

FRICTION STIR WELDING – POTENTIAL USED IN MARINE APPLICATION

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PPNS
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WEBINAR IV



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FUSION WELDING PROCESS



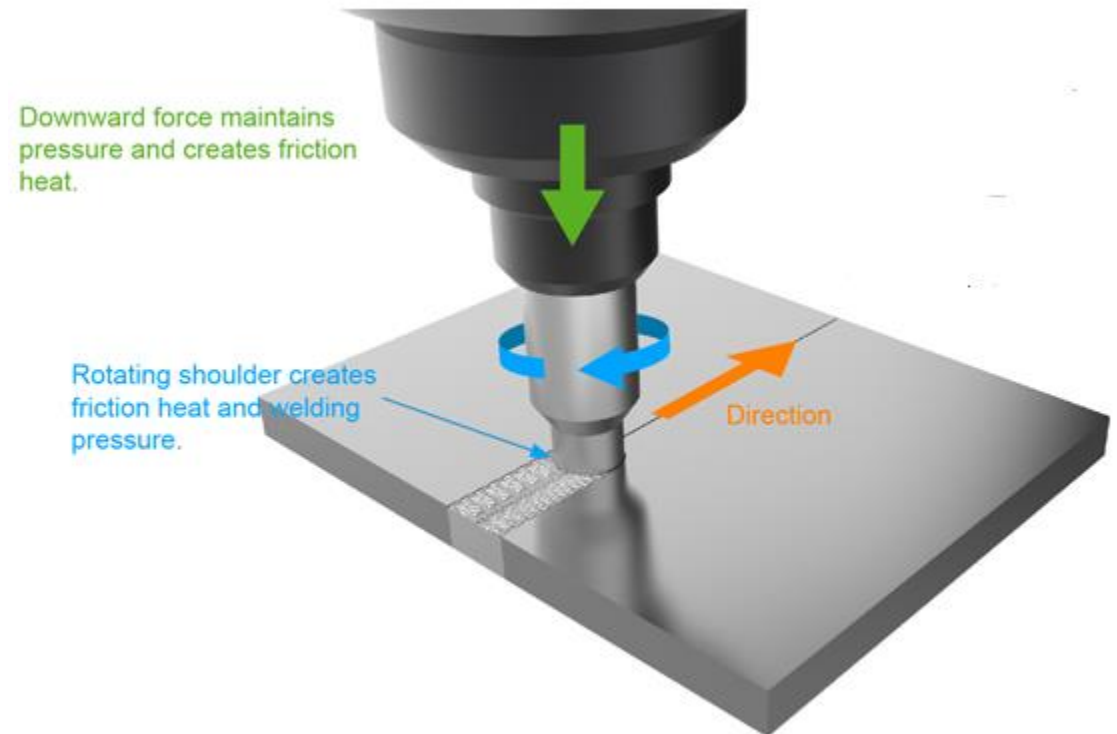
DISADVANTAGES: ARC RAYS, FUMES, SHIELDING GAS OR FLUX COATED ELECTRODE, FILLER METAL, MULTIPLE RUNS

FUSION WELDING vs FSW (SOLID –STATE WELDING)

