

# COMMUNION

JOINING OF 3D TPC/METAL MULTIMATERIAL COMPONENTS

Event, place and date

ComMUnion Project

## **H2020-FoF12-2015: ComMUnion**

Net-shape joining technology to manufacture 3D multi-materials components based on metal alloys and **thermoplastic composites**



# ComMUnion Outlook

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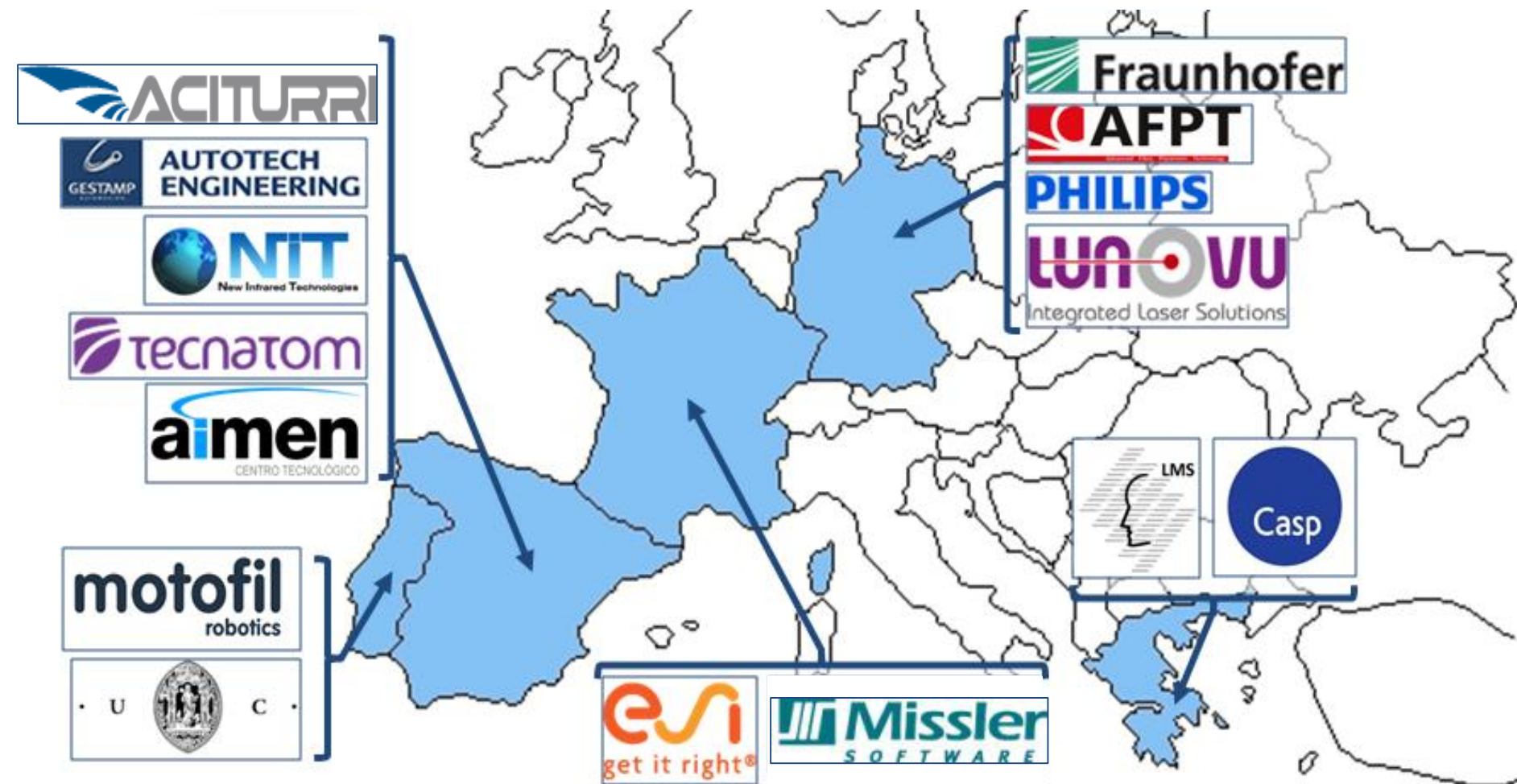
# ComMUnion Outlook

