



***UMBRA GROUP***

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[umbragroup.com](http://umbragroup.com)

# UMBRA GROUP

a 10 years path for aircraft electrification



European  
Copper Institute  
Copper Alliance

Rome, March 13<sup>rd</sup> 2018

# OUTLINE

Content of this presentation

- ➔ *Company introduction*
- ➔ *Research Background*
- ➔ *More Electric Aircraft*





## COMPANY INTRODUCTION

# COMPANIES OF UMBRAGROUP



UMBRA CUSCINETTI Inc.

Everett  
Gears, torque tubes



UMBRA CUSCINETTI S.p.A.

Foligno  
 Ballscrews, actuators, bearings,  
electrospindles and milling heads

KUHN PRÄZISIONSSPINDELN  
und GEWINDETECHNIK GmbH

Freiberg  
 Ballscrews

PRÄZISIONSKUGELN ELTMANN GmbH

Eltmann  
 Balls

UMBRA CUSCINETTI S.p.A.

Albanella  
 Research Centre

# COMPANY INTRODUCTION

Sectors of interest and products: AEROSPACE



ACME SCREWS



BALLSCREWS



ELECTROMECHANICAL  
ACTUATORS



SHAFTS



GEARS



STEEL BALLS

# COMPANY INTRODUCTION

Sectors of interest and products: INDUSTRIAL



STEEL BALLS  
Diameter:  
18.256mm-200mm



BEARINGS  
(Balls, Cylindrical, Conical)  
External diameter:  
200mm-750mm  
7.8-29.5 inches



BALLSCREWS  
(Precision Classes  
ISO 1-3-5-7)  
Max. width:  
13m-42 feet  
Max diameter:  
300mm-8.85 inches



ELECTROSPINDLES  
AND MILLING HEADS  
Available power:  
from 2kw up 60kw



ELECTROMECHANICAL  
ACTUATORS  
High load actuators:  
forces up to 5000KN  
High speed actuators:  
speed up to 200m/min  
High frequency actuators:  
frequency up to 40Hz

# COMPANY INTRODUCTION

Sectors of interest and products: ENERGY



STEEL BALLS  
Diameter:  
18.256mm-200mm



BEARINGS  
(Balls, Cylindrical, Conical)  
External Diameter:  
200mm-750mm  
7.8-29.5 inches



ELECTROMECHANICAL  
ACTUATORS



GENERATORS

# COMPANY INTRODUCTION

Sectors of interest and products: OCEAN ENERGY

The challenges involved in maximum power extraction suggests that direct drive generators could be a viable alternative to the more used hydraulic systems.

Reciprocating Linear Alternators have been proposed as a suitable power take-off system for a straightforward applicability to some type of WECs such as Attenuators, OWSCs and Point Absorbers.



## RECIPROCATING LINEAR ALTERNATOR

Power generator sizes:

5KW to 250KW

(the linear generator is fully reversible)

# COMPANY INTRODUCTION

Sectors of interest and products: AUTOMOTIVE



ELECTROMECHANICAL  
ACTUATORS



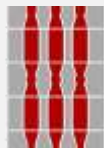
BALLSCREWS



BEARINGS



## RESEARCH BACKGROUND





## More Electric Aircraft

# MORE ELECTRIC AIRCRAFT

a 10 years path for aircraft electrification

## THE APPLICATIONS: NEW PRODUCTS

The adoption of MEA in the future aircraft either in civil or military sectors results in tremendous benefits such as:

1. Removing hydraulic systems improves the aircraft reliability, vulnerability, and reduces complexity, redundancy, weight, installation and running cost.
2. Employing electrical starting for the aero-engine through the engine starter/generator eliminates the engine tower shaft and gears, power take-off shaft, accessory gearboxes, and reduces engine starting power especially in the cold conditions.
3. Using the Advanced Magnetic Bearing (AMB) system, which could be integrated into the internal starter/generator for both the main engine and auxiliary power units, allows for oil-free, gear-free engine.
4. Using a fan shaft generator that allows emergency power extraction under windmill conditions, removes the conventional inefficient single-shot ram air turbine, which increases the aircraft reliability, and survivability under engine-failure conditions.
5. Replacing the engine-bleed system by electric motor-driven pumps reduces the complexity and the installation cost.

# MORE ELECTRIC AIRCRAFT

a 10 years path for aircraft electrification

## THE APPLICATIONS: NEW PRODUCTS

FOCUS on power processing systems elimination of hydraulics in favor of ElectroMechanical Actuators (EMA)



