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U.S. Army Combat Capabilities Development Command – Ground Vehicle Systems Center

Warren, Michigan 48397-5000

Commercial Extended Life Coolants for Military Ground Vehicle Usage – Market Survey Responses

**Kathryn Pruski
Zackery Schroeder**

Force Projection Technology – Fuels and Lubricants Branch

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- Fuels and Lubricants Branch (F&L) and Force Projection Technology's Senior Technical Expert for helping to review this report and formulate questions regarding coolant in Army ground vehicles.

1. Introduction

Currently, U.S. Army engine coolant is governed by Commercial Item Description (CID) A-A-52624A, which mandates the use of older conventional, supplemental coolant additive (SCA) based technology. SCA based coolant lacks key advantages of the newer more widely used Organic Acid Technology (OAT) based coolant, also known as Extended-Life Coolant (ELC). ELC has been commercially available and used in passenger cars since 1995, with General Motors being the first OEM to adopt OAT technology in their factory fills, but the Military has not yet adopted the use of OAT technology [1][2]. One disadvantage of SCA coolant is that it has a short life span of two years, and that is only if additives are reinhibited every six months. In 2015, GVSC learned from CASCOC that the reinhibition process was not occurring at field level maintenance, and instead a full flush and refill was conducted annually. This unnecessarily increases the maintenance burden and quantity of coolant being used by the Army.

In contrast to conventional SCA technology, ELC generally has an increased lifespan of 150,000 miles or 5+ years of service because the additives do not deplete as quickly over time [1]-[5]. Additionally, conventional coolant technology is often said to offer less protection to aluminum engine components from cavitation corrosion and provide lower heat transfer compared to some ELCs [1][6][7]. These advances in coolant technology over the last 25 years have brought to light the need for the Army to transition from conventional to extended-life coolant.

2. Project Background

This market survey report is in support of a development effort starting in FY21 funded by the U. S. Army Combat Capabilities Development Command Ground Vehicle Systems Center (CCDC GVSC) titled “Enhanced Performance Coolants” (EPC). The objective of this development effort is to evaluate commercially available ELCs and define military-specific coolant requirements to ultimately transition Army ground vehicles from SCA-based coolant to ELC. The goal of the market survey was to identify current commercially available ELCs. A secondary goal was to gather knowledge of commercially available ELCs, specifically in the following areas:

- Heat transfer capability and/or testing
- Coolant technology type and base chemistry
- Commercial availability
- Compatibility testing performed
- Product color
- Service life and interval testing

This information then aided in the identification of possible coolant candidates to be used in the EPC effort.

3. Approach

In order to reach out to the entire market, GVSC developed a market survey which was posted for 34 days: 29 JUN 20 through 31 JUL 20. The market survey was posted on beta.sam.gov.

The posted market survey consisted of two parts. Part I consisted of questions relating to operating information on the business entity. Part II consisted of questions relating directly to the extended life coolant offered by the business. GVSC's desire was to target commercial products conforming to ASTM coolant specifications (e.g. ASTM D6210, ASTM D3306), as well as any products currently in the research and development phase. In an effort to gain additional responses to the posted market survey, GVSC contacted the following twenty-five companies to encourage them to respond to the posted market survey:

- Acustrip Co Inc
- Allegheny Petroleum Products
- BG Products Inc
- CCI Corporation
- Center For Quality Assurance
- Chem-Group
- Cummins Filtration
- De Menno-Kerdoon World Oil Recycling
- Dober Chemical
- Evans Cooling Systems, Ins
- Global Tech Fluids
- Kost USA Inc
- Kukdong USA Inc
- Lubrication Technologies, Inc
- Northland Products Co
- Nuset Industries, Inc
- Old World Industries
- Prestone Products
- Recochem (Bc) Inc
- Reliance Fluid Technologies, LLC
- Safety-Kleen Systems, Inc
- Samato Kft
- Shell Oil Company
- The Valvoline Co
- Vantage Oleochemicals

GVSC received 11 responses to the survey. The posted market survey can be found in Appendix A. The responses from the companies who replied have been removed from the public release version of this document as they contain proprietary information from commercial suppliers.

The market survey was used for data collection only which fed into a second report where final candidate selection was performed.

4. Discussion & Conclusion

Market Survey Results:

The following 11 companies responded to the market survey:

- CCI Manufacturing IL Corp, Inc.
- Chem-Group
- Chevron Lubricants
- Cummins Filtration
- De Menno-Kerdoon World Oil Recycling
- Global Tech Fluids
- Kost USA, Inc
- Old World Industries
- Prestone Products
- Shell Oil Company
- The Colonna Group

See Appendix B for a consolidation of the market survey non-proprietary results. Most information captured in this survey is proprietary and cannot be shared publically, but the types of products offered and their coolant technologies are listed in Table 1 of Appendix B.

