# Swift Enterprises Briefing Summary

1. **Swift Fuel and its Status**

   Swift Fuel is a blend of two hydrocarbons, isopentane and an aromatic hydrocarbon called mesitylene, also known as 1,3,5-trimethylbenzene. Isopentane is commonly available; mesitylene is currently produced chiefly in China and Poland and must be shipped to the United States. Purchased mesitylene is prohibitively expensive. Therefore……

   Swift owns a catalytic process which can convert acetone to mesitylene. Acetone can, in turn, be manufactured from propylene {oil refinery product} or from biomass. Acetone is a commonly available compound.

   Questions/Answers:

   a. Is the fuel you are currently testing your final recipe, or can further changes be expected? Is this an exclusively biomass fuel?

      *A: Final recipe since 2007; not exclusively biomass {see above.}*

   b. What are you planning as a feedstock for the biomass fuel component, to support commercial volumes?

      *A: Varies, not restricted; could be many different crops depending upon area of country and other factors*

   c. Last year Swift issued a press release mentioning use of a petroleum-based formula instead of biomass. Why? Is that still an option?

      *A: Yes. The two fuel components can be made from multiple sources; economics will determine which process is used long-term. See above.*

   d. With whom are you testing the fuel; which engines/aircraft?

      *A: Embry Riddle/Cessna/Lycoming on Cessna 172S; Trace Engines in OE600A V8 engine other OEM's and companies that have tested Swift Fuel include: AvFuel Corporation, Teledyne Continental Motors, Beechcraft Aircraft Company, Dixie Services (ASTM Test Laboratory), General Aviation Modifications Incorporated (GAMI), Purdue University Aviation Technology Dept., National Institute of Standards and Technology (NIST), & United States Air Force Research Labs (AFRL).*

   e. What problems have been discovered during testing that remain unresolved?

      *A: At this point, our industry and FAA testing partners have found no "show-stoppers." That being said, we are continuing to fully evaluate 100SF on all*

*extreme engine/airframe combinations.*

f. Have you tested for cold temperature extremes, both starting and operating? How cold? Same question for hot extremes. What problems arose in these environments, and what is the solution?

*A: Cold environs tested, further testing with ERAU; hot extremes also tend not to be an issue, although further proving by independent 3rd party evaluators continue.*

g. Have you discovered any materials compatibility issues? Do you believe you are familiar with any such issues that might arise, and are there any for which you have not yet tested?

*A: Testing remains; expecting none, but won't know until aircraft manufacturers identify their concerns and testing is accomplished; currently testing at Cirrus*

h. What are the observed consumption rates for comparable HP output {for the fuel being tested} – eg, 250 HP?

*A: Not directly answered; however, energy density is 7-15% higher than 100LL. Specific fuel consumption for equivalent horsepower was roughly equivalent (±3%)*

i. What is the weight/gallon for your fuel?

*A: 6.5-6.6 lb/gallon; 100LL ranges from 5.8-6.5 lb/gallon*

j. Other comments:

i. Can mix with 100LL in any ratio without adverse operations

ii. While this fuel is not technically a drop-in {no fuel with TEL would be}, it is non-compliant to D910 in only 4 of 26 parameters –presence of lead, two points on the distillation curve, and energy content per pound (although energy content per gallon is higher, leading to increased range per gallon)

iii. Health hazards of pure components are known and listed on MSDS sheets when the pure chemicals are purchased from specialty chemical suppliers. Swift has compiled an MSDS sheet on 100SF based on the two for the individual components. There is no known carcinogenic effect for either of the fuel components. From a safety standpoint, 100SF should be

treated like regular unleaded gasoline.

iv. Swift fuel separates from water more easily, and quickly, than 100LL and is less hydrophilic.

v. During testing no injection or carburetion jetting/fouling problems have been encountered.

vi. Purpose for lead includes management of the combustion flame front {ie, need for octane}; and lubrication for valves, valve guides and seats in some older engines using non-hardened valve components. And it's cheap. Testing so far indicates Swift fuel lubricity is adequate but more testing needs to be done on higher power engines such as Merlin and various high-power radials.

vii. Test cell performance using a brand-new Lycoming IO-540, burning through 4,500 gallons of fuel, demonstrated better detonation margin for Swift when compared with 100LL, and equivalent wear on parts {ie, equal lubricity – see previous comment}

2. **Approval and Qualification Process**

Swift Fuel has first been tested for compliance with ASTM 7547, which is D910 without the requirement for either lead or petroleum as the source material. Approved by the ASTM Aviation Fuels Subcommittee in December 2010, Swift has additionally created a Test Fuel Specification {no number assigned} which is a specification for a full performing fuel {per D910} but for use in testing applications only. This spec has been successfully tested by 14 organizations. Swift expects approval by the full ASTM Petroleum Products and Lubricants Committee by 31 March, 2011, followed shortly by the assignment of an ASTM specification number.. However, a conforming fuel will not yet be ready for sale to the public, as this specification is only valid for testing purposes in the short term. After more extensive testing, Swift will open the specification up to commercial use via a balloting procedure in ASTM International. The industry is still trying to determine exactly how to bridge the gap between ASTM 7547 and D910 or the new spec and D910. It is expected that FAA's Avgas Transition ARC will help solve this problem.

a. We understand you are currently testing to ASTM 7547, an existing 91 octane spec. How will you get to a 100 octane spec? Are you considering blending with your higher grade fuel; if so, what octane will that yield? How will that be approved?

