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Electrical Network Challenges in Delivering Large Civil Aircraft Electric Propulsion Solutions

Future Propulsion Conference, February 2026

Mark Husband

GKN AEROSPACE

Our Mission:
To be the most
TRUSTED and **SUSTAINABLE**
partner in the sky

CIVIL | ENGINES | DEFENCE

MAKING THINGS FLY

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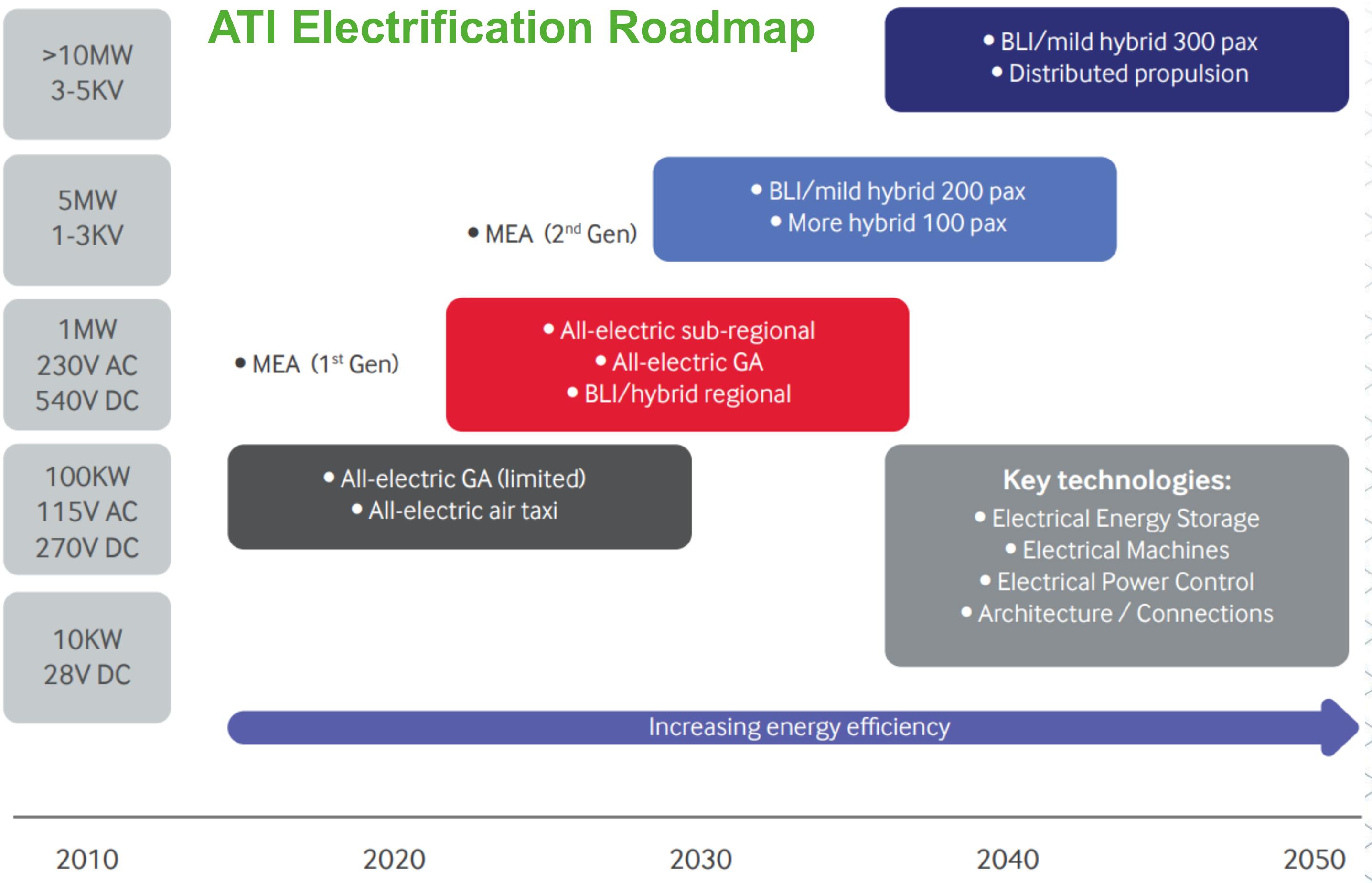
Sustainable Aviation is Driving Electrification in Aerospace CS25 All-Electric Aircraft

