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Hybrid drive concepts for small scale aviation for CNG and LNG fuel

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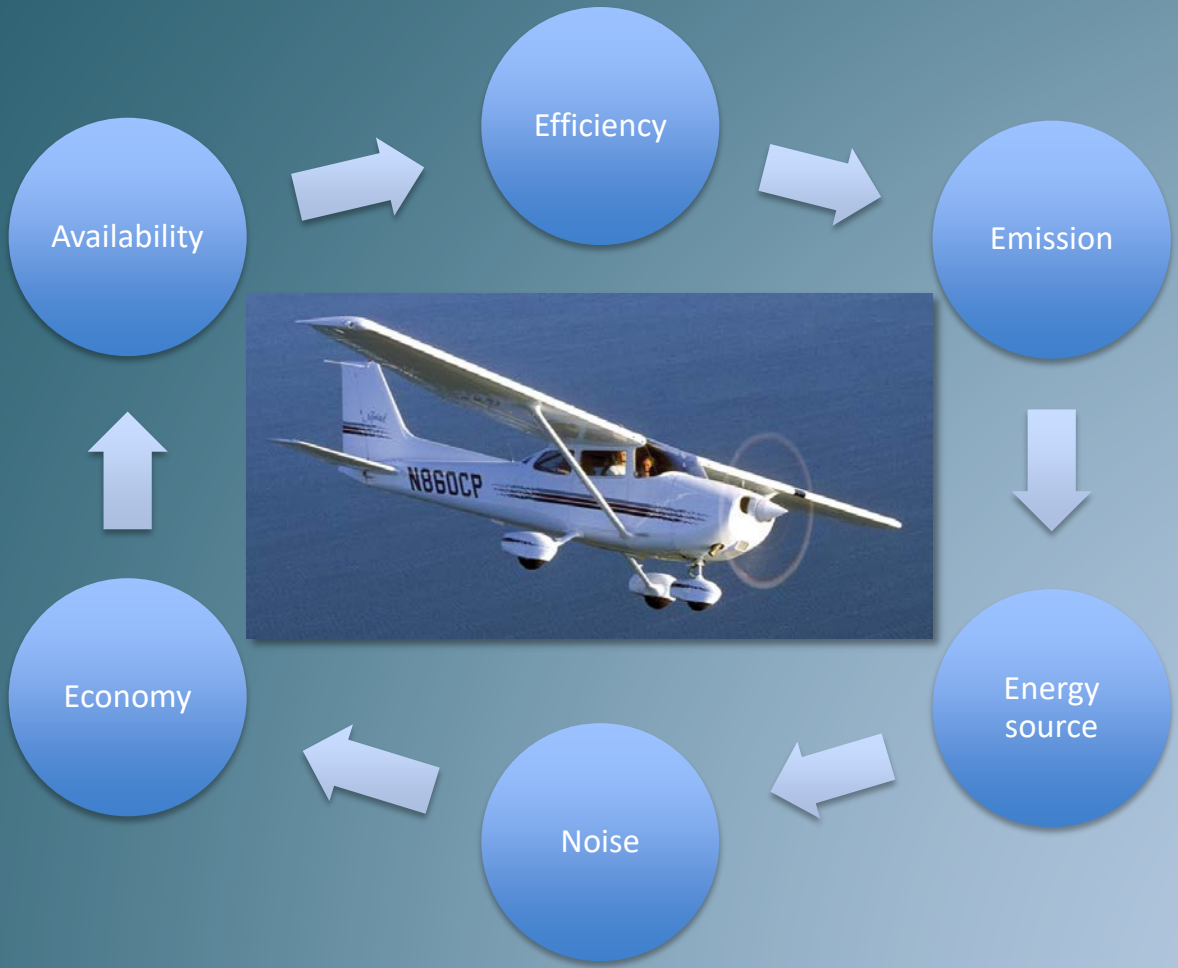
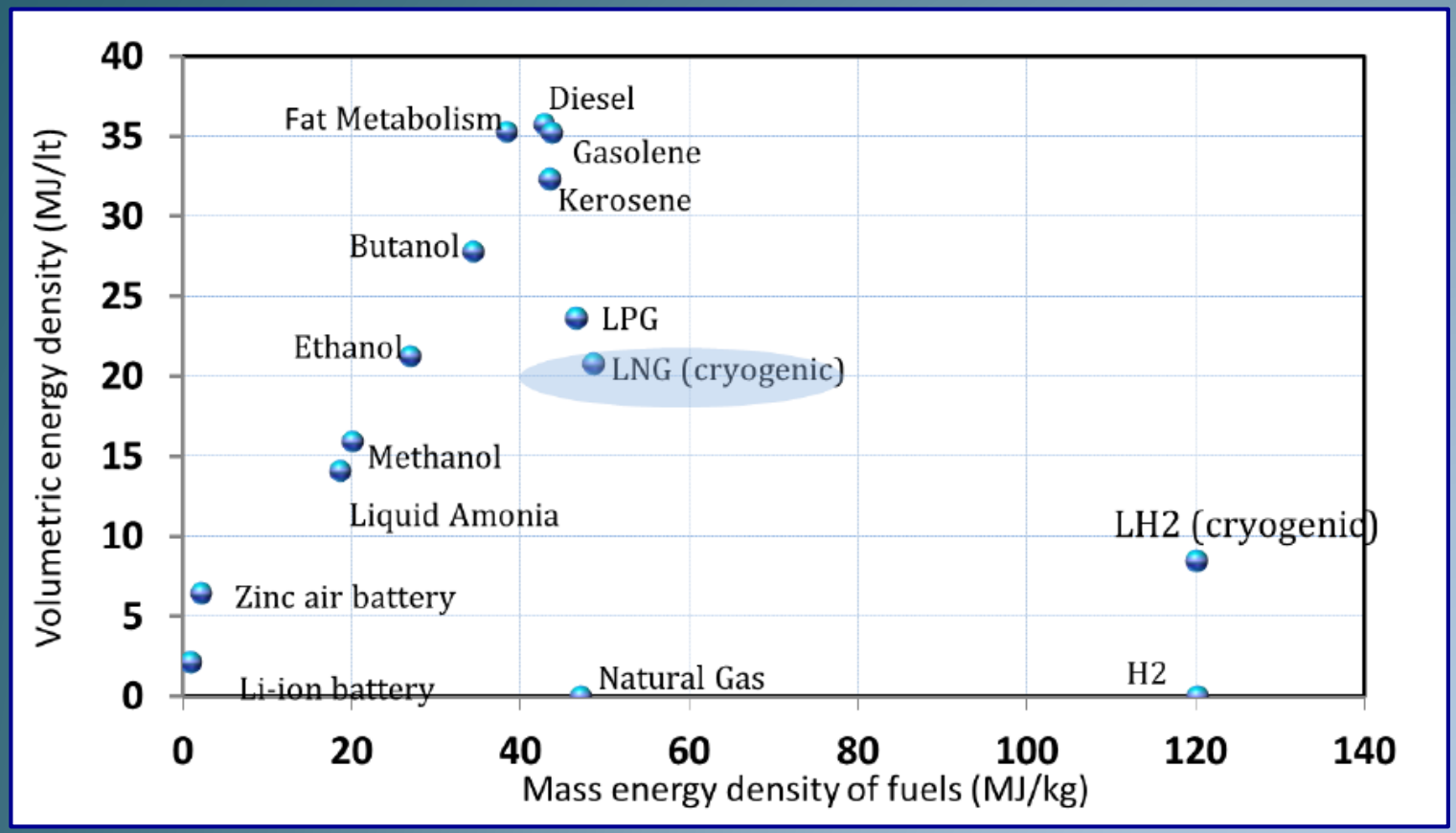
Aviation main challenges



