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ANALYSIS OF REQUIREMENTS TO QUALITY OF JET FUELS FOR MILITARY AND CIVIL USE

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Abstract. The paper is devoted to the analysis of the current state in availability of military and civil jet fuels, their quality requirements and production prospects to meet growing needs. The brief outline about the history of development and use of aviation fuels is provided. The paper presents general classification of aviation fuels, which are used today, their designation and area of application. It is shown how the conditions of aircraft exploitation determine requirements to quality of jet fuels. From other side the interconnection between production processes, composition and quality parameters of available today civil and military aviation fuels is analyzed. The performed analytical study gives grounds for further theoretical and experimental works related to production, use and quality assessment of aviation fuels.

Keywords: jet fuel; quality requirements; additives; physical-chemical properties; composition safety

1. INTRODUCTION

The issue of fuel quality provision is of prior importance when it comes to safety and reliability of flights. Development of aircraft, designing of new of turbine engines, and evolving complexity of aircraft systems logically leads to increased requirements for the quality and purity of aviation fuels. Attention to ensuring the quality of aviation fuels is caused by the fact that fuel quality determines flight safety, ensures reliability, and increase the lifespan of aircraft system components; all these is directly connected to financial, human and time resources required for technical maintenance of aircraft. These issues are especially important for the military aviation fuels.

Today we observe constant growth of the military jet fuel market. In 2022 it was estimated at $9.03 billion, in 2024 at $10.07 billion, and it is expected to reach $12.15 billion by 2028 [1, 2]. The main reason for such trend is intensification of global security threats, which results in growing expenditures of governments in the defense sector that consequently drives the military jet fuel market. Asia-Pacific region with the rising defense sector budget and the developing fleet of air force and navy planes is one of the main players on the market. The growth of the market is also associated with the high costs of jet fuel. Today the key global producers of military jet fuels are Shell PLC, BP PLC, Honeywell International Inc., Repsol SA, GS Caltex Corporation and some others [1, 2].

The military conflict in Ukraine started in 2022 is an illustrative example of the impact of rising threats to global security on the market of military aviation fuels. Within the framework of support from NATO countries there was a decision to transfer F16 fighter aircraft to Ukraine. Among other preparatory activities (like training of pilots and technicians, provision of infrastructure etc.) the issue of the jet fuel supply has aroused. F16 aircrafts are designed to be powered with military jet fuel of grade JP-8. Despite the fact that Ukraine has an operating oil refinery, so far, no fuel of this grade has been produced. Only aviation fuels for commercial use of grades TS-1 and RT and later Jet A-1 have been produced. Therefore, now the country is faced to a question of providing stable military fuel supply, either via import from other countries or via production on its own facilities [3].

Taking into account the mentioned above, the main *objective* of this paper is to analyze the current state in range of military and civil jet fuels, their quality requirements and production prospects to meet growing needs.

Jet fuel, or turbine fuel, is one of the main fuels for internal combustion engines worldwide and is the most common aviation fuel for both military and civil aviation. The general term "jet fuel" is applied to fuels that meet the required properties for use in jet engines and aircraft gas turbine engines. Due to its availability and ease of production compared to gasoline, commercial lighting kerosene (kerosene) was chosen for the first jet engines during wartime. As a result, the development of commercial aircraft, in particular jet aircraft, after World War II was focused mainly on the use of kerosene-based fuels. Today, most commercial jet fuels have a composition and properties similar to kerosene, but they are subject to more stringent quality requirements [4].

The beginning of the development of aviation fuel production and use in Europe and the United States was different. One of the first types of jet fuel used in military jet aircraft was JP-1. The abbreviation JP is an acronym for jet propellant. JP-1 fuel was used since 1944 and was distinguished by its low crystallization temperature, which, according to AN-F-32, should not exceed minus 60ºC.

In 1947, the production and use of JP-3 fuel, which had a wider fractional composition and contained both kerosene and gasoline fractions, began. During the Korean War (1950-1953), military aviation shifted to the use of JP-3 fuel. The Navy and Marine Corps aircraft used in Korea were designed to use JP-3 fuel, but could also use Avgas 100/130 or Avgas 115/145 aviation gasoline. Jet fuel of a wide fractional composition based on kerosene fractions began to be produced in the United States under the JP-4 brand, in which light gasoline fractions were added into the kerosene fraction.

