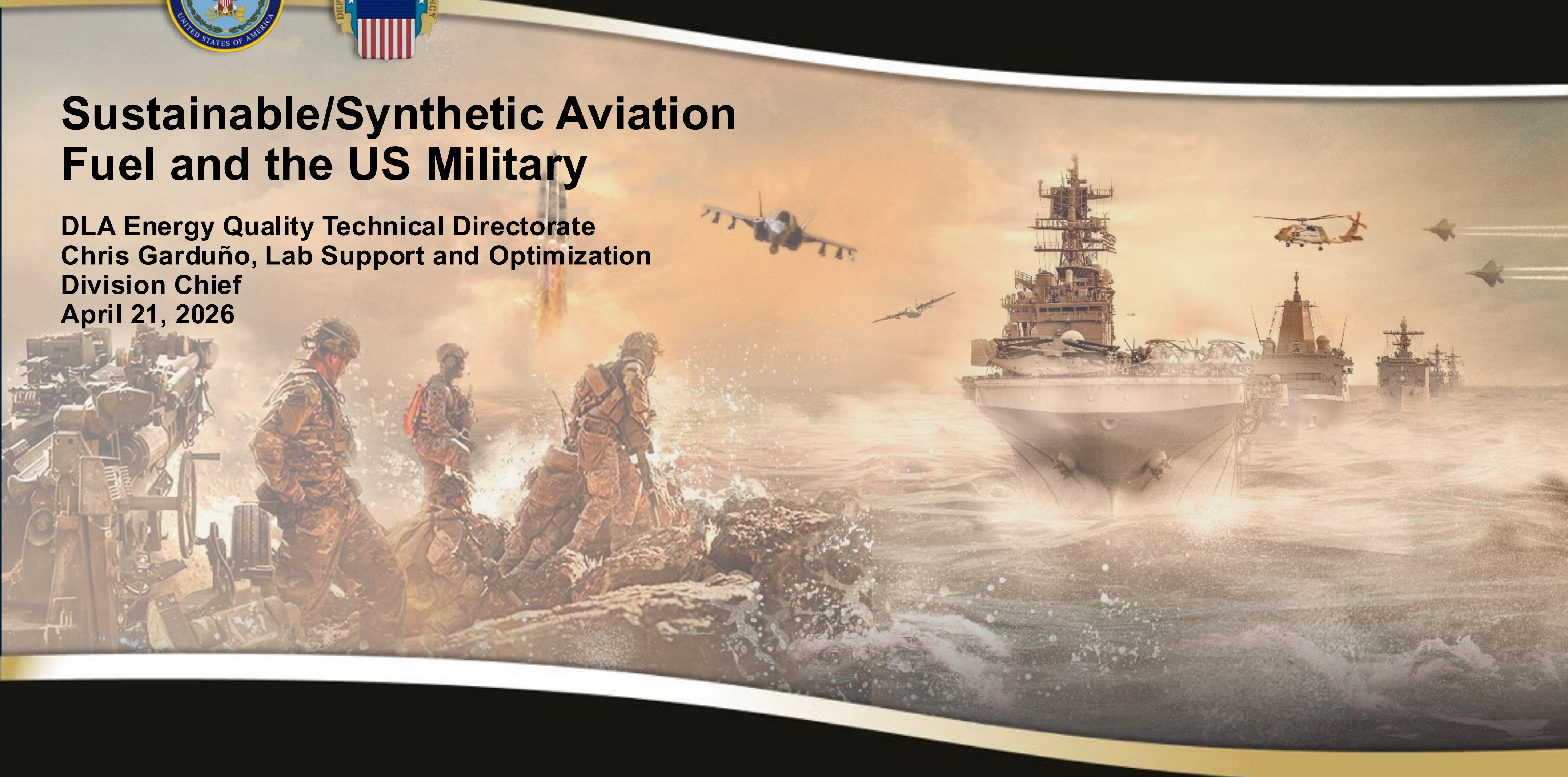
DEFENSE LOGISTICS AGENCY

Established 1961



Sustainable/Synthetic Aviation Fuel and the US Military

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THE NATION'S LOGISTICS COMBAT SUPPORT AGENCY

SAF and SATF in the US Military

2026 Worldwide Energy Conference

Purpose:

Explanation of and latest developments for Sustainable and Synthetic Aviation Turbine fuel.