# MORE ELECTRIC AIRCRAFT

a 10 years path for aircraft electrification

## **THE APPLICATIONS: NEW PRODUCTS**

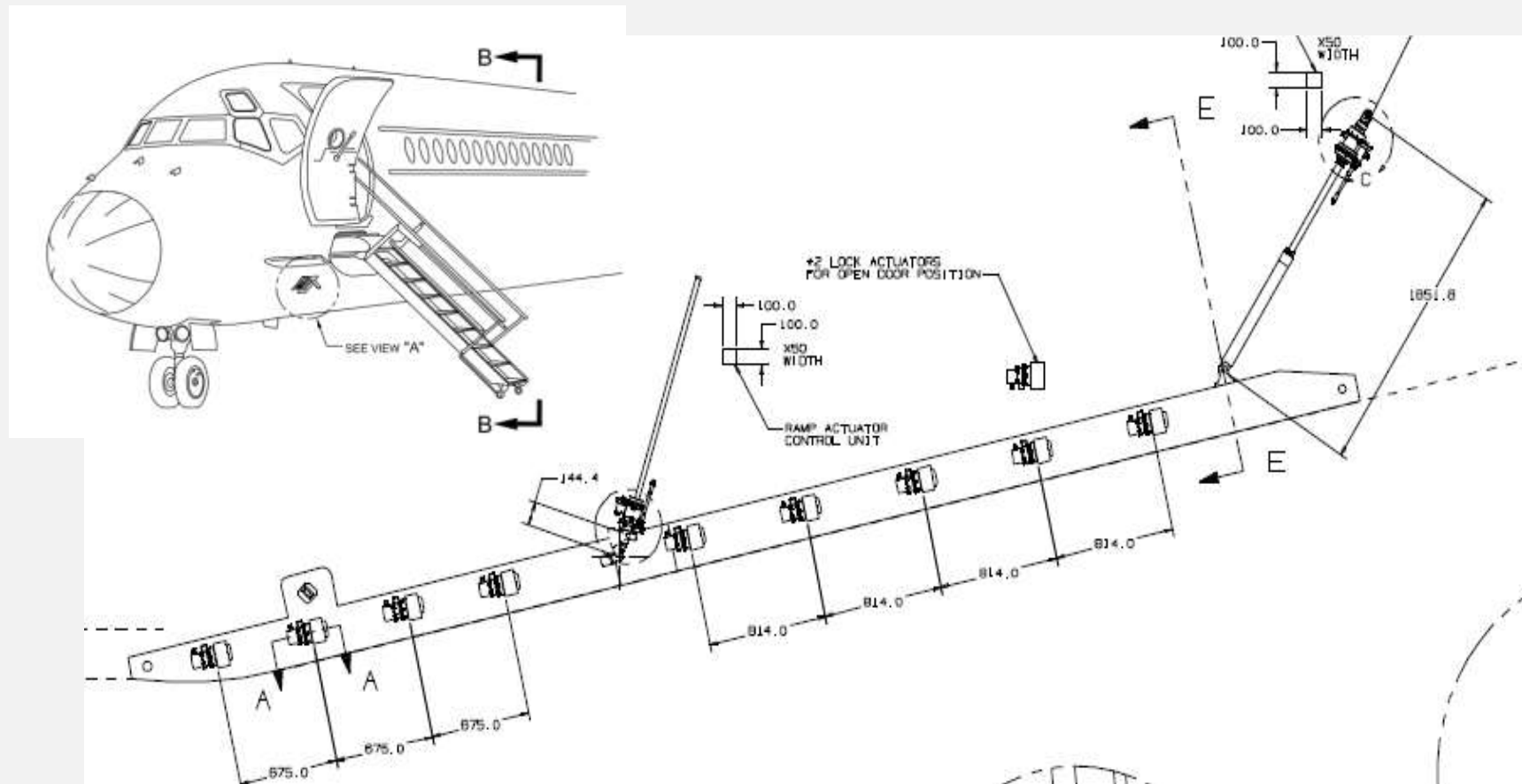
The general requirements, which these systems should satisfy, are:

1. The system should have light weight and small size.
2. The system should be fault-tolerant, which implies its ability to continue functioning under abnormal conditions without much loss in the output power or degradation of the performance or should have a very high reliability.
3. The system should be efficient and have the ability for operation in harsh conditions such as high temperature and low maintenance.

# MORE ELECTRIC AIRCRAFT

## a 10 years path for aircraft electrification

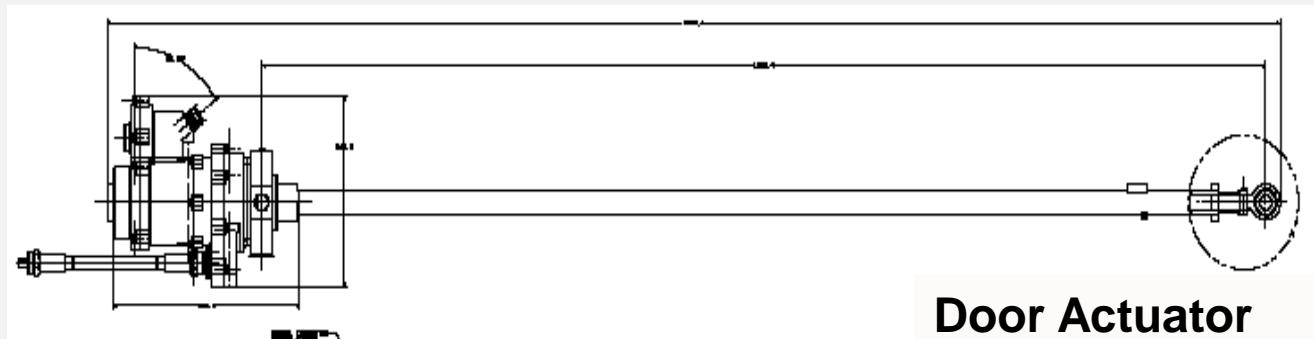
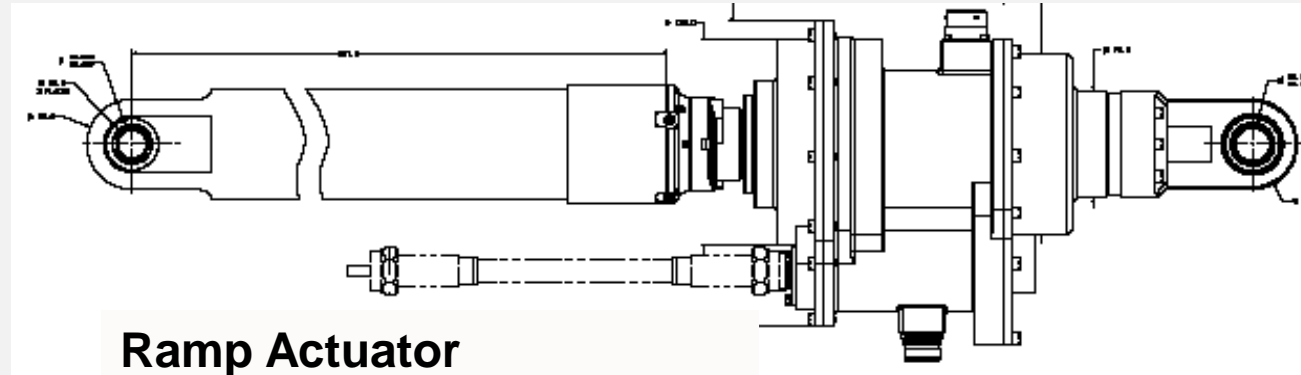
- **Installation** : Bombardier C-390
- **Type of application** : airstairs actuator