Fuels for aviation

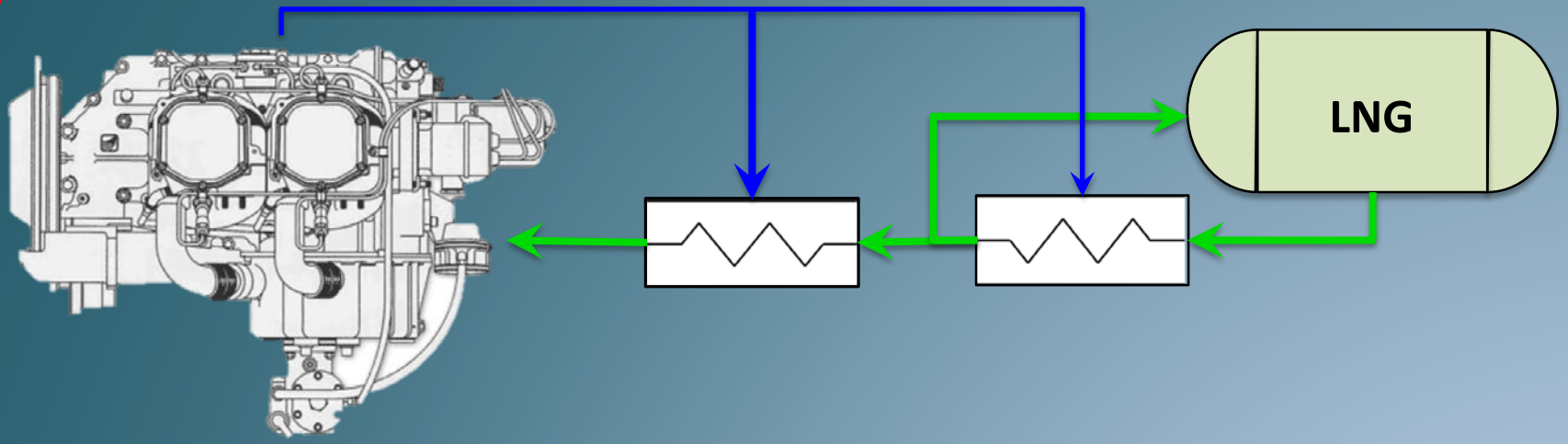


Propulsion concepts

- Typical fuel consumption: 18 l/hour
- Endurance: 4 hours
- Avgas (reference fuel): 721kg/m3
- NG: 0.721 kg/m3

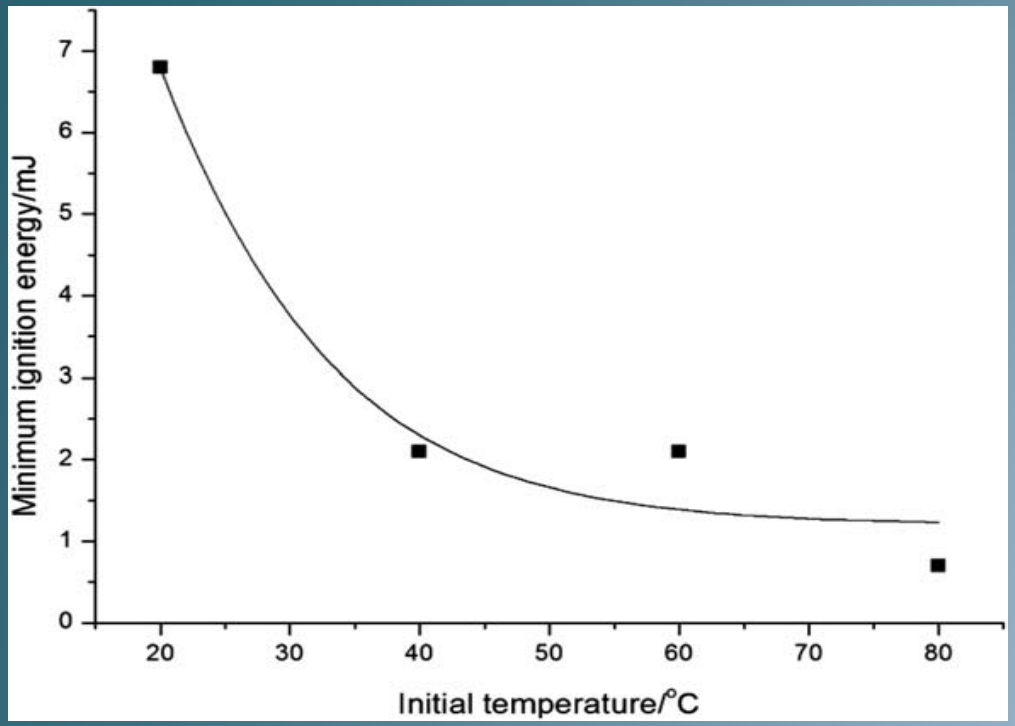
Concept	Fuel	Storage	Engine
1	NG	CNG @ 300 bara	Gas engine, direct drive
2	NG	LNG @ 1 bara	Gas engine, direct drive
3	NG	LNG @ 1 bara	GasGen electric drive
4	NG	LNG @ 1 bara	NG fuel cell electric drive

Typical Lycoming O-360 LNG fuel system layout



Propulsion concepts

- Three recent breakthroughs have made natural gas a very interesting fuel:
- Ceramic fuel cells that can make electricity from natural gas at 60% efficiency.
- ANG: Adsorption stores natural gas at low (500 psi) pressure in compact tanks.
- A glut of cheap natural gas caused by new shale drilling/extraction techniques.


Minimum ignition energy/mJ
0
1
2
3
4
5
6
7
20
30
40
50
60
70
80
Initial temperature/°C

Equipment

- Running engine (what data is available from manufacturer?) with appendages Lyc – O - 360
- ECU (normal fuel, software source available?)