Syntroleum®
The Clear Choice. Now.



Syntroleum FT Process and Fuels

What It Took to Get Here…Where We're Headed Next

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Washington, DC
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Syntroleum Fuels in Washington DC
DOE 3-Month Road Test 2005

First Successful B-52 Flight Test With Syntroleum FT Synthetic Jet Fuel

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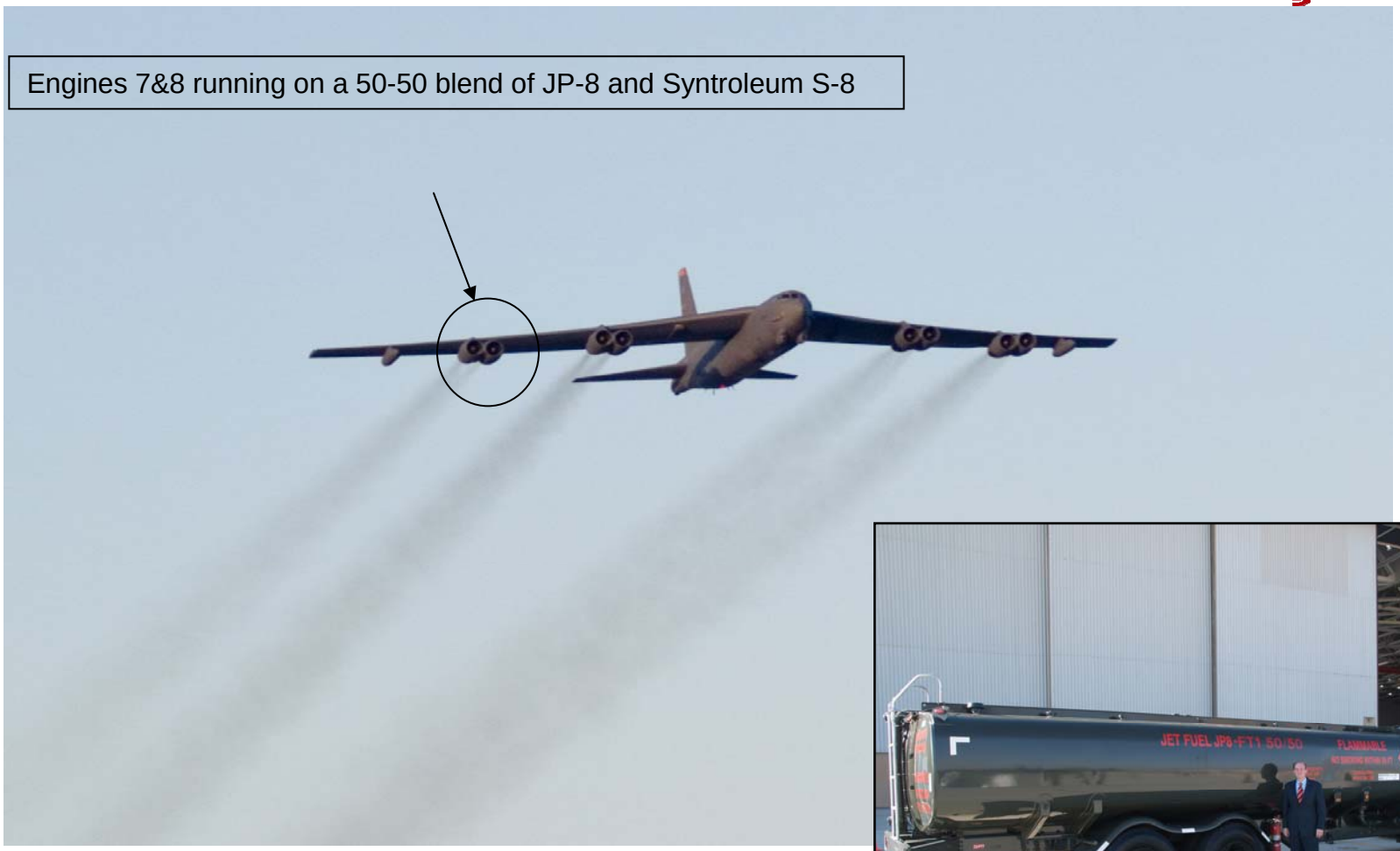


