STANDARDIZATION of MILITARY FUELS and LUBRICANTS

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Outline

- Military Objectives in Standardizations
  - NATO Work Program
  - NATO Petroleum Committee
  - Standardized Petroleum Products
  - Fuel Initiatives
  - NATO Single Fuel Policy (SFP)
  - SFP Implementation and Challenges

- Future Fuels
- Way Forward
- Summary
- Questions
“Fuel is the life blood of modern armed forces. Without an adequate supply, nothing can happen.”

Field Marshal Erwin Rommel, 1942
Objective of Military Forces

PROVIDE MORE CAPABLE AND INTEROPERABLE JOINT LOGISTICS CAPABILITIES AT THE REQUIRED READINESS LEVEL

Fuel is a logistical capability
- Develop Multinational Fuels Support
- Enhance Fuels Interoperability and Cooperation via Working Group Activity
- Enhance Petroleum Training
- Enhance Fuels Information Management
- Enhance Fuels Reporting
NATO Petroleum Work Program

¬ Aim

“Ensure efficient fuel and lubricants support to Alliance’s missions including territorial defence, expeditionary operations, energy security and alternative fuels”

¬ Engagement of National Technical Authorities to align petroleum products specification and standards
Interchangeability of Fuels, Lubricants and Associated Products used by the Armed Forces of the North Atlantic Treaty Organisations (STANAG 1135)

- The aim of this agreement is to standardise petroleum products intended for use by NATO armed forces.
- The participating nations agree:
  - on the Interchangeability of standardised products: Fuels, Lubricating oil, Hydraulic Fluids, Greases, Radar Coolants and specialty products,
  - to use the Interchangeability Chart (Annex C), as revised annually by the Naval, Army and Aviation Fuels & Lubricants Working Parties (FLWPs),
  - to include all products corresponding to their entries within their distribution, organisation, with no obligation in respect of stock levels;
  - to use the NATO code number for the marking of packaging for standardised products,
  - to apply the quality control measures defined in STANAG 3149.
Fuel Initiatives

- Development and review of Petroleum Committee’s Vision on Future Fuels
- Implementation of Minimum Fuel Quality Control
- Review of military fuel specifications and update of Standardization Documents such as STANAG/AFLPs
- R&D on future fuels and impact on military equipment
- Document the progression and impact of engine certification Programs on the use of alternative fuels
- *Use of Single Fuel Policy (SFP) in NATO operations*
Single Fuel Concept
1988 - To achieve equipment interoperability through a **single fuel for use on the battlefield** and for land based air operations, ensuring that the specification of the fuel is standardised with its commercial equivalent in common use in NATO Europe, and that the physical and chemical characteristics of the fuel are such that it can be introduced, stored, transported and distributed by the NATO Pipeline System.

2005 - Single Fuel Policy applicable NATO wide
Single Fuel Policy

Jet-A1
+ S-1745
+ S-1747
Military Aviation use
F-34
+ S-1750
Jet-A1
F-35
+ S-1750
F-63
WWEC 11 Apr 2017
SFP Implementation

- Stage 1 – Replacement of high volatile F-40 (Jet B with mil additives) with F-34 (Jet A-1 with mil additives) for use by land based aircraft - **Completed**

- Stage 2 – Replacement of diesel fuel F-54 with F-34 for use by land based vehicles/equipment with compression ignition or turbine engines - **Ongoing**

- Stage 3 – Elimination of gasoline from military use - **Ongoing**
SFP Challenges

- Chemical and physical properties
- Fit for use in aircraft turbine engines
- Fit for use in vehicles and ground equipment using compression ignition engines
- Worldwide availability and compliance with a well known standard IAW STANAG 3747 (ASTM D1655/Def Stan 91-91)

