The Gammon 2025 Aviation Fuel Handling Training Symposium

Kerojet® Aquarius®

A Fuel Management Additive

Provided by: **Melanie Thom - Baere Aerospace**

Dissolved water in Jet Fuel

- → Typically, 50-100 ppmv **dissolved water** in Jet Fuel
- → **Below 0°C**, dissolved water **results in free water** in aircraft wing tanks
- → **Free** water can **form ice at low temperature** and blocks fuel lines/pumps
- → During descent, **humid air** enters fuel tanks introducing additional water into fuel systems
- → Accumulation of free water will freeze during flight at low temperatures

Water in an aircraft fuel tank represents operational challenges

Common problems with water accumulation in aircraft tanks…..

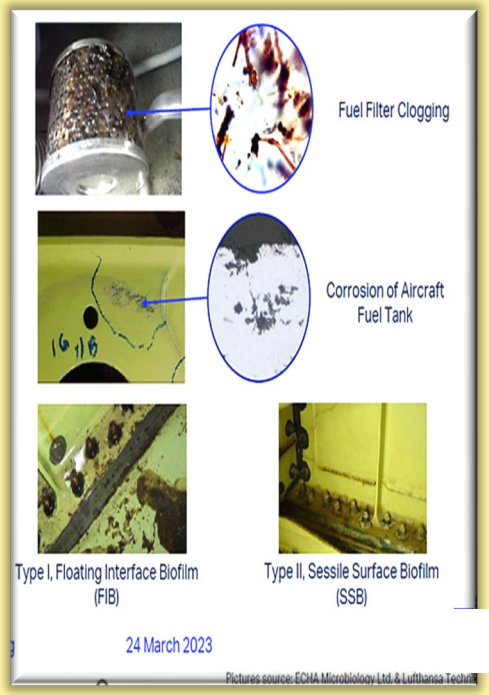
Sumping – Two issues you may come across:

- You get a good sample, removing dirt and water
- **Nothing…** *due to an unknown amount of ice/water*
- **Non-Stop Flow…** *due to drain being jammed with ice*

Source: MSN 360 Test Flight with Airbus and Rolls Royce. Refer to ASTM Research Report D02-2001.

Other Potential Issues:

- **Fuel filter blockage**
- **Pump failures**
- **Corrosion**
- **Fuel probe fouling**
- **Sealants/coatings issues**
- **Blocked engine filters**
- **Microbial proliferation**



Potential for icing is removed if no free water available

Current solution: Costly Regular Water Drainage

- → AC **not flying**! Takes away operational time
- → Requires time for **ice to melt**
- → **Unnecessary** additional **weight** from water
- → **Time and Labour** to drain water
- → **Un-scheduled** maintenance

- → Can cause **contamination** (Microbe Growth)
- → **Hangar** costs
- → **Insurance** costs
- → **Disposal** costs
- → Can cause **corrosion**

Lost Time and Costs Accumulate

What is Aquarius®?

What is Aquarius®?

- Fuel treatment for dealing with **water contamination in fuel**
- Designed to **prevent the build-up** of **free water** in a Jet fuel
- **'No Harms'** demonstrated during the extensive Approval Process

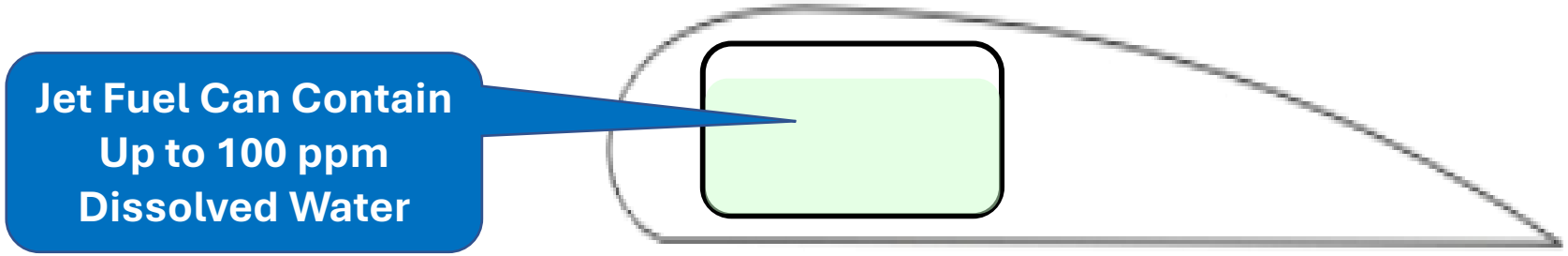
Uses and Effects

- Controlled usage: Aquarius® is optional - **added** at the wing **post filtration**
- **Reduced water** accumulation in fuel system/drains
- Reduced **ice** threat
- Reduced **corrosion**
- Potentially reduced microbe **contamination**
- Needs to be **used frequently** to maximise the listed benefits