Agenda:

- Terms and Definitions
- US and UK/EU legal environment
- Standards
- SATF pathways and SBCs
- Military and Procurement Perspective

Briefing Type:

- Information

Terms and Definitions

SAF/SATF Primer

SAF – Sustainable Aviation Fuel

- A low-carbon alternative to conventional jet fuel. It's designed to reduce greenhouse gas emissions from aviation without requiring changes to aircraft engines or fueling infrastructure.
- It can be produced from a number of sources (feedstock) including waste oil and fats, green and municipal waste and non-food crops.

Drop-In

- Can be directly blended into existing fuel infrastructure at airports and are fully compatible with modern aircraft.
- Doesn't signify a 100% jet fuel replacement…by all current and existing regulations it must be blended.

SBC – Synthetic Blending Component

- Renewable fuel component made from sustainable sources.
- Currently, must be blended with fossil jet fuel, is not a fuel in itself.

SATF – Synthetic Aviation Turbine Fuel.

Sustainable ("SAF") versus Synthetic ("SATF")

Executive Orders (EOs)

US Legislative Environment

EO 13990 – "Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis"

- **Revoked on 20JAN2025**

EO 14008 – "Tackling the Climate Crisis at Home and Abroad"

- **Revoked on 05FEB2025**

EO 14057 – "Catalyzing Clean Energy Industries and Jobs Through Federal Sustainability"

- **Revoked on 20JAN2025**

There are no executive orders opposing SAF. However, the revocation of climate-focused EOs may indirectly slow federal momentum behind SAF initiatives.

Other Federal Initiatives

EPA's Renewable Fuel Standard 2 (RSF2)

- 2007 mandate to have renewable blends exceed 36B gals. by 2022.
- Initial focus on ground fuels (ethanol, biodiesel).
- Greenhouse gas (GHG) reduction.

DOE's SAF Grand Challenge

- **Target:** 3b gals. of SAF production by 2030.
  - 2021: 5M gals. produced.
  - 2024: 93M gals. produced.
- **Milestones**
  - 2025: Scale pilot SAF facilities
  - 2030: Achieve 3B gals/year with >50% GHG reduction.
  - 2040: Expand feedstock supply chains.
  - 2050: Reach 35B gals/year with net-zero GHG emissions.
- **Focus** on EPA approved feedstocks and conversion technologies.
  - Agriculture waste and Alcohol-to-Jet (65% GHG reduction)
  - Waste oils and HEFA (70%)
  - CO2 + Renewable Hydrogen (90%)

Incentives (USA) vs. Mandates (UK/EU)

California - Low Carbon Fuel Standard (LCFS)

- **Incentive:** $1.50 – 3.00 per gallon
- **Credits:** SAF producers earn credits to sell to companies that need to offset traditional fuel usage.

Illinois

- **Incentive**: $1.50 per gallon SAF tax credit (2023–2032)
- **Example**: United Airlines signed a deal with Neste to use SAF at Chicago O'Hare.

Washington

- **Incentive**: $1.00 per gallon SAF tax credit (can increase up to $2.00 based on GHG reductions)
- **Unique Feature**: Allows **co-processing**, which is banned under federal IRA 45Z

2024 State by State SAF Scorecard (ICCT)

- Lack of long-term certainty.
- Subsidizes SAF instead of penalizing aviation emissions.

ReFuelEU Aviation Regulation (EU2023/2405)

- **Effective JAN 2025**
- **Mandates SAF blending into jet fuel at EU airports:**
  - **2025:** 2%
  - **2030:** 6% (with 1.2% synthetic fuels)
  - **2035:** 20%
  - **2050:** 70% (with 35% synthetic Fuels)
- **Scope:** Applies to fuel suppliers, airlines, and airports across EU
- **Implementation:** Fuel suppliers must report SAF volumes. Airlines must refuel at EU airports. Airports must provide infrastructure for SAF delivery and storage

United Kingdom

UK Legislative Environment

Renewable Transport Fuel Obligations (Sustainable Aviation Fuel) Order 2024 Effective JAN 2025

- **SAF requirements for suppliers (>15.9 terajoules):**
  - **2025: 2%**
  - **2030: 10%**
  - **2050: 22%**
- **Scope:** Focus on SAF certificates (digital credits).
- Certificates can be traded/transferred allowing obligated parties to but certificates if they haven't supplied enough SAF ("buy-out"). Incentive to supply SAF or fund other SAF suppliers.