Additive technologies ranged, but all companies who responded to this survey offer OAT coolant. Most offer more than one type of technology in addition to OAT, Nitrited OAT (NOAT) being the most common. Base chemistry was predominantly ethylene glycol, with a couple companies also offering propylene glycol.

One interesting detail learned from the market survey is that some commercial OEMs state their coolant life could be as long as 8 years or 1,000,000 miles as long as tests are performed at 300,000 mile intervals to ensure the additive levels, glycol levels, and pH are still satisfactory. There is little data to back up these claims, but interesting that ELCs may last even longer than their usually stated 3-5 year lifespan.

In terms of compatibility, the general trend was that there are no known compatibility issues when mixing ELC with other ELC or conventional coolant, however, most companies recommended that their product not be diluted by more than 20% - 25% of another type of coolant. This will decrease the performance of the coolant.

In addition to a successful response rate, GVSC made many new industry contacts, both in the sales sector and technical sector of heavy-duty coolant. These contacts have already been helpful to GVSC and will continue to be key players in helping the Army develop and transition to ELC.

Conclusion:

The market survey was very successful and received more responses than GVSC expected. Products identified span a wide range of extended-life coolant technologies, including OAT, Hybrid OAT (HOAT), Nitrited OAT (NOAT), and other emerging types like poly-organic (POAT). Some of the fluids identified are for typical passenger car use, while others are designed for heavy-duty vehicles similar to the ones used in Military applications. The range of products identified provided a good cross section of products available on the market that could be ideal solutions for Army ground vehicle application.

The data collected in this market survey was used as a starting point for the selection of coolant candidates for the Enhanced Performance Coolants (EPC) developmental effort. This survey, used in tandem with a Field Survey also conducted by GVSC during FY20, produced 5 selected candidate coolants for the EPC effort.

5. References

1. Yang, B., Gershun, A., and Woyciesjes, P., “Development of Extended Life Coolant Technologies—Past, Present, and Future,” *Global Testing of Extended Service Engine Coolants and Related Fluids, STP 1556*, 2014.
2. “A History of Automotive Coolants,” Know Your Parts, 20 March 2017. [Online] Available: <https://www.knowyourparts.com/technical-resources/engine/a-history-of-automotive-coolants>
3. Bartley, L., Fritz, P., Pellet, R., Moser, V., et al., “Extreme Field Test for Organic Additive Coolant Technology,” *SAE Technical Paper Series*, 2005.
4. Chen, Y., Hudgens, D., and Eaton, E., “Comparison of Bench Test Methods to Evaluate Heavy Duty Coolant Thermal Stability,” *Journal of ASTM International*, 2007.
5. Weir, T. and Van de Ven, P., “Review of Organic Acids as Inhibitors in Engine Coolants,” *SAE Technical Paper Series*, 1996.
6. Mori, Y., Abel, M., and Miyake, Y., “Cavitation Protection Performance of Nitrite-Free Organic Acid Based Coolant for Heavy-Duty Engines,” *Journal of ASTM International*, 2007.
7. Mowlem, J., and Van de Ven, P., “Comparison of Surface Coatings Formed from Carboxylic Acid-Based and Conventional Coolants in a Field-Test Study,” *SAE Technical Paper Series*, 1996.

6. Appendix A – Posted Market Survey

Request for Information/Market Survey

Commercial Extended Life Coolants for Military Ground Vehicle Usage

DESCRIPTION OF INTENT:

THIS IS A REQUEST FOR INFORMATION (RFI), A MARKET SURVEY REQUEST IN SUPPORT OF THE FOLLOWING STUDY. No contract will be awarded from this announcement. This is not a Request for Proposal (RFP) or an announcement of a forthcoming solicitation, nor is it a request seeking Offerors to be placed on a solicitation mailing list. Response to this survey is voluntary and no reimbursement will be made for any costs associated with providing information in response to this market survey and any follow-up information requests. No solicitation document exists at this time, and calls requesting a solicitation will not be answered.

STUDY:

The U.S. Army Combat Capabilities Development Command (CCDC) Ground Vehicle Systems Center (GVSC) is conducting a market survey to identify commercial extended life coolants (ELC) utilizing organic acid technology (OAT) on the market. It is critical to identify the wide variety of ELCs available on the market in order to support the Army's fleet of ground vehicles and ground support equipment. The intent of the market survey is to identify sources of supply. These sources may be commercially available or under development.

