Flexible 3D-Additive-Manufacturing

GULLIVER® ADDITIVE TECHNOLOGIES

LILLIPUT® Additive Technologies

LARGE FUNCTIONAL POSSIBILITIES

SMALLER PARTS IN SERIES PRODUCTION

IN METAL AND PLASTICS

WITH OPTIMIZED MATERIAL PROPERTIES

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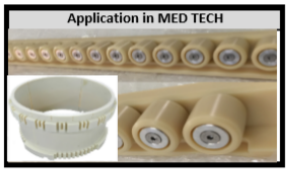

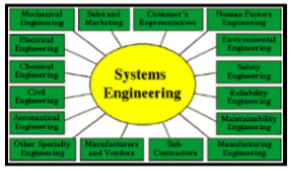

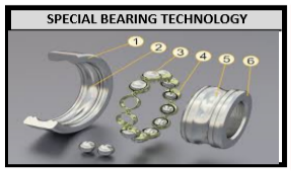

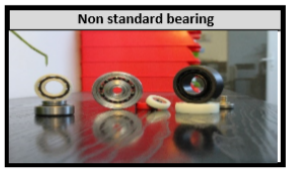

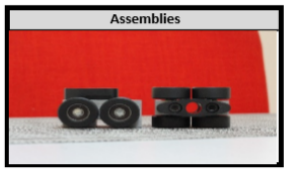

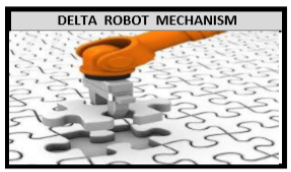

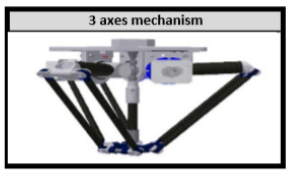

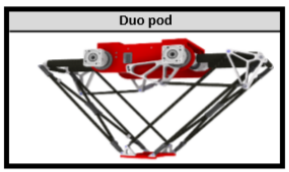

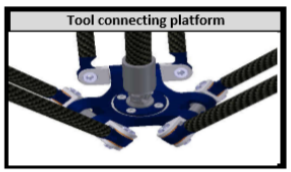

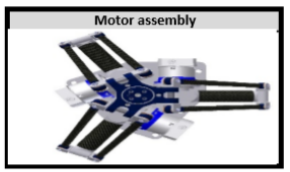

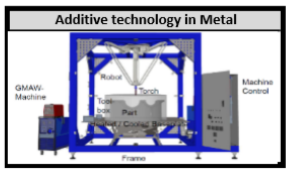

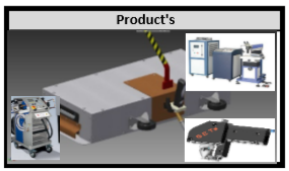

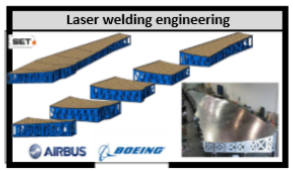

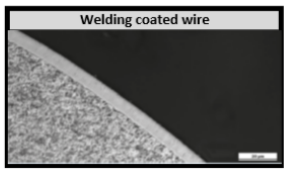

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OUR MOTIVATION

- There are **many different processes** on the market to print metal parts – **but most of them are slowly and too precise** for many functional components in Aerospace, Shipbuilding and Mechanical Engineering

- What about using a **faster procedure** which is a **common process and proven over generations** and **combine it with state of the art robot, control and sensor Technology?**

- **Trends**
  - XS to XXL-Components
  - Prototypes as well as Series Production
  - Partly Repair
  - Complexity – Multimaterial Design

