FACTSHEET – GUIDANCE ON THE USE OF SYNTHETIC AVIATION TURBINE FUELS

AIM

This factsheet provides guidance regarding the use of synthetic aviation turbine fuels within the Defence and Defence Aviation Safety Regulation (DASR) context. The aim of the factsheet is to provide guidance for the Military Air Operator (MAO) and the Military Type Certificate Holder (MTCH) organisation to ensure the use of synthetic aviation turbine fuels remains in-accordance-with the platform's Military Type Certificate (MTC). This factsheet also discusses the role of fuel suppliers, noting however, that these organisations are not DASA regulated entities.

SCOPE

The scope of this factsheet pertains to the use of *synthetic aviation turbine fuels* for aircraft with a DASA type certificate.

SYNTHETIC AVIATION TURBINE FUELS

Whilst there are many different terms used within the aviation industry, DASA considers 'synthetic aviation turbine fuel' to be the broadest term that describes turbine (kerosene) fuels that include components produced from non-conventional sources[1]. Despite a myriad of other terms, the aviation industry has settled on the term ***Sustainable*** Aviation Fuel (SAF) for those synthetic fuel products whose net lifecycle carbon emissions are less than conventionally produced fuels.

Conventional aviation turbine fuels are produced using hydrocarbons from crude oil, liquid condensates, heavy oil, shale oil and oil sands. Synthetic aviation turbine fuels encompass a broad category of fuels derived from non-conventional hydrocarbons (such as coal, natural gas and biological feedstocks such as plant oils and animal fats) through well-established chemical and industrial processes such as Fischer-Tropsch synthesis, hydroprocessing of plant oils and animal fats, and the fermentation of sugars. The synthetic raw materials (gas, coal, biological feedstocks, etc.) undergo traditional refining steps, which include distillation and hydroprocessing to produce a kerosene. The increased Defence use of synthetic aviation turbine fuels is primarily related to security of fuel supply through lower reliance on conventional fuels, with the lower carbon footprint of fuels produced through sustainable pathways being an additional benefit.

All aviation fuels must meet defined performance criteria irrespective of their feedstock raw material. The two most widely used and recognised aviation turbine fuel specifications are ASTM D1655 (Jet A / A-1[2]) and DEF STAN 91-091 (Jet A-1)[3]. Fuels produced to these specifications form the base for military-grade turbine fuels such as F-24 and F-34 (JP-8), which include additives defined by their relevant military specifications.

The internationally recognised standard for synthetic aviation turbine fuels is ASTM D7566, which, at the time of the release of this factsheet, includes eight approved pathways for producing aviation turbine fuels with a Synthetic Blending Component (SBC). The SBC produced in accordance with ASTM D7566 can be blended with conventional fuel (up to defined blend limits[4]), and then re-identified as ASTM D1655 or DEF STAN 91-091 Jet A / A-1. ASTM D1655 and DEF STAN 91-091 also allow 'co-processing' of conventional and non-conventional feedstock to produce Jet A / A-1. The important point is that any product that meets the requirements of ASTM D1655 and DEF STAN 91-091 is considered Jet A / A-1, and there is no differentiation made based on the feedstock(s) and / or pathway used. There is also no differentiation made for military grade turbine fuel designations (e.g. F-24 and F-34) when a synthetic-blend base fuel is utilised.

Within the civil aviation sector, Jet A / A-1 are the dominant fuel types used in Five Eyes (FVEYs) countries, and ASTM D1655 or DEF STAN 91-091 are the primary specifications used depending upon location. Outside the

[1] Not all pathways for producing ***synthetic*** aviation turbine fuels can be considered sustainable.

[2] Whilst ASTM D1655 includes Jet A-1 requirements, it is primarily used as the Jet A specification.

[3] DEF STAN 91-091 is the globally recognised commercial Jet A-1 specification.

[4] Blend limits are defined in ASTM D7566, and are currently up to 50% blend for most pathways noting that it may not be achievable depending on the properties of the base fuel. Two pathways, SIP-SPK and HC-HEFA-SPK have limits of 10 % max.

continental USA, the globally recognised Jet A-1 specification is DEF STAN 91-091. Through fuel standardisation bodies, the commercial aviation community (including the main civil aviation safety authorities, and aircraft and engine OEMs) has accepted the use of all synthetic co-processing / pathways approved within ASTM D1655, ASTM D7566 and DEF STAN 91-091. Within the civil aviation sector, synthetic fuel blends re-identified as Jet A / A-1 are considered as 'drop-in' replacements with no additional requirements or limitations at the aircraft and engine level.