# MORE ELECTRIC AIRCRAFT

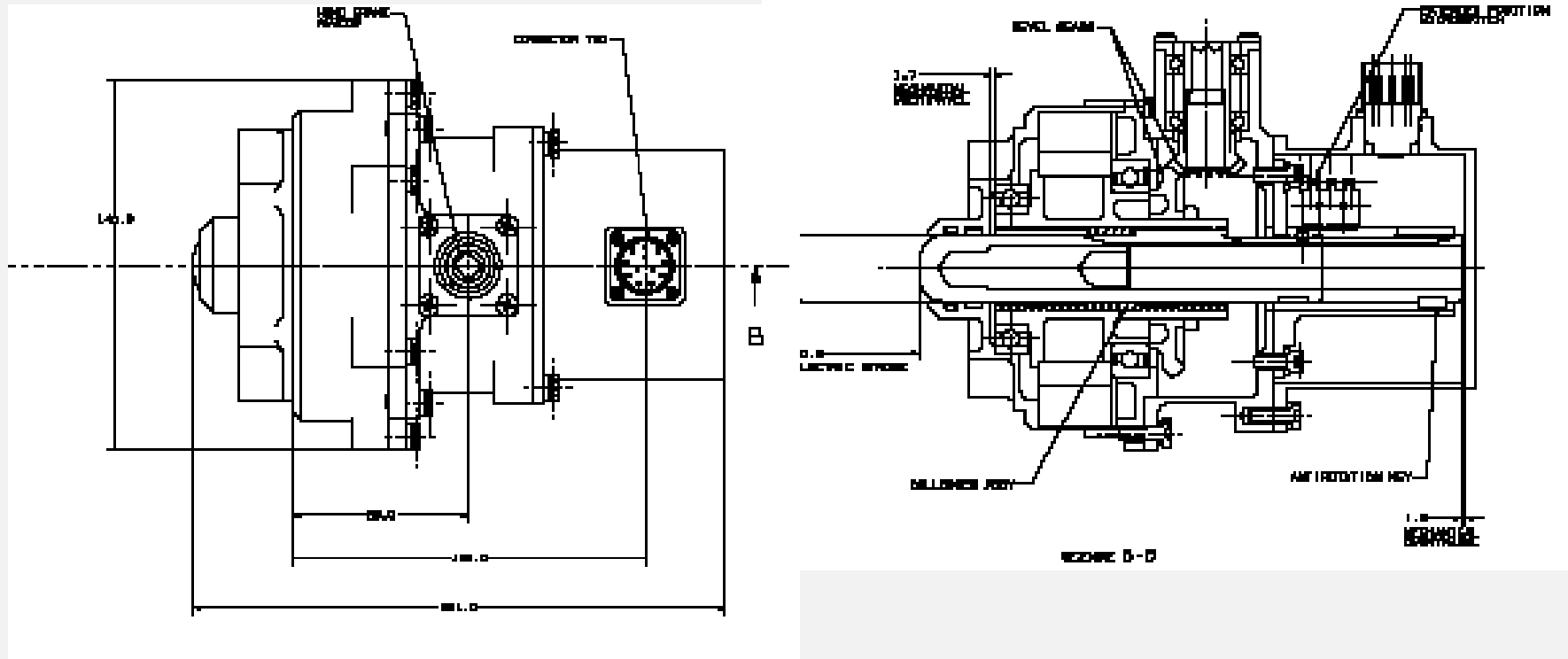
a 10 years path for aircraft electrification

- **Installation** : Bombardier C-390
- **Type of application** : ramp and rear door actuator



## a 10 years path for aircraft electrification

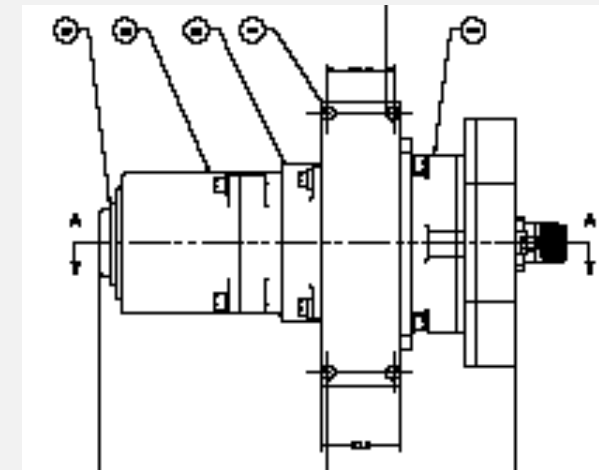
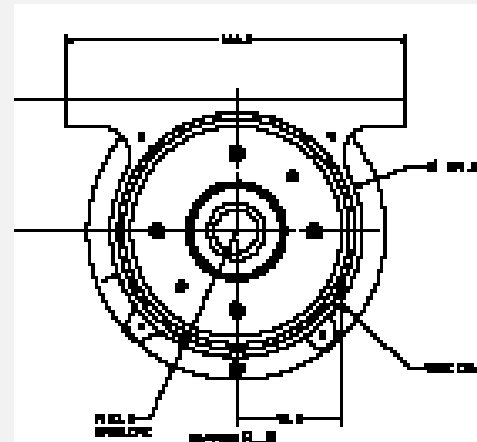
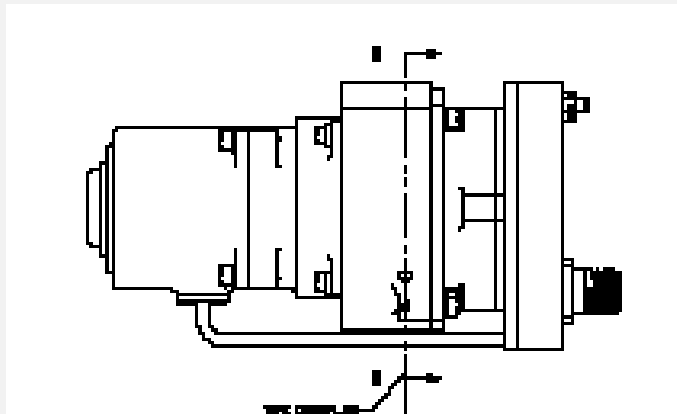
- **Installation** : Bombardier C-390
- **Type of application** : lock actuator