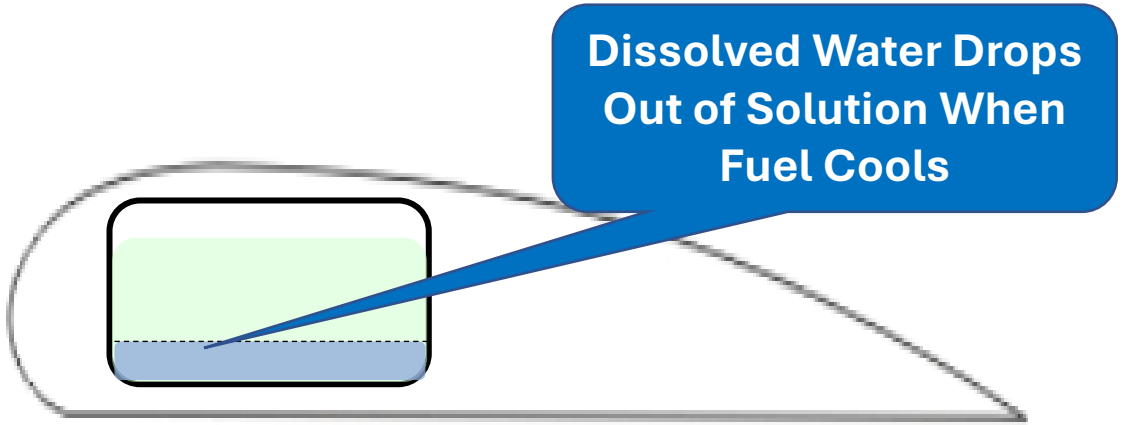
Aquarius® deals with water contamination in fuel

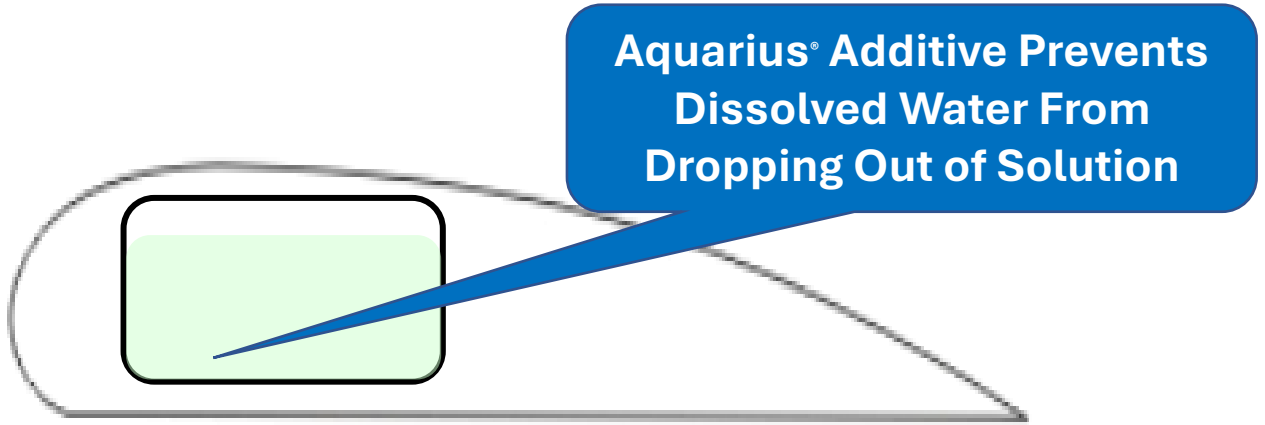
Why should aircraft use Aquarius®?

On the Ground: Jet Fuel Uplifted to Aircraft



In Flight: Aircraft WITHOUT Aquarius® **OR** **In Flight: Aircraft WITH Aquarius®**





Aircraft Wing - Schematic Illustration Only

How is Aquarius® applied?

- Added post filtration, at time of aircraft refueling
- Standard dosing and injection equipment
- No changes to aircraft
- Completely miscible with Jet fuel – no mixing equipment needed

Photos from In-Service Evaluation

Controlled usage: Aquarius® is optional - added at the wing post filtration

Reduced Water Accumulation in Fuel System/Drains

8 aircraft
flown with Aquarius®

~10 t
of Aquarius® used

3 airports
with Aquarius®

6 trailers
with Aquarius®

Proof of Concept via 3-Month In-Service Evaluation (ISE)

- **Lufthansa/Airbus:** Shared results AFC March 2019
- **Aquarius usage:** Only **50%** of the time
- **Water drain volumes:** Reduced by **50%**
- **Water draining task**: Carried out weekly
  - The weekly water drain task was not changed during the ISE

