DESIGN POINT, OPERATING POINT AND PRODUCTIVITY OF TRANSPORT AIRPLANES

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BACKGROUND OF SENIOR AEROSPACE ENGINEERING STUDENTS

(+)

- Good analytical skills after 15+ years of studies
- Well trained for solving closed problems

(-)

- Fragmented knowledge
- Lack of communication skills
- Difficulties for creativity and innovation

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“Schools must stop turning out graduates who make good scientists but mediocre engineers”

(Leland Nicolai)

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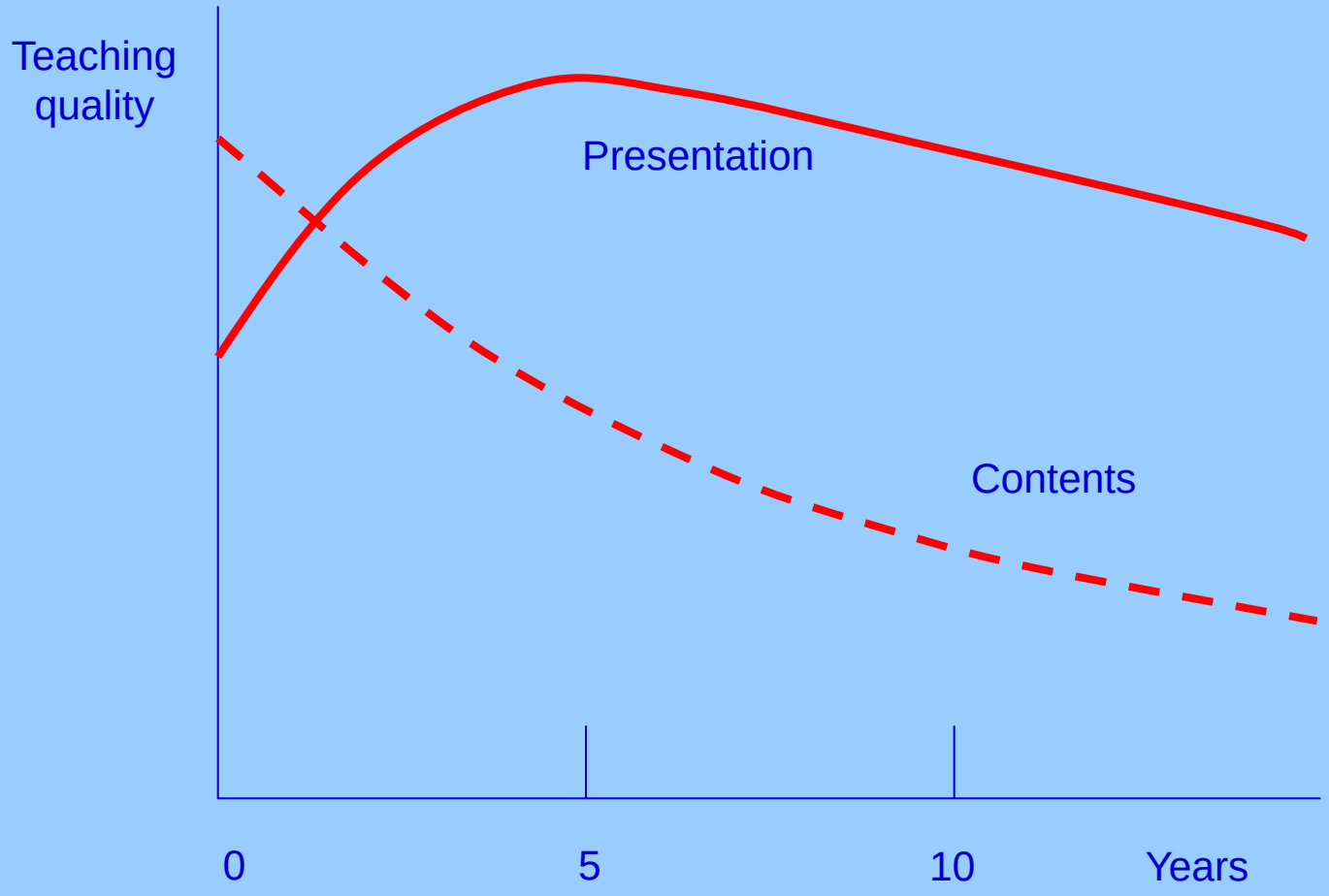
EVOLUTION OF TEACHING QUALITY



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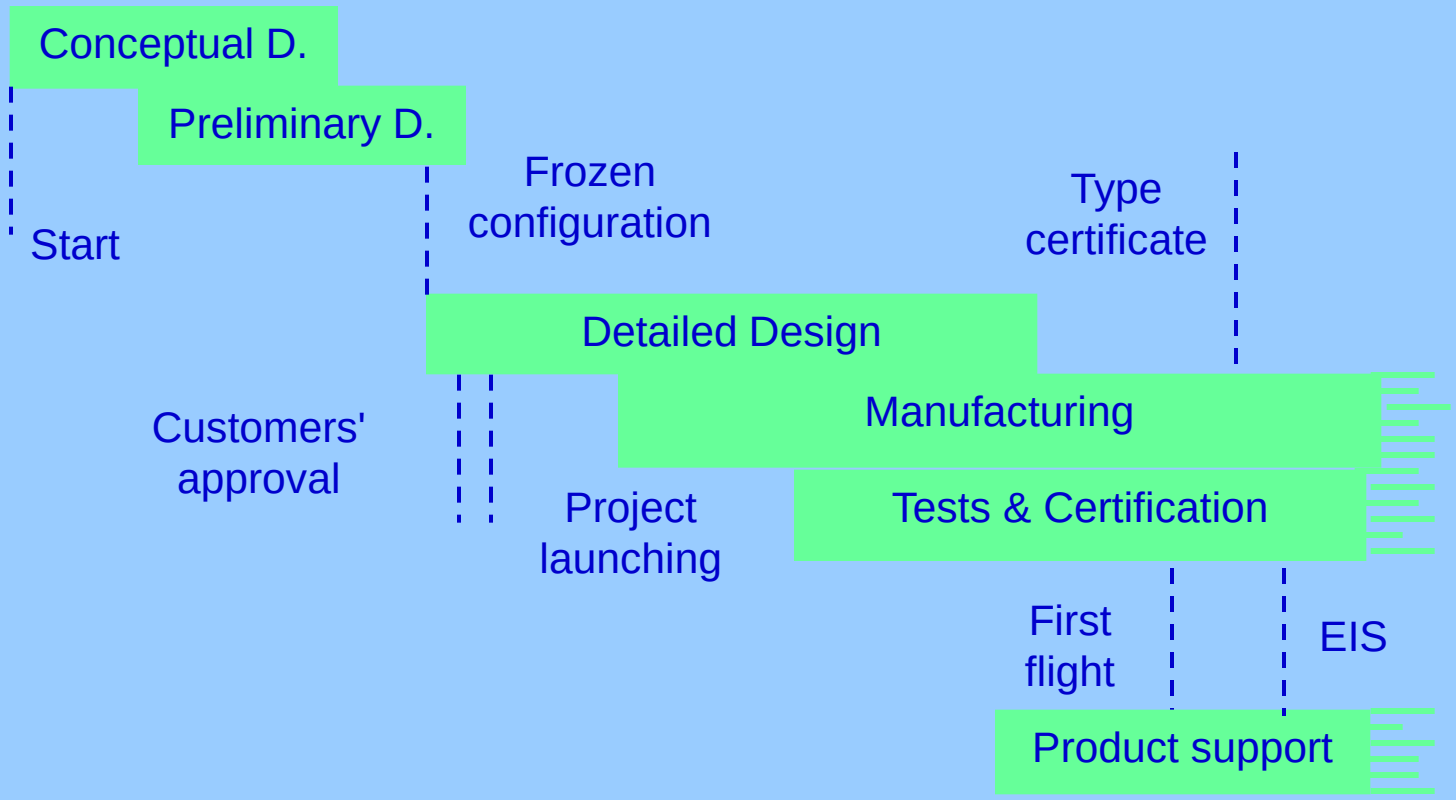
PHASES AND MAIN EVENTS OF A PROJECT