Within the military aviation sector, the acceptance and use of synthetic aviation turbine fuels is currently more fragmented and depends upon national military specifications and specific approvals. Some military operators approach approval to use synthetic aviation turbine fuels on a platform-by-platform basis, whilst some nations lag in terms of including approval for all ASTM D7566 pathways in their respective specifications for military grade fuels. Efforts are currently ongoing through the Air Force Interoperability Council (AFIC) to improve harmonisation of acceptance of synthetic aviation turbine fuels between Five Eyes partners. AFIC Information Publication FLG 5045 *Synthetic Aviation Turbine Fuel: Specification and Platform Certification Status, Process Definitions, Terminology, Specification Approvals and Reports* was updated to Edition 2 in Feb 2024 and contains the current status of certification efforts between the Five Eyes partners.

FUEL SPECIFICATION AND CERTIFICATION UNDER DASR

Like most aviation safety authorities, DASA does not publish fuel specifications and instead relies upon consensus standards such as ASTM D1655 and DEF STAN 91-091. DASA considers that a fuel specification is applicable once the relevant standardisation body has officially approved it.

As part of the certification processes for aircraft, engines and auxiliary power units (APUs), applicants are required to establish the list of fuel grades and fuel specifications, including the fuel additives specifications, that are compatible and fit for purpose with their product (aircraft, engine or APU). At aircraft level, the authorised fuel specifications are considered as operating limitations, and are explicitly listed as such in the Type Certificate Data Sheet (TCDS) and Aircraft Flight Manual (AFM)[5]. It is the responsibility of the aircraft operator to ensure that the fuel used for its operation is in accordance with the specifications and limitations listed in the AFM.

EASA Certification Memorandum (CM)-PIFS-009 *Fuel Specification Changes* contains further information on EASA's policy with respect to fuel specifications, including changes thereof, and this information is broadly relevant to the listing and management of fuel specifications under the DASR. Of particular relevance to this factsheet is the information within the CM regarding listing of fuel specifications with or without suffix (revision level).

RESPONSIBILITIES OF THE MILITARY AIR OPERATOR

The MAO and Continuing Airworthiness Management Organisation (CAMO) are responsible for all actions required under the pre-flight inspections to ensure that the aircraft is fit for the intended flight. The pre-flight activities include the control of the fuel uplifted prior to flight is of the correct specification, free of contamination and correctly recorded (refer to AMC M.A.301(a)(1) para 1.c.).

As noted above, synthetic aviation turbine fuels will be re-identified by the supplier per the standard fuel designations (Jet A / A-1, F-24, F-34, F-44 or equivalent US designation). Therefore, ensuring that fuel uplifted is of the 'correct specification' remains a simple confirmation that the fuel type is authorised via the AFM. If the MAO or CAMO has specific questions regarding whether synthetic aviation turbine fuels are authorised for their specific platform then they should contact the MTCH.

The same principle applies whether operating from Defence aerodromes[6] or non-Defence aerodromes; i.e. the MAO must adhere to the authorised fuels within the AFM. If the civil aerodrome fuel supplier provides the same designation of fuel as detailed in the AFM (e.g. Jet A-1) then no further investigation or checks beyond the standard AFM requirements are needed; the fuel can be used directly. Most civil aerodromes declare their fuel supply types via their online presence (e.g. website). As part of standard pre-flight preparation procedures, ADF operators should check that the destination aerodrome can provide suitable fuel supply.

[5] It should be noted that the data in both sources should be complementary and any discrepancies should be reported to the platform MTCH, who will take the necessary action to rectify those discrepancies.

[6] For the purposes of this factsheet, 'Defence aerodromes' includes heliports and Navy vessels.

