International Initiatives

Moderated by: Lourdes Maurice, FAA
Special Guest: Jane Hupe,
Chief of ICAO Environment Branch
Coordinating with Global Efforts

- Formal and informal coordination
- Coordination with R&D organizations
- International Airshows
- Bilateral Cooperation Agreements
- ICAO as forum for exchange
SUSTAINABLE ALTERNATIVE FUELS IN THE CONTEXT OF INTERNATIONAL AVIATION

Jane Hupe
Chief, ICAO Environment Branch
About ICAO

International Civil Aviation Organization

• **Specialized Agency of the United Nations**

• **Created** in 1944 by the Convention on International Civil Aviation (Chicago Convention)

• **Membership:** 191 Member States

• **Mission:** to ensure the safe and orderly development of international civil aviation

• **Mandate:** to establish and update the Standards and Recommended Practices (SARPs) of the Annexes to the Convention
About the ICAO Assembly

- The ICAO Assembly is the Organization’s sovereign body.
- It meets at least once every three years and is convened by ICAO’s governing body, the Council.
- ICAO's 191 Member States and a large number of international organizations are invited to the Assembly, which establishes the worldwide policy of the Organization for the upcoming triennium.
ICAO Environmental Goals

Limit or reduce the impact of aviation GHG emissions on *global climate*

Limit or reduce the number of people affected by significant aircraft *noise*

Limit or reduce the impact of aviation emissions on *local air quality*

**Minimize the adverse effect of global civil aviation on the environment**
ICAO’s Role with Alternative Fuels

ICAO is a FACILITATOR

- Outreach
- Information exchange
- International collaboration
- Broader view
- Globally
ICAO’s Work on Alternative Fuels

Resolution A36-22
Promote improved understanding

Rio Conference
ICAO as a facilitator
GFAAF Created

Rio+20: the ICAO’s “Flightpath” Initiative

Resolution A38-18

2007
2009
2009
2011
2012
2013
2013

Workshop
Cooperation and Harmonization

Workshop
States, financial institutions and stakeholders

ICAO SUSTAF Group
Input to Assembly
Climate change
Aspirational goals and basket of measures

Contribution of Measures for Reducing International Aviation Net CO₂ Emissions

- 2010 Fleet and Operational Efficiency
- ATM & Infrastructure
- Aircraft Technology
- Sustainable Alternative Fuels and Market-Based Measures
- Carbon Neutral Growth from 2020

Basket of Measures

International Aviation Net CO₂ Emissions (MT)

2010 2020 2030 2040
Global Framework for Aviation Alternative Fuels (GFAAF)

The Global Framework for Aviation Alternative Fuels (GFAAF) was launched at the ICAO Conference on Aviation and Alternative Fuels in 2008, as part of ICAO strategy to support solutions that reduce aviation contribution to climate change.

It provides a continuously updated database about activities and development in the field of alternatives for aviation, as well as useful documentation and links, to support information sharing and dissemination for the benefit of aviation fuels community.

New ICAO’s SUSTAF Expert Group Report (May 2013):

The Challenges for the Development and Deployment of Sustainable Alternative Fuels in Aviation
Resolution A38-18: ICAO’s Mandate from its 191 States on Alt. Fuels

- Member States, industry, financial institutions and other international organizations to actively participate in exchange of information and best practices and in further work under ICAO on sustainable alternative fuels for aviation

- Continue to maintain the ICAO Global Framework for Aviation Alternative Fuels (GFAAF)

- Collect information on progress of alternative fuels in aviation, to give a global view of the future use of alternative jet fuels and to account for changes in life cycle GHG emissions in order to assess progress toward achieving global aspirational goals

- Work with financial institutions to facilitate access to financing infrastructure development projects dedicated to sustainable aviation alternative fuels and incentives to overcome initial market hurdles

29 January 2014
Resolution A38-18: Additional related requests

- Voluntary preparation and update by States of *action plans* outlining policy actions on CO₂ emissions reduction and fuel efficiency improvement activities
- **Guidance and assistance** for preparation of action plans
- **Estimation, monitoring and verification** of global greenhouse gas (GHG) emissions produced by international aviation
- **Update of environmental trends assessment**
- Many elements developed with the support of CAEP
Committee for Aviation Environmental Protection (CAEP)

