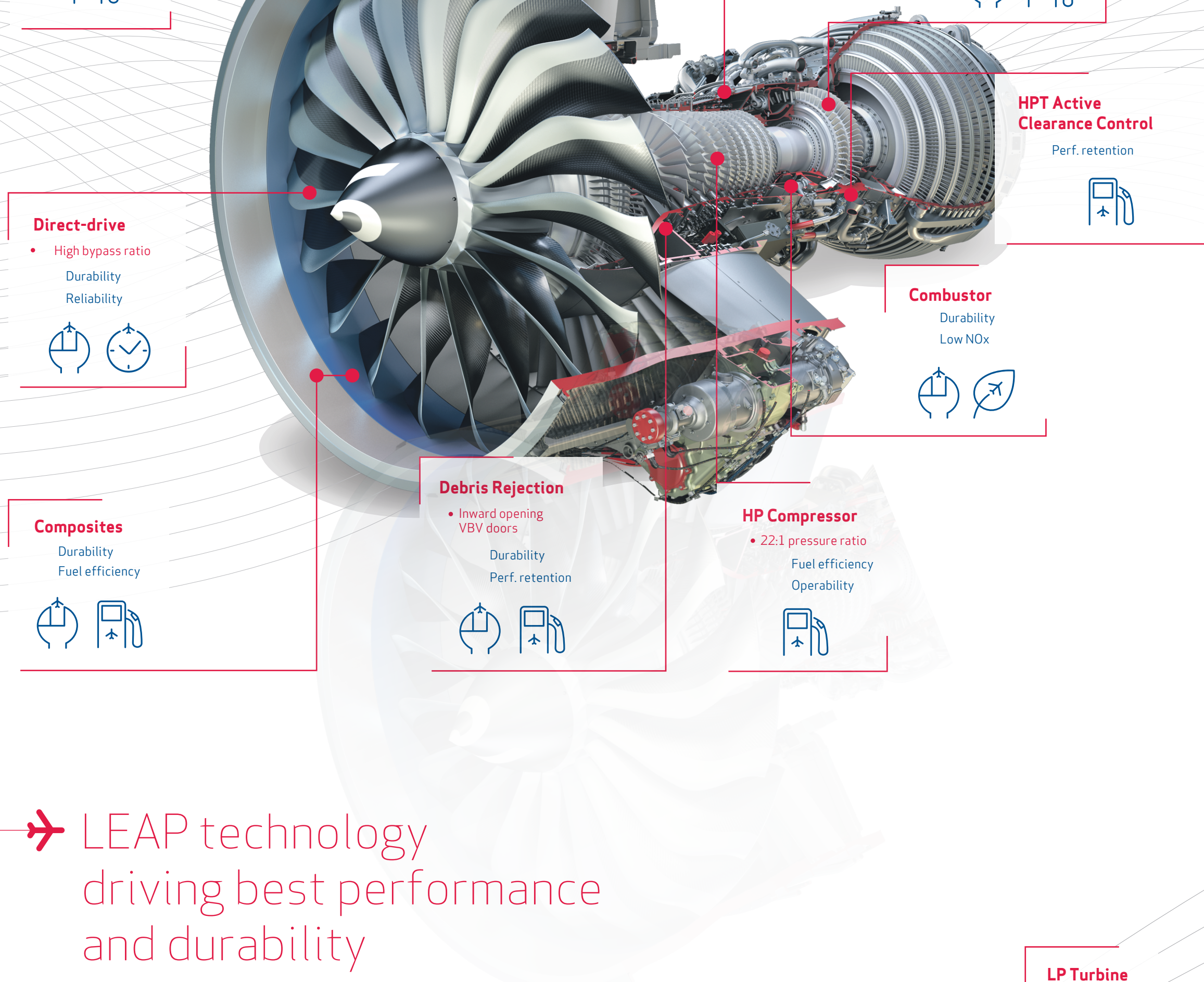
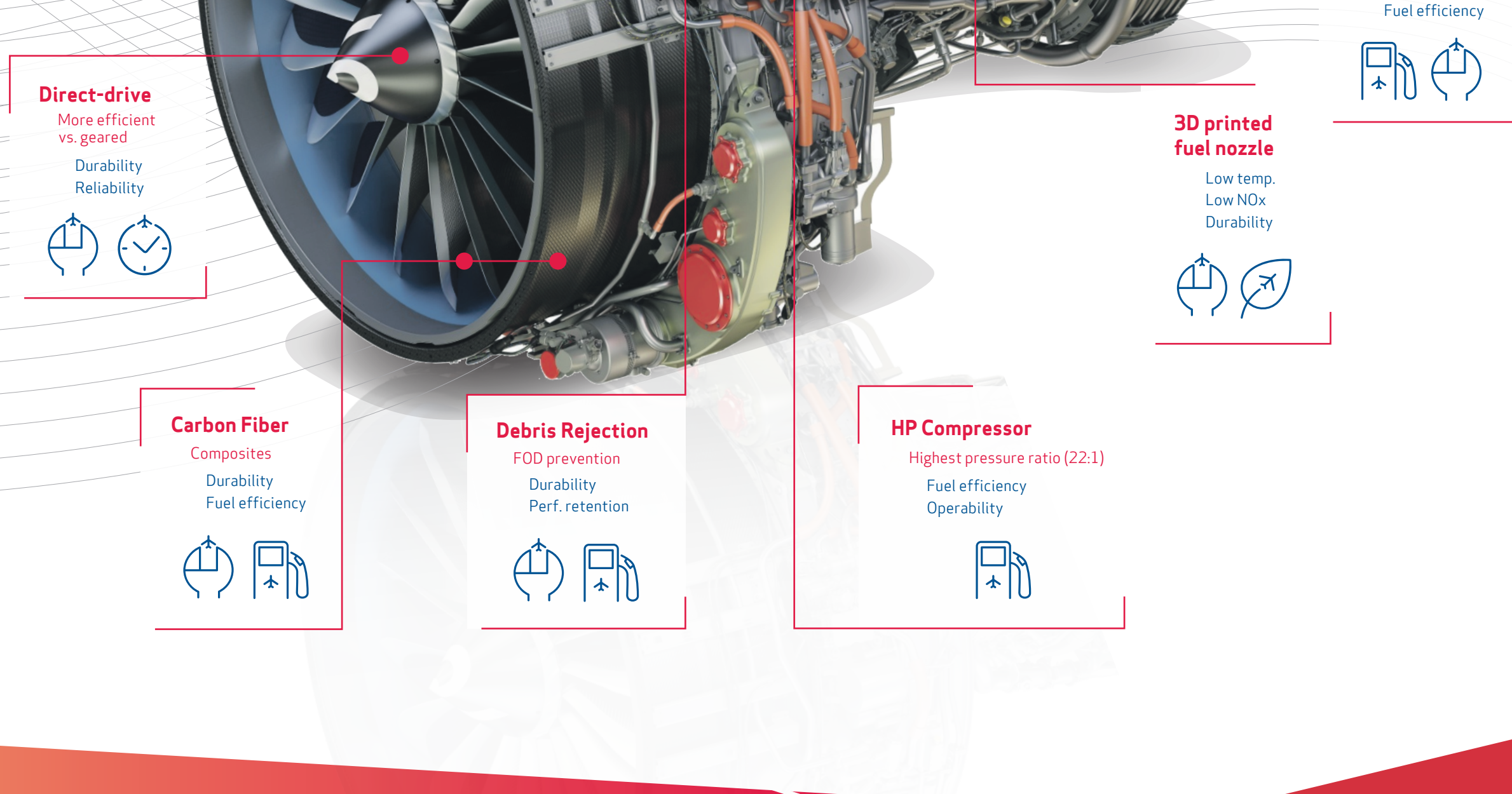


