# AMATHO

Additive MAnufacturing of Tiltrotor HOusing Proposal #717194

# **Kick off Meeting** Politecnico di Milano December 20<sup>th</sup> 2016





Innovation takes off

#### AGENDA

Venue: December, 20th, 2016 Politecnico di Milano (via La Masa 1, Milano) plus teleconf.

- 9:30 Welcome participants (G. Sala)
  AMATHO consortium & staff (partners)
  Project description (Sala & WP leaders)
- 11:30 AMATHO-JU Relationship (Podsadovski)

13:00 End of meeting



#### **Consortium Participants**

1) Politecnico di Milano (coordinator)



#### 2) SUPSI - Scuola Universitaria Professionale della Svizzera Italiana SUPSI

3) PRIMA - Prima Industrie SPA



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#### Participants - 1/3

#### Politecnico di Milano

#### Founded in 1863, is the leading University in Italy for Architecture, Design and Engineering



Participates with 2 Departments:

- Dept. of Aerospace Science and Engineering (DSTA) http://www.aero.polimi.it
- Dept. of Mechanics (DM) http://www.mecc.polimi.it

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#### Participants - 2/3

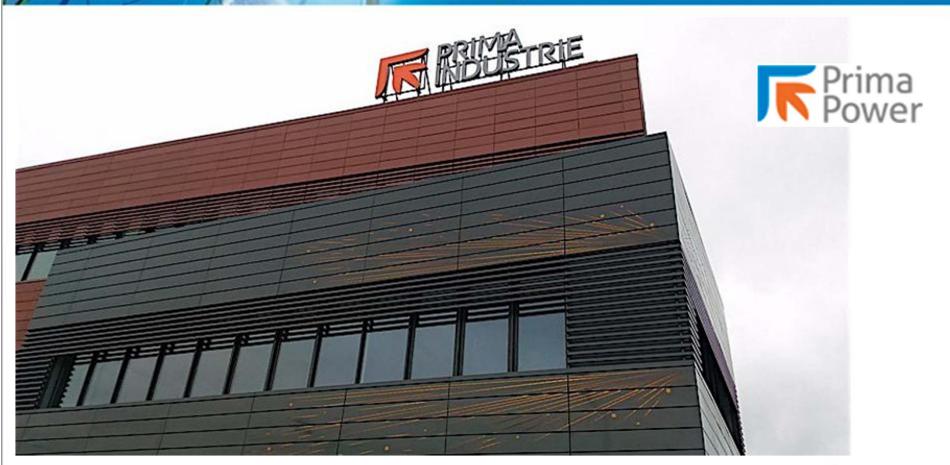


#### **SUPSI**

Participates through its Department of Innovative Technologies (DTI), Institute of Systems and Technologies for Sustainable Production (ISTePS).



### Participants - 3/3



#### PRIMA

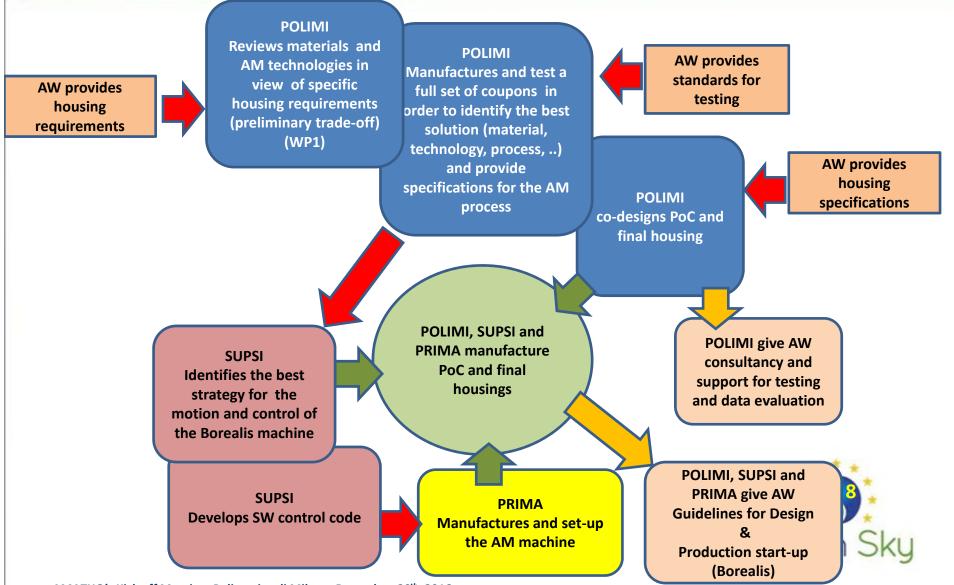
Participates with its machinery division having its main office at Via Antonelli 32, Collegno (TO), Italy.



