Electrical Propulstion for Transport Category Aircraft

DNW Symposium: Future Needs

14th March 2018

<200B.C.

Gaston & Albert Tissandier

1883

Fokker DXXIII

1939

Hunting Jetflap

1963

MacCready Gossamer Condor

1977

MacCready Gossamer Albatross

1979

Montgolfier

1783

Sir G. Cayley

1853

Wright Flyer

1903

He-178

1939

de Havilland Comet

1949

Militky MB-E1

1973

MacCready Solar Challenger

1981

Solar Impulse

2015

Bell X-1

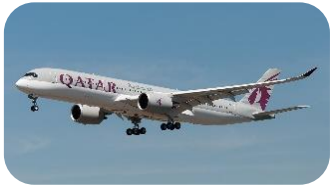
1947

Concorde

1969











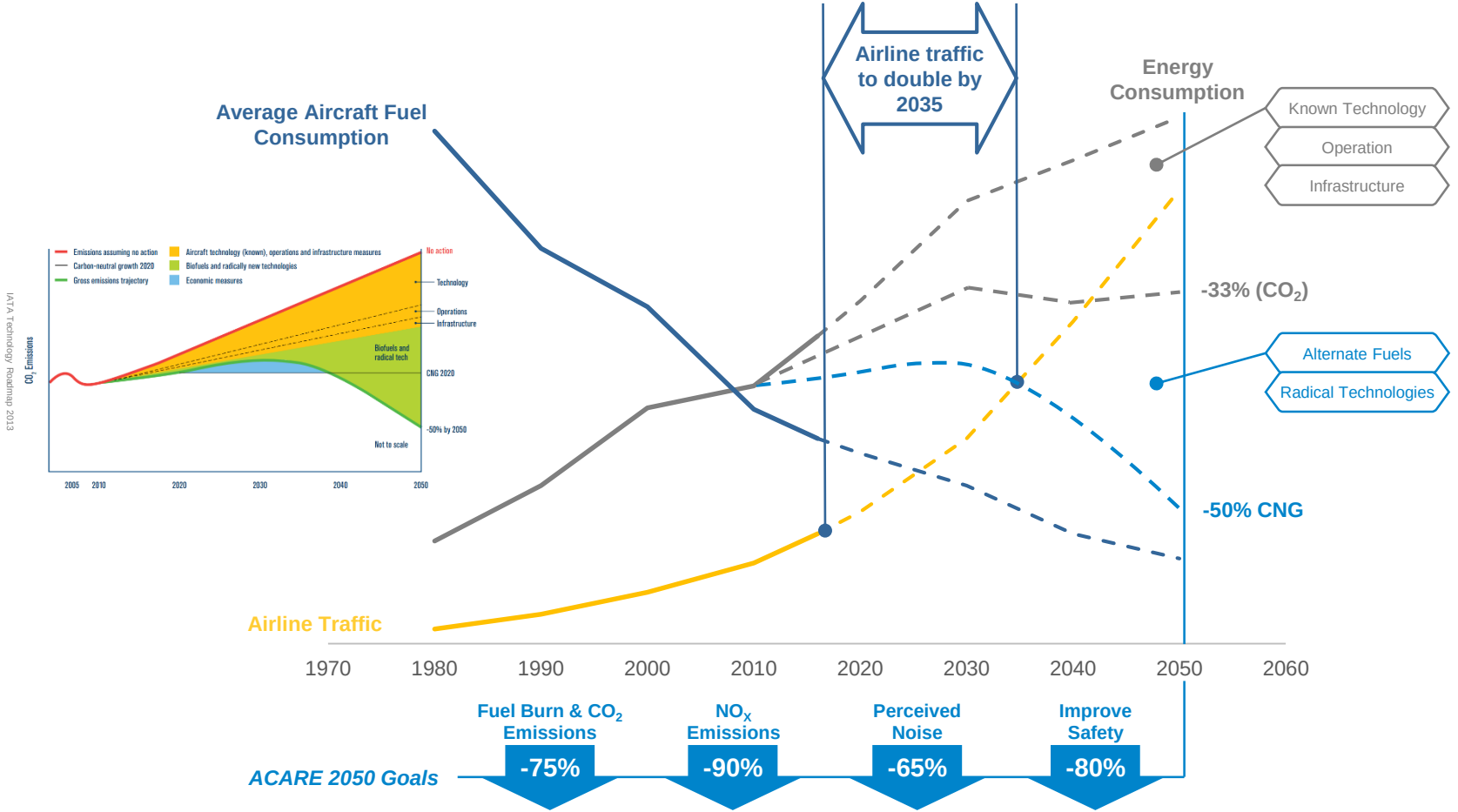






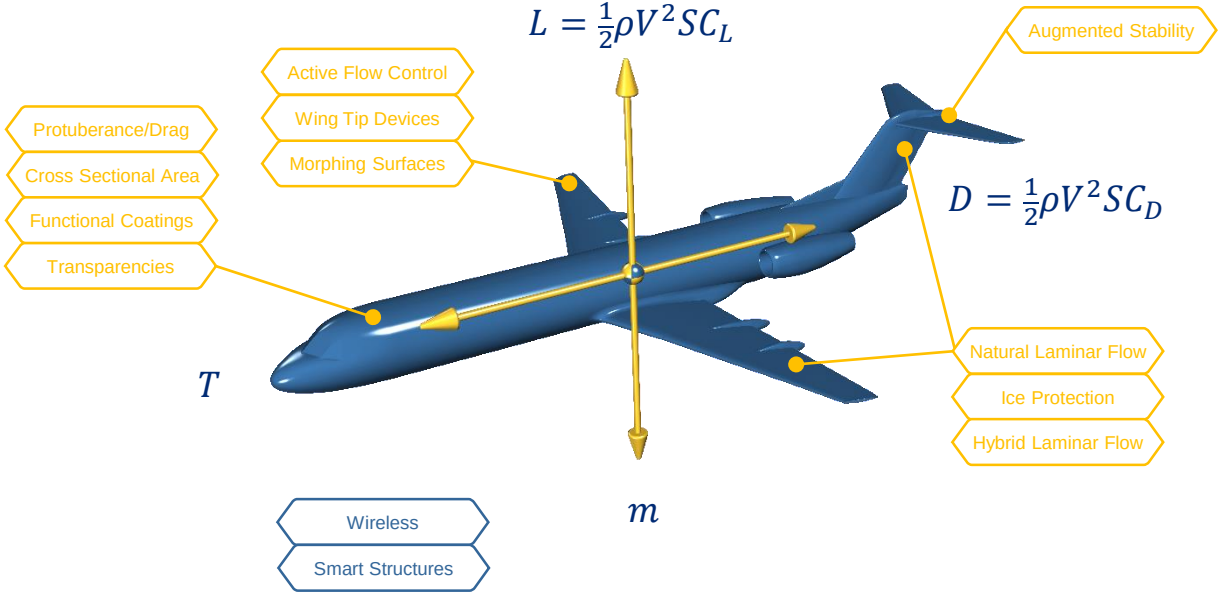
Fokker

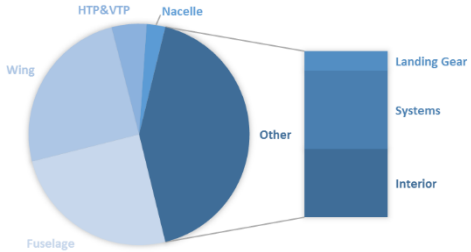
GKN AEROSPACE

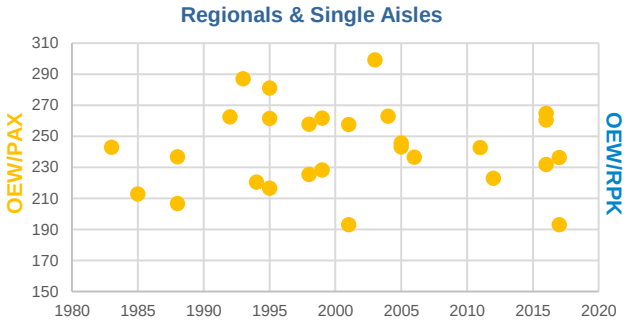


IATA Technology Roadmap 2013