September 19, 2006

Fischer-Tropsch: 80+ Years of History

Franz Fischer in 1918

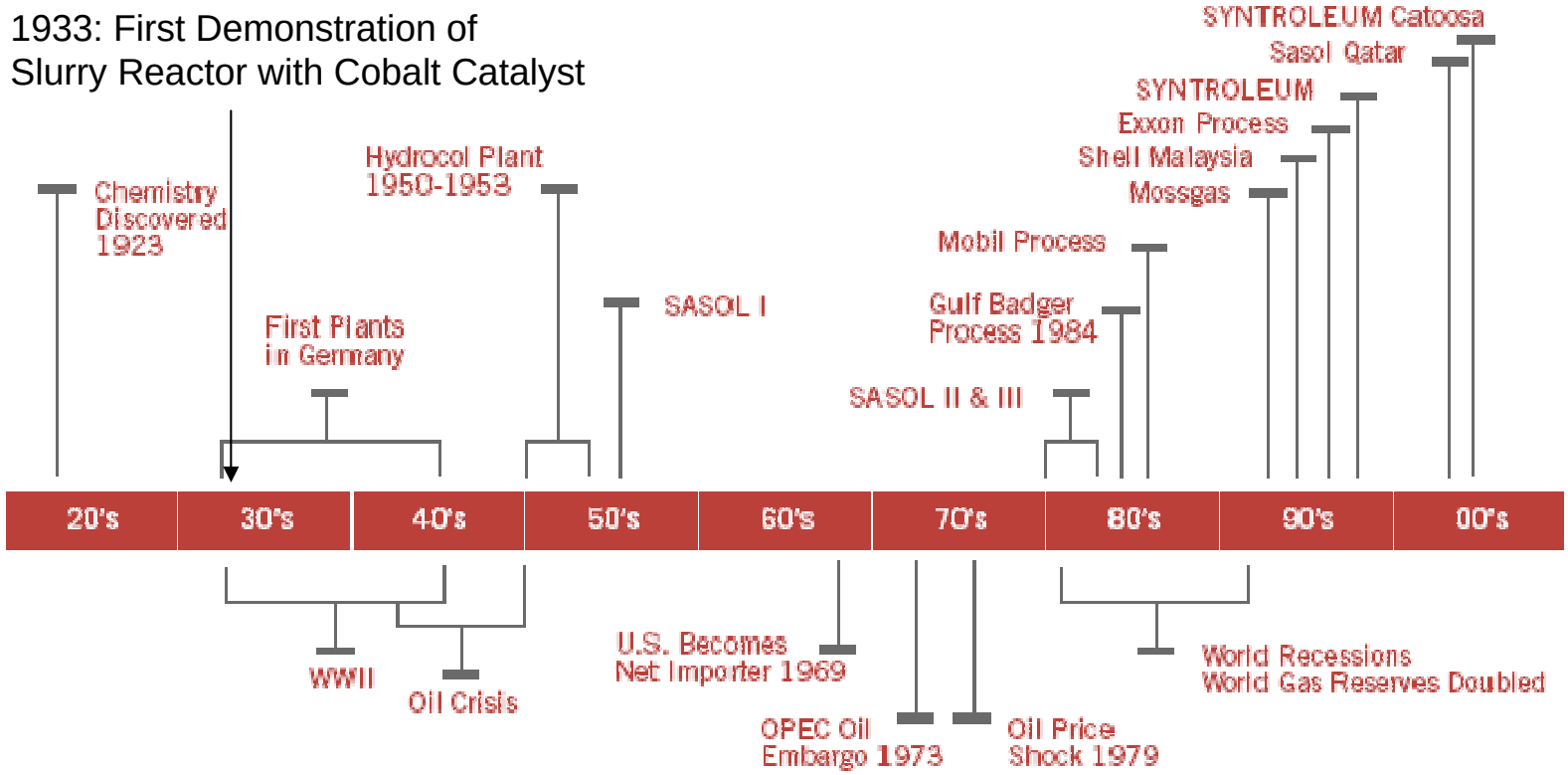
Alternatives Explored

Project Development: Government vs. Industry

Catalyst Design: Iron vs. Cobalt

Reactor Design: Fixed Tube vs. Slurry Bubble

1933: First Demonstration of
Slurry Reactor with Cobalt Catalyst



Fischer-Tropsch Technology: Moving Forward to Commercial Deployment

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- Although FT chemistry has been known since 1923, the technology development has been a lengthy and expensive process for industry and governments