EU and UK Mandates

Key Differences

Aspect	EU	UK
SAF% by 2030	6%	9.5%
Enforcement	Penalties for Suppliers	Buy-out mechanism with steep costs
Feedstock Strategy	Broad inclusion	Limits on HEFA to encourage diversification
Compliance Tools	Refueling rules, reporting	Certificates and Voluntary Schemes

Military Standards

Recent SAF Updates

DEF STAN 91-091 - UK Ministry of Defence's official specification for aviation turbine fuel

Issue 28 SAF related updates (May 2025)

- 30% Co-Processing Approval
  - Sharp increase from previous 5% limit, to increase SAF scalability
- Feedstock Flexibility
  - Vegetable oils, waste oils and fats, biomass sources. No major refinery infrastructure changes.
- Industry Collaboration
  - British Petroleum (BP) led taskforce in partnership with OEMs, IATA, Suppliers, and Airlines.

MIL-DTL-83313 (JP8) and MIL-DTL-5624 (JP5)

Latest updates incorporate:

- Three of four co-processing pathways.
  - Remaining pathway in review.
- 5 and ½ of the 8 synthetic blend components.
  - Another SBC in review.

EI 1533 – Quality assurance requirements for semi-synthetic jet fuel and synthetic blending components (SBC)

- Manufacture of SBCs
- Blending of SBCs with traditional jet fuel
- Co-processing of SBCs
- Export/Import and distribution of SBCs
- Testing and handling protocols
- Soak testing (material combability)
- Tank change guidelines
- Maintains alignment with D7566

SAF Pathways

ASTM D7566

ASTM D1655 - Standard Specification for Aviation Turbine Fuels

- Annex A1. FUELS FROM NON-CONVENTIONAL SOURCES
  - "Jet fuel has contained synthesized hydrocarbons since the inception of D1655. However, these synthesized materials are generated from petroleum, oil sand or shale derived feedstocks in the refinery and exhibit properties substantially similar to historically refined kerosene."
  - "the use of synthesized hydrocarbon blend stocks from new sources requires specific guidance. This guidance can be found in D7566."

ASTM D7566 - Standard Specification for Aviation Turbine Fuel Containing Synthesized Hydrocarbons

- Covers the manufacture of aviation turbine fuel that consists of conventional and synthetic blending components.

ASTM D4054 - Standard Practice for Evaluation of New Aviation Turbine Fuels and Fuel Additives

- Provides procedures to develop data for use in research reports for new aviation turbine fuels.