# LEAP TECHNOLOGY

## driving performance and durability



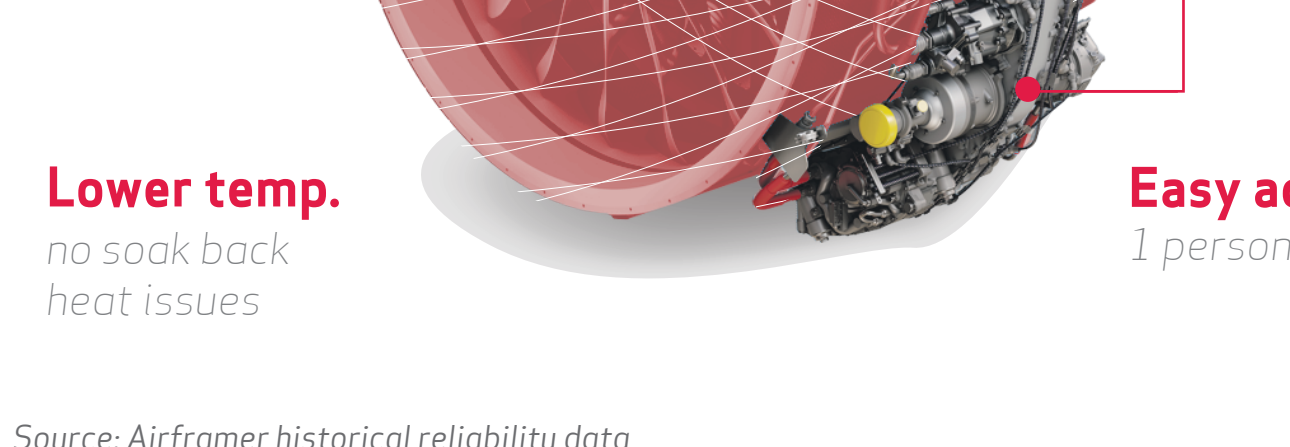
### → LEAP technology driving best performance and durability



