



Rapid Innovation

through an evolutionary design process

Robert Edson Swain
aircraft intelligence





aircraft intelligenceTM

partners in innovation

global cooperation

cross-disciplinary

systemic solutions

practical results

*discovery is to see
what everybody has seen
and think what nobody has thought*
Albert Szent-Gyorgyi

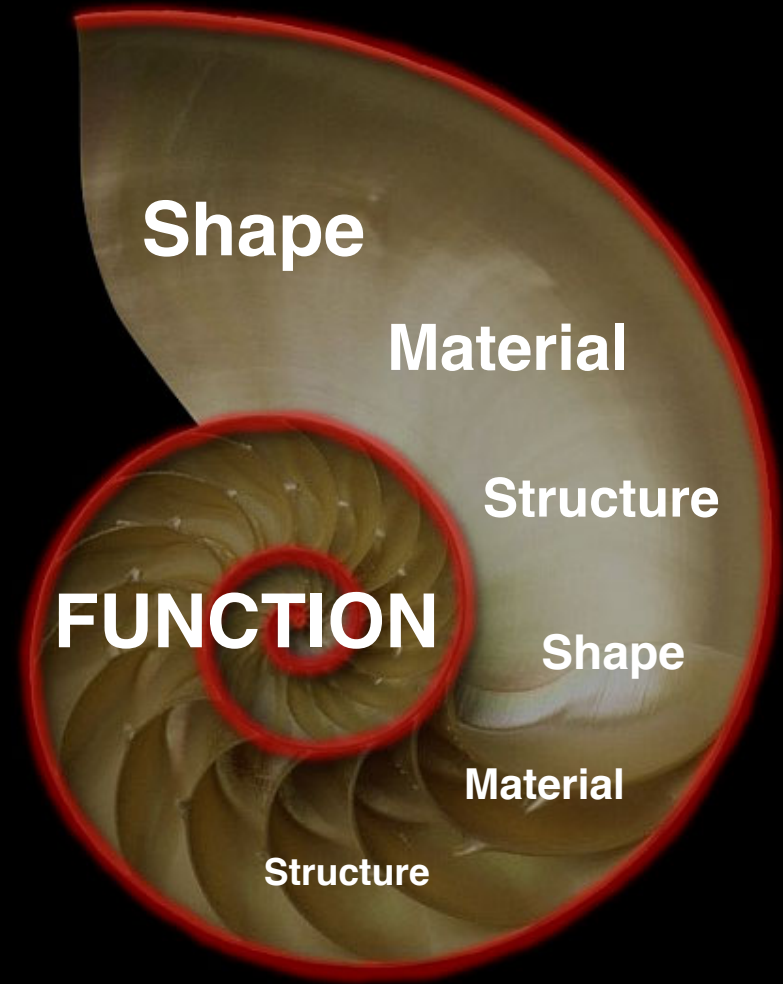


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Evolution

Non-linear

Nature-Inspired



SYSTEMIC OPTIMIZATION



domus bbj design competition

TEAM BUILDING

DESIGN INTEGRITY AND PERMANENCE

francois burkhardt



TEAM BUILDING



DESIGN INTEGRITY AND PERMANENCE

MANUFACTURING EXCELLENCE AND INTEREST IN PERFECTION

toyo ito

francois burkhardt



TEAM BUILDING

DESIGN INTEGRITY AND PERMANENCE

MANUFACTURING EXCELLENCE AND INTEREST IN PERFECTION

ENTREPRENEURIAL APPROACH AND INNOVATION

toyo ito

francois burkhardt

bob swain



TEAM BUILDING

TEAM

Culture

Size

Alignment

Vision

Depth

A black and white photograph of a group of people in a meeting. Several individuals are visible, some looking at documents on a table. The lighting is dramatic, with strong highlights and deep shadows. The overall mood is professional and collaborative.

TEAM BUILDING

A red curved arrow graphic pointing upwards and to the right, ending in a grey arrowhead with a white dashed line.

