Reaction Engines

Heat management for a cooler, cleaner world.

COMPANY HERITAGE

Founded 1989

To pioneer a single stage, reusable rocket engine, with horizontal take off and landing capability.

Applied Technologies established 4 years ago to commercialise advanced heat exchanger & thermal management technologies

USA Office:
Denver, Colorado

Headquarters: Culham Science Centre
Oxfordshire, UK

Colin Kedge

Product Development Lead
(Industrial Heat Exchangers)

Colin.kedge@reactionengines.co.uk
https://reactionengines.co.uk

Reaction Engines

Our partners:

BOEING

SDF صندوق تنمية القطاعات الاستراتيجية

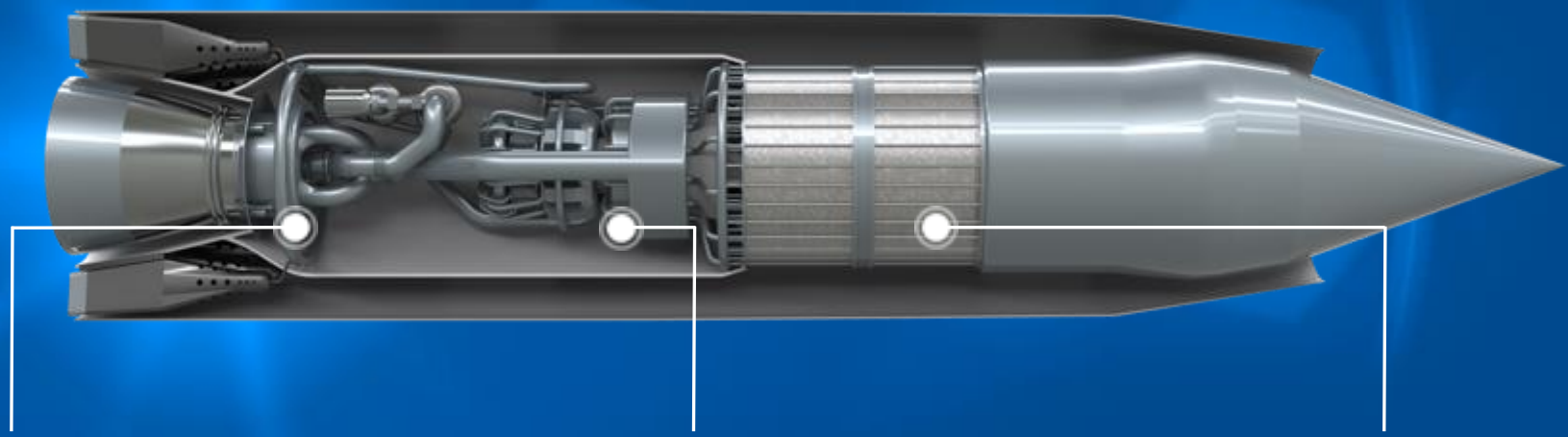
BAE SYSTEMS

ROLLS ROYCE

SABRE.

How it all Started

A truly versatile propulsion system – SABRE is an air-breathing rocket engine that can propel an aircraft from zero to five times the speed of sound in the atmosphere and 25 times the speed of sound for space access.



1. Integrate

Combine jet and rocket to create engine class capable of high Mach atmospheric and space flight in a single engine

2. Regenerate

Re-inject the heat captured into the engine to drive components, thereby reducing fuel consumption

3. Cool

Cool the hot incoming air from 1000°C to -150°C in 1/20th second to operate 2x faster than current technology (Mach 5)

Reaction Engines

Reaction Engines Vision & Technology Areas

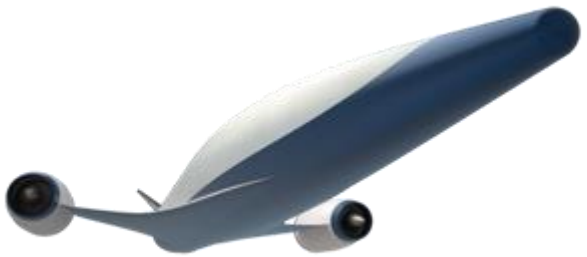
Unlock the Future of Space Access and High-Speed Flight

1. SABRE

- New class of propulsion
- Capable of operating in both air-breathing and rocket modes to power a vehicle from runway into space

2. High Speed Flight

- SABRE-derived technologies
- Combined with state of the art jet engines, delivering the capability to meet future high-speed and hypersonic needs



Reaction Engines Vision & Technology Areas

Applied Technologies Heat Management

3. Aerospace & Defence

The sky is not the limit. Lower weight and drag ultimately means less fuel consumption – dramatically improving aircraft efficiency.