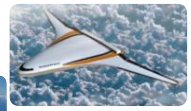
		η_{af}	η_T	$\eta_{int\text{-}UHBR}$	Biofuels	η_{op}, η_{int}
						Electrical Propulsion
Emissions	CO_2, CO	↘	↘	↗ η_{af}	↘	⇩
	NO_x		⇨		⇕	
	NMVOC		⇕		↘	
	PM2,5, PM10				↘	
	SO_x		⇨		↘	
	NOISE	↘	↘	↘	⇨	⇩







>10MW (200-300 PAX)



5-10MW Regional (100-150 PAX)

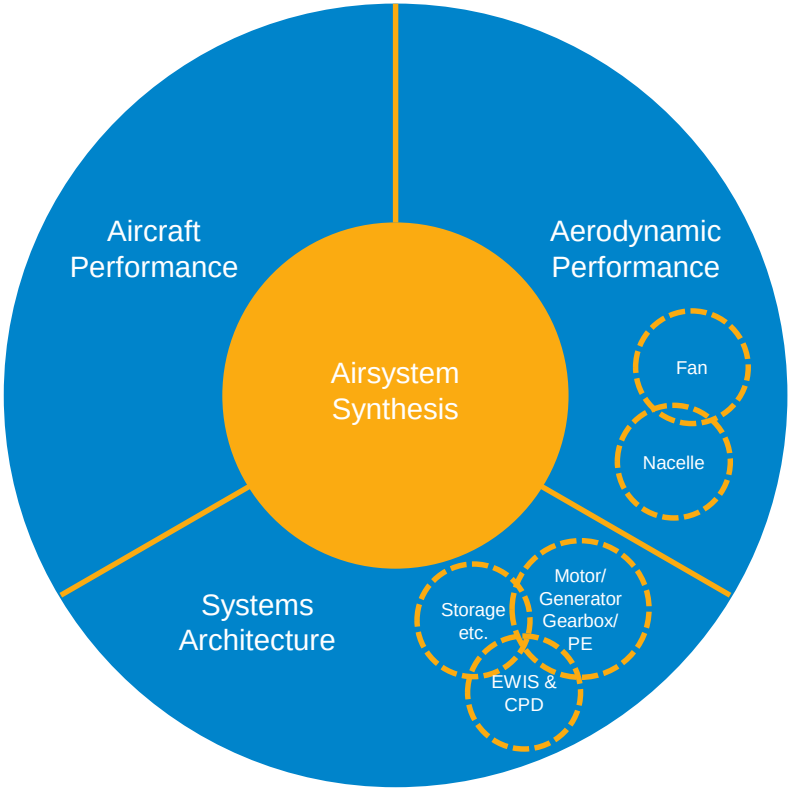
NSA?