- Early development driven by politics not economics
  - Germany in WWII
  - South Africa during Apartheid Era

- Recent history shows improved economics due to engineering and scientific advances as well as global energy imbalances

- Commercial FT technology still has hurdles to overcome to be financable
  - “Everyone wants to be the first to build the second plant”, Jack Holmes.
  - Needs high oil prices and relatively low feedstock cost
  - Long-term off-take contracts required for bank financing
  - Technology providers must have demonstrated know-how and successful operating experience and “process guarantees”

- Government strategic issues still important drivers for FT industry
  - Minimize the dependence on foreign oil
  - Utilize large domestic coal reserves, reduce transportation logistics
  - Enhance national security by dispersing domestic supply sources
  - Create jobs in the U.S.

Commercial FT Deployment: Success Factors for a Technology Provider

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Technology….Patents….Know-How….Demonstration

- Substantial R&D Expenditures Over Long Period of Time*
  - People
  - Facilities
  - Focused Programs

* Syntroleum has spent $250+ million

- Significant Technical Facilities
  - Testing Laboratories
  - Pilot Plant
  - Scaleable Demonstration Plant

- Third-Party Validation of Process and Products
  - Process modeling, engineering, technology audits
  - Product quality, Demonstration both Lab and “Road-Test”

Syntroleum Process Technology Demonstrated With Long-term Successful Operations Experience

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Pilot Plant
Coweta
Fixed Bed, 2 BPD

ARCO Cherry Point
Demonstration Plant
Slurry, 70 BPD

Catoosa Demonstration
Facility
Slurry, 70 BPD

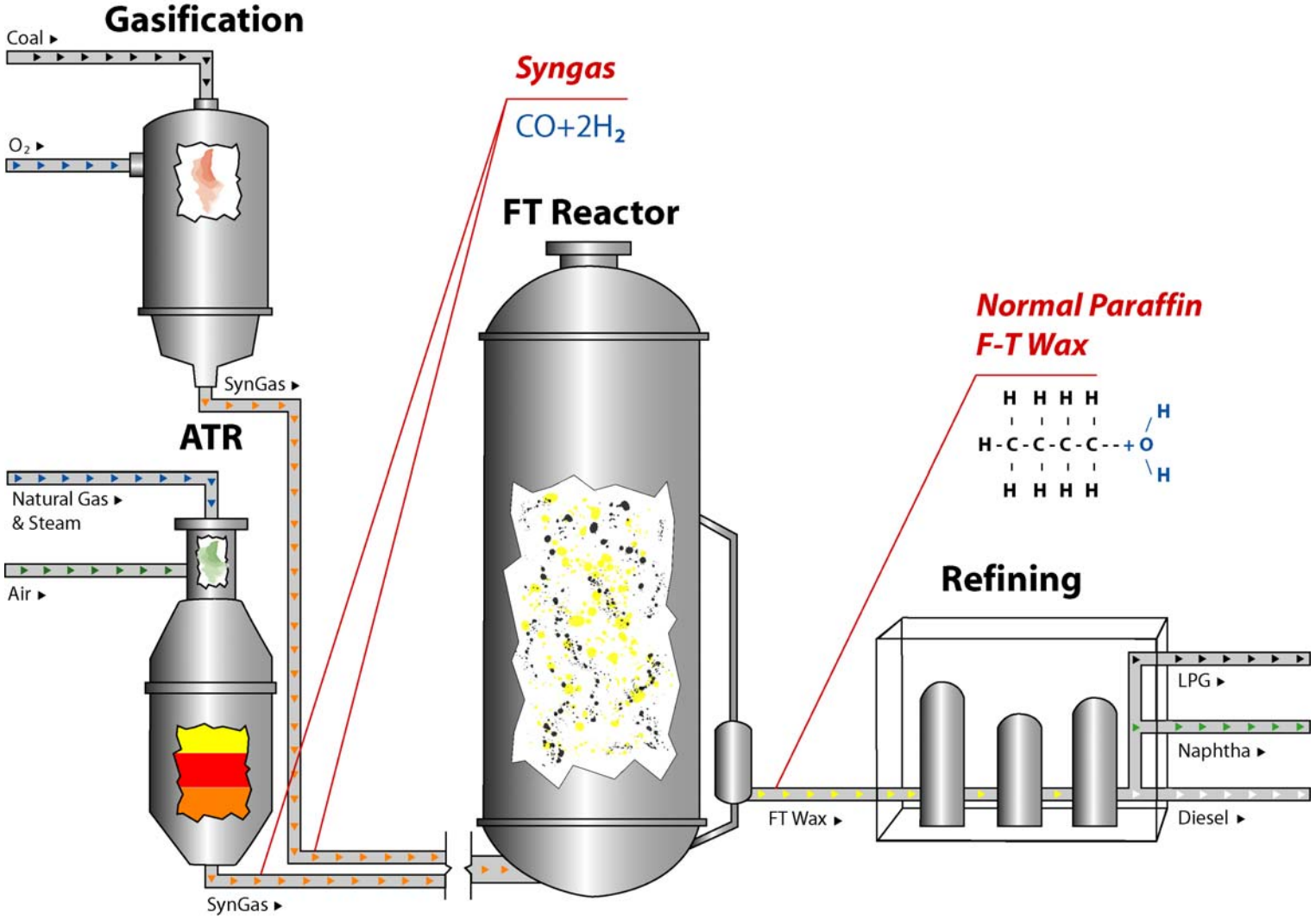
1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006