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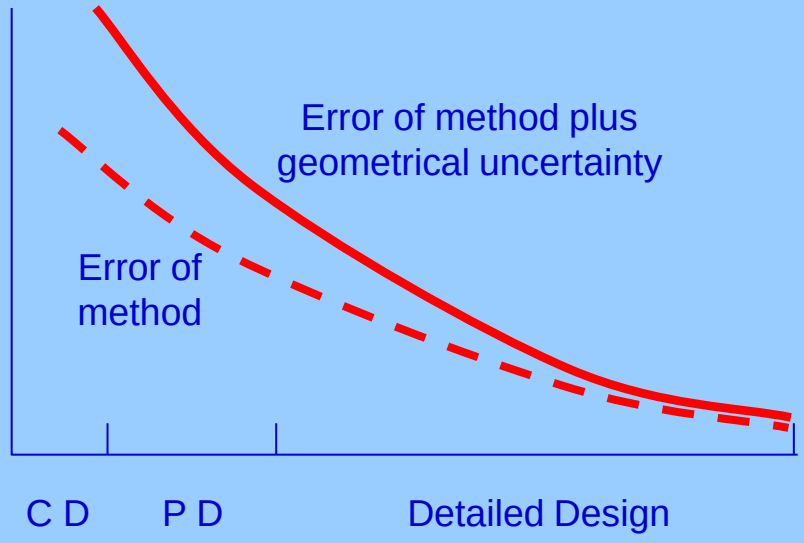
PHASES OF THE DESIGN PROCESS

- ✓ Conceptual design: outlining and assessment of alternative concepts fulfilling all specifications and requirements
- ✓ Preliminary design: optimisation of a few concepts and selection of the definitive configuration
- ✓ Detail design: extensive and complete definition of the chosen configuration



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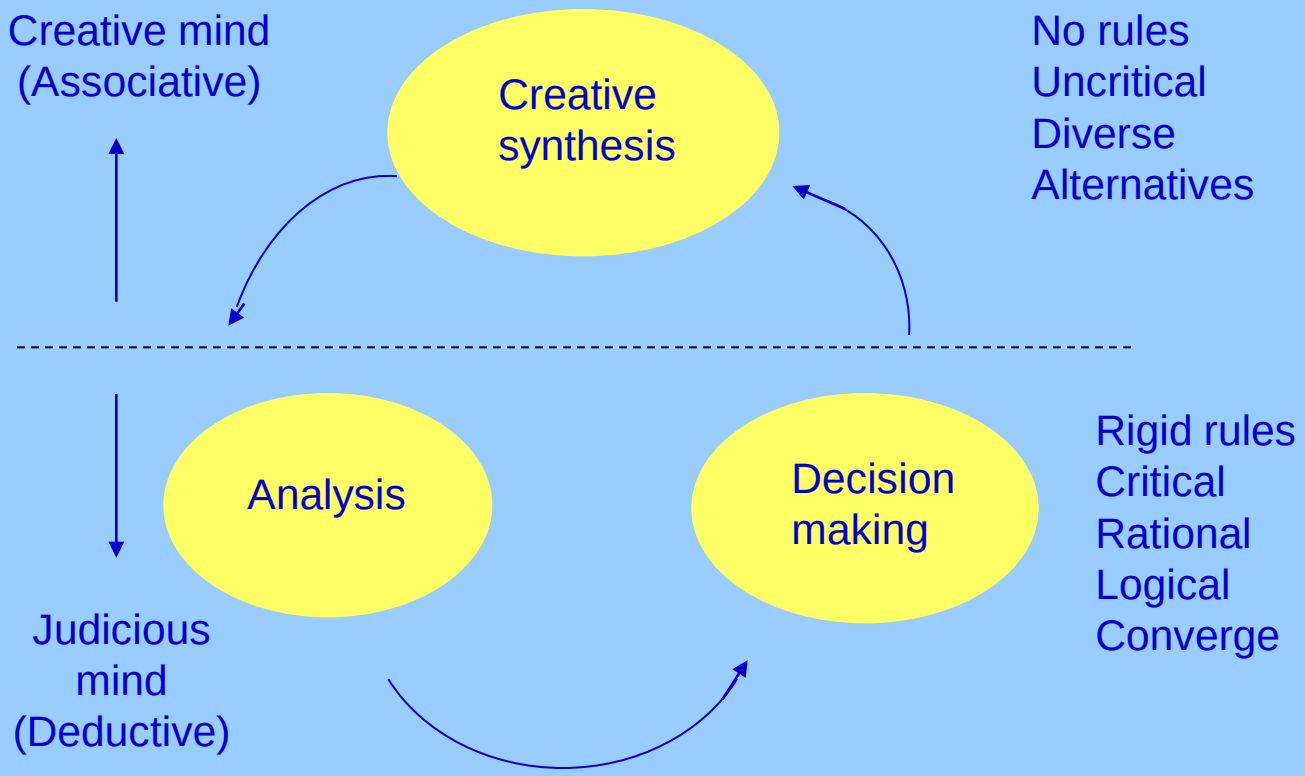
INTELLECTUAL CAPABILITIES IN THE ENGINEERING DESIGN PROCESS



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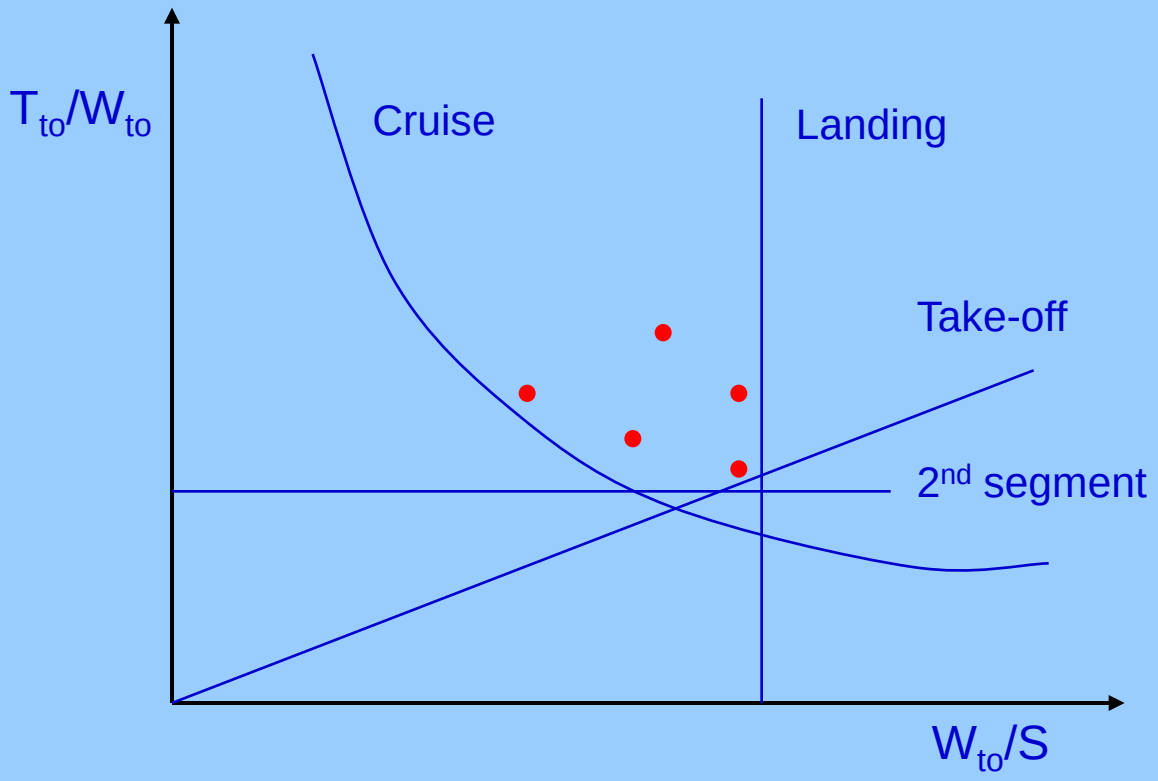
DESIGN POINT OF A TRANSPORT AIRPLANE