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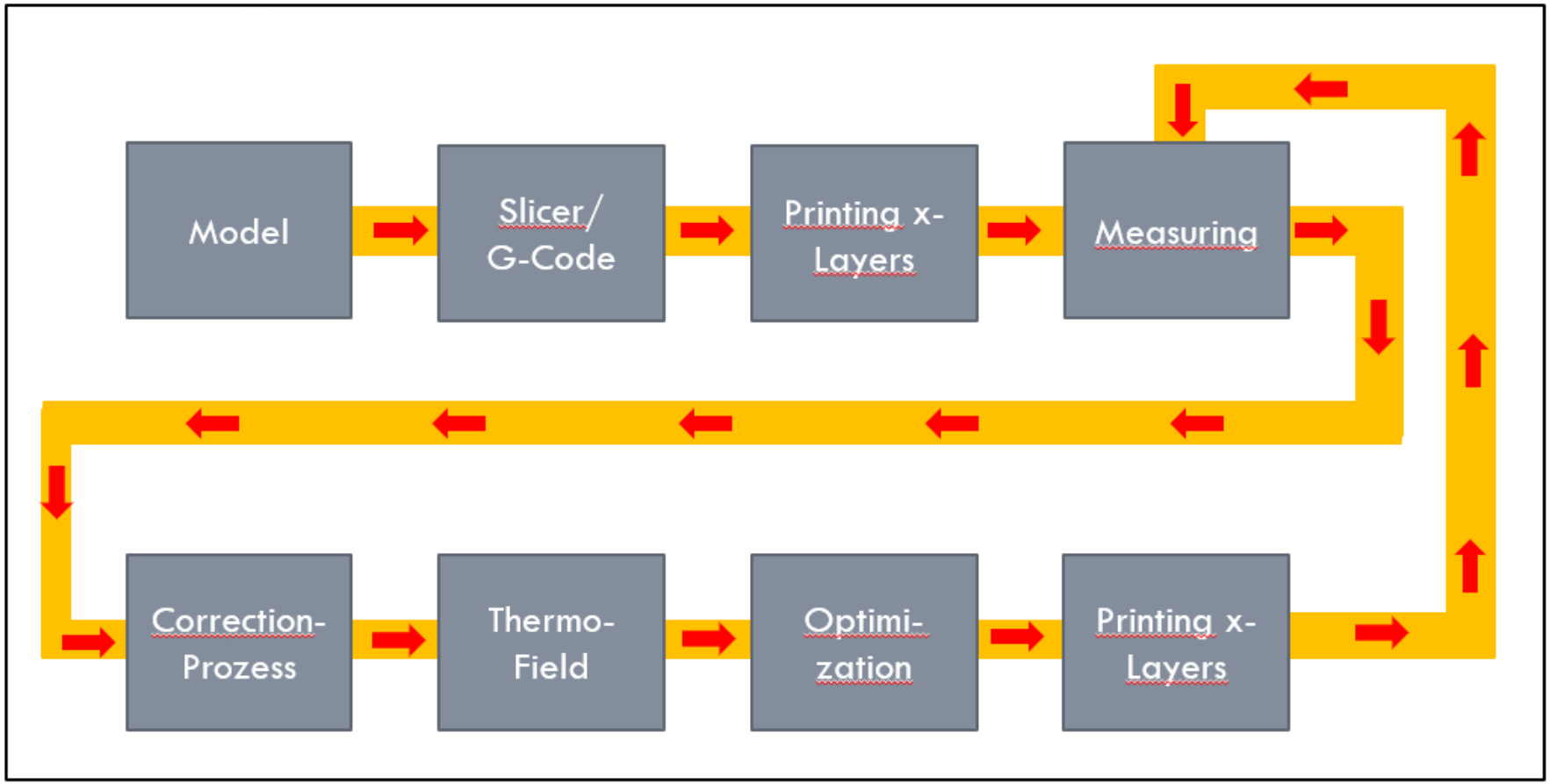
OUR PROCESS



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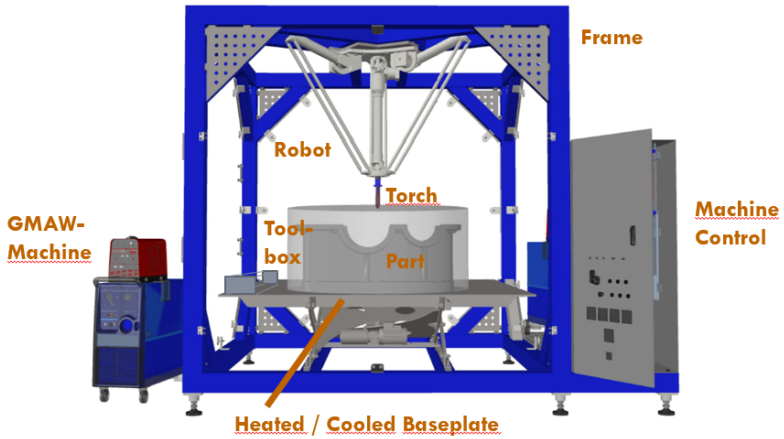
OUR EQUIPMENT

GULLIVER® ADDITIVE TECHNOLOGIES



LILLIPUT® Additive Technologies

D x H: 1800 x 800 mm = 5,9 x 2.6 ft	Maximum size	D x H: 500 x 100 mm = 1.6 x 0.3 ft
4.000 kg = 8,800 lb	Maximum weight	15 kg = 33.1 lb
15 - 20 kg = 33 - 44 lb	Productivity per hour	0,1 – 0,3 kg = 0.22 – 0.66 lb
up to XXL and series	Componentes	XS

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WHAT ARE OUR PROCESSES IN DETAIL

- For Metals:
  - **WASP®** – **W**ire and **A**rc **S**hape **P**roduction, advanced WAAM
- For Plastics:
  - **FDM®** – **F**used **D**eposition **M**odeling
- For all Materials:
  - **Mechanical Processing** – Milling, Grinding, Drilling

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HOW WE DO IT

- Flexible 3D-Additive-Manufacturer for metals with **WASP®** (Wire and Arc Shape Production) as well as plastics with FDM
- In co-operation with our sister company **HLT CWW** special Coated Welding Wires can be produced with optimized material properties on demand
- High material flexibility by using a fast changing system for baseplate and toolbox
- Integration of Quality Cycles for avoiding hot spots and stress zones by a special developed camera system
- Integration of mechanical processes