4. Automotive

Smaller, lighter, faster – our heat exchange systems reduce weight and size to improve performance.

5. Energy & Marine

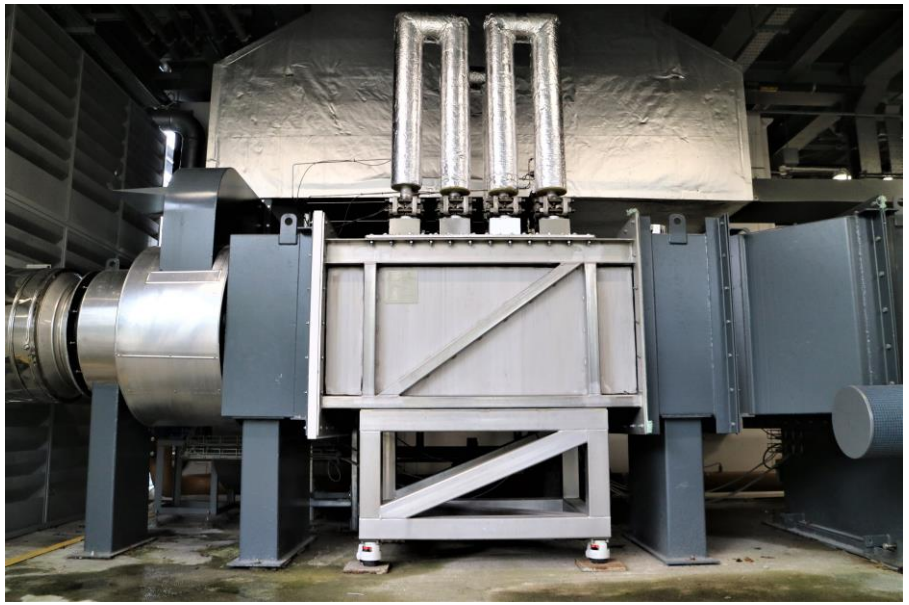
Turning waste heat and energy into new energy and power – reducing the industry's carbon footprint. Stepping towards net-zero and a greener future.

Primary heat exchanger for sCO_2 waste heat recovery system

RE's first commercially supplied heat exchanger - installed in 2019

Brunel University wished to demonstrate how an sCO2 closed loop cycle could be used for waste heat recovery from industrial processes

- Key features of our heat exchanger:
- Low shell side (flue gas) pressure drop
- Working tube pressures of up to 130 bar (tested to 230 bar)
- Shell side temperatures up to 650°C (sCO2 in tubes up to 500°C)
- Fully CE marked (Cat IV PED) - designed and manufactured to ASME BPVC



Rocket Plume Intercooler

Operational since May 2021

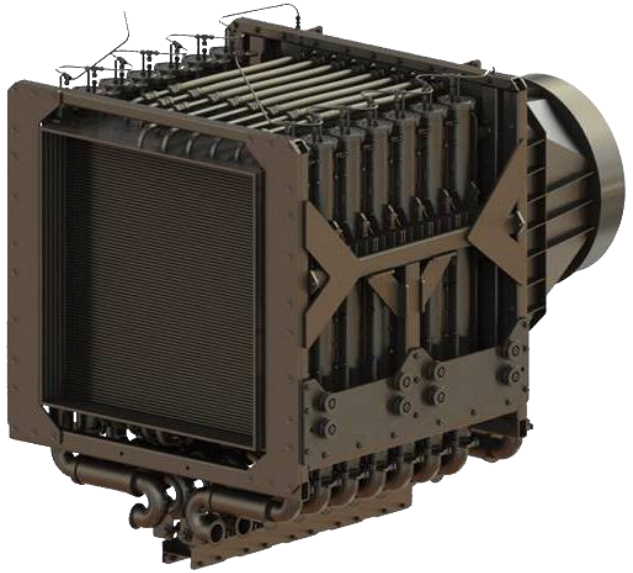
Reaction Engines designed and built a bespoke plume intercooler for a new high altitude rocket test facility for Nammo Westcott.

