

A GREAT IDEA!

AEROWING

Advanced Ground Support



*An Advanced, Worldwide Leader in **Rapid...***

- ***Leak Detection***
- ***Sealant Removal***
- ***Curing Repair***

STANDARD REPAIR TIMES

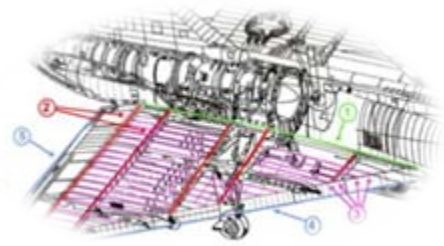
➤ Engine Change 4 to 6 hours



➤ R & R a component Few minutes to few hours



➤ Fuel Leak. Unknown, several hours to several days! Typical fuel leak can ground an aircraft for days, sometimes weeks!!! Leaks occur anytime, anywhere. All aircraft develop fuel leaks at one time or another; Usually, at the most costly time (urgent military operation, passengers waiting at both ends of the flight). Fuel leaks are one of the most time consuming maintenance tasks required on an aircraft.



HISTORY OF THE IDEA



Building on CTMA's leak detection project, which began in 1999, we recognized that demand was strong in the military and commercial market to reduce aircraft downtime, due to fuel leaks. It is estimated that, combined, militaries and commercial aircraft operators lose over one billion dollars per year, due to fuel leaks!

After working with  **BOEING** and  **AIRBUS** for manufacturing implementation, AEROWING decided to bring and adapt its technology to the maintenance field, where the need was even more evident.

Beginning in 2002, we started working with the US Navy, in Jacksonville, FL, in order to investigate potential improvement for the F14 & EA6B Heavy Mx. line.

After the F14 was retired, we began development for the F18 with Northrop Grumman, in El Segundo, CA, where the Helium leak detection is currently being used for production.

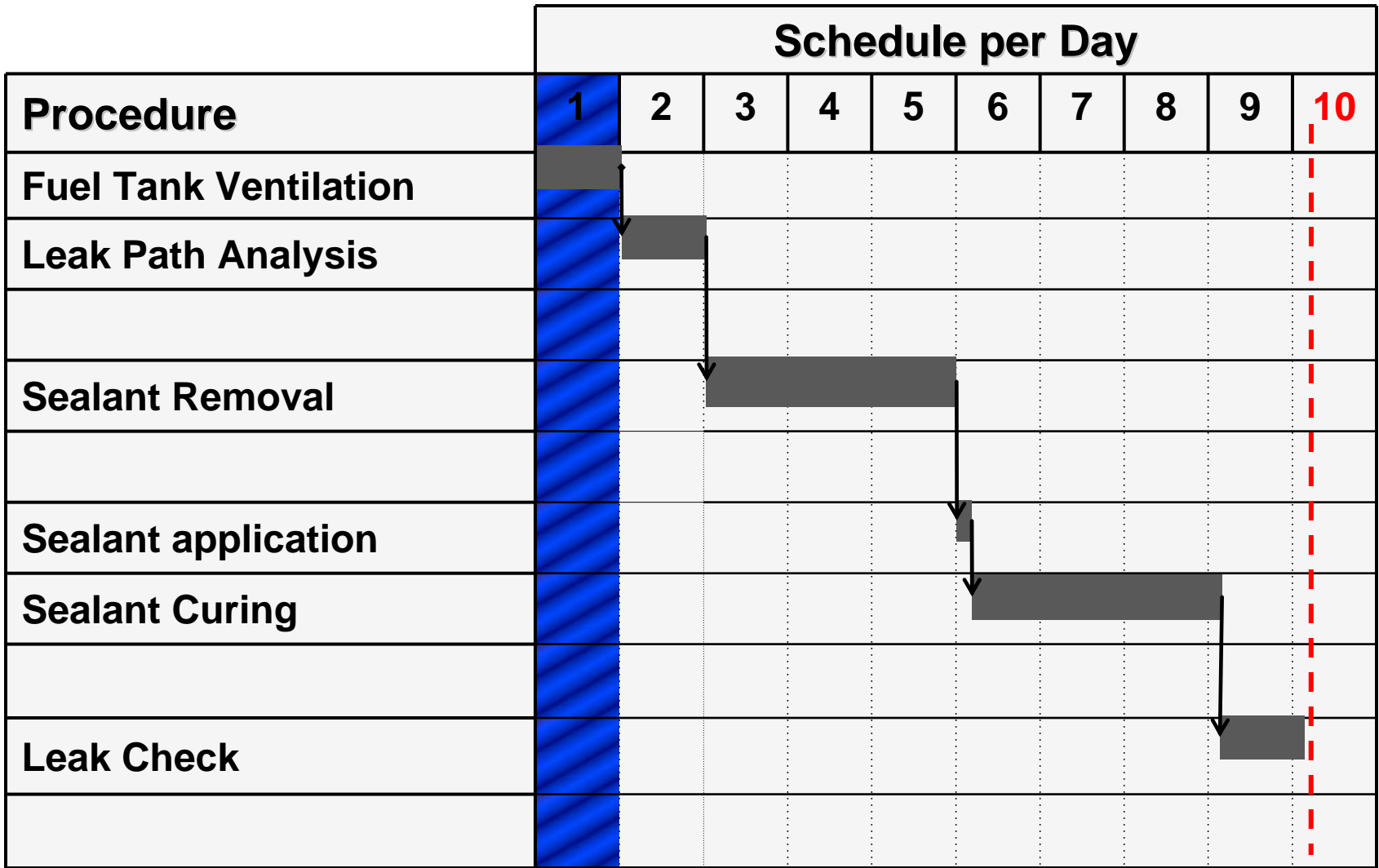
Since 2002, numerous Air Force & Air National Guard squadrons, around the world, have been gaining experience and seeing the benefits of this technology and procedures, drastically reducing downtime.