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OUR TECHNOLOGY FOR METAL

WASP®

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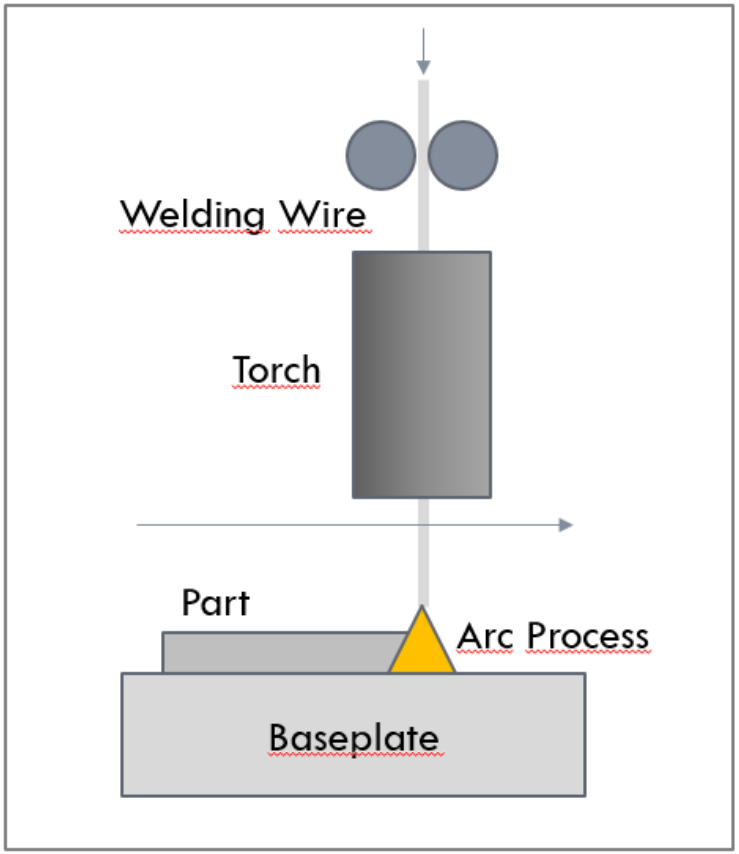
WAAM WAS YESTERDAY – TODAY IS WASP®

Controlled Short Arc Process for Metals – WASP®

Layerwise production process using GMAW-welding with permanently fed wire. The wire is also used as electrode for the process. Depending on the material an inert or active gas is being used.

- Mild Steel
- Aluminium
- Titan
- Nickelalloys e.g. INVAR36
- High Alloyed Steel and Tooling Steel
- Others



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WELDING ISSUES BY USING WAAM

- Concentration of Pure Welding Material
- Different Time-Temperature-Cycles
- Inhomogenious Temperatures

lead to

- Inhomogenious Micro Structure
- Imperfections
  - Cracks
  - Deformations

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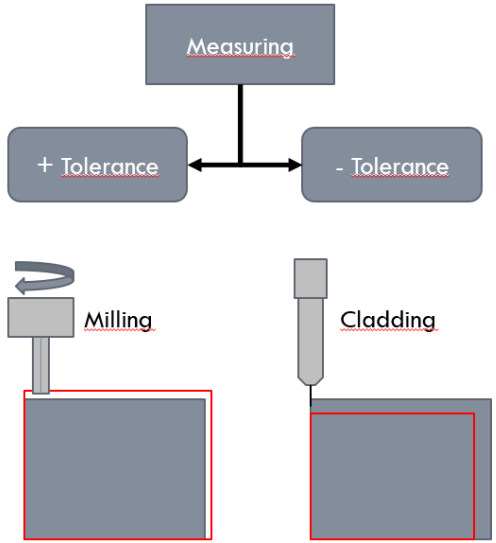
WHAT IMPROVES WASP®

- **WASP®** is an advanced WAAM procedure to get higher quality and better components avoiding imperfections

- **WASP®** improves WAAM by using 2 further quality cycles
  - Correction imperfection of WAAM process
  - Optimizing welding path depending on thermal conditions of the real part

- **WASP®** improves WAAM by using correction processes



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OUR TECHNOLOGY FOR PLASTICS

FDM

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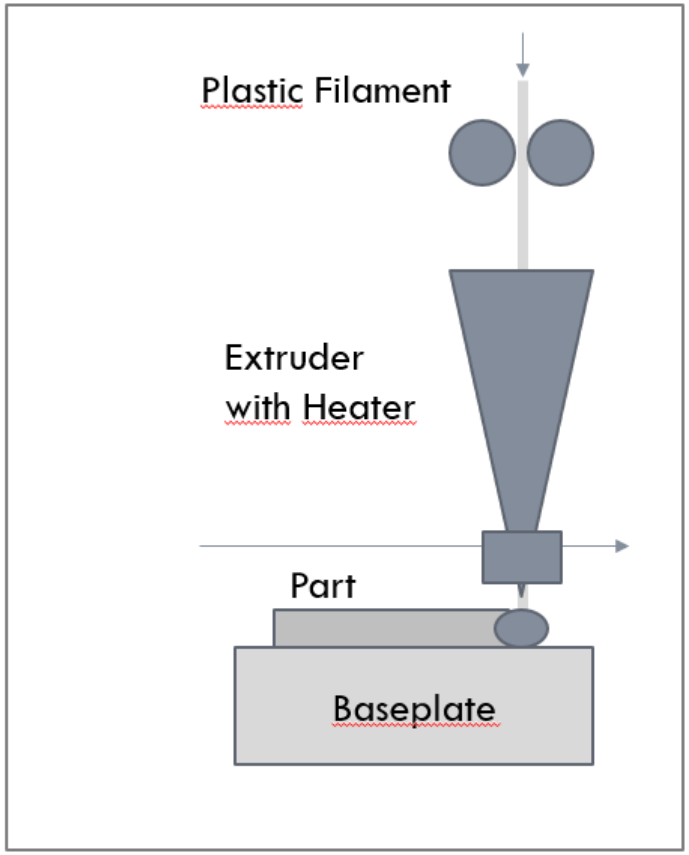
OUR TECHNOLOGY FOR PLASTICS – FDM

FDM for Plastics

A plastic wire (Filament) is heated in an extruder and plastifies being pressed through a nozzle. The layerwise deposition of the Filament let the part grow.