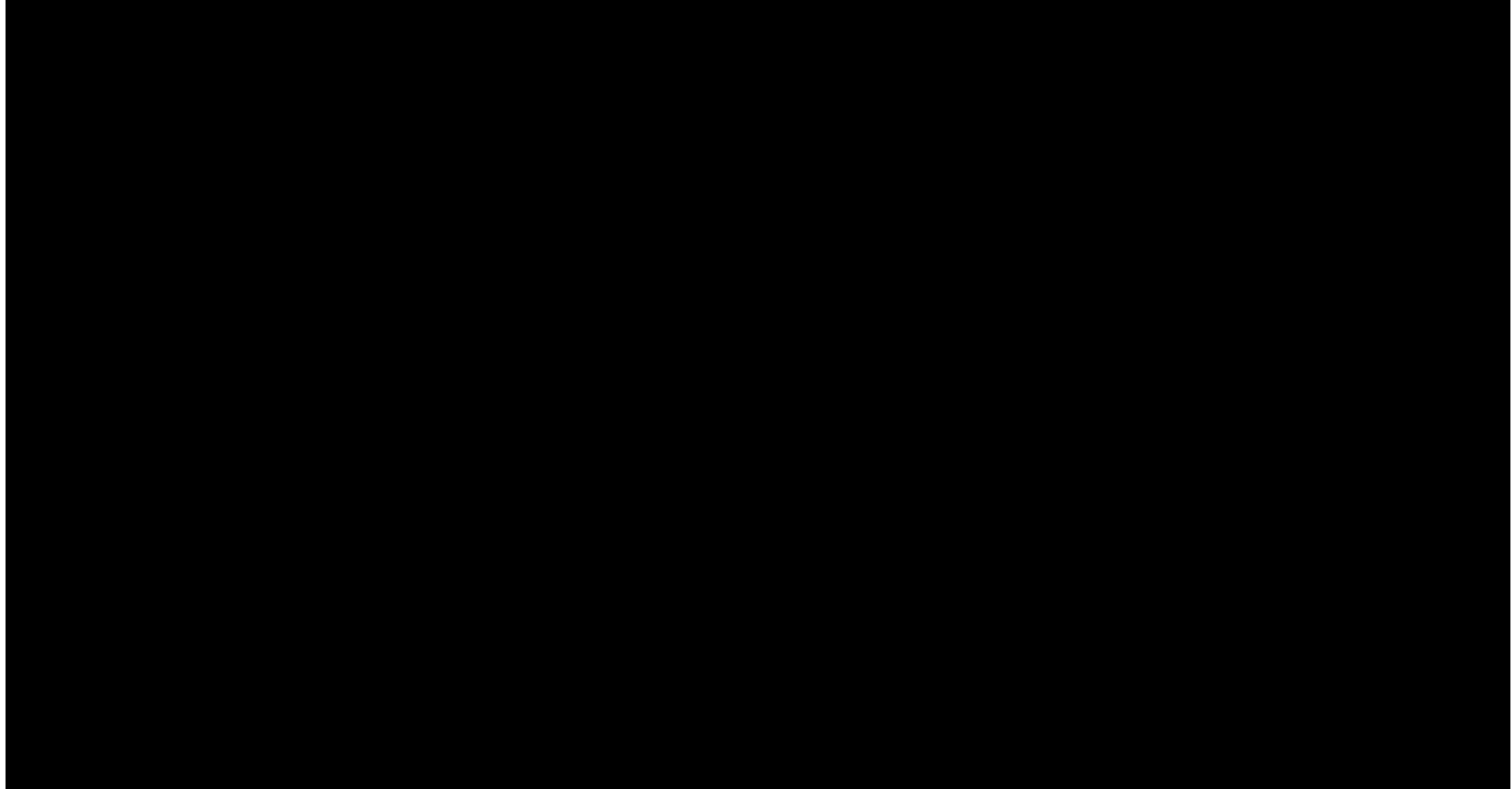
- Fusion welding - joining processes that rely on MELTING to join materials



- Solid-state welding – joining that occur below the melting point of materials



BASIC CONCEPT - FSW



FSW – PIPE JOINING



ADVANTAGES Vs DISADVANTAGES

- **Advantages**

- Single run process
- No edge preparation, closed butt joint.
- No arc
- No fumes
- No filler metal required
- No shielding gas
- Less/no distortion even for long weld
- Excellent strength
- Caters ferrous and non-ferrous materials
- Non-consumable tool (>1000m)
- Can operate in all positions
- No post weld cleaning required
- Excellent weld appearance

- **Disadvantages**

- Customised fixture is required.
- High capital cost for initial setup
- Exit hole
- Not suitable for irregular shape