- Established by the ICAO Council in 1983
- 23 members States – 16 Observer States and Organizations
- 400 internationally-renowned experts involved
CAEP Alternative Fuels Task Force

• Goal: assessing the potential range of emissions reductions from the use of alternative Fuels to 2050

• 2 directions of work:
  – Life Cycle Assessment of alternative jet fuels
  – Projection of the future production of alternative jet fuels
Conclusion

• International cooperation is the core of ICAO’s activities
  – Information/best practices sharing and dissemination
  – Global view to support decision making built on States’ contributions

• Cooperation among aviation stakeholders and with the energy sector is key, in particular to addressing sustainability and securing access of aviation to sustainable fuels
For more information on our activities, please visit ICAO’ website: http://www.icao.int/env
Joachim Buse,
Vice Chairman, Av. Init. for Renewable Energy in Germany e.V., aireg
The future of climate-friendly aviation: Ten percent alternative aviation fuels by 2025

Joachim Buse
Deputy Chairman
Washington D.C.
Jan. 29th, 2014
### Global Aviation Market Forecast 2013

<table>
<thead>
<tr>
<th>Category</th>
<th>2012</th>
<th>2032</th>
<th>% Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>World Fleet Forecast</td>
<td>16,094</td>
<td>33,651</td>
<td>109%</td>
</tr>
<tr>
<td>RPK (trillions)</td>
<td>5.5</td>
<td>13.9</td>
<td>151%</td>
</tr>
<tr>
<td>New passenger aircraft deliveries</td>
<td>28,355</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dedicated freighters</td>
<td>1,645</td>
<td>2,905</td>
<td>77%</td>
</tr>
<tr>
<td>New freighter aircraft deliveries</td>
<td>871</td>
<td></td>
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</tr>
<tr>
<td><strong>Total New Aircraft Deliveries</strong></td>
<td></td>
<td>29,226</td>
<td></td>
</tr>
</tbody>
</table>

**Market value of $4.4 trillion**

Source: Airbus
Goals have been defined

“The future of climate-friendly aviation:
Ten percent alternative aviation fuels by 2025”

Top-3-goals for 2025, to achieve CO₂-reduction targets set by policymakers and the aviation industry:

• Domestic biorefining capacity with at least one industrial-scale facility

• Bilateral government agreements to safeguard provision of foreign feedstock

• Blending of 10% alternative aviation fuel in Germany
33 members
Working groups

Provision of Feedstock

Technologies of Fuel Production

Fuel Utilisation

Quality and Certification

Sustainability

5 Working Groups cover the core areas from crop to tank
First agreements have been signed

- **USA and Germany** signed a government agreement to support and use alternative aviation fuel during ILA Berlin Air Show 2012
- **Goals:** Strengthening of cooperation for the development of sustainability standards, the qualification of new production pathways and the expansion of the feedstock base for alternative aviation fuel
Federal Mobility and Fuels Strategy

• The Mobility and Fuels Strategy of the Federal German Government calls for a “National Development Plan Alternative Aviation Fuels”

• aireg suggests following items for the Development Plan to follow:

1. Provision of Feedstocks:
   Pilot projects and risk minimization

2. Biorefineries:
   Location scouting and investment support

3. Market Readiness:
   Reduction of margins and upscaling
Provision of Feedstocks – goal: risk minimization

**Status quo:**
- Financing of biomass projects is too often hampered by investment risks
- Security of supply as a policy goals is underrated

**Suggested abatement / mitigation measure:**
- Lowering of investment risks (country and climate risk) through publically financed and scientifically conducted pilot projects

**Realization:**
- *e.g. extension of the scope of the German Raw Materials Agency (DERA) to include biomass as a strategic resource*
- Goal: bioenergy task force to identify, organize and finance feedstock trials

**Deliverables:**
- Selection of biomass project with predictable success rate
- Bilateral gov’t agreements on production and export criteria
- Clarification of market potential of by-products
- **Costs:** ca. 30 Mio. € over a 10-year timeframe
Provision of Feedstocks – structure of DERA bioenergy task force

DERA’s mission statement:

“The German Raw Materials Agency (DERA) is the center of competence for the feedstock industry and the central platform for information and consulting on mineral and energy resources for the German Economy.”