Most Common Methods Used for Finding Fuel Leaks at that time were:

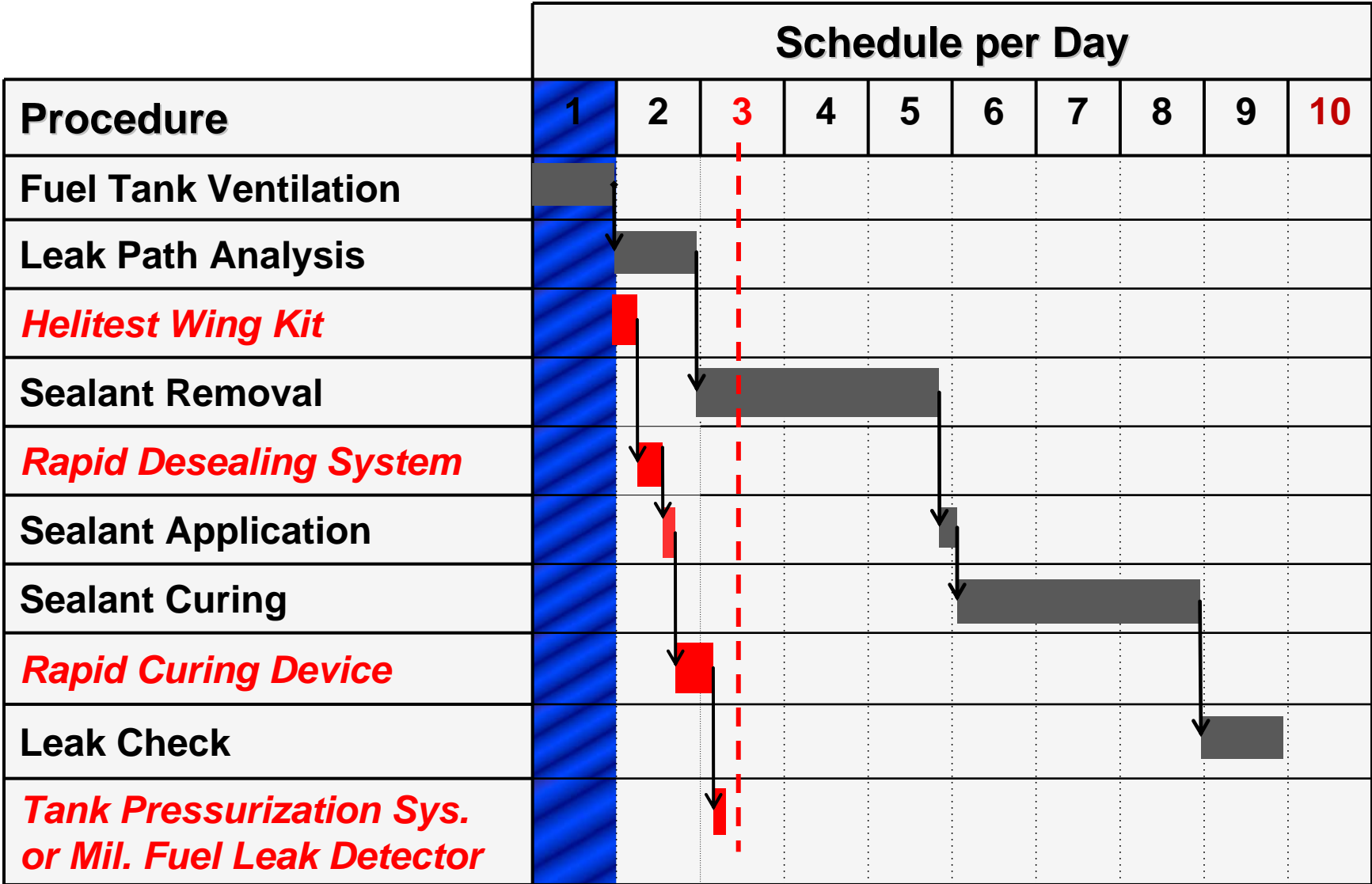
- 1) “Blow Back Method” - High pressure air applied from the outside leak point and searching for bubbles inside the tank (admitted by Boeing to be around 60% accurate) Sensitivity limited to $1.10e-2$ stdcc/sec.**
- 2) Dye Penetrant Method – Using low viscosity penetrating fluid. (very hard to use, even in the best scenarios.)**

Therefore, there was a strong need to use a new technology, very sensitive ($1.10e-5$ stdcc/sec), flexible and easy to use, allowing a rapid leak source location and eventually a repair quality check, before refueling. Of course, first requirement would be to significantly increase the performance and reliability of the findings.

