



Friction Stir Welding for Production

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Contents

FSW process from laboratory to production

Production Application areas in focus

- Custom built – SuperStir™
- Modular – Legio™
- Robotic – Rosio™



Friction Stir Welding

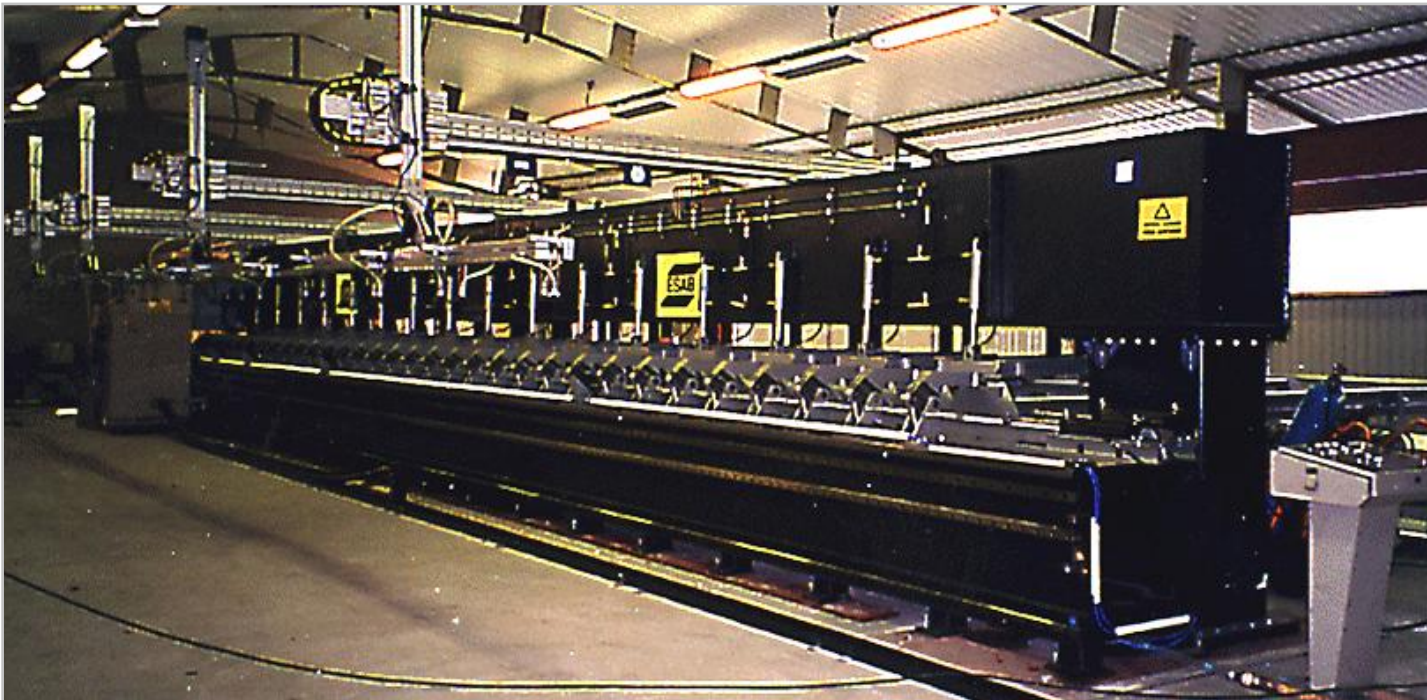
History

- Friction Stir Welding invented by TWI 1991.
- TWI ran a group sponsored project in 3 phases to develop the new Friction Stir Technique.
- ESAB joined the first phase in 1992.