Comparison of aireg goals and DERA’s mission

<table>
<thead>
<tr>
<th>aireg goal</th>
<th>DERA’s mission</th>
<th>Compatibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Financing of biomass trials</td>
<td>exploration support program</td>
<td>✓</td>
</tr>
<tr>
<td>Investment guarantees for biomass projects</td>
<td>Investment guarantees for exploration</td>
<td>✓</td>
</tr>
</tbody>
</table>

Possible structure and competencies of DERA bioenergy task force

<table>
<thead>
<tr>
<th>Financial Support</th>
<th>Country Expertise</th>
<th>Co-Financing</th>
<th>Consulting</th>
<th>Demand</th>
</tr>
</thead>
<tbody>
<tr>
<td>DERA</td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>Bundesministerium für wirtschaftliche Zusammenarbeit und Entwicklung</td>
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“Research, development, testing and use of regenerative fuels should be accelerated for aviation.” (German Energy Agency (dena), 2011)

**IMPORTANT:**

**Study on German biorefining options**

- Analysis of all German refineries regarding suitability for upgrading or extension into biorefineries (HEFA, BioGtL, Co-Processing)
- Evaluation of economic benefit of domestic biorefineries, incl. export opportunities for plant manufacturers and reduction of dependency on product imports
- Suggestions for operator models and marketing of by-products

**Costs: ca. 500,000 €**
Biorefineries - Financing

**KfW investment program “biorefineries”**

- On the basis of the aforementioned study, the construction of a biorefinery of industrial scale shall begin until 2015
- An investment facility “biorefineries” by the public banking group KfW is to give grants of 30% of the investment costs (€ 0.6 to 1 billion for each plant)
- Benefit:
  - Construction of next-generation biorefineries
  - Synthetic fuel for several modes of transport without blending walls
  - Support for the “Energiewende” in the transport sector
  - Competitive advantage for export-oriented plant manufacturers
- **Cost share: ca. € 600 Mio. for 2 plants**
- Example: Environmental Innovation Program
  (German Ministry of the Environment)
Market readiness – enhancing competitiveness

Current price differences prohibit an increased usage of alternative aviation fuel

- The aforementioned measures contribute to lowering the high price of alternative aviation fuel
- The most important lever is the price of feedstock

[Diagram with costs in US Dollar per metric tonne showing:
- JET A1: current 1003, expected 1372
- HEFA: current 1100, expected 2500
- Bio-GTL: current 1753, expected 2500

Legend:
- The increase of biomethane production lowers costs towards the price range of natural gas
- The up-scaling of FT-production lowers unit costs
- Long-term supply agreements lower and fix the plant oil price

* The increasing demand, especially for middle distillates (diesel, jet fuel) is probable cause for a further price increase of fossil fuel. Therefore price parity is just a matter of time.
- The arrow sign shows the price range of Jet A1 in the last five years. The costs of biogenic jet fuel on the basis of HEFA and Bio-GTL is given a bandwidth of +/-10% on the basis of aireg’s cost calculations.
Thank you!

Contact:

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10117 Berlin
Germany

kontakt@aireg.de
www.aireg.de

Hope to see you again at Berlin!
May 20-25, 2014
Susan Pond,
Chair, Australian Initiative for Sustainable Aviation Fuels, AISAF
• Founded in August 2012 within The United States Studies Centre at the University of Sydney by consortium of leaders in the public and private sectors

• Strategic direction-setting group aiming to
  – facilitate the development and growth of SAF industry in Australia
  – create a platform of robust collaborations throughout the entire SAF value chain, including civil and military aviation
  – work collaboratively with international partners, including CAAFI under the US Australia MOU signed in Sep 2011

• Joined forces with Aviation Aerospace Australia August 2013
AISAF Structure & Governance

Steering Committee Chair & Members

Working Groups

1. Feedstocks & Processing Technologies
   - Collaborate on R&D gaps
   - Support novel fuel R&D
   - Share technology info
   - Identify feedstock issues