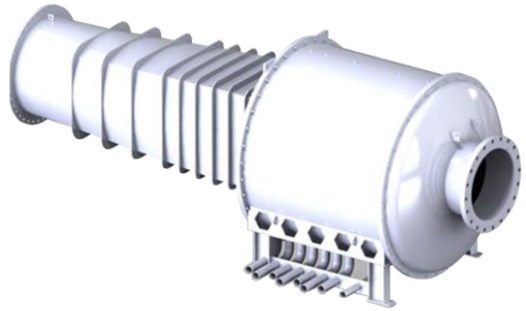
The straight rack heat exchange solution consists of multiple modules using water as the working fluid to cool the rocket plume entering the unit from over 2,300°C to less than 50°C in less than a meter's distance.

The heat exchanger modules are designed, and vacuum brazed to ASME BPVC and ISO EN standards.

NAMMO WESTCOTT ROCKET PLUME INTERCOOLER

Vessel Diameter	1.7 m
Total Height	1.8 m
HX Core Size	1 m x 1 m x 1 m
HX Mass	810 kg
Inlet temperature ('shell side')	~2,300°C
Outlet Temperature ('shell side')	<50°C
Heat Rejection Rate	1.5 - 2 MW





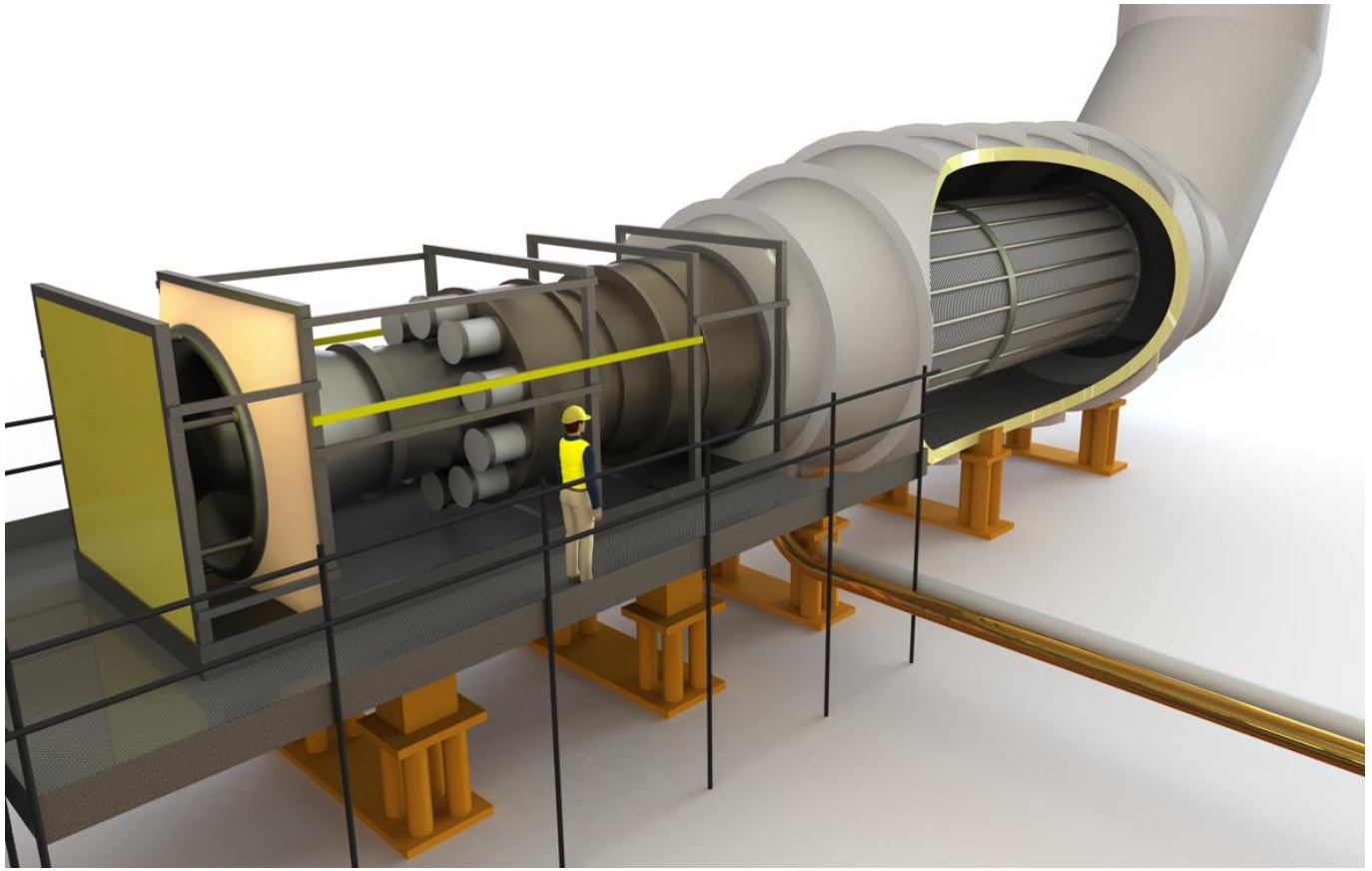
CASE STUDY

Enabling Carbon Capture from Waste Heat Recovery (WHR)

Unprecedented heat removal without impacting on GT performance

Ongoing feasibility project with “Top 10 Oil & Gas” company designing WHR heat exchanger to enable carbon capture behind a GT. :

- Design baselined against a 90 MWe GT
- Heat removed post GT = ~150 MW
- Exit temperature post WHRU < 50°C
- Pressure drop thru. WHRU < 6” of water (<1,500 Pa)
- WHRU approximately Ø8 m × 8 m (dia. × length)