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## Partners



Participant No *	Participant organisation name	Part. short name	Country
1 (coordinator)	ASOCIACION DE INVESTIGACION METALURGICA DEL NOROESTE	AIMEN	Spain
2	AUTOTECH ENGINEERING, AIE	AUTOTECH	Spain
3	AFPT GmbH	AFPT	Germany
4	NEW INFRARED TECHNOLOGIES SL	NIT	Spain
5	TECNATOM S.A.	TECNATOM	Spain
6	MOTOFIL ROBOTICS, S.A.	MOTOFIL	Portugal
7	HILIPS GmbH	PHILIPS	Germany
8	FRAUNHOFER-GESELLSCHAFT ZUR FOERDERUNG DER ANGEWANDTEN FORSCHUNG E.V	FhG	Germany
9	UNIVERSITY OF PATRAS	LMS	Greece
10	UNIVERSITY OF COIMBRA	COIMBRA	Portugal
11	MISSLER SOFTWARE	MISSLER	France
12	ACITURRI ENGINEERING SL	ACIENG	Spain
13	SYM VOULOI KAI PROIONTA LOGISMIKOU AE	CASP	Greece
14	LUNOVU GmbH	LUNOVU	Germany
15	ESI GROUP	ESI	France



# ComMUnion Outlook

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## Objectives

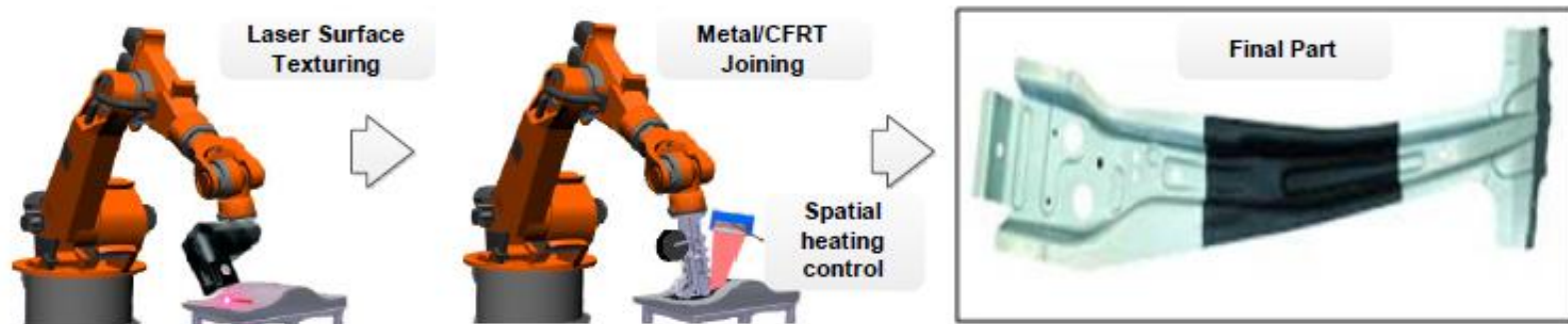




## MAIN OBJETIVE

**ComMUnion** enables productive and cost effective manufacturing of **3D metal/CFRTs multi-material components**. Automatic tape placement of **CFRTs** with controlled **laser-assisted heating**, **high-speed laser texturing** and **cleaning**, **on-line monitoring and inspection**, and **computational multi-scale modeling** will be combined in a **multi-stage robot solution for joining** to provide the greatest performance joints. Tools for **quality diagnosis and decision support** will be also implemented under a cognitive approach