- Aerospace sustainability is supported by Hydrogen Fuel and increasing electrification
- GKN Aerospace is targeting the electrical distribution solutions for a future all-electric large civil aircraft (CS25) using Liquid Hydrogen
- Step-change in electrical power requirements:
  - Conventional 1MW - B787 and A380 for electric accessories.
  - Compared to 8MW for 96PAX fully electric aircraft with electric engines
- To achieve the power density and efficiency targets for a larger aircraft the electric propulsion system is cryogenically cooled.
  - Other systems conventionally cooled



Step-Change Growth in Electric Power

Sustainable CS25 Aviation drives All-Electric Aircraft requiring Step-Change Electric Propulsion

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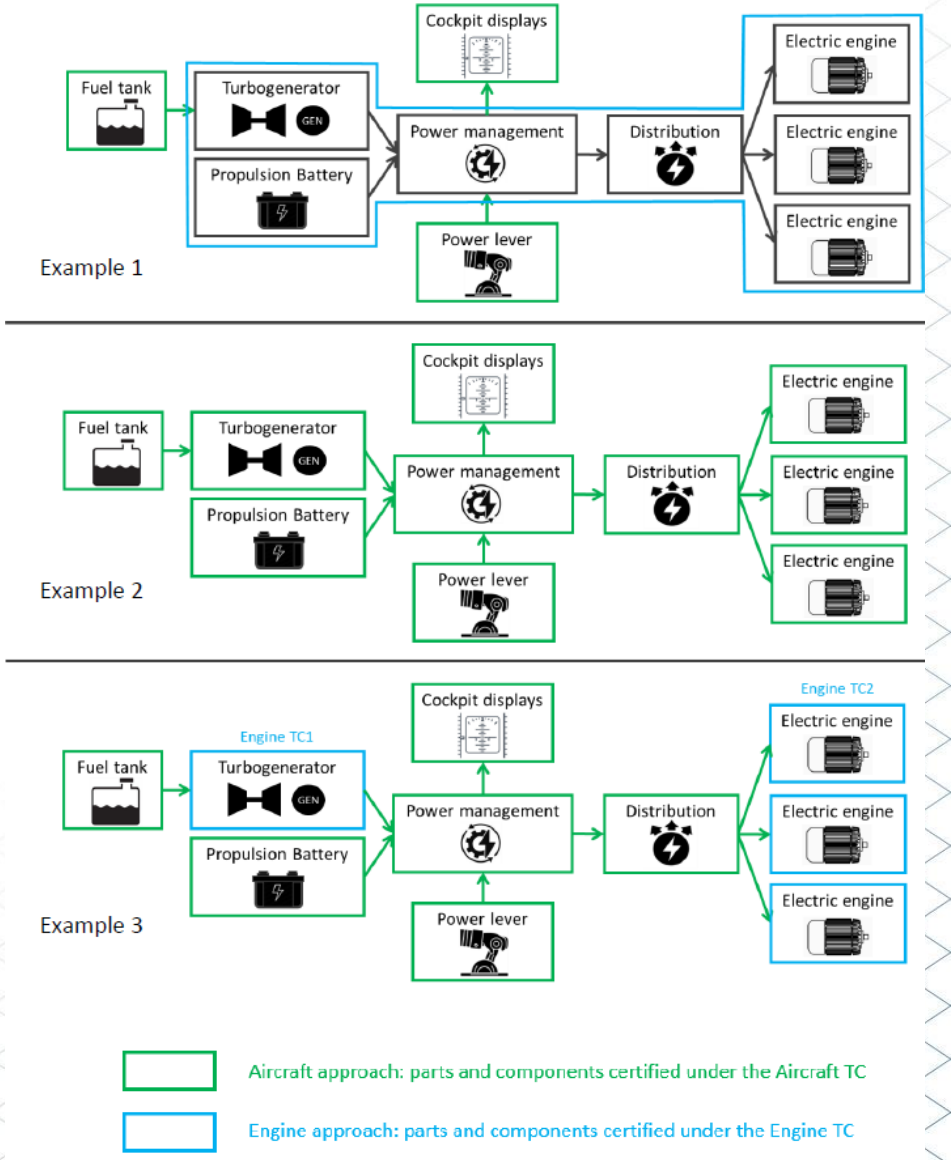
Regulatory Framework – Certification Challenge