In European countries, gasoline was less available, so aviation fuel based on kerosene fractions prevailed. In the post-war years, as a result of NATO's desire for standardization, the British AVTAG fuel with a wide fractional composition was brought into line with JP-4 fuel. Subsequently, NATO's air fleet was completely converted from JP-4 to JP-8 fuel. This process was completed by 1990 [5].

The production and use of aviation fuels in Soviet Union and later in post-soviet countries started from aviation gasoline and after the Second World War become mainly focused on development of several jet fuels to provide the needs of various jet airliners. Fuels of grades T-1 and T-2 were developed. Later the fuel of grade TS-1 became the most popular fuel for subsonic and supersonic aircraft. By its characteristics and area of application it somehow corresponds to Jet-A-1 kerosene. The second popular fuel is grade RT, which is high-quality fully hydrotreated fuel. Due to its exceptional performance it may be used for some military aircraft and may be a substitute for the grade TS-1. Two other grades T-6 and T-8B are thermally stable fuels for supersonic aircraft and produced for military needs. During several decades the grade Jet A-1 is also in use for providing international flights [3].

2. CURRENT STATE IN PRODUCTION AND USE OF JET FUELS

2.1. General classification of aviation fuels

Today, aviation fuels are generally classified into 4 main types:

Aviation gasoline (AGAS) is a fuel produced by refining petroleum and has a boiling point range of 35-165°C. Aviation gasoline is used in aircraft equipped with piston engines. Instead, gasoline is not used in aircraft turbojet and turboprop engines due to poor lubrication properties compared to kerosene, as well as the presence of lead additives that negatively affect the operation of aircraft turbine engines. The most well-known brands of aviation gasoline are Avgas 100 and Avgas 100LL .

Aviation wide fractional composition fuels (AVTAG) are fuels produced by blending kerosene and gasoline fractions that have a boiling point range of 35-315°C. These wide-fraction fuels were first developed in the United States, where readily available gasoline fractions were used as a supplement to the main kerosene fuel. This type of fuel includes JP 4 (military) and Jet B (commercial) grades.

Aviation fuels such as kerosene (AVTUR) are petroleum distillate fuels based on the kerosene fraction with an approximate boiling point of 165-290°C. After the Second World War, they became widespread in the world, particularly in Europe, and are the most popular aviation. Among the most well-known brands of this type of fuel are JP 8 (military), Jet A 1 and Jet A (commercial).

Aviation fuels with a high flash point (AVCAT) are petroleum distillate fuels based on the kerosene fraction with a high flash point. Typically, the fuels have almost the same characteristics as kerosene-type fuels, but the flash point must be at least 60°C. These fuels are typically used in naval aircraft to ensure fire safety on board aircraft carriers. This type of fuel includes JP 8 (military grade).

All of the above four fuels can be used in gas turbine engines with certain restrictions. However, due to its high volatility and minimum octane requirements, aviation gasoline is only suitable for use in piston engines. Within each type of aviation fuel, there are usually several grades that differ slightly in some quality indicators. Military and civil fuels are labelled separately, and their quality requirements are defined by different regulations. Tab. 1 shows the classification of the most common aviation fuels fuel, area of application and the specifications that define their quality requirements. In some cases, when military fuel is not available, suitable commercial fuels can be used as a substitute. In addition, for turbojet and turboprop engines, different grades of military fuel (JP 4, JP 5 or JP 8) are allowed to be blended in the aircraft fuel tanks [4-6].

Table 1. General classification of aviation fuels

-	US specification	British specification	NATO code	Common service designation	Fuel type and area of application
Avgas 100	ASTM D910	Def Stan 91-90		AVGAS 100	Fuel for aviation piston engines grade 100/130
Avgas 100LL	ASTM D910	Def Stan 91-90	F-18	AVGAS 100LL	Fuel for aviation piston engines grade 100/130 with low lead content
Jet A-1	ASTM D1655	Def Stan 91-91	F-35/ F-34	AVTUR	Fuel for aviation turbine engines of the kerosene type
Jet A	ASTM D1655	Def Stan 91-91	F-44	AVCAT/FSII	Fuel for aviation turbine engines of the kerosene type with freezing point below -40 °C
Jet B	ASTM D6615	-	F-44	AVCAT	Fuel for aircraft turbine engines with a wide fractional composition
JP-4	MIL-DTL-5624	-	F-40	AVTAG	Fuel for aircraft turbine engines with a wide fractional composition
JP-5	MIL-DTL-5624	Def Stan 91-86	F-44	AVCAT/FSII	Fuel for aviation turbine engines of the kerosene type with a high flash point and an anti-icing additive
JP-8	MIL-DTL-83133	Def Stan 91-87	F-34	AVTUR/FSII	Fuel for aviation turbine engines of the kerosene type with an anti-icing additive
JP-8 +100	MIL-DTL-83133	-	F-37	-	Fuel for aviation turbine engines of the kerosene type with anti-icing additive and thermal oxidation stability improver