TYPICAL EXAMPLE OF FUEL LEAK REPAIR SCHEDULE



FUEL LEAK REPAIR SCHEDULE *with Aerowing's Technologies*



HELIUM LEAK DETECTION : WHY HELIUM and HYDROGEN

Leak Detection

Remove Sealant

Cure New Sealant

Check Quality Repair

HELIUM IS A SAFE AND LIGHT INERT GAS

- It is the lightest and smallest inert gas molecule
- It easily flows through very small leak paths
- It permits non destructive and dynamic testing
- Helium is non toxic and non reactive
- Helium is non hazardous
- Helium is non flammable, nor explosive
- Helium is 1000 times more sensitive than bubbles

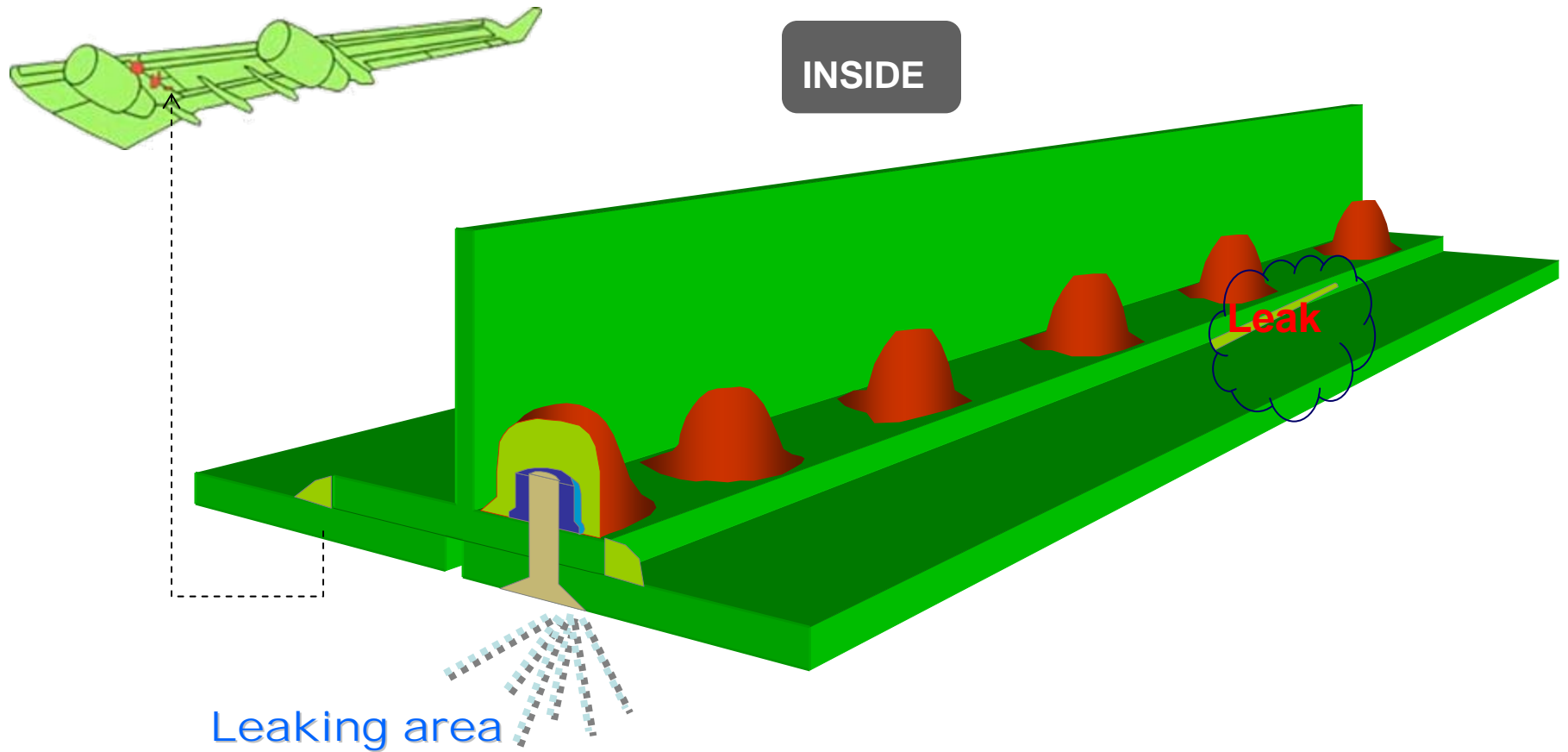
Helium Leak Detector



Low dissipation that creates concentration at leak source outlet

Use to scan and pinpoint leak source (mainly on large surfaces)

