EWADE 2013

11th European Workshop on Aircraft Design Education

17 to 19 September 2013, Linköping University, Sweden

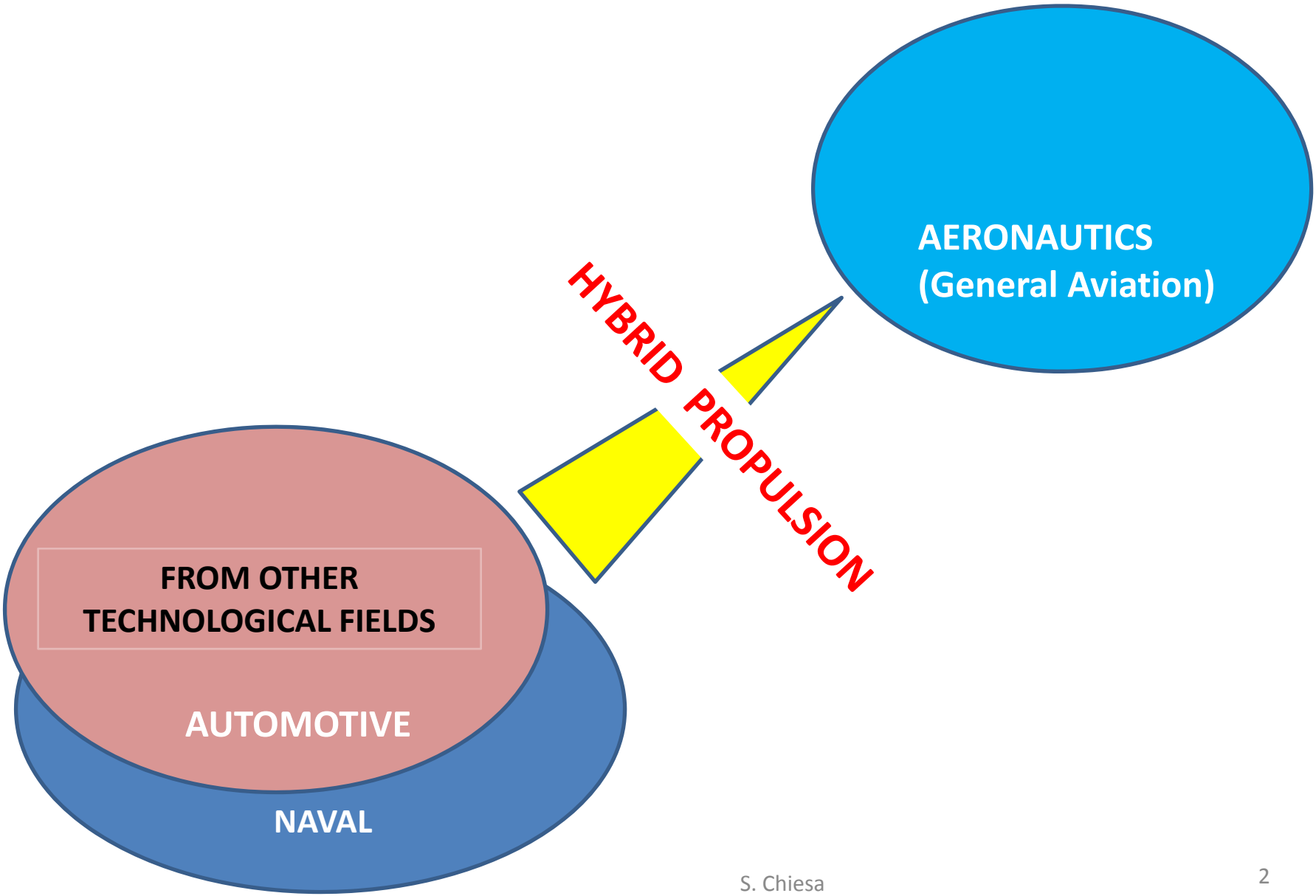
CONTRIBUTIONS FROM EDUCATIONAL ACTIVITIES TO RESEARCHES ABOUT HYBRID PROPULSION OPPORTUNITIES FOR LIGHT AIRCAFT

Sergio CHIESA, Giovanni DI MEO, Marco FIORITI, Roberta FUSARO

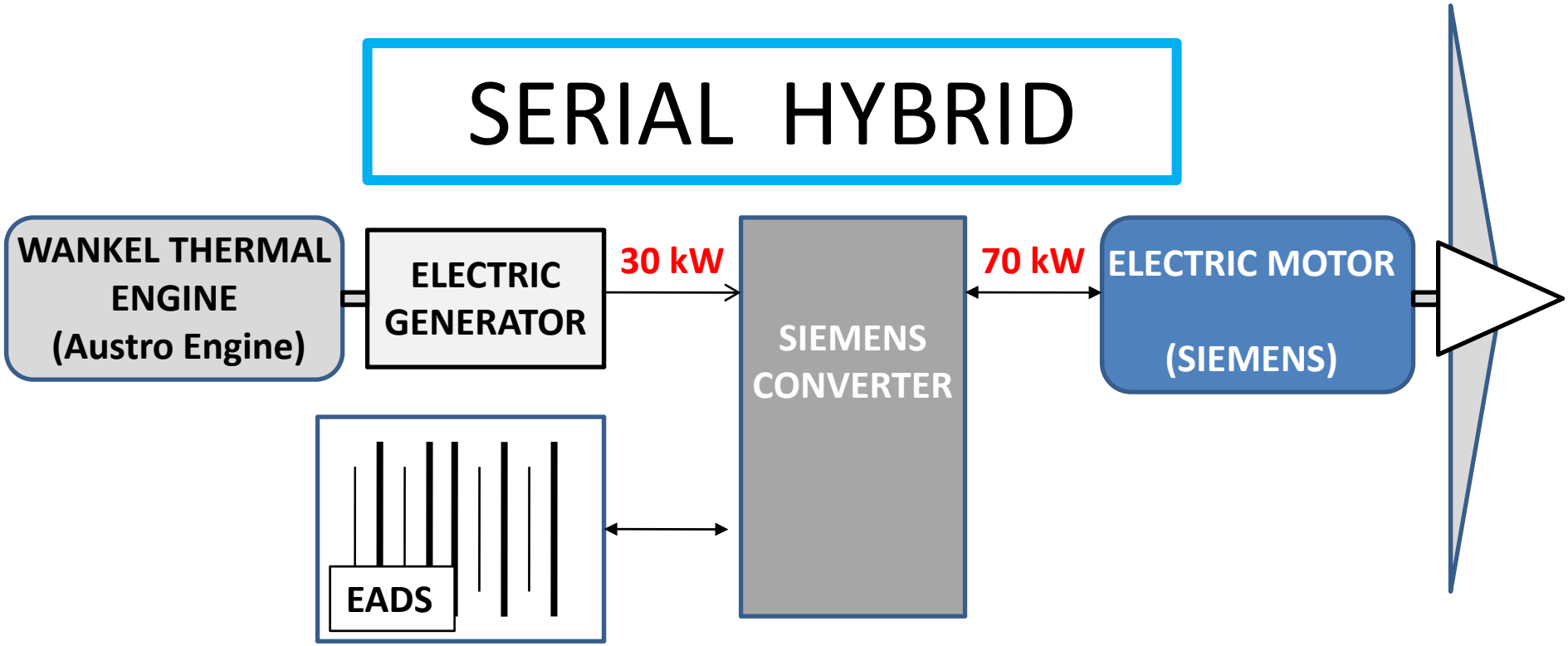
(ASSET GROUP, DIMEAS, POLITECNICO di TORINO - ITALY)