# MORE ELECTRIC AIRCRAFT

a 10 years path for aircraft electrification

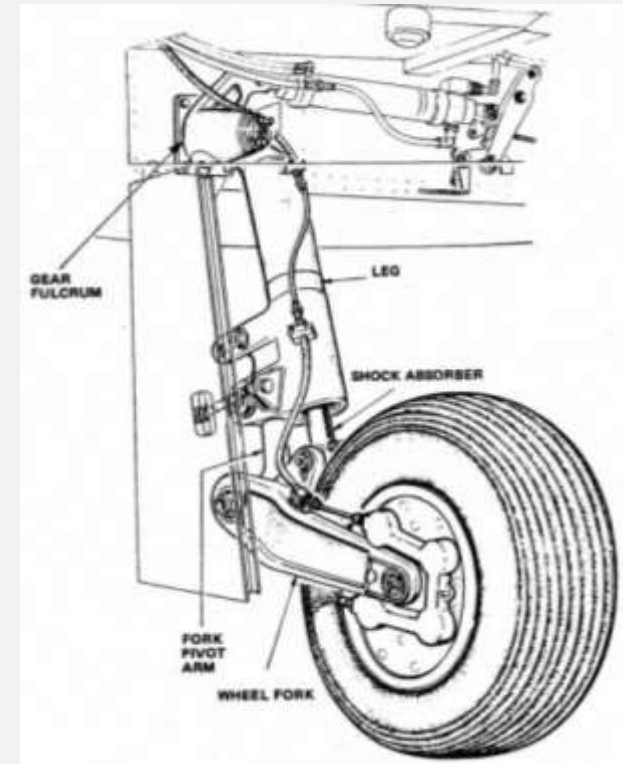
- **Installation** : Phenom 100
- **Type of application** : stick pusher actuator



# MORE ELECTRIC AIRCRAFT

a 10 years path for aircraft electrification

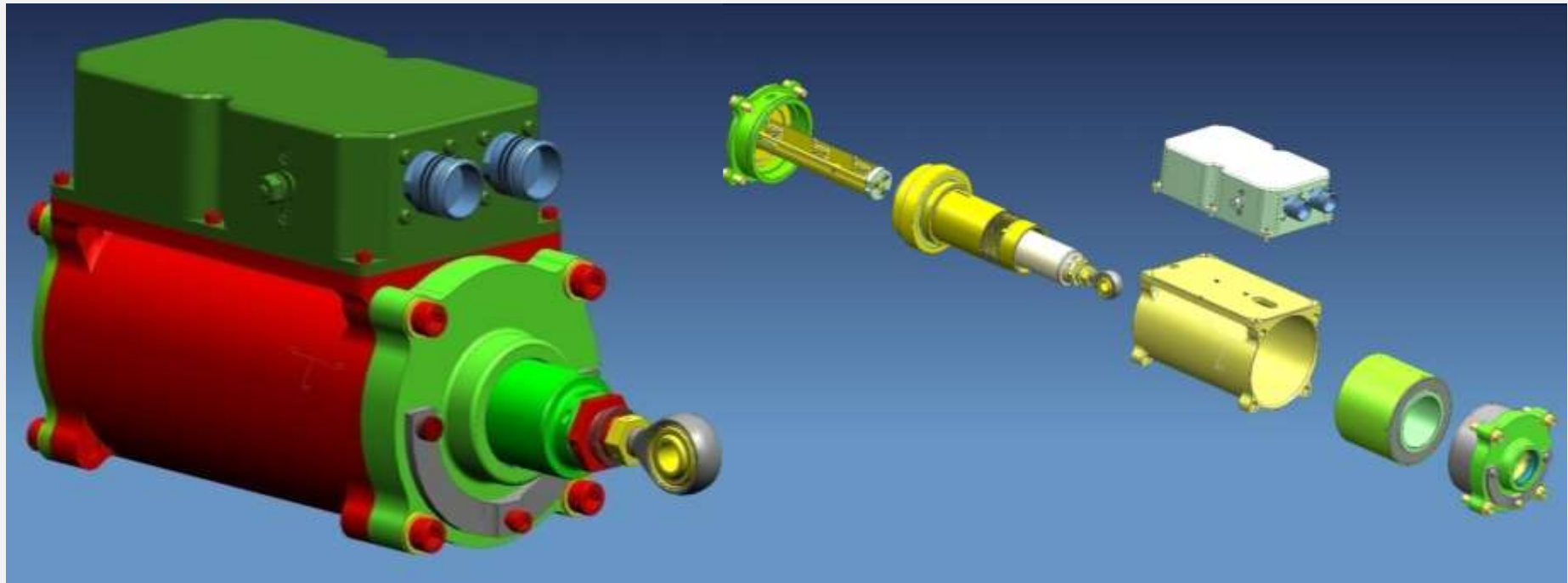
- **Installation** : Unmanned Air Vehicle (UAV)
- **Type of application** : wheel brake