### *MULTI-STAGE COMMUNION PROCESS APROACH*



## TECHNICAL GOALS

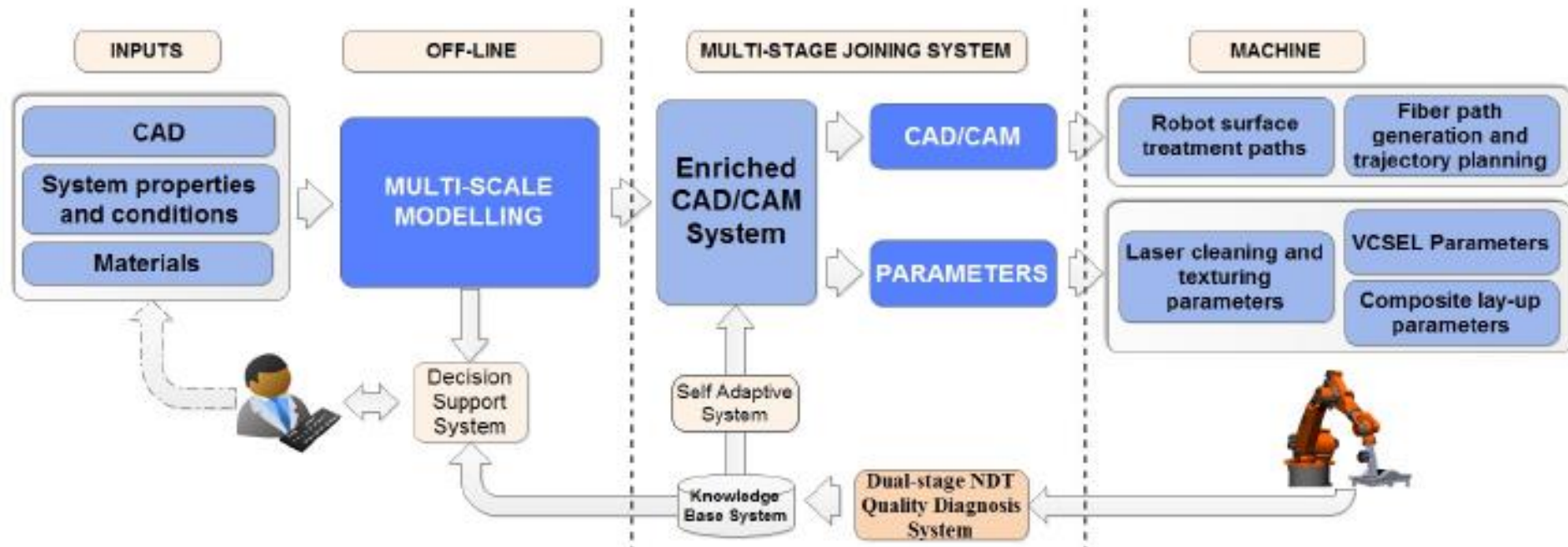
- O1:** Developing a new **multistage joining robotic solution**
- O2:** **High efficient and flexible surface condition** solution
- O3:** Developing a **multi-scale modelling system**
- O4:** Implementing an **embedded flexible control of the laser-assisted heating profile**
- O5:** Developing **QDS, Quality Diagnosis System**, in a multi-stage **manufacturing** approach based on **thermography and speckle active imaging techniques**.
- O6:** **Self-adjustment of process parameters**
- O7:** Demonstration of **recycling/reuse by direct heating of the metal**
- O8:** Demonstration of a **fully automated 3D joining multimaterial technology** applied to **automotive and aeronautics**