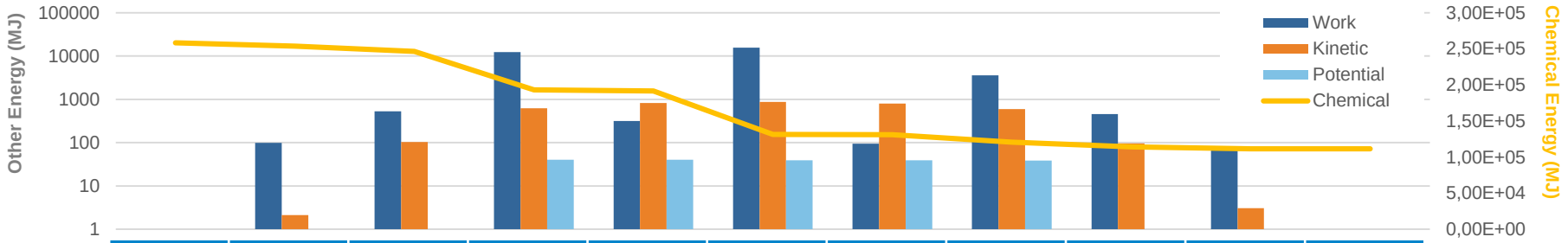
2-5MW Regional (50-100 PAX)

