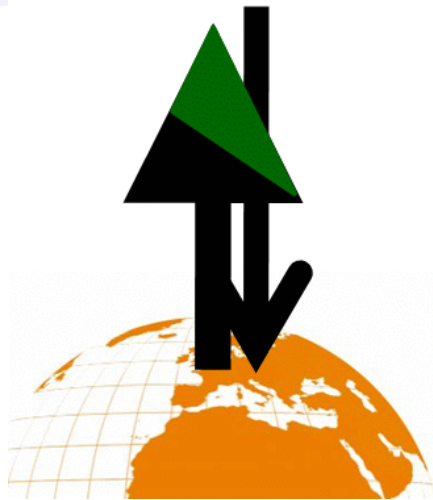


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## Scramjet-Engine Concept

Innovative ignition  
Innovative heat balance  
Application of multiple flow principle

### Patent Application:

- 15 Pages
- 16 Claims
- 11 Figures

### Content:

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Use of the "Ram effect" + pressure surges in supersonic → Supersonic Combustion Ramjet

- Compression via inlet geometry Engine flow permanently supersonic
- No moving parts as with turbine
- High face velocity required

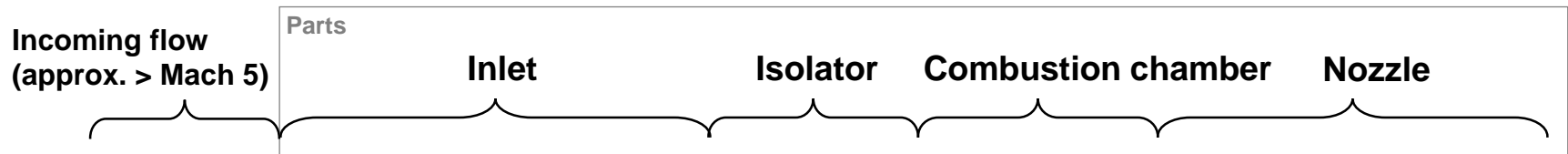
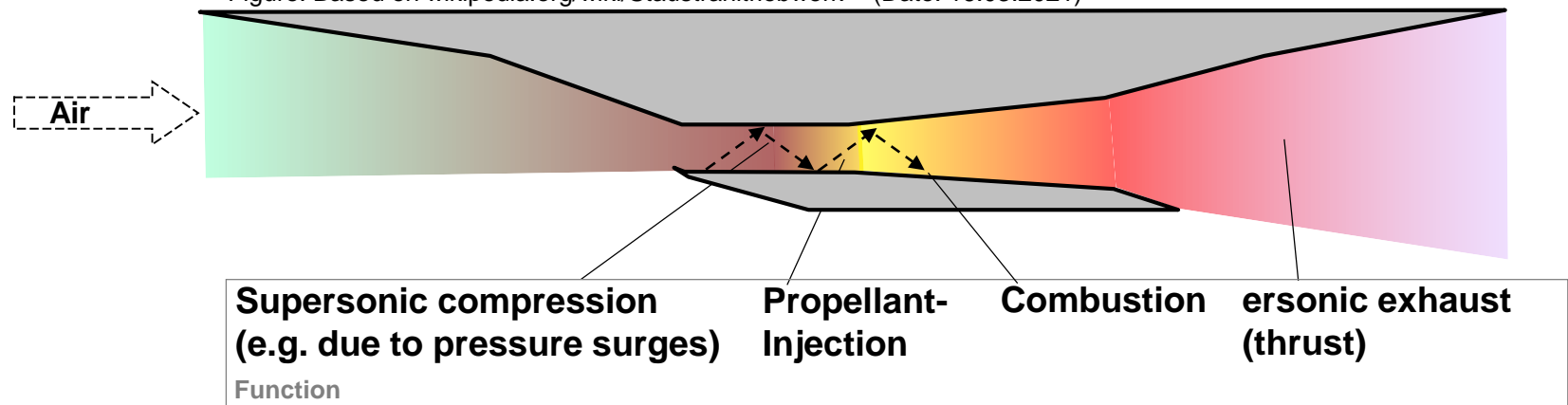
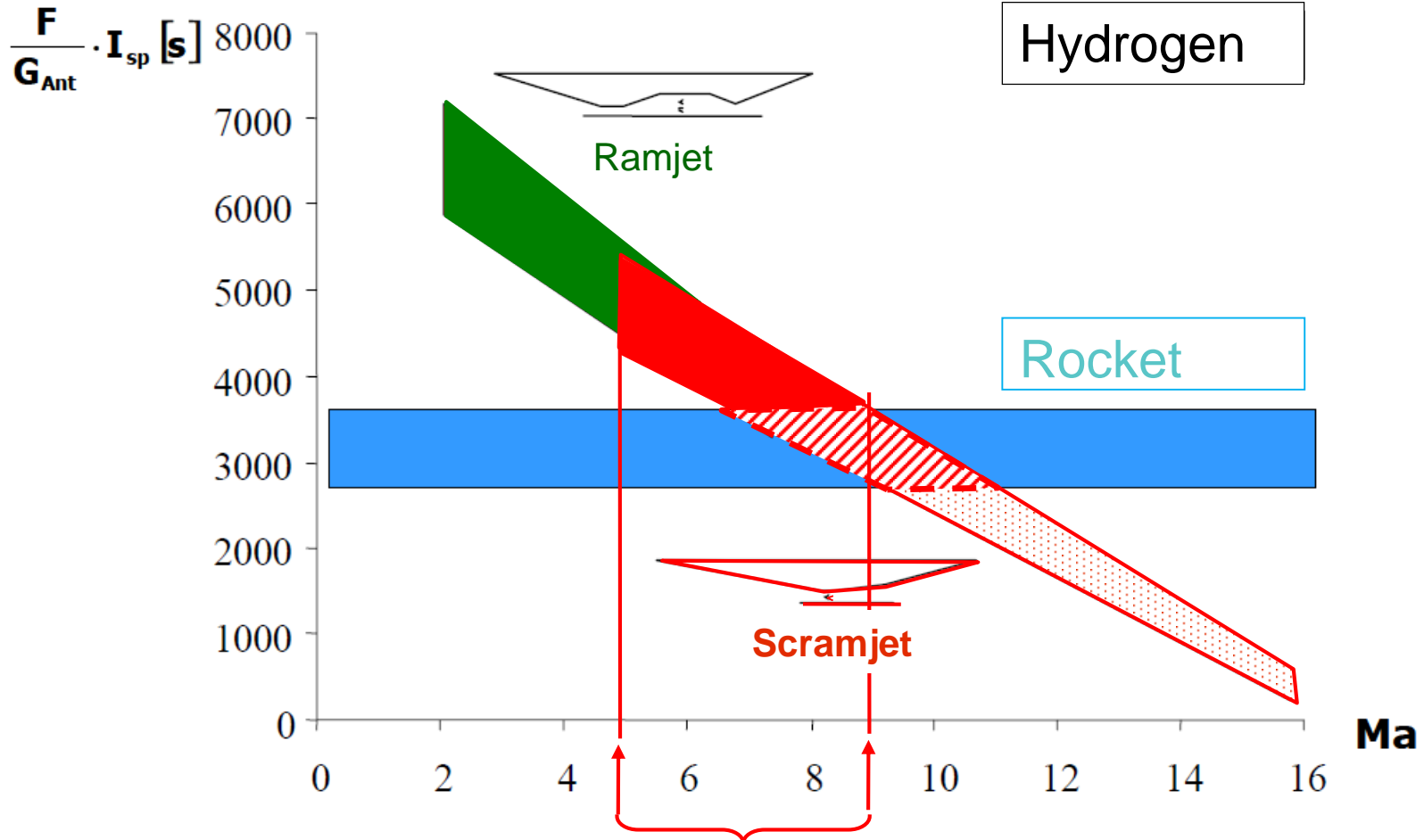


Figure: Based on wikipedia.org/wiki/Staustrahltriebwerk (Date: 16.03.2021)