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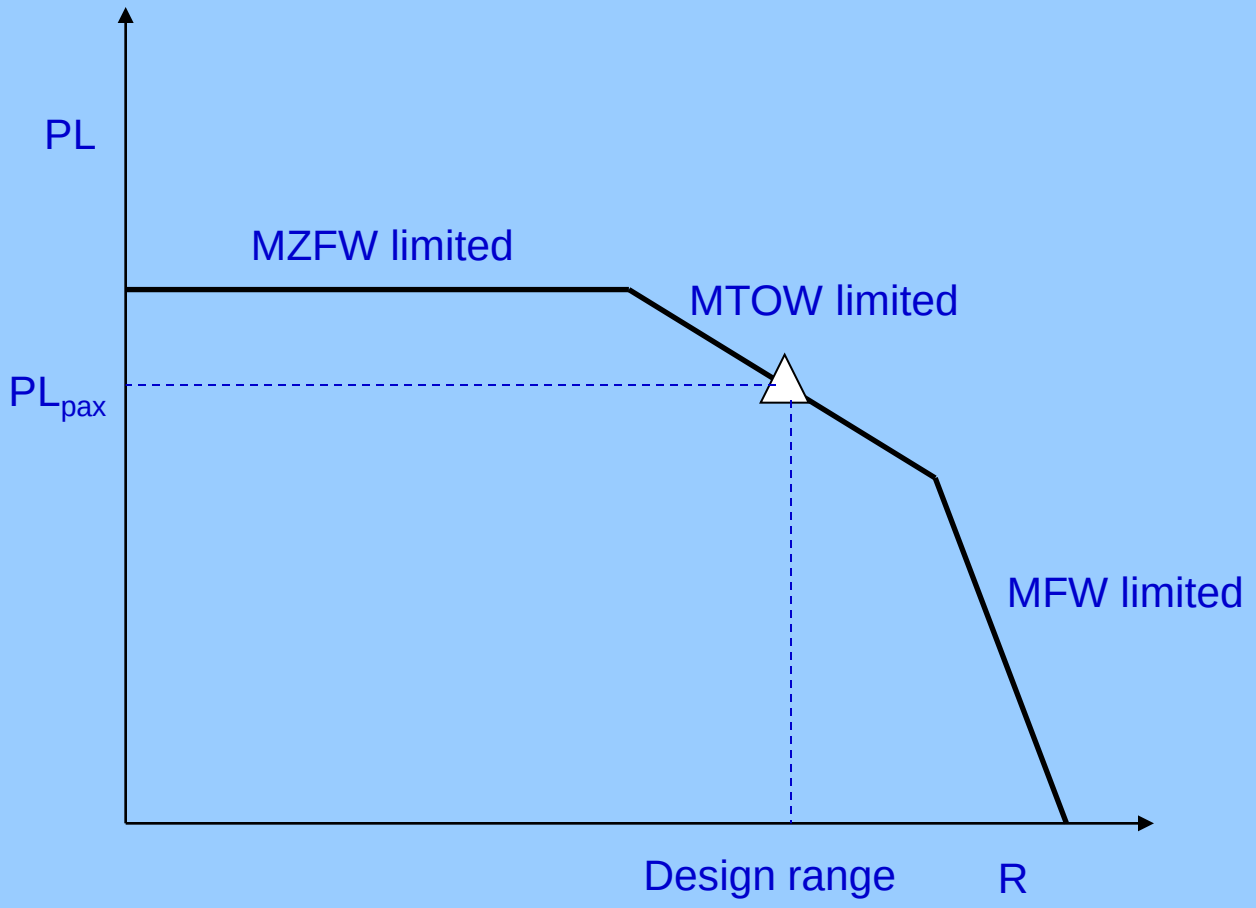
PAYLOAD-RANGE DIAGRAM



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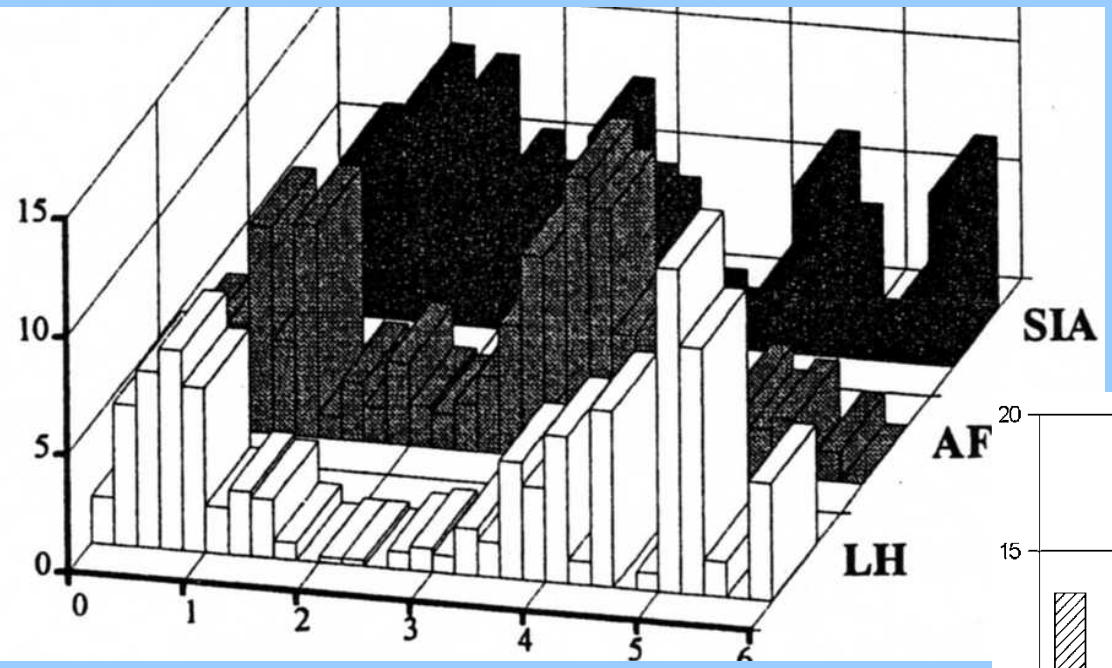
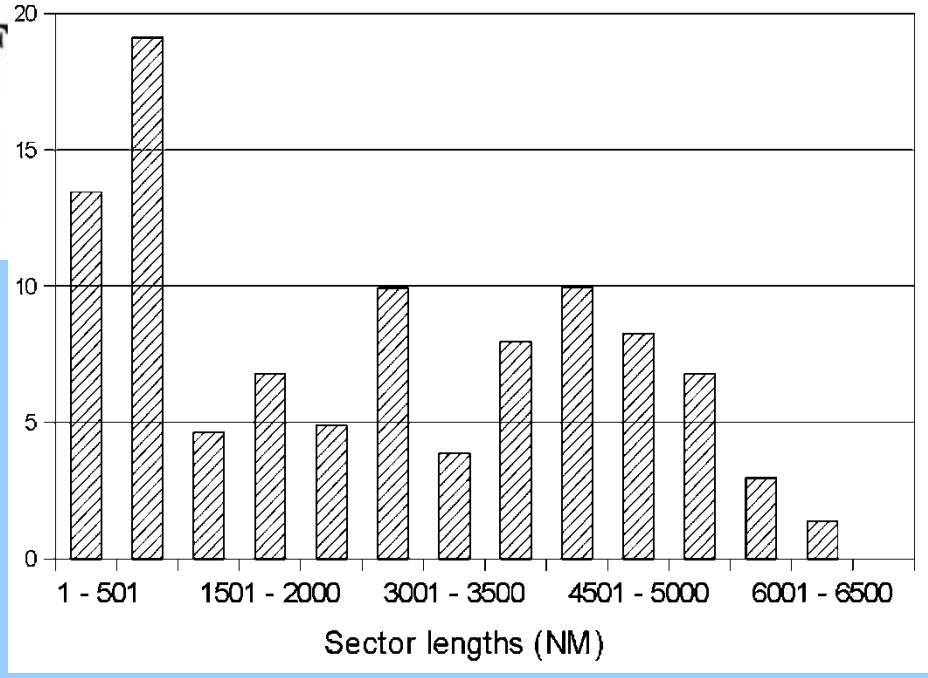