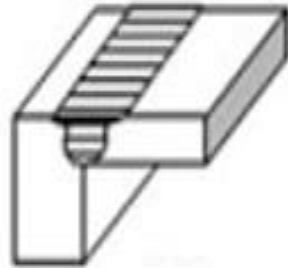


Double sided friction stir weld in 75 mm thick aluminium plates produced at TWI

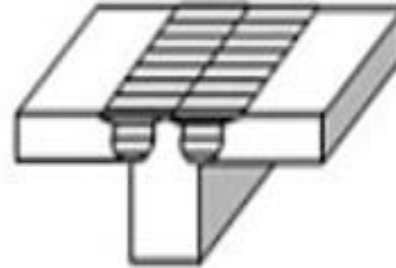
TYPES OF FRICTION STIR WELDED JOINTS



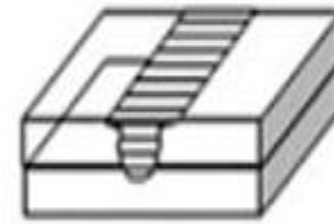
Butt joint



Edge joint



T-butt joint



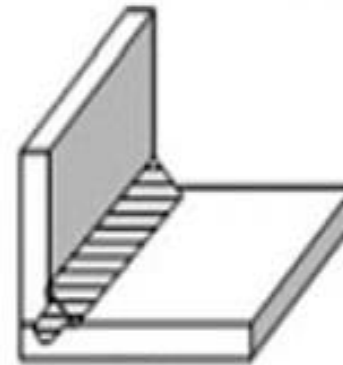
Lap joint



Multiple lap joint

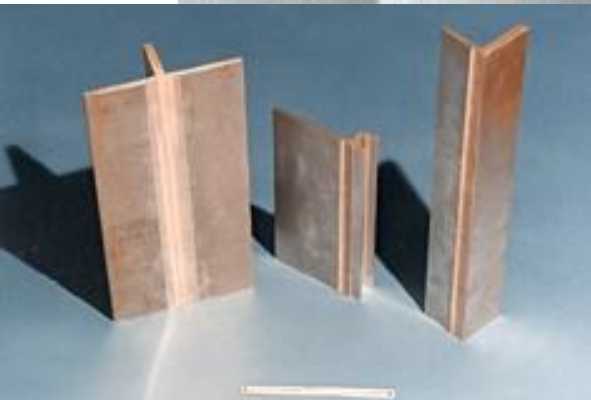
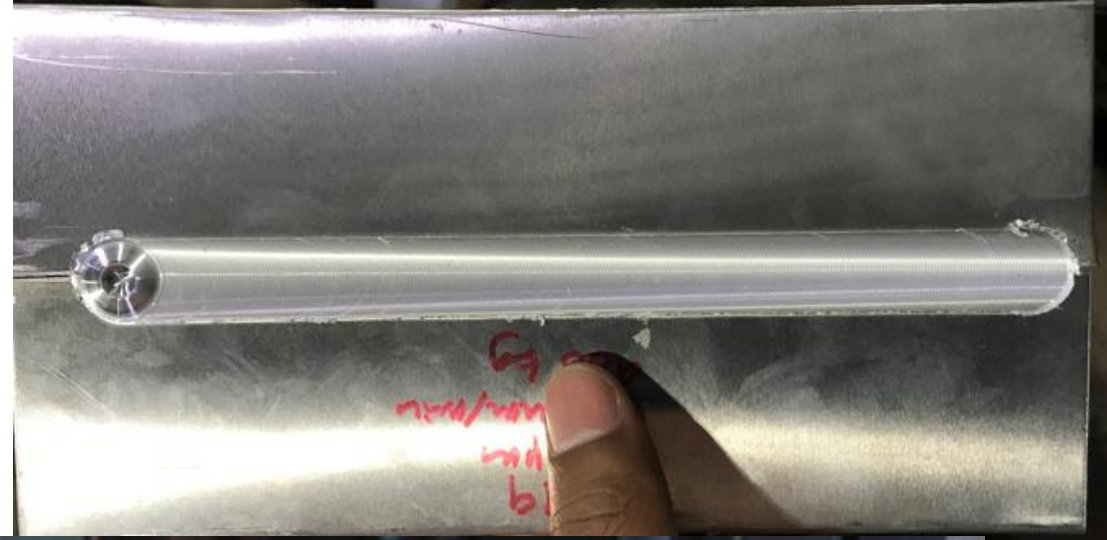