Tulsa Pilot Plant
Fixed Bed, 2 BPD

Refining Pilot Unit
2 BPD

Tulsa Pilot Plant
Slurry, 2 BPD

Syntroleum F-T Reactor is Indifferent to Source of Syngas and Produces Same Ultra-Clean Fuels



Fischer – Tropsch Development Facilities: What it Takes for Commercial Design

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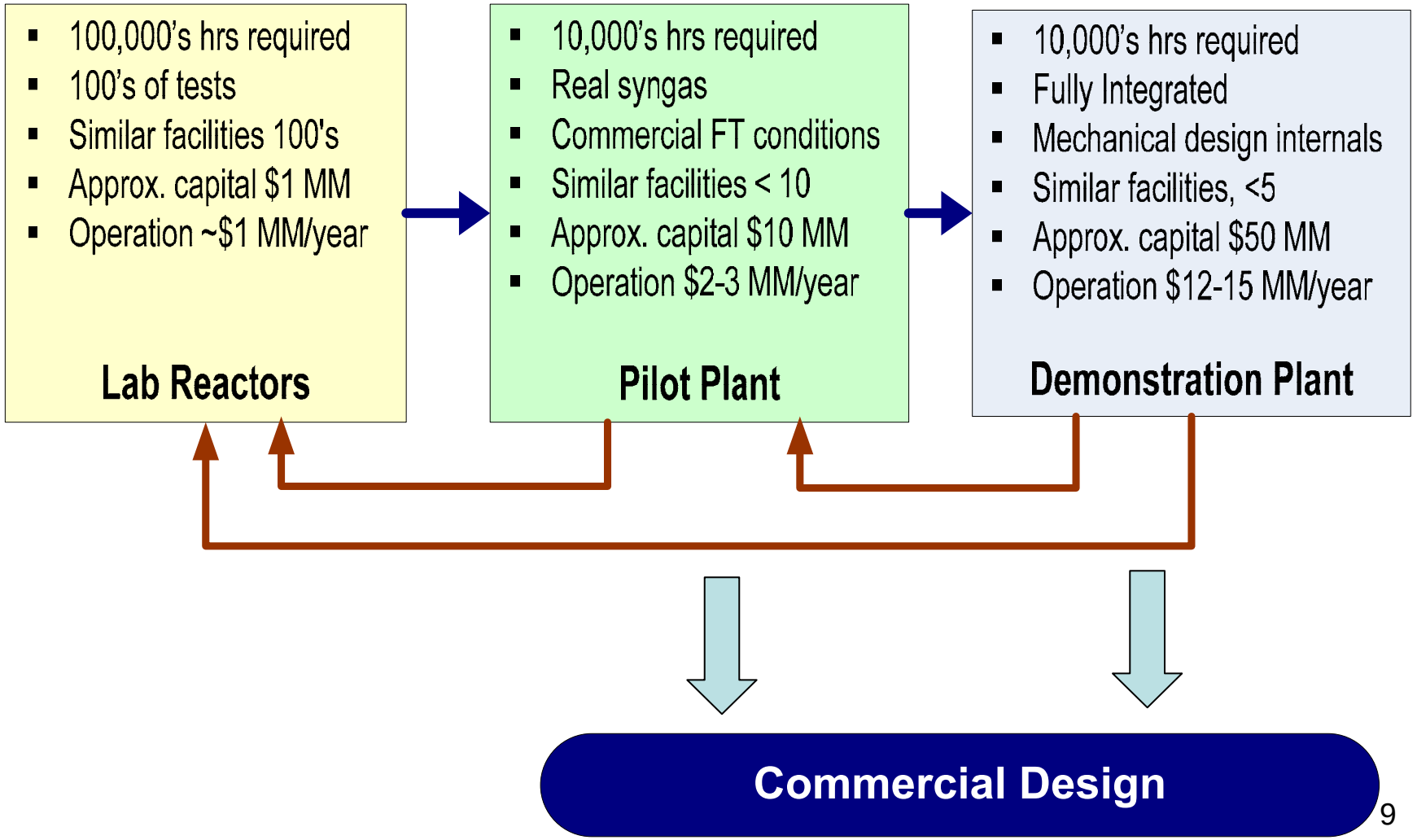