RESPONSIBILITIES OF THE MILITARY TYPE CERTIFICATE HOLDER

As part of their obligations for the provision of Instructions for Continuing Airworthiness the MTCH is responsible for ensuring that authorised fuels are compatible with all aircraft parts, components and equipment, including the engine and APU, and the listing of authorised fuels in the TCDS and AFM. Within the Defence context, the MTCH will usually rely on the respective OEMs (aircraft, engine and APU) to determine and qualify fuels compatibility, and the DASR TCDS should reflect the fuel designations / specifications authorised by the OEM. The TCDS may refer directly to the authorised fuels, or it may refer to other manuals or documents where the authorised fuels are listed.

Both the TCDS and AFM will typically list fuel requirements by designation (e.g. JET A-1, JET A, JP-8, JP-5, etc.) and most will also list the relevant specification for each fuel type (e.g. ASTM D1655, DEF STAN 91-091, etc.).

To enable the MAO and CAMO organisations to be most informed, and to enable risks to be appropriately managed, DASA recommends that the MTCH should document and promulgate the approval status of fuels from synthetic sources in an appropriate location accessible to the MAO and CAMO. A note or clarifying information within the TCDS and / or AFM is one means by which this could be achieved, although DASA acknowledges that the US DoD and OEMs may not intend to update primary source AFMs with this information (unless an explicit restriction is required), in which case alternative means may be more appropriate.

DASA guidance with respect to the use of synthetic aviation turbine fuels for Defence aircraft is as follows:

- If the TCDS and / or AFM explicitly lists or mentions ASTM D7566 as an approved source of fuel or contains other explicit approvals regarding the use of certain synthetic fuels, these fuels are approved for use and no TCDS or AFM updates are needed.

- If the TCDS and / or AFM lists Jet A / Jet A-1, ASTM D1655 or DEF STAN 91-091 without a revision level, or ASTM D1655 or DEF STAN 91-091 with a revision level that post-dates the inclusion of ASTM D7566[7], then the platform can in principle use synthetic aviation turbine fuels. As detailed previously, all synthetic aviation turbine fuel pathways that are approved through ASTM D1655 and DEF STAN 91-091 have been accepted by all the main aircraft and engine OEMs. Furthermore, as outlined within EASA (CM)-PIFS-009, listing of fuel specifications without a revision level should signify that the OEM has a robust system to follow all changes to the fuel specifications and to evaluate any effects on their products. Noting the differences with respect to acceptance of synthetic aviation turbine fuels between the civil and military sectors, DASA also offers the following guidance:

    - For civil derivative platforms where the ADF configuration, role and environment (CRE) is not appreciably different to the civil CRE, the use of synthetic aviation turbine fuel should be inherently authorised through the civil certification process and the listing of ASTM D1655 or DEF STAN 91-091. Extending from the guidance above, MTCHs for civil derivative platforms should proactively confirm that the DASA TCDS and AFM listing of fuel specifications replicates the information listed in the respective civil aircraft and engine TCDS and AFM.

    - For non civil derivative platforms, the MTCH should seek confirmation from the engine, APU and airframe OEMs that use of synthetic aviation turbine fuel is authorised, under the expectation of an affirmative response. DASA also recommends maintaining alignment with the respective military certification authority (e.g. USAF, USN, US Army) for their platform where relevant, and AFIC advisory position. The MTCH should investigate the status of synthetic aviation turbine fuel authorisation for their platform(s), proactively conduct further due diligence as required, and update the TCDS and / or AFM with relevant guidance. The inclusion of additional guidance material within the AFM that clarifies existing information is not considered a change to type certificate or limitations and therefore may be processed as an administrative update.

- If the TCDS and / or AFM lists ASTM D1655 or DEF STAN 91-091 with a revision level that pre-dates the inclusion of ASTM D7566 within the specification, then the MTCH should seek OEM (aircraft, engine and APU) input for approval to use synthetic aviation fuels. As required, the MTCH will then need to update the authorised fuel specification(s) via application to DASA for a Major Change to the Type Certificate.

[7] ASTM D7566 has been included within these specifications from ASTM D1655-09 (1 Dec 2009) and DEF STAN 91-091 Issue 7 (18 Feb 2011). Note, however, that introduction of ASTM D7566 into DEF STAN 91-091 was graduated, with only the specific ASTM D7566 Annexes approved at the time being initially listed. It was from DEF STAN 91-091 Issue 10 (28 Sep 2018) that the approval for any fuel produced in accordance with ASTM D7566 has been included.