Production of Jet Fuel containing SBCs

ASTM D7566

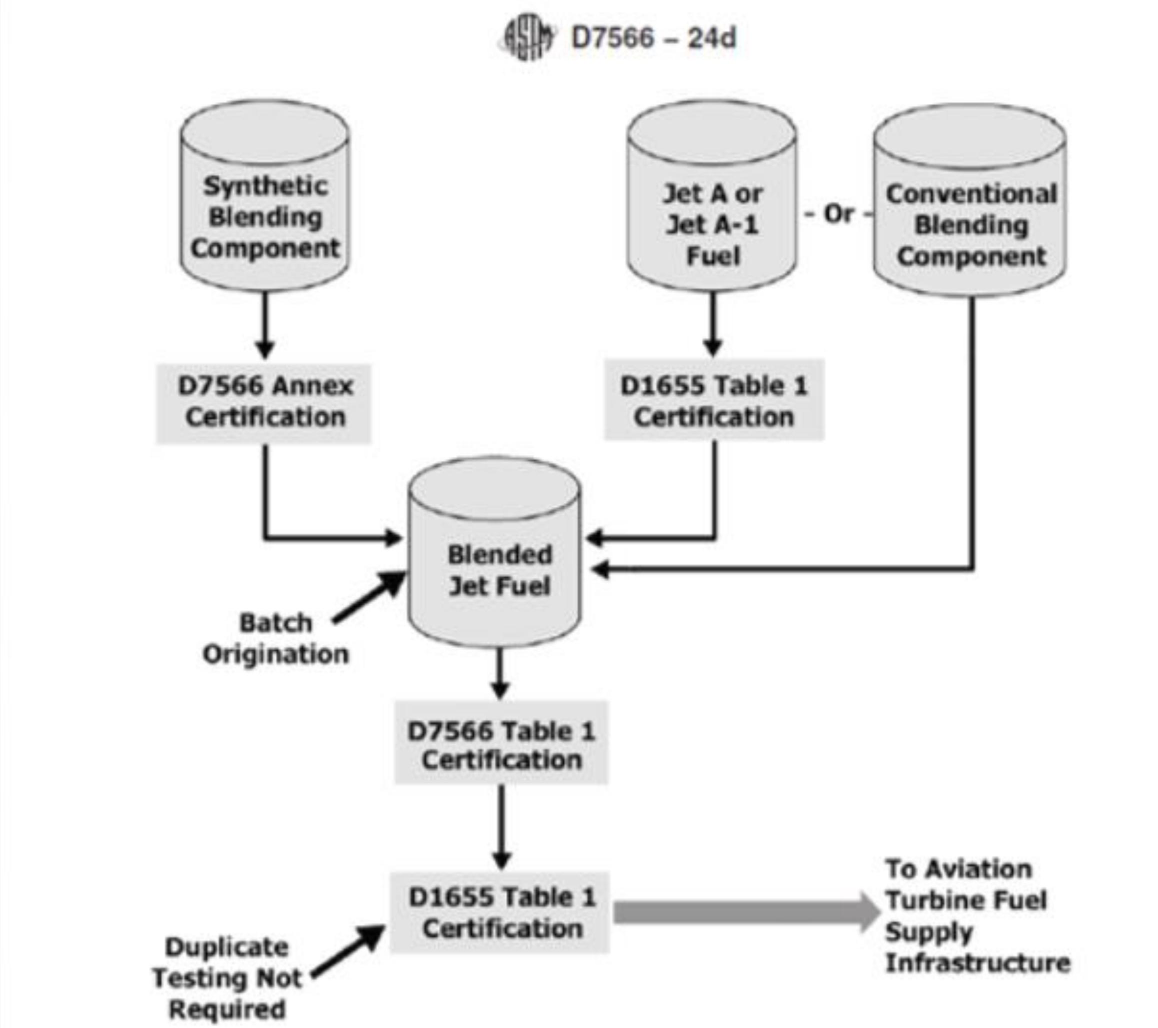


FIG. X2.1 Production of Jet A or Jet A-1 Aviation Turbine Fuel Containing Synthetic Blending Components

ReFuelEU Mandate	
Year	SAF Blend
2025	2%
2030	6%
2035	20%
2050	70%

EU's Jet Fuel Use – 14.2B gals.