- Two possible certification approaches exist within current aerospace regulatory framework (EASA MOC-EHPS.80)
  - Engine level - Certified in-line with existing engines.
  - Aircraft level - Certified as part of the overall aircraft.

- Conventional Engines certification based on the engines being federated.

- Aircraft level certification enables every electric propulsion solution to be considered but has more commercial complexities with the electric engine supplier being dependent on the airframer.

- GKN have identified electric architectures (electrical distribution & electric engine) to best match an all-electric aircraft through an aircraft level approach.



Aircraft Certification Approach enables Integrated Electric Propulsion options to be considered

Aerospace Safety Challenge – Introducing New Technology

[AMC 25.1309]

Classification of Failure Conditions	No Safety Effect	Minor	Major	Hazardous	Catastrophic
Allowable Qualitative Probability	No Probability Requirement	<-Probable->	<--Remote-->	Extremely <--------------> Remote	Extremely Improbable
Allowable Quantitative	No Probability Requirement	<-------------->	<-------------->	<-------------->	
Probability: Average Probability per Flight Hour on the Order of:		$<10^{-3}$ Note 1	$<10^{-5}$	$<10^{-7}$	$<10^{-9}$

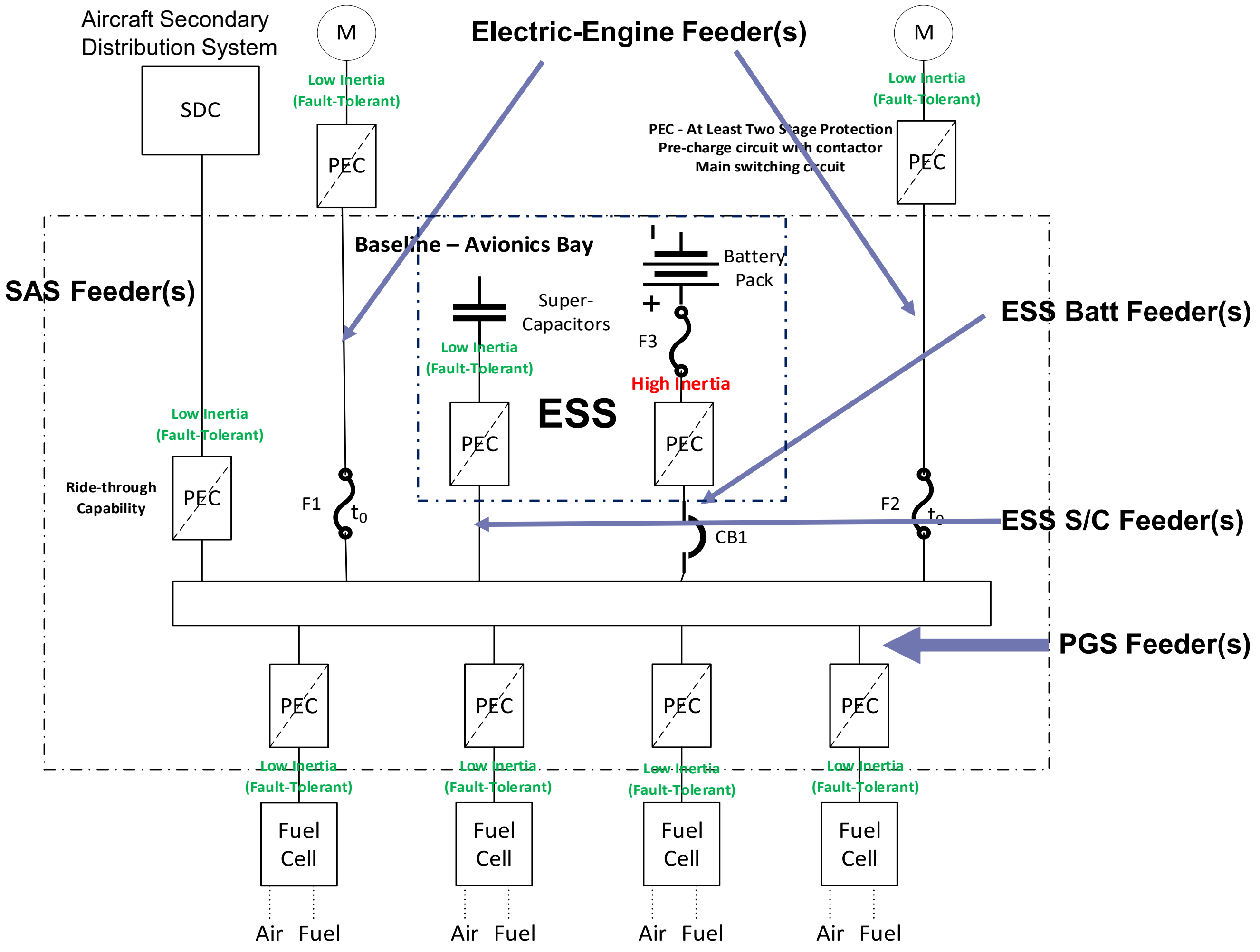
Note 1: A numerical probability range is provided here as a reference. The applicant is not required to perform a quantitative analysis, nor substantiate by such an analysis, that this numerical criteria has been met for Minor Failure Conditions. Current transport category aeroplane products are regarded as meeting this standard simply by using current commonly-accepted industry practice.

No Safety Effect (NSE): Failure conditions that would have no effect on safety; for example, failure conditions that would not affect the operational capability of the aeroplane or increase crew workload.

