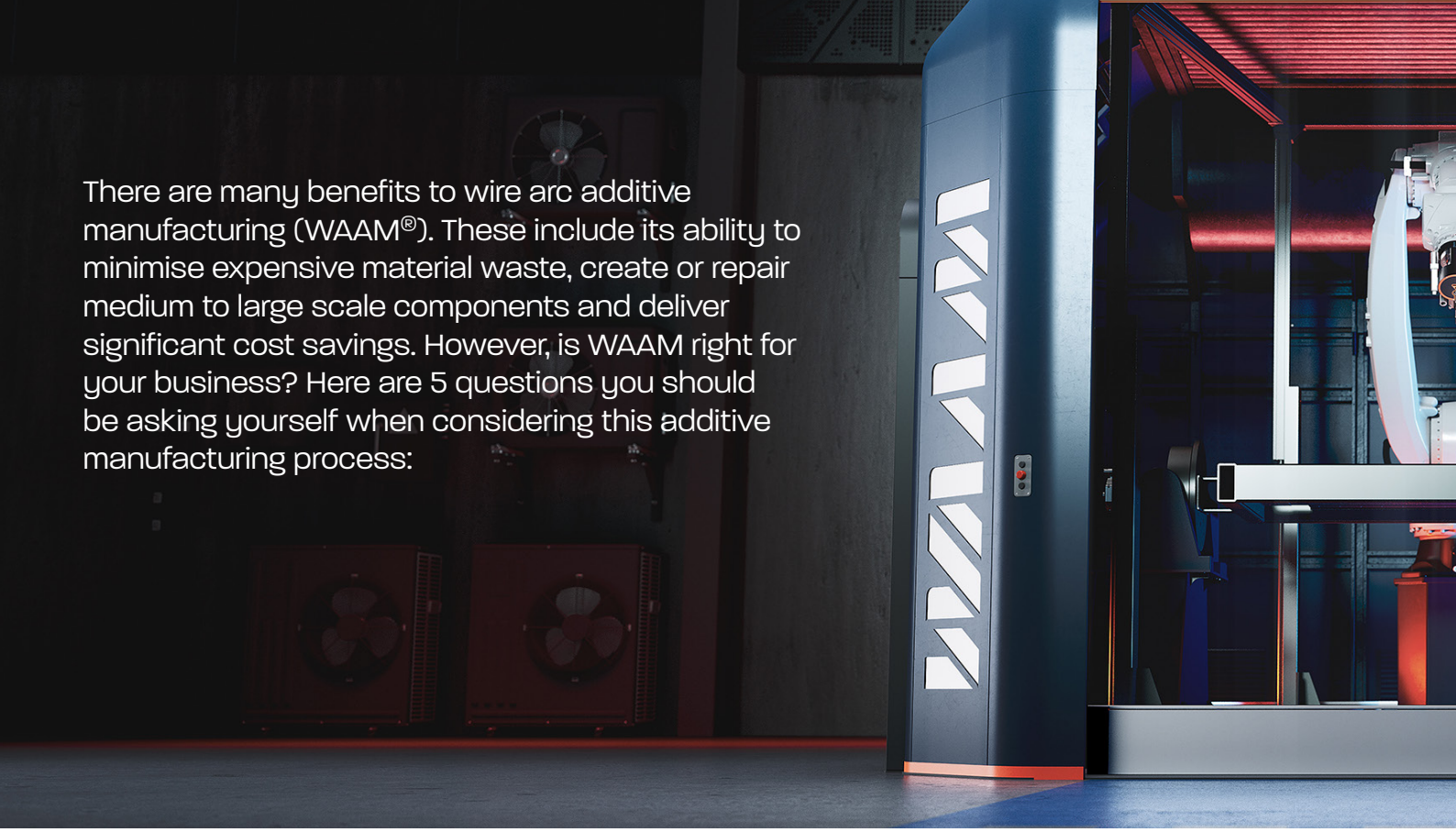
WIRE ARC ADDITIVE MANUFACTURING

Your 5-point guide to WAAM technology

5 questions to see if WAAM is right for you?



There are many benefits to wire arc additive manufacturing (WAAM®). These include its ability to minimise expensive material waste, create or repair medium to large scale components and deliver significant cost savings. However, is WAAM right for your business? Here are 5 questions you should be asking yourself when considering this additive manufacturing process:

1 How big do I want to go?

WAAM provides potentially unlimited build volume since it is not limited by a chamber, especially if local shielding solutions are deployed (J. Ding et al. 2015; Williams 2016; Dilip & Ram 2012). This means that WAAM is suitable for medium-to-large scale prototype and component development and repair. To date, WAAM3D has produced components measuring 6m x 2m (the largest that Laser Powder Bed Fusion (LBPF) can go up to is 1m x 1m).