*A: There is nothing defined yet (see above), but if Swift ends up on this specification, it will more than likely be as a second grade of fuel with a 100+*

*minimum MON.*

b. Where are you along your ASTM pathway? What bottlenecks are you currently encountering as you try to move toward approval?

*A: The FAA's ARC should determine the final pathway, allowing us to determine exactly how far down the path we are, but the pending approval of the test fuel specification means that most of the work on the text of the specification document is now complete, leaving us only the job of gathering a small amount of additional data to convince the industry that the fuel operates safely in all flight regimes.*

c. What is your understanding of the differences between the current qualification advisory circular {Ac20-24B} and the proposed replacement {C}? Which do you prefer; why?

*A: Swift is not in favor of any process which avoids industry consensus from the outset {that is, Swift prefers ASTM first, not STC first}. No fuel will be manufactured or distributed which does not contain the liability umbrella offered by ASTM {it's the consensus thing – everybody in this together.} So this question is not relevant to Swift.*

d. In your view, what is the purpose of ARC? What do you expect will be the final work product? How optimistic are you for this outcome? Are you sending a representative?

*A: The ARC ideally will define once and for all the pathway that needs to be walked by any new avgas manufacturer to get their fuel to market.*

e. Other Comments:

i. The objective is to obtain fleet-wide fuel certification for a replacement fuel – perhaps FAA declaring the replacement fuel as backwards compatible with 100LL-capable aircraft

ii. Someone in the ASTM avgas committee commented that Swift is 2/3 of the way through approvals.

**3. Economic Factors**

a. What does your business model suggest the unit cost of production would be for your fuel assuming it is produced in current 100LL production volumes {including all factors – i.e., materials, manufacturing, distribution, fixed and variable costs}? What would this model suggest for production volumes at half the current 100LL production rate?

*A: Unit cost (FOB) is based on volumes produced. When producing only a few gallons per year the price will be higher than if we are producing several hundred thousand gallons. Our current numbers and estimates provided by the toll producers indicate that at half of the 100LL demand we will be able to match current 100LL (FOB) prices. If the demand increases from that we are estimating that our FOB price could be half-as expensive.*

b. We understand you are trying to meet a cost out of the plant of $2-$2.25 per finished gallon, and that the conversion of acetone is a key step in the manufacturing. What do you think the purchased cost of acetone needs to be for you to achieve the $2-$2.25 goal?

*A: Undetermined, however, at current market prices for acetone Swift Fuel even in current volumes {small} should not exceed current 100LL prices. Direct purchase of mesitylene would be prohibitive in the extreme.*

c. At what volumes are you currently producing?

*A: Swift had a small-pilot facility locally in West Lafayette, Indiana, that produced roughly 200 gallons per day. Swift is currently in the process of contracting out a production campaign in which 10,000 gallons would be produced in a week through the Swift process.*

d. Do you expect to manufacture in volume, or will another entity to do this? If another identity, has it been identified?

*A: The current model is for commercial-scale production to be licensed to entities. There are currently no license-holders.*

e. Last year at Air Venture Swift revealed it had letters of intent to distribute from Shell, Chevron and AvFuel. What is the status of these agreements? If you earned fuels approval tomorrow, would these distributors be able to begin immediately delivering your fuel? Are there other distributors with whom you are in discussions?

*A: Of six US distributors, Swift has letters of intent/understanding to distribute with five, comprising 93% of the supply chain. Swift could begin deliveries immediately upon certification.*

f. What do you estimate the capital investment requirements to be to complete development and certification, manufacturing and distribution? Have you raised this capital? If not, when do you intend to do so? Are you having difficulty locating capital?

*A: General answer – current funding via angel investors; no additional professional capital anticipated; further capital will be required, expected to be sourced via strategic partnerships other than oil companies, probably other entities with an interest in the future of avgas. Aggregate funding requirement not revealed.*

4. We are seeing interest for a non-ethanol mogas from the lower horsepower crowd {which consists of around 70% of the GA fleet}. The motivation is the expectation that a replacement for 100LL will be much too expensive for recreational flyers – current pump prices for 100LL are claimed to be $2/gal too high. If this effort gains traction how will it affect Swift Fuel?

   *A: In many industry expert opinions the availability of an ethanol-free fuel is dwindling only further as time continues. Most motor fuel is blended at the rack or pre-rack with ethanol. This means that in most cases, distributors cannot even get ethanol-free mogas. This is not showing signs of stopping. Nonetheless, even if it was available, it would not fill the need of the 100LL market. The above-referenced 70% of the fleet only uses 30% of the annual 100LL demand. The remaining 30% of the fleet that requires a +100MON fuel, which accounts for nearly ¾ of the 100LL sold annually in the US.*

5. How can The Clean 100 Coalition assist your effort?

   *A: Keep spreading the word, but avoid creating panic. Let pilots know that 100-octane gasoline is a must and that there is a viable solution. We will not let GA be grounded.*