2.2. Composition and properties of aviation fuels for the military and commercial use

Until recently, almost all aviation fuels were made from kerosene derived from oil; a small percentage was produced from oil sands. Today, alternative aviation fuels derived from non-oil (renewable) raw materials are being actively developed and introduced. The requirements for such fuels are set out in the ASTM D7655 specification [7]. Kerosene is produced by direct distillation of crude oil at atmospheric pressure (straight-run kerosene) or by catalytic, thermal or steam cracking of heavier oil fractions (hydrotreated kerosene) [4, 5]. The individual elemental and hydrocarbon composition of each particular batch of aviation fuel depends on the composition of the crude oil from which it was obtained and the refining processes used to produce it. Regardless of the composition of the feedstock and its refining processes, jet fuel mainly consists of C9 to C16 hydrocarbons with a boiling point range of 145-300°C. Traditional analytical methods do not allow characterization of all individual components of complex hydrocarbon mixtures in the kerosene fraction; according to literature data, kerosene contains more than 1,000 individual hydrocarbons [8]. Based on the available literature [7-10], the predominant components of jet fuels are linear and branched paraffins (n- and iso-alkanes) and naphthenes (cycloalkanes), which typically account for more than 70% of the components by volume. Aromatic hydrocarbons, such as alkyl benzene and naphthalene, do not exceed 25% of the total volume of kerosene [8]. Olefins make up an insignificant proportion of such fuels as JP-5, JP-8 and Jet A. The typical hydrocarbon composition of aviation fuels is shown in Tab. 2. A commercial product must have the required physical, chemical and operational properties and meet the requirements of regulatory documents for a particular fuel grade. ASTM International and the UK Ministry of Defense develop and publish specifications (standards) and test methods for commercial aviation fuels, and more information on these standards is available from these organizations. These specifications also contain descriptions of the various additives that are permitted in the respective aviation fuels. Along with the quality requirements for commercial aviation fuels, requirements for military aviation fuels have been developed and are contained in separate specifications.

Table 2. Typical hydrocarbon composition of aviation fuels

Components	Average content of different classes of hydrocarbons, % (mas.)		
	Jet A-1 [9, 10]	JP-8 [10, 11]	JP-5 [10-12]
n- and iso-paraffins	32,6 – 59,1	57.2 – 63.53	32.26 – 53.0
Naphthenes	18,3 – 44,1	22.91 – 24.1	31.0 – 47.37
Aromatic hydrocarbons	17,9 – 27,2	13.56 – 18.7	16 – 20.36
Olefins	0 – 1,4	-	0 – 0.5

For commercial aviation, the most common and used are two grades of aviation fuel: Jet A and Jet A-1. Military aviation uses two kerosene-based fuels, JP-5 and JP-8. JP-8 is the military equivalent of Jet A-1. The main characteristics and properties of the these aviation fuels are given below. Standard requirements to quality of these fuels is presented in tab. 3.

Jet A-1 aviation fuel (AVTUR). Kerosene type fuel produced by mixing straight-run fractions and hydrogenation components of kerosene fractions of oil with a boiling point of 205-300 °C. This fuel is suitable for use in most of the air jet engines. It is a thermostable fuel, and therefore suitable for heat-stressed engines of aircraft with extended supersonic flight duration. This fuel has a slightly higher flash point (not lower than 38 °C) and auto-ignition temperature compared to domestic aviation fuels, which makes it safer to use. According to the standards, the freezing point of the fuel should not exceed minus 47 °C. This type of fuel is used globally in civil aviation aircraft and meets the requirements of ASTM and DEF STAN international standards. JP-8 (AVTUR/FSII) fuel used in military aviation is an analogue of Jet A-1 [4-6, 8].