HELIUM METHOD - Structural Tank



INSIDE

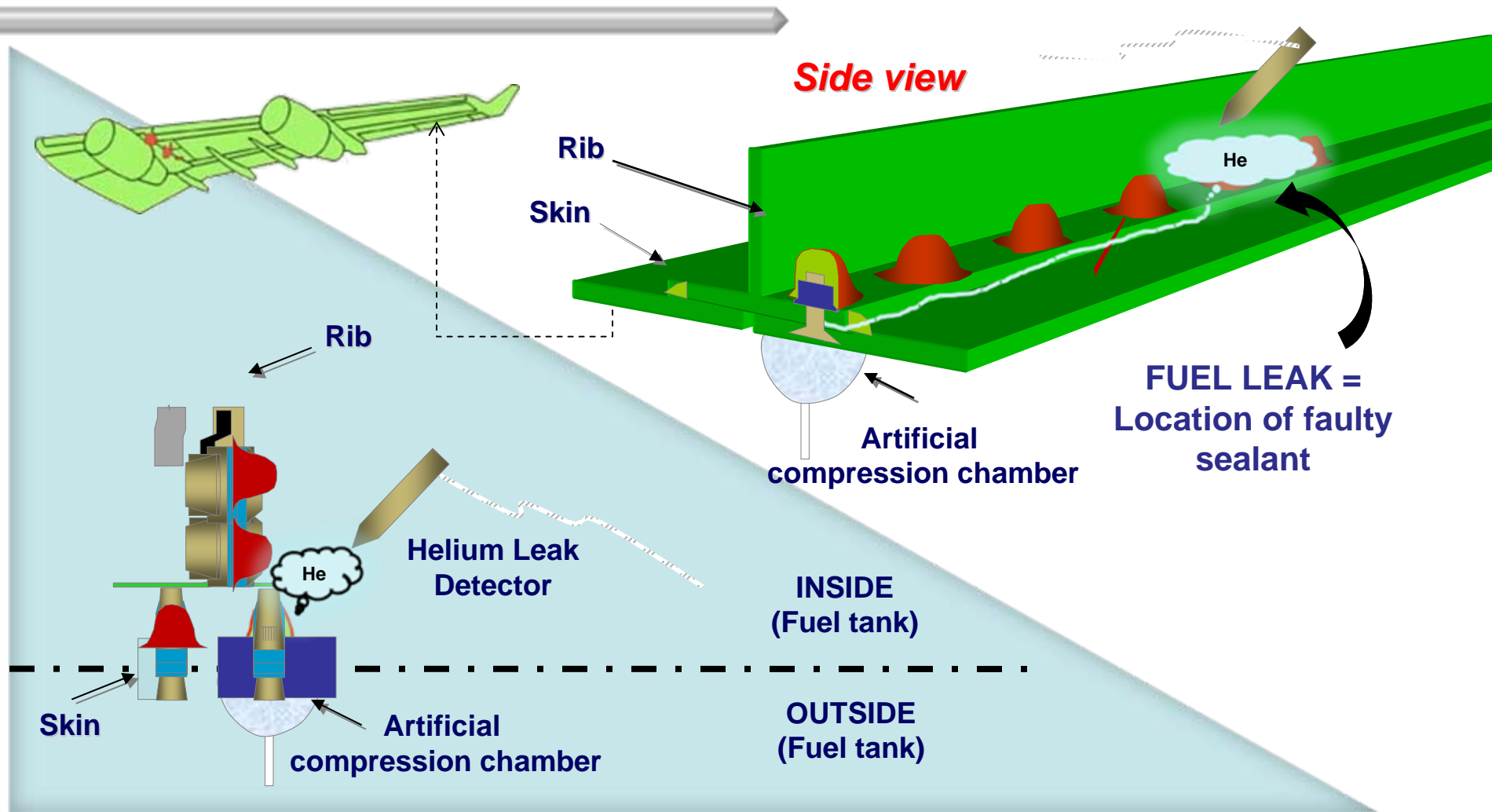
Leak

Leaking area

OUTSIDE

Because of the structural assembly, the leak seen on the outside can travel along paths of several feet.