Friction Stir Welding

Historical perspective

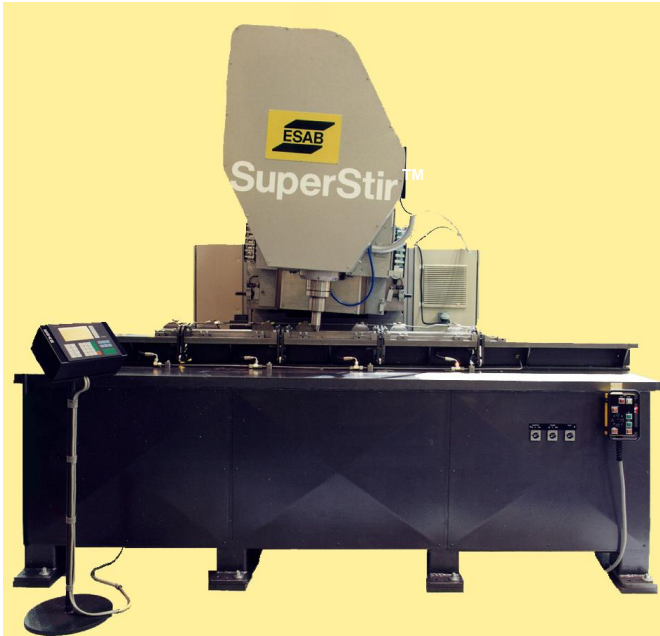
- The first purpose built FSW machine manufactured by ESAB 1996.
- Today ESAB has delivered over 40 purpose built FSW ESAB machines.



Friction Stir Welding

Historical perspective

- Machines are designed for heavy duty welding of small workpieces.
- Thickness 1.6-15(75) mm
- Weld length up to 2 m
- FSW welding for development and customer testing as well as prototype production.



**Manufactured for use in ESAB
lab sold to the Boeing Company
Laboratory (now at AJT) US**



**ESAB Lab
in Laxå Sweden**



Rosio™

Robot Friction Stir Welder

Robot Friction Stir Welder Rosio™

System overview



- ESAB Rosio system based on a Standard industrial robot;
ABB IRB 7600-500
Established solution, lower cost, flexible work space.
- Integrated welding equipment;
Increase capacity, maximized stability.
- Teach in programming
or fully integrated Offline programming
Path planning and simulation based on
CAD models





Legio™

Friction Stir Welder

Modular Friction Stir Welder

ESAB LEGIO™



The first FSW machines where purposed built

- The experience converted to a Modular system:
 - Heads in different sizes
 - Carrier in different sizes
 - Control system designed for FSW
- Well tested design gives a high **reliability**
 - Important for production machines