# ComMUnion Outlook

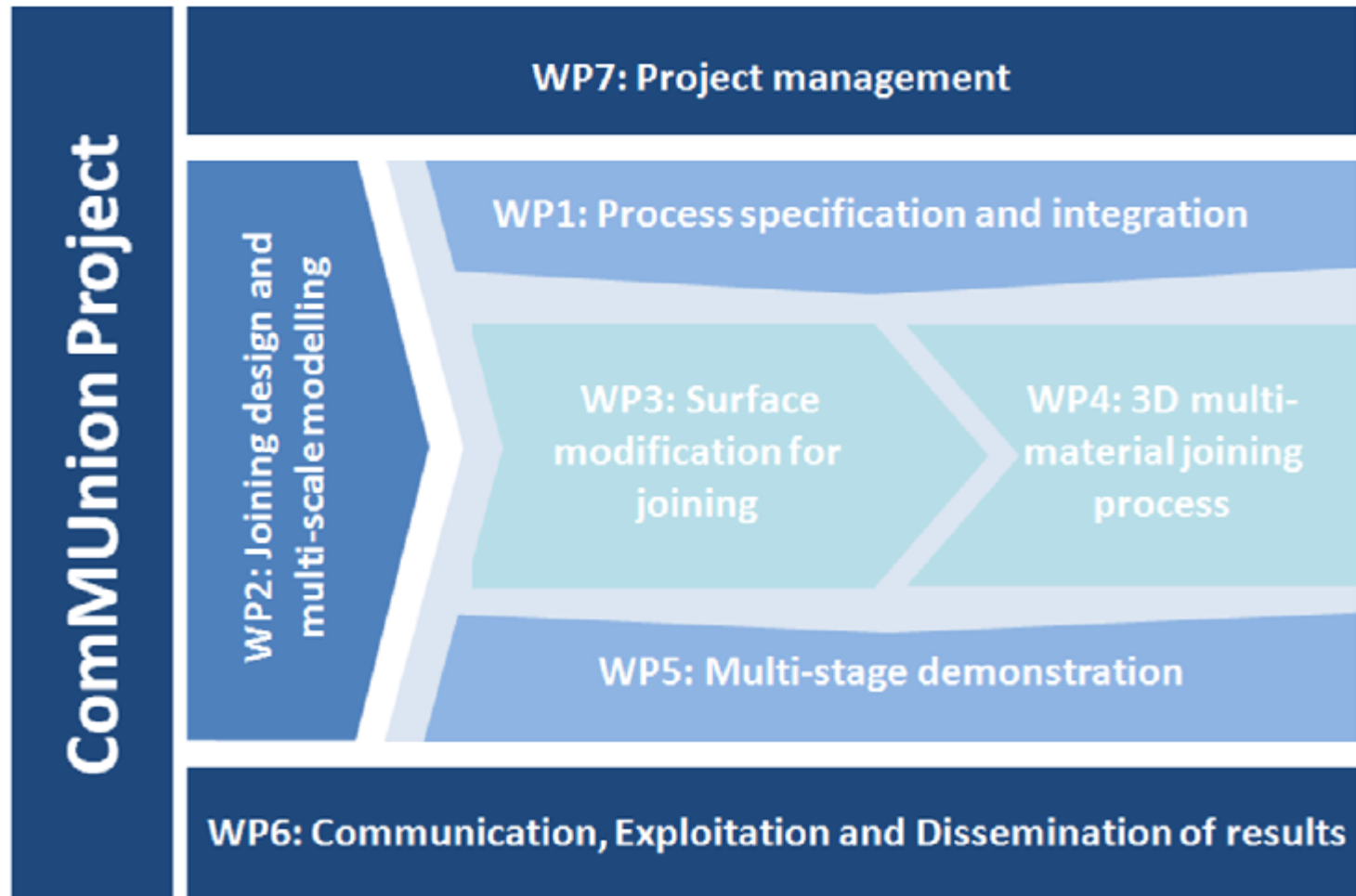
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Concept



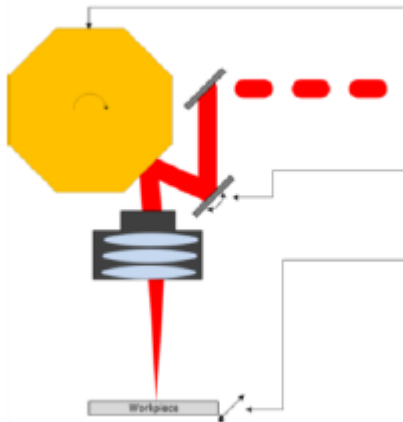


## WORK PACKAGES AND INTERDEPENDENCES

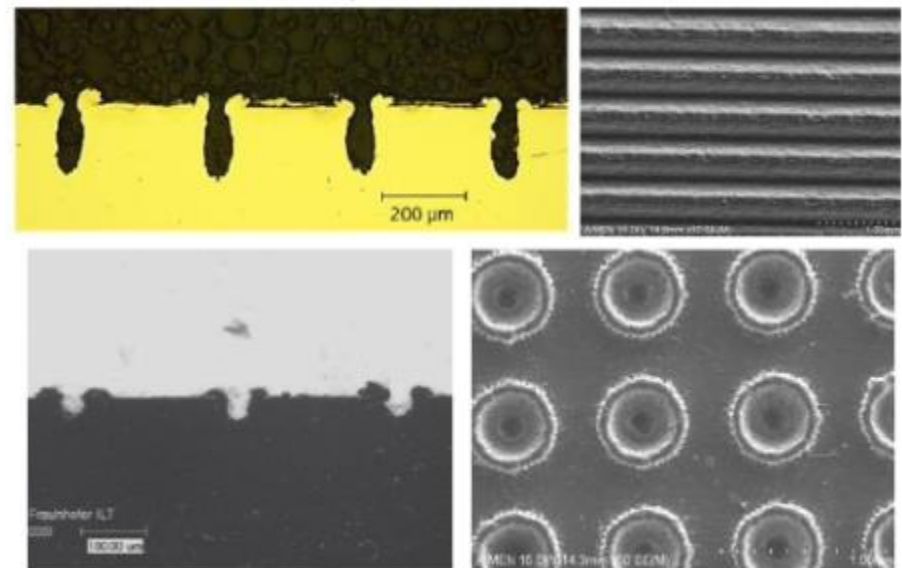


## LASER TEXTURING AND CLEANING OF SURFACES

ELIMINATION OF UNDESIRABLE SUBSTANCES AND CREATION OF CONTROLLED STRUCTURES ON THE METAL SURFACE FOR THE ANCHORAGE OF THE POLYMER MATRIX OF THE COMPOSITE.