TOOLS

Scalable methods

Visual knowledge base

Simplified technologies

Fluid communications

Concise analysis



TEAM BUILDING



BREAKTHROUGH SOLUTIONS

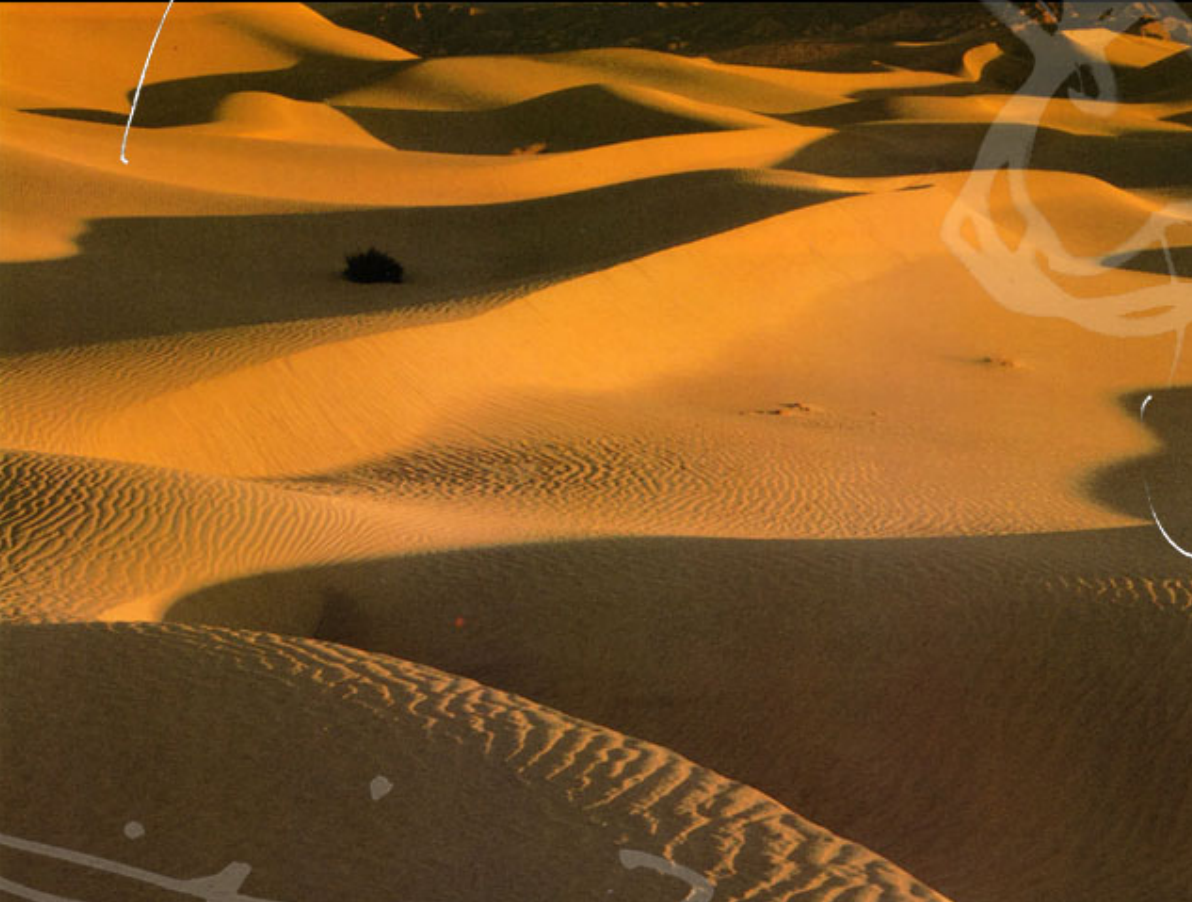
Sand dunes

FUNCTION : carry air, reduce noise

SHAPE

MATERIAL

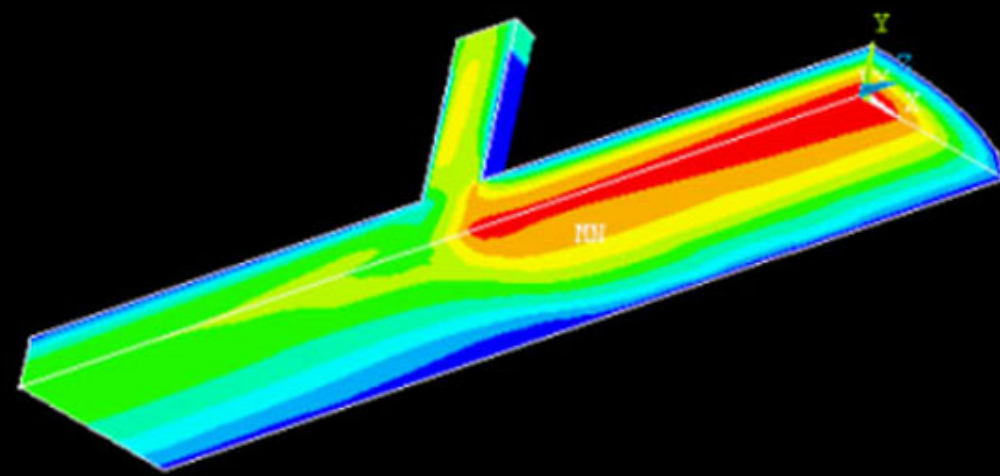
STRUCTURE



natural airflow management

NOISE ATTENUATION

1 Velocity distribution inside a pipe with elliptical section

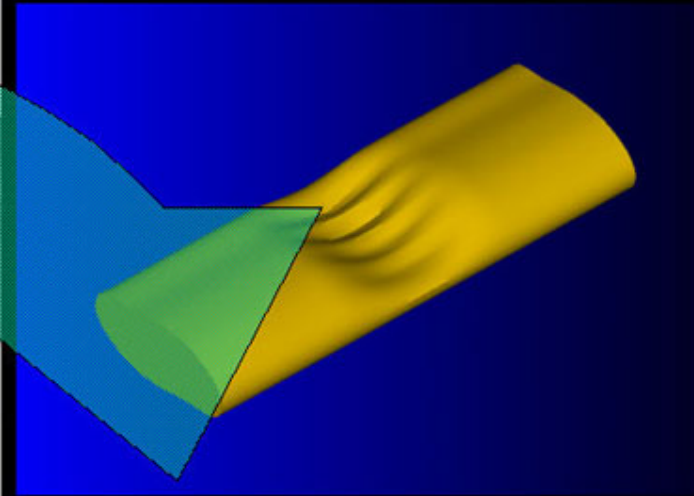
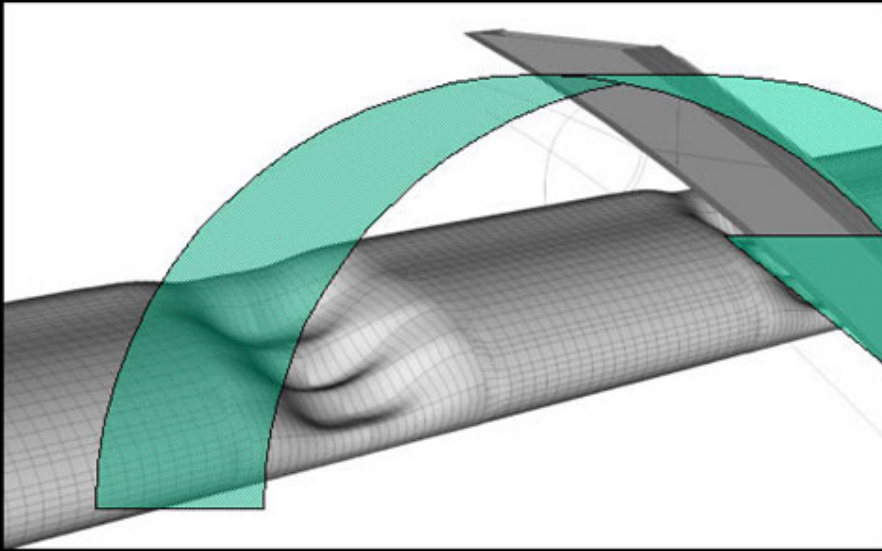


Different colors represent different velocity inside the pipe

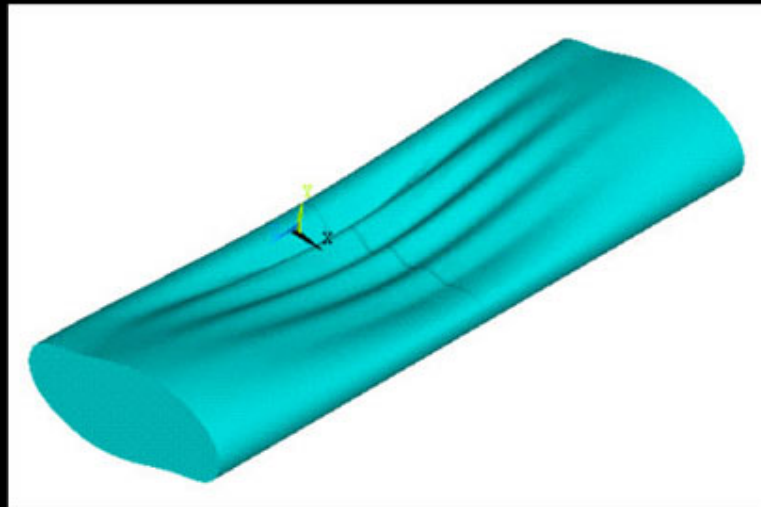
NODAL SOLUTION
STEP=7
SUB =1
VSUM (AVG)
RSYS=0
PowerGraphics
EFACET=1
AVRES=Mat
SMX =.724324
0
.08048
.160961
.241441
.321922
.402402
.482883
.563363
.643844
.724324