HELIUM METHOD - structural tank



Cross-sectional view

By applying low pressure helium back through the leak path, we can locate the origin of the leak

TANKS PRESSURIZATION SYSTEM

Leak Detection

Remove Sealant

Cure New Sealant

Check Quality Repair



A new generation of Vent Plugs

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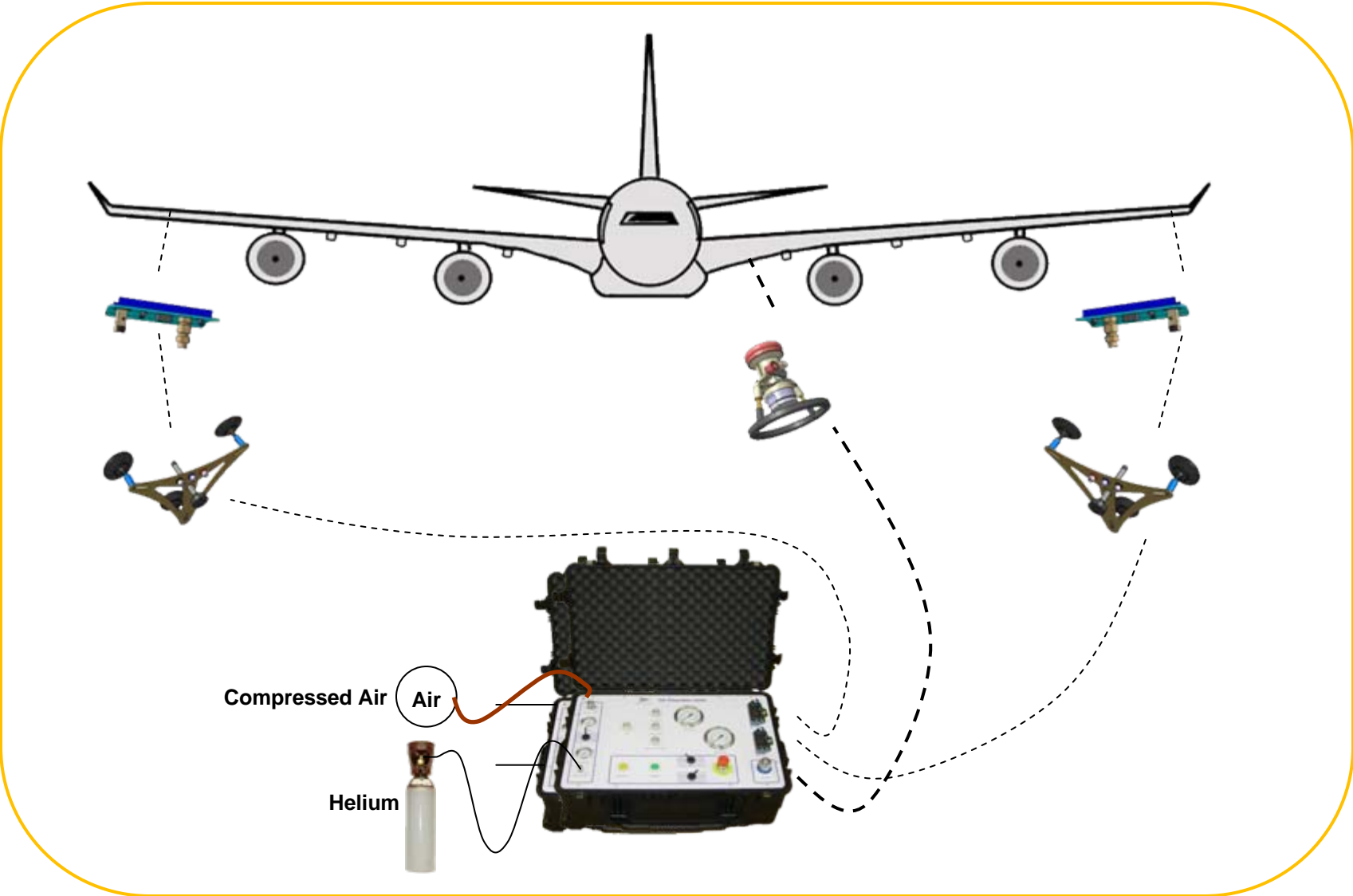
Patented Process



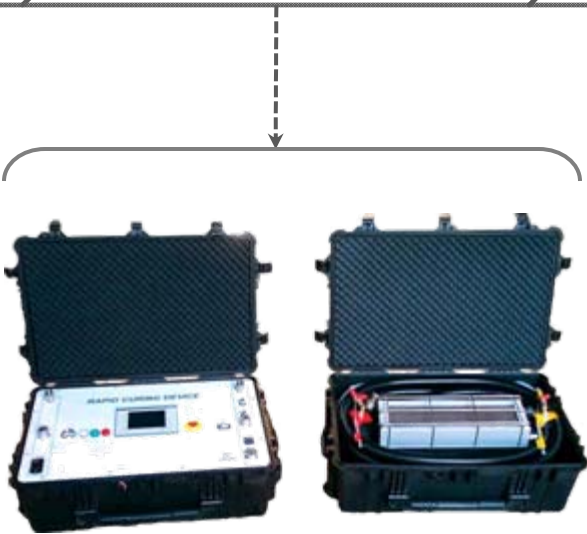
- Significant time savings: 2 hour check
- No refueling needed
- No aircraft disassembly
- Safe and clean process, aircraft is still in the hangar