B747

A340



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DESIGN RANGE AND AVERAGE SECTOR LENGTH OF COMMON NARROW BODIES

Aircraft	Average range	Design range
A320-200	1950 km	5100 km
B737-300	980 km	4080 km
B757-200	2070 km	5100 km
Fokker 100	830 km	2750 km

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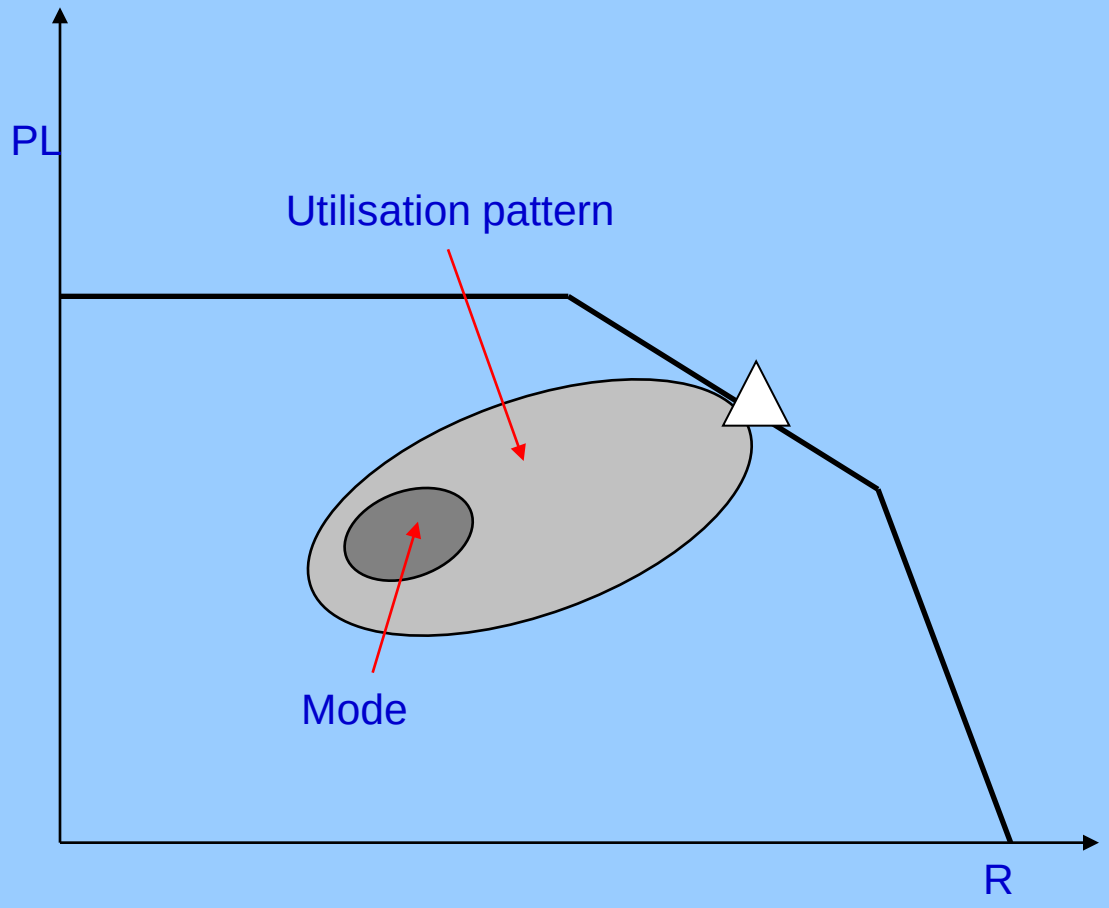
DESIGN SPECIFICATION AND ACTUAL UTILISATION



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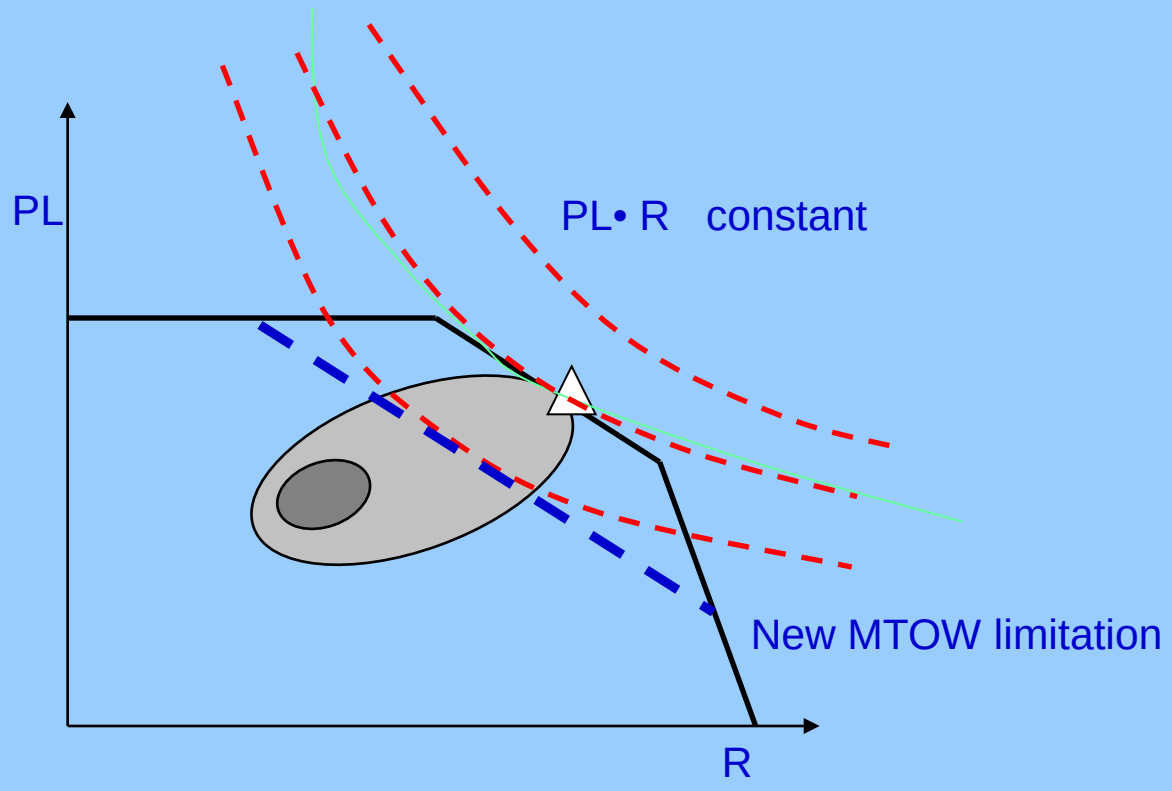
MATCHING DESIGN RANGE TO ACTUAL UTILISATION