The velocity scale is in m/s

NOISE ATTENUATION

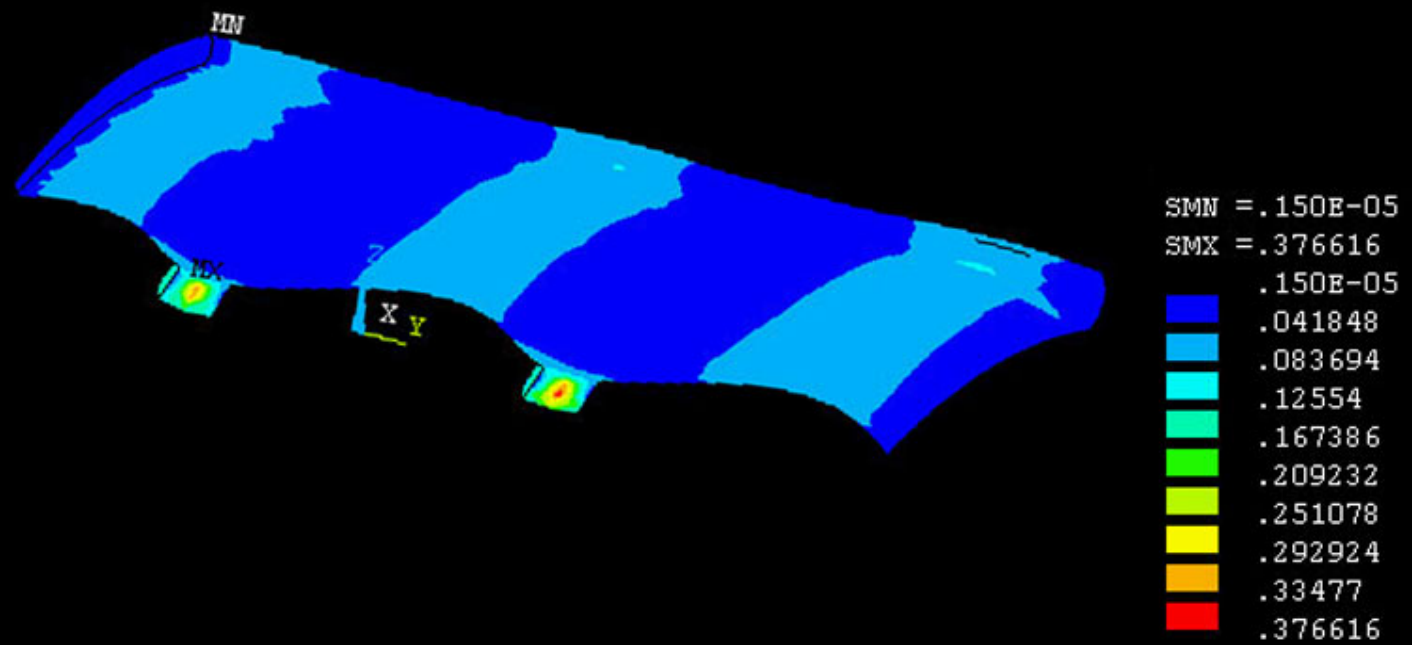


Evolution of shape:
optimized for
uniform flow

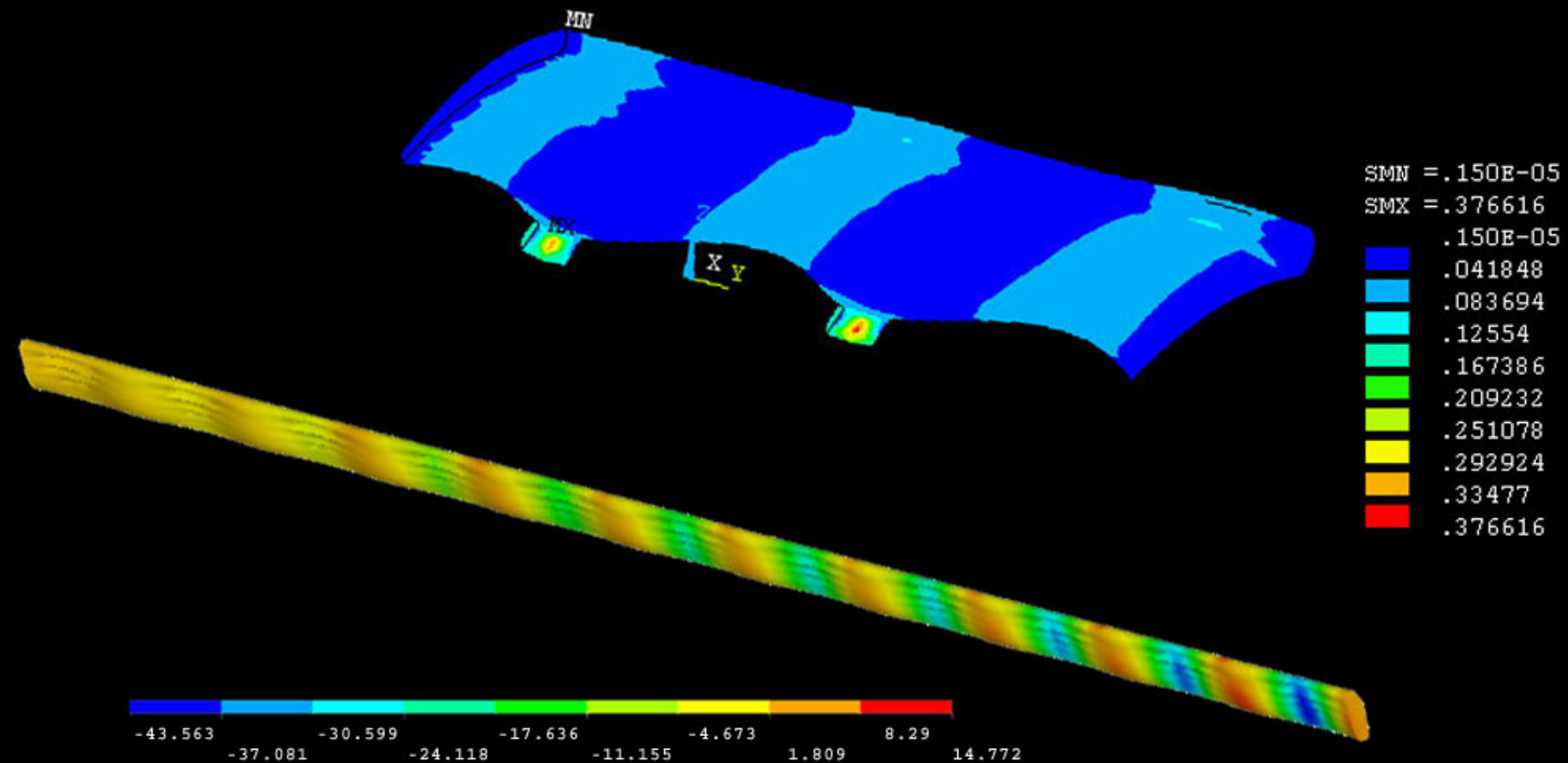


NOISE ATTENUATION

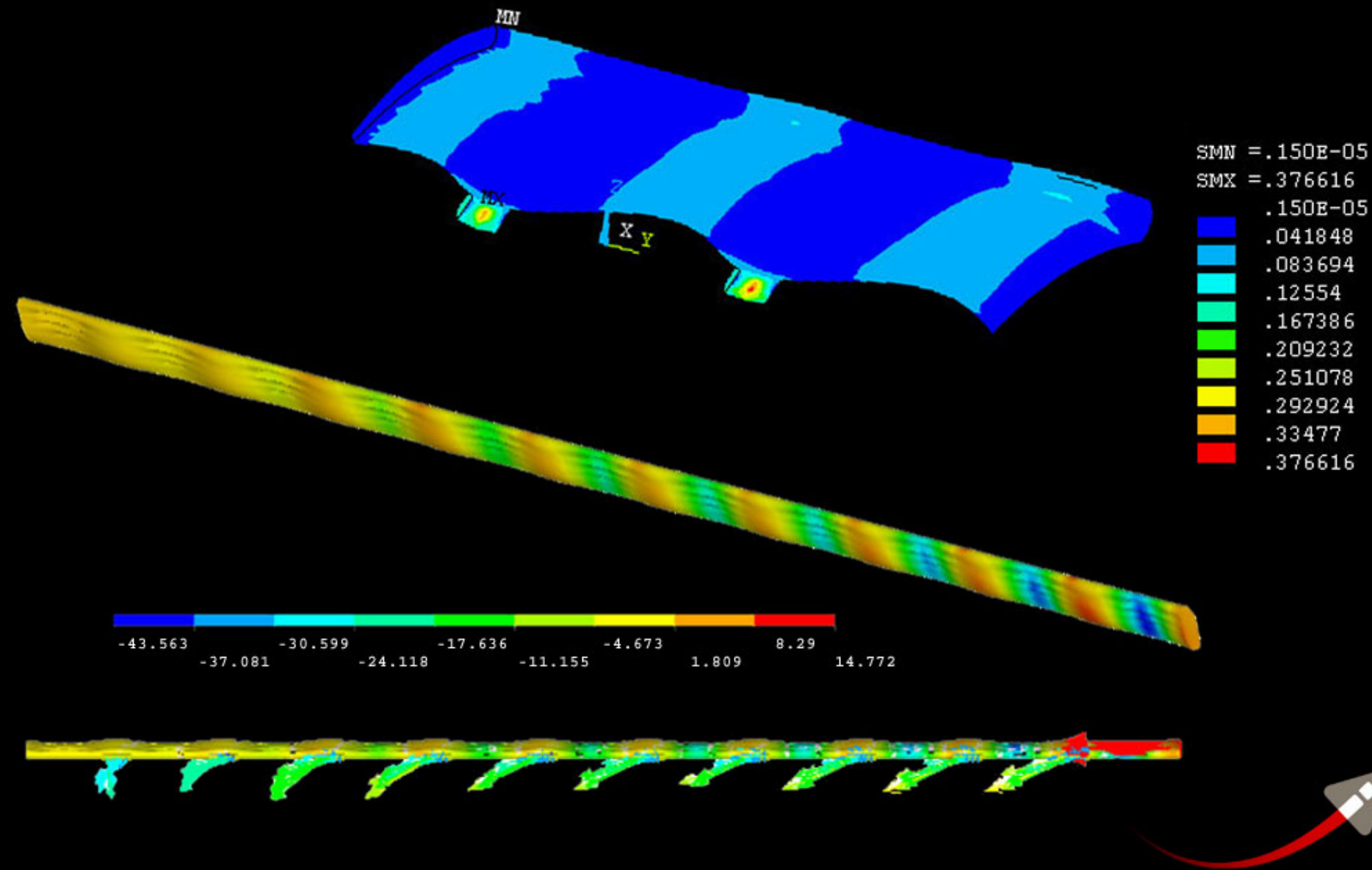




NOISE ATTENUATION



NOISE ATTENUATION



NOISE ATTENUATION



Air ducts
suspended in
space-frame truss

NOISE ATTENUATION

Boundary noise

Space frame

NOISE ATTENUATION





Boundary noise

Space frame to

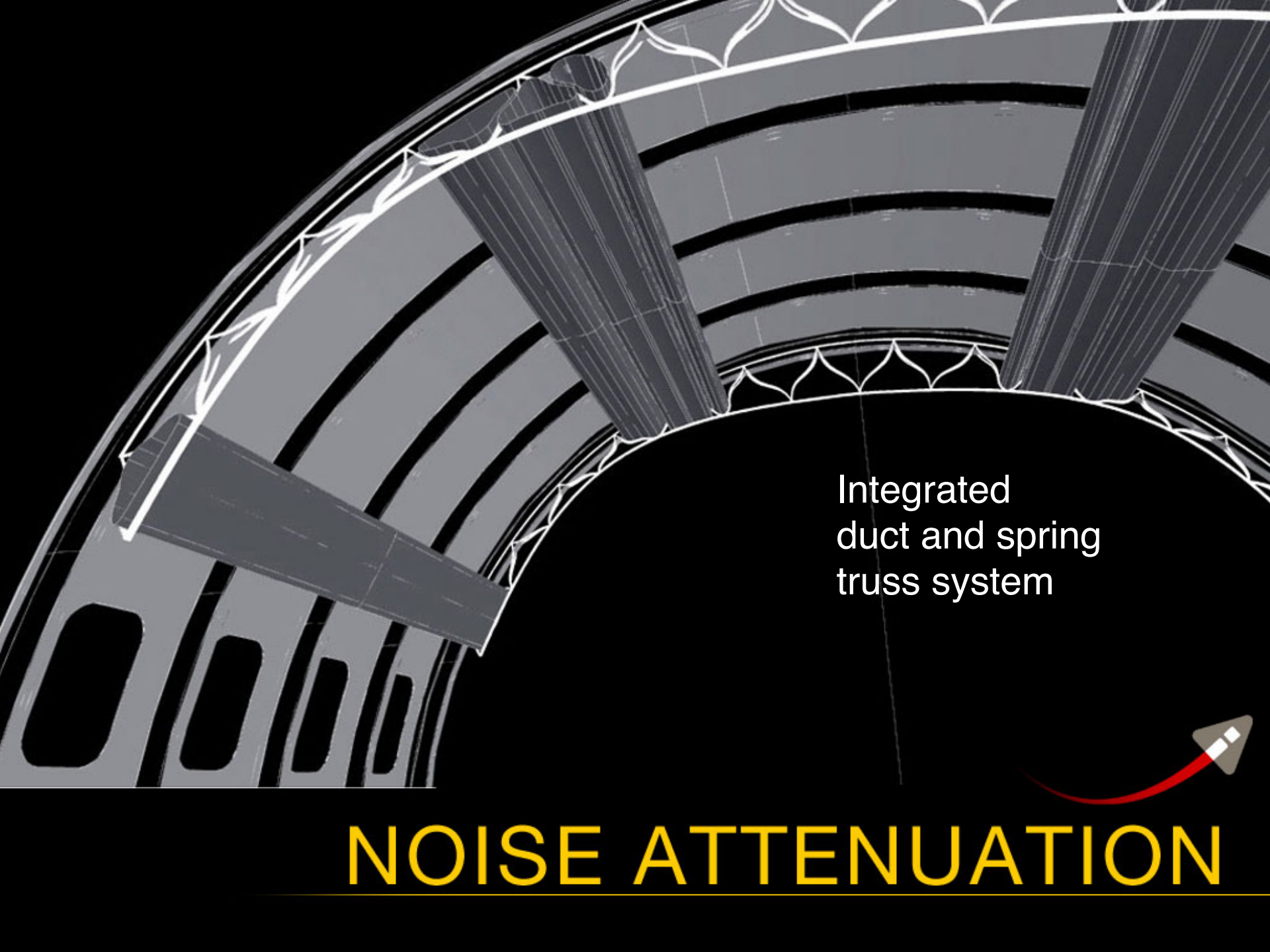
NOISE ATTENUATION

The diagram illustrates a noise attenuation process. It features a series of white curved lines at the top, representing a boundary or noise source. Below these, a red line forms a series of connected, rounded peaks, representing a truss structure. The text 'Boundary noise' is positioned to the left of the white lines. The text 'Space frame to spring truss' is positioned to the right of the red line. At the bottom, the text 'NOISE ATTENUATION' is written in large, bold, yellow capital letters. A small red arrow with a white dashed line points towards the bottom right corner.