polygon scan laser (Source: FhG-ILT)



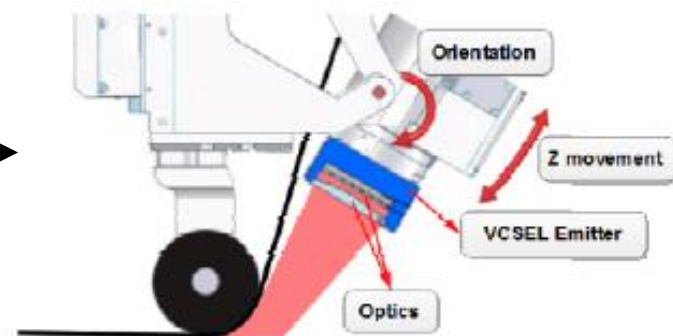
Texturized surfaces details (Source: FhG-ILT & AIMEN)

IMPROVED WETTABILITY AND MECHANICAL INTERACTION COMPOSITE-ADHESIVE/METAL INCREASED

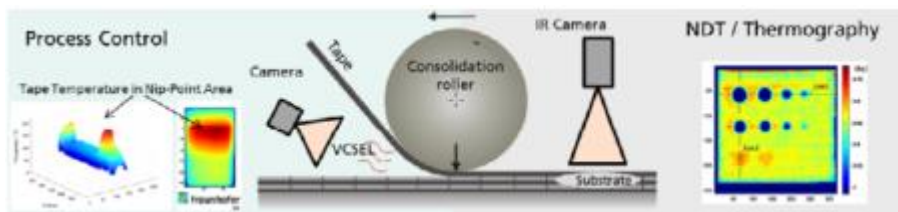
## LASER ASSISTED SYSTEM TO HEAT LARGE WIDTH THERMOPLASTIC COMPOSITES/ FLEXIBLE HEAD FOR METAL-COMPOSITE JOINING FOR COMPLEX SHAPES



VCSEL heating system (Source: Philips)

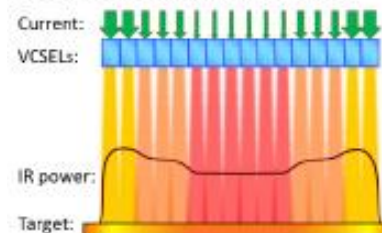


automatic lay-up system (Source: FhG-IPT & AIMEN)



process control (Source: FhG-IPT & AIMEN)