TANKS PRESSURIZATION SYSTEM : APPLICATION

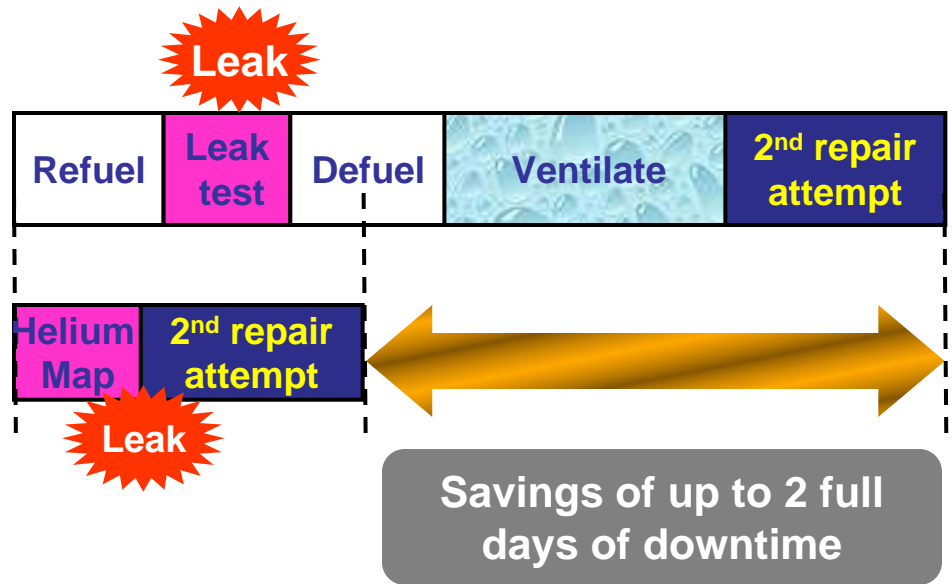
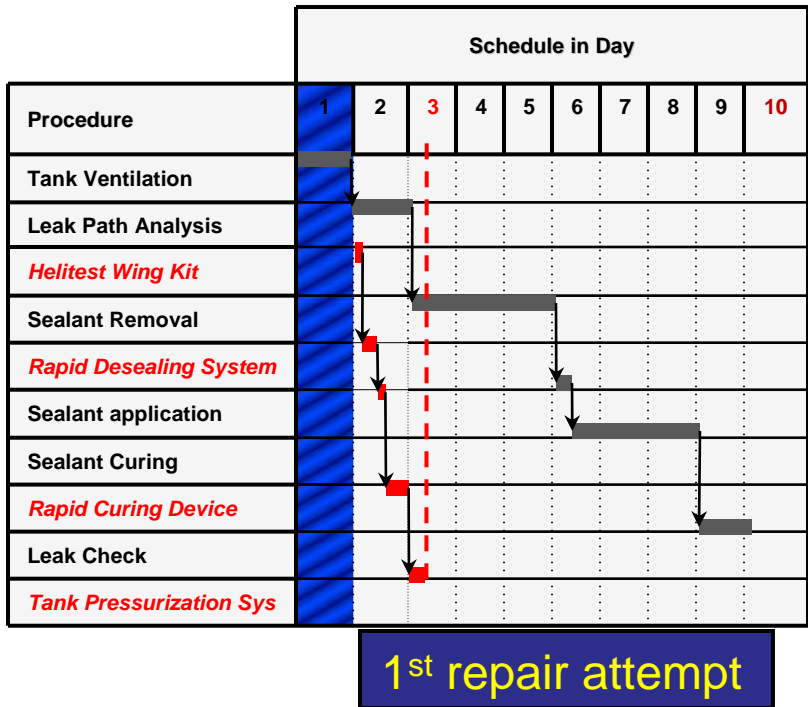


AEROWING SOLUTION FOR HEAVY AIRCRAFT & FIGHTER JETS



TANK PRESSURIZATION SYSTEM

Extra benefit of Helium Mapping in case of an unsuccessful repair



HELIUM METHOD - F18 bladder cell



The US NAVY request:

