Gas-to-Liquids
Jet Fuel development

An update on progress of the Synthetic Jet Fuel Consortium

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QATAR AIRWAYS القطرية

AIRBUS

وقود WOQOD

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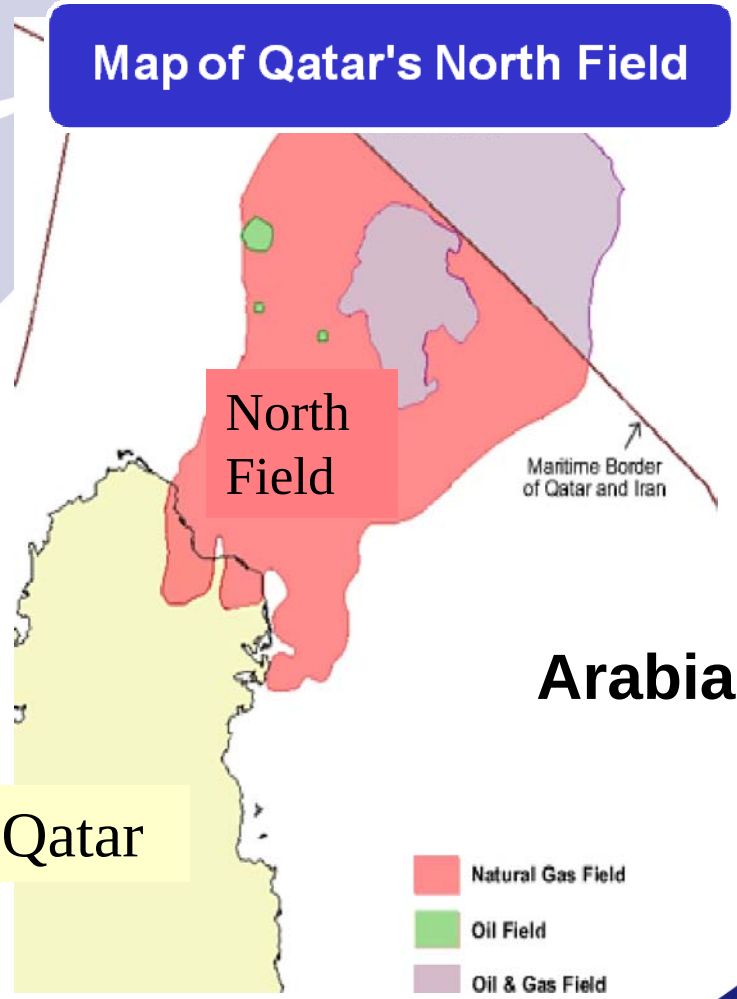
Overview of Qatar

- Land area 11,000 km2
- 1.5 m people,≈≈20% are Qatari
- Qatar's proven natural gas reserves stood at 910 trillion cubic feet (Tcf).
- 15 percent of total world reserves and the third-largest in the world .
- Most of Qatar's natural gas is located in the massive offshore North Field.
- the largest exporter of LNG in the world.



Qatar Growth Enabler: Energy

- State-owned Qatar Petroleum (QP) controls all aspects of Qatar's oil sector.
- Qatar Petroleum (QP) have paid GTL projects significant attention over the last several years. By 2012, Qatar is likely to have 177,000 bbl/d of GTL capacity at two facilities: the Oryx GTL plant & the Pearl GTL project.
- In 2003, QP and Sasol formed Oryx GTL, world's first commercial-scale GTL Plant. with the capacity to produce 34,000 bbl/d of low-sulfur & high-quality liquid fuels.
- In 2007, QP and Shell formed Pearl GTL company. 140 000 bbl/d GTL liquids from end 2010.