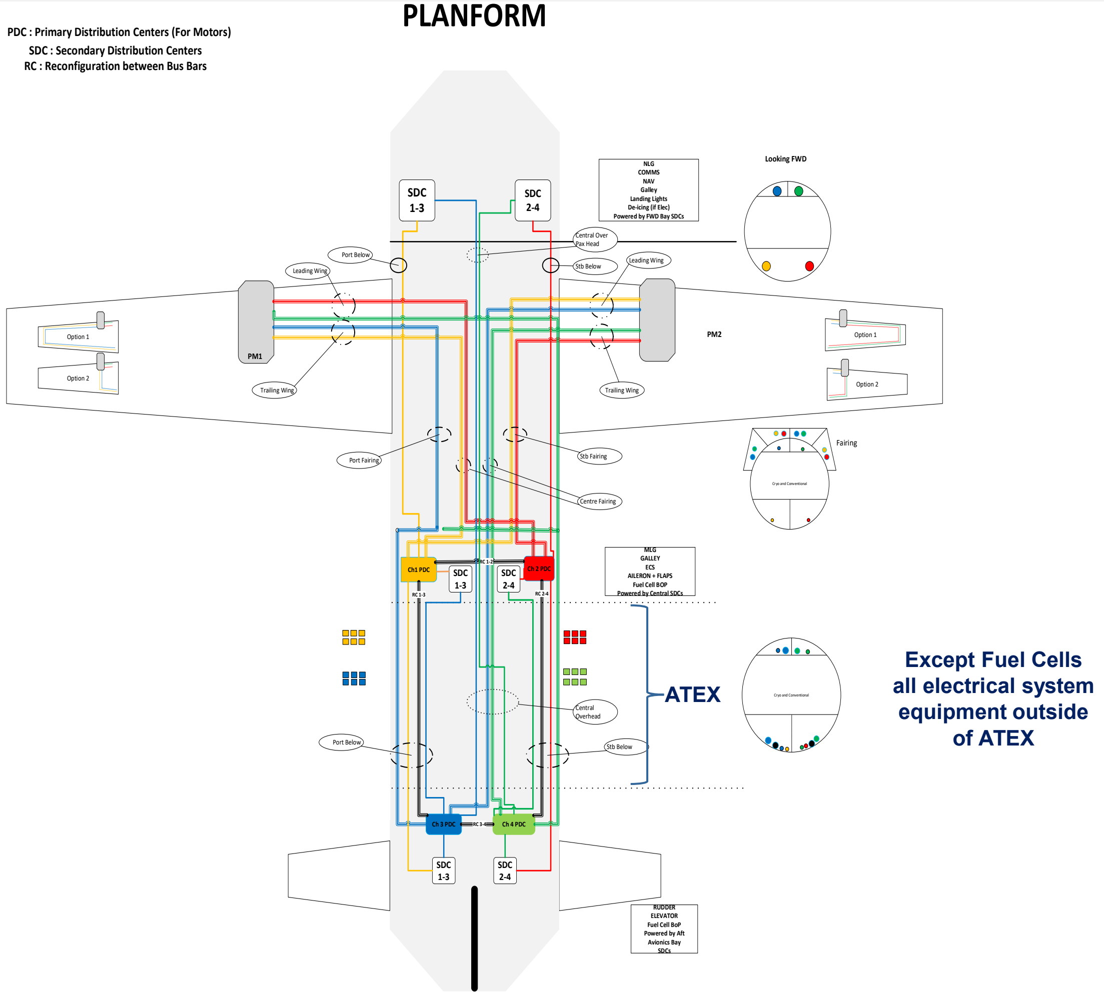
- CS25.1309 – Safety Approach
- Aircraft Level compliance (primarily CS25.1310) must consider a "probable operating combinations" failure approach.
- NSE GKN assumptions:
  - Electric design must be NSE if unable to provide (lifetime) probability by aircraft launch
  - Redundancy - 4 independent novel channels required if loss of channels can result in a CAT failure.
  - Key Focus – "Take-off":
    - A key probable operating combination is loss of independent electric channel and loss of one electric engine.
    - Must also consider availability (cost of ownership). Ability to dispatch with failure(s).
  - Redundancy must be achieved at power source, electric engine and electric distribution levels

Electric Propulsion is Novel driving an Electrical Architecture with Increased Redundancy

Example Architecture & Planform



REDUNDANCY (per Channel) – 4 Channels



SEGREGATION (Twin shown for resilience)

Redundancy & Segregation Minimises Installed Capacity against Probable Operating Combinations