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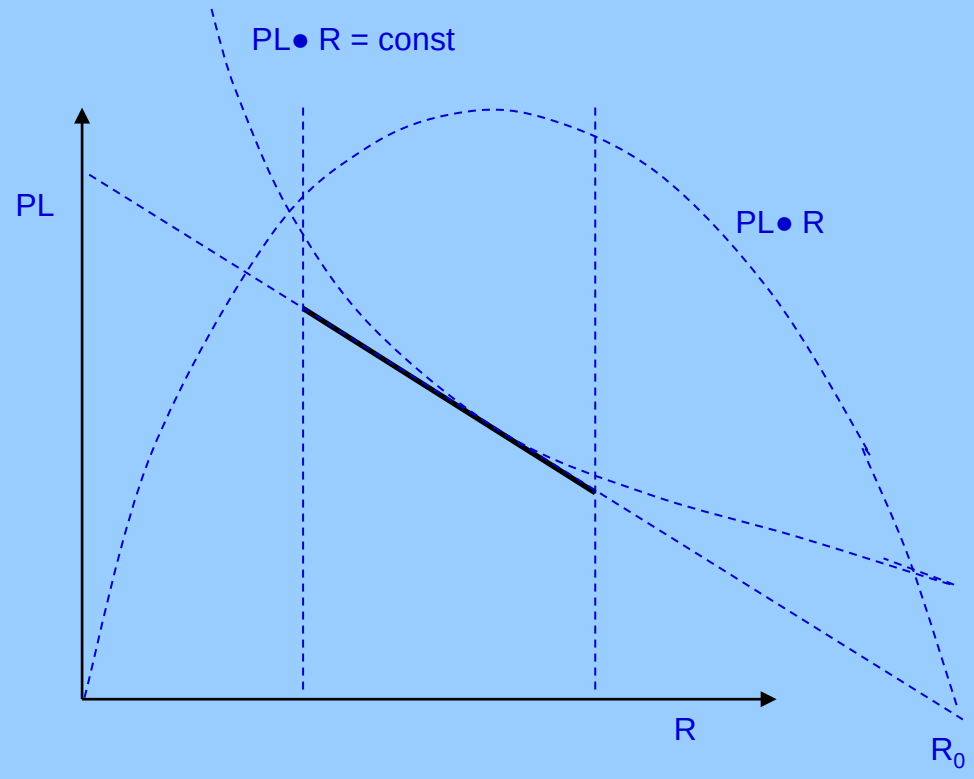
PRODUCTIVITY OF AIRPLANE OPERATION



Productivity = PL ● R

Maximum prod. at $R_0/2$

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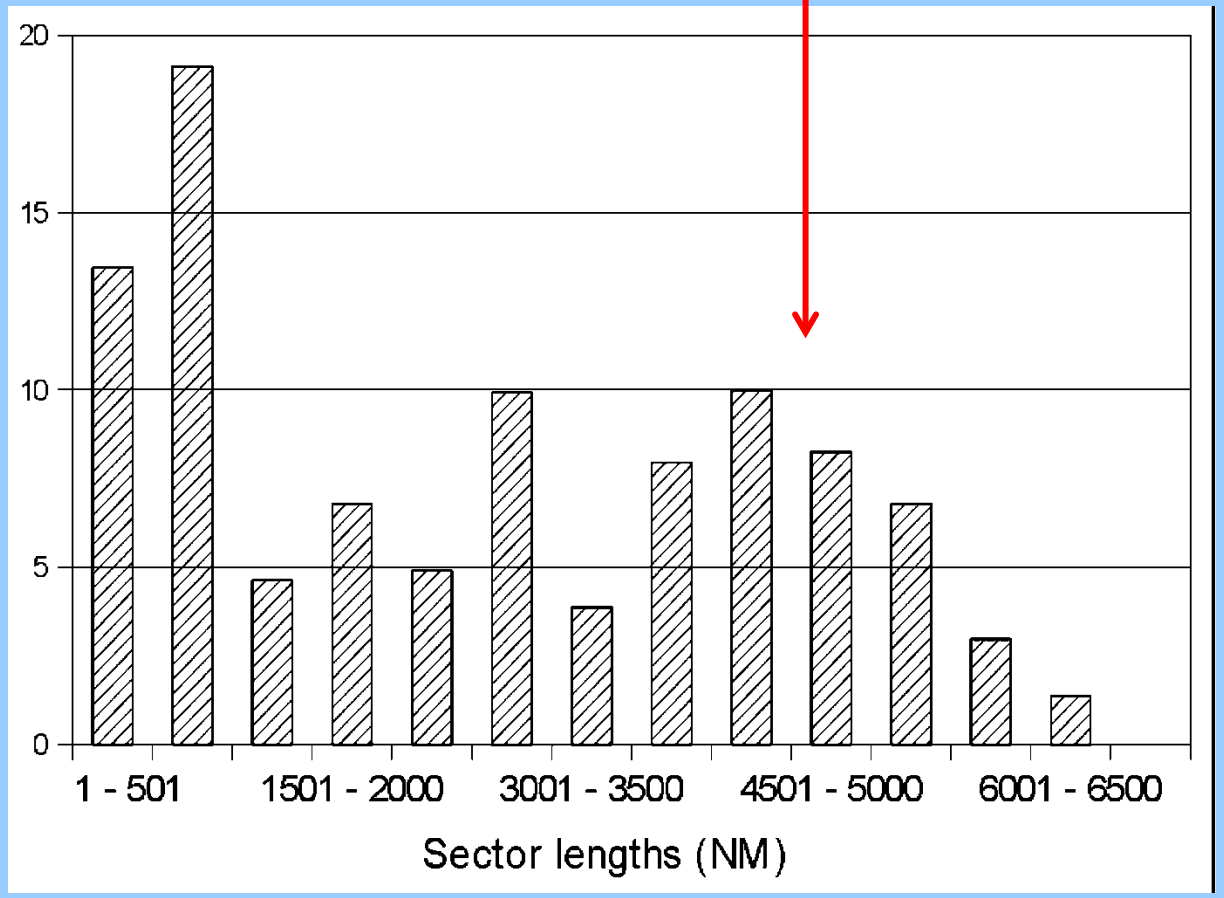
MARKET CAPTURE AND RANGE REDUCTION FOR A340

