CLAIMS

What is claimed is:

1. A process for producing aviation fuel from syngas, said process comprising:

(a) providing a starting syngas stream comprising H_2 and CO;

(b) purifying said syngas feed stream to generate a clean syngas stream;

(c) optionally, adjusting said H_2/CO ratio of said starting syngas stream or said clean syngas stream;

(d) feeding said clean syngas stream to an alcohol-synthesis reactor operated at effective alcohol-synthesis conditions and in the presence of an alcohol-synthesis catalyst, to catalytically convert at least a portion of said H_2 and said CO to a C_1–C_{10} mixed-alcohol stream and a reactor off-gas;

(e) optionally, purifying said C_1–C_{10} mixed-alcohol stream to generate a clean C_1–C_{10} mixed-alcohol stream;

(f) feeding said C_1–C_{10} mixed-alcohol stream or, if step (e) is conducted, said clean C_1–C_{10} mixed-alcohol stream to a dehydration reactor operated at effective alcohol-dehydration conditions and in the presence of a dehydration catalyst, to catalytically convert at least a portion of said C_1–C_{10} mixed alcohols to C_2–C_{10} mixed olefins;

(g) feeding said C_2–C_{10} mixed olefins to an oligomerization reactor operated at effective oligomerization conditions and in the presence of an oligomerization catalyst, to catalytically convert at least a portion of said C_2–C_{10} mixed olefins to a hydrocarbon stream comprising C_5–C_{16} mixed hydrocarbons;

(h) optionally, separating and removing light or heavy hydrocarbons that are not within the C_5–C_{16} range, from said hydrocarbon stream;

(i) feeding said C_5–C_{16} mixed hydrocarbons and hydrogen to a hydrogenation reactor operated at effective hydrogenation conditions and in the presence of a hydrogenation catalyst, to catalytically hydrogenate at least some C=C double bonds within said C_5–C_{16} mixed hydrocarbons, thereby generating stabilized C_5–C_{16} mixed hydrocarbons; and

(j) recovering said stabilized C_5–C_{16} mixed hydrocarbons as aviation fuel,

wherein the starting syngas stream is obtained from a source selected from the group consisting of methane steam reforming, methane autothermal reforming, methane partial oxidation, biomass gasification, waste polymer gasification, municipal solid waste gasification or plasma treatment, coal gasification, coke gasification, CO_2 conversion to syngas, and combinations thereof.

2. The process of claim 1, wherein said clean C_1–C_{10} mixed-alcohol stream is a C_2–C_5 mixed-alcohol stream.

3. The process of claim 1, wherein said clean C_1–C_{10} mixed-alcohol stream has a number-average carbon number selected from 2 to 5.

4. The process of claim 1, wherein said C_5–C_{16} mixed hydrocarbons are C_8–C_{16} mixed hydrocarbons, and C_5–C_{15} mixed hydrocarbons.

5. The process of claim 1, wherein said process further comprises a step of feeding a portion of said starting syngas stream and/or said clean syngas stream, as an aromatics-allocated syngas stream, to a syngas-to-aromatics reactor operated at effective aromatization conditions in the presence of an aromatization catalyst, to catalytically convert at least a portion of said aromatics-allocated syngas stream to a C_6–C_{16} mixed aromatics stream.

6. The process of claim 5, wherein said C_6–C_{16} mixed aromatics stream is combined with said stabilized C_5–C_{16} mixed hydrocarbons to generate an aromatics-containing aviation fuel.

7. The process of claim 6, wherein said aromatics-containing aviation fuel contains from about 8 vol% to about 20 vol% total aromatics content.

8. The process of claim 1, wherein said starting syngas stream has a starting H_2/CO ratio selected from about 0.7 to about 1.6, preferably from about 0.8 to about 1.2.

9. The process of claim 1, wherein said clean syngas stream has a reactor-feed H_2/CO ratio selected from about 0.7 to about 1.6, preferably from about 0.8 to about 1.2.

10. The process of claim 1, wherein said starting syngas stream contains excess H_2 relative to a selected reactor-feed H_2/CO ratio, and wherein said excess H_2 is separated from said starting syngas stream or from said clean syngas stream, and wherein said excess H_2 is utilized as at least some of said hydrogen in step (i) as feed to said hydrogenation reactor.

11. The process of claim 1, wherein substantially no methanol feeds into said dehydration reactor in step (f).

12. The process of claim 1, wherein in step (d), said alcohol-synthesis catalyst is a metal sulfide catalyst.

13. The process of claim 12, wherein said metal sulfide catalyst is a sulfided cobalt-molybdenum catalyst, and wherein said sulfided cobalt-molybdenum catalyst is potassium-promoted.

14. The process of claim 1, wherein step (e) includes one or more of sulfur removal, water removal, and distillation.

15. The process of claim 1, wherein said reactor off-gas is recycled to step (b).

16. The process of claim 1, wherein step (h) is conducted.

17. The process of claim 16, wherein step (h) utilizes distillation.

18. The process of claim 1, wherein said process uses heat evolved from at least one of step (d), step (g), or step (i), in at least one of step (f) or step (h).

19. The process of claim 1, wherein said aviation fuel qualifies as sustainable aviation fuel under ASTM D7566-24a.