- PLA
- ABS
- PA 6 = Nylon 6
- PA 12 = Nylon 12
- PEEK
- Others



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OUR QUALITY PHILOSOPHY AND CERTIFICATES

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OUR QUALITY PHILOSOPHY

- The GULLIVER is operated via work instructions “Additive Manufacturing – process-no. A 20-14-01” to support the machine operator and to comply with the requirements of DIN ISO 9100.
- The system has integrated measuring cycles to determine the local temperature fields as well as the geometry data. For this purpose, a thermal camera and two cameras are used for geometry measurement.
- The measurement takes place according to a number of layers. In accordance with an implemented correction process (WASP), a geometry measurement is carried out with, if necessary, automated correction.
- Once this process has been completed, the temperature fields are measured with subsequent correction of the welding strategy to reduce temperature peaks.
- Accompanying the automated process, the machine operator uses infrared thermometers to record the surface temperatures at predetermined points and records them in a measurement report.
- After completion of the order, this document is stored for 25 years together with a process accompanying sample and a data carrier with the transient process data and the measured values of geometry sensors and thermal camera.

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OUR CERTIFICATE – EN 9100

CISQ is a member of IQNet

ICIM

Certificate No. / *Certificato N.* 9245/0

WE HEREBY CERTIFY THAT THE QUALITY MANAGEMENT SYSTEM OPERATED BY
SI CERTIFICA CHE IL SISTEMA DI GESTIONE PER LA QUALITÀ DI

ROBAPRO, SE

Certification Structure / *Modello Organizzativo*
CAMPUS

HEADQUARTER AND OPERATIVE UNIT / *FUNZIONE CENTRALE ED UNITÀ OPERATIVA*

Videnska 104, Vestec 25250,
Czech Republic

IS IN COMPLIANCE WITH THE STANDARD / *È CONFORME ALLA NORMA*

EN9100:2018

TECHNICALLY EQUIVALENT TO / *TECNICAMENTE EQUIVALENTE A*

AS9100D - JIS Q9100:2016

FOR THE FOLLOWING ACTIVITIES / *PER LE SEGUENTI ATTIVITÀ*

EA: 18 - 19 - 21

Distribution, development and manufacture of additive coated welding wires, additive manufacturing applications, facilities and technologies for plastics and metals and mobile welding applications with a focus on laser welding and their services.

Allegato: Appendice Funzione Centrale ed unità operative (l'appendice è parte integrante del presente certificato)
Annex: Appendix Central function and operative units (the appendix is part of this certificate)

La valutazione è stata eseguita in accordo ai requisiti della norma UNI EN 9104:001:2013 e del Regolamento Tecnico di ACCREDIA RT-18.
The evaluation has been performed in accordance with EN 9104-001:2013 standard and ACCREDIA Technical Regulation RT-18 requirements.

DATA EMISSIONE *ISSUE DATE*	EMISSIONE CORRENTE *REISSUE DATE*	DATA DI SCADENZA *EXPIRY DATE*
05/12/2018	05/12/2018	04/12/2021

ICIM S.p.A.
Piazza Don Enrico Mapelli, 75 - 20099 Sesto San Giovanni (MI) - www.icim.it

0456CM_02_IT

ACCREDIA — SGQ N° 004 A
Membro degli Accordi di Mutuo Riconoscimento EA, IAF e ILAC
Signatory of EA, IAF and ILAC Mutual Recognition Agreements

SC Schema di Certificazione Settore Aerospaziale

FEDERAZIONE CISQ — www.cisq.com
CISQ è la Federazione Italiana di Organismi di Certificazione dei sistemi di gestione aziendale.
CISQ is the Italian Federation of management system Certification Bodies.

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Certificate No. / *Certificato N.* 9245/0

ROBAPRO, SE

Certification Structure / *Modello Organizzativo*
CAMPUS

Central function and operative unit / *Funzione centrale e Unità Operativa*

Videnska 104, Vestec 25250, Czech Republic	Management, Resources, Manufacturing, Maintenance, Logistics.

Unità Operative / *Operative Units*

HLT GULLIVER UG Dammstrasse 8, 30938 Burgwedel Germany	Project Management, Engineering and Order preparation of additive manufacturing applications, facilities and technologies for plastics and metals.
HLT-CWW GmbH Dammstrasse 8, 30938 Burgwedel Germany	Project Management, Engineering and Order preparation of additive coated welding wires.
Set Ltd. Dammstrasse 8, 30938 Burgwedel Germany	Project Management, Engineering, Order preparation, External Order Fulfilment of mobile welding applications with a focus on laser welding and their services.

Il presente Allegato non è da ritenersi valido se non accompagnato dal relativo Certificato.
This Annex is not valid without the relevant Certificate.