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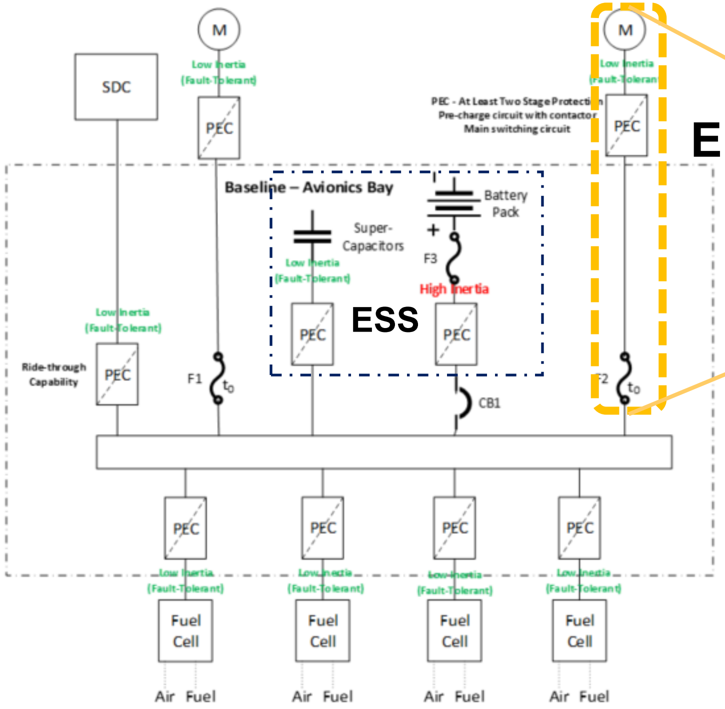
Example Electrical Protection – Managing Electrical PRAs

PRA = Particular Risk Assessment

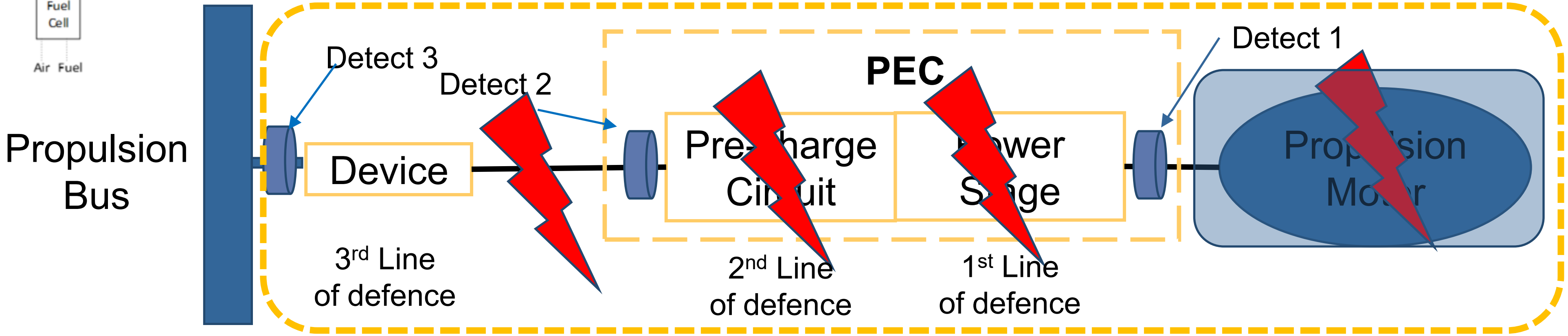


Electric Engine Protection

Incorporates 3 lines of detection and isolation defence

- Provides electrical system protection against component failure
- PRA - The potential root causes to short-circuits should be identified when reviewing the design of the electric engine (EASA MOC-EHPS.80)

Drives Key Electric Engine Requirements



Managing Electrical Particular Risks also drives Key Electrical System Requirements

Conclusion

- Sustainable Aviation is driving more-electrification in aerospace including electric propulsion
- GKN Aerospace is investigating electric distribution systems for Liquid Hydrogen Fuel Cell Powered Large Passenger (CS-25) All-Electric Powered Aircraft.
- All-electric aircraft involve a step-change in electric power levels and criticality of electrical power system compared with conventional aircraft.
- Electric Distribution System and Electric Engine must meet:
  - Aerospace regulatory challenges – drive certification and business challenges
  - Aerospace safety approaches – drive electrical design redundancy and segregation requirements
  - Electrical Particular Risk Assessments (PRA) drive additional design requirements
- Welcome sharing of regulatory specifications and technologies across different sectors
- Acknowledgement - GKN with the support of the ATI funding [H2FLYGHT] are developing enabling technologies to enable future CS-25 all-electric propulsion

Thanks for Listening

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