# MORE ELECTRIC AIRCRAFT

a 10 years path for aircraft electrification

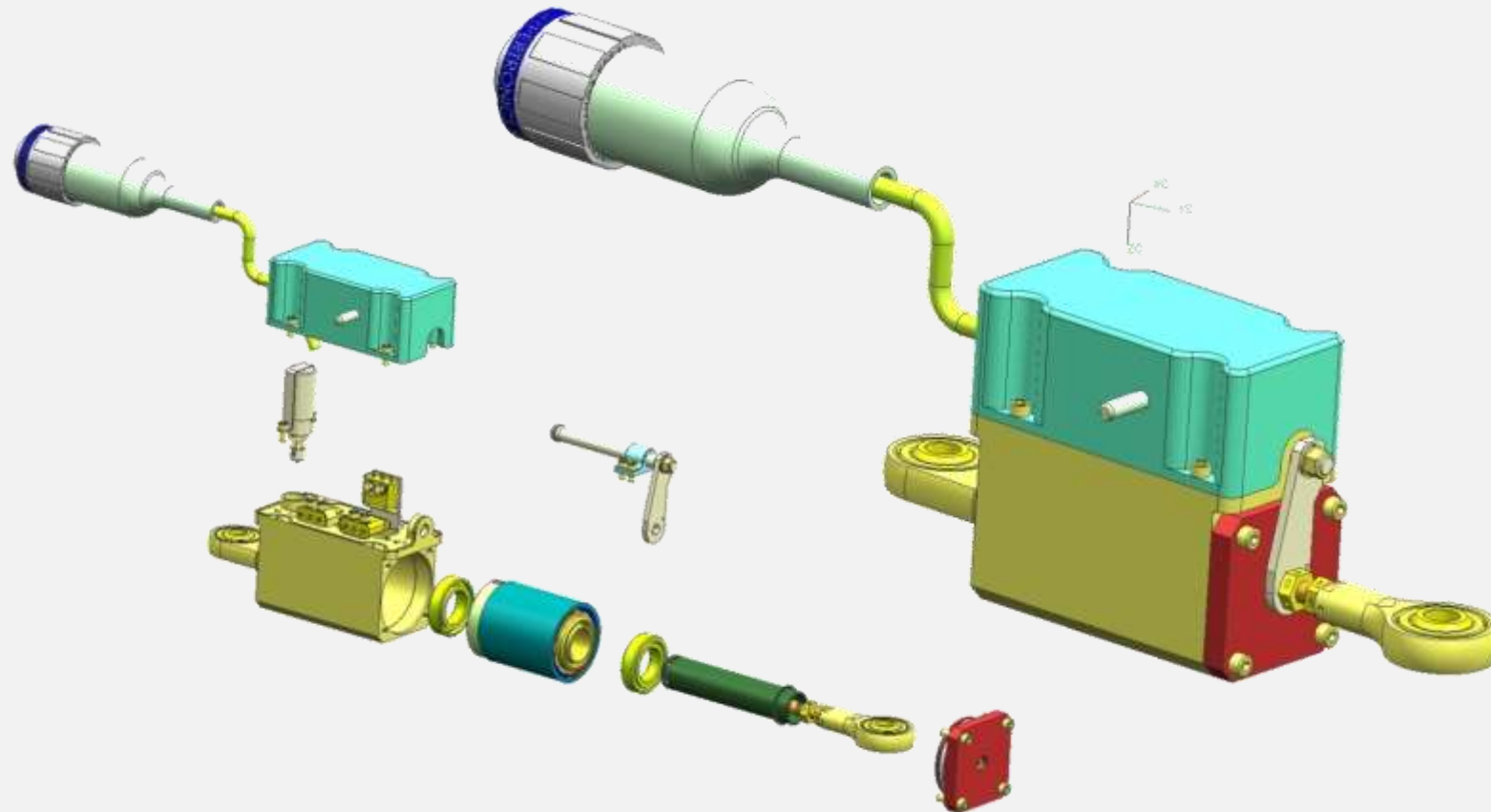
- **Installation:** Phenom 100
- **Type of application :** speed brake system



# MORE ELECTRIC AIRCRAFT

a 10 years path for aircraft electrification

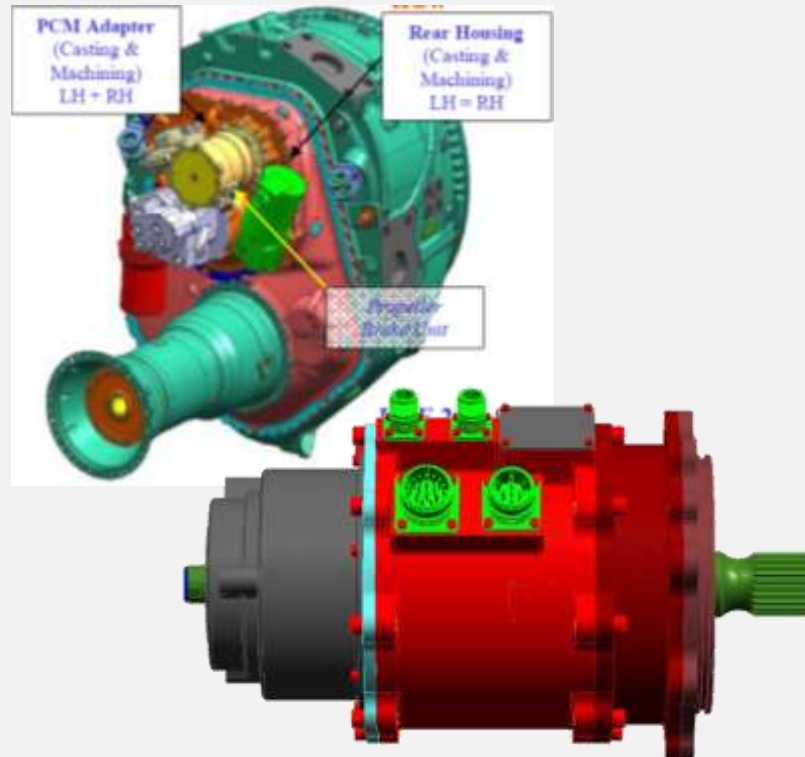
- **Installation:** Phenom 100
- **Type of application :** gust lock actuator