## LEAP design decisions support engine reliability

### → LEAP ACCESSORY GEAR BOX (AGB)

Fan mounted at 8 o'clock position



#### Proven design

All single-aisle aircraft engines

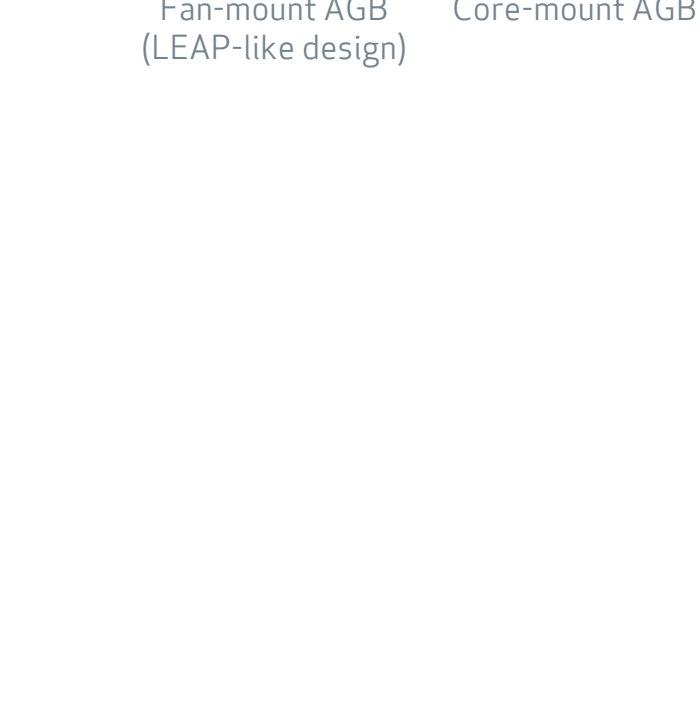
#### Lower temp.

no soak back heat issues

#### Easy access

1 person, 2 minutes

#### Schedule interruptions (per million departures)



Source: Airframer historical reliability data

### → CARBON FIBER COMPOSITES

Less weight, more durable

#### LEAP benefits



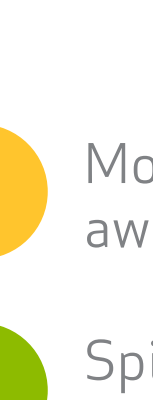
Lighter  
Fan disk  
Containment  
Structures



