



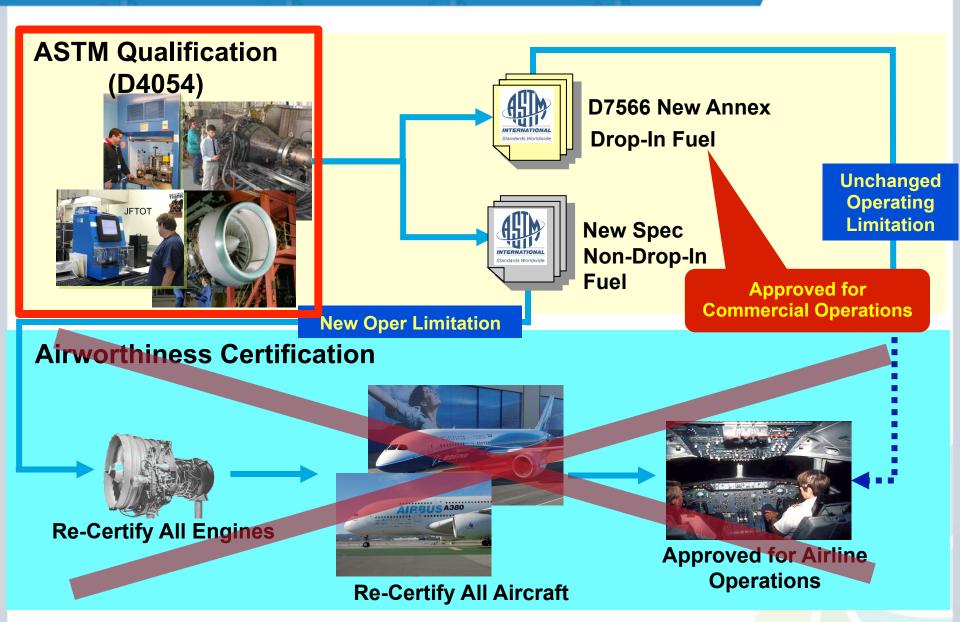
ATJ-SPK - A Certification Story

November 17th, 2016



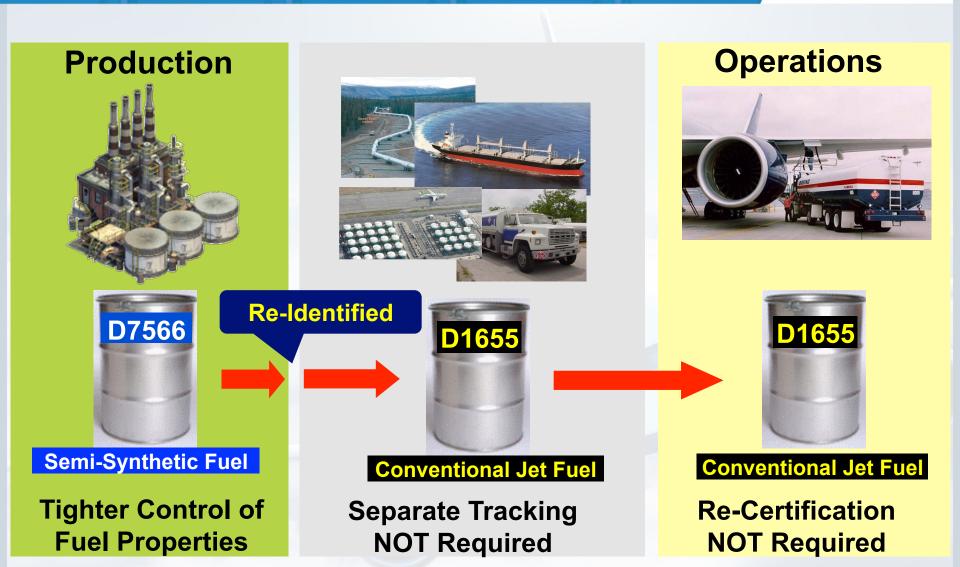
## Integrated ASTM/FAA Process





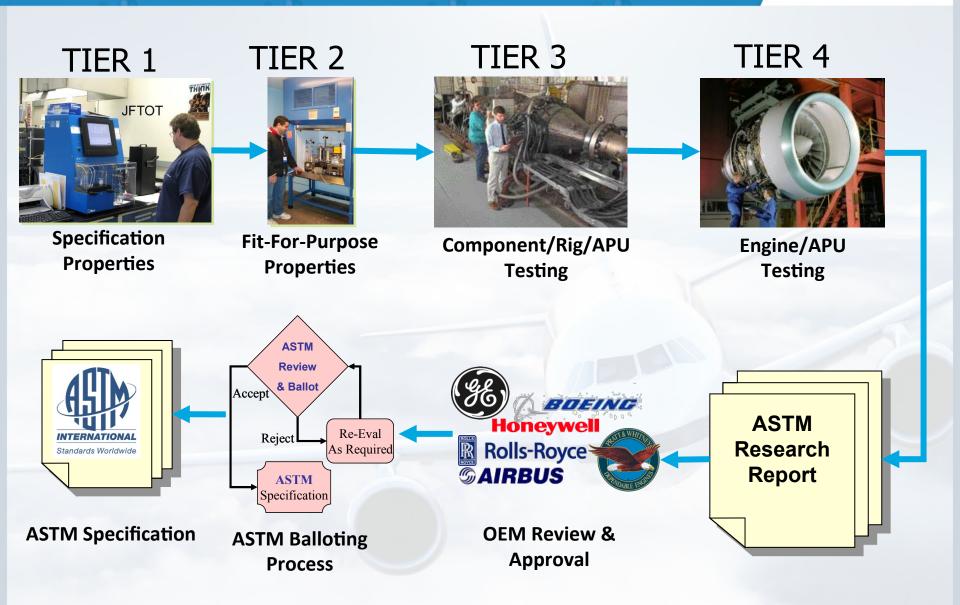
## How ASTM D7566 Enables Drop-In Fuel