65% R_{max} → 80+% market



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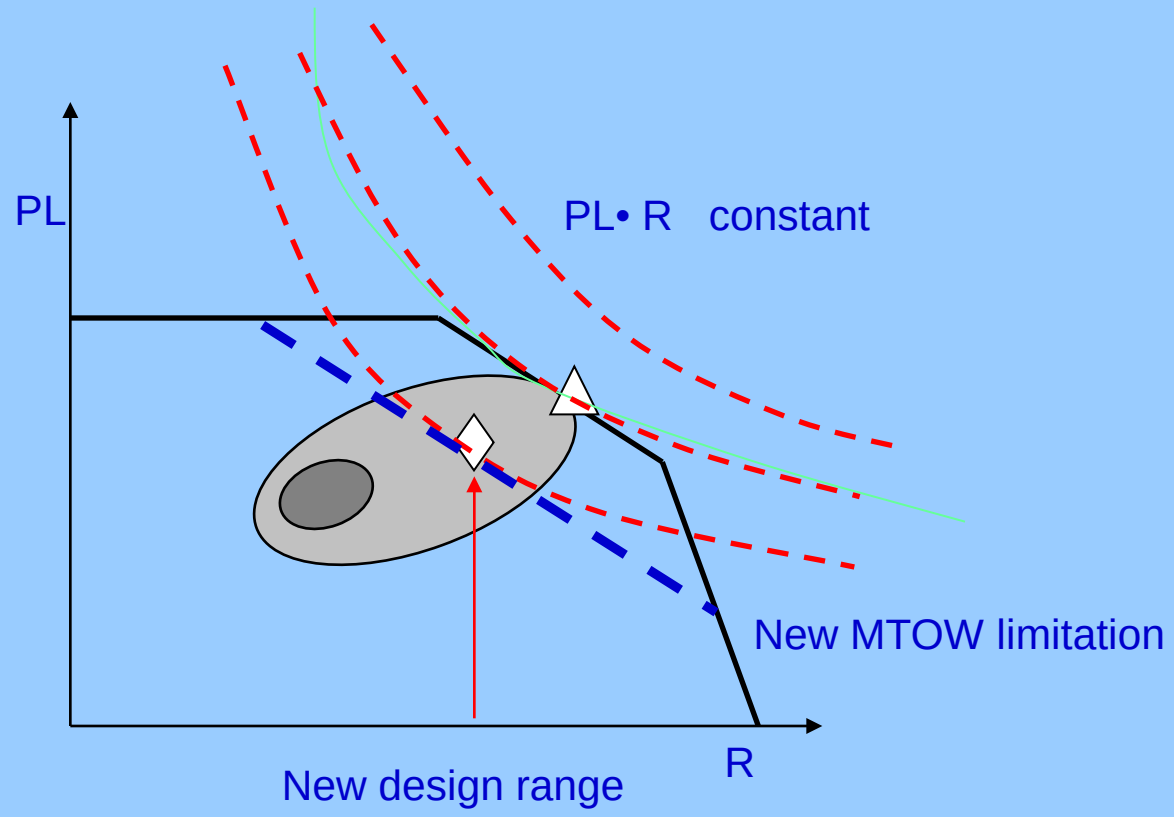
MATCHING DESIGN RANGE TO ACTUAL UTILISATION



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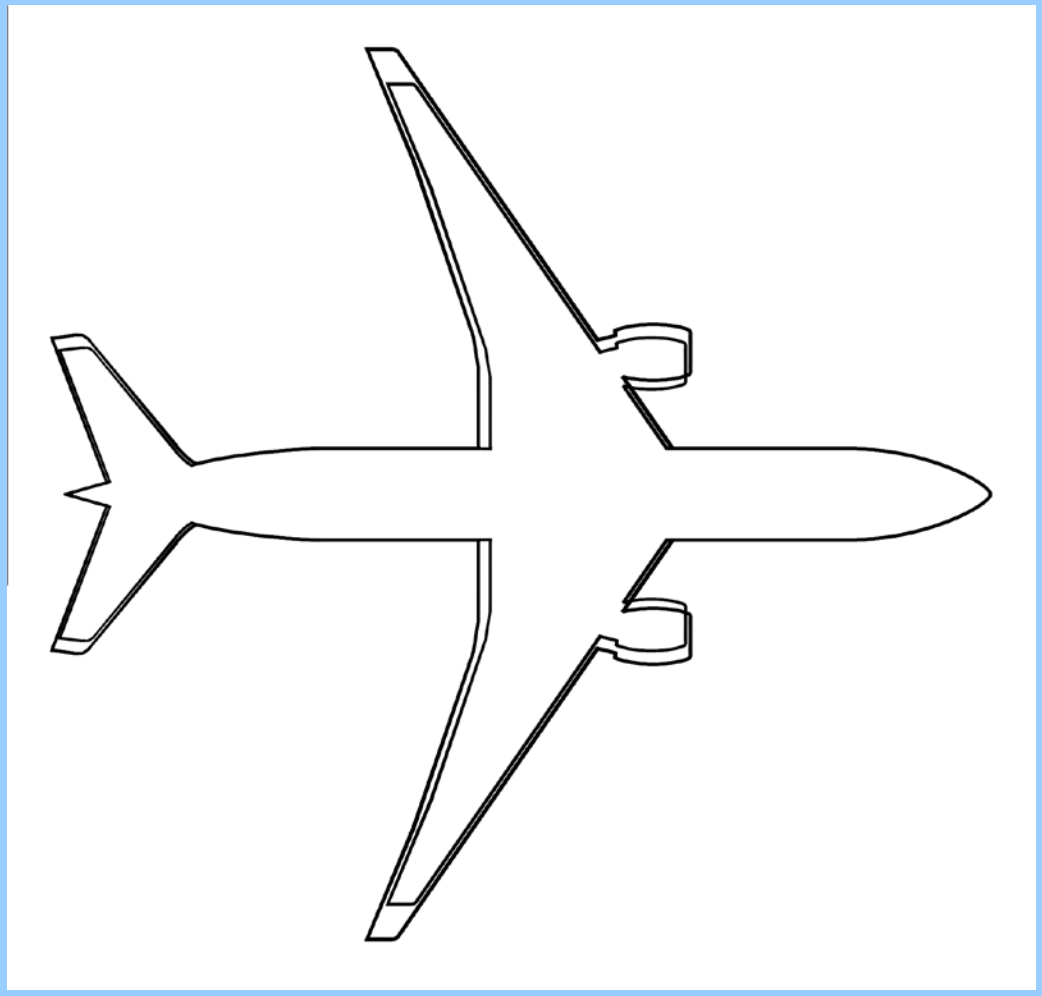
B777 TYPE AIRCRAFT AND ALTERNATIVE AIRPLANE WITH SAME CAPACITY BUT 60% RANGE (85% WING AREA)