No relube



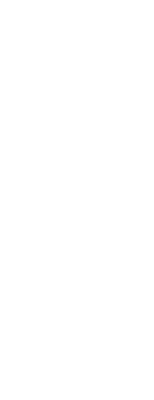
Woven composite



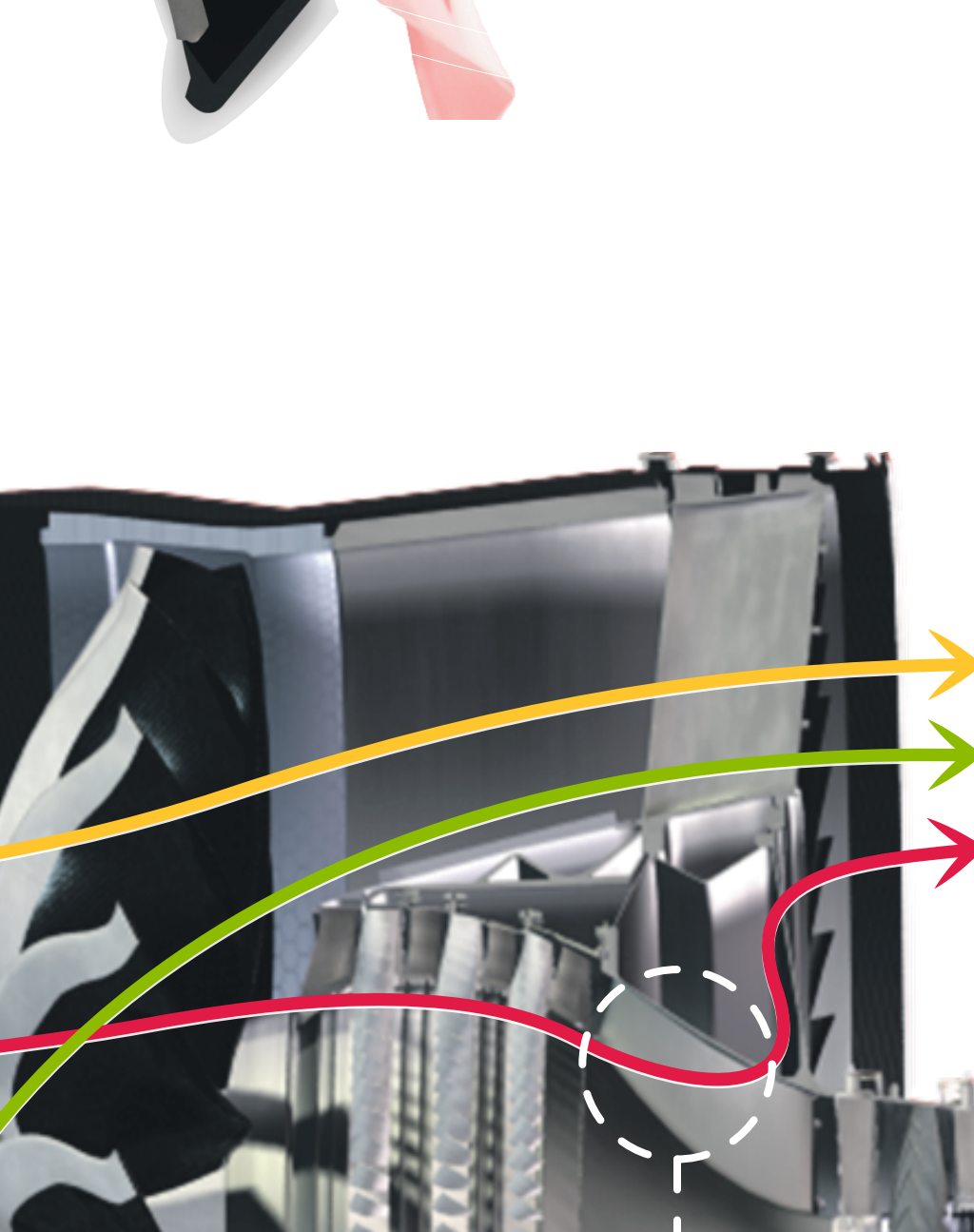
No dovetail wear



1000 pounds less weight per airplane

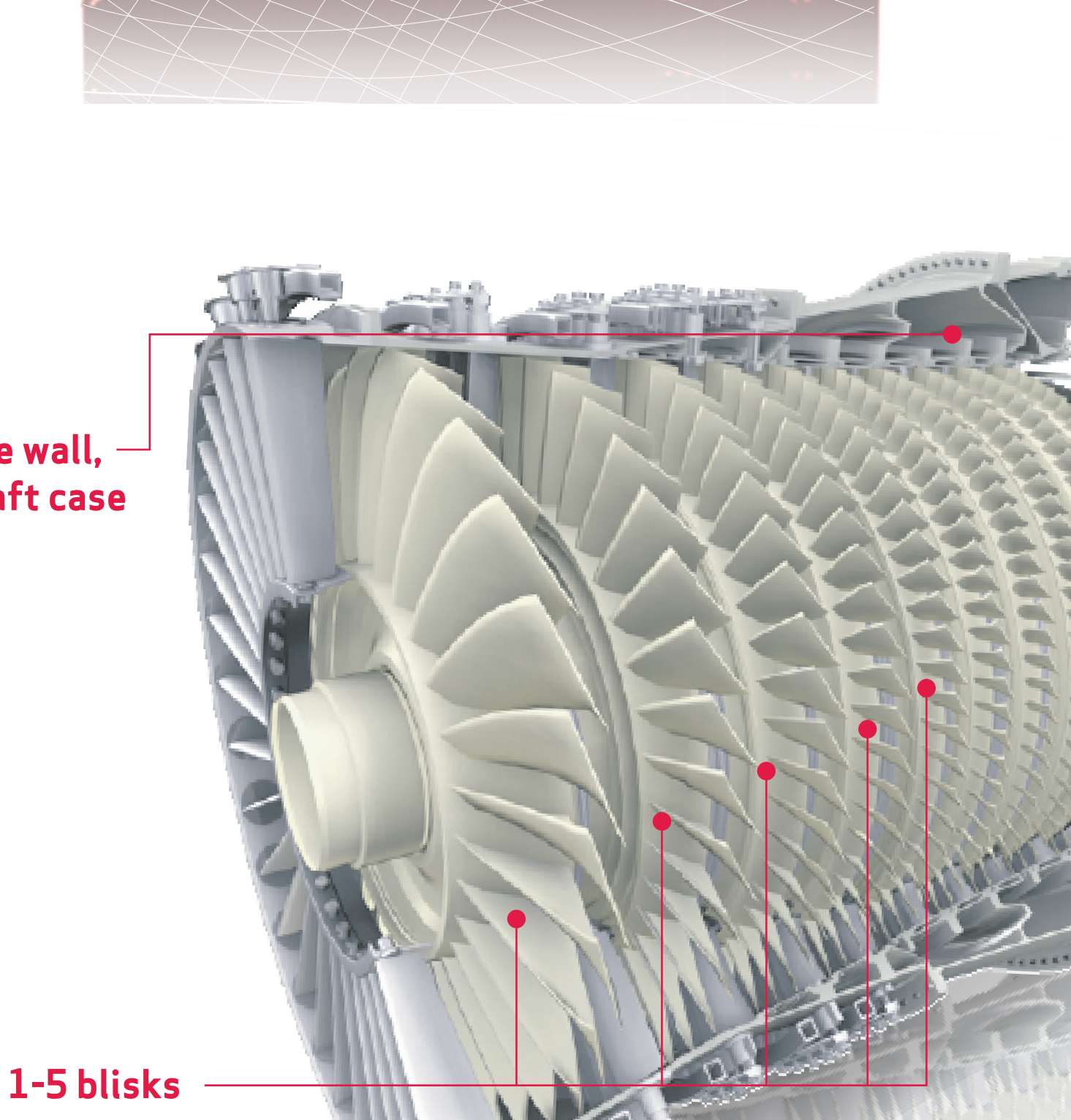


More impact resistant



### → ONLY ACTIVE DEBRIS REJECTION SYSTEM IN SINGLE-AISLE MARKET

- Most particles centrifuged away by wide chord fan blade
- Spinner directs debris into bypass flow