Boundary noise

Space frame to spring truss

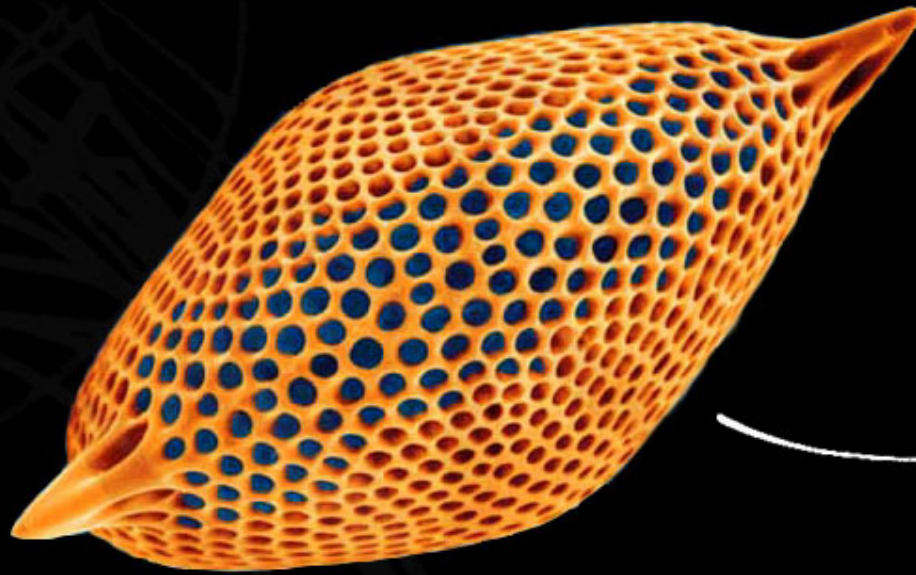
NOISE ATTENUATION



Integrated
duct and spring
truss system

NOISE ATTENUATION

FUNCTION : control climate		
SHAPE	MATERIAL	STRUCTURE

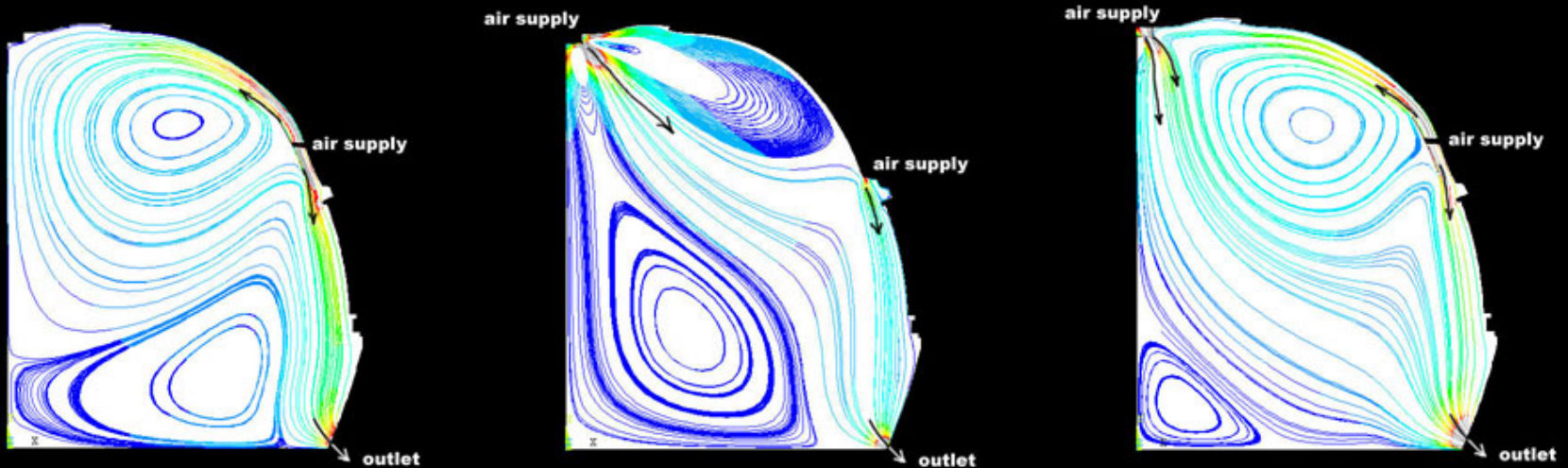


Radiolarian
micro organism

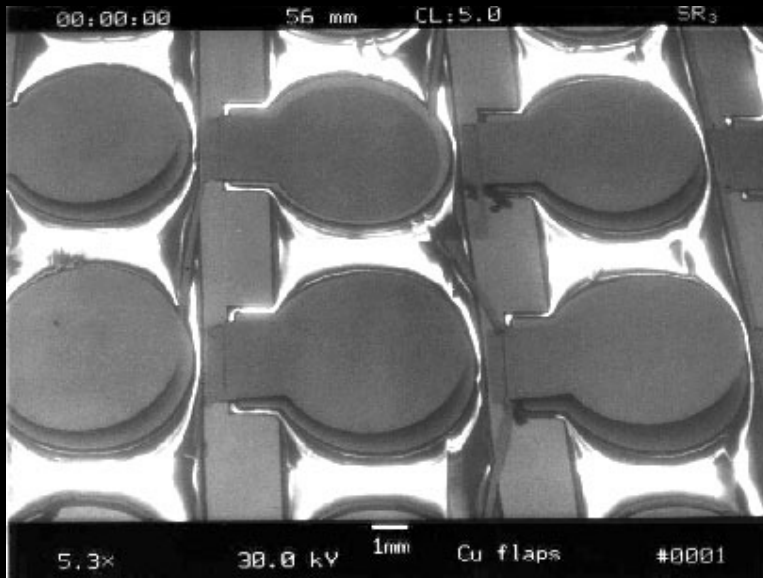


MICRO-CLIMATE

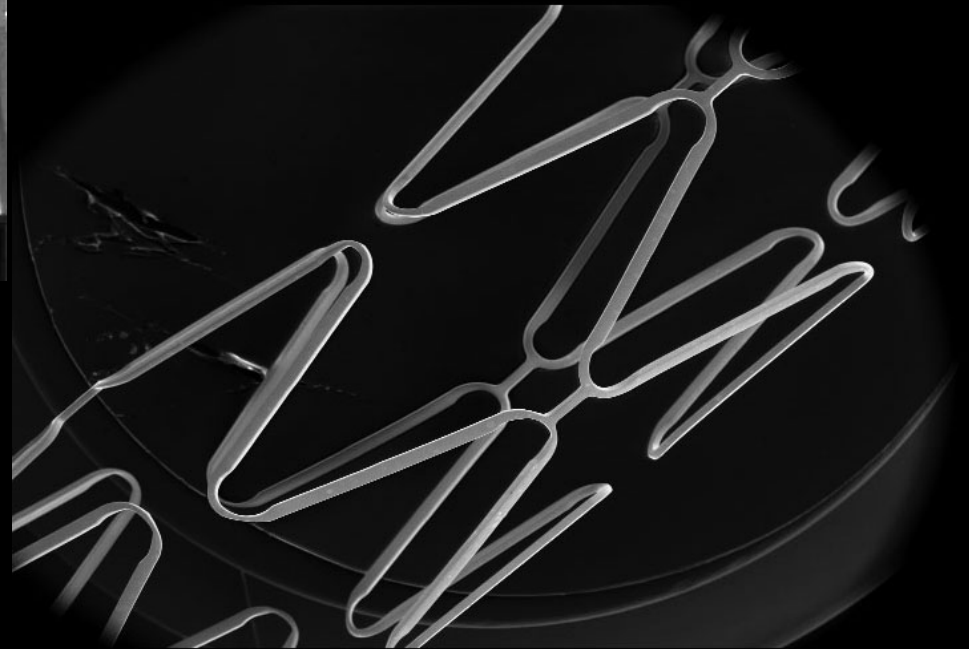
Cabin air temperature distribution



MICRO-CLIMATE

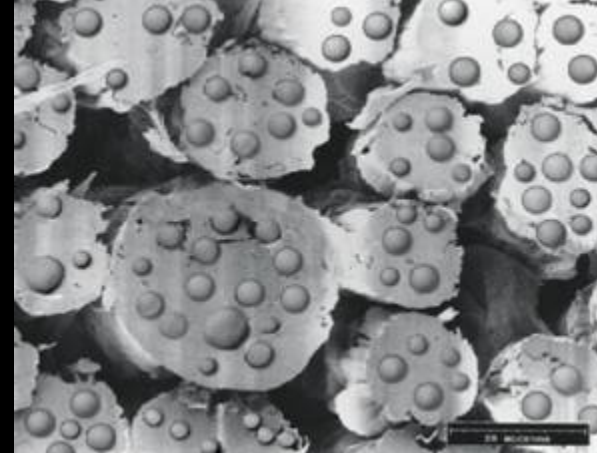
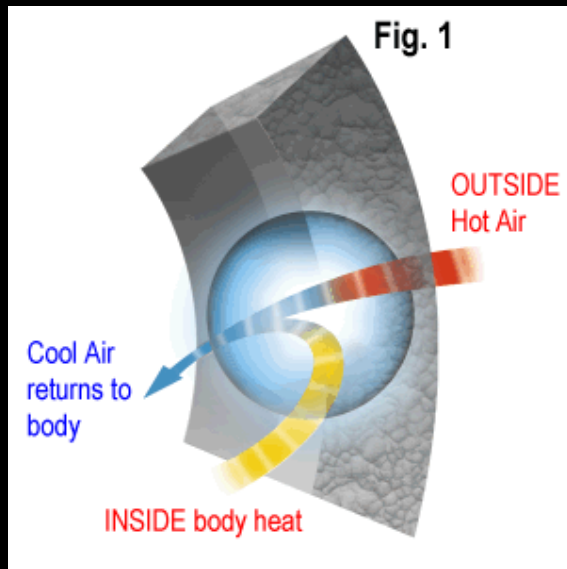