1-2MW Commutors & Helicopters

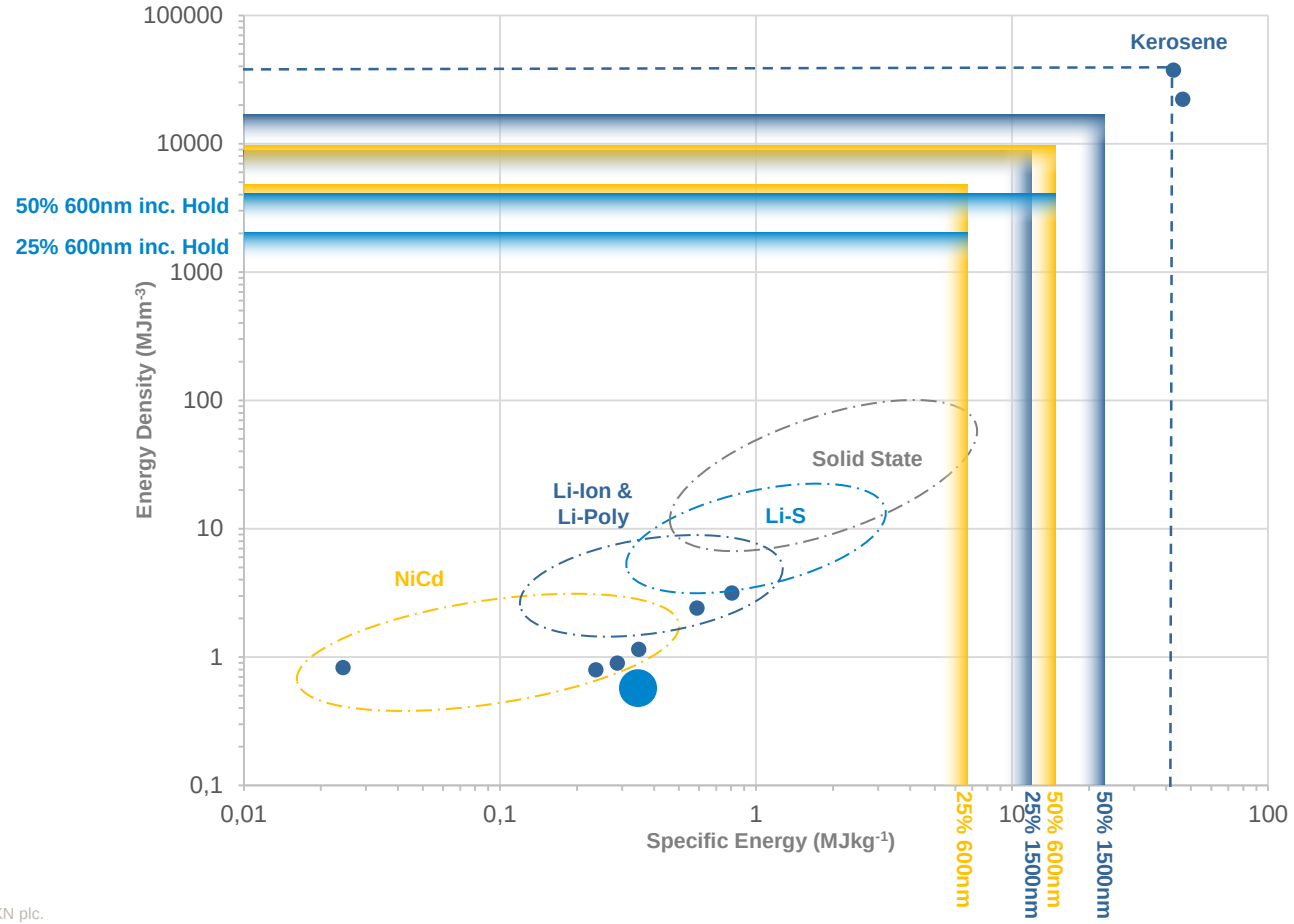
kW General Aviation

Today 2020 2030 2040 2050 2060

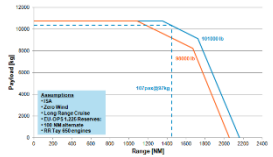




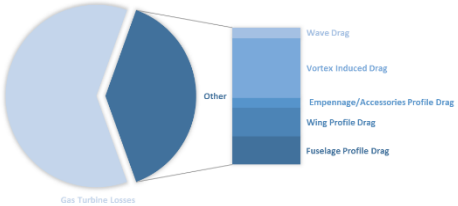
	Ground	Taxi-out	Takeoff	ROM Climb	Acceleration to Cruise	Cruise	Deceleration to Descent	ROM Descent	Approach and Landing	Taxi-in	Ground
Chem. E (MJ)	0,00	4793,60	7019,20	53414,40	1626,40	60305,20	128,40	10486,00	6420,00	2653,60	0,00
% Block Fuel	0,00	1,85	2,72	20,67	0,63	23,33	0,05	4,06	2,48	1,03	0,00
% Miss. Fuel	0,00	3,26	4,78	36,37	1,11	41,07	0,09	7,14	4,37	1,81	0,00
T (min)	0,00	9,00	1,70	23,20	1,00	47,90	0,30	18,80	6,00	5,00	0,00

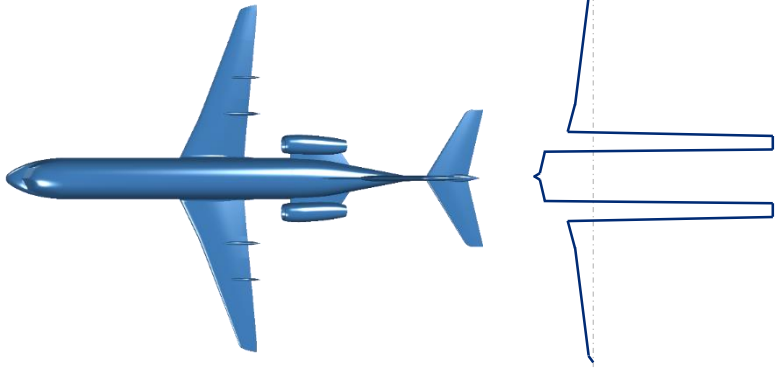


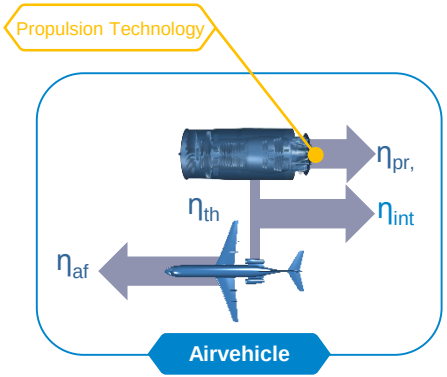
MTOW (TAY650)	≈45T
OEW	≈25T
Max Fuel (Std)	≈10T
Fuel Volume	13.365l