T-lap joint

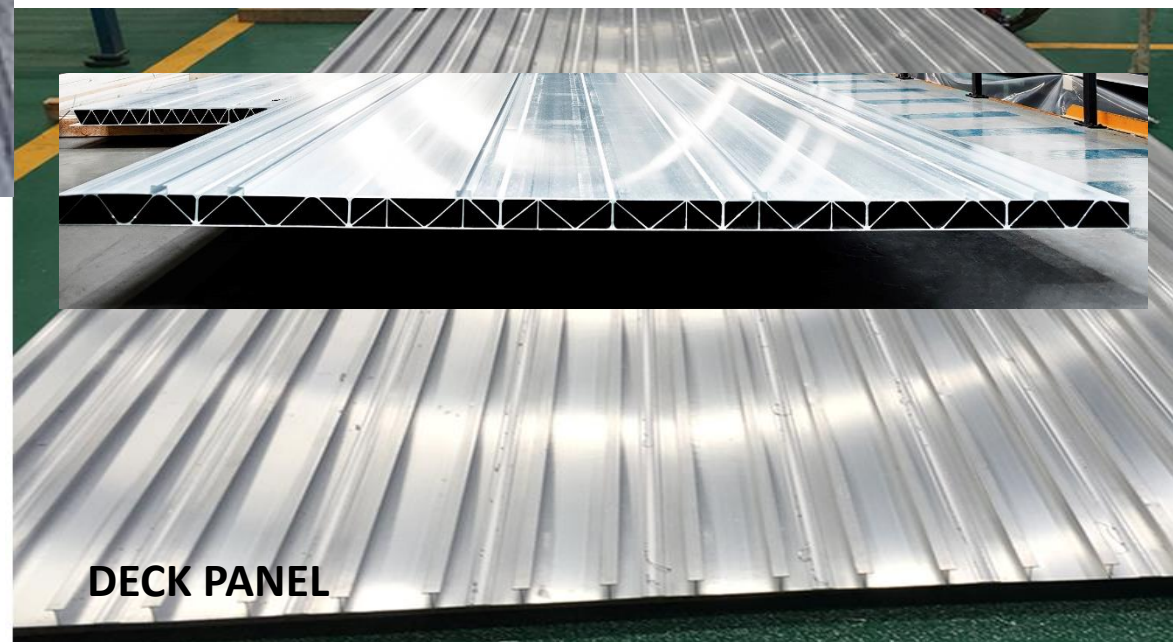