0456CM_02_IT

ACCREDIA — SGQ N° 004 A
Membro degli Accordi di Mutuo Riconoscimento EA, IAF e ILAC
Signatory of EA, IAF and ILAC Mutual Recognition Agreements

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YOUR BENEFITS

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YOUR BENEFITS

- Fast process with a common and proven welding technology over generations
- Big material spectrum:
  - from Aluminum over High Alloyed Steels and Nickel Alloys to Titanium and others
  - from ABS over PLA, PA 6 and PA 12 to PEEK and others
- Modification and optimization of welding wires by using the competence of **HLT CWW**
- Production of components without any molds reduces time and saves costs
- Fast changing system for baseplate and toolbox reduces down time costs

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APPLICATIONS

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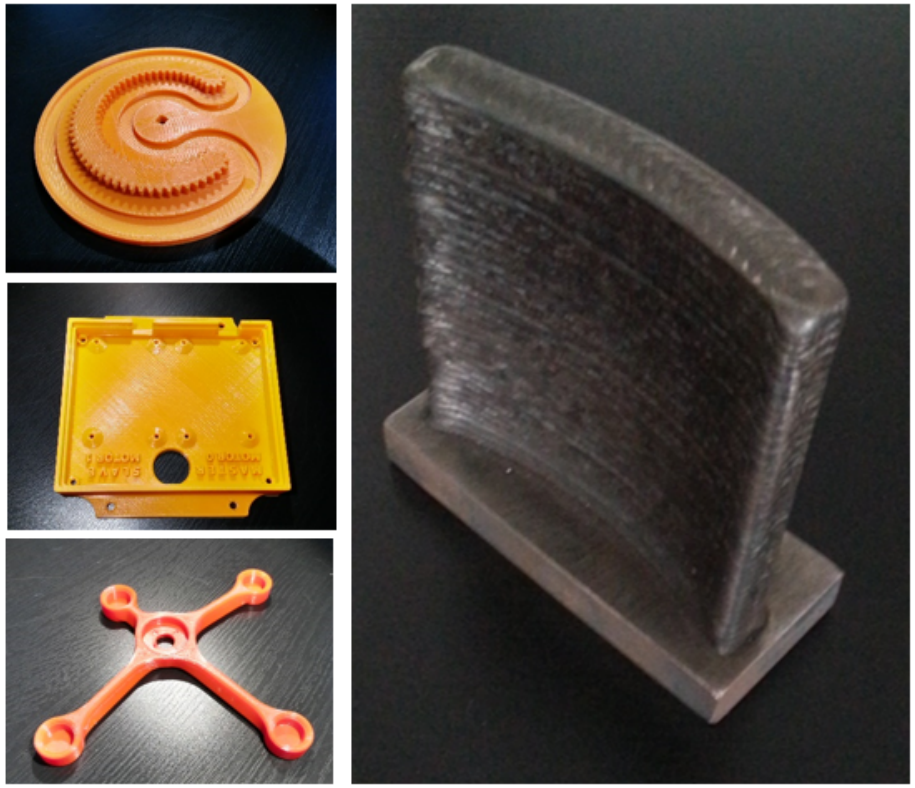
APPLICATIONS

- Tooling
- Prototypes out of metal or plastics
- Small series
- Part reconstruction



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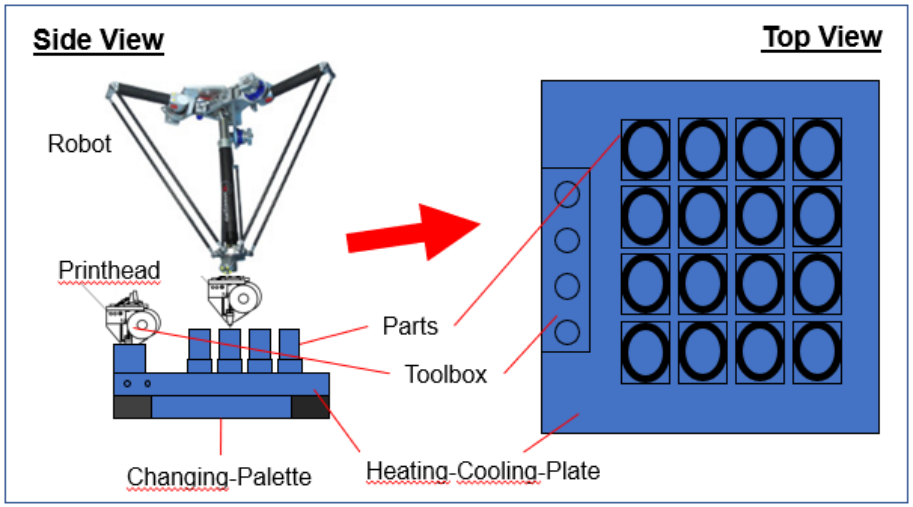
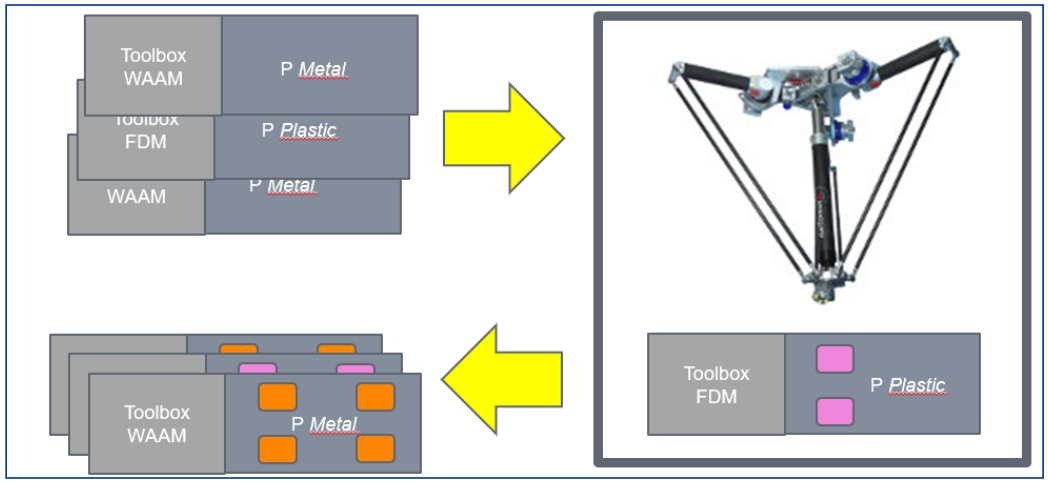
HOW WE PRODUCE SMALLER SERIES