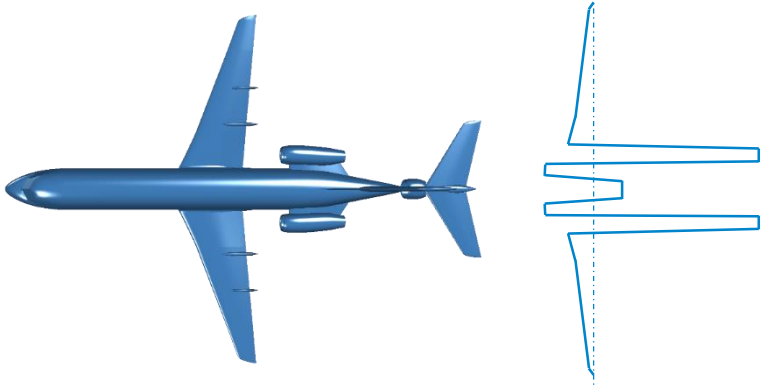


Max Speed	M0,77
Cruise Speed	M0,74

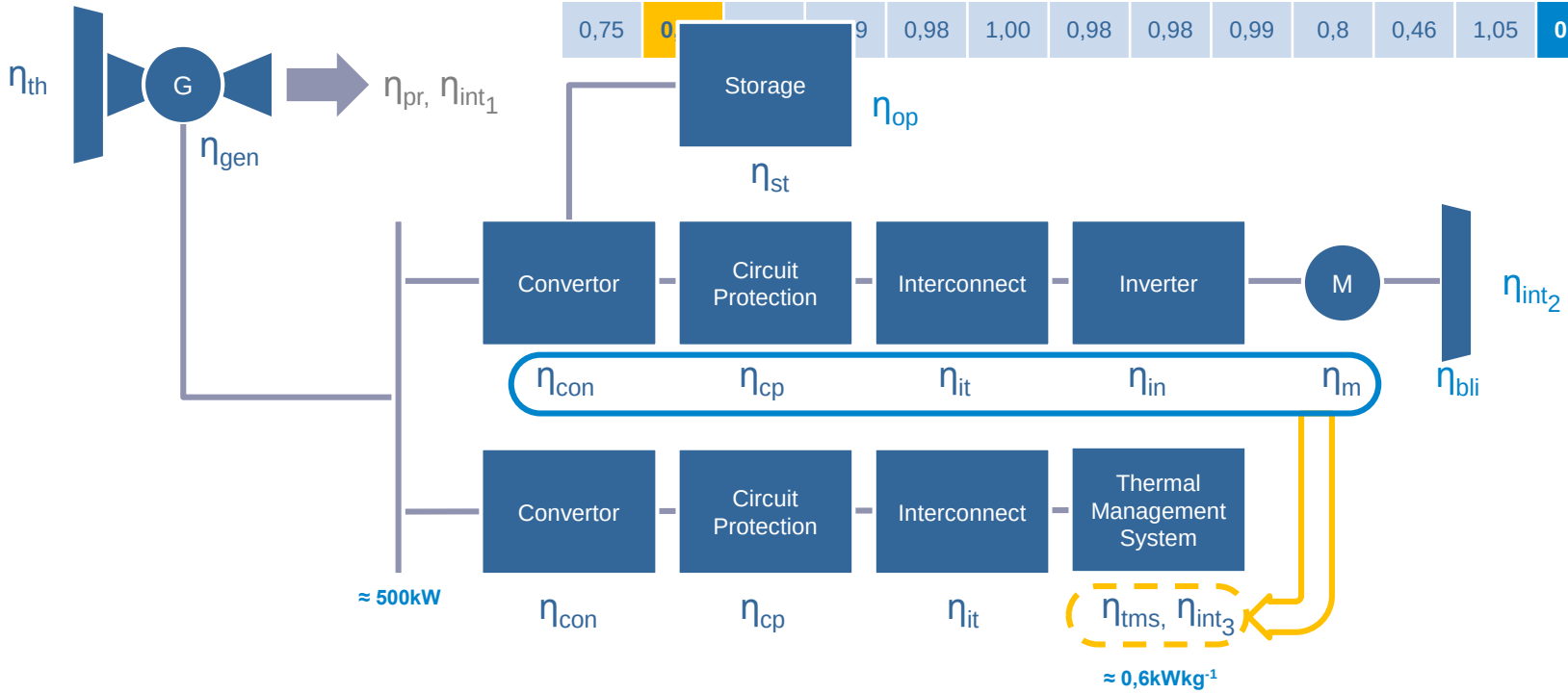


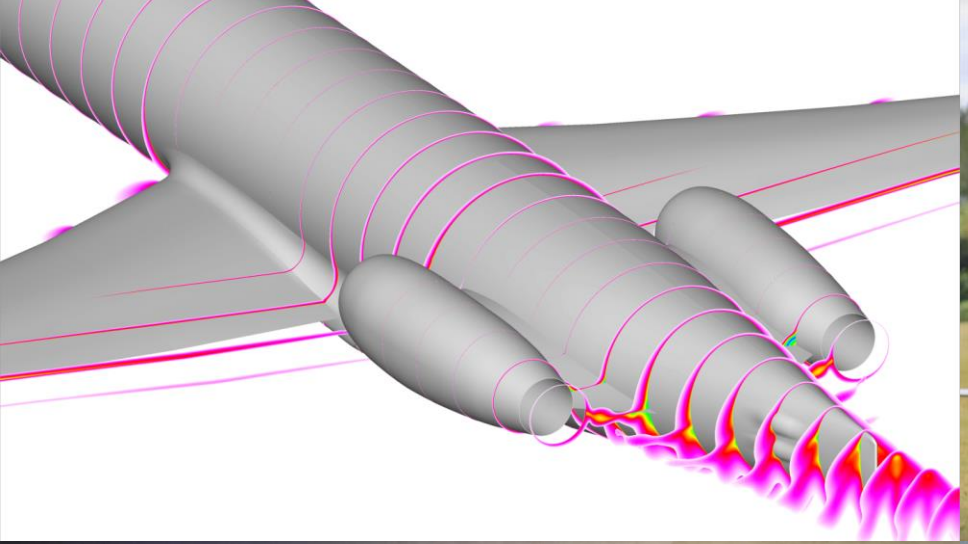




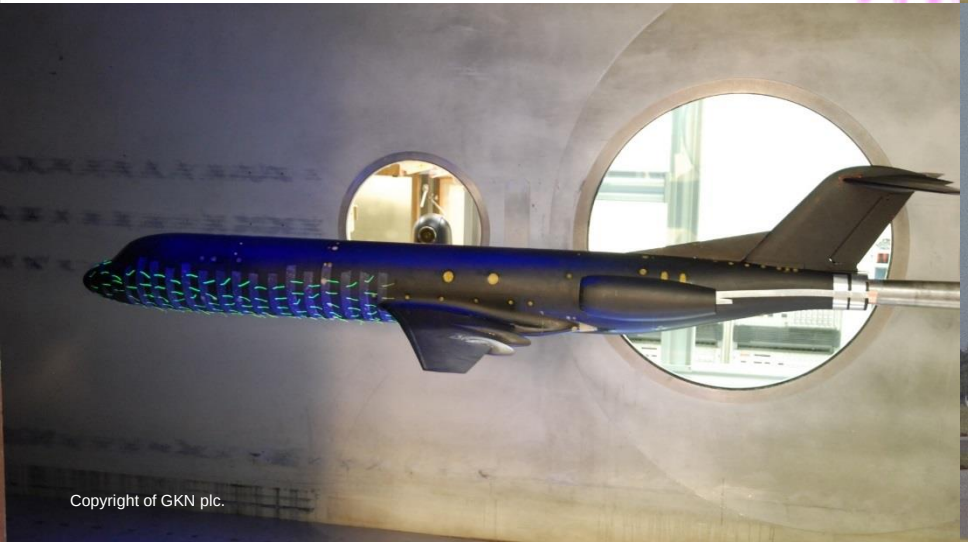


η_{pr}	η_T	η_{th}	η_{gen}	η_{con}	η_{cpd}	η_{it}	η_{in}	η_m	η_{bli}	η_{tot}	η_{int}	η_{hep}
0,72	**0,41**	0,57	0,95	0,95	1,00	0,95	0,95	0,95	0,8	0,35	1,10	**0,39**
0,78	**0,48**	0,63	0,98	0,98	1,00	0,98	0,98	0,98	0,8	0,45	1,10	**0,50**
0,75	**0**		9	0,98	1,00	0,98	0,98	0,99	0,8	0,46	1,05	**0,48**






Courtesy P and R Bellingers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1st TRI 650 powered Fokker 100