- Smaller particles exit through VBV doors



### → COMPRESSOR DELIVERS

Efficiency and retention

#### Performance efficiency

- Next generation 3D Aero
- 22:1 pressure ratio in 10 stages, best in single-aisle market

#### Performance retention

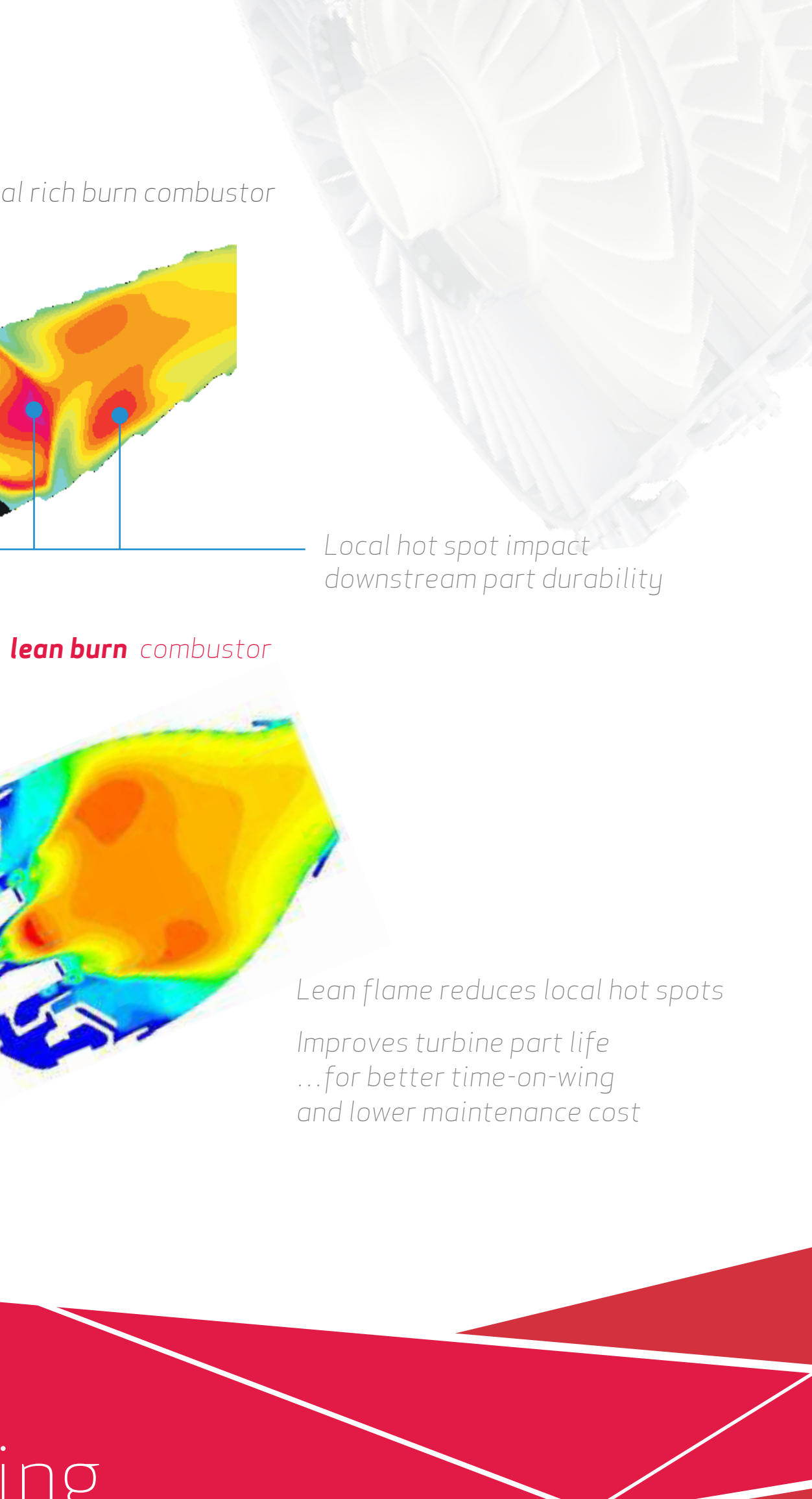
- Short, stiff core retains performance
- Rigid aft case holds roundness and maintains clearances
- Blisks minimize dovetail leakage

