Tackling Jet Fuel Quality Degradation During Long Term Storage

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Outline

- Problem
- History
  - Solutions
  - Actions and Recommendations
    - Cost Estimates
    - Recap

Background

- American Society for Testing and Materials
  - Standards for quality control
- Contamination arising during long term storage leads to degradation of jet fuel quality

Airport Jet Fuel Tanks (Platecon, 2009)

So, What's the Problem?

- Contamination leads to:
  - Damage of aircraft/engine
  - Engine-failure
  - Interrupted fuel supply

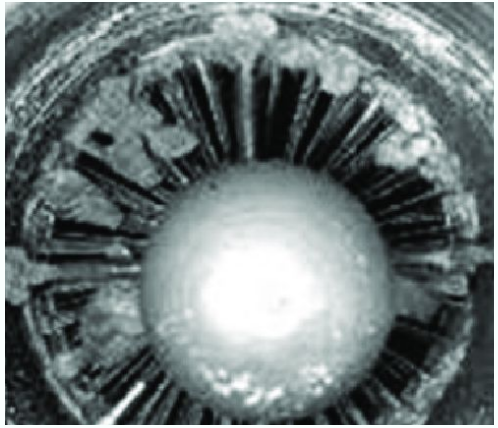
The 10 Greatest Emergency Landings (HistoryNet, 2016)

- Total system failure→

  Fatal plane crashes & emergency landings

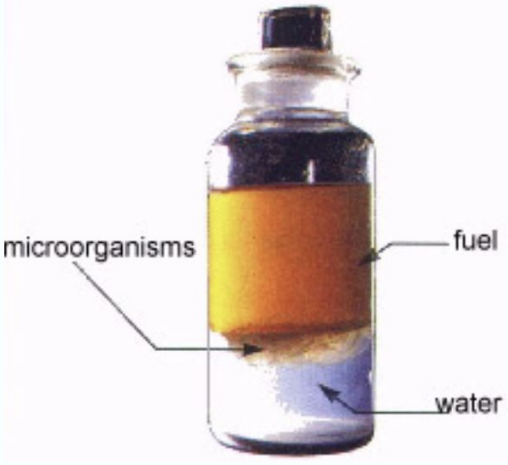
Contamination: Fuel Degradation

- Contamination methods:
  - water, particulate, and microbial growth



Aviation Safety the Basics (Alasadi, 2016)

Engine Corrosion Tips From RAM Aircraft (AVweb, 2017)



Microbial Growth (Artzi, n,d.)

History

October 2012

FlyMontserrat islander crash

Three people were killed

May 2015

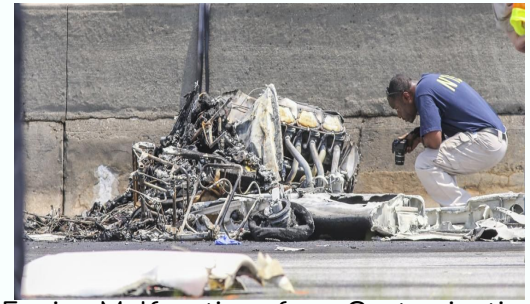
Engine fuel malfunction

Plane crash that killed four people

August 2015

Superstol pilot had engine sputter

Plane crash into a treeline



Engine Malfunctions from Contamination (Boone, 2016)

FlyMontserrat Islander Crash Aftermath (Harro, 2018)

What Happened?

Answer: Contamination in the jet fuel allowed for the engine to sputter and eventually shut off

Solutions

- Prevention of contamination
- Early detection of microbial growths

Contamination Prevention

100% stainless steel interior

Contamination Prevention

- 100% stainless steel interior
- Fights rust and corrosion
- Doubles tank lifespan
- Focuses on new tanks

Microbial Contamination

- Microbial contamination is inevitable
  - Bred by water and alkanes
  - Treated by biocide
  - Overtreatment mechanically damages the aircraft

Microbial Growth Clogging an Air Filter (Shefke, 2017)

Early Detection

Biannual quality tests → early detection and easier treatment

Investigate fuel quality → Drain any existing water → Treat fuel if needed

Actions and Recommendations

- Pass laws to:
  - Regulate water allowed in tank: **30 g per 1000 kg**

    -typical airliner holds ~260,000 kg of jet fuel

  - Require companies to implement the stainless steel solution

Volume comparison for water
(SKS Science, 2019)

Why Should Companies Change?

- Receive tax deductions upon following new rules
- Achieve cost effectiveness in the long run
- Have a longer tank lifespan

(New and Improved, 2018)

(Bernard, 2013)

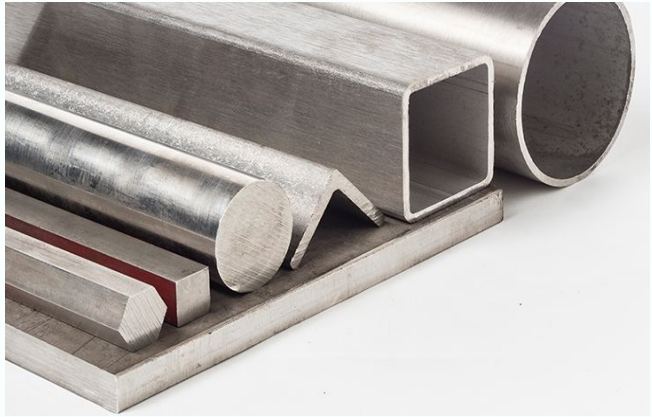
Cost Estimates: Epoxy

- Periodic check is needed
- A 10,000-gallon tank's initial epoxy lining could cost some $6,700 andrea cost about $10,000
- Uses less expensive metals
- Guarantees 10 years of use

Epoxy Pipe-lining (Stemmle, 2015)

Cost Estimates: Epoxy vs Steel

- The customer doesn’t have to keep checking the coating periodically for a breakdown of the epoxy material
- Cost of the reapplication process is eliminated with the stainless steel inner lining
- Steel gives double the amount of usage time



304 Stainless Steel (Supermarkets, 2018)

Cost Estimates: Biannual Checking

- For the solution of implementing a biannual testing cycle, our group can assure that no additional personnel will be needed for the additional testing.
- No significant additional costs associated with staffing upon implementation.

Conclusion

- Fuel degradation is a major safety concern
- Solution:
  - 100% stainless steel interiors
  - Biannual quality tests
- Pass regulations to enforce solutions
- Achieve safety and cost effectiveness

Who Has the First Question?

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