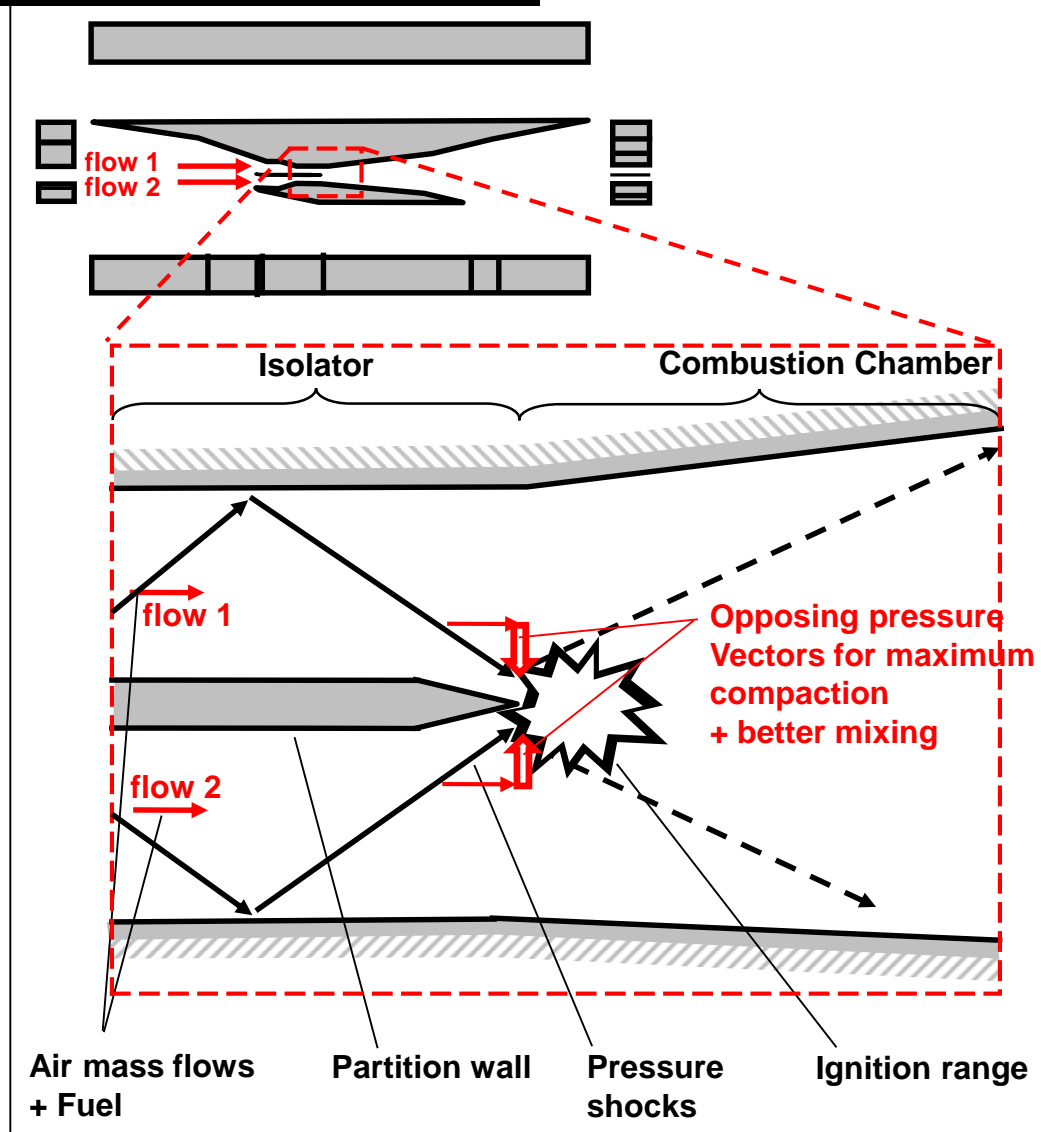
**Ideal operating range → approx. Mach 4.5 - 9**

**Diagram 1: Performance comparison of different drives**

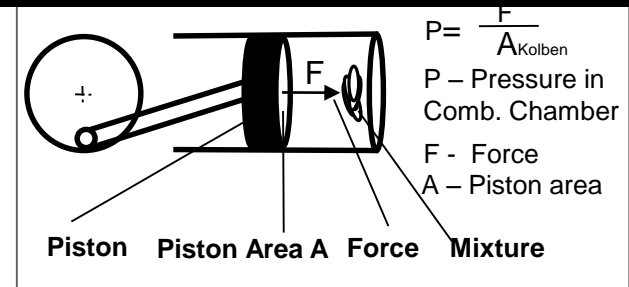
Source: Dipl.-Ing. Mirko Hornung (Dissertation): „Entwurf einer luftatmenden Oberstufe und Gesamtoptimierung eines transatmosphärischen Raumtransportsystems“; 07.06.2002; Universität der Bundeswehr München