2. Certification
   - Coordinate data/activities
   - Advocate new certifications
   - Support commercial flights

3. Environmental Impacts
   - Coordinate analysis
   - Address research gaps
   - Advocate standards

4. Commercialisation
   - Share commercial analyses
   - Share methodologies
   - Share supply chain best practice

Industry & Government Stakeholders
## SAF Industry Opportunity for Australia

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Market Need/Leading Edge Customers</td>
<td>✓✓✓</td>
</tr>
<tr>
<td>In Australia’s national Interest – security, economy</td>
<td>✓✓</td>
</tr>
<tr>
<td>Competitive capacity/capability to build on</td>
<td>✓✓</td>
</tr>
<tr>
<td>Comparative advantage to exploit</td>
<td>✓✓✓</td>
</tr>
<tr>
<td>Not too late to enter field</td>
<td>✓✓✓</td>
</tr>
<tr>
<td>Evident overseas market opportunity</td>
<td>✓✓✓</td>
</tr>
</tbody>
</table>

Australian Market Leading Demand

2012 fuel costs: Qantas, $4B; Virgin, $1B
ADF, premium, boutique, low volume fuels
Government engagement

http://www.aisaf.org.au/events/advanced-biofuels-industry-day
Current Production of SAF
A long-term future for aviation powered by sustainable fuels

W: aisaf.org.au
E: aisaf-chair@aviationaerospace.org.au
Dez Maiores Mercados - Passageiros (em Milhões)

Emissões de CO₂ - em toneladas

Source: ANAC Emissions Mapping System - MIAIA
Regulatory Framework

ANP Resolution 20
June 2013

Approves the usage of alternative fuels in country; (ASTM 7566).

Brazilian Action Plan

Presented to ICAO during the 38th Assembly;

Brazil presented a reservation to the item in the resolution that propose the 2020 carbon neutral growth.
Objective: Foster the development and adoption of locally produced biofuel, based on existing feedstock sugarcane by providing precise information regarding the environment benefits of this particular type of renewable biofuel.

Objective: Provide support for government and industry actions/decisions based on a common goal for renewable bio-jet fuel production within the country.
THANK YOU!

Alexandre Filizola
Manager of Environmental Analysis
Superintendence of International Relations
Email: alexandre.filizola@anac.gov.br
+ 55 61 3314-4620
www.anac.gov.br
“Brazilian Biojetfuel Platform”

Jan. 28 – 29th, 2014
2014 CAAFI General Meeting Washington, D.C.
Brazilian Biojetfuel Platform
Taking off with Sustainability

### BRAZILIAN BIOJETFUEL PLATFORM

#### Advisory Board
- **ABENOR**
- **Boeing**
- **GE**
- **EMBRAPA Agroenergia**
- **IAPAR**
- **IAC**
- **IICA**
- **GOL**
- **Ubrabio**

#### Steering Committee
- **Amyris**
- **Byogy**
- **Curci**
- **IICA**
- **SGB**
- **UFMG**
- **UFRJ**
- **UF**

### R, D & I
- **Aviation Technology**
  - Boeing
  - GE
- **Biomass**
  - CTC
  - Embrapa Agroenergia
  - IAPAR
  - IAC
  - IICA
  - SGB
  - UFMG
  - UFRJ
  - UF

#### Feedstock
- **Camelina**
  - Camelina Co.
  - Planaspec
- **Jatropha**
  - Curcas
  - SGB
- **Sugarcane**
  - Tonon*
  - Bunge*
- **UCO**
  - Curcas

#### Process
- **ATJ**
- **Byogy**
- **DSHC**
- **Amyris**
- **HEFA**
- **Curcas**
- **Solzyme**

#### Logistics
- **Operators**
  - Air BP
  - BR Aviation
  - Raizen-Shell
  - Sky NRG
- **Airports**
  - GIG
  - GRU
  - CNF

#### End Users
- **ABEAR**
  - Avianca
  - TAM
  - GOL

---

* Suppliers

**CURCAS – Integration**
**RSB Services - Sustainability**
• Formally structured in August 2013 to implement a feedstock agnostic, multi-process platform: HEFA, DSHC, ATJ.
• Focus on integrated value chain and sustainable feedstock production based on the Brazilian biodiversity, climatic conditions, Family Farming, and Agribusiness.