#### **Project Objectives**

- 1<sup>st</sup>: to develop, assess and produce a **tiltrotor main drive system housing** compliant to these requirements, exploiting the features of innovative AM techniques.
- 2<sup>nd</sup>: to set-up an AM DLD **process/machinery** able to produce a monolithic fullscale large-dimension housing made of the best-performing material largedimension housing made of the **best-performing material**
- 3<sup>rd</sup>: to trade-off among production processes EBM, SLM, DLD and their joining and machining techniques, in view of the optimization process and **to allow** sound and reliable **mid-term industrial choices** 
  - 4<sup>th</sup>: to manufacture specimens, POCs and full scale components to allow experimental assessment to realize a fully reliable and repeatable manufacturing process optimized with regard to the process and machine parameters and behavior;
  - 5<sup>th</sup>: to build a closed loop monitoring infrastructure running in-line with the machine CNC to persistently optimize the product quality by adapting the process and machine manufacturing strategy;
  - 6<sup>th</sup>: to provide a decision support tool to support the realization of large and complex shape components designed as monoliths and assembly;
  - 7<sup>th</sup>: to provide supporting guidelines about precursor powders choice, procedures and processes, materials characterization, testing and NDI techniques, structural design, optimization and substantiation tools, industrial engineering, flight clearance, in order to allow a complete technology transfer process towards the topic leader.

#### **Description of Work**



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#### Project structure and Collaborating staff

WP1: Feasibility Study & Preliminary Design

WP2: Material Characterization

WP3: Detailed Design and Process Development

WP4: Prototype and pre-production evaluation

WP5: Communication. Dissemination and Exploit

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WP6: Proiect Management

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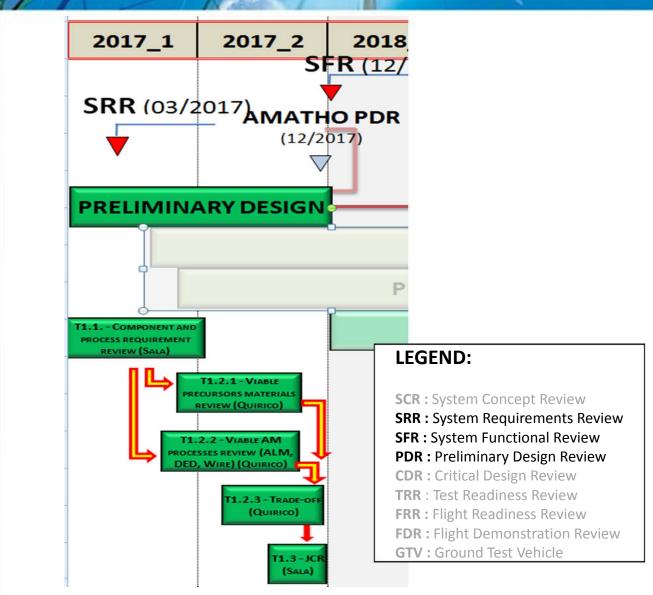
# WP1: Feasibility study and preliminary design

T1.1: Component and process requirement review (1)

T1.2: ALM process and material concept definition (1)



TL in parentheses





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# **WP2: Material Characterization**

T2.1: Specimen Test Campaign (1)

T2.2: Prototype and test of drive system POCs (1)