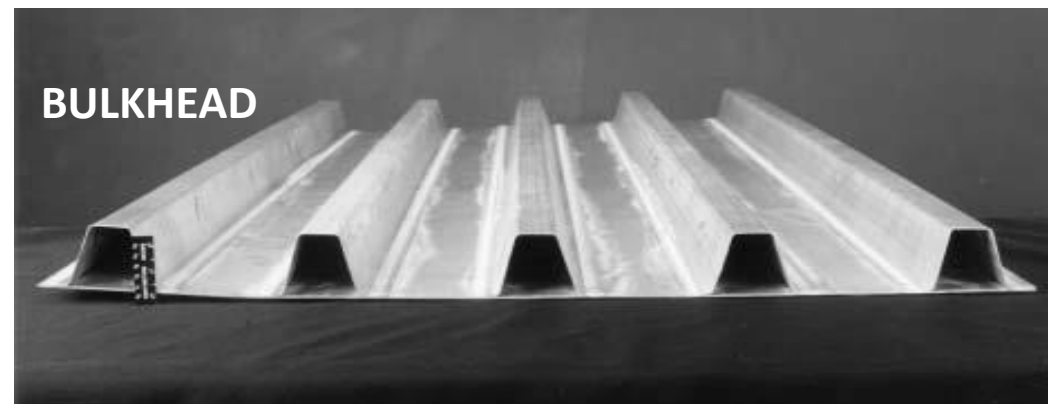
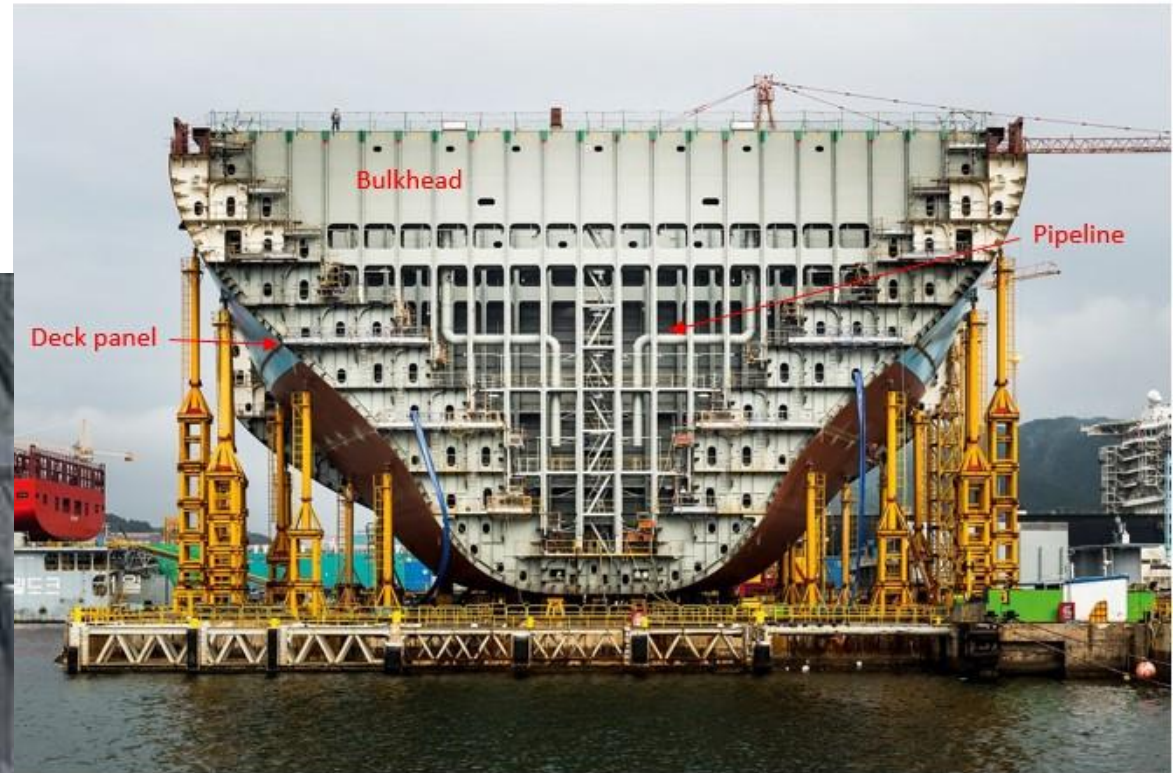