Syntroleum FT Labs:
19 Bench Scale Reactors Tests Catalysts

- **Resources**
  - 11 CSTR (Continuous Stirred Tank Reactor) and 4 fixed beds, 4 fluid bed reactors
  - Computer controlled operation – Automated analytical
- **Uses**
  - Develop commercial catalyst formula
  - Establish procedures, ie activation, regeneration, start-up
  - Catalyst kinetics evaluation
  - Qualify commercial catalyst vendors
- **Accomplishments**
  - Over 1,000,000 hrs of run time
  - Tested over 1000 variations in catalyst formula
  - Individual runs in excess 6000 hours
  - Developed patented regeneration procedure

Syntroleum Tulsa Pilot Plant: 2 barrels/day Tests Process Performance

- **Resources**
  - Nominal up to 3 BPD capacity
  - Integrated syngas generation and 2-stage FT reactors
  - Extensive (scaleable) syngas clean-up with state of the art analytical tools
- **Uses**
  - Smallest scale to operate FT slurry catalyst in a commercial environment
    - Real world syngas
    - Churn turbulent slurry operation
  - Demonstrate long term catalyst activity maintenance
- **Accomplishments**
  - 36,000 hrs of runtime
  - Demonstrated both fixed bed and slurry bed catalyst systems
  - Demonstrated low FT catalyst deactivation rates

Syntroleum Catoosa Demonstration Plant: 70 barrels/day Proves Commercial Design

- **Resources**
  - Fully integrated 70 BPD operation:
  - 2 Slurry reactors
    - Internal/External filters
    - Multiple heat transfer coils
    - 2 different feed distributors
    - Catalyst regeneration system
- **Uses**
  - Produce products
  - Develop design basis for ATR and FT internals
- **Accomplishments**
  - Over 18,000 hrs of runtime
  - Over 500,000 gallons of FT products
  - Over 300,000 gallons of FT Fuels
  - Demonstrated ATR and FT reactor design principles
  - **Detailed mechanical design of FT reactor underway**

Only Fully Integrated FT Plant Operating in the United States

FT Fuels are Ultra-Clean and Compatible with Existing Engines

Property	Current ASTM D975 Diesel	October 2006 EPA Diesel	Current E.U.-EN590 Diesel	Syntroleum FT Diesel
Sulfur (PPM)	500	15	50	0
Aromatics (%)	35	35	N/A	0
Cetane Number	40	40	51	74+