قطر للبترول
Qatar Petroleum

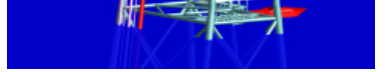
ORYX GTL
QP - SASOL joint venture

Qatar Growth Enabler: Energy

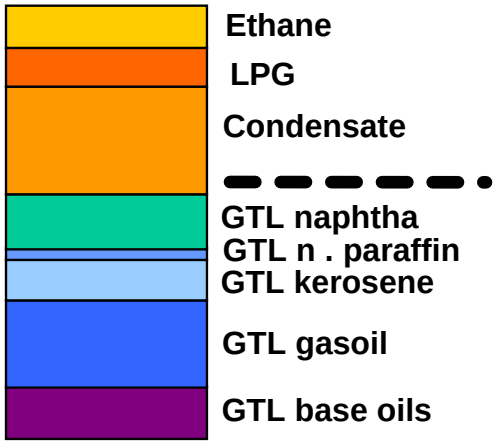
- Qatar Fuel (WOQOD) distributes petroleum products manufactured by QP.
- Public share company 60%, QP 40%.
- Q jet, a subsidiary of WOQOD, supplies aviation fuels to more than 35 international airlines at Doha International Airport.
- The new Doha International Airport will have an annual passenger capacity of 24M which is projected to grow to 50M by 2015.
- Qatar Airways has one of the youngest fleets globally and flies to 90 destinations. Current fleet size 65 aircraft, planned to reach 110 by 2013.

Pearl GTL – project overview

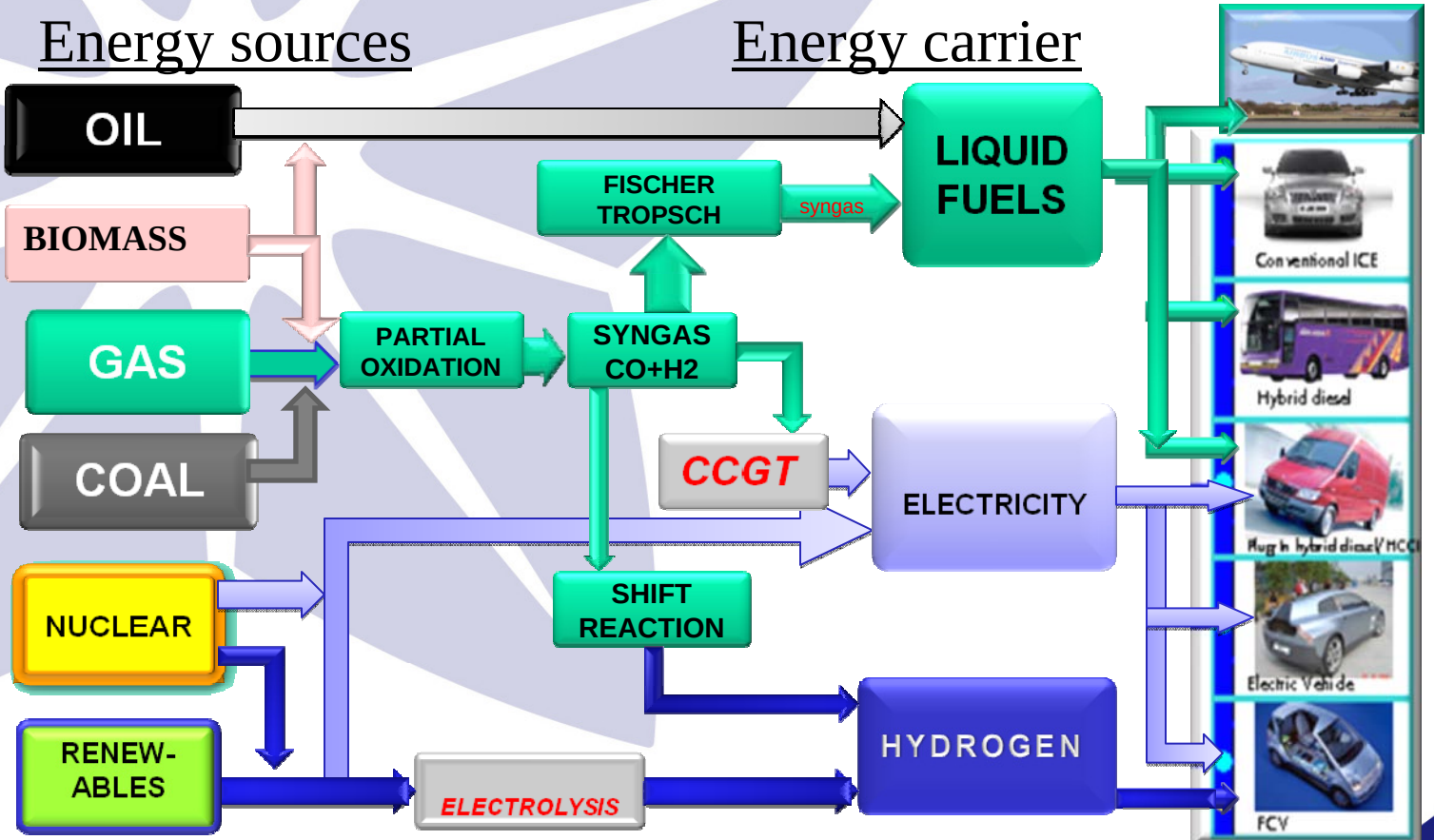
- Fully integrated project “from reservoir to market”.
- Development & Production Sharing Agreement.
- QP 70% , Shell 30% +Pearl project Operator.
- 1,600 MMscf/d well head gas
- 140,000 b/d capacity for GTL products.
- 120,000 boe /d upstream products.
- Phase I 70.000 bbl/d -2010
- Phase II 70.000 bbl/d -2011