http://ewade2013.AircraftDesign.org
http://dx.doi.org/10.5281/zenodo.21440

A new TREND in Aeronautics

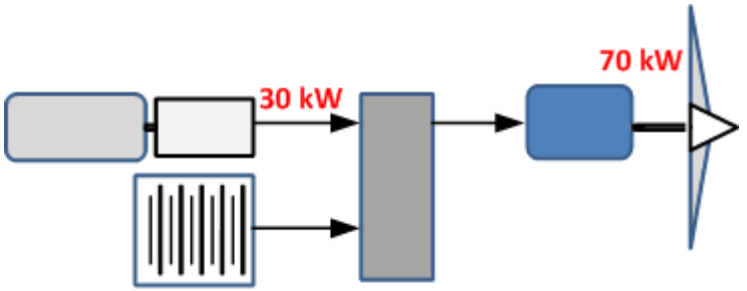


SERIAL HYBRID

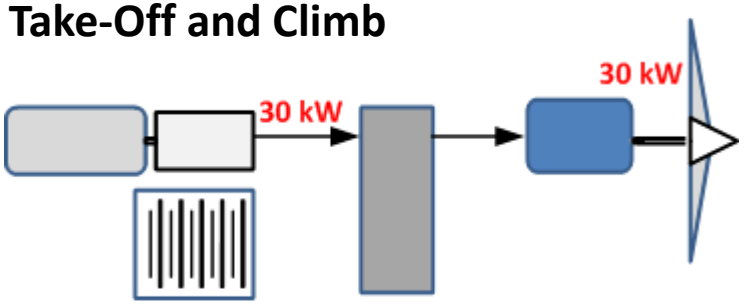


World's first serial **hybrid** electric aircraft to fly at Le Bourget 2011

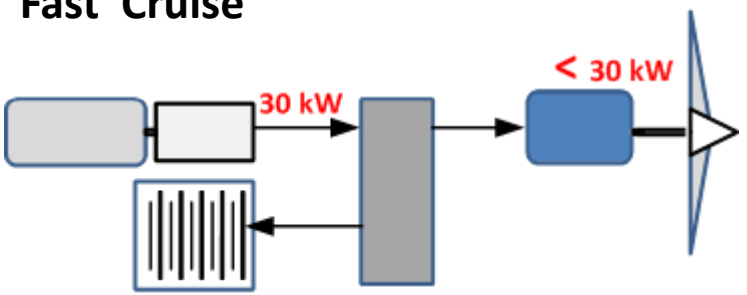
A motor glider, which is based on Diamond Aircraft's HK36 Super Dimona, is the first to use a so-called serial hybrid electric drive.