Characteristics of FT Fuels

- Non-detectable sulfur, aromatics, or metals
- High cetane number (74+)
- Colorless
- Very low toxicity
- Good to Excellent Biodegradable
- Immiscible with water (<0.1%)
- Compatible with existing fuel distribution infrastructure
- Producible from many raw materials
  - Natural Gas
  - Coal/Petroleum Coke
  - Biomass
  - Land Fill Waste

Syntroleum FT Diesel:

- Can be sold in existing markets
- Compatible with existing infrastructure (pipelines, storage terminals, retail pumps)
- No sulfur or aromatics
- Biodegradable and non-toxic
- Performs better than conventional diesel
- Valuable blending stock to meet new guidelines

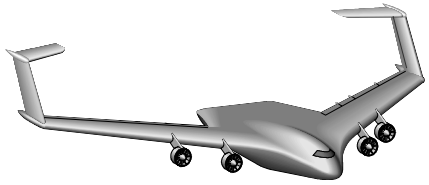
Syntroleum FT Fuels Demonstrated to Improve Aerospace Propulsion and Power Systems

FT iso-paraffinic kerosene (100%)

low emissions, high stability

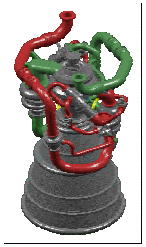
2.2X – 9X increase in cooling

Current and advanced gas turbine aircraft
(Jet A/JP-8 replacement)



High thermal stability, high H/C

ISP=362.5

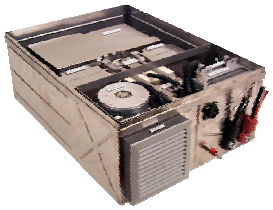


Hydrocarbon Rockets
(RP-1 replacement)

No sulfur, no aromatics

No poisoning, less coking of reformer catalyst

Hydrocarbon reformers
(fuel cell power generation)



high stability, endotherm

1200 Btu/lb cooling

Hypersonic Vehicles
(JP-7 replacement)

Muzzell, Harrison, "An Emerging New Fuel—Fischer-Tropsch Fuels" DESC WWEC, Sept 29, 2004

Syntroleum Fuels Delivered World-Wide With Documented High Quality and Performance

- Worldwide technical validation of Syntroleum fuel quality
  - Department of Defense
  - Department of Energy
  - Department of Transportation
  - DaimlerChrysler
  - Toyota
  - Volkswagen
  - Japan Automotive Research Institute
  - Southwest Research Institute
  - MIT, University of Alaska, UWV
- Syntroleum fuels road tested and flight tested
  - Washington DC Metro Buses
  - Denali National Park Vehicles
  - Pikes Peak Hill Climb Race
  - Tulsa Metro Transit
  - Military Vehicles (Single Battlefield Fuels)
  - Air Force Jet Engines, B-52 Flight Tests

Delivery of Syntroleum Fuels Enables Commercial Deployment of FT

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YEAR	Vol (gal)	CUSTOMER
1999	200	Dodge “Power Wagon” Advanced Concept Truck
2000	100	S-5 Office of Naval Research (ONR)
2001	~100	SL-2, 3, 4, 7 Base Oils to Auto Industry
2002	550	S-2 diesel and FC-2 to 3rd party
2002	1000	S-5 to TACOM
2004	22,600	S-1 Arctic to Denali NP, Univ. of AK
2004	76,600	S-2 to Denali NP, MIT, AVL, WMATA, TTA
2004	10,300	S-8 to DOD
2005	4,600	S-8 to WPAFB
2005	21,000	S-2 to 3rd Party
2006	100,000	S-8 to Air Force (Edwards, Tinker, WP), Patuxent NAS
2006	6,000	S-2 to Edwards AFB