At the time of release of this factsheet, the TCDS for several platforms on the Defence register have not transitioned to DASR format and do not contain information on authorised fuel for the platform. In those instances the MTCH should make sure that the original certification (e.g. civil, foreign military, etc.) for both the airframe and the engine (usually separate TCDS for civil-certified platforms) is available to the CAMO and operators as well as the AFM. The MTCH should make sure that the AFM (and potentially other manuals) authorised fuel information is the same as the foreign (e.g. FAA, EASA, etc.) TCDS information.

Upon transition of TCDS to DASR format, the MTCH should make sure that the acceptable fuel information remains current through scheduled review and update cycles of the TCDS.

ROLE OF FUEL SUPPLIERS

This section introduces the role of the main organisations within the Defence Fuel Supply Chain (DFSC). Note that the organisations and roles below are not regulated by DASA (with respect to fuel supply), but are included herein to summarise the roles and actions that ensure fuel of the correct specification is supplied to the aircraft operator.

Organisations involved in the supply of fuel include:

- fuel vendors;
- Fuel Services Branch (FSB), who are responsible for fuel procurement, operations and maintenance of Defence Fuel Installations and in-ground pipelines;
- other approved local procurement agencies (aside from FSB); and
- units such as Combat Support Group (CSG), including the individual Mechanical Equipment, Operations and Maintenance Sections (MEOMS), and contractors who provide on-base fuel supply services.

Within this ecosystem, FSB is the primary organisation for procurement and distribution of aviation fuel to Defence aerodromes. To achieve their primary role as procurement agency, FSB undertakes certain assurance functions as described below:

- There are some technical differences between the specifications for military grade fuels across the FVEYs, due to various national legislative frameworks and the difference in base fuel grades. The Australian specification DEF(AUST)5240, Aviation Turbine Fuel (Military Grades F-34 and F-44) is maintained by FSB and provides the Australian requirements whilst aligning with NATO AFLP-3747. DEF(AUST)5240 is levied by FSB on fuel vendors for procurement purposes only. In accordance with current DEF(AUST)5240 requirements at time of writing, vendors may provide fuel with a blended component conforming to ASTM D7566 Annex A1 or A2 at a maximum of 50 percent volume. Once accepted into the DFSC, the provision of such fuel is undeclared to the end-user.
- The FSB conducts assurance across the DFSC via a tiered Advise / Accompany / Assist approach.

Tier	Name	Responsibility	FSB Role
1	Self-Assessment	Operating Agents	FSB provides Self-Assessment Tool (SAT) SAT reported to Services (action) and FSB (info)
2	Formation Level	Group / Services	FSB Advise and Assist Formation level and Contractors at Regional level
3	Service Level	Delivery Support	FSB Advise, Accompany and Assist Services and Contractors at National level
4	FSB Led	FSB Assurance	FSB Assurance team conducts assurance activities in accordance with published schedule

- The responsibilities of FSB range from fuel procurement through to the provision of fuel to individual base / aerodrome fuel cells, and ensuring fuel is kept within specification through the aforementioned assurance and advice processes. Although FSB is not responsible for delivery of fuel to the aircraft, it provides operational advice, training and assurance services described above.

Where, due to operational requirements (e.g. specific fuel trial activities), platform operators are approved to source fuel, especially synthetic aviation turbine fuels, from sources outside the FSB procurement system, the responsibility for procuring the correct specification fuel for the specific platform lies entirely with the relevant Defence procurement agency (e.g. CASG SPO), who may engage FSB for assistance and advice. The Defence

procurement agency must ensure the fuel supplied complies with the specifications defined in the platform TCDS and AFM, and they should engage with the MTCH accordingly.

POINTS OF CONTACT

DASA Point of Contact: email: daveng.submissions@defence.gov.au
FSB Point of Contact: email: fsb.poleng@defence.gov.au
DST Group Point of Contact: email david.evans29@defence.gov.au

FREQUENTLY ASKED QUESTIONS

1. *Can I uplift synthetic aviation turbine fuel to an aircraft that already contains conventional fuel?*

   Provided the fuel is authorised for the aircraft type, yes. Synthetic aviation turbine fuel is blended with conventional fuel up to the blend limits defined within the ASTM and DEF STAN specifications. Adding an authorised synthetic fuel to an aircraft that already contains conventional fuel will only further dilute the synthetic component, and is therefore acceptable.