Corner joint

FSW – PLATE & PIPE



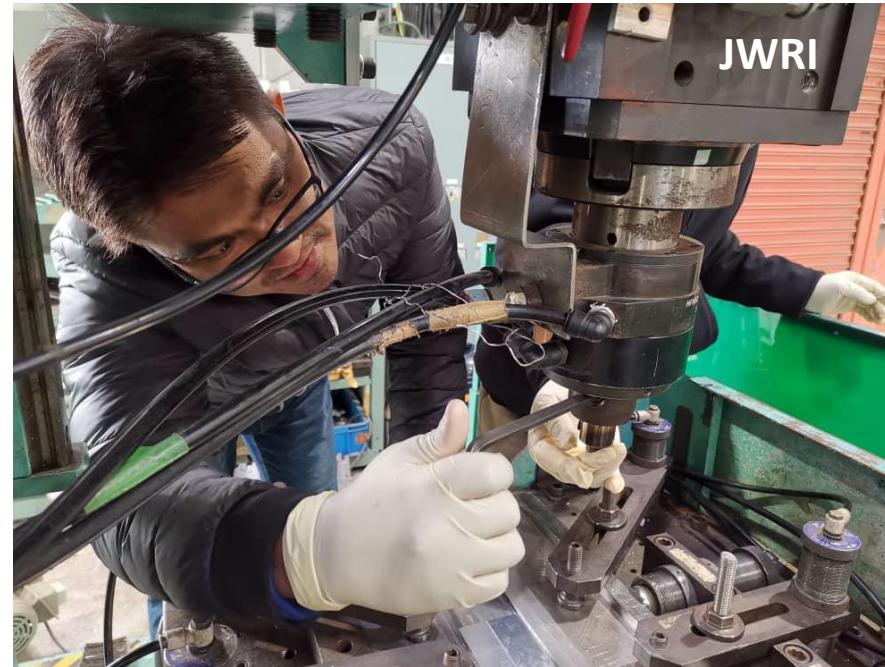
FSW APPLICATIONS



FSW MACHINE



FSW MACHINE



MODIFICATION OF MILLING MACHINE

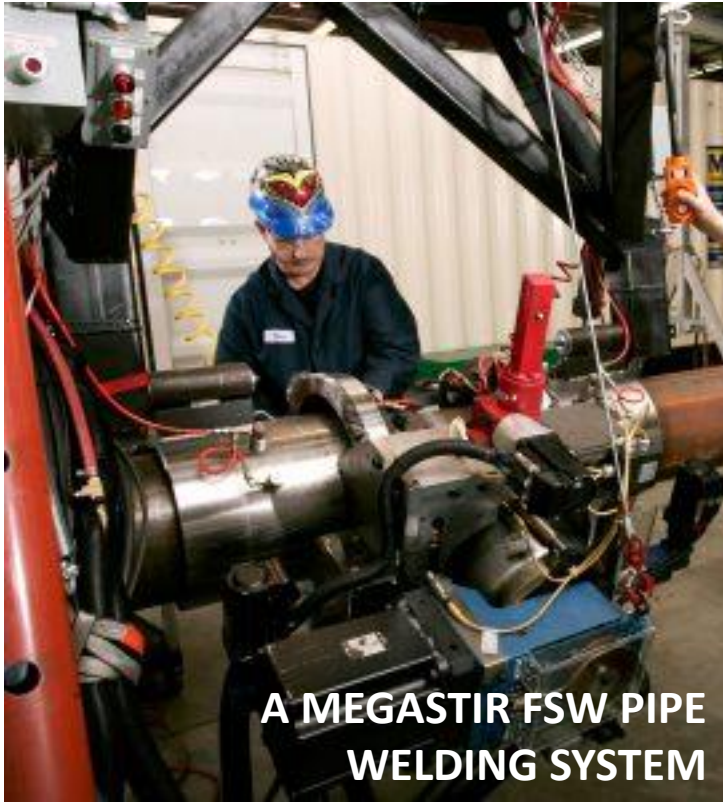


ENDMILL

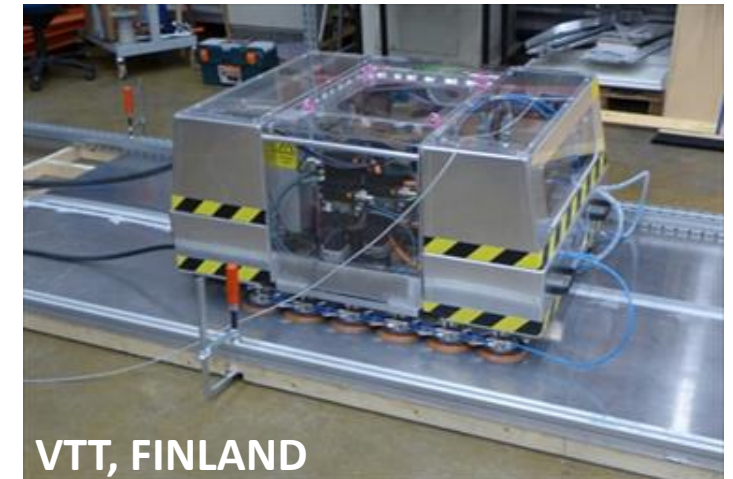
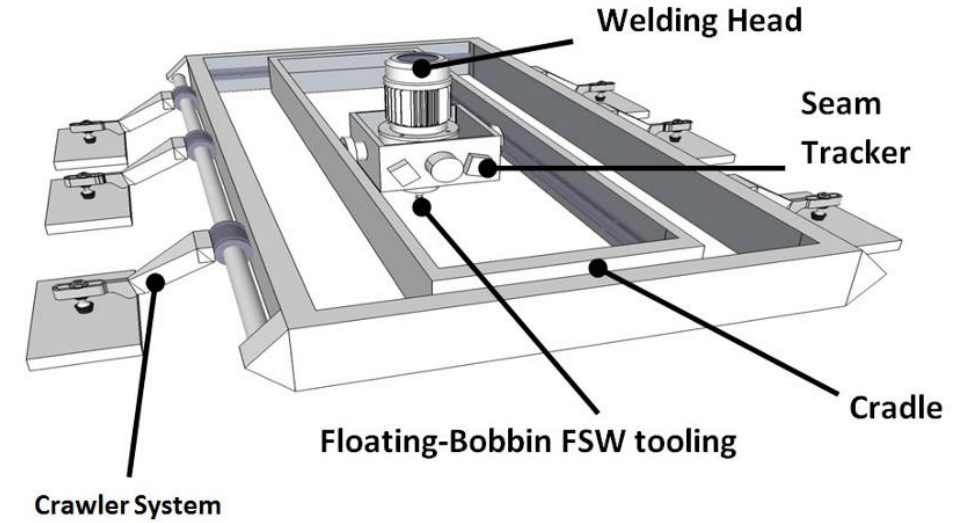


FSW TOOL

WORLDWIDE FSW DEVELOPMENT



EU MOBILE-WELD PROJECT (EURO 1.5mill)



SUPPLIERS/COMMERCIAL USERS





'The World' contains friction stir welded decks



'The Boss' by RFI in Australia



Super Liner Ogasawara' with 42.8 knots max speed by Mitsui Engineering & Shipbuilding (MES) in Japan