# MORE ELECTRIC AIRCRAFT

a 10 years path for aircraft electrification

- **Installation** : Airbus A400M
- **Type of application** : propeller brake unit



# MORE ELECTRIC AIRCRAFT

a 10 years path for aircraft electrification

- **Installation** : Augusta NH-90
- **Type of application** : antenna actuator



# MORE ELECTRIC AIRCRAFT

a 10 years path for aircraft electrification

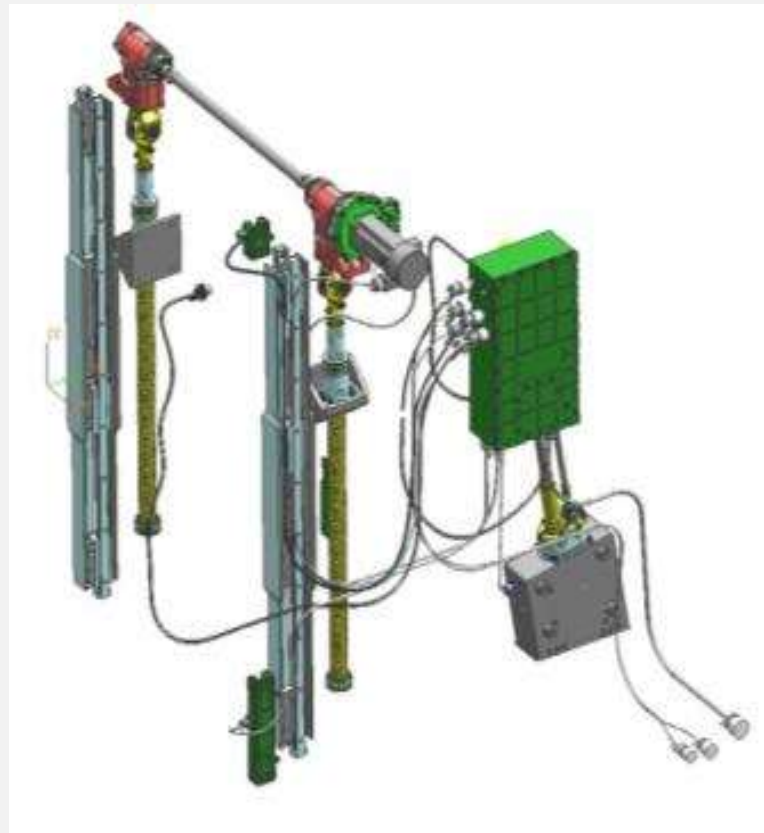
- **Installation** : Augusta EH-101
- **Type of application** : folding-unfolding actuator



# MORE ELECTRIC AIRCRAFT

a 10 years path for aircraft electrification

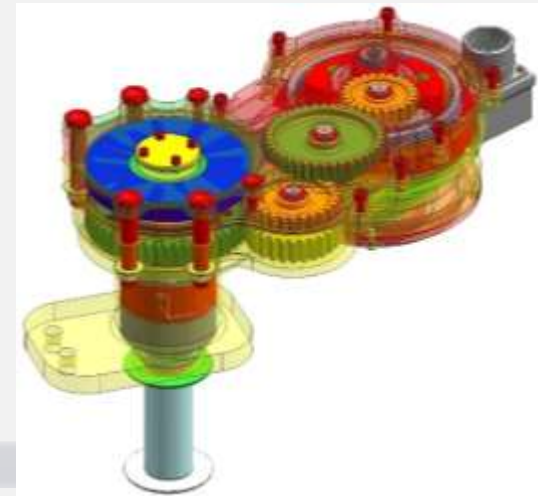
- **Installation** : Boeing 777
- **Type of application** : OCAS lift system



# MORE ELECTRIC AIRCRAFT

a 10 years path for aircraft electrification

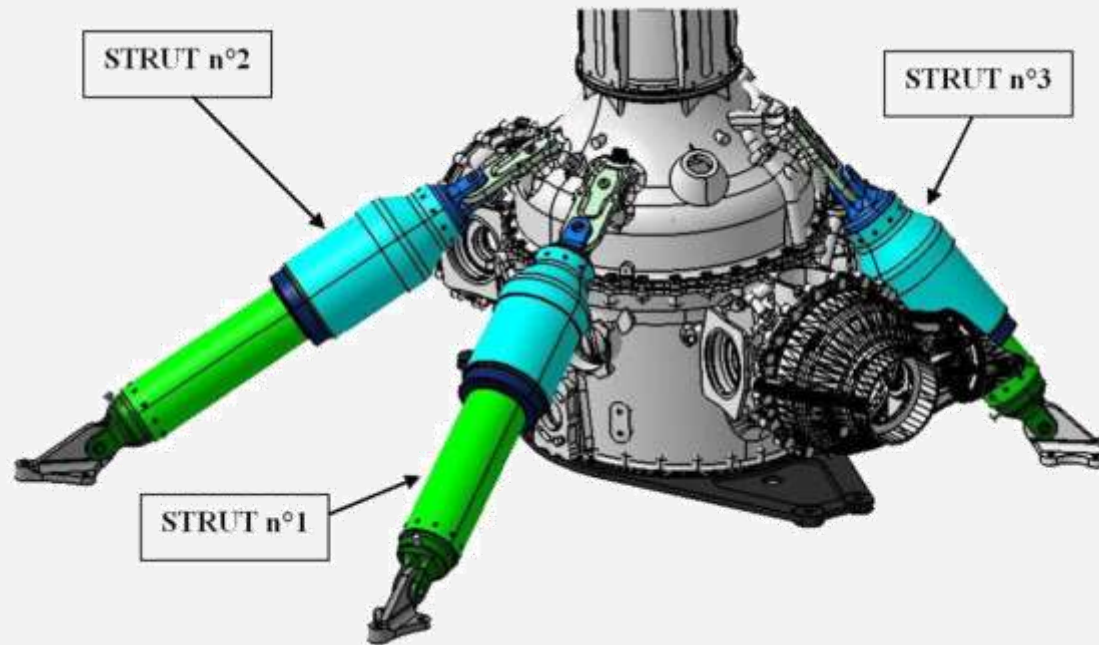
- **Installation** : Bombardier C-Series (4-wheel Commercial Jet)
- **Type of application** : wheel brake