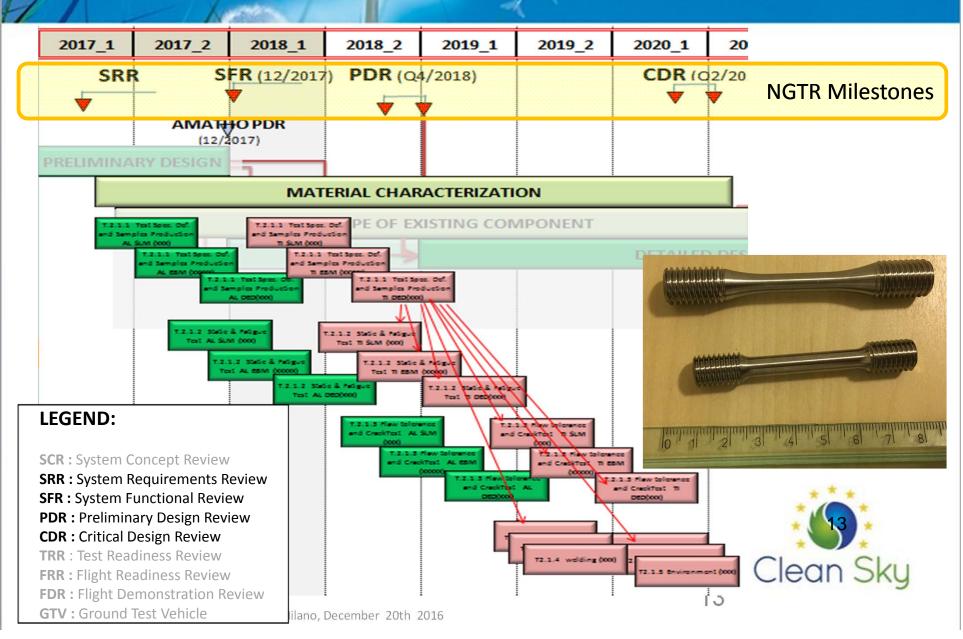
T2.3: Definition of design rules and supporting numerical tools (1)

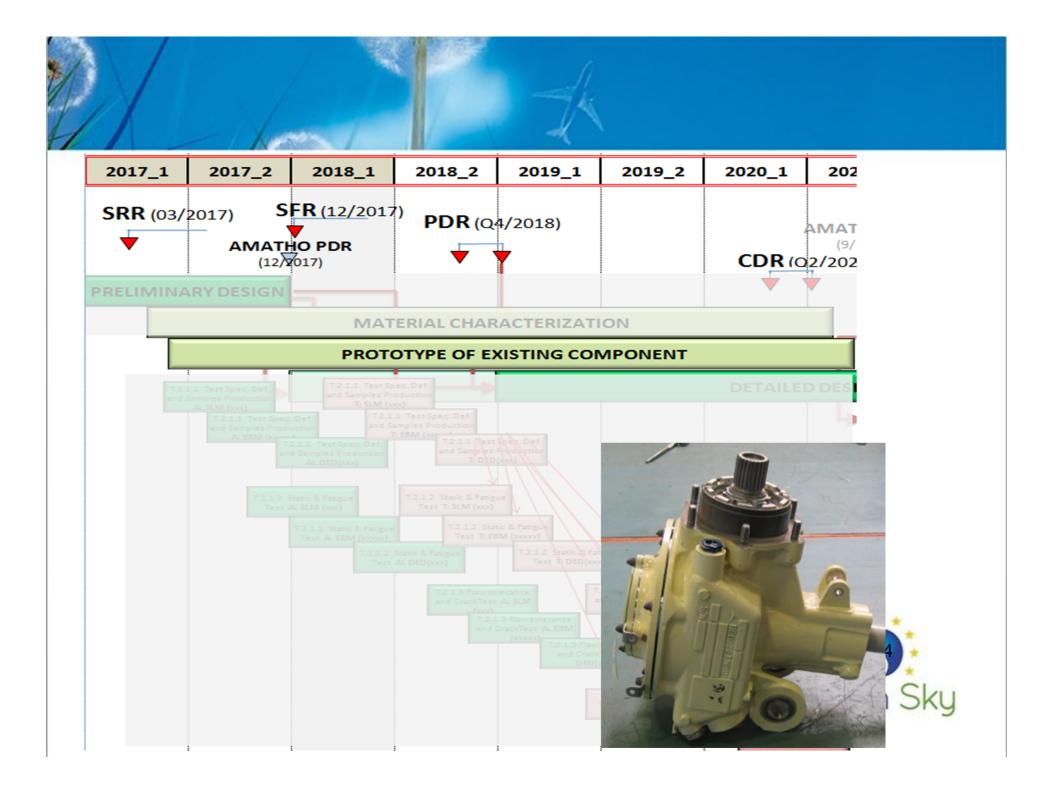
T2.4: Joint concept review (1)