Fast Changing System



Series Production

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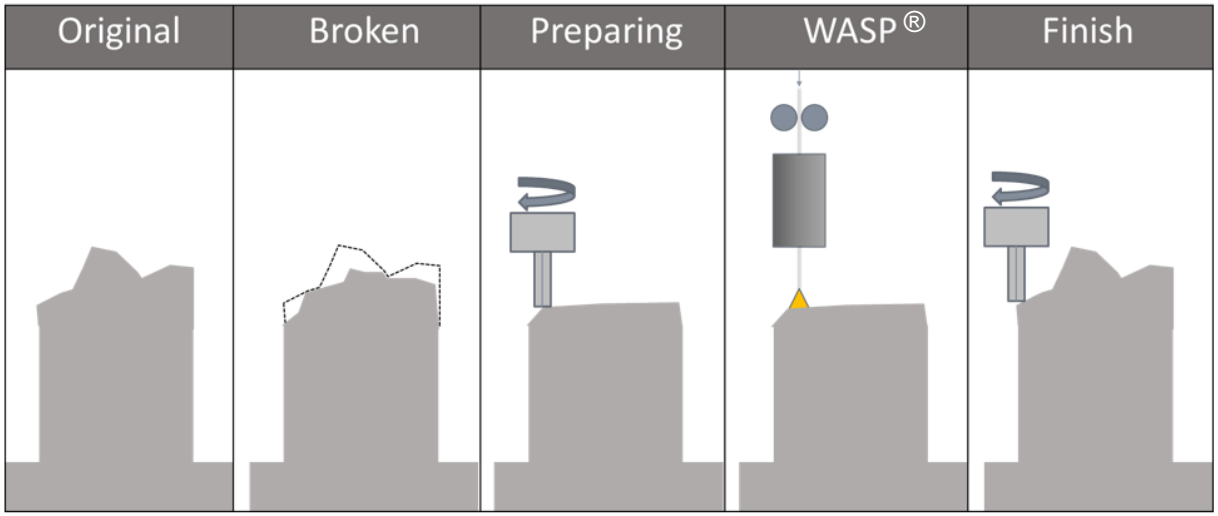
HOW WE CAN REPAIR PARTS PARTLY

- Current situation with damaged parts of old machines and specially manufactured parts:
  - Long delivery time for spare parts
  - High costs

New Opportunity

- Partly repair of broken areas with WASP®
- Scanning in the GULLIVER® printer
- Partly rebuilding directly on broken areas



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HLT CWW – Coated Welding Wires

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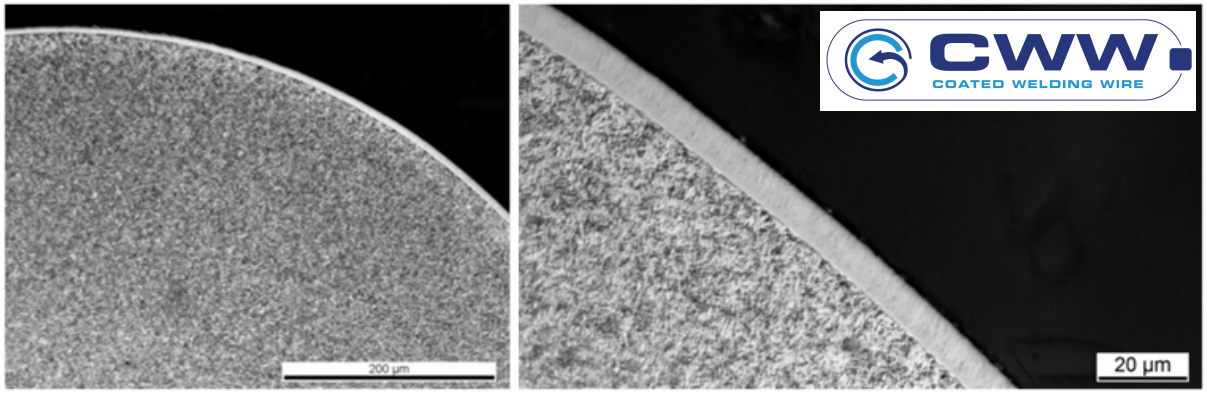
WHY WE IMPROVE THE WIRE BY HVW