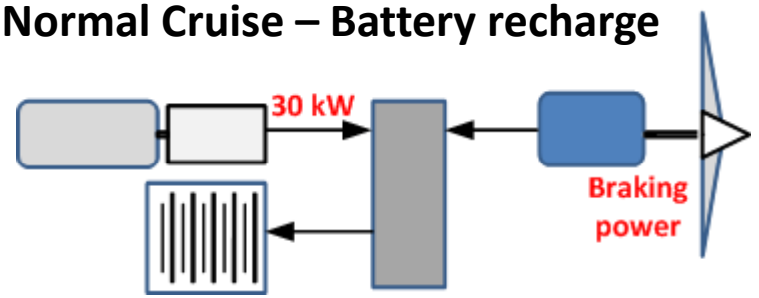
Take-Off and Climb



Fast Cruise



Normal Cruise – Battery recharge

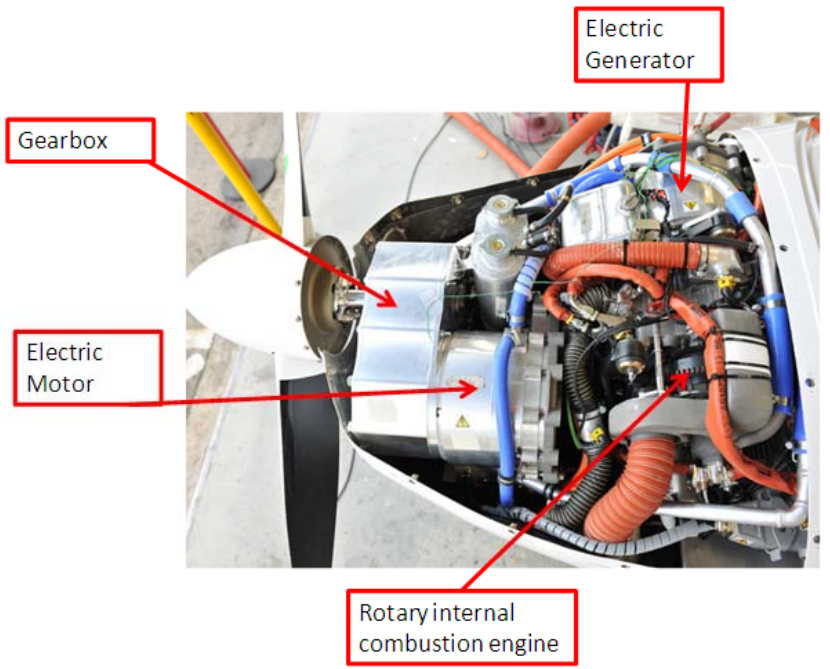


Descent and Landing – Battery recharge

Alternative "Green and Quite" Take-Off is possible, only using batteries

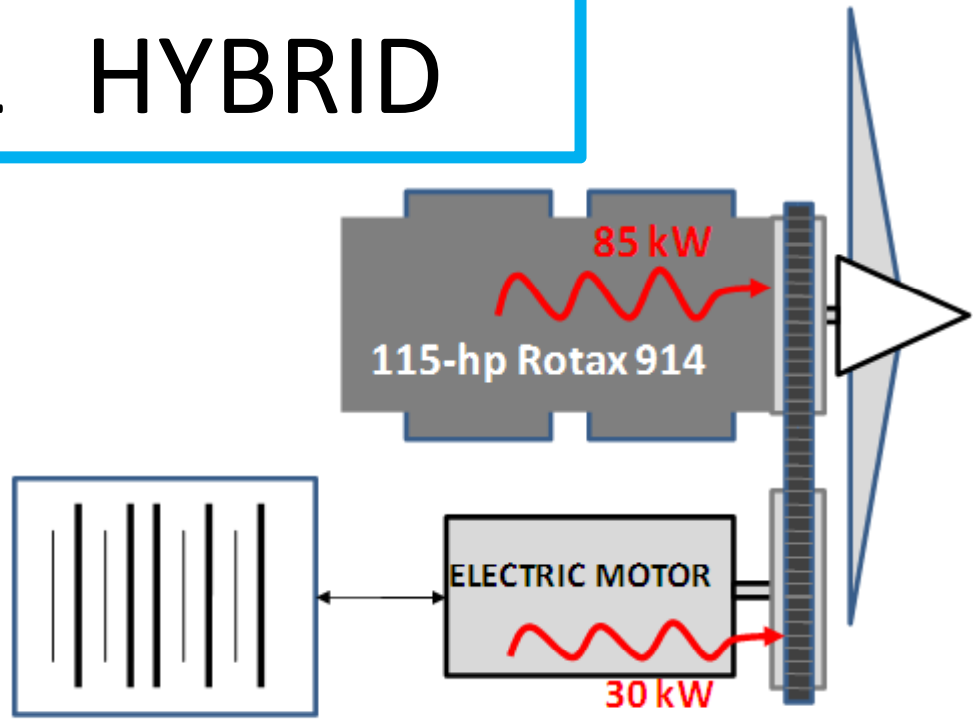
In cruise the recharge of batteries is possible. The costant ratio of running of Thermal engine / generator, offers reduced fuel consumption

The system is regenerative, with possibility of recovering energy during descent and landing



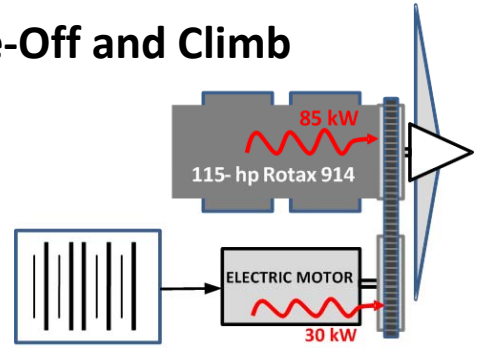
PARALLEL HYBRID

Flight Design, a producer of light aircraft , proposes a parallel Hybrid base on well known ROTAX Engine

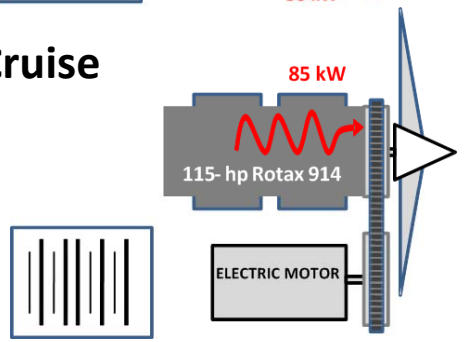


Particularly interesting is the possibility of OVER-BOOST, i.e. the sum of thermal and electric powers