Houbei class new-generation stealth missile fast attack craft

INSPECTION METHOD AND STANDARD

• INSPECTION METHOD

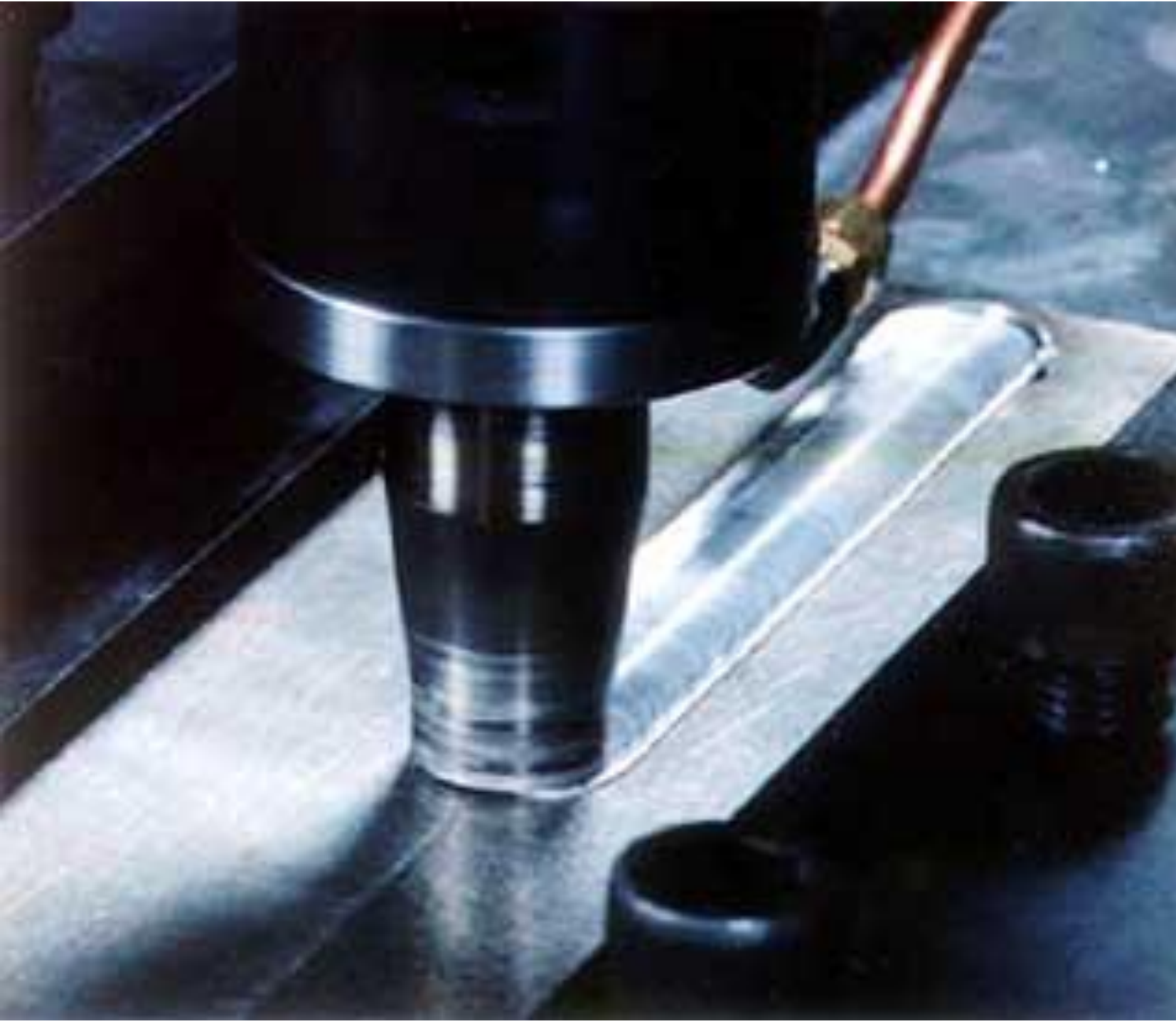
- Visual inspection + Weld gauge
- Ultrasound Phased Array Inspection

• ACCEPTANCE STANDARDS

- **American Bureau of Shipping (2011)** : The Approval of FSW in Aluminium.
- **ISO 25239 (2011)**: Friction stir welding – Aluminium
- **AWS D17.3 (2016)**: Specification for Friction Stir Welding of Aluminum Alloys for Aerospace Applications

CLOSING REMARKS

- FSW is a good alternative welding method for marine application especially in term of pre-fabricated parts.
- This could improve the quality of welded parts to directly benefit the end-user safety and investment.



Thank You

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