Coated Welding Wires opens new opportunities

- Influencing the Arc Length
- Control of Drop Transition
- Reducing the loss of alloying components
- Justification of mechanical properties
- Reducing Grain Size (e.g. Aluminum)



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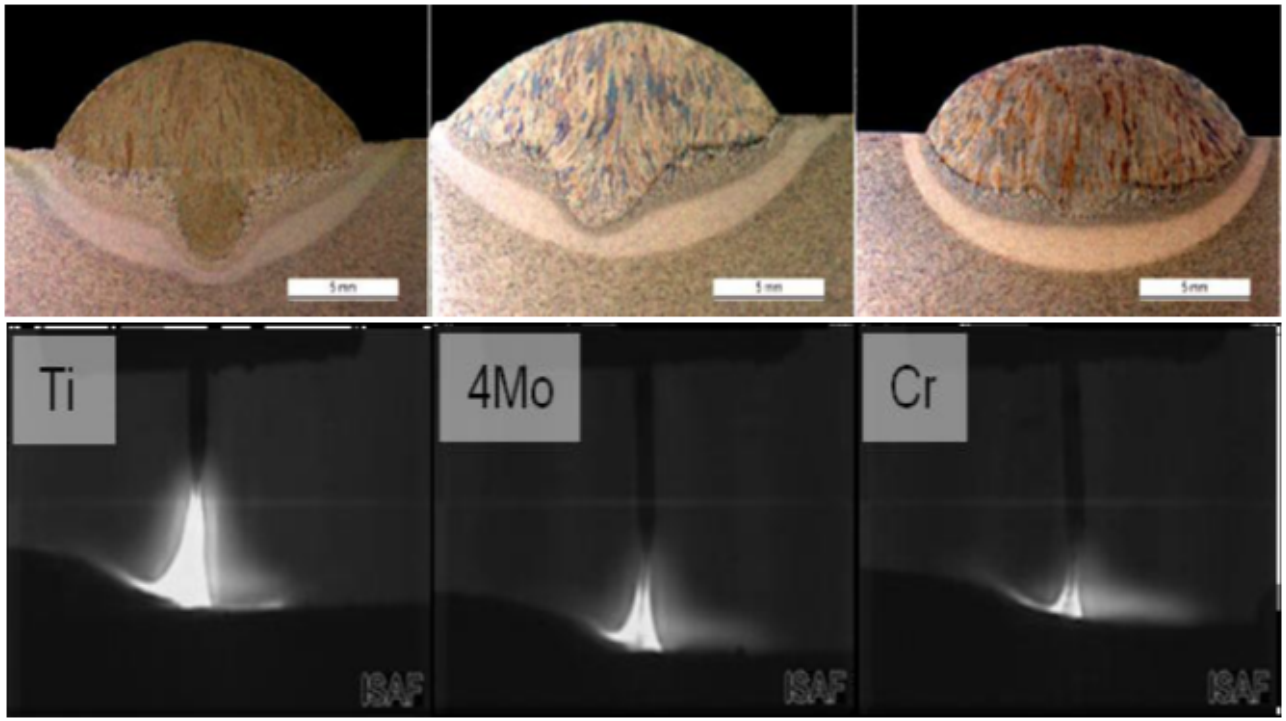
HOW WE OPTIMIZE THE PROCESS

Process optimizing by using CWW-Wires



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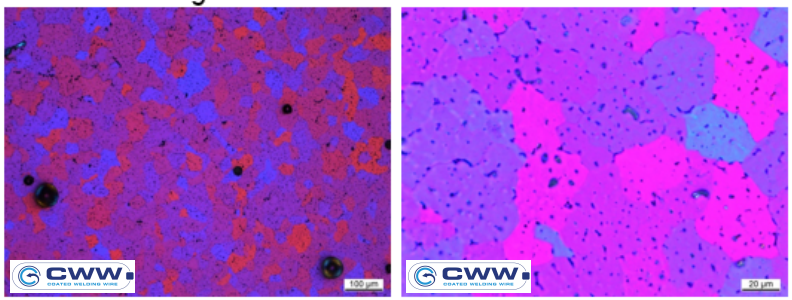
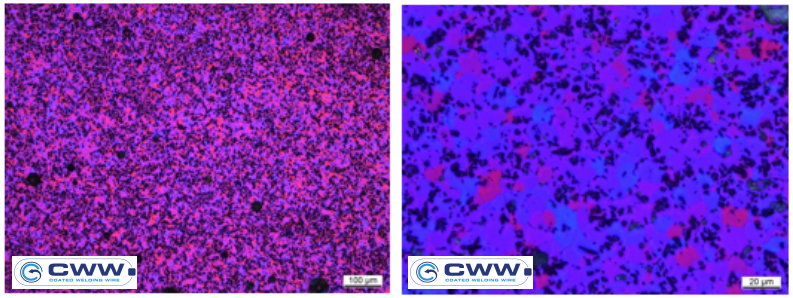
HOW WE DO GRAIN REFINEMENTS