Micro-electro mechanical

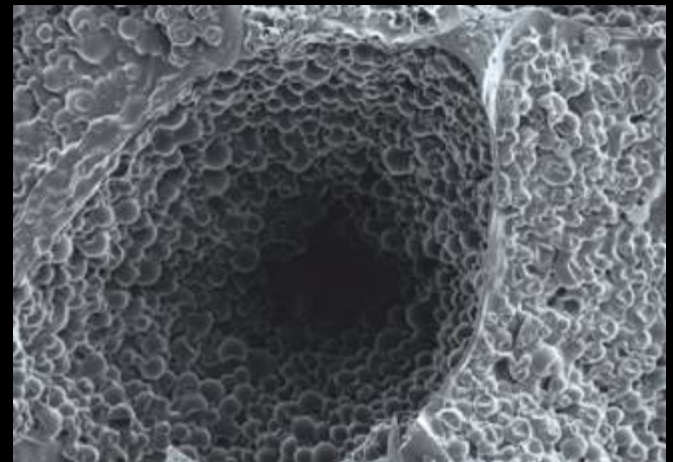
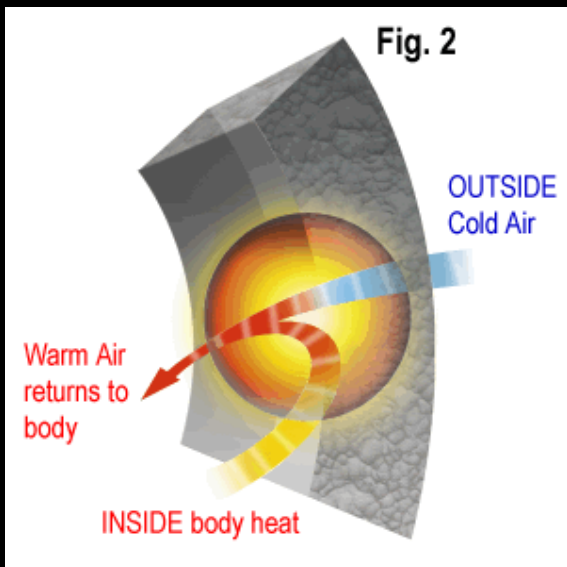


Smart wire (Nitinol)