2 Is cost of part production very important?

Under most circumstances, WAAM has been shown to be a more economic option than machining components from solid. Also, although powder-feed technology, such as Laser Powder Bed Fusion, is capable of producing more complex components due to its higher dimensional accuracy; WAAM has higher deposition rates, enabling it to significantly reduce cost and lead times compared to conventional manufacturing methods (Olakanmi et al. 2015; Williams 2016). Combine this with WAAM's excellent BTF ratio[1] ((BTF) to <2 (Dutta & Froes 2017)) and overall, WAAM has been shown to have a lower part cost (Busachi et al., 2017, Busachi et al., 2018, Colegrove 2010; D. Ding et al. 2015b) than powder-feed technology.

Moreover, although electricity is considered as a relatively minor factor of the total cost, WAAM processes achieve much higher energy efficiencies (70%) than other additive manufacturing processes such as Electron Beam Powder Bed Fusion (EBPBF) (20%) and laser technologies (5%)[2].

3 What material am I wanting to use?

The WAAM process allows a wide variety of metal feedstocks to be used. It avoids the expensive waste associated with machining materials such as titanium and can create structures in a range of materials (from titanium, aluminium, refractory metals, steel, bronze and copper to Invar®, Inconel® and magnesium). WAAM also creates structures with exceptionally high levels of mechanical integrity that have a high yield strength, with tensile strength and elongation values that can be even better than those of comparable forged parts, especially thanks to WAAM3D's patented in-process addition of cold-work.

WAAM3D is also highly experienced at developing new chemistries that match the required process; with a series of signature aluminium based alloys with the addition of scandium and other niche elements that work extremely well with the WAAM process. Crucially WAAM3D's wire making process has been fine-tuned to achieve better wires in terms of their geometrical stability and surface characteristics, together with larger spools and more controlled packaging.

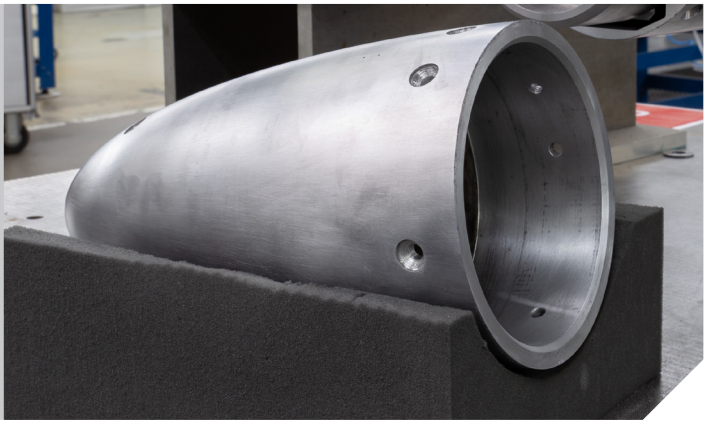
4 Is sustainability an issue?

With waste reduction a key benefit of WAAM, it is an attractive additive manufacturing technique when sustainability is a priority. WAAM has been shown to be cleaner and more environmentally friendly (D. Ding et al. 2015b) than other powder-feed additive manufacturing technologies. Also, it offers higher material efficiency of the process (90% - 100%) (Colegrove 2010; D. Ding et al. 2015b), due to its excellent buy-to-fly (BTF) raw material reduction. However, it is worth remembering that finish-machining might be required (D. Ding et al. 2015a; S. W. Williams et al. 2016b).

5 Am I looking for complex or more simple component creation?

WAAM exploits the power of TIG, MIG and plasma welding technologies to create less complex, medium-to-large scale three-dimensional metal structures. With this in mind, WAAM is ideal for lower to medium levels of component complexity (Colegrove 2010). If higher degrees of complexity are required then powder-feed technology, such as Laser Powder Bed Fusion (LPBF), is recommended (Colegrove 2010). WAAM delivers lower accuracy levels than powder-feed technologies (Szost et al. 2016; Zhang et al. 2016, Gibson et al. 2015), so is not recommended for projects where high levels of accuracy are essential.

WAAM offers manufacturers a wide range of benefits. If medium to large-scale components or repairs of moderate complexity are required, that deliver in terms of both reduced costs and lead times, then why not find out more from WAAM3D?



Sources:

1 The buy-to-fly ratio is the ratio of the mass of the starting billet of material to the mass of the final, finished part.

2 Garcia-Colomo, Alberto & Wood, Dudley & Martina, Filomeno & Williams, Stewart. (2019). A comparison framework to support the selection of the best additive manufacturing process for specific aerospace applications. International Journal of Rapid Manufacturing

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