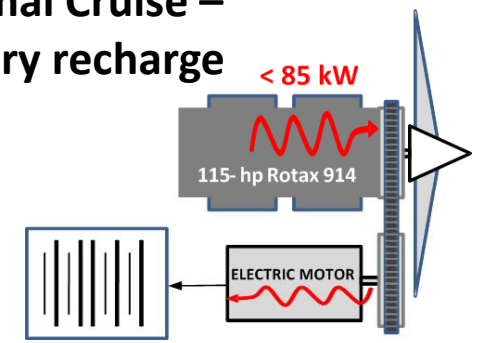
Take-Off and Climb



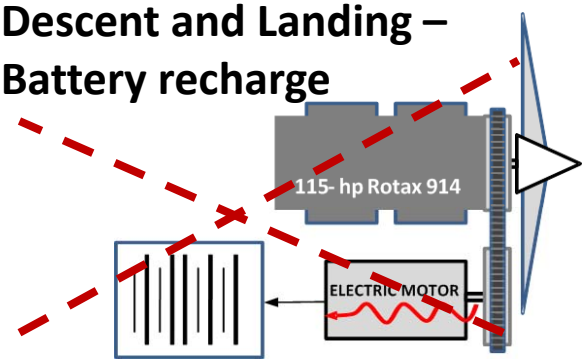
Fast Cruise



Normal Cruise – Battery recharge



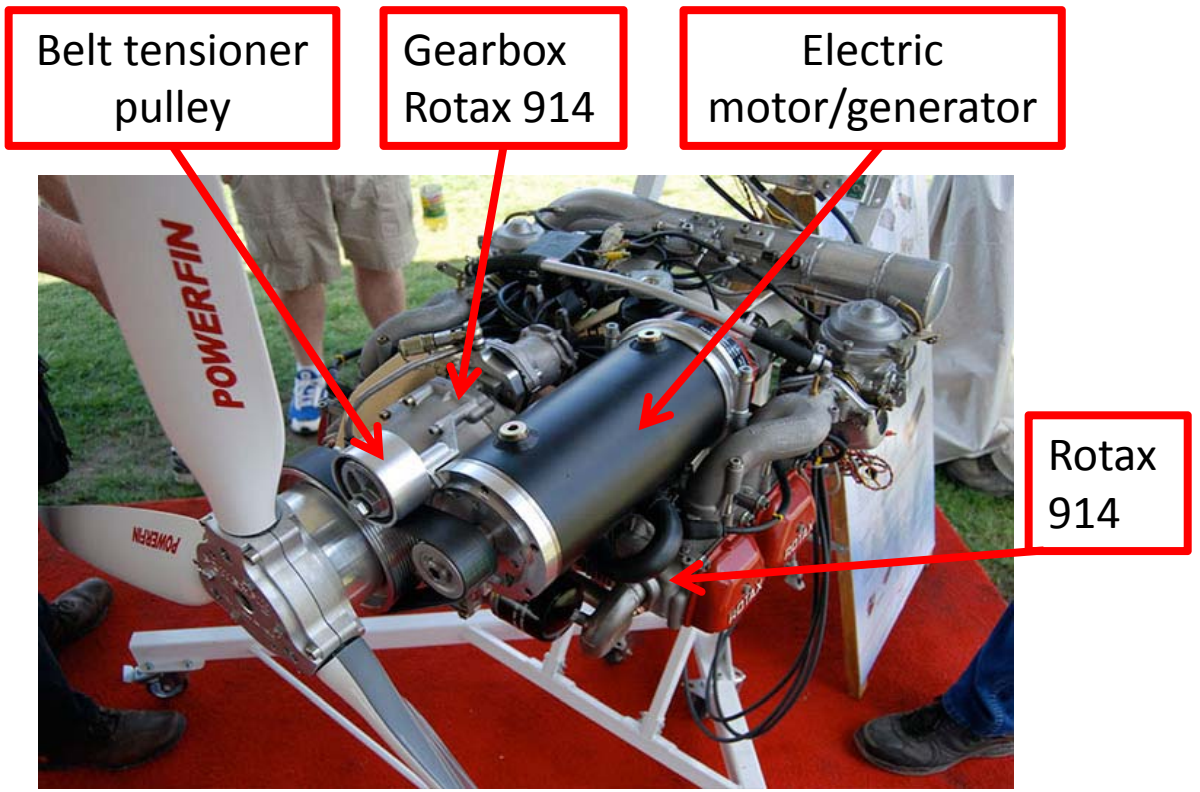
Descent and Landing – Battery recharge



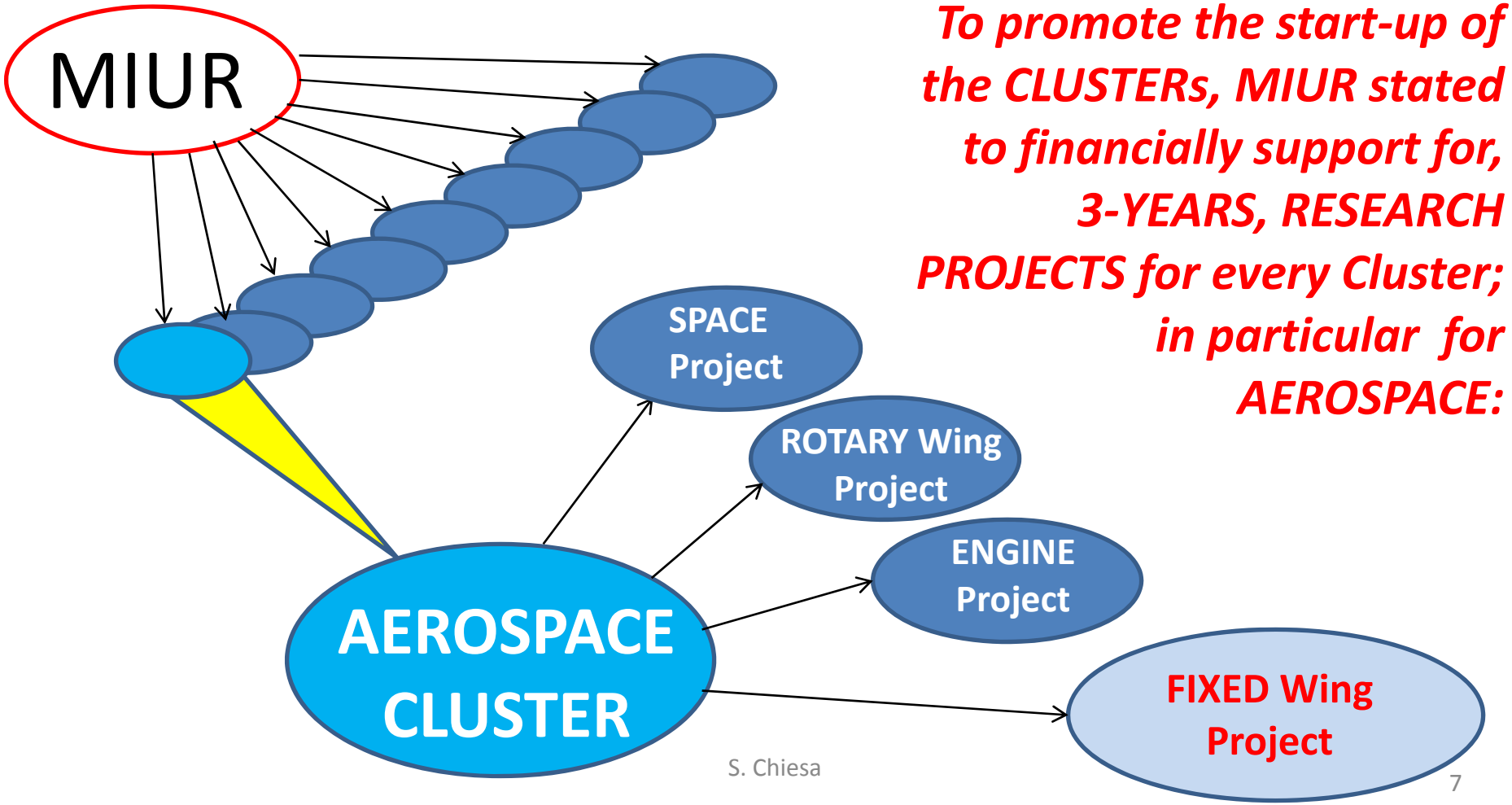
Over-boost, given by electric motor, can be useful, other than in Take-Off and Climb, FOR every other contingencies

The only electric motor Power can add Safety in the case of Main engine failure

The system is regenerative, with possibility of recovering energy during descent and landing



In 2012 the Italian University and Research Ministry (MIUR) promoted the establishment of TECHNOLOGICAL CLUSTERS (Groups of Research Centres, Universities, Big Industries, SME) in 9 fields considered "Strategic" for future development of the Country