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#### Project organisation – 3/6

# WP3: Feasibility study and preliminary design

T3.1: Design and structural optimization (2)

T3.2: Process development (3)

T3.3: Methodologies for design, optimization, structural substantiation of AM parts (1)

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TL in parentheses

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T GEN PDR (Q4 2018)	ri 28/12/18	Fri 28/12/18									۱	28/12							
abilty of drawing and technical requirements of the final Molonstrator	on 31/12/18	Mon 31/12/18									۲	31/12	2						
- Design and structural optimization Mon	on 04/12/17	Fri 28/08/20																	
Process development Mo	on 04/12/17	Mon 30/11/20											Ŷ		*****			-	
8.2.1 - Methodologies for in-process monitoring forAM Turo ocesses	ie 30/01/18	Wed 29/05/19																	
8.2.2 - Product- and process- based requirement Mon efinition for the chosen process machine	on 04/12/17	Mon 01/07/19											<b></b>					_	
3.D1 Optimisation process procedure (t0+31) Tu	ie 02/07/19	Tue 02/07/19									*****		*	02/07	*****		CD	ĸ	
8.2.3 - Laser source, optical system and machine Mon onfiguration and set-up for the chosen processes	on 02/07/18	Mon 30/11/20														((	ע2/"	20)	
Methodologies for design, optimization and The stural substantiation of ALM components	nu 02/08/18	Mon 30/11/20															く	>	
11 Technical drawings availability T0+44 Mon	on 31/08/20	Mon 31/08/20															+	31/08	
2 Production cycles availability T0+48 Tu	ue 01/12/20	Tue 01/12/20																•	01/
2 Structural substantiation (T0+ 36) The	nu 01/10/20	Thu 01/10/20	1								****							01/1	10
eptance and inspection criteria acceptance by AW Th	nu 01/10/20	Thu 01/10/20	1														•	01/1	10
3 Preliminary Test Phase Review meeting (T0+28) Fi	ri 01/03/19	Fri 01/03/19	1									♦ 0	1/03						
4 Critical Design Review meeting (T0+44) Fi	ri 31/07/20	Fri 31/07/20	1								******						<b>\$</b> 3	1/07	
3 Review meeting MoM (T0+45) Mon	on 31/08/20	Mon 31/08/20															٠	31/08	:
3 Review meeting MoM (T0+45) Mon	on 31/08/20	Mon 31/08/20											C	ie	u		.	•	+ 31/08

# WP4: Prototype and pre-production evaluation

T4.1: Full-scale component manufacturing (3)

T4.2: Structural and Functional Tests support (1)

T4.3: Production start-up support (1)