• Consolidates the stakeholders of the full spectrum of the value chain: optimization.
• Committed to the efforts of the Brazilian Action Plan submitted to ICAO.
Sustainable DSHC value chain

DSHC Value chain sustainability certification

Sugar cane Biomass Tonon

Farnesene Production Amyris

Farnasene Hydroprocessing Air Liquide

Blending FFP Distribution

Off Take GOL

Bonaça, SP

Brotas, SP

Paulínia, SP

Paulínia, SP

CNF
Belos Horizonte, MG

GRU
São Paulo, SP

GIG
Rio Janeiro, RJ

Bonsuco

RSB
Biojetfuel HEFA value chain

INTEGRATED BIOJETFUEL VALUE CHAIN

FEEDSTOCK

RESEARCH
- Farming
  - Jatropha
  - Camelina
  - Macauba
  - Algae
- Extraction
  - MACAUBA

PLANTATION
- Biodiesel
- Planting & Cultivation
- Picked fruit
- Extraction

CRUSHING
- Grains
- Crushing & oil expelling
- Grains
- Oil

HYDROPROCESSING
- Coal
- Hydroprocessing
- Biofuel

BLENDING & DISTRIBUTION
- Biodiesel
- Blending
- Sales

INTEGRATION, BIG DATA COLLECTION, LOGISTICS, RSB AUDIT FILES, CARBON FOOTPRINT

CLOUD
Brazilian Biodiversity: Macaúba value chain
Flying Green Program
Carbon Footprint Offset
Flying Green Carbon Footprint

### Sistema de Gestão da Pégada de Carbono

**Plataforma Brasileira do Bioqueoseo**

**GA3-1823**

**FOR ➔ GRU**

**GOL**

### Mapa

**G3-1823**

**Avianca**

Voos: 8  
Consumo BioQAV: 40.125 kg  
GEE Savings: 14.043 kg  
Emissões CO₂: 156.487 kg

**Azul**

Voos: 0  
Consumo BioQAV: 0 kg  
GEE Savings: 0 kg  
Emissões CO₂: 0 kg

**GOL**

Voos: 10  
Consumo BioQAV: 47.820 kg  
GEE Savings: 16.737 kg  
Emissões CO₂: 186.498 kg

**TAM**

Voos: 9  
Consumo BioQAV: 44.870 kg  
GEE Savings: 15.704 kg  
Emissões CO₂: 174.993 kg

**TOTAL**

Voos: 27  
Consumo BioQAV: 132.815 kg  
GEE Savings: 46.484 kg  
Emissões CO₂: 517.978 kg
Thanks!

Mike Lu
Coordinator Brazilian Biojetfuel Platform
mike.lu.44@gmail.com
+55 11 98438 3743
2011

Supported by Management

**FEEDSTOCK**
- camellina company
- tecBIO
- ALGAENERGY
- tecnalia

**TECHNOLOGY**
- UOP
- REPSOL
- MURATA SYSTEMS
- ABENGOA BIOENERGIA
- CEPSA

**LOGISTICS/USE**
- CLH
- SENASA
- PULLMANAIR
- AIRBUS
- IBERIA

**SUSTAINABILITY**
- OBSA
- CIEMAT
- RSB

2012 US – SPAIN Declaration of Cooperation on Aviation Alt. Fuels
Roadmap

2010 – 2011
FEASIBILITY STUDY

2011 – 2013
DEMONSTRATION PHASE

2014 – onwards
IMPLEMENTATION PHASE

12 partners
from 9 States

www.itaka-project.eu
Roadmap

2010 – 2011
FEASIBILITY STUDY

2011 – 2013
DEMONSTRATION PHASE

2014 – onwards
IMPLEMENTATION PHASE

European coordination and support actions

FORUM-AE

www.core-jetfuel.eu

ICAO CAEP
Alternative Fuels Task Force (ATFT)