# Geometry new - multi-current principle

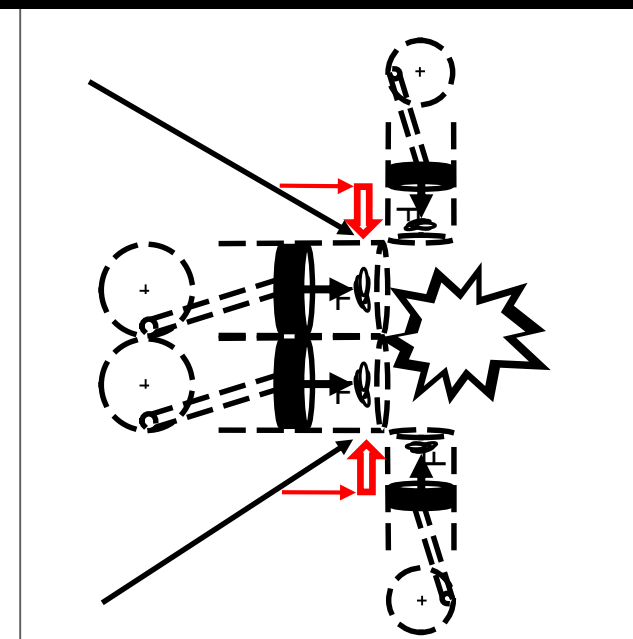
## Geometry of an embodiment



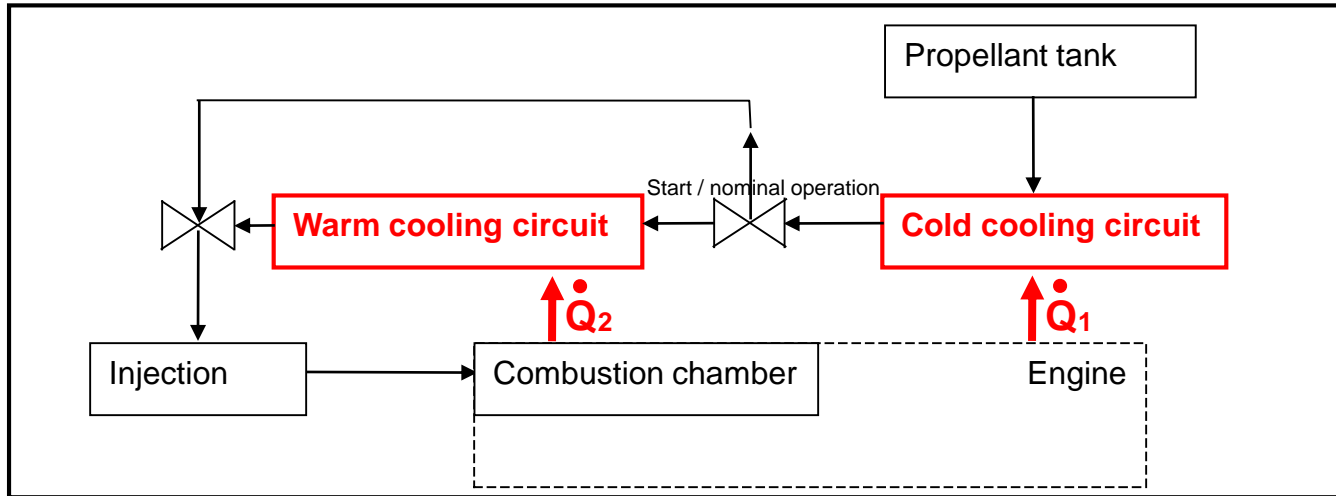
## Principle - compression (shocks ~ comparison with piston)