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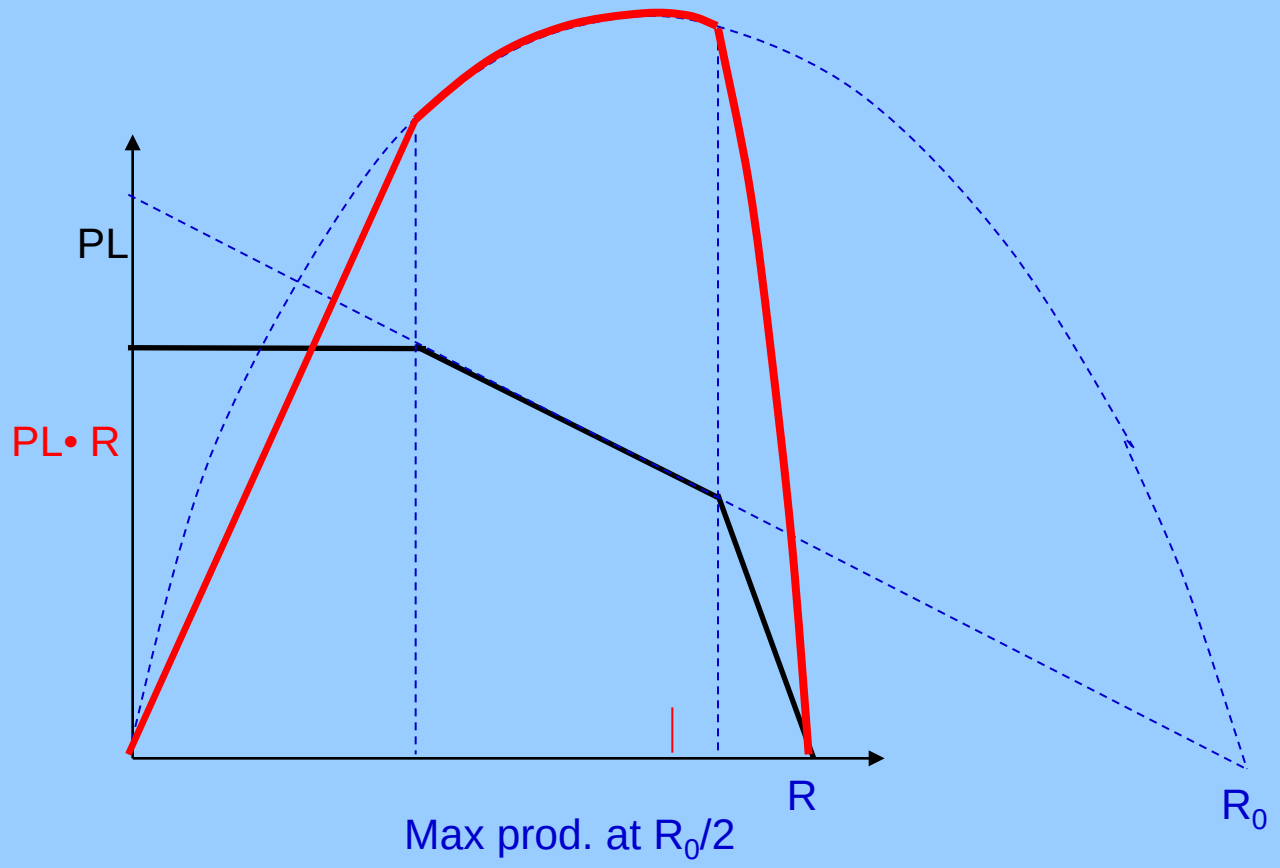
ACTUAL PRODUCTIVITY OF AIRPLANE OPERATION



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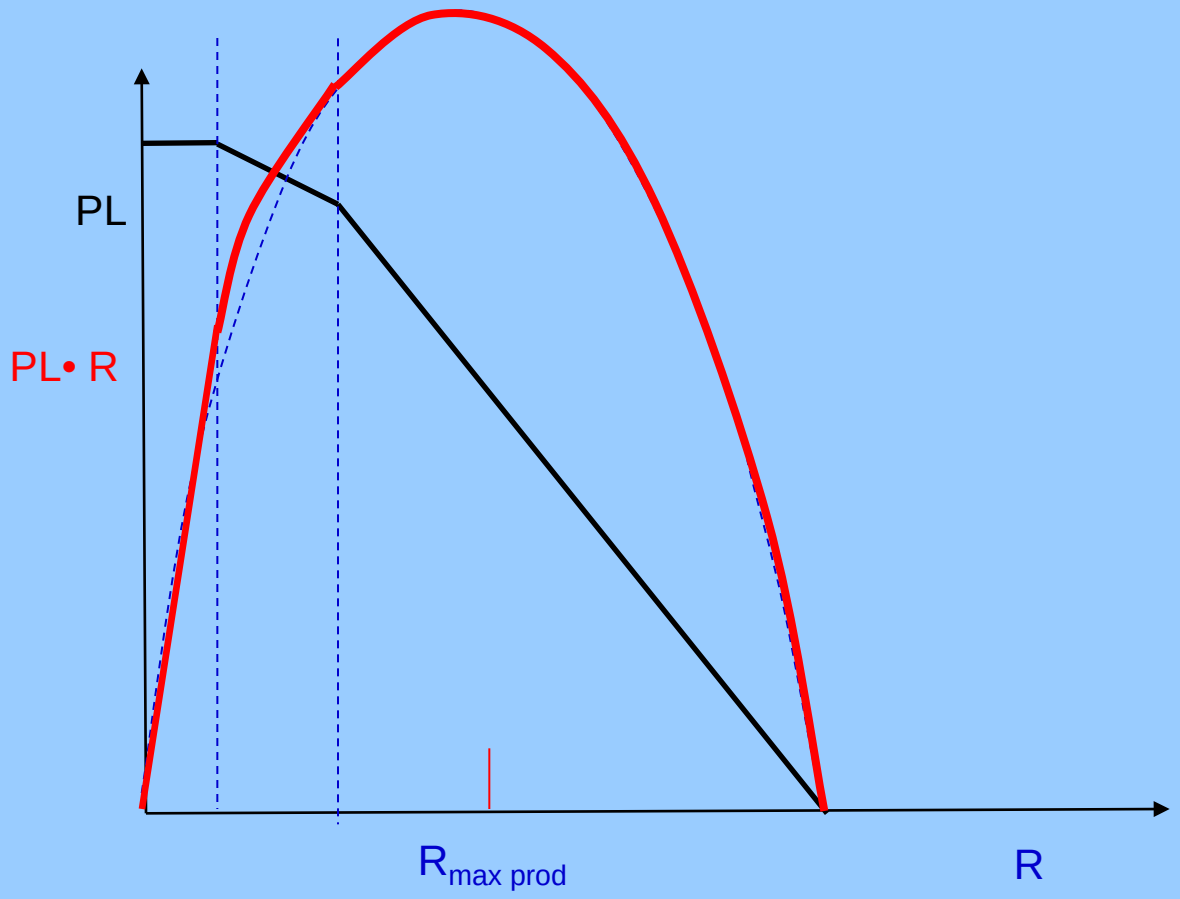
MAXIMUM PRODUCTIVITY AT MFW SEGMENT