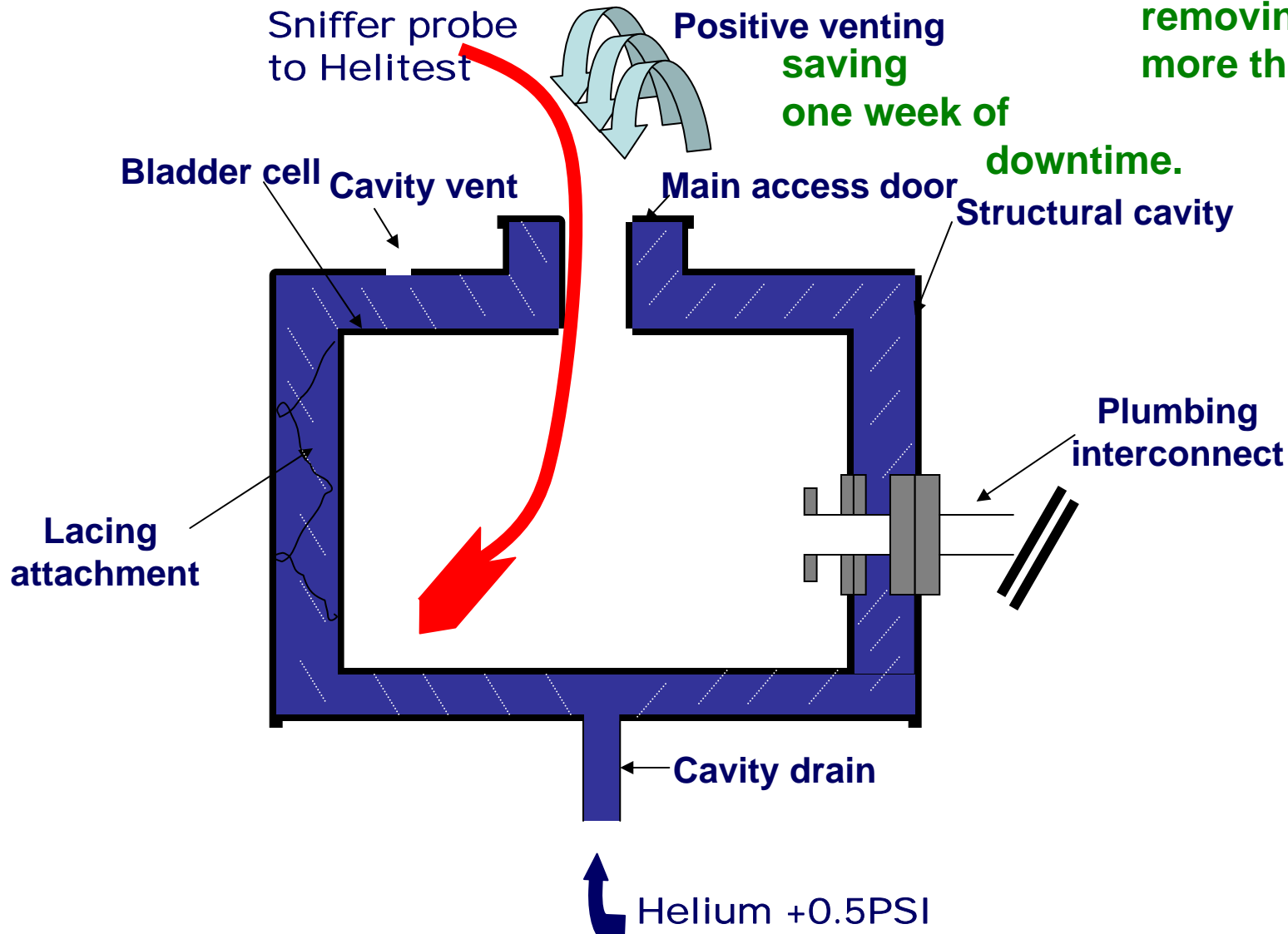
- Identify the leak origin inside the Fuel Cell N° 1,2,3,4,5, and be able to repair it without any disassembly of the leaking bladder cell.
- Quickly verify leak free integrity of the numerous couplings, especially in the n° 4 tank

HELIUM METHOD - F18 bladder cell

With helium introduced into the cavity, it will pass through the leak path, into the bladder cell. Able to identify the leak location and repair leak **WITHOUT**

removing cell, more than

Positive venting saving one week of downtime.



HELIUM METHOD - F18 bladder cell leakage trouble shooting and rapid repair:



Portable MFLD applies a controlled pressure of helium to the cavity with pressurization network ranging at 2PSI full scale.

- **Two safety loops for redundant safety against over pressurization.**
- **Additional vacuum pump for the helium detection unit (mouth piece).**
- **Safety feature includes Class1 Div1 certification, for use in fuel areas.**
- **High sensitivity leak detection (in the range of $1 \cdot 10^{-5}$ stdcc/sec).**
- **Easy set-up and perfect for dry testing, good for health and safety.**

R.O.I : F18 in the fleet



In the fleet, standard repair process of a leaking bladder cell takes between 2 to 4 weeks, depending on the damage.

Cost of repair is combined with bladder cell exchange and manhours (more than \$100,000.00).

With the Helium technology, the bladder cell stays onboard and the repair will take no longer than 24 hours.

Again, the kit is amortized with the first aircraft repair.