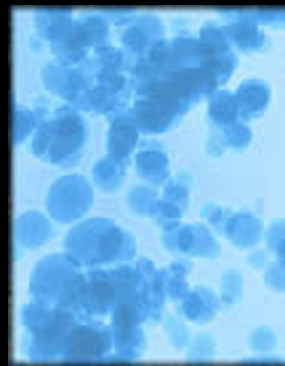
MICRO-CLIMATE



FIBER + thermo-active filler

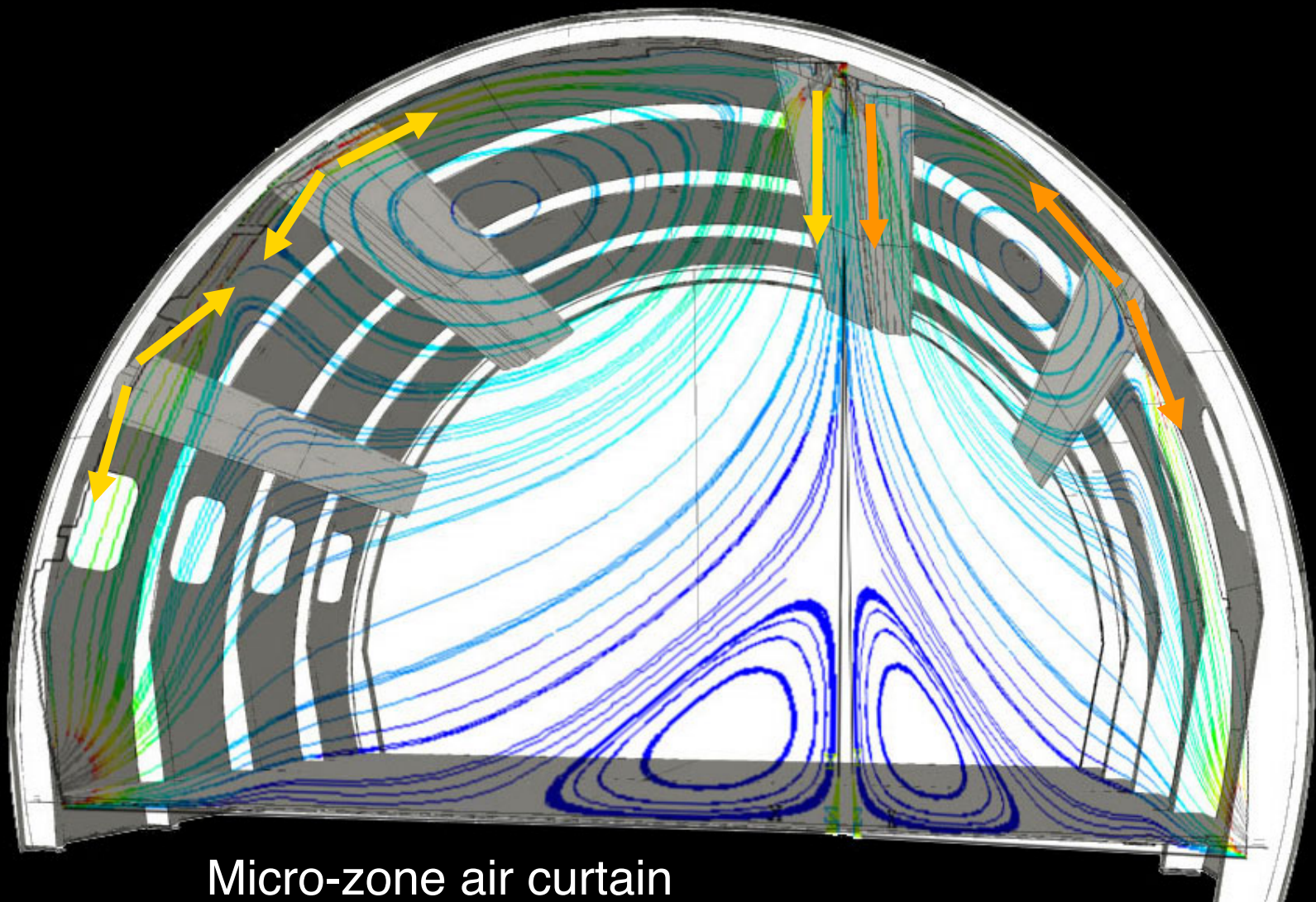


FOAM + thermo-active filler



Nano-silica

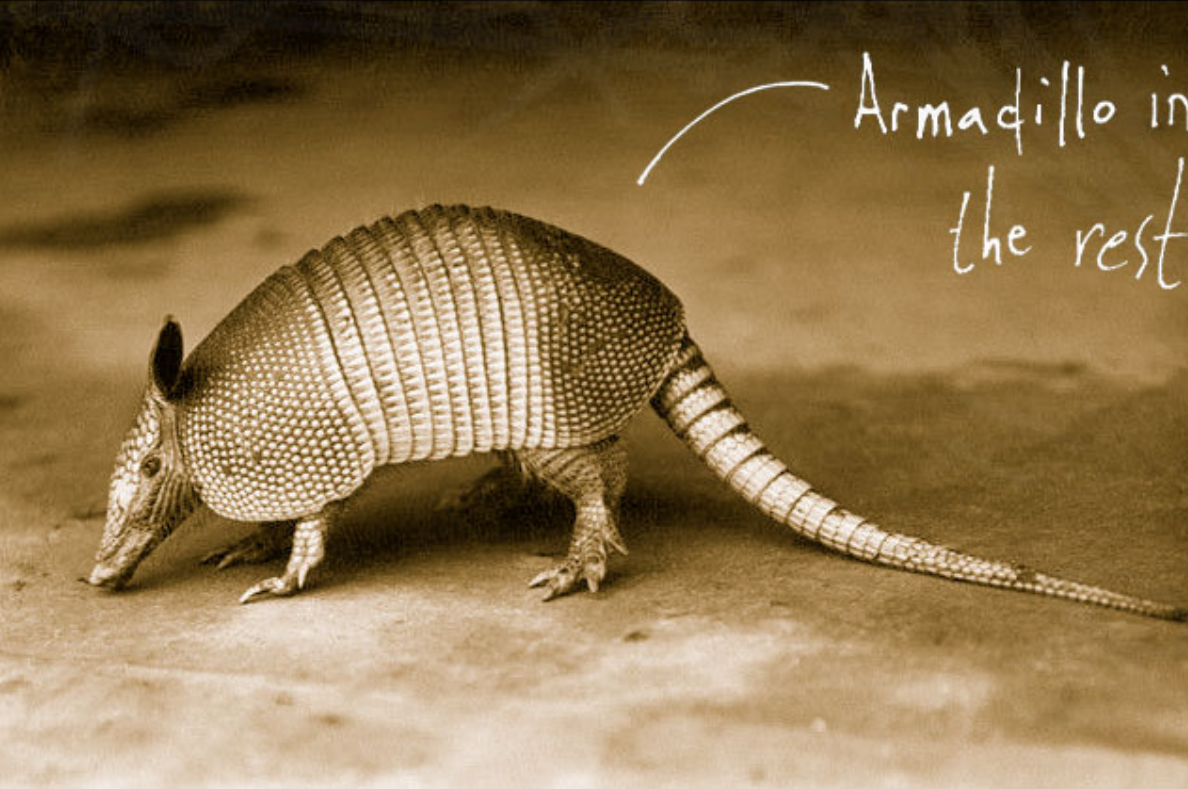
MICRO-CLIMATE



Micro-zone air curtain

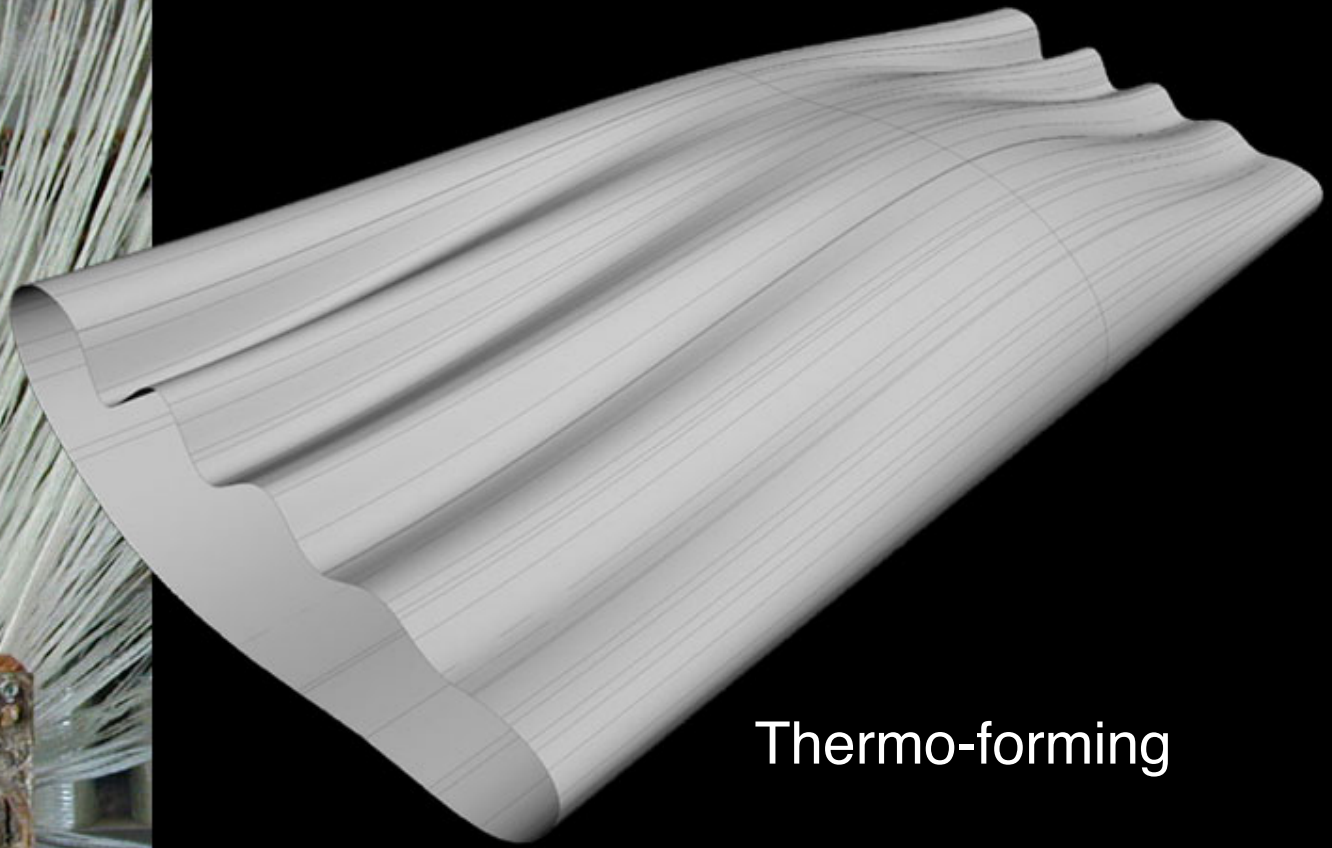
MICRO-CLIMATE

FUNCTION : provide flexible panels		
SHAPE	MATERIAL	STRUCTURE



Armadillo integrates its shell with the rest of its soft body.