MARKET SURVEY QUESTIONS:

Part I. Business Information:

1. Company Name:
2. Type and Size of Business:
3. Manufacturer:
4. CAGE Code:
5. Company Point of Contact:
 - a. Name:
 - b. Title:
 - c. Telephone:
 - d. Email address:
6. Business Address:
7. Web page URL:
8. Approved site certifications (e.g. ISO 14001):

Part II. ELC Survey Questions:

Section a. Basic Technical Information

1. ELC Product Name(s):
2. What is the base chemistry of the product(s) (e.g. ethylene glycol)?
3. What type of additive technology (e.g. HOAT, NOAT, OAT, etc) is used in the product(s)?
4. Are any of the components of the product(s) hazardous/toxic? If so, please provide explanation and toxicity information.
5. What color is the product(s)?
6. What are the recommended service intervals for the product(s) (e.g. reinhibiton, draining and refilling)? Please give in terms of time and/or mileage.
7. What sort of testing is conducted to determine when the product(s) should be changed out?
8. Has any compatibility testing been done on the product(s) with other ELC products? What sort of testing? Are there any ELC products that are incompatible with your product(s)?
9. What is the shelf-life of the product(s)?
10. Does the product(s) offer any heat transfer benefits over other products?
11. Is your product(s) recycled?
12. Has any standard performance specification testing been completed on the product(s) (e.g. OEM-specific, SAE, ASTM, DOT etc...)? If standard performance specification testing has been completed, please list the specification(s).

Section b. Marketing Information

13. Who are the typical users of your product(s)?
14. Has the US military ever purchased your product(s)?
15. What is the unit cost of your product(s)?
16. How is the product(s) packaged (e.g. what type of containers and in what sizes)?
17. Is the product(s) readily available in the commercial market? If so, where is it manufactured?
18. If the product(s) is manufactured outside of the United States, can it be shipped to the United States for testing?
19. If the product(s) is manufactured in the United States, can it be shipped overseas?
20. Provide Safety Data Sheet (SDS) and Technical Documents pertaining to the product(s).

RESPONSES DUE:

Responses to this market survey are DUE BY 31 JULY 2020. Please submit all completed questionnaires and any questions you may have via email to: Kathryn Pruski, US Army CCDC GVSC, kathryn.l.pruski.civ@mail.mil.

Please format the subject line of the response email as follows: “[Organization Name] response to Request for Information – Commercial Extended Life Coolants for Military Ground Vehicle Usage” Provide the email responses in PDF format. Only electronic responses will be accepted.

All interested parties and organizations are encouraged to respond to this request for information. All material submitted in response to this RFI must be unclassified and properly marked. No manufacturer/distributor shall be given a copy of another manufacture's/distributor's product information collected in this survey. GVSC will use the information gathered for studying and investigating the current available ELCs to potentially introduce to the Army's fleet of vehicles and equipment.

7. Appendix B – Consolidation of Market Survey Responses

Table 1. Market Survey Responses		
Manufacturer	Product Name(s)	Coolant Technology Type(s)
CCI Manufacturing IL	L433	OAT Only
	L437	OAT Only
	L288	LP-OAT
	L415	OAT (Mo)
	L435	OAT (Si)
	L265	OAT (P, Mo)
Chevron Lubricants	Delo ELC Advanced Antifreeze/Coolant	NOAT & OAT
	Delo ELC Antifreeze/Coolant	
	Delo XLC Antifreeze/Coolant	
	Delo ELC PG Antifreeze/Coolant	
	Havoline Universal Antifreeze/Coolant	
	Havoline Xtended Life Antifreeze/Coolant	
Cummins Filtration	ES Compleat OAT (nitrite-free)	OAT
	ES Compleat	HOAT
	ES Compleat NOAT	NOAT
DeMenmo Kerdoon dba World Oil Recycling	World Oil Pre-diluted Heavy Duty Extended Life Nitrite Free (DK750P)	Multi OAT technology
	World Oil Pre-diluted Heavy Duty Extended Life –N Antifreeze (DK612P)	
Global Tech Fluids	CelCool	Multi OAT technology
	Hydraulicool	
KOST USA	DefendAL Global Automotive Extended Life	Light Duty OAT
	DefendAL DEX-COOL	Light Duty OAT
	DefendAL HD Extended Life	Heavy Duty NOAT
	DefendAL HD NF Extended Life	Heavy Duty OAT
	DefendAL Global HD Extended Life	Heavy Duty SOAT
Old World Industries	Final Charge Global / Peak ELC-NF	OAT
ORG Chem-Group	PowerGard ELC	HOAT
		POAT (poly-organic)
Prestone	Prestone All Makes/All Model/Dexcool	OAT
	Prestone Cor Guard	POAT (poly-organic)
	Prestone CommandHeavy Duty NOAT	NOAT
	Prestone CommandHeavy Duty OAT	OAT
	Prestone CommandHeavy Duty CorGuard	Nitrite Free POAT
Shell	Rotella ELC NF	OAT or NOAT
	Rotella ELC	
	ShellZone Dexcool	
The Colonna Group	Infinity ELC Heavy Duty Coolant product line	OAT with Nitrite & Molybdate