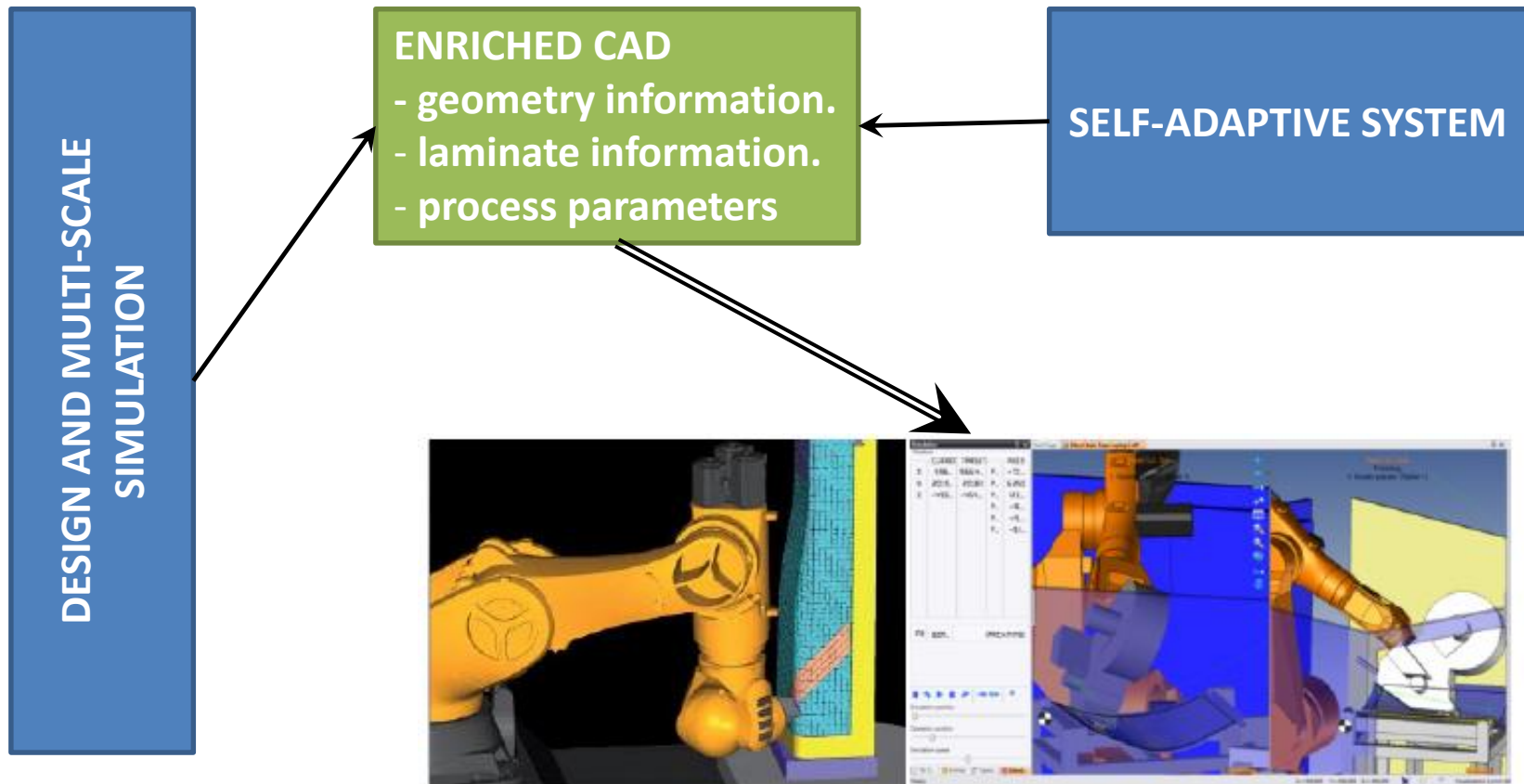
Heating zones controlled individually



adjustable heating profile (Source: Philips)