Pearl GTL product slate

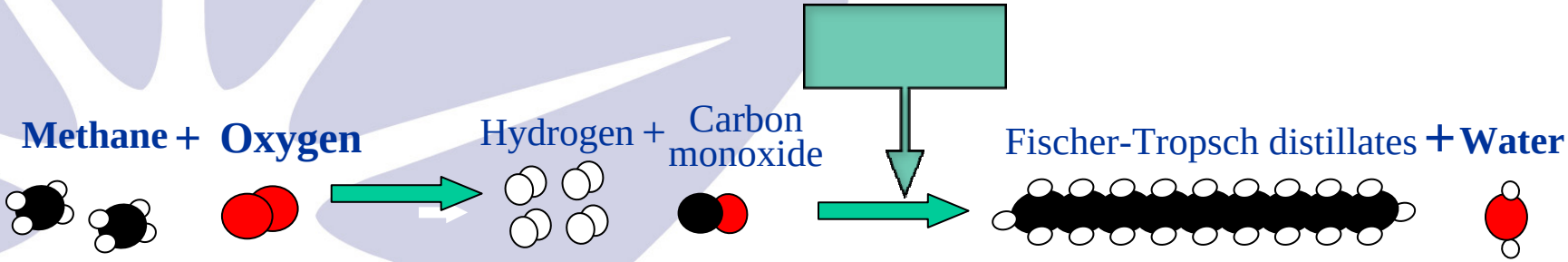


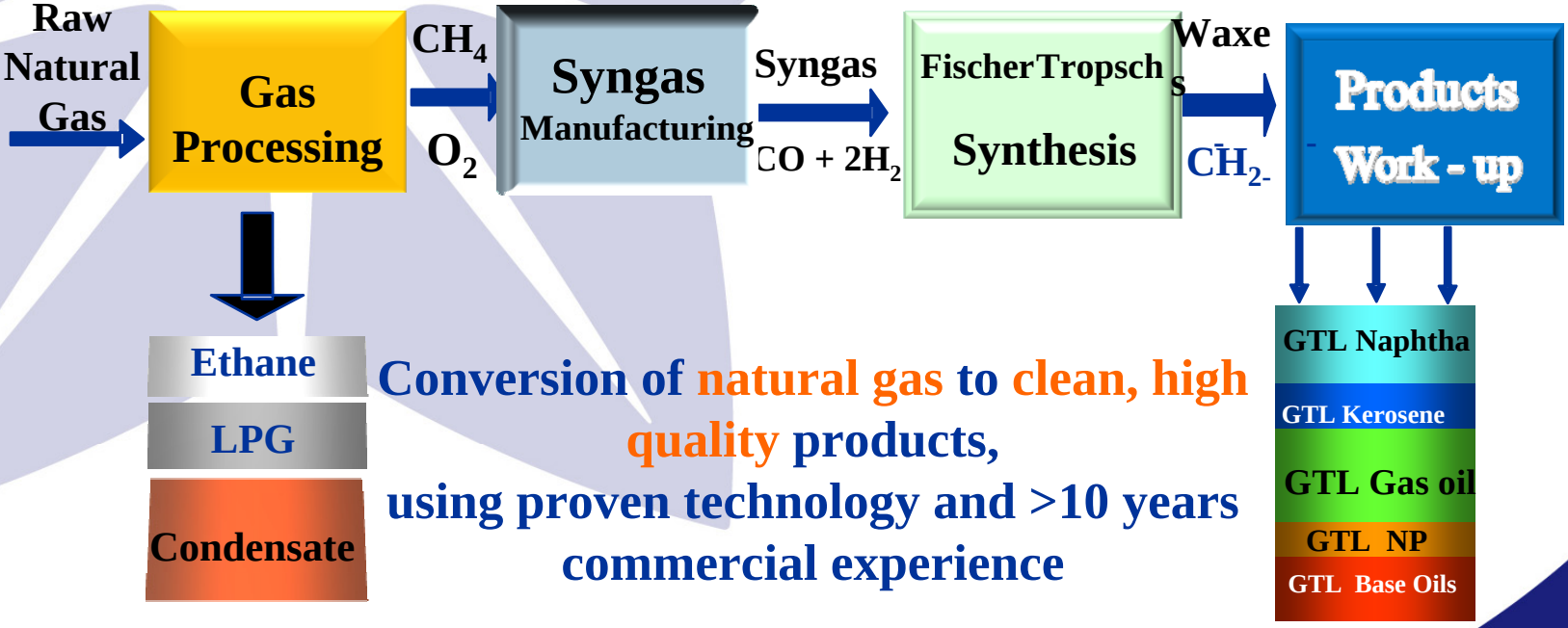
Synthetic fuels can meet the technical challenges of today and tomorrow