6%

2030 SBC need – 865M gals.

Technology – Approved Pathways

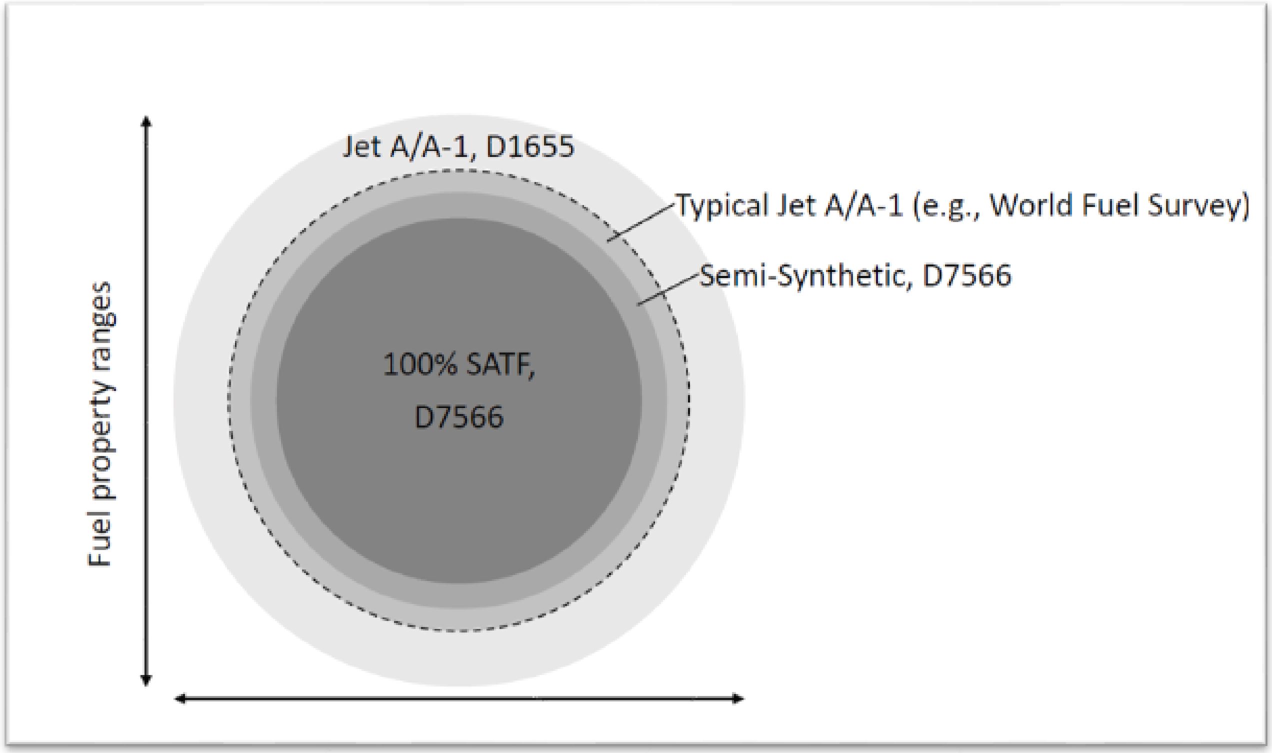
ASTM D7566

D7566 Approved Pathways		
Annex	Pathway	DoD Approved? Max Blend
A1	FISCHER-TROPSCH HYDROPROCESSED SYNTHESIZED PARAFFINIC KEROSINE (FT-SPK)	Yes – 50%
A2	SYNTHESIZED PARAFFINIC KEROSINE FROM HYDROPROCESSED ESTERS AND FATTY ACIDS (HEFA-SPK)	Yes – 50%
A3	SYNTHESIZED ISO-PARAFFINS FROM HYDROPROCESSED FERMENTED SUGARS (SIP)	Yes – 10%
A4	SYNTHESIZED KEROSINE WITH AROMATICS DERIVED BY ALKYLATION OF LIGHT AROMATICS FROM NON-PETROLEUM SOURCES (FT-SPK/A)	Yes – 50%
A5	ALCOHOL-TO-JET SYNTHETIC PARAFFINIC KEROSENE (ATJ-SPK)	Ethanol Only – 50%
A6	SYNTHESIZED KEROSINE FROM HYDROTHERMAL CONVERSION OF FATTY ACID ESTERS AND FATTY ACIDS (CH-SK or CHJ)	No
A7	SYNTHESIZED PARAFFINIC KEROSINE FROM HYDROPROCESSED HYDROCARBONS, ESTERS AND FATTY ACIDS (HHC-SPK or HC-HEFA)	Yes – 10%
A8	ALCOHOL-TO-JET SYNTHETIC PARAFFINIC KEROSENE WITH AROMATICS (ATJ-SKA)	In Process

Coprocessing (A1) – When a refinery simultaneously processes two or more feedstocks, such as an approved renewable feedstock along with a petroleum-based feedstock. DoD approved 3 of 4 pathways.

100% SAF / SATF

Is it possible?



- Claim that SBCs meet tighter limits than traditional jet fuel.
- Demonstration flights using 100% SAF.
- OEMs and producers pushing for 100% SAF certification

- Standards currently limit SAF to 50% blends.
- Some cases where aromatics are lower in SAF, unknown effects on fuel systems (elastomers).
- Infrastructure, airports and supply chains are built around traditional jet fuel. Full SAF adoption requires upgrades and planning. Blend issues at bases (matching SBCs to Fuel).

US Military Perspective

Technical oversight

Tri-Service POL Users Group (TRIPOL)

- Established in 2005 to unify Service efforts in guiding, advocating, and advancing fuel and POL technologies that support readiness, capability, and affordability across legacy and future platforms.