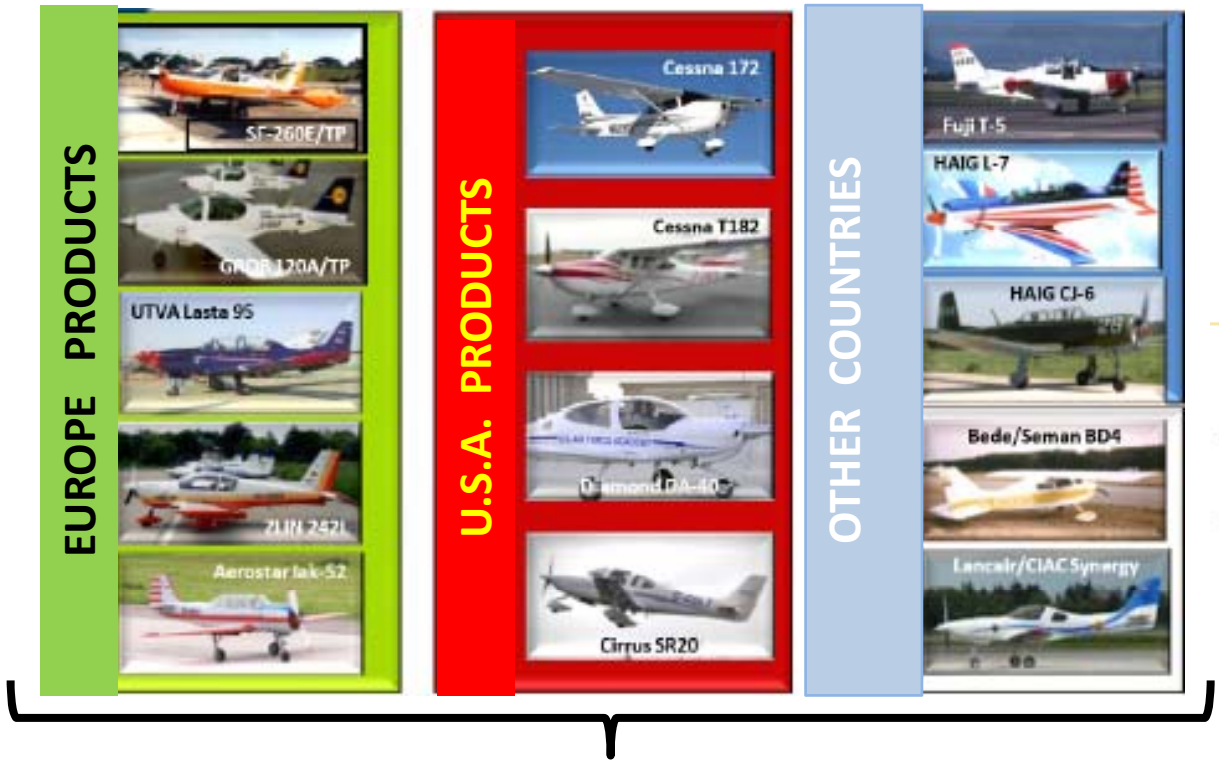
To promote the start-up of the CLUSTERs, MIUR stated to financially support for, 3-YEARS, RESEARCH PROJECTS for every Cluster; in particular for AEROSPACE:

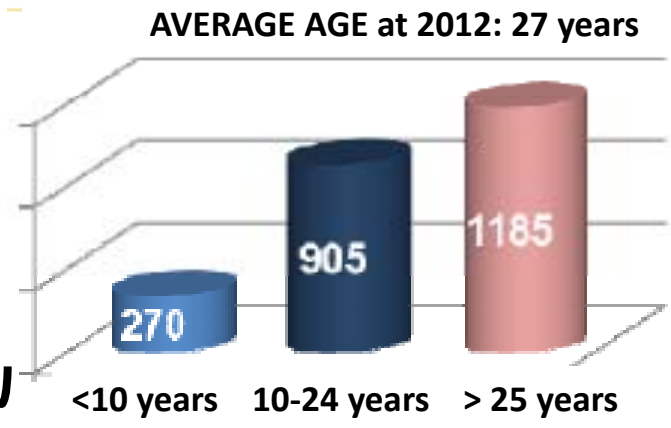
FIXED Wing Project

TIVANO

Tecnologie **I**nnovative per **V**elivoli di **A**viazione Generale di **N**uova Generazi**O**ne
(Innovative Technologies for General Aviation airplane)

MOTIVATIONS





General Aviation but also Initial Trainers /Screeners and possible platform for UAS

FIXED Wing Project

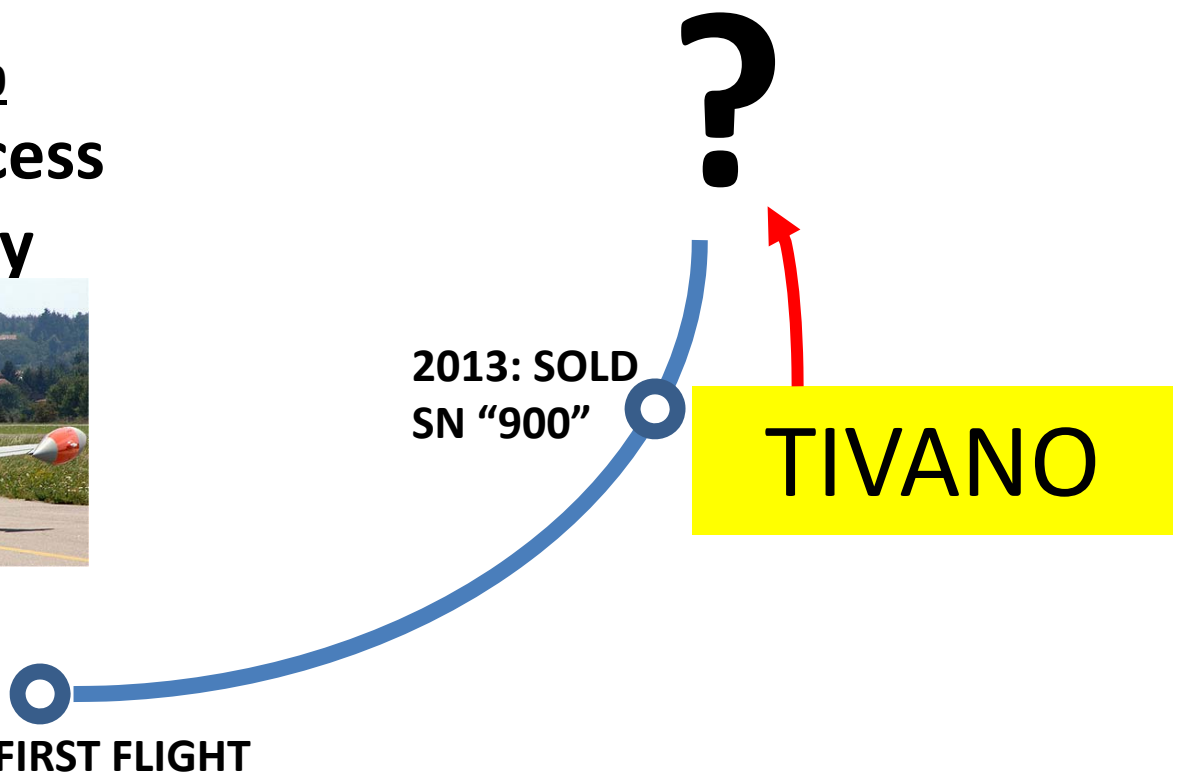
TIVANO

Tecnologie **I**nnovative per **V**elivoli di **A**viazione Generale di **N**uova Generazi**O**ne
(Innovative General Aviation Technologies)