Long Standing Successful Collaboration with U.S. Government

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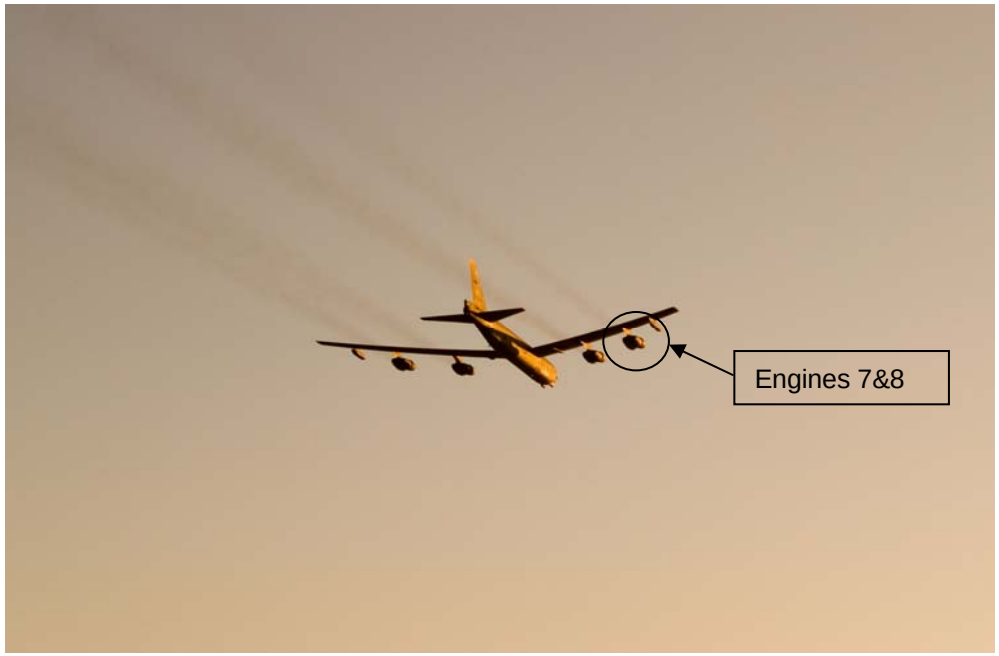
Governmental Entity - Description	Term	Total $ SYNM Contract	Appropriation $ Amount
DOD, Navy Fuel Testing	2001		
DOD, Phase I, Barge-Mounted GTL Plant	2003		
DOE, Catoosa Demonstration Facility Constr/Oper	2002-2005		
DOE, Nat'l Renewable Energy Lab Testing	2004		
DOD, Phase II – Seal Swell Test, GTL Design	2004-2005		
DOD, Phase III Fuel Conversion, FPSO Design	2005-2006		
DOT, Alaska Artic Diesel Fuel Test	2005-2006		
DOT, Tulsa Transit, Auburn Univ Road Test	2005-2006		
DOT, Tulsa Transit Road Test	2005-2006		
DOD, FT Production Run for Jet Fuel Testing	2006		
DOE, CTL Process Development, Testing	2006-2007		
TOTAL		$ 25 million	$ 37 million

B-52 Flight Test Using Syntroleum S-8



B-52 Flight Test - Edwards Air Force Base
September 19, 2006

- Landmark achievement for DOD and Syntroleum synthetic fuels
- Two engines (7&8) used a 50-50 blend of JP-8 and Syntroleum synthetic jet fuel S-8
- Result of Syntroleum's long collaboration with and support from the DOE, the DOD, and other stakeholders.
- B-52 flight test with all engines running on 50-50 blend of JP-8 and S-8 scheduled for later this year
- Jet engines cold start testing scheduled for the near future.

Commercial Deployment of FT Technology Where Do We Go From Here

- Syntroleum has made significant investments over 20 years and we are ready to help bring FT to commercial reality in the US…projects being developed
- Syntroleum believes FT fuels from coal are a viable means to significantly diminish U.S. dependence on foreign oil
- We congratulate the DOE and DOD in assuming their leadership roles that are helping to enable the FT industry to emerge in the U.S.
- The industry cannot afford to have an early failure…we in industry must do our part to assure FT technology is delivered successfully
- We hope that the momentum created by the DOD FT fuels certification program will continue…leading to bankable long term off-take agreements
- Additional government economic incentives for FT Jet will likely be needed in the short run to help launch the industry producing military fuels
- Working together, industry and government will assure that the strategic FT fuel needs of the U.S. will be met timely and economically

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