Approved SAF Pathways ≠ Approved Military Usage

- Services own the military fuel specifications, type certificates for most DoD aircraft.
- Commercial airframe derivatives can have very different operations and needs.
- Most fuel for military use is procured from commercial specifications.
- Fungible conveyance systems.

Key Areas

- Operational Risk
  - Performance, Durability
  - Distribution
  - Mission Capability
- Interoperability
  - Service, Partner, Commercial Interchangability
- Resiliency
  - Supply chain diversification

Military SAF Utilization Factors

Technical

- Qualification/Approval by Military and OEMs (Original Equipment Manufacturer).
- About 9/12 SAF Pathways approved (2024).

Availability

- "Book-and-claim" – Carbon accounting mechanism where airline buys SAF to claim, but fuel is actually used elsewhere.
- Demand outweighs supply.
  - Commercial aviation – 14.2B gals. (87%)
  - Military aviation – 2.2B gals. (13%)

Cost

- 10 USC 2922h – "The Secretary of Defense may not bulk-purchase drop-in fuels unless their fully burdened cost is cost-competitive with traditional petroleum-based fuels."

Procurement

- General approach, "lowest priced, technically acceptable" excludes SAF option without mandate.
- 2024 USCG SAF procurement successful (non-DoD partner, Inflation Reduction Act money/mandate)

SAF-Related Provisions in the 2025 NDAA

DoD SAF Pilot Expansion

- Include Air Mobility Command and Pacific Air Forces.
- Focus on testing blends in logistics and refueling.

Lifecycle Emissions Reporting

- DoD to report on the carbon intensity of fuels used in military aviation.
- Alignment with GREET (Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation) model standards from the Inflation Reduction Act.
- Integrate SAF into military emission tracking.

Fuel Supply Chain Resilience

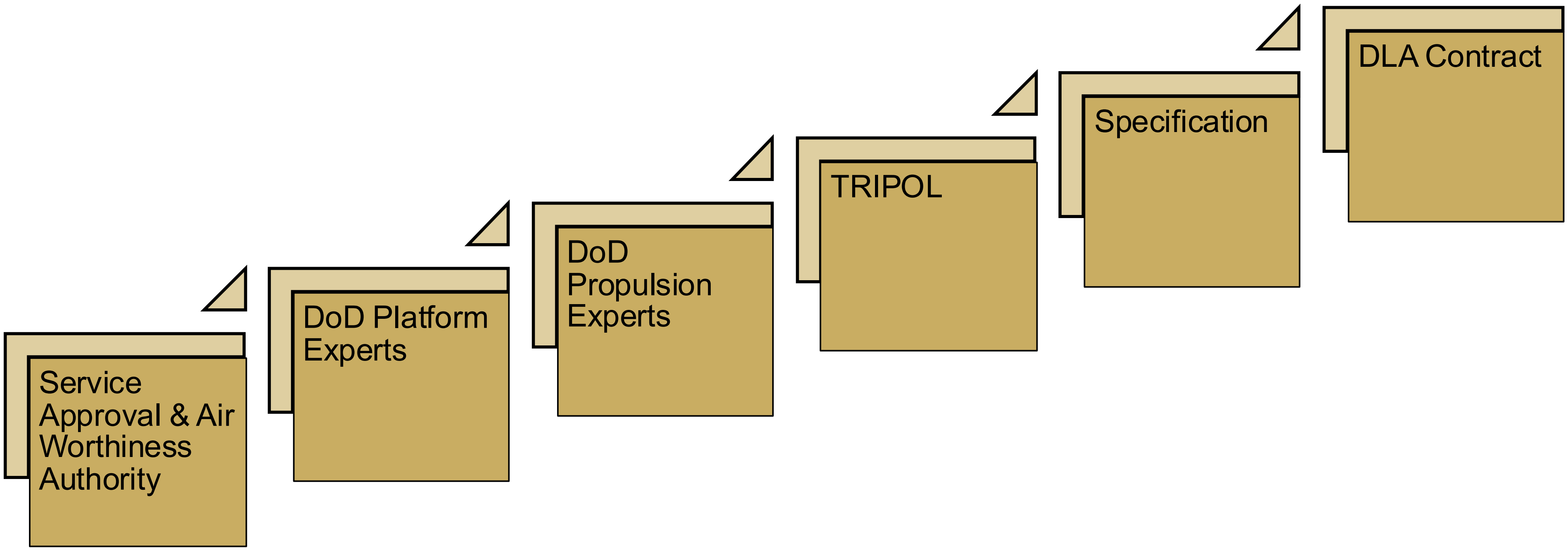
- Assess feasibility of domestic SAF production for strategic reserves.
- Increase focus on non-food feedstocks and waste derived fuels.