C130 Heavy Maintenance



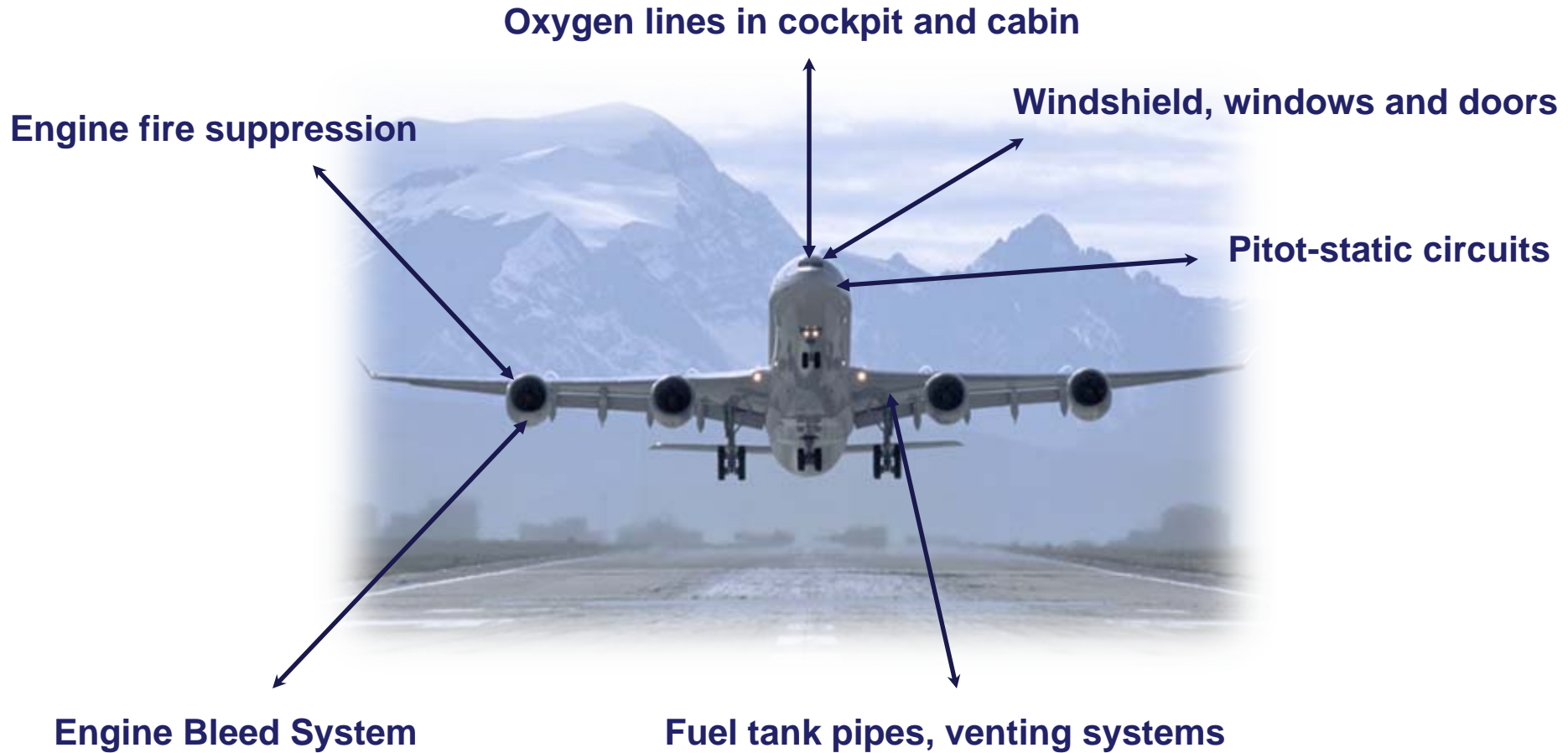
Currently, at the end of heavy mx., several roundtrips to the refuel dock may be necessary to fix all fuel leaks that were not found by current maintenance practices (sometimes up to 10 trips).

Each roundtrip costs \$40,000.00.

Leak detection kit cost is amortized after the first airplane. Can help eliminate trips to the refuel dock by testing the integrity of the leak repairs, using helium.

Easy extrapolation can be made for C5, C17, KC10, KC135, B1, B2, etc...

NUMEROUS OTHER AIRCRAFT LEAK DETECTION NEEDS



Other components : Bladder Cells, Valves, Slides, Wave Guide, etc...

Military implementation around the world



U.S. AIR FORCE

All DoD services can benefit from the technology presented. There is room for growth and additional implementation across DoD platforms.



Current Utilization

More than 35 ANG KC-135 locations /
Tinker (KC-135) Heavy Mx. /
Warner Robins (C-5) Heavy Mx. /
Ellsworth (B-1) Squadron Operations

US NAVY at NAS Jacksonville, FL - F18

- Royal Australian AF
- Spanish AF
- French AF
- Finnish AF
- German luftwaffe
- Royal Oman AF
- Pakistan AF
- Kuwait AF

- Boeing
- E.A.D.S
- Northrop Grumman
- Vought
- Embraer
- L3
- Dassault



THANKS FOR YOUR ATTENTION