FLEXIBLE SYSTEMS



Thermo-forming

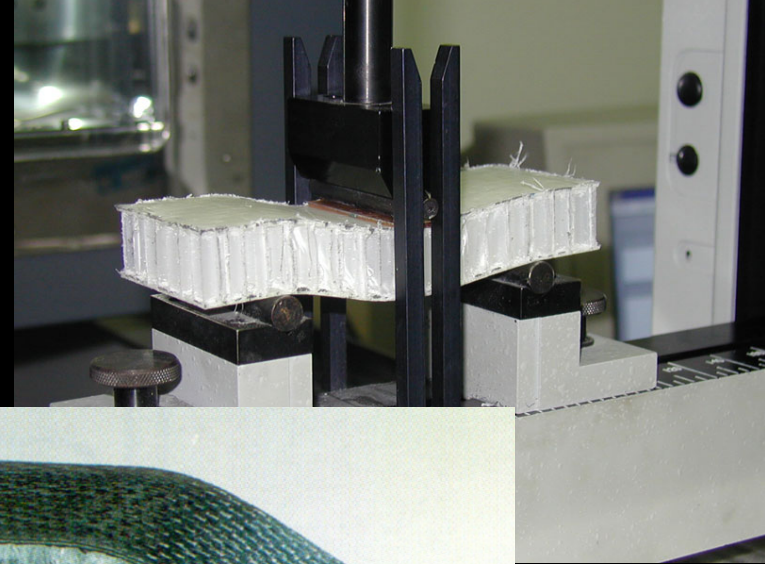
Continuous process manufacturing

FLEXIBLE SYSTEMS





Resilient
strength



On-site fabrication

FLEXIBLE SYSTEMS





Flexible,
sophisticated,
yet simple



FLEXIBLE SYSTEMS

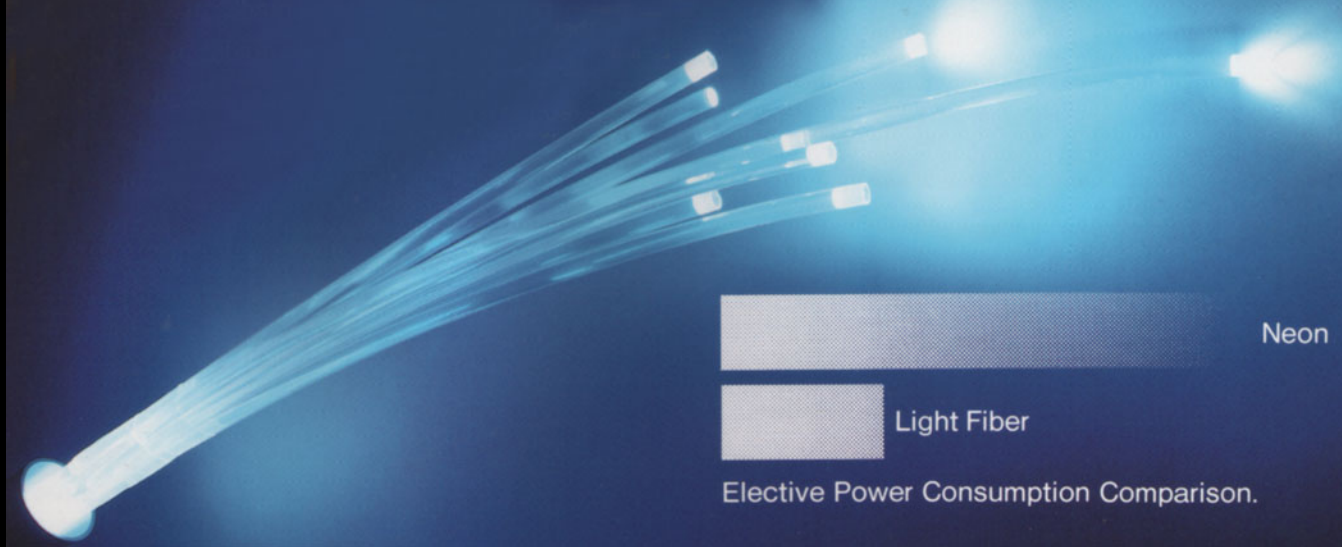
FUNCTION : carry light		
SHAPE	MATERIAL	STRUCTURE

Ancient Rome



light sources found where
they're least expected

LIGHT SYSTEMS



Fiber optic lighting

LED
light source

Computer-controlled
color management



LIGHT SYSTEMS

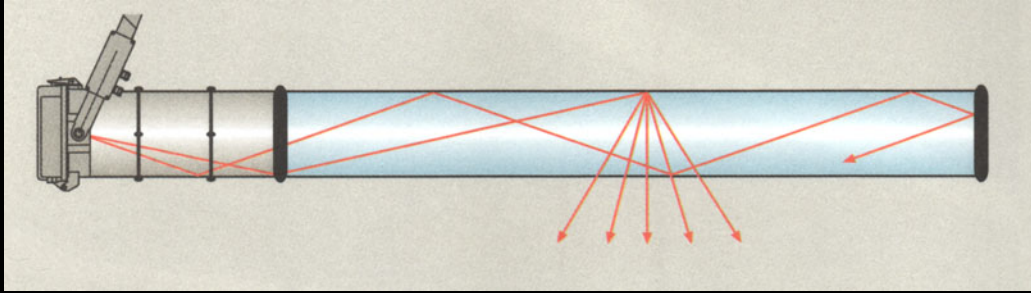


Reflected,
ducted
daylighting

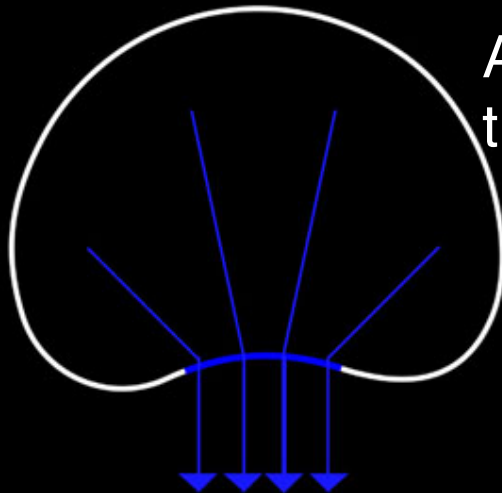
A river of light from an external source



LIGHT SYSTEMS



Light projected through tubes



Air ducts:
transmitting light



Radiant mirror film

LIGHT SYSTEMS

Passenger Comfort

Flexible Designs

Maximum Interior Space

Greater Range

NOISE ATTENUATION

MICRO-CLIMATE

Reduce Weight

Reduce Installation Time

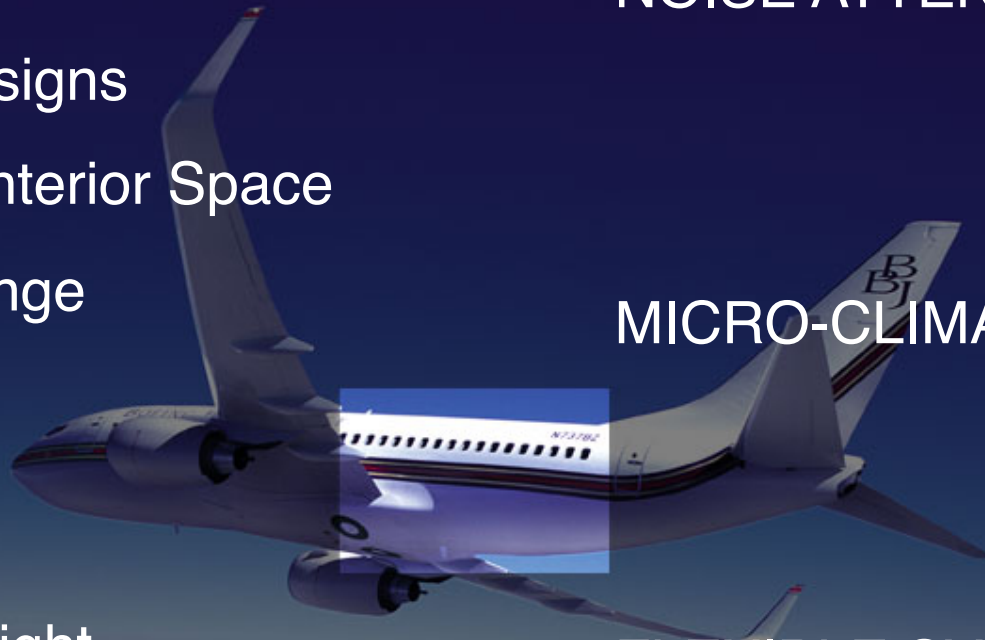
Speed Maintenance

Simplify Manufacturing

FLEXIBLE SYSTEMS

LIGHT SYSTEMS

TRANSFORMING TRAVEL





Second University of Naples, Italy

Industrial Design • Research • Industrial Integration



Full Professors:

Antonio Apicella, Material Engineering

Robert Edson Swain, Sustainable Mobility





aircraft intelligenceTM

Seattle

Robert Swain

Rob Klengler

Wesley Pierce

Napoli

Antonio Apicella

Mimmo Ianello

Frankfurt

Lutz Pankow

Miami

Greg Horn



Our thanks to Gil Key of Boeing Business Jets

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