STRATEGY

ALENIA-AERMACCHI SF 260

A continuous success over half a century

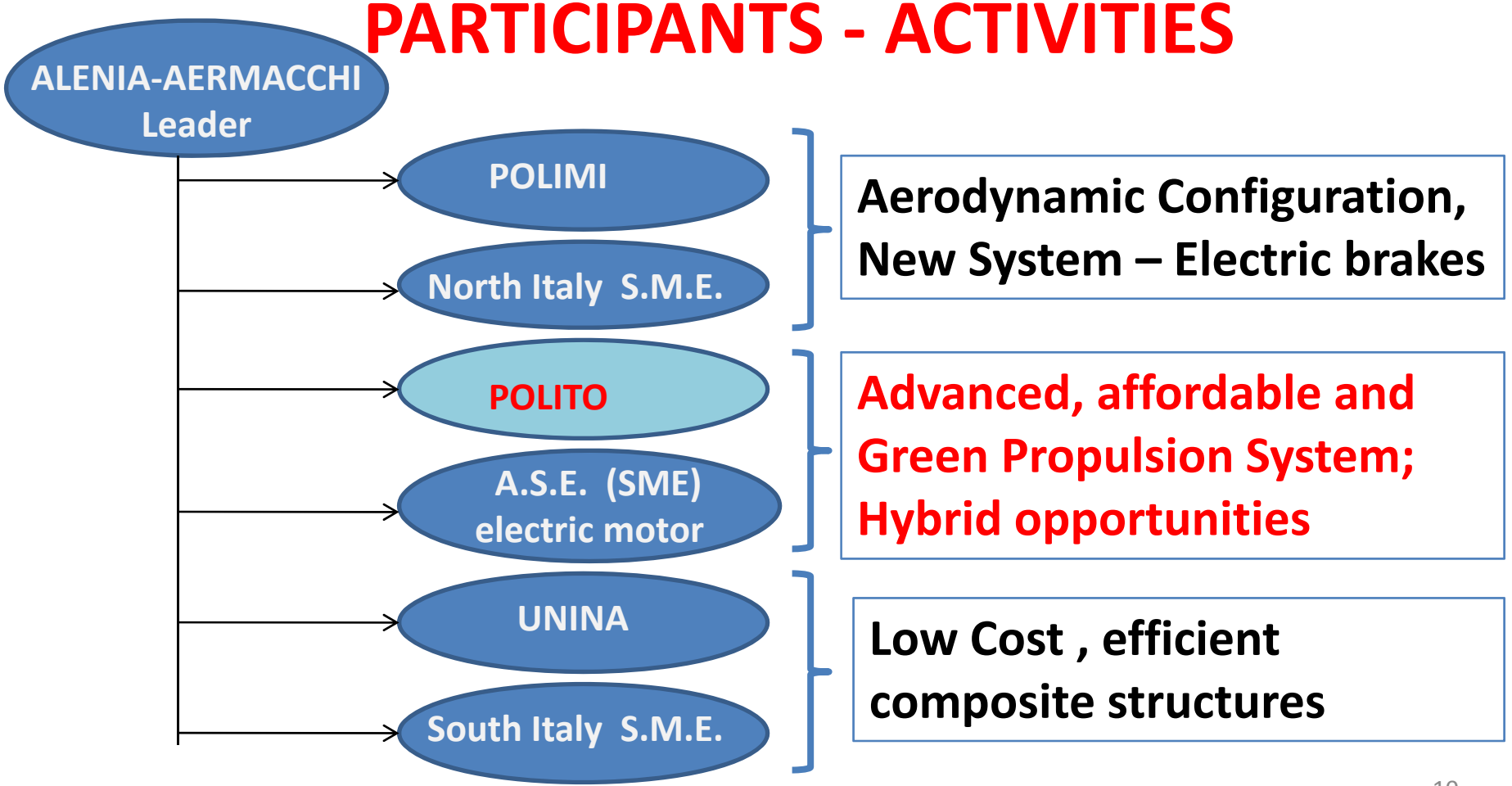


FIXED Wing Project

TIVANO

Tecnologie **I**nnovative per **V**elivoli di **A**viazione Generale di **N**uova Generazi**O**ne
(Innovative General Aviation Technologies)

PARTICIPANTS - ACTIVITIES



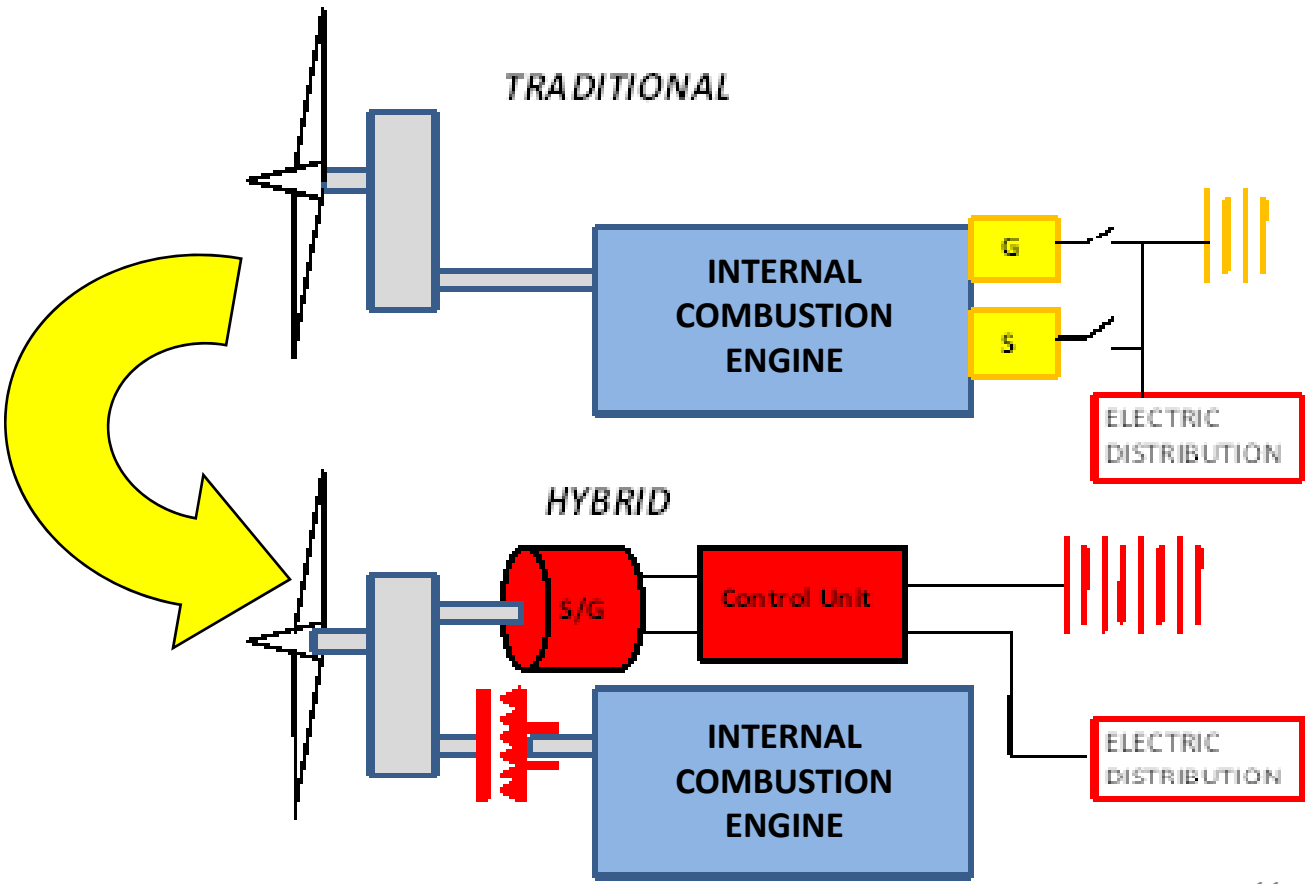
POLITO

ALENIA-AERMACCHI

A.S.E. (SME) electric motor

Advanced, affordable and Green Propulsion System; Hybrid opportunities

BASIC IDEA:



POLITO

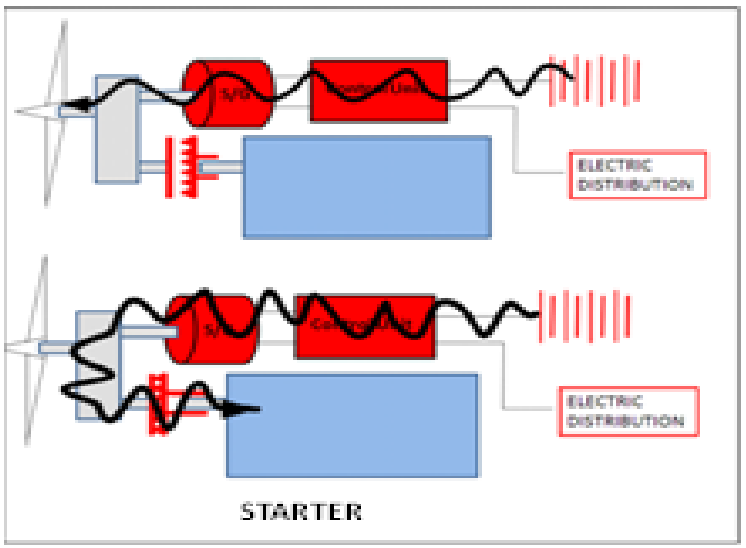
ALENIA-AERMACCHI

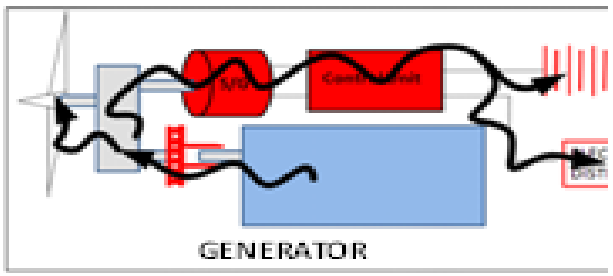
A.S.E. (SME) electric motor

Advanced, affordable and Green Propulsion System; Hybrid opportunities

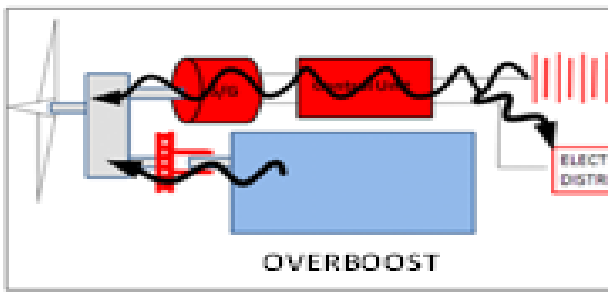
OPPORTUNITIES:

