Anniston
- Partial cost sharing of downsizing
- Engineering funding for evolutionary engine upgrade program

OPTION C: (Do Not Plan to Retain SAEP)

- Current engineering and parts funding to alternate source

Recommendations:

1. The Task Force recommends that the issue of a significant restructuring and downsizing effort at the dual-use Stratford Army Engine Plant continue to be aggressively worked between Textron and the Army.
2. Dual-use leases for the Stratford Army Engine Plant should be immediately pursued. Such leases would permit Textron to continue government work while also pursuing appropriate commercial work at the facility. The Army is currently discussing a dual-use lease for the government furnished equipment in the Allison Transmission Division Facility. We recommend that this effort be expanded to include Textron and that both lease arrangements be supported.
3. The Army needs to maintain a "critical mass" of support engineering and logistics capability at Textron for an extended period (even when there is no production), due to Textron's unique knowledge and capability. The Army must plan and fund this effort. Additionally, some design engineering work is needed for potential future upgrades of the current engine. The Army must also fund this.
4. Some additional work may need to be transferred to the Stratford Army Engine Plant in order to maintain a viable overall operation, as well as potential equipment upgrade and/or manufacturing capability. In addition, there are mission critical spare parts, such as recouperators, that only Textron can produce. The Army must fund this work.
5. Option B should be pursued as a reasonable hedge for risk reduction in the near-term and as a step toward a potential long-term solution. This option:
   - Adds costs of approximately $9M per year of engineering and one-time downsizing of $6M (for the government's share)
   - Assumes $20M per year of overhaul work transferred from Anniston to Stratford
   - Includes development of dual-use lease arrangements for key elements of industrial base
   - Includes DoD release $17M designated for long lead time orders (FY94 money)
6. Army should assess trade-off of turbine and diesel engines for all future heavy vehicles, including replacement for AGT 1500. Additional funding (estimated at $2-4M/yr) is required for independent, funded analyses and comparisons to assess the options.

III. Generic Guidance for Defense Industrial Base (Private and Public)

The Task Force characterized the following future needs from the Defense Industrial Base, ranked by priority:

1. Maintenance and upgrades of current equipment (including surge)
2. State-of-the-art technology in critical areas and systems engineering/integration (alternative sources desirable)
3. State-of-the-art, high-quality, low-cost manufacturing potential , including critical skills (alternative sources desirable)
4. Rapid availability of field service, spare parts and expendables (for crises)
5. Responsiveness and flexibility for changing demands (from threats, technology, and/or geopolitics)
6. "Smart buyer" expertise
7. Industrial base independence of foreign military sales for long-term survival.

The Task Force formulated the following assumptions upon which the priority order of industrial preferences should be based:

1. A dual-use, world-class supplier is attractive because it must meet competitive commercial tests on cost, quality, performance and support, and has inherent surge capability.
2. In general, a private sector defense supplier is more attractive than a public sector supplier because it inherently integrates engineering, production and support; is inherently more flexible to changing technological needs; and has greater potential for dual-use activities.
3. A public sector supplier is more attractive when the work is "inherently governmental" or requires truly unique government assets/facilities

Given these assumptions, the Task Force suggests the following potential OSD guidelines for the desired overall 21st century defense industrial base structure:

1. Technological leadership must be maintained in deployed equipment and in the supporting industrial base in each critical sector (prime and lower tiers). The specific, essential skills must be defined in each sector (both private and public).
2. Work should be done in the private sector unless "inherently governmental", a unique government capability (such as a special facility or equipment), or as required by law.
3. Major system and subsystem work (including upgrades, modifications, and overhauls) should generally be done in the private sector (e.g., OEMs and major subs)
4. Wherever possible, maximum use should be made of private sector, dual-use facilities, manufacturing equipment, labor, parts, etc.

5. Private sector market forces (via the presence of credible alternatives) are preferable to sole-source regulations as a means to achieve high performance, low cost, high quality, military equipment.
6. There must be assured access to the industrial base when crisis demands require it.
7. The government must be assured of receiving a fair and reasonable price from its suppliers (whether competitive or sole source) -- and this can be achieved through market price analysis and use of other commercial practices.

Summary

The Task Force identified several positive trends within the existing DoD efforts:

- During the course of the Task Force effort:
  - There was an Army shifting of priorities to consider the long range viability of the tracked vehicle industrial base.
  - The Army and its tank engine contractor have made significant efforts to reduce costs.
- Currently, two Army/Textron process action teams are addressing tank engine issues:
  - Defining the optimum cost/performance configuration of engine overhauls
  - Addressing work allocation for the optimum industrial base

In summary, the Task Force concluded that continuity in the tracked vehicle industrial base must be maintained.

The overall direction of near-term Army programs and plans appears appropriate, except for tank engines; where the Task Force recommends some specific, limited funding and come shifting of work. However, the Task Force believes the overall program is embarrassingly underfunded and stretched out.

In midterm, there is a need for a strengthened program including:

- Continued M1 tank and M2/M3 upgrades
- Next generation tracked vehicles (system engineering)
- Technology base insertions

Finally, the Task Force found the current long range plans inadequate for structuring or maintaining a viable tracked vehicle industrial base. There is a need for increased long term tracked vehicle planning (e.g., systems engineering and next generation systems). There is also a need for planning and implementation of long-term downsizing of private and public sector facilities.

Underlying any efforts in support of the tracked vehicle industrial base is the need for broader acquisition reform to make dual-use of facilities, equipment and engineering attractive to government and industry:

- Encourage commercial work, particularly for sub-tiers

- Make government practices less unique and less administratively burdensome
- Facilitate use of commercial accounting standards
- Equitable sharing of overhead as military/commercial ratio varies
- Facilitate employment of other applicable commercial practices