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WP 4 Prototype and pre-production evaluation	Tue 28/01/20	Thu 02/12/21						 					•	_			->		~	
4 T4.1 Full scale component manufacturing	Tue 28/01/20	Tue 04/05/21												_			->	•		
T.4.1.1 Machine motion strategy design and path planning	Tue 28/01/20	Tue 01/12/20														}				
T.4.1.2 Machine control strategy design and configuration	Tue 31/03/20	Thu 28/01/21																		
T.4.1.3 Machine in-line closed loop monitoring policy design and implementation	Mon 02/11/20	Tue 02/03/21																		
T.4.1.4 Machine and process optimization for the manufacturing of final product demonstrator	Wed 02/12/20	Thu 29/04/21														Ì		]		
T.4.1.5 Manufacturing of final product demonstrator	Wed 02/12/20	Tue 04/05/21														I		ľ		
T4.D1 ALM Prototypes(delivered to AW) (T0+52)	Wed 31/03/21	Wed 31/03/21					*****										•	31/03		
T4.M1 ALM Prototypes availability (T0+52)	Wed 31/03/21	Wed 31/03/21															•	31/03	81	
4 T4.2 Structural and Functional Tests support	Mon 01/06/20	Thu 02/12/21													-				-	
T4.2.1 Test Plan Proposal	Mon 01/06/20	Thu 01/10/20																		
T4.2.2 Structural and Functional Tests support (AS TESTS WILL BE EXECUTED BY AW)	Fri 02/10/20	Thu 02/12/21														Ľ				
T4.D2 Test plan + Review meeting MoM (T0+48)	Mon 30/11/20	Mon 30/11/20		1					-		-	-	1	1		•	30/11			
T4.M2 Test Phase Review meeting (T0+48)	Mon 30/11/20	Tue 01/12/20	1										-			•	30/11			
T4.D3 Review meeting MoM (T0+57)	Mon 30/11/20	Mon 30/11/20								F	-		-			•	30/11			
T4.M3 Tests Readiness Review meeting (T0+56)	Tue 31/08/21	Wed 01/09/21								-	~		(.	)					<ul><li>31/0</li></ul>	8
Structural / Functional Tests execution ( BY AW)	Wed 05/05/21	Wed 01/12/21						1	1	X					-		►	Innn	The second se	
T4.M4 Structural / Functional Tests execution (COMPLETED BY AW) (T0+60)	Thu 02/12/21	Thu 02/12/21					*************		1			K		1	-				*	02/12
T4.D5 Test Report (T0+60)	Wed 01/12/21	Wed 01/12/21						5						11					+	01/12
T4.M5 Flight clearance approved by AW T0+60	Wed 01/12/21	Wed 01/12/21								1		1	1	F					+	01/12
T4.3 Production start-up SUPPORT	Wed 01/09/21	Tue 30/11/21						T)	1	5	5	3	-	2	2					

#### Project organisation – 5/6

# WP5: Communication, Dissemination & Exploitation

T5.1:Information dissemination (2)

T5.2: Exploitation (2)





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# WP6: Project Management

T6.1: General management and coordination (1)

T6.2: Technical and financial management (1)

T6.3: Management of knowledge and Intellectual Property Rights (1)

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TL in parentheses

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VP6. Project Management	Thu 01/12/16	Fri 29/11/24	¢	~~	¢	~									_
T6.1 General management and coordination	Thu 01/12/16	Mon 29/11/21	1												
T6.D1 Consortium Agreement (T0+2)	Thu 01/12/16	Thu 01/12/16	•	01/12											
T6.D2 Project Management Document (T0+6)	Mon 30/01/17	Mon 30/01/17	1	♦ 30	01										
T6.D3 Periodic reports (tech and financial) (T0+19+every periods)	Fri 01/12/17	Fri 01/12/17				•	01/13	2							
T6.D4 Periodic Meeting reports (tech and financial) (T0+19+every periods)	Thu 01/12/16	Thu 01/12/16	•	01/12											
T6.D5 Implementation Plan updates (T0+19+?)	Thu 01/12/16	Thu 01/12/16	•	01/12											
T6.M1 Kick-off meeting	Thu 01/12/16	Thu 01/12/16	•	01/12											
T6.2 Technical and financial management	Thu 01/12/16	Mon 29/11/21									-		-		
T6.M2 Intermediate project reviews	Tue 16/05/17	Tue 16/05/17	-		16/0	5									
T6.D6 Risk management register (T0+2+to be maintained within the project)	Mon 30/01/17	Mon 30/01/17		♦ 30	01										
T6.M3 Joint team (Consortium-AW) Kick-off meeting	Wed 01/03/17			<b>◆</b> 0	1/03										
T6.3 Management of knowledge and IPR	Thu 01/12/16	Fri 29/11/24													
T6.D7 Exploitation Agreement (T0+6)	Wed 01/03/17			<b>♦</b> (	1/03										
T6.D8 D0- Rep. on the Impl. Agreem. Signature (T0+1)	Fri 30/12/16	Fri 30/12/16		<ul><li>30/1</li></ul>	2										

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