#### Operability

- Stall-free performance

#### Double wall, 360° aft case

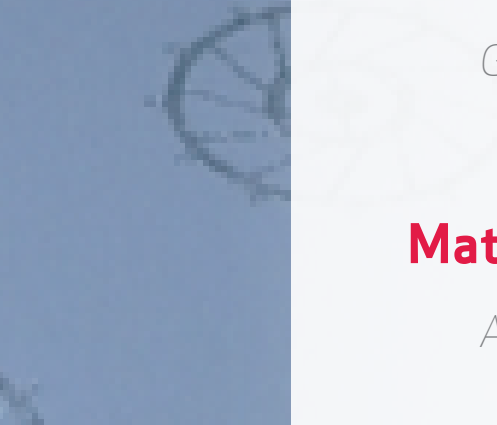
#### Stage 1-5 blisks



### → LEAN BURN. LOW EMISSIONS.

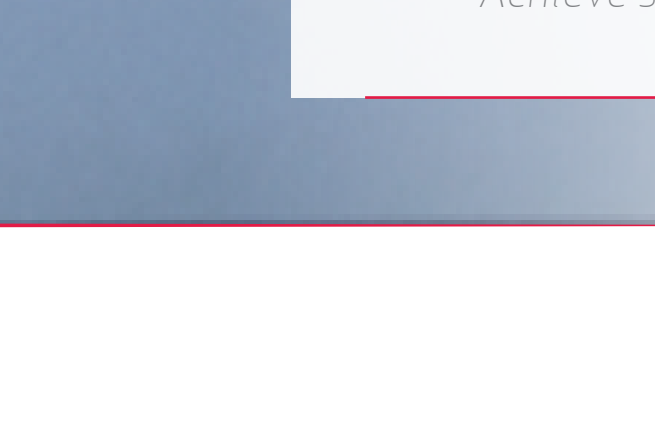


#### Typical rich burn combustor



Local hot spot impact downstream part durability

#### LEAP lean burn combustor



Lean flame reduces local hot spots  
Improves turbine part life ... for better time-on-wing and lower maintenance cost