Proof of concept for water reduction achieved during ISE

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Reduced ice accumulation via Airbus Rig Test

- Different scenarios tested with different Aquarius/water concentrations
- Different operating conditions using specific temperature profiles (to -40ºC)

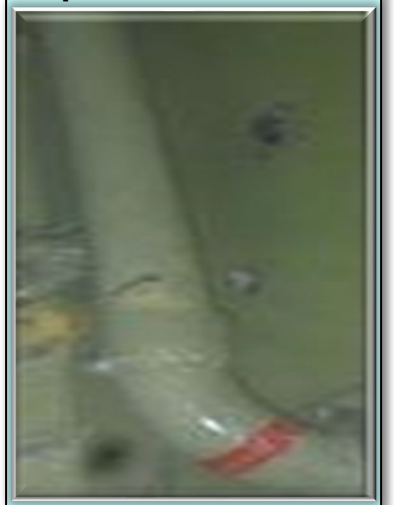
Baseline Run 1.4

Aquarius 0 ppmv
Total Water 260 ppmv
Free water 200 ppmv
Ice seen

Aquarius Run 7.1

Aquarius 250 ppmv
Total Water 260 ppmv
Free water 200 ppmv
No ice seen

Aquarius Run 2.6



Aquarius 250 ppmv
Total Water 430 ppmv
Free water 200 ppmv
Ice much reduced

Aquarius® **significantly reduced the ice** threat **reducing the amount of ice deposited** on the cold surfaces - the increased amount of **water remained in solution** rather than precipitating out as would occur without the use of Aquarius®

Source: ASTM Research Report D02-2001. Photos of Runs 1.4, 7.1, 2.6. Courtesy of Airbus (Filton)

Reduction in ice accreted and visibly less ice than Baseline Fuel within tank and pipework.

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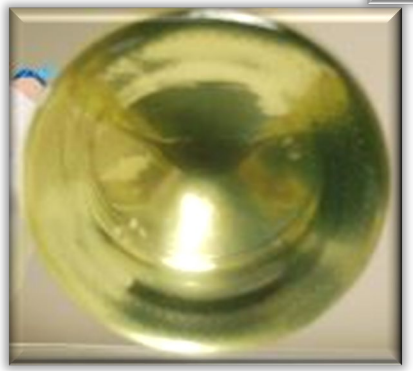
ECHA Microbiology Ltd
Week 10 Result

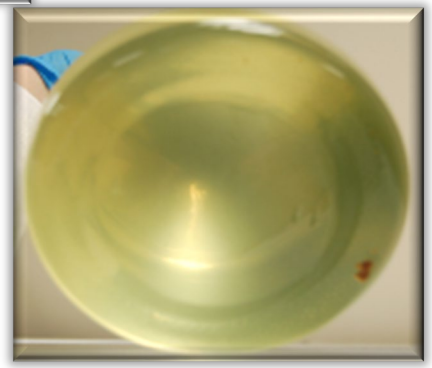
Microcosm A1: Both **Shaking** and **Static** environments showed **No** microbial growth

Microcosm A2: IP613 MicrobMonitor®2 kits**.** Extensive **microbial** growth.

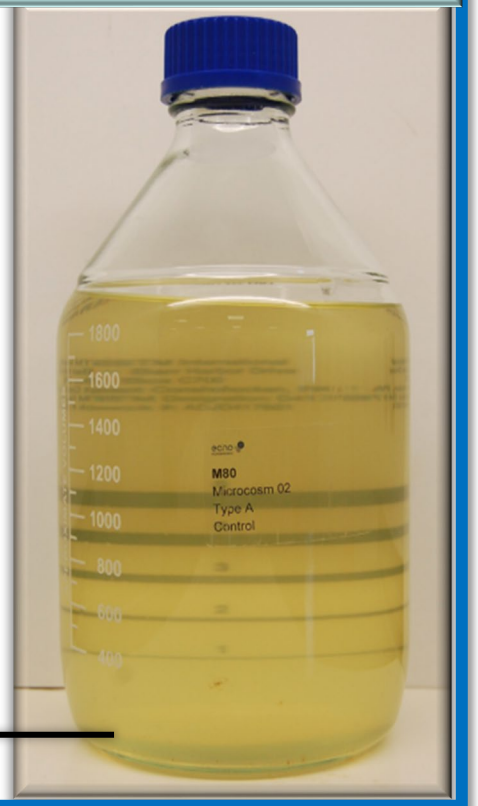
Week 10 - Microcosm A1 Aquarius 250 ppmv + Water 200 ppmv	Week 10 - Microcosm A2 Aquarius 0 ppmv + Water 200 ppmv