# MORE ELECTRIC AIRCRAFT

a 10 years path for aircraft electrification

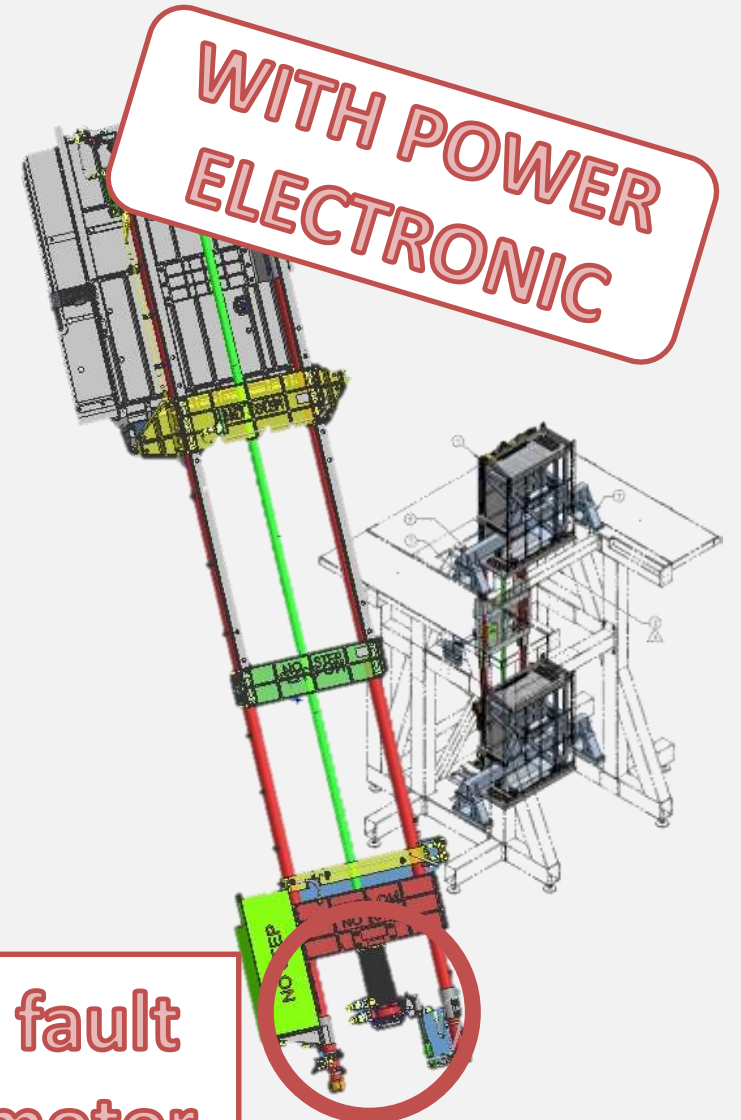
- **Installation** : Eurocopter
- **Type of application** : Active GyroX Vibration Reduction



# MORE ELECTRIC AIRCRAFT

a 10 years path for aircraft electrification

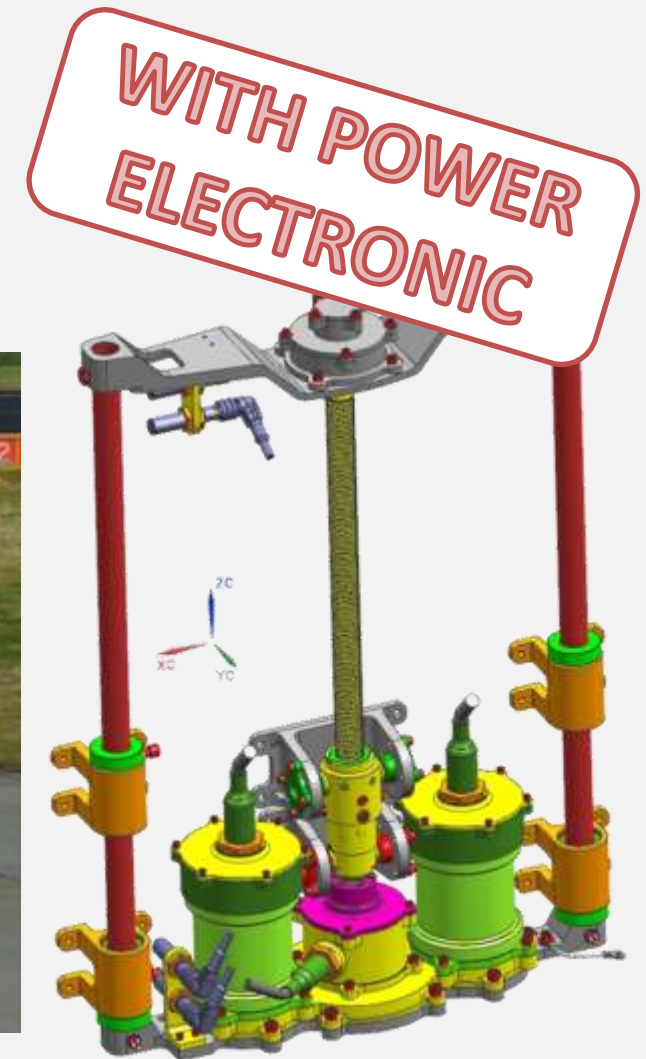
- **Installation** : Boeing 787-8l
- **Type of application** : CLS lift system