**AVIATION TURBINE FUEL - NATO CODE - F-34**
SFP - Challenges

- Availability of F-34
- Power loss in certain (older) vehicles
- Minor modifications to (older) equipment might be needed
- Wide range of cetane number of synthetic fuels
- Possible reduction in lubricity
- Use of lubricity and cetane improver additives may be necessary (S-1750)
- Compatibility with engines using advanced emission reduction technologies
- Sulphur concentration below 15 mg/kg due to advance emission systems and strict environmental emission legislations
Impact of stringent emission legislation on military equipment and SFP

Future fuels and the impact on military equipment and SFP
**Impact of Emission Regulations**

- **Engine technology and design**

  ![Diagram](source: DaimlerChrysler)

  *Advanced Emissions Reduction Technologies sensitive to sulphur content in fuel*

- **Fuel Specifications must keep-up with legislated controls**

  E.g., F-54 (EN 590/ASTM D975 diesel) – max 10/15 mg/kg sulphur, but … F-34 (SFP) max 3000 mg/kg and ISAF diesel 7000 mg/kg

(Source: DaimlerChrysler)
Coordination Activities

Fuel Specifications Evolved to Support Both Aviation and The Petroleum Industry

Petroleum Industry

Civil Aviation

Ease of Movement

Demanding Performance
NATO/ASIC rely on National Technical Authorities for Fuel Specification to establish fuel common grounds and address technical challenges

- Responsible for fuel standards and product specifications
- Investigation, specialized tests and evaluation
- Technical advice and consultation
- Support to domestic and deployed operations
- Participation in international and national committees such as ASTM, CGSB, CRC, EI, SAE etc.

Services

- Technical direction and support to the development, acquisition, upgrade or disposal of petroleum products and facilities
- Chemical and physico-chemical (performance specs) testing of petroleum, oil and lubricants (POL)
- Technical support to equipment managers and operators
- Facilitating new technology implementation including renewable fuels
What « new » fuels can we expect to enter the marketplace?

- **Near term (now)**
  - Drop-in alternative fuels
  - Biodiesel
  - Synthetic Fuels
    - (Fischer-Tropsch (FT) – GTL - HVO)

- **Medium Term (10 to 20 years)**
  - Synthetic Fuels “Drop-in Fuels”
    - (HEFA – ATJ – waste and biomass)

- **Long Term (20 years +)**
  - Synthetic Fuels (XTL - Algae)
Sources must be sustainable and renewable,

Production and distribution processes shall not exacerbate GHG emissions: Life Cycle Impact Assessment,

Synthetic fuels must be approved and qualified by the aviation industry through formal protocol such as ASTM D7566,

Biofuels shall have same performance characteristics, hence minimal impact on Quality Control program throughout the supply chain i.e. from refinery to aircraft skin,

Biofuels shall not introduce any additional contaminants to the supply chain such as surfactants, heavy metals, organo-metallic, oxygenates and nitrogen components etc.,

No negative impact on long term fuel storage stability,

Synthetic components shall be a “drop-in” product,

Zero change to current global fuel infrastructure.
Way Forward

- ASTM D4054 is a recognized certification process by which we hope that OEMs internal analysis will include military systems,

- ASTM D7566 specification is the reference for the acceptance of alternative fuels,

- Work actively with NATO allies to certify common platforms to increase interoperability,

- Work closely with Technical Airworthiness Authorities (TAAs) and OEMs to ensure smooth integration of renewable fuels in the fuel supply chain,

- Continue to monitor fuel manufacturers and research organisations initiatives in regards to alternative fuels.
NATO SFP Implementation is challenging due to stringent emission controls on ground equipment while aviation fuel specs do not mandate low sulphur, lubricity, cetane number, cloud point etc.

Initiatives undertaken by the NATO to investigate the impact of changing fuel on land, air and naval vehicles.

Future Challenges for SFP is to understand the impact of synthetic fuels into the marketplace.

NATO members are proactively engaging their TAAs/OEMs in the approval of certified synthetic fuels.
There is no going back!
Questions ?