- COMPUTATIONAL FLUID DYNAMICS (CFD)
- NASA STRUCTURAL ANALYSIS (NASTRAN)
- AIR TRAFFIC MANAGEMENT
- COMPOSITE STRUCTURES
- AIRBORNE WIND SHEAR DETECTION
- LIGHTNING PROTECTION STANDARDS
- DIGITAL FLY-BY-WIRE
- GLASS COCKPIT
- AREA RULE
- JET ENGINE COMBUSTORS
- SUPERCRITICAL AIRFOIL
- DAMAGE-TOLERANT FAN CASING
- ENGINE NOZZLE CHEVRONS
- WINGLETS
- ICING DETECTION
- RUNWAY GROOVES

★ Applies also to general aviation aircraft
❖ Applies also to military aircraft
DEcadal survey of civil aeronautics

Foundation for the Future

National Research Council of the National Academies

2006
GLOBAL GROWTH IN AVIATION

2016 GLOBAL AVIATION INDUSTRY
3.8 B Passenger Trips
North America & Europe combined is half of all passenger trips

2035 GLOBAL AVIATION INDUSTRY
7.2 B Passenger Trips
Asia-Pacific passenger trips equal to North America & Europe combined

Top Five Fastest-Growing Markets

<table>
<thead>
<tr>
<th>Market</th>
<th>2016 ( Millions )</th>
<th>Growth thru 2035 ( Billions )</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>1.3 B</td>
<td></td>
</tr>
<tr>
<td>U.S.</td>
<td></td>
<td>1.1 B</td>
</tr>
<tr>
<td>India</td>
<td></td>
<td>422 M</td>
</tr>
<tr>
<td>Indonesia</td>
<td></td>
<td>242 M</td>
</tr>
<tr>
<td>Vietnam</td>
<td></td>
<td>150 M</td>
</tr>
</tbody>
</table>

Over 36,000 new aircraft required (replacement and growth) over the 20 year period ($4-$5 T value)
RECAPTURING NASA'S AERONAUTICS FLIGHT RESEARCH CAPABILITIES

NATIONAL RESEARCH COUNCIL OF THE NATIONAL ACADEMIES
NEW AVIATION HORIZONS
CLEANER, FASTER, QUIETER
CONVERGENCE
OF DISPARATE TECHNOLOGIES
AIR TAXI IN DUBAI
HYBRID ELECTRIC

- Objectionable noise reduced by more than 65%
- Energy usage reduced by more than 60%
- Harmful emissions reduced by more than 90%
FROM SONIC BOOM TO SONIC "THUMP" OVER LAND