Bottom view





IP613 Microbe Count - Dead Bottom



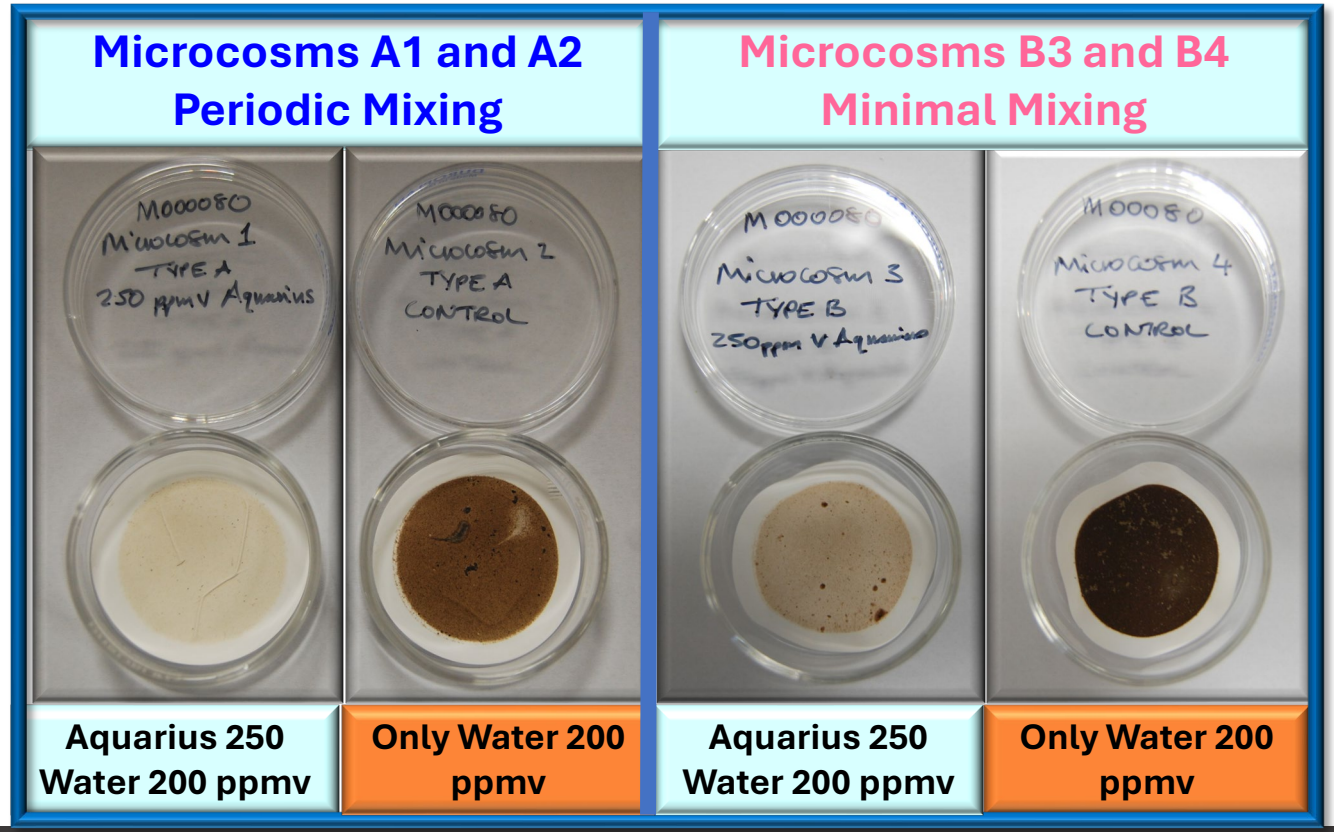
Aquarius® is not a Biostat or a Biocide. Encapsulated water = **No** water layer = **No** bugs

After Filtration and Drying

Test Program at ECHA Microbiology Ltd

Testing examined various scenarios with varying amount of water contamination and sample agitation

- **Filtration Photos:** Self Explanatory. Filters cleaner with Aquarius® treated fuels
- **Encapsulated** water =>**No** water layer = **No** microbial proliferation
- Presence of water bottom => Aquarius® treated fuels outperformed baseline fuels
- Regular use may potentially eliminate water contamination issues



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Aquarius®: Enhanced Water Management Tool

Value Proposition

- Improved aircraft turnaround times
- Reduced water drain frequency
- Reduced icing
- Reduced corrosion
- Clean

Water Management

- Reduced AC downtime
- Reduced unwanted/unscheduled costs
- Reduced hangar and insurance costs
- Biodegradable: Improves operator safety and toxicological footprint

Reduced water drain frequency, corrosion, and ice accretion

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Thank you for the Opportunity

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