- Synthetic fuels can be produced from Gas, Coal and Biomass
- Synthetic fuels are cost effective as they are compatible with the fuel infrastructure and
- drive trains of both today and tomorrow

What is Gas to Liquids (GTL)?





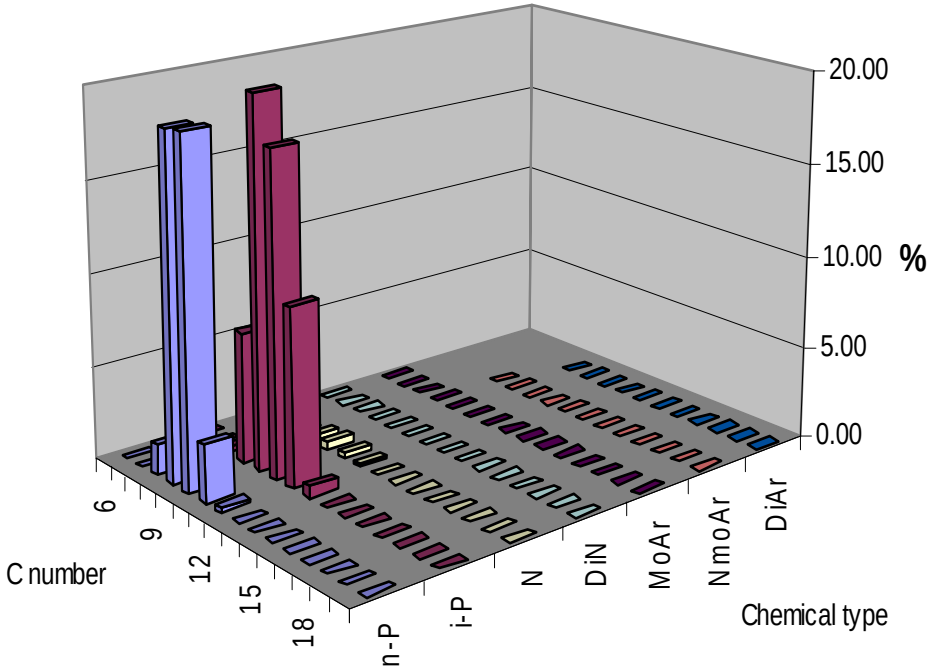
Conversion of natural gas to clean, high quality products, using proven technology and >10 years commercial experience

What is Gas-to-Liquids jet fuel?