## Piston area nodal point = ignition

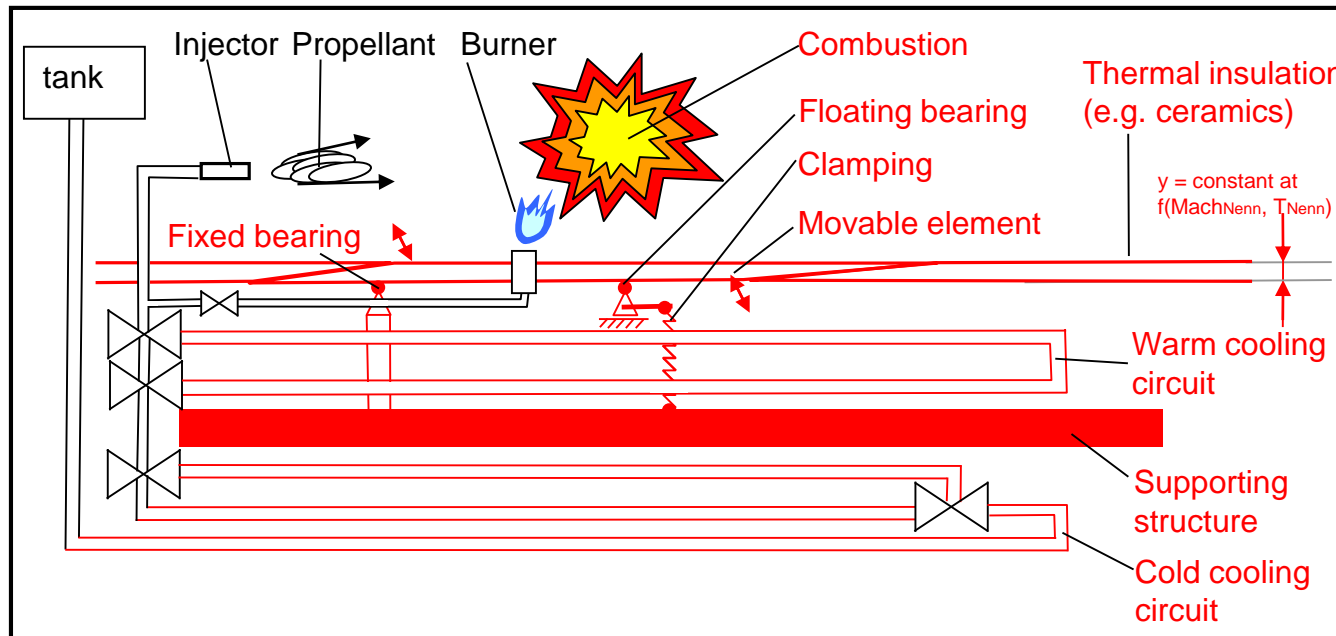


➔ Cf. multi-current principle e.g. jacket flow operation with modern turbines



## Measures:

- 2 cooling circuits
- Hot injection of the fuel
- Increase thrust
- less consumption