Jet A aviation fuel (AVCAT/FSII). Kerosene type fuel produced from straight-run fractions of oil refining. Its properties and characteristics are quite similar to Jet A 1, except for a higher minimum freezing point, which should not exceed minus 40 °C. This fuel is used in civil aviation aircraft and is supplied only for use in the United States. The Jet A fuel specification does not require the addition of corrosion inhibitors or fuel system de-icing agents. In addition, Jet A typically does not contain the static dissipator additive used for Jet A-1 fuel [4-6].

Jet B aviation fuel (AVCAT). A kerosene-type petroleum fuel produced from straight-run fractions of crude oil refining. Its properties are similar to JP-4 and JP-5 military aviation fuels. The main difference between this fuel is the requirement for a freezing point that should not exceed minus 50 °C. The Jet B fuel specification does not require the use of corrosion inhibitors or fuel system deicing inhibitors. Currently, Jet B fuel is used only on domestic commercial flights in Canada [4-6].

Aviation fuel grade JP-4 (AVTAG), NATO code F-40. JP-4 fuel is a medium distillate petroleum product and was one of the most common petroleum products used in military aircraft of the US Armed Forces. JP-4 was the standard fuel of the US Air Force and Army aviation, and at one time accounted for 85% of the jet fuel used by the US Department of Defense. This fuel is produced by blending heavy ligroin fractions and kerosene fractions in a ratio of 36:65 to 50:50. The fuel contains paraffins, cycloparaffins, aromatics and olefins, with usual carbon number distribution from C9 to C20. Aromatics include alkyl benzene, toluene, naphthalene and polycyclic aromatic hydrocarbons. JP-4 fuel is interchangeable with NATO standard fuels coded F-40. The main difference between JP-4 and Jet B fuels is that JP-4 fuel must contain three mandatory additives, while Jet B fuel does not require these additives unless requested at the time of procurement. The conversion of US and NATO air force bases from JP-4 to JP-8 was carried out before 1990. Thus, today JP-4 fuel is practically not used anymore [4-6].

Aviation fuel grade JP-5 (AVCAT/FSII), NATO code F-44. Medium-distillate kerosene-type fuel produced from straight-run fractions of crude oil refining and used for gas turbine military aircraft. JP-5 fuel contains C9-C16 (about 53%), cycloparaffins (about 31%), aromatics (16% on average) and a small amount of olefins (up to 0.5%). The content of aromatic compounds in JP-5 fuel can vary from less than 2.5% to more than 22% by volume. The content of benzene usually does not exceed 0.02%, and a small amount of polycyclic aromatic hydrocarbons may also be present. JP-5 fuel is considered the naval equivalent of JP-4, the former standard fuel of the US Air Force and Army aviation. Naval aircraft have more stringent requirements for aviation fuel than land-based aircraft. In particular, they must be less volatile and have a higher flash point to minimize the impact of fuel vapors on personnel and reduce the risk of fires in enclosed spaces below decks. These needs of naval aviation led to the development of JP-5 fuel, which has a minimum flash point of at least 60 °C. To prevent ice formation in aircraft fuel systems, JP-5 fuel must be supplemented with a fuel system icing inhibitor (FSII) [4-6].

Aviation fuel grade JP-8 (AVTUR/FSII), NATO code F-34. Kerosene oil fuel produced by blending middle distillate straight-run fractions of crude oil refining. JP-8 fuel is interchangeable with NATO standard fuels with the F-34 code. The Ministry of Defense (MoD) Directive No. 4140.43 of 5 December 1975 stipulated that all new gas turbine-powered aircraft should be fueled by JP-8 as the main jet fuel, along with JP-5 and JP-4 fuels. Since then, JP-8 has been designated as the only fuel for military aircraft. Only naval aircraft will continue to use JP-5 for the time being due to safety concerns in the storage and handling of fuel on board ships. Currently, these types of aviation fuels are regularly used in the world, which should be taken into account when designing new aircraft systems. All other fuels are defined as alternative, limited or emergency fuels [4-6].