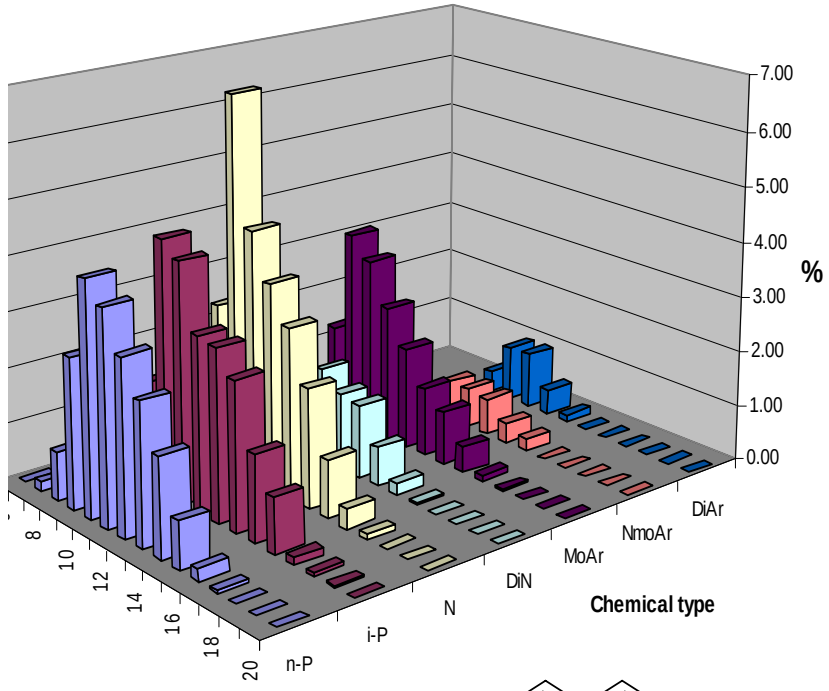
- Liquid kerosene fuel derived by synthesis of Natural Gas via the Fisher-Tropsch process
- GTL contributes to the 'Diversity of Supply' of jet fuel to the aviation industry by creating a performance fuel component from non-crude oil feedstock
- The GTL kerosene is used in a blend with conventional Jet fuel
- The GTL Jet fuel component is Sulphur free and has no aromatics
  - ✓ Excellent freeze-point
  - ✓ High energy content (per unit weight)
  - ✓ Good combustion and emission properties (local air quality)
- Life-cycle analysis shows that the CO2 footprint of a GTL-plant is similar to a modern complex refinery

Fuel composition

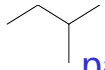
Gas-to-Liquids Jet



Typical UK Jet A1

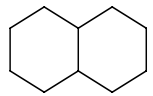


n-paraffinic

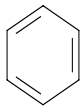


iso-paraffinic

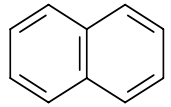
naphthene



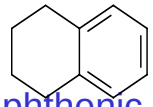
di-naphthene



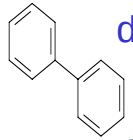
aromatic



di-aromatic



naphthenic mono-aromatic



di-aromatic

Potential use of GTL Kerosene in Jet Fuel

❑ Opportunity to use GTL Kero as blend component for jet fuel in aviation

- ✓ **Blend ratios from 35% up to 50% GTL Kero are being tested**

❑ GTL Kero can potentially offer the following benefits:

- ✓ **Improved engine performance from better thermal stability thus permitting hotter engines**
- ✓ **Virtually zero aromatics which leads to reduced soot emissions – less contrails and improvement in air quality**
- ✓ **Potential fuel economy (higher specific energy, lower density), improvement in payload range**

❑ Business case to be developed

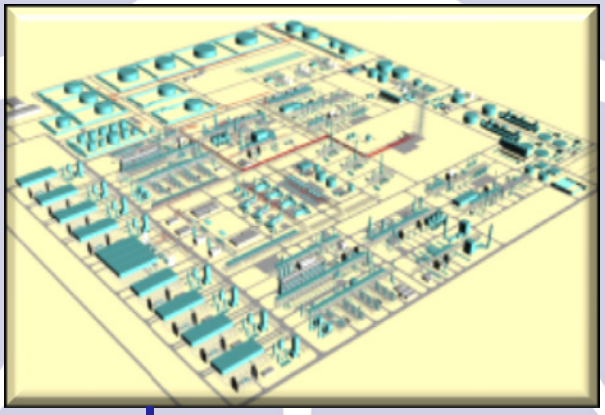
- ✓ **BOD for anti-oxidant additive injection equipment at Pearl (w.i.p.)**
- ✓ **Product approval targeted for 1st half 2009 (see slide)**
- ✓ **Complex logistics – supply chain (see slide)**