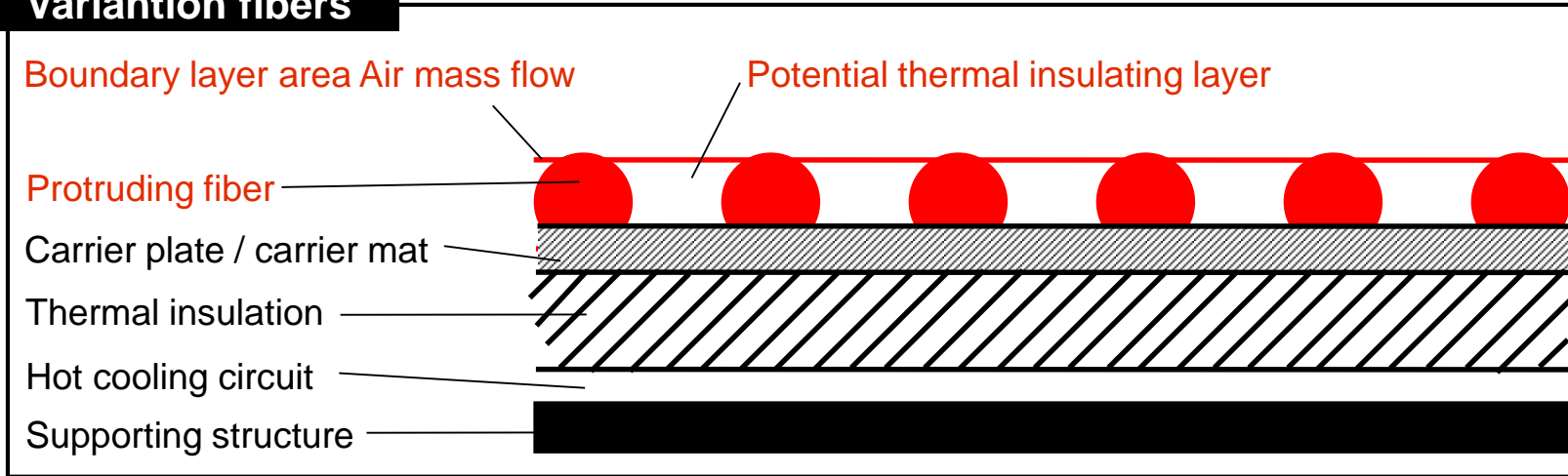


## Thermal:

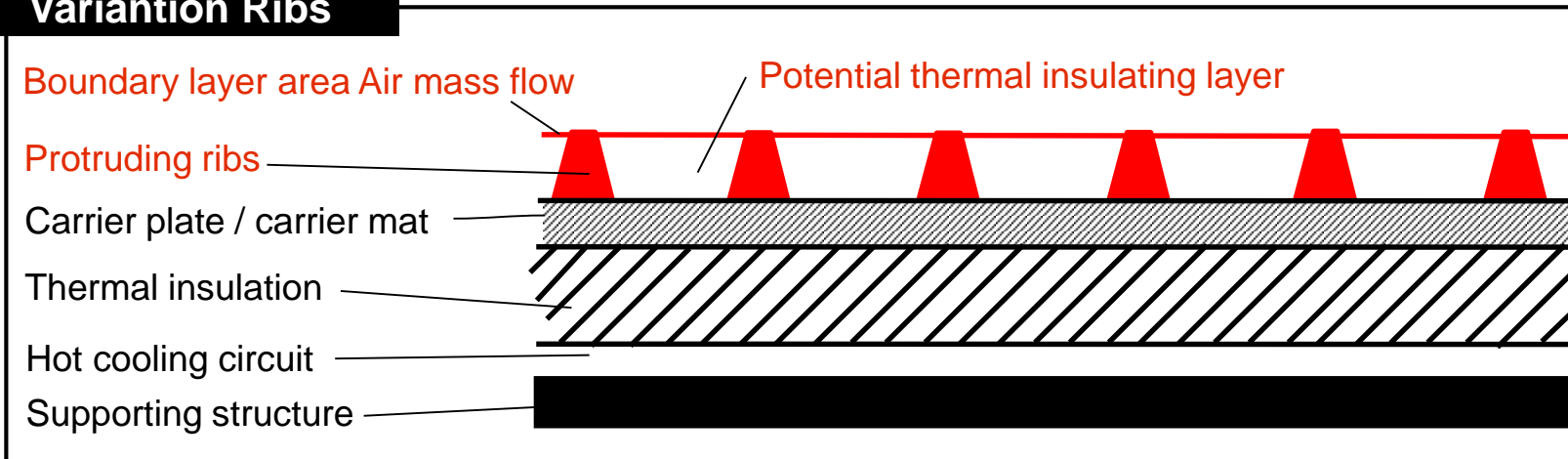
- Cladding (e.g. with flexible ceramic plates)

Bionics / Sharkskin: Ribs or fibers reduce contact area with fluid flowing longitudinally past → Less friction, more net thrust