2. *I am going to refuel my aircraft at a non-Defence aerodrome. Do I need to ask if the fuel they supply is produced via synthetic pathways?*

   If the operator's TCDS, AFM or other ICA prohibit the use of synthetic aviation turbine fuels then they should put in place controls to ensure the aircraft limitations are followed, in other cases, the operator should not need to ask if the fuel being supplied is produced via synthetic pathways. As noted above, DASA highly encourages MTCHs to be proactive in confirming that synthetic aviation turbine fuels are authorised for use on their platform(s) and documenting the status within the TCDS and AFM.

3. *How can I determine the type of synthetic aviation turbine fuel to use in my aircraft?*

   The TCDS and AFM should provide information of the authorised fuels than can be used in the platform. If the fuel complies with the specifications listed in the TCDS and AFM, then it is authorised for use. The specifications listed in the TCDS and AFM are unlikely to explicitly mention synthetic aviation turbine fuels. As explained above, fuels produced in accordance with ASTM D7566 are re-identified Jet A / A-1 in accordance with ASTM D1655 or DEF STAN 91-091.

4. *Can you tell me more about the 'AFIC harmonisation efforts' and what this means for individual platform approvals?*

   The Five Eyes Air Force Interoperability Council (AFIC) is aware that some nations have previously received letters of No Technical Objection (NTO) from major OEMs regarding the use of SAF for some or all of their platforms. However, these letters have been bi-lateral in nature and therefore not transferable to other nations. The AFIC community are therefore currently in the process of writing a letter for signature by all AFIC National Directors that is intended to go to all major engine and airframe OEMs seeking letters of NTO for the use of SAF on their aircraft/engines. Whilst release of the AFIC letter is proceeding with some urgency, the timeframe for individual OEM responses is unknown. Boeing have proactively provided an NTO letter providing No Technical Objection for the use of synthetic fuels meeting the requirements of ASTM D 7566. A copy can be provided on request. Any additional OEM responses received will be distributed to relevant stakeholders for awareness. Due to the uncertainty in the timeframes for the release of the letter and the responses, MTCH organisations are encouraged to continue individual engagements if required.

5. *As the MTCH, I need to seek guidance from my platform OEMs on the approval status of my aircraft. How should I go about this?*

   The platform MTCH organisation should approach both the aircraft and engine OEM through their sustainment contractual arrangements query/answering service. The MTCH should request confirmation that use of synthetic aviation turbine fuels produced in accordance with ASTM D7566 is authorised for the platform / engine, and request any relevant documentation that details the authorisation (e.g., AFM, Aircraft Maintenance Manual, Service Bulletin, Service Information Letter, etc.). The MTCH should request a formal response (e.g. Minute, Company letter, etc).

6. *An OEM has notified me that my engine or aircraft is NOT certified for all, or certain types of, synthetic aviation turbine fuels, or have not responded to my queries. What should I do?*

The platform MTCH organisation should ensure that their TCDS and AFM are updated to note the applicable restrictions. Additionally they should ensure the operator is aware of the restrictions and notify DASA, FSB and DSTG points of contact listed above of the restrictions associated with their platform.

7. *DEFGRAM 083/2024 states, inter alia, that "Aircraft Flight Manuals, Pilot Operating Instructions, or TCDSs that specify ASTM D1655 Jet A/F-35/Jet A-1 fuel, DEFSTAN 91-091, F-34/JP-8 or F-44/JP-5 as an operating limitation do not require revision to use these fuels", whilst this fact sheet suggests revisions may be required in certain circumstances, can you clarify?*

   This fact sheet provides DASA guidance on the responsibilities of MAO and MTCH organisations under DASRs. This includes a responsibility for the platform MTCH organisation to ensure the accuracy of the limitations within their TCDS and AFM. Guidance is also provided on circumstances where the MTCH organisation should seek confirmation from their OEMs, under the expectation of an affirmative response, that the use of synthetic aviation turbine fuel is authorised. If the platform MTCH organisation is aware of a valid limitation for their aircraft type that is not listed within the AFM, TCDS or other ICA, then an update is required.