Grain refinements in aluminum base alloys

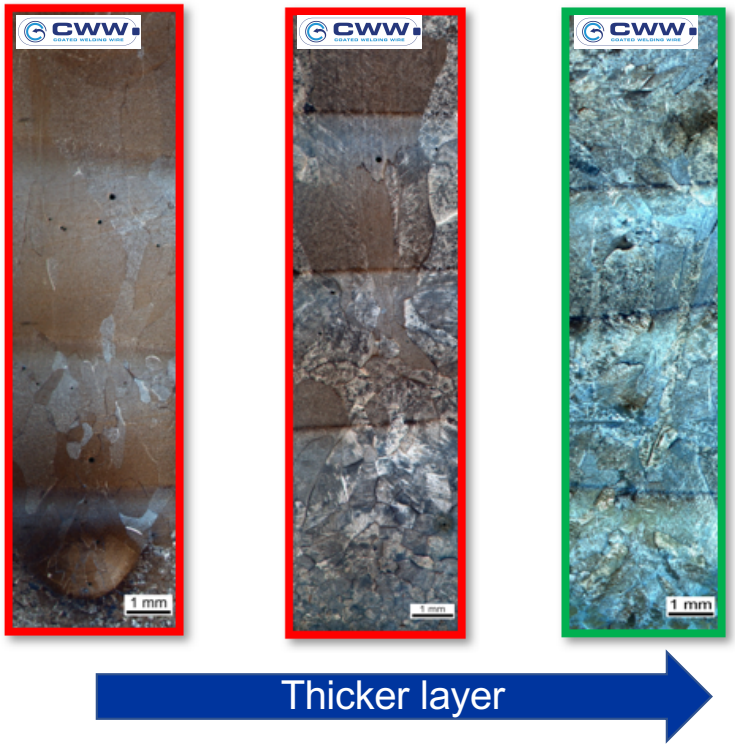
Without Ti-coating



Ti-coated



Grain refinements of Titanium using a CWW-Ti-coating



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Thank you for your attention

and

we would be happy to answer your questions

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CONTACT

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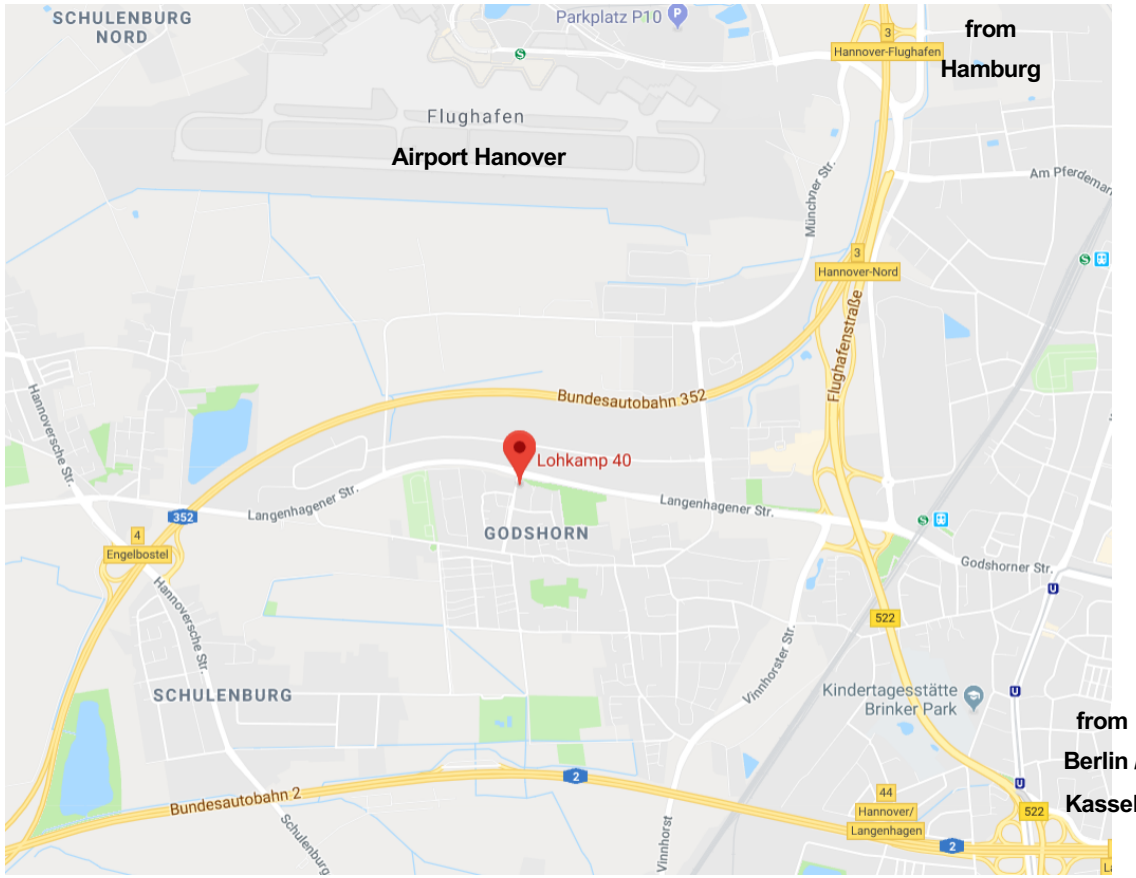

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