Engine starting



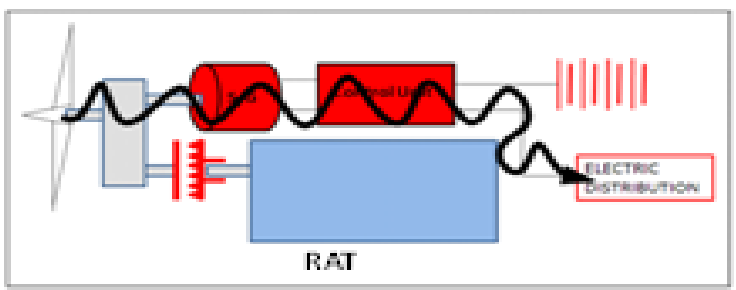


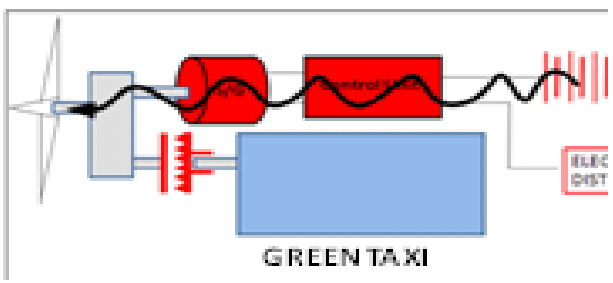
Cruise



Take-off and climb

Ram Air Turbine

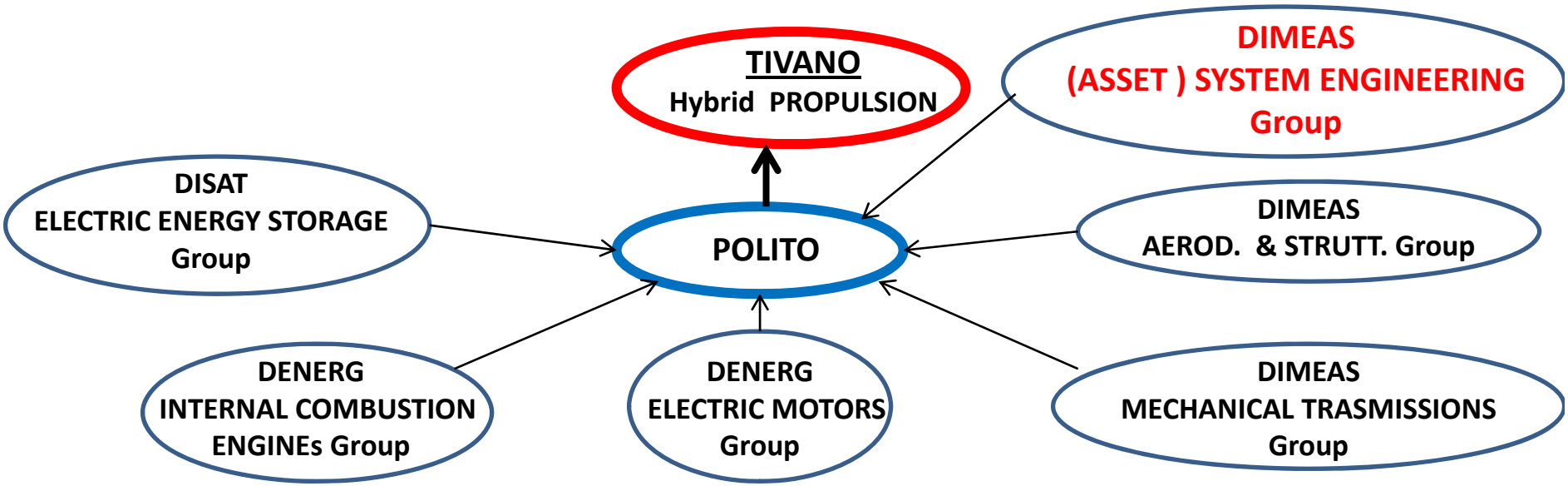


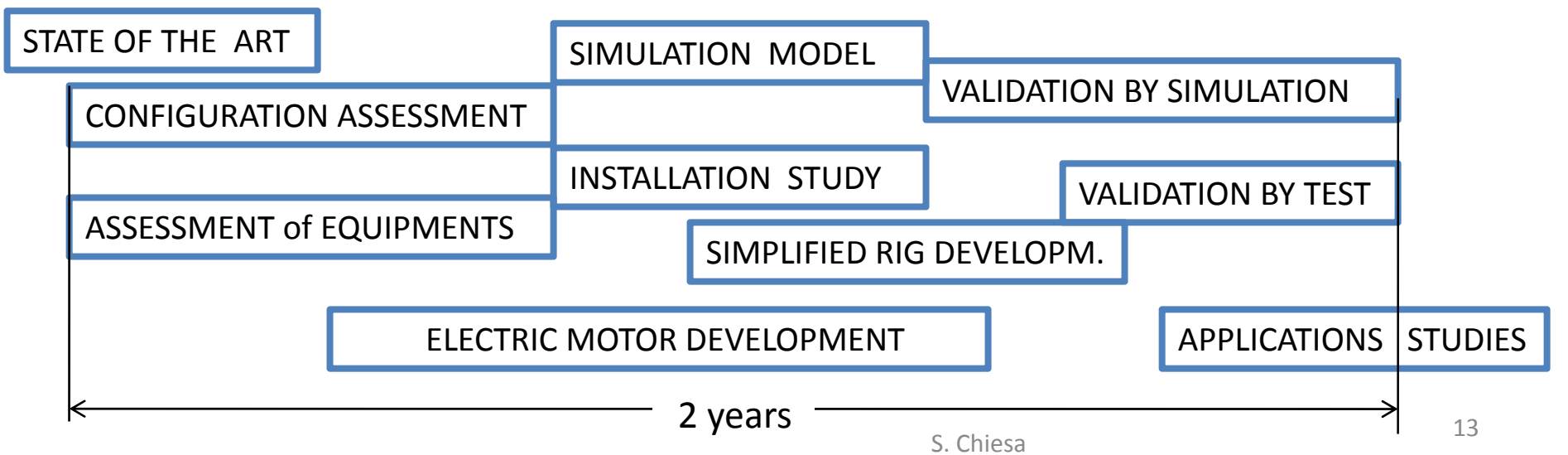


Green taxi

ACTIVITIES & SCHEDULE

POLITO



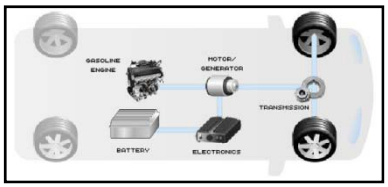


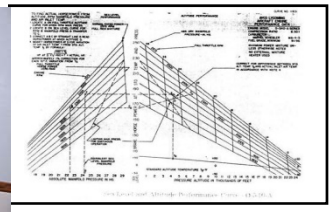
EDUCATIONAL ACTIVITIES AIMED TO TIVANO

(ASSET) SYSTEM ENGINEERING Group

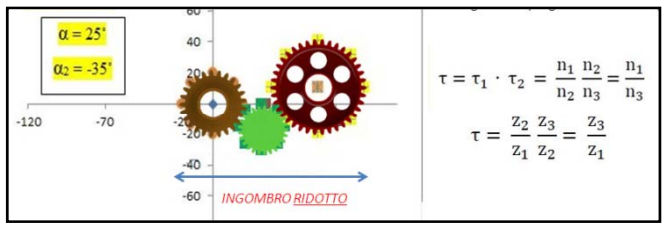
a) PREPARATION PHASE

1) Franco Zurletti ***"HYBRID PROPULSION SYSTEMS ANALYSIS"*** Degree Thesis in Aerospace Engineering –POLITECNICO di TORINO, December 2012

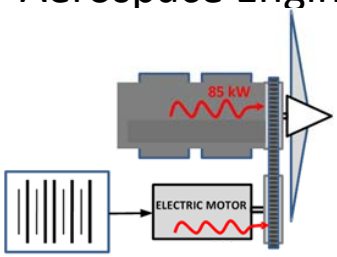


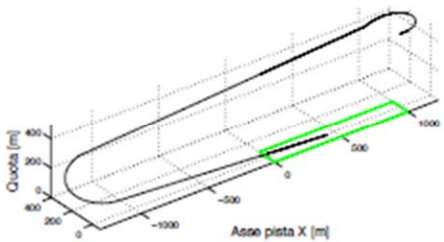



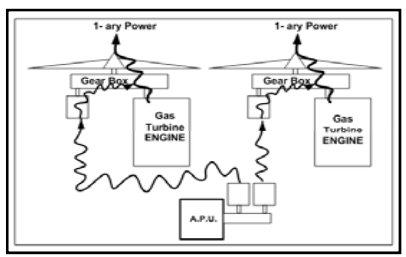
2) Andrea Buscemi "***METHODOLOGY FOR MECHANICAL TRANSMISSIONS IN AERONAUTIC DEFINITION*** " *Master* Degree Thesis in Aerospace Engineering – POLITECNICO di TORINO, July 2013

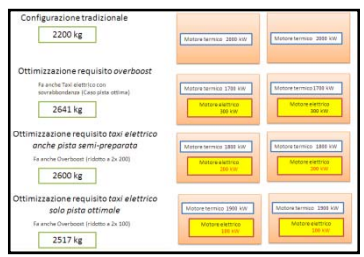



3) Roberta Fusaro "***HYBRID PROPULSION IN AERONAUTICS"*** *Master* Degree Thesis in Aerospace Engineering –POLITECNICO di TORINO, (in progress…)









EDUCATIONAL ACTIVITIES AIMED TO TIVANO

(ASSET) SYSTEM ENGINEERING Group

b)IN FUTURE, during development of the Project

The MIUR stated that all the Research Project of the Cluster must be comprehensive of an "Educational Program" (about 10% of the total amount of every Project)

So TIVANO will pay five grants for Ph D Students that will work for three years on the Project both in Industry and at University. The Tutor will be Academic

POLITO will account three of the aforesaid PhD Students in the Team that will work on the previous described activities

We hope that at EWADE 2015 these Ph D Students will present the progress of their works!