Table 3. Chemical and physical requirements and test methods

Property	**JP-4 (F-40)** MIL-DTL-5624W [13]	**JP-5 (F-44)** MIL-DTL-5624W [13]	**JP-8 (F-34/F-35)** MIL-DTL-83133K [14]	**Jet A-1** ASTM D1655 [15]
COMPOSITION				
Color, Saybolt[1]	report	report	report	report
Total acid number, mg KOH/g	-	<0.015	<0.015	
Aromatics, % (vol.)	<25.0[1]	<25.0[1]	<25.0[1]	<25.0[1]

	<26.5[2]	<26.5[2]	<26.5[2]	<26.5[2]
Sulfur, total, % (mas.)	<0.3	<0.2	<0.30	<0.30
Sulfur, mercaptan, % (mas.) or Doctor test[4]	<0.003 negative	<0.002 negative	<0.002 negative	<0.003 negative
VOLATILITY				
Distillation temperature, °C Initial boiling point 10 percent recovered 20 percent recovered 50 percent recovered 90 percent recovered Final boiling point Residue, % (vol.) Loss, % (vol.)	 reported reported 90 – 145 110 – 190 <245 reported <1.5 <1.5	 reported <205 reported reported reported <300 <1.5 <1.5	 reported <205 reported reported reported 300 <1.5 <1.5	 reported <205 reported reported reported 300 <1.5 <1.5
Flash point, °C [8]	-	>60	>38	>38
Density Density, kg/L at 15 °C or Gravity, API at 60 °F	 0.751 - 0.802 57.0 - 45.0	 0.788 - 0.845 48.0 - 36.0	 0.775 - 0.840 37.0 – 51.0	 0.775 - 0.840
Vapor pressure, at 37.8° C, kPa	14 – 21	-	-	-
FLUIDITY				
Freezing point, °C	<-50	<-46	<-47	<-47
Viscosity, at -20 °C, mm^2 /s	-	<7.0	<8.0	<8.0
COMBUSTION				
Net heat of combustion, MJ/kg	>42.8	>42.6	>42.8	>42.8
Hydrogen content, % (mas.)	-	>13.4	>13.4	-
Smoke point, mm or Smoke point, mm, and Naphthalenes, % (vol.)	>25.0 >18.0 <3.0	>25.0 >18.0 <3.0	>25.0 >19.0 <3.0	>25.0 >18.0 <3.0
Calculated cetane index [1]	-	reported	reported	-
CORROSION				
Copper strip corrosion, 2 hr at 100 °C	No.1	No.1	No.1	No.1
THERMAL STABILITY				
Thermal stability (2.5 hr at 260 °C) - Change in pressure drop, mm Hg - Tube rating: One of the following requirements shall be met: (1) Annex A1 VTR or (2) Annex A3 ETR or Annex A2 ITR, average deposit thickness, nm, over area of 2.5 mm	 <25 <3 -	 <25 <3 85	 <25 <3 85	 <25 <3 85
ADDITIVES				
FSII, %(vol.)	0.10 – 0.15	0.08 – 0.11	0.07 – 0.10	-
Fuel electrical conductivity, pS/m	150 – 600	-	[3]	50 – 600
CONTAMINANTS				
Existent gum, mg/100 mL	<7	<7	<7	<7
Microseparometer Rating - Without electrical conductivity additive	[4]	[4]	[4]	>85

- With electrical conductivity additive				>70

1. Determined by ASTM D1319 (or IP 156) – referee test method
2. Determined by ASTM D6379 / IP 436
3. The conductivity under the conditions at point of delivery shall be as follows:
- JP-8 (NATO F-34) between 150 pS/m and 600 pS/m;
- NATO F-35 between 50 pS/m and 600 pS/m;
- JP-8+100 (NATO F-37) between 150 pS/m to 500 pS/m.
4. The minimum microseparometer rating at point of manufacture using a Micro-Separometer (MSEP) shall be as follows:

JP-4, JP-5 and JP-8 Additives	**MSEP Rating, min.**
Antioxidant (AO), Metal Deactivator (MDA)	90
AO, MDA, and Fuel System Icing Inhibitor (FSII)	85
AO, MDA, and Corrosion Inhibitor/Lubricity Improver (CI/LI)	80
AO, MDA, FSII, and CI/LI	70

Following the global trends in transition to alternative energy sources specifications to fuels JP-5 (since 2016) and JP-8 (since 2018) allow content of synthesized hydrocarbons. Specification MIL-DTL-5624W for JP-5 fuel determines content of FT-SPK or HEFA components in quantity up to 50 % (vol.) and SIP component in quantity up to 10 % (vol.) [7, 8, 13]. Specification MIL-DTL-83133K for JP-8 fuel determines content of FT-SPK or HEFA components in quantity up to 50 % (vol.) [7, 8, 13]. Detailed requirement to composition and quality of synthesized hydrocarbons are specified by ASTM D7566 [7].