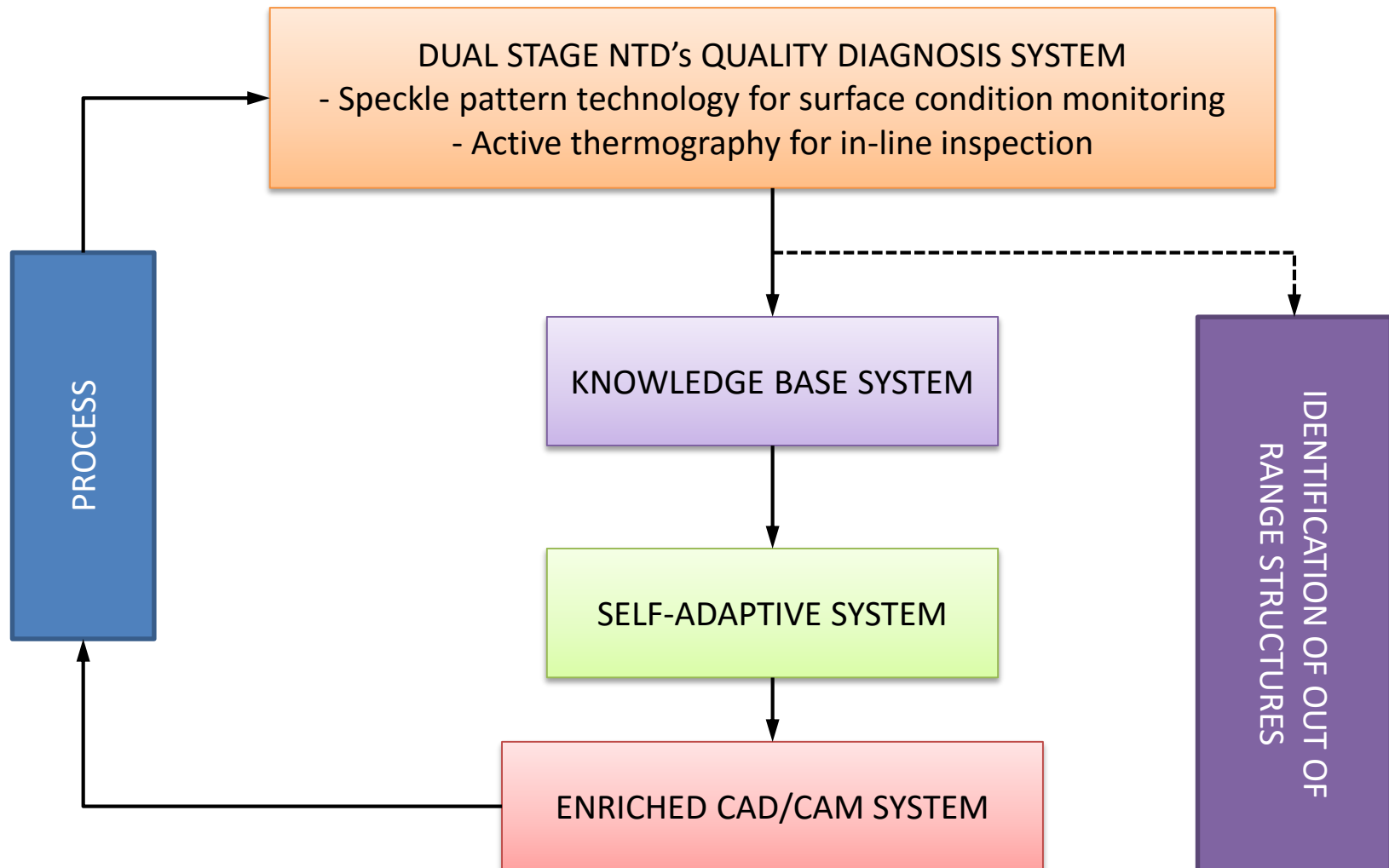
## PARAMETERIZED ENRICHED CAD/CAM SYSTEM



CAD/CAM robot planning system applied to tape-laying  
 (Source: <http://www.fibrechain.eu/publication/index.jsp>)