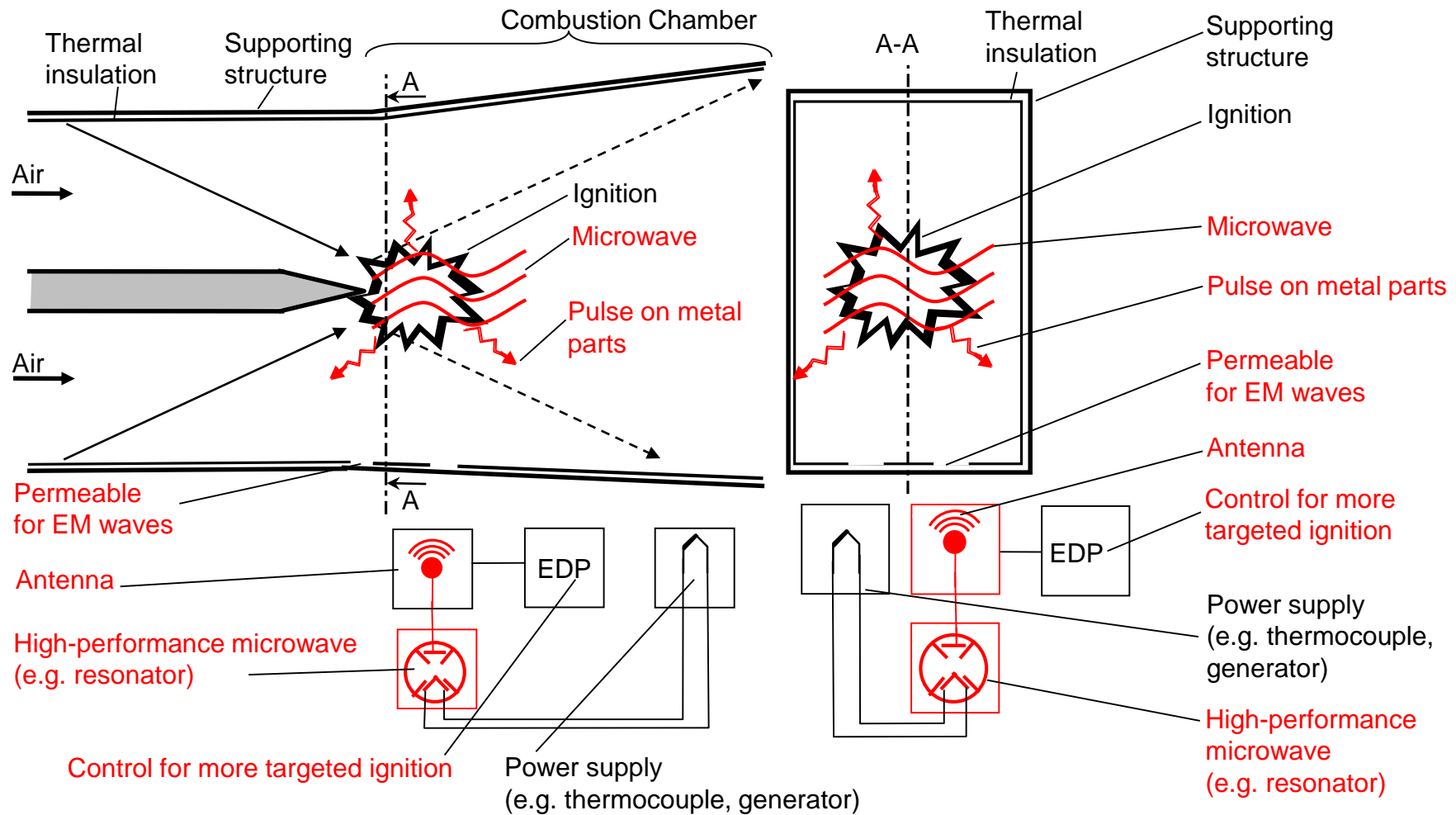
## Variation fibers



## Variation Ribs



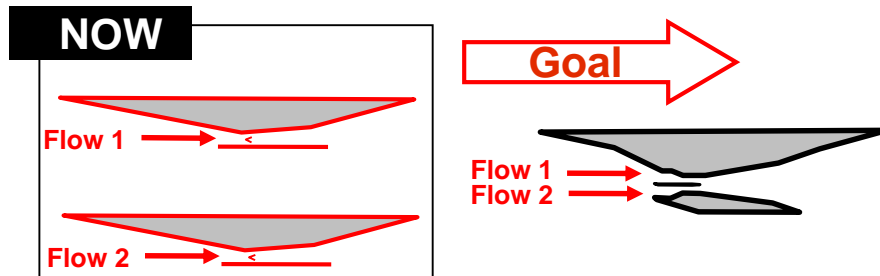
## Addition of metal parts concentrates / absorbs Microwaves



→ Heat dissipation in the engine flow at cooler boundary layers

Summary:

**SCRAMJET DRIVE CONCEPT INCLUDES VARIANT TO:  
geometry, injection, ignition, heat balance.**



## ADVANTAGES:

- Enlargement of the engine cross-section  
Lower aerodynamic resistance
- Reduction of inlet-to-combustion chamber communication → Increase of permissible combustion chamber pressure
- Better mixing of air mass flow and fuel in combustion chamber despite short residence time
- Improvement of thermal balance due to functional separation of thermal protection  
And load structure
- Innovative ignition from outside, larger ignition ranges, more uniform and better combustion