Courtesy Andrew Thomas

Courtesy Aurora Flight Sciences

Courtesy NASA

Courtesy KLM Cityhopper

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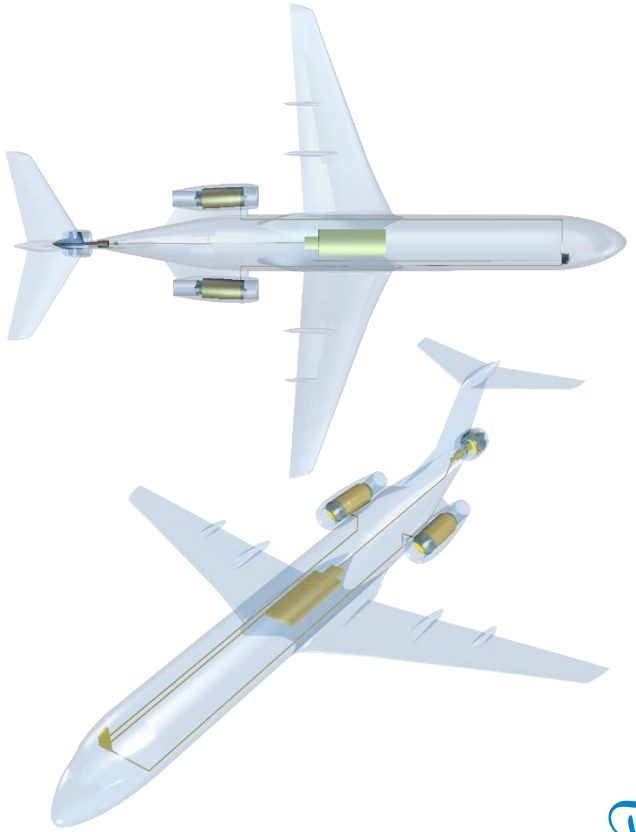
e-volution Phase 1 - Feasibility Study Highlights

- Performance
  - Energy based Mission Analysis
  - Axisymmetric, Simplified & Full Field CFD
- Technologies
  - Component
  - System
- Demonstrator
  - Airworthiness & Safety
  - Stability & Control
  - Structural Integrity
- Prepare for potential Phase 2



Thank you for your attention

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GKN Products & Technologies
Aerospace

AEROSTRUCTURES

- Fuselage, wing primary structures
- Nacelle & pylon
- Empennage

ENGINE SYSTEMS

- Fan static & rotating structures
- Titanium engine inlet parts
- Compressor & turbine Exit
- Space nozzle & subsystems

SPECIALPRODUCTS

- Transparencies
- Ice protection systems
- Lightweight missile canisters

ELECTRICAL SYSTEMS

- Integrated systems
- Electrical interconnection systems

LANDING GEAR

- Helicopter landing gear
- Composite landing gear components

GLOBAL SERVICES

- Availability services, MRO, conversion and completion for mature and legacy aircraft