## ON-LINE QUALITY DIAGNOSIS SYSTEM BASED ON NDT's

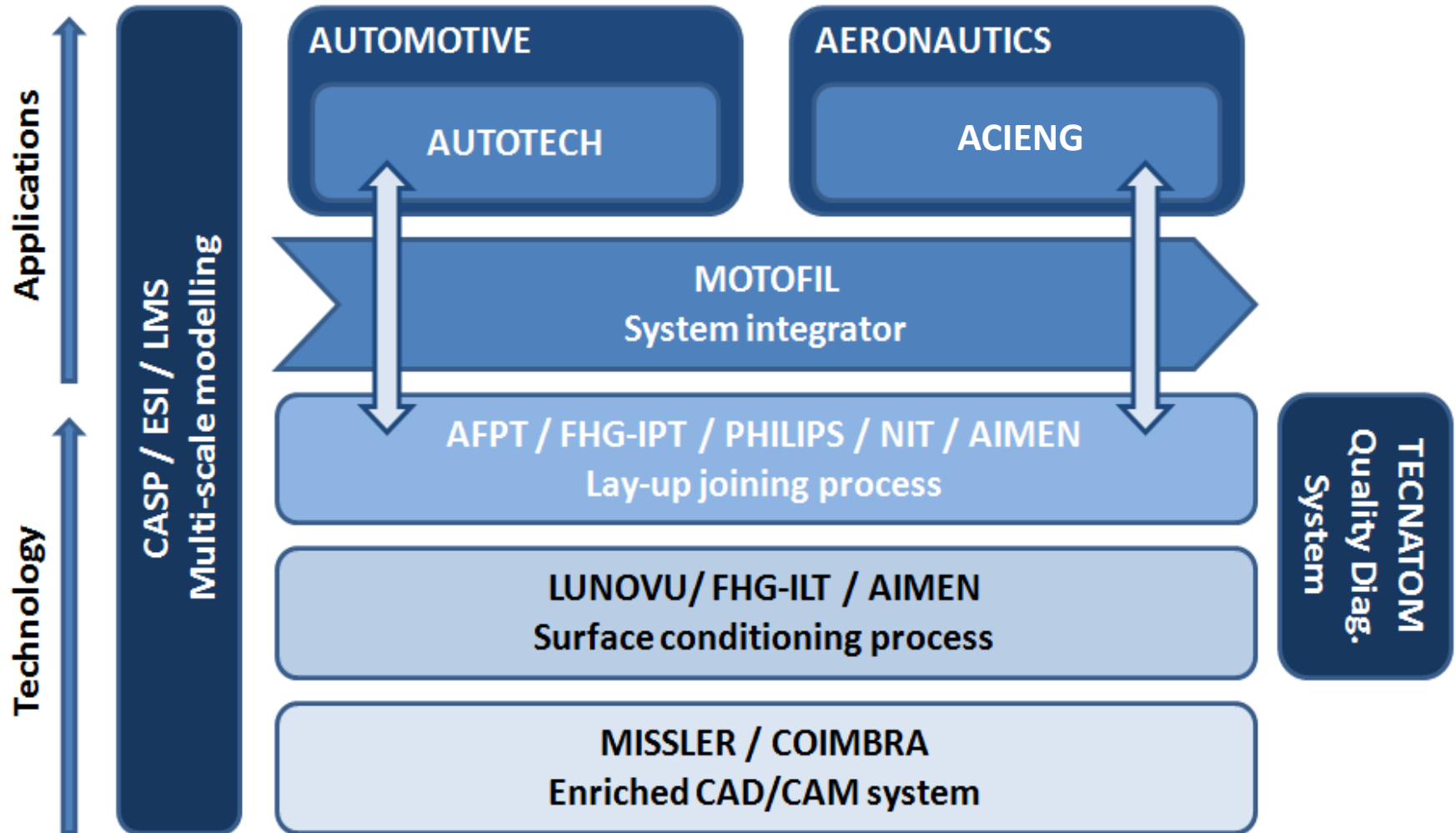


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## Value Chain





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## Impact





## IMPACT

- ✓ At least 20% decrease in the consumption of high cost and critical materials.

	Reference	Material	Weight (kg)	Cost: material (€)
	Traditional bearing rib	Ti6Al4V	100 (ref. value)	6000 (considering ref. weight)
	ComMUnion bearing rib	Ti6Al4V /PPS-CFRT	50+15 (titanium+CFRT)	4500

- ✓ At least 30% improvement of product performance.
- ✓ High level of automation and lower production times compared to current technologies.

	Joining metal/CFRs components	Material	Fabrication	Joining technol.	Surface modification	NDT	Control
Currently Manual		Metal/ TSC	Separately: TSC are manufactured by hand lay-up, infusion	TS adhesives	Manual or automated, little innovative (sand blasting, primer)	Offline	No
ComMUnion approach		Metal/ CFRT	Direct joining: CFRTs are joined to metal surface by laser assisted automated tape placement (with TP adhesive at interface)		Innovative high speed laser and texturing cleaning	Online	Online control of joining parameters



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**The dissemination of results herein reflects only the author's view and the European Commission is not responsible for any use that may be made of the information it contains**



# Consortium

Asociación de Investigación  
Metalúrgica del Noroeste (AIMEN)

AUTOTECH ENGINEERING, AIE  
(AUTOTECH)

AFPT GMBH (AFPT)

New Infrared Technologies SL  
(NIT)

TECNATOM S.A. (TECNATOM)

Motofil Robotics, S.A. (MOTOFIL)

Philips GmbH (PHILIPS)

FRAUNHOFER GESELLSCHAFT  
ZUR FÖRDERUNG DER  
ANGEWANDTEN FORSCHUNG  
EV (FHG)

UNIVERSITY OF PATRAS (LMS)

UNIVERSIDADE DE COIMBRA  
(COIMBRA)

Missler Software (MISSLER)

ACITURRI ENGINEERING SL  
(ACIENG)

SYM VOULOI KAI PROIONTA  
LOGISMIKOU AE (CASP)

LUNOVU GMBH (LUNOVU)

ESI GROUP (ESI)



UNIVERSIDADE DE COIMBRA



## Thanks for your attention

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Name and Position

Phone | e-mail



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