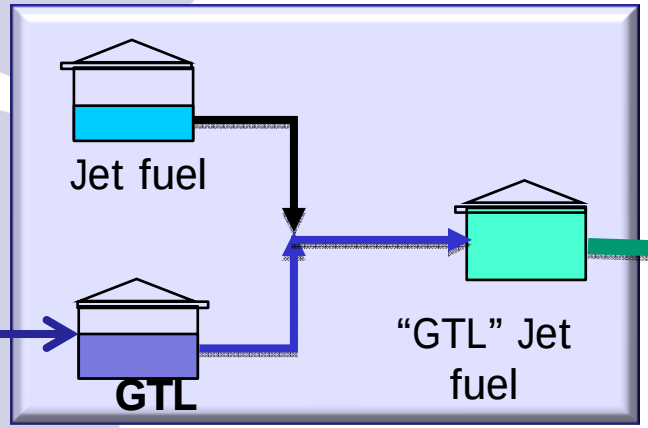
❑ Potential customers

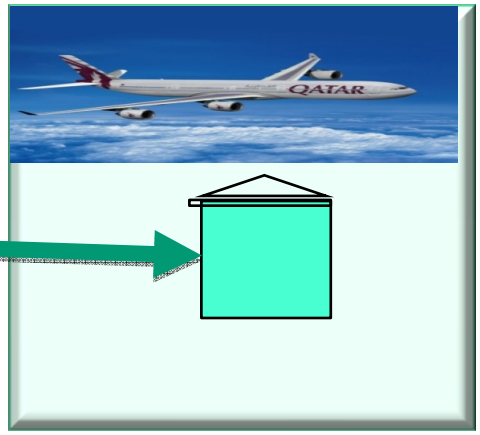
- ✓ **Airports in GCC countries**
- ✓ **Mega-City airports with air quality issues (e.g. London City airport)**

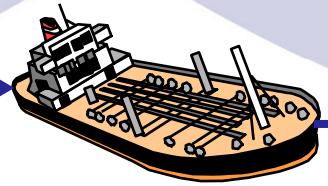
Supply-Chain: GTL Kero to GTL Jet blend

Primary Supply | **Product Importation** | **Distribution**









Price FOB Ras Laffan

Pearl GTL
(Ras Laffan)

Freight (RLC to Terminal)

Terminal/Refinery
For Storage & Blending (up to 50/50%)

Transport to Airports

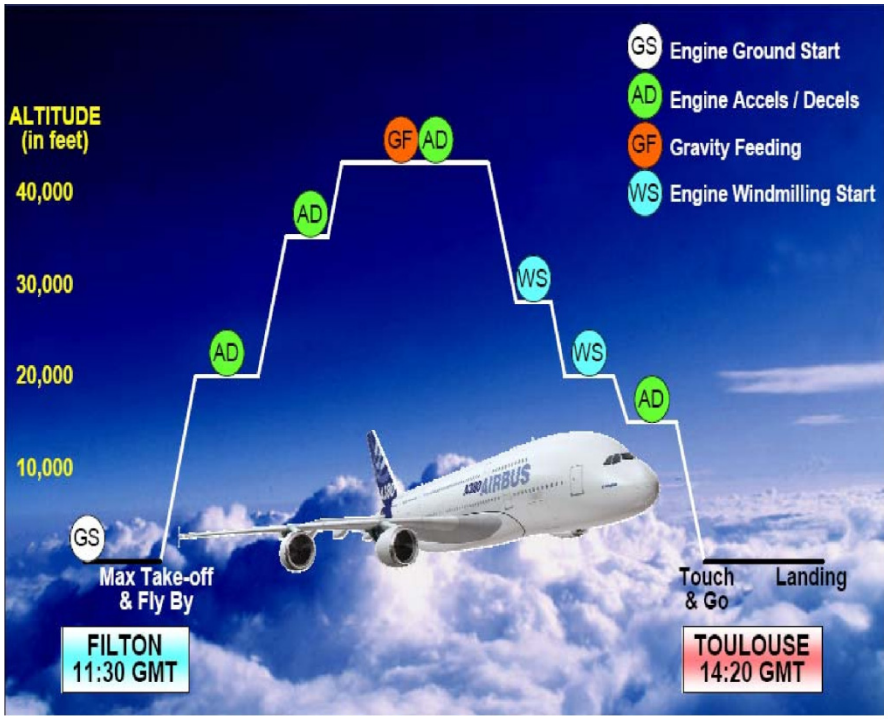
Airport

Synthetic jet fuel agreement signing ceremony

- QP & Shell to become largest producer globally of GTL fuels around the end of the decade.
- QR and partners studying potential benefits under November 2007 agreement