# **ASTM Specification Process (ASTM D4054)**



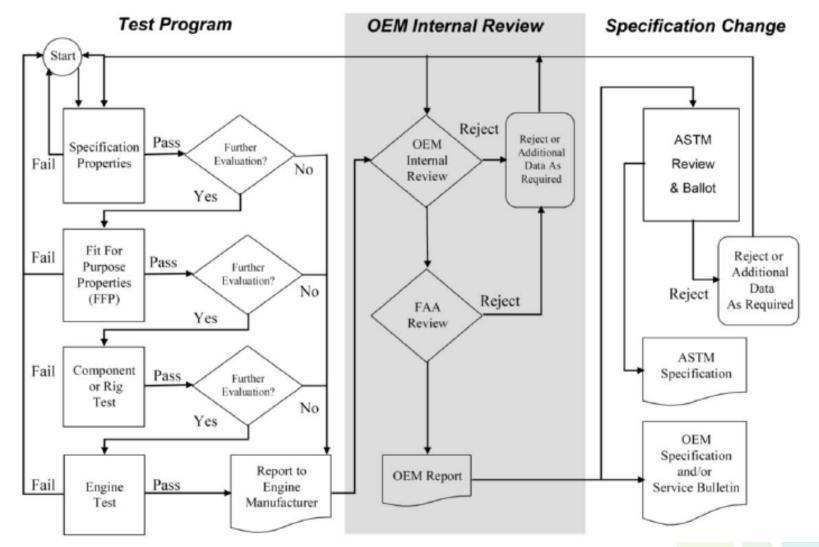


### **ASTM D4054**



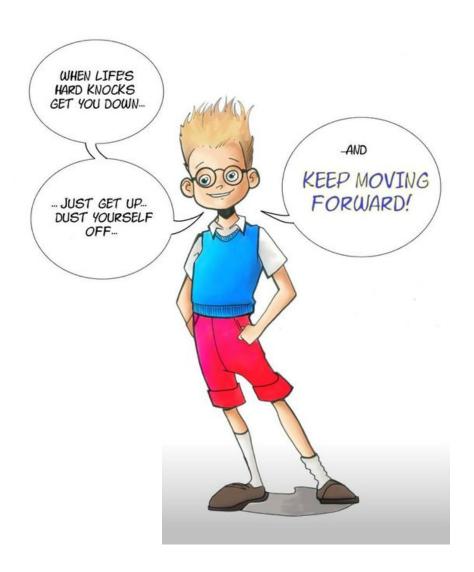
Standard Practice for Qualification and Approval of New Aviation Turbine Fuels and Fuel Additives