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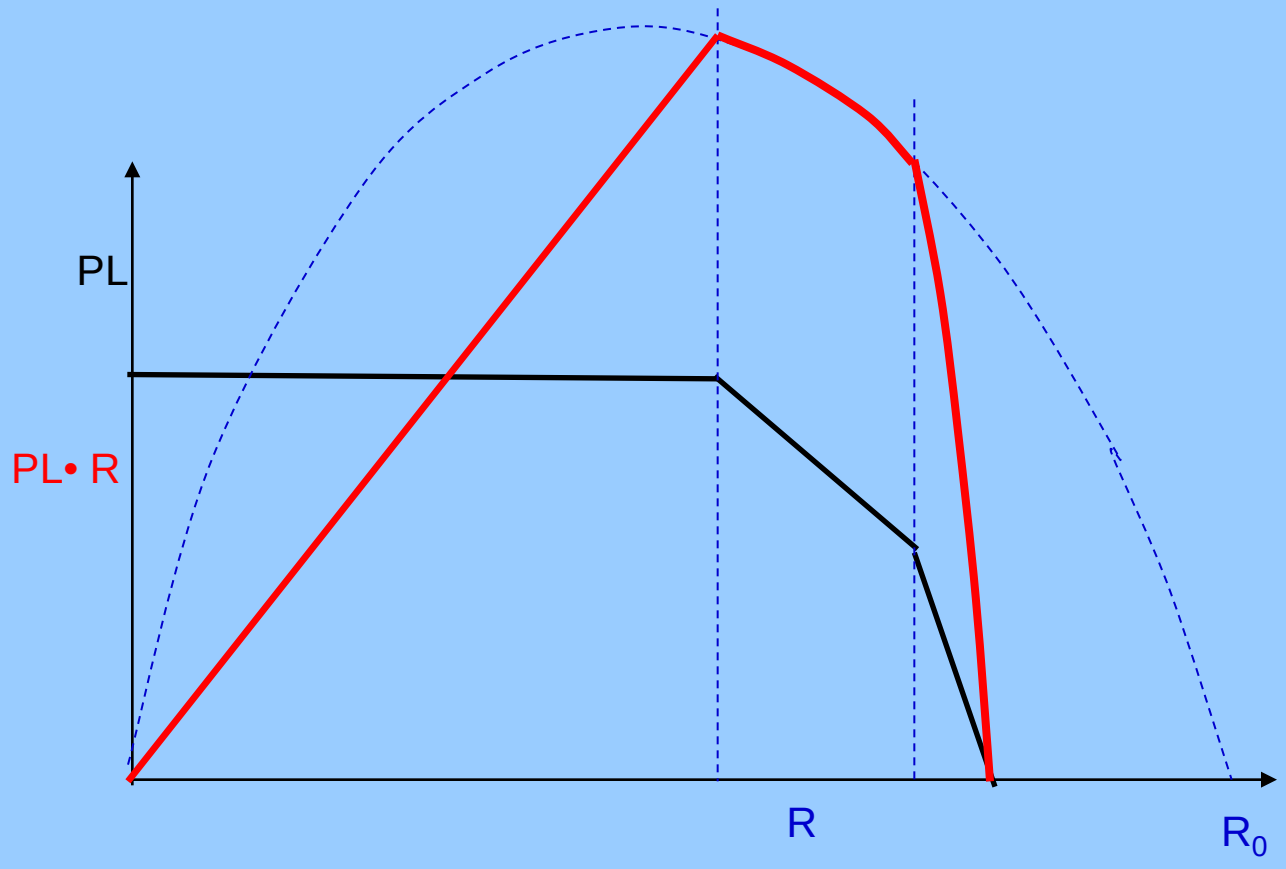
MAXIMUM PRODUCTIVITY AT MZFW



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MATCHING INITIAL SPECIFICATIONS, DESIGN PROCESS AND ACTUAL UTILISATION

Design point

Design range

Point data

$$\frac{W_{to}/S}{\frac{\gamma}{2} p M^2} \frac{W_{cr}}{W_{to}} = C_{Lcr} = C' \sqrt{C_{D0} \pi A \varphi}$$

Integral data

PL-R diagram

Fleet utilisation

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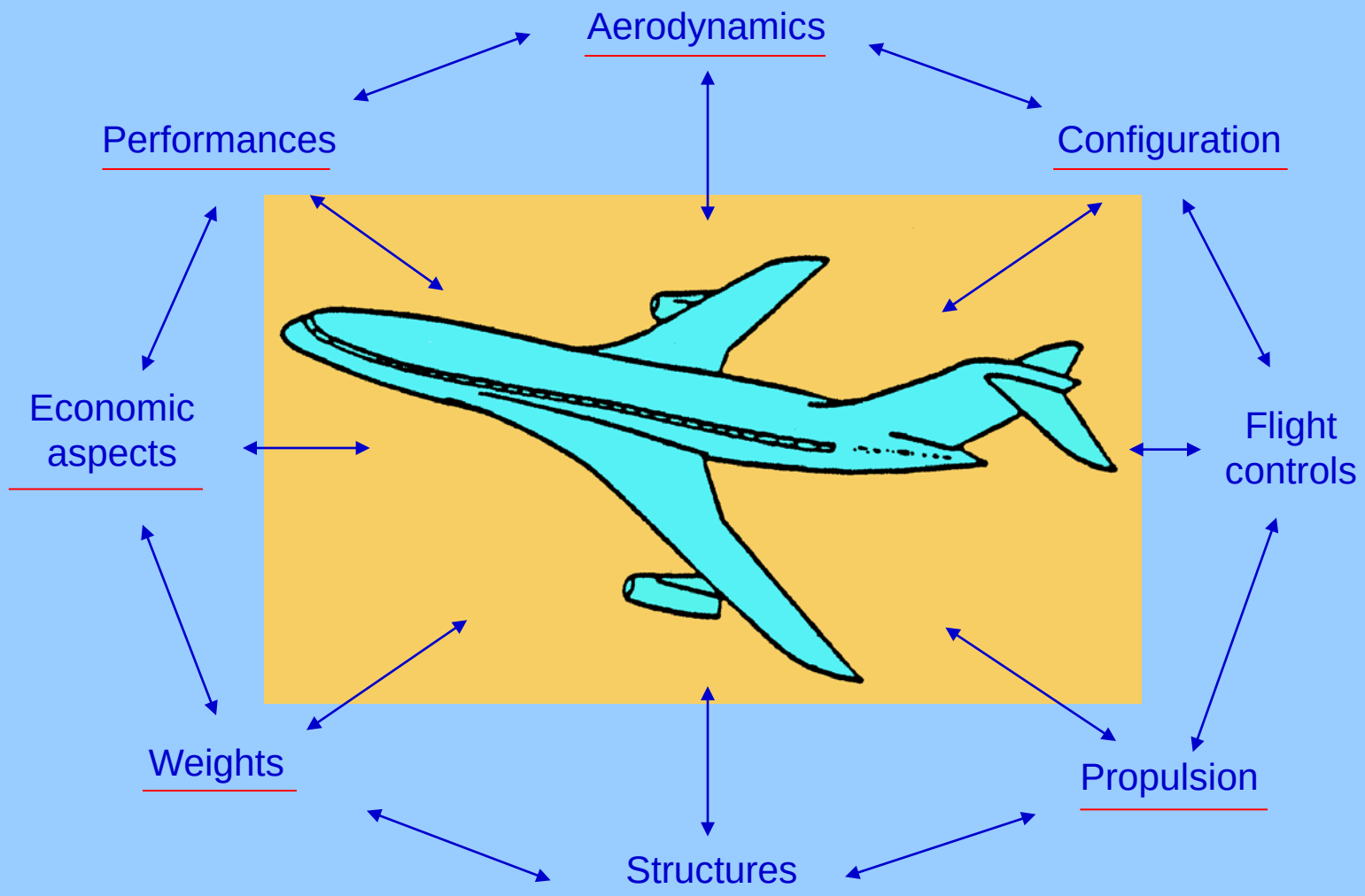
MULTIDISCIPLINARY APPROACH ON THE PROBLEM STUDIED



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