# MORE ELECTRIC AIRCRAFT

a 10 years path for aircraft electrification

- **Installation** : Piaggio P180-MPA
- **Type of application** : TEAS actuator

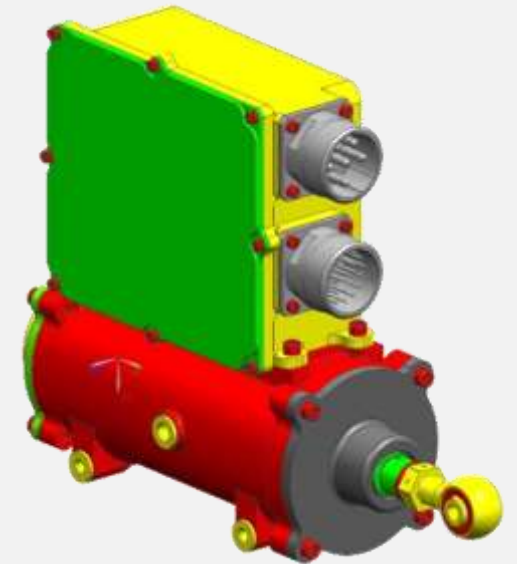


# MORE ELECTRIC AIRCRAFT

a 10 years path for aircraft electrification

- **Installation** : Piaggio P1HH
- **Type of application** : Primary Flight Control actuator

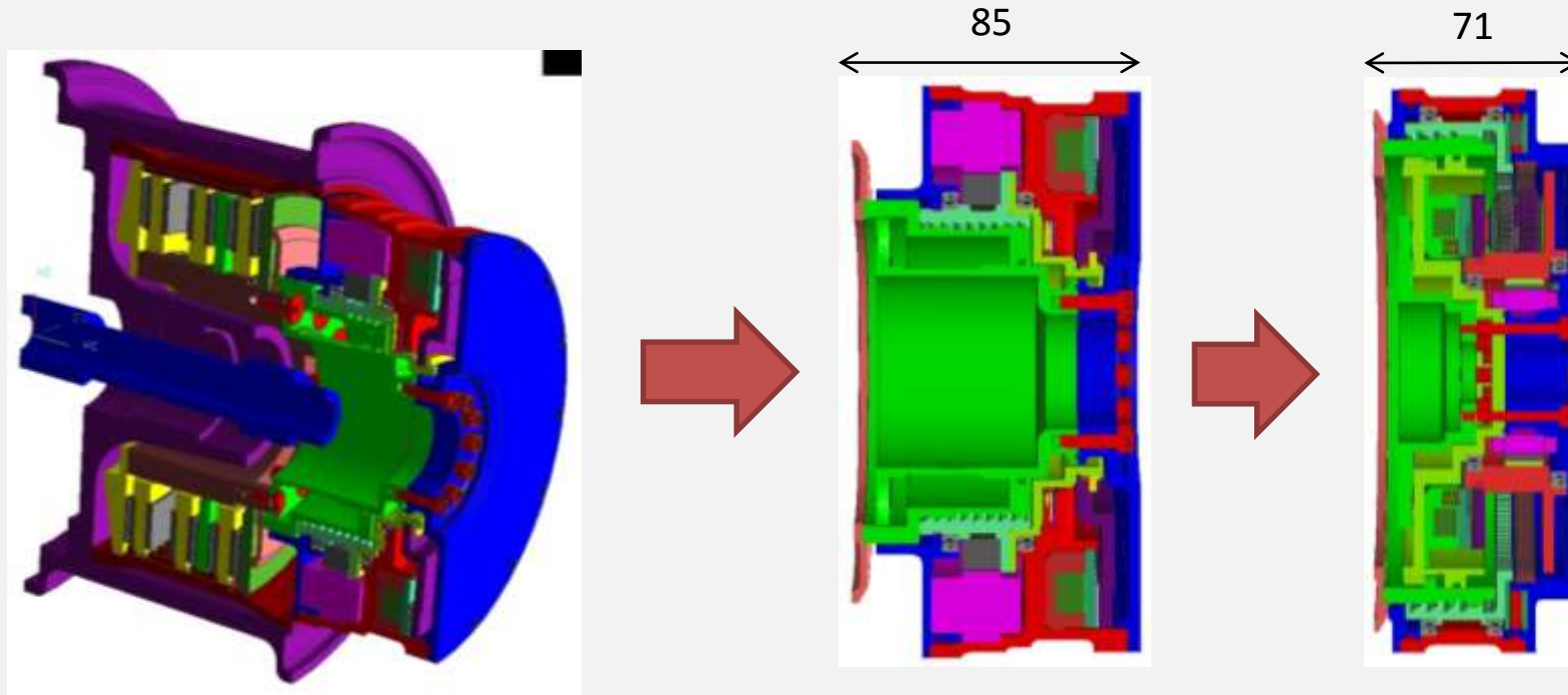
WITH POWER  
ELECTRONIC



# MORE ELECTRIC AIRCRAFT

a 10 years path for aircraft electrification

- **Installation** : Unmanned Air Vehicle (UAV)
- **Type of application** : disk brake



**A CONTINUOUS CHALLENGE**

# CONCLUSION

MEA: a 10 years path for aircraft electrification

In general, adopting MEA revolutionizes the aerospace industry completely, and significant improvements in terms of aircraft-empty weight, reconfigurability, fuel consumption, overall cost, maintainability, supportability, and system reliability, can be achieved.

On the other side, the MEA concept requires increased demands on the aircraft electric power system in areas of power generation and handling, reliability, and fault tolerance, which mandates innovations in power generation, processing, distribution and management systems.

# ACTION PROPOSAL

MEA: a 10 years path for aircraft electrification

## WEIGHT REDUCTION

### WHY?

metal	g/cm <sup>3</sup>
aluminum	2.70
zinc	7.13
iron	7.87
copper	8.96

### HOW?

- improving electric and thermal designs
- any new copper alloy for the wires



THANK YOU FOR THE ATTENTION