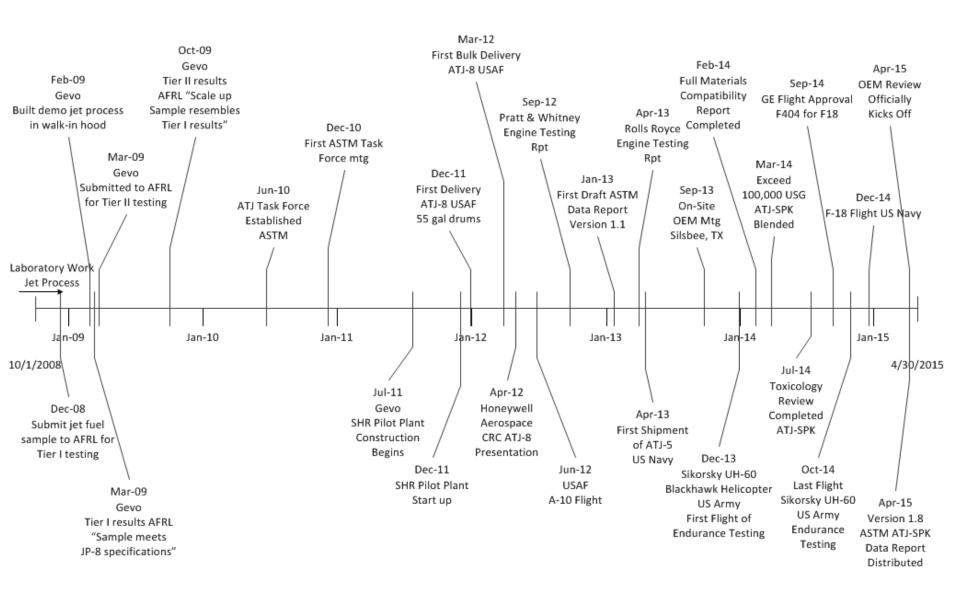
Schematic of the overall qualification process for new fuels



# Quote of the process







### **ASTM History**



- ASTM Task Force in ASTM D02-J6 Initiated in June 2010
- Group of producers assembled (Fall 2010)
- First task force meeting with engine OEMs at (Dec 2010 ASTM)
- Task Force meetings held at both 2011 ASTM and CAAFI meetings
- Task Force was broken into two main areas:
  - ATJ-SPK (paraffins) Current Research Report
  - ATK-SKA (w/aromatics) Drafting Research Report
- Over 100,000 gallons of ATJ-SPK 50/50 blend has been produced and flown.
- Gevo operates a demo scale facility in Silsbee, TX which has been operating 24/7 for the past 3 years producing ATJ-SPK.
- Extensive testing has also been completed on ground diesel engines through work funded by US Army at SwRI.

### **ATJ-SPK Testing Completed**

- AFRL Fit-for-Purpose testing 2009-2013
- Rolls Royce AE3007 testing 2012
- GE TF34 engine testing 2012
- US AFRL A-10 flight 2012
- Goodrich fuel gauging analysis 2012
- Pratt & Wittney Canada PW 615F testing
- Honeywell G230 and 131-9 testing 2011.



# Honeywell



























### ASTM D7566 Annex 5





Designation: D7566 - 16

### Standard Specification for Aviation Turbine Fuel Containing Synthesized Hydrocarbons<sup>1</sup>

This standard is insued under the fixed designation DTSMs the number insteadulely following the designation indicates the year of original adoption or, in the case of technics, the year of last revision. A number in parameters indicates the year of last reapproval, A supersofter species (s) indicates an editorial change since the last revision or reapproval.

This standard has been approved for use by apercies of the U.S. Department of Bafanse

#### 1. Scope\*

1.1 This specification covers the manufacture of aviation turbine fael that consists of conventional and synthetic blending components.

1.2 This specification applies only at the point of batch origination, as follows:

1.2.1 Aviation turbine fuel manufactured, certified, and released to all the requirements of Table 1 of this specification (D7566), musts the requirements of Specification D1655 and shall be regarded as Specification D1655 turbine fuel. Duplicate testing is not necessary; the same data may be used for both D7566 and D1655 compliance. Once the fuel is released to this specification (D7566) the unique requirements of this specification are no longer applicable; any recertification shall be done in accordance with Table 1 of Specification D1655.