Flight Test Results

- **Successful trial on 1st Feb 2008 of GTL Jet fuel blended with conventional kerosene used on Airbus A 380 test flight from Filton, UK to Toulouse, France.**

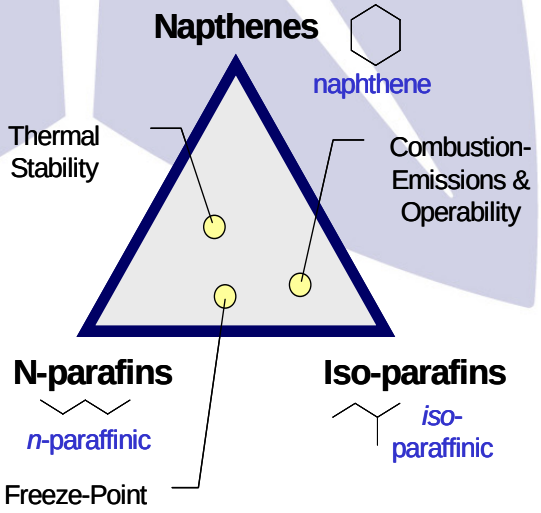


A380 Flight Profile

Consortium research programme

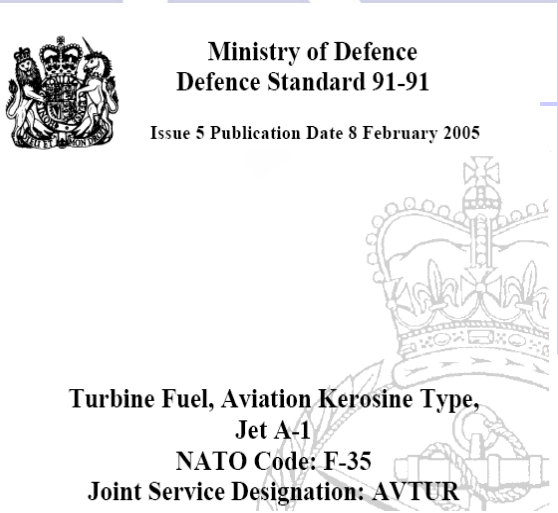
GTL jet fuel programme
To fully quantify GTL impact on:
- The global environment
- Local air quality
- Fuel burn

Performance	Combustion	Properties
Quantify fuel effects on Payload/Range performance Airbus, Qatar Airways	Quantify effects of fuel composition on altitude relight , emissions Rolls-Royce	Assess fit-for-purpose props, compatibility, thermal stability Qatar Petroleum, Shell, WOQOD



- **The programme will assess:**
  - ✓ **Performance (payload/range)**
  - ✓ **Combustion (operational & emissions)**
  - ✓ **Properties (compatibility & thermal stability)**
- **Research carried out in leading institutes in Europe & Qatar Science & Technology Park**
- **Programme investigates properties of modular paraffinic fuels and therefore applicable to a wide range of alternative fuels – not only GTL**

Fuel approval status



- **Significant progress on 50/50 blend clearance of Fisher-Tropsch fuels in global specifications:**
  - ✓ **ASTM D 1655**
  - ✓ **DEFSTAN 91-91**
- **Exhaustive research report defines compositional envelope based on suite of 5 FT fuels**
- **Consortia partners actively support the CAAFI (FAA-led) and UK AFC certification efforts**
- **ASTM ballot flagged only minor comments and full approval of 50/50 FT semi-synthetic fuel widely expected by June 2009**

Next Steps

- Continue to support Fisher-Tropsch approval for commercial aviation via agreed industry protocols (CAAFI, ASTM, & DEF-STAN)
- Commercial GTL flight by Qatar Airways once approval is in place
- Additional testing and investigation within the Qatari consortium to fully quantify synthetic fuel impact on:
  - ✓The global environment
  - ✓Local air quality
  - ✓Fuel burn
- Publication of research findings to benefit wider industry and broad range of synthetic alternative fuels and inform future specification setting efforts

Thank You