## LEAP technology extends to manufacturing

### Additive manufacturing



#### Design freedom

Complex parts not typically possible

#### Time savings

Fast turnarounds  
Grow complex parts in one build

#### Material strength

Achieve fully dense properties

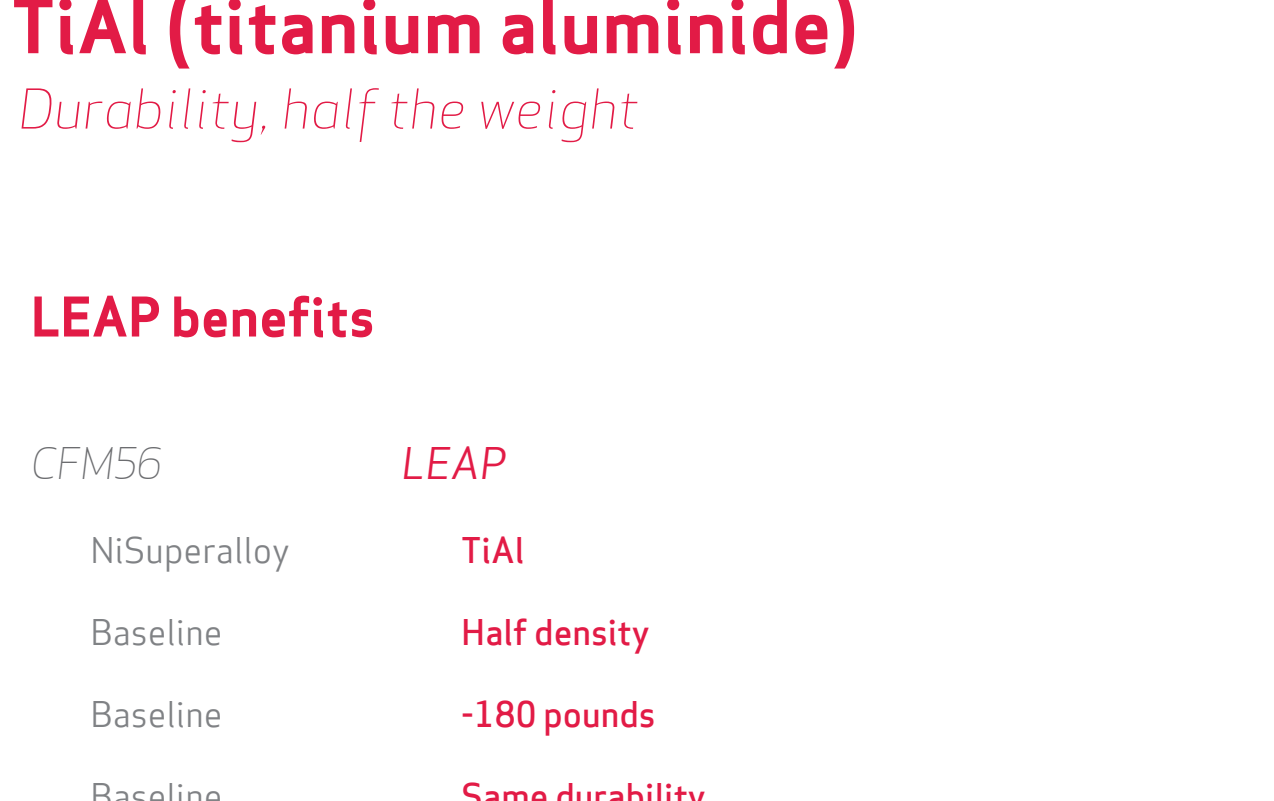
#### Lighter weights

Achieve strength while reducing weight

### → CERAMIC MATRIX COMPOSITES

Beyond metals

#### CMC thermal capabilities



#### CMC shroud



1/3 the weight

Less cooling air

20% greater thermal capability

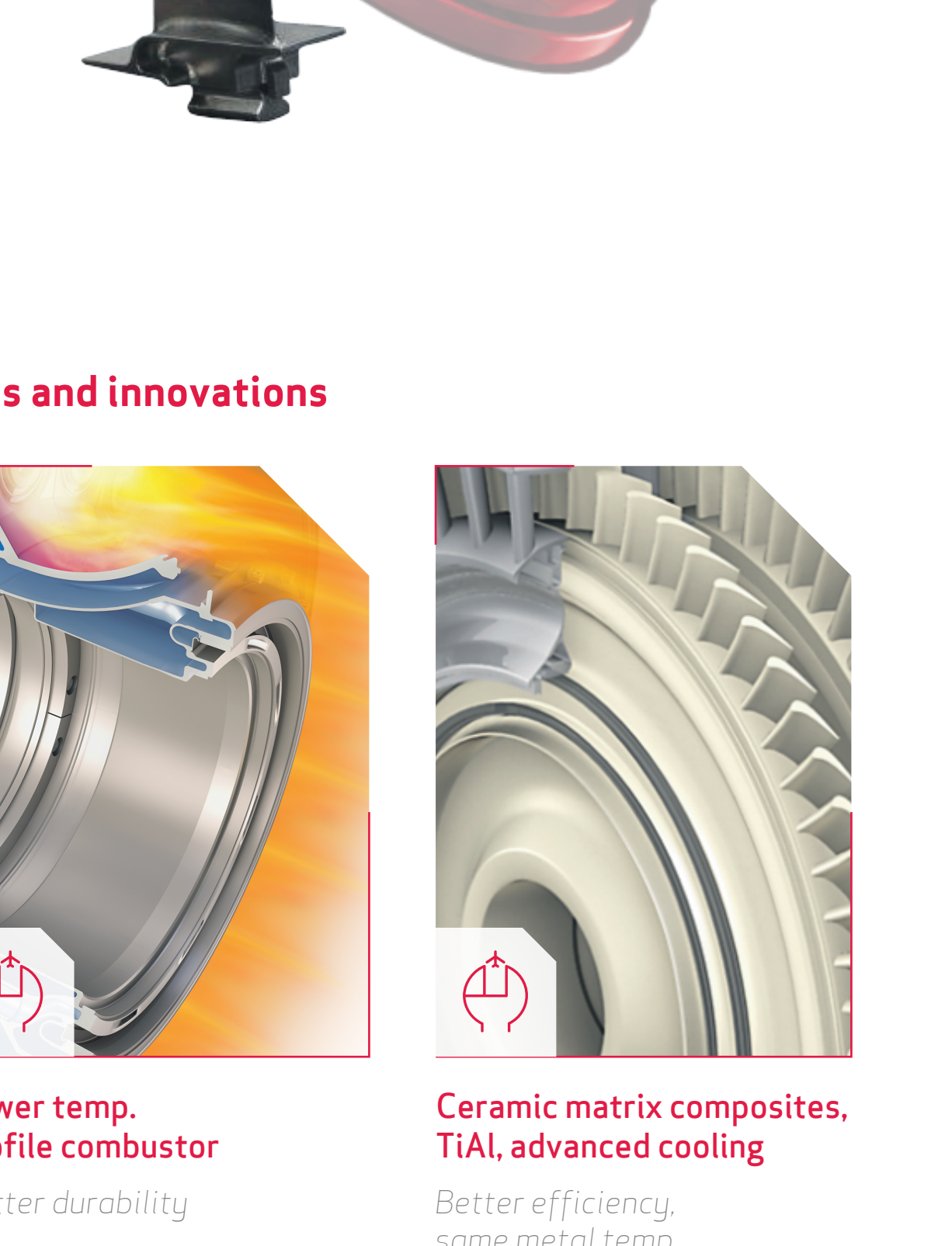
2x material strength

### → TiAl (titanium aluminide)

Durability, half the weight

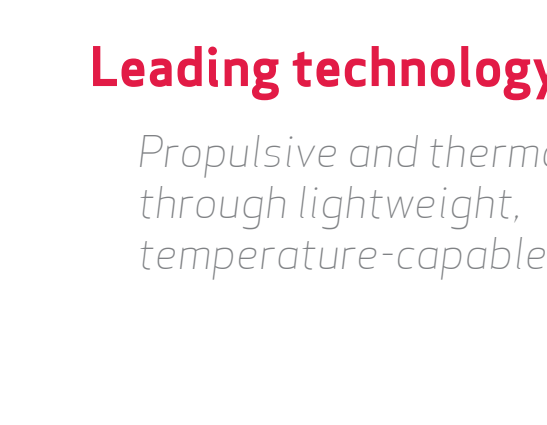
#### LEAP benefits

CFM56	LEAP
NiSuperalloy	TiAl
Baseline	Half density
Baseline	-180 pounds
Baseline	Same durability



### → MULTIPLE, UNIQUE TECHNOLOGIES DRIVE LEAP PERFORMANCE

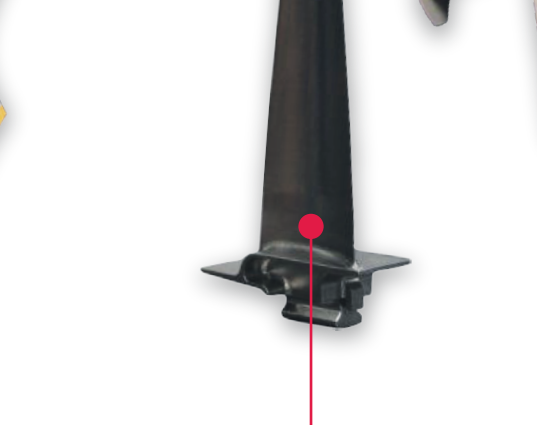
#### Continuous investment produces multiple technologies and innovations



Carbon fiber composites  
Light, durable blades and case, low maintenance



Next gen. 3D Aero and debris rejection  
High efficiency and FOD protection



Lower temp. profile combustor  
Better durability



Ceramic matrix composites, TiAl, advanced cooling  
Better efficiency, some metal temp, better durability

### → LEAP CORE CUSTOMER COMMITMENTS

#### Proven performance

Fuel burn, maintenance cost, reliability, emissions and residual value

#### Low execution risk

21 CFM engine service entries and 8 engine upgrades

#### Leading technology

Propulsive and thermal efficiency through lightweight, temperature-capable materials

#### Carbon fiber composites

1000 lbs. less weight per airplane

#### Ceramic matrix composites

1/3 weight, 20% higher thermal capability

#### Titanium Aluminide

50% weight reduction