1.2.2 Field blending of synthesized paraffinic kerosine (SPK) blendstocks, as described in Annex A1 (FT SPK), Annex A2 (HEFA SPK), Annex A3 (SIP), synthesized paraffinic kerosine plus aromatics (SPK/A), or Annex A5 (ATI) as described in Annex A4 with D1655 fuel (which may on the whole or in part have originated as D7566 fuel) shall be considered batch origination in which case all of the requirements of Table 1 of this specification (D7566) apply and shall be evaluated. Short form conformance test programs commonly used to ensure transportation quality are not sufficient. The feel shall be regarded as D1655 turbine fael after certification and release as described in 1.2.1.

1.2.3 Once a fuel is redesignated as D1655 axiation turbine fuel, it can be handled in the same fashion as the equivalent refined D1655 aviation turbine fuel.

1.3 This specification defines specific types of aviation turbine fuel that contain synthesized hydrocurbons for civil use in the operation and cartification of aircraft and describes fuels found satisfactory for the operation of aircraft and ongines. The

specification is intended to be used as a standard in describing. the quality of aviation turbine feels and synthetic blending components at the place of manufacture but can be used t describe the quality of aviation turbine faels for contractual transfer at all points in the distribution system.

1.4 This specification does not define the quality assurance testing and procedures necessary to ensure that fuel in the distribution system continues to comply with this specification after batch certification. Such procedures are defined disewhere, for example in ICAO 9977, EMRG Standard 1530, JIG 1, JIG 2, API 1543, API 1595, and ATA-103.

1.5 This specification does not include all faels satisfactory for aviation turbine engines. Certain equipment or conditions of use may permit a wider, or require a narrower, range of characteristics than is shown by this specification.

1.6 While aviation turbine feels defined by Table 1 of this specification can be used in applications other than aviation turbine engines, requirements for such other applications have not been considered in the development of this specification.

1.7 Synthetic blending components, synthetic fixels, and blends of synthetic fisels with conventional petroleum-derived faels in this specification have been evaluated and approved in accordance with the principles established in Practice D4054.

1.8 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this

1.9 This standard does not purport to address all of the suferly concerns, if any associated with its use. It is the responsibility of the user of this standard to establish approrate safety and health practices and determine the applicahility of regulatory limitations prior to use.

#### 2. Referenced Documents 2.1 ASTM Standards<sup>2</sup>

D56 Test Method for Flash Point by Tag Closed Cup Tester

<sup>2</sup> For referenced ASTM standards, visit the ASTM website, www.asim.org, or retact ASTM Contenue Newton at service/Fastm.org, For Annual Book of ASTM tandards volume information, refer to the standard's Document Summary page on the ARTM website.

\*This specification is under the jurisdiction of ASTM Commission Distriction Transaction Transaction Transaction Transaction Transaction and a first responsibility of Commission Commission Agency April 1, 1970. Published Age 2100. Originally approved in 2000, Last previous edition approved in 2015 as D2506—15c. DOI: 10.1509/07506-16. DOI: 10.1509/07506-16.

\*A Summary of Changes section appears at the end of this standard

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### 4Eb D7566 - 16

TABLE A4.2 Other Detailed Requirements; SPK/A*		
SPICA	Test Method <sup>®</sup>	
167	00406	
20	00406	
region	00426	
99.5	CHEST	
2 75 15	046294P 879 06904 or IP 498 06453, 02682	
0.1 per metal	5P111 or UOP 369	
1	07969	
	50°N/A 100° 20 report 98.5 2 75 15	

ortis of Table AA2, see 7.4.

teril experience with the approved synthetic fuels and is within the range of what is beloal for refined let fuel.

#### IL-TO-JET SYNTHETIC PARAFFINIC KEROSENE (ATJ-SPK)

jet synthetic paraffinic ending component for reraft and engines. The ed for contractual ex-

ments defined in this turbine engines unless entional blending comous described in 6.1.5. are to be regarded as nt are included in this

body of this specifica-

Thir Apper: officic kerosene (ATIslookel and processed tion, oligomerization,

components shall be red paraffinic kerosene iote A5.1) processed drogenation, and frac-

20

Non A5.1-It is the ultimate objective of this committee to permit use of all C2 to C3 alcohols for production of ATJ-SPK once sufficient test data is available for these other alcohols.