From the table above it is seen that general requirements to composition and quality of turbine fuels of grades Jet A-1 and JP-8 are almost identical. An important peculiarity of military fuel, which determines the main difference from civil one is the use of three special additives, which are CI/LI, FSII and Static Dissipater Additive (SDA). Application of these additives is set to be mandatory for all types of military fuels (JP-4, JP-5 and JP-8). This is determined by necessity to provide safe, reliable and durable operation of military aircraft in a wide range of operation conditions. The detailed description and requirements to the use of additives in military fuels is given in tab. 4. These additives as well as some other (biocidal additive, leak detection additive, into-plane water management) are optional for commercial aviation fuels [13-15].

Table 4. Specific requirements for the use of additives

<table>
<tr><td rowspan="2">Additive</td><td colspan="3">Grade of jet fuel</td></tr>
<tr><td>JP-4</td><td>JP-5</td><td>JP-8</td></tr>
<tr><td>AO</td><td>- 17.2 – 24.0 mg/l for hydrotreated fuel (mandatory)
- <24.0 mg/l for non-hydrotreated fuel (optional)</td><td>17.2 – 24.0 mg/l (mandatory)</td><td>- 17.2 – 24.0 mg/l for fuel containing hydrotreated or synthetic components (mandatory)
- <24.0 mg/l for fuel without hydrotreated or synthetic components (optional)</td></tr>
<tr><td>MDA</td><td colspan="3">- <2 mg/l (at refinery)
- <5.7 mg/l (during refilling)
Optional</td></tr>
<tr><td>CI/LI</td><td colspan="2">Equal to or greater than the minimum effective concentration
Mandatory</td><td>Equal to or greater than the minimum effective concentration
JP-8 (NATO F-34) – mandatory
NATO F-35 – optional</td></tr>
</table>

FSII	*Mandatory*		JP-8 (NATO F-34) – *mandatory* NATO F-35 – *optional*
SDA	Shal be used in amounts to meet fuel conductivity requirements specified in standards (table 3) *Mandatory*		
+100 additive	-	-	Additive SPEC AID 8Q462 or SPEC AID 8Q462W in dosage 256 mg/l The fuel should be designated as JP 8 +100 (NATO F-37) *Shall be used in JP-8 only under approval.*

Special consideration required to the use of thermal oxidation stability improver. Except the main role of energy provision turbine fuels act as a heat absorber for modern aircraft engines. They absorb heat from engine oil, hydraulic fluid and air conditioners. Taking into account more severe operation condition of high-power military aircraft comparing to civil jet liners, military fuels should possess increased thermal stability. As a reply to this need in the late 1990s, the US Air Force Research Laboratory developed the “+100” additive. The +100 additive is a fuel injector cleaning additive package consisting of detergent, dispersant, metal deactivators and an antioxidant and increases the thermal oxidation stability of the fuel by 100°F. Fuel of grade JP-8 containing this additive package are designated as JP-8+100 or NATO F-37. During field trials on F-16 aircraft, a reduction in engine coking was noted. However, the additive was found to disable the currently used coalescing filter elements, mainly for removing water and mechanical impurities. To overcome this problem the method of injecting the +100 additive after filtering the fuel through in-line filters was developed for use on aircraft refueled from trucks [5]. Currently the +100 additive may be used under approval and strict control.

3. CONCLUSIONS

The fulfilled analysis has allowed consideration of current state in production and use of aviation turbine fuels for civil and military applications. It is shown that the main quality requirements to military jet fuels are determined by the conditions of aircraft exploitation and the need to provide safe, reliable and durable operation. Taking into account current global military sector development the tendency for standardization and unification in design of military aircraft is observed, which is also reflected in requirements to jet fuels quality. This have led to the use of two grades of military jet fuel: JP-5 – the main fuel for naval aircraft and JP-8 – the main fuel for all other military aircraft. Further evolution of new gas turbine engines for military aircraft was oriented on the use of JP-8 fuel.

Analysis of the production process, properties, composition and technical requirements has shown that commercial fuel Jet A-1 possess almost the same characteristics as military fuel JP-8. The only difference is the use of set of additives, which should be obligatory introduced into JP-8 fuel right after production or before fueling the aircraft. It means that the need in military jet fuel may be provided by currently operating oil processing plants, where commercial Jet A-1 fuel is produced at regular base.

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