Strategic Posture

- SAF as energy resilience strategy for forward-deployed forces.
- Support SAF use in contingency planning for INDOPAC and European Deterrence Initiative

US Military Perspective

Approval Coordination



Other Parties:

Engine OEMs, NATO/AFIC Allies, Commercial Suppliers, Standard Organizations, US Government Agencies (FAA)

Align Mil-Specs with Commercial Specs

Developing Qualification Protocol for Deployable Fuel Production Processes

- Resiliency

Obtain "No Technical Objection" Letters (NTOs) from OEMs

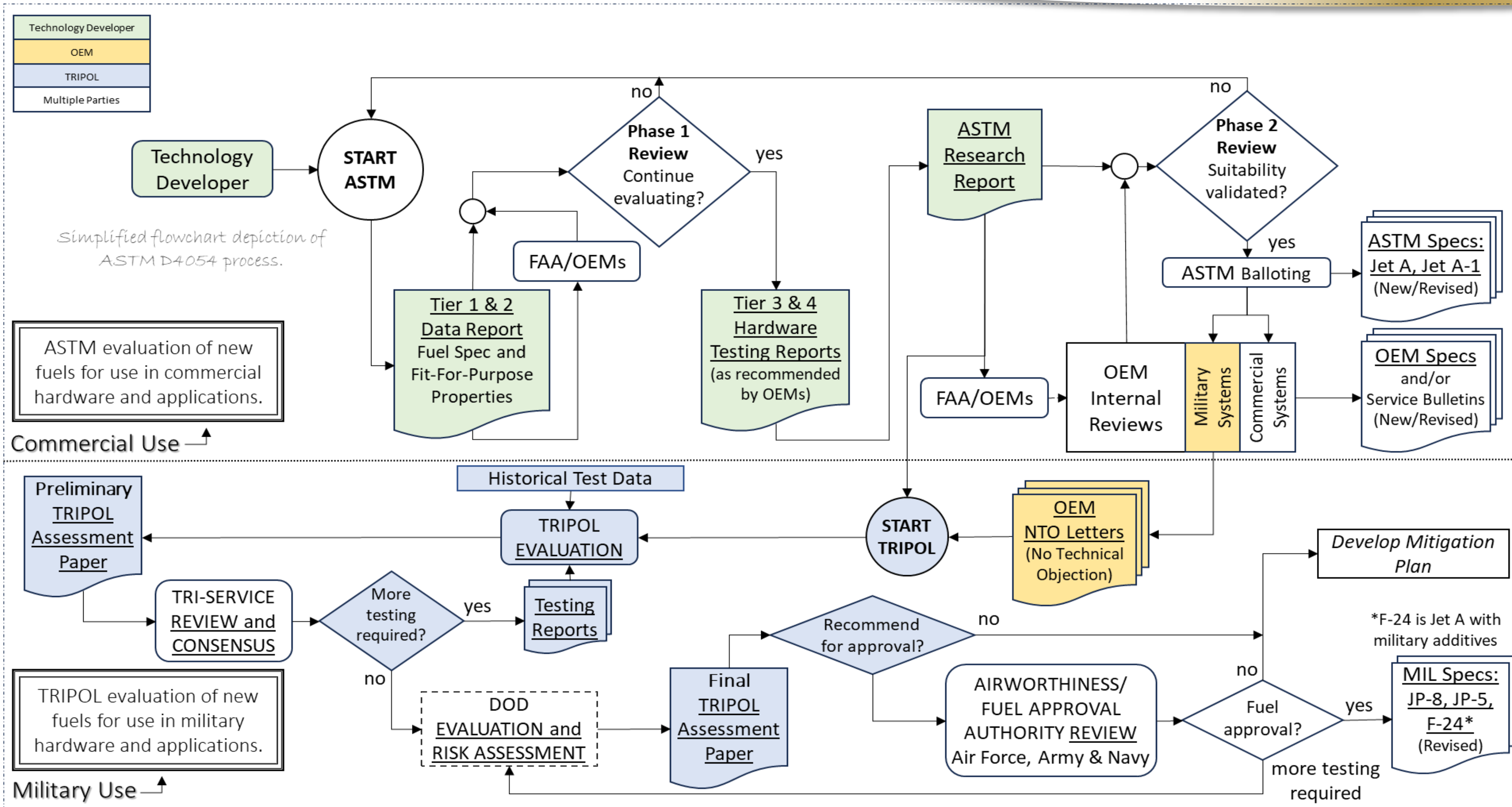
- Rolls-Royce, Pratt & Whitney, General Electric, Honeywell, Boeing
- Expand NTOs to cover Allied Nations military aircraft
- Utilize analytical assessment by similarity vice full protocol hardware testing, ASCENT 90