#### A5.5 Detailed Batch Requirements

A5.5.1 Each batch of synthetic blending component shall conform to the requirements prescribed in Table A5.1.

A5.5.2 Test Methods-Determine the requirements enumerated in this annex in accordance with the following test

A5.5.2.1 Density-Test Method D1298/IP 160, D4052 or IP

A5.5.2.2 Distillation-Test Methods D86 or IP 123, and D2887/IP 406.

A5.5.2.3 Flash Point-Test Method D56, D3828, IP 170, or IP 523.

A5.5.2.4 Freezing Point-Test Method D5972/IP 435, D7153/IP 529, D7154/IP 528, or D2386/IP 16. Any of these test methods may be used to certify and recertify jet fael. However, Test Method D2386/IP 16 is the referee method. An interlaboratory study (RR:D02-157216) that evaluated the ability of freezing point methods to detect jet fuel contamination by diesel fuel determined that Test Methods D5972/IP 435 and D7153/IP 529 provided significantly more consistent detection of freeze point changes caused by contamination than Test Methods D2386/IP 16 and D7154/IP 528. It is recommended to certify and recertify jet fuel using either Test Method D5972/IP 435 or Test Method D7153/IP 529, or both, on the basis of the reproducibility and cross-contamination detection reported in RR:D02-1572.16 The cause of freezing point results outside specification limits by automated methods should be investigated, but such results do not disqualify the fael from aviation use if the results from the referee method (Test Method D2386/IP 16) are within the specification limit. A5.5.2.5 Total Acidly—Test Method D3242/IP 354.

A5.5.2.6 Thermal Stability-Test Method D3241/IP 323.

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	AT J-SPK	"lest Method"
Max	0.015	D0042/IP 954
		DBM <sup>®</sup> or IP 123 <sup>®</sup>
Max	206 report report	
Max	300	
MIL	21	
Max	1.8	
Mile	1.0	
MIII	287	DNA, DOMENT, IF THE OF ITS
	730 % 770	DIDWAYF 160, D6052 of IF 36
Mile	-40	DESCRIPTION COS. DITTERNY 529
		CITISAND NOS, OF COMMOND 1
Mile	320'	G0041 <sup>6</sup> AP 303 <sup>6</sup>
Mari	26	1000
	-	
Less than	3	
	No peacock or abnormal octor	
	deposits	
Max	86	
Min	17	
More	24	

purchaser and suggiller. When the agreed flash point is less than 38 °C then the product believing component. Igned by Teat Mathod (166), which is the preferred method, in case of dispute, Teat Wathod

with werification of process stability and compositional consistency, the are used to assess the subscript of let but for available, operation statistic and regulatory set coupting media the requirements in 2004. Takes 0 and give equivalent 2004 it results teld protocol to demonstrate agricultures of heater tables from other applicate in ordinary Report 192,000-1930. Traillant tables and fifter 4th, manufactured by the COM (FAC, 8004 AP 323 test method. Heater tube and filter kits, manufactured by Falex (Falex Corporation, ulvalent results (see 0354n for research report references).

ation by ASTM international A3 ETR, when available. If the Annex A2 ITR device reports "NA" for a lubers volume us rating of the heater tube by the method in D0341 Avnex A1 is not required when Avnex see of dispute between results from visual and methological methods, the referee shall be

is that will significantly expose the product to an and in such a way as to ensure adequate smaller to prevent perceibation and gum formation after manufacture. In line tripotion and

A5.6.2.1 Cyclopuraffes-Test Method D2425. A5.6.2.2 Animatics-Test Method D2425. AS.6.2.3 Paraffee...Test Method D2425. A5.6.2.4 Carbon and Hydrogen-Test Method D5291.

A5.6.2.5 Nitrogen-D4629/IP 379. A5.6.2.6 Water-Test Method D6304 or IP 438.

A5.6.2.7 Sulfur-Test Methods D5453 or D2622. Either of these test methods can be used to certify and recertify jet fuel. However, Test Method D5453 is the referee method. A5.6.2.8 Metals-Test Method D7111 or UOP 389.

A5.6.2.9 Halogens-Test Method D7359.