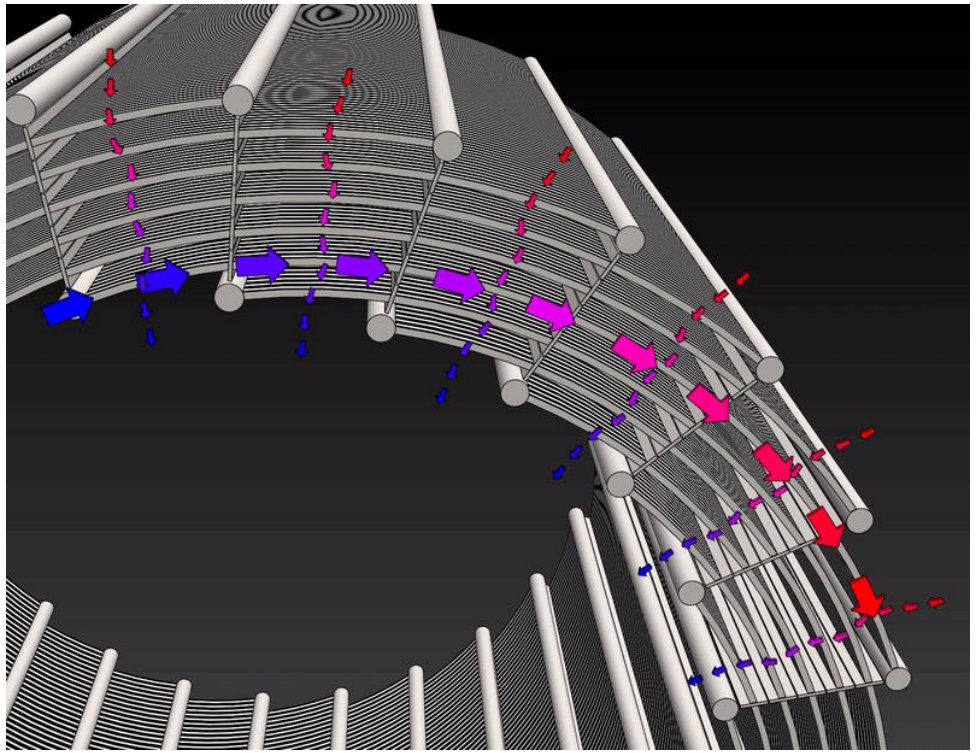


Reaction Engines
APPLIED TECHNOLOGIES

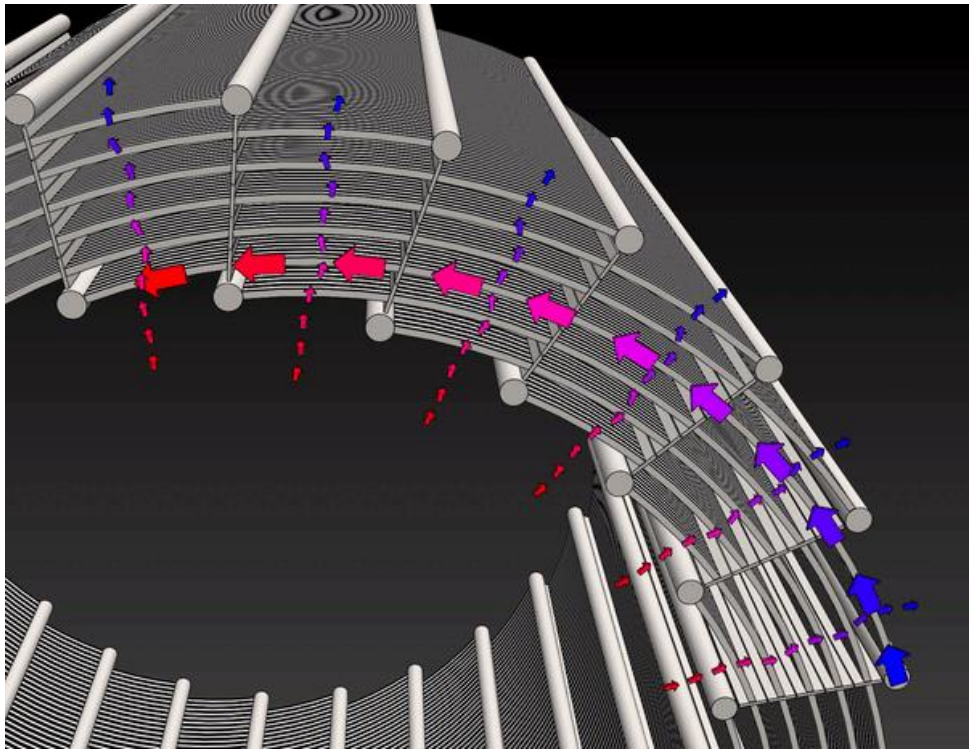
Patented, high performance micro-tube heat exchanger Technology

RE spiral wound HX architecture results in a compact heat exchanger with a unique counter AND cross flow characteristics.
These can be operated in either direction, depending on the design requirements, with shell side fluid moving:

Out > In



In > Out



Benefits of RE HX Technology

REDUCED OPERATING COSTS

The effectiveness (heat captured) of the system can be optimised to recover more heat for increased system efficiency.

SMALLER, LIGHTER

Our development in high performance heat exchangers facilitates smaller, lighter units that can be easily transported and result in reduced installation costs.

REDUCE CARBON FOOTPRINT

Waste heat recovery enabled by our heat exchangers can reduce carbon usage in industrial processes to aid the path to net zero.

EASY TO INTEGRATE

Our spiral geometry heat exchangers are uniquely capable to retrofit existing systems. Their modular assembly allows for cost-effective maintenance with reduced downtime and lower end of life cost.

Reaction Engines
APPLIED TECHNOLOGIES

Thank You

Colin Kedge
colin.kedge@reactionengines.co.uk

Roger White
Roger.white@reactionengines.co.uk