Harmonize efforts with Allies

- NATO AVT-397 – Research task group under NATO Science and Technology Organization, SAF in a Military Context.
- Purpose – Certification and deployment across NATO platforms, interoperability, collaboration between national certification authorities and OEMs
- Product – Report addressing current status and future needs. Detailing emerging and existing SAF, civil and military aviation fuel standards, infrastructure and logistics related to usage.

US Military Perspective

Evaluation and Assessment



Credit – 2024 WWEC SAF Brief (Kamin, Navy)

SATF Approval and Certification Overview

What's Approved?

- SATF pathways are approved – not individual aircraft.
- Once a pathway meets spec, *all platforms* using that spec can use it.

Certification Process

- Managed by TRIPOL.
- SMEs review commercial data, coordinate with OEMs.
- Produce technical assessment and risk evaluation.

Final Approval Authority

- Each Service's Technical/Air Worthiness Authority.
- Must all concur for pathway to be approved for military use.

Current Gaps and Next Steps

- ATJ-SPK (Isobutanol): Risk at high blend ratio due to low cetane.
  - R&D funded for FY26.
- CHJ SBC: Not yet evaluated.
  - Navy has tested 100% CHJ.
  - Awaiting commercialization plan for further evaluation.

US DoD Approval

↓

NATO Approval?

Military-specific considerations:

Afterburner compatibility
- Thermal stability at extreme temperatures, consistent energy density, clean combustion

Extreme environmental performance
- Maintain low freezing point, phase separation, stable combustion

In-flight refueling
- Compatibility with refueling tankers, flow properties, filter clogging

Elastomer and tank material compatibility
- Seals and leaks, compatibility and contaminants, long term exposure

Additive requirements
- Interferences, reformulations to meet mil specs

Storage and mixing of different SAF types
- Blending to achieve mandates, cross contamination, long term storage

NATO Single Fuel Policy
- Use of SAF aviation fuel in diesel engines.

The US position on Synthetic Aviation Turbine Fuel (SATF):

- **FUEL EQUIVALENCE:**
  - SATFs – whether derived via co-processing or standalone SBCs – are not considered new fuels. Instead, they represent alternative production pathways for generating fuels that meet existing specifications. The focus is on whether these pathways can yield fuels equivalent to those produced form conventional petroleum sources using standard refining methods.
- **BATTLEFIELD COMPATIBILITY:**
  - In alignment with the "single fuel on the battlefield" doctrine, any approved SATF must be fully compatible with all U.S. military assets—both aircraft and ground vehicles—that may operate in combat environments. Approvals are not granted on a platform-by-platform basis but rather on the fuel's ability to meet universal specification standards across all operational systems.

Procurement Perspective

Strategic Risks

Feedstock Competition and Inflation

- Mandates creating aggressive SAF demand, price spikes and supply bottlenecks, forward deployed NATO forces
- SAF is currently about 5x more expensive than traditional petroleum. Trade-offs in readiness and training budgets.

Out of Specification SBCs

- Loss of traceability due to blending.

Infrastructure Gaps

- EU airports are scaling SAF infrastructure, but can military bases also scale up?

Fuel Availability during Crisis

- If SAF becomes dominant fuel type, retain access to conventional jet fuel, single fuel policies.

Certification and Compatibility

- Suppliers may prioritize civil aviation standards, delaying mil spec priorities

Import Dependence

- Feedstock supply chain security and foreign influence.

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