Application area

R&D LEGIO™-system



Cewac, Belgium

5/3ST



SLV, Berlin, Germany
and CSM, Italy

3UT



5U



IST, Portugal

3U



Khrunichev State Research and
Production Space Center, Russia



SuperStir™

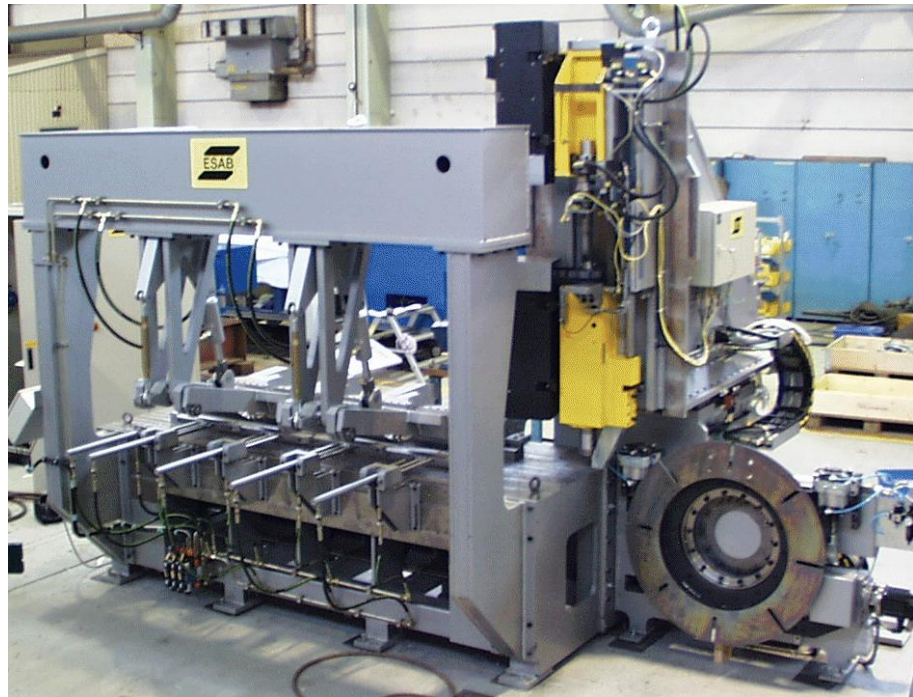
Friction Stir Welder

Application area

R & D for Aerospace



- For longitudinal welding, 2D and circumferential welding.
- Hydraulic clamping.
- Also with Bobbin tool head



Delivered to **EADS CCR**
and
Institute de Soudure in France

Application area

R & D and panel production

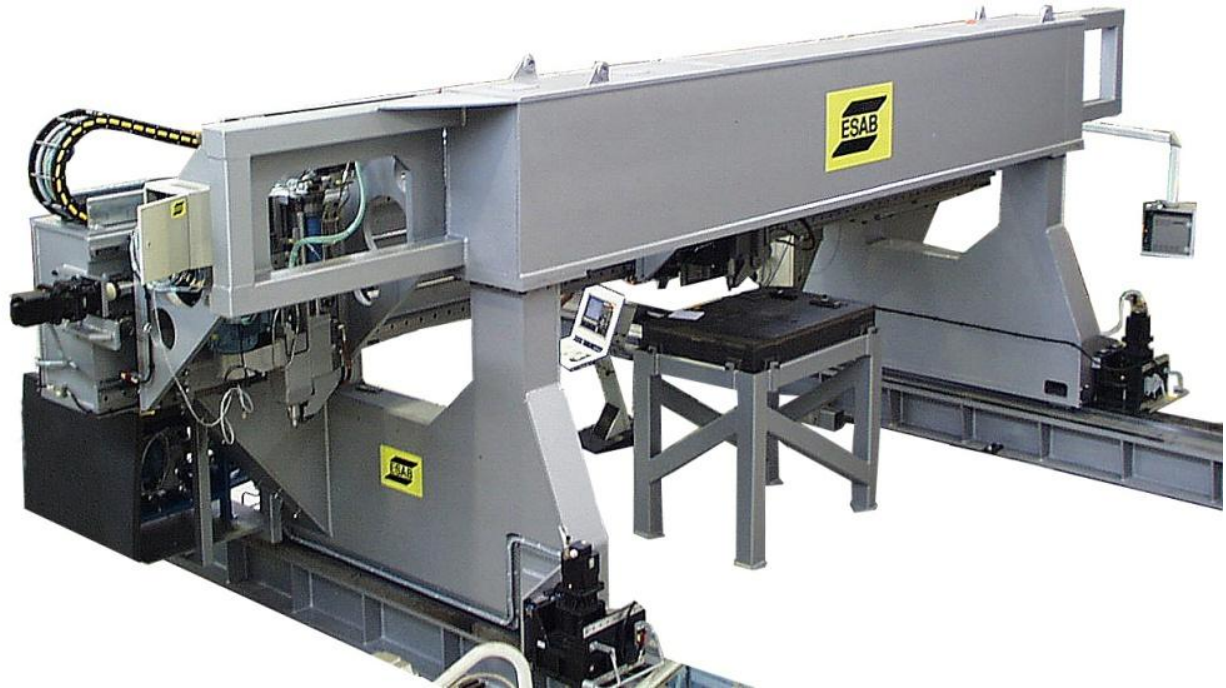


Gantry Machines

Equipped with two sizes of welding heads.

3D-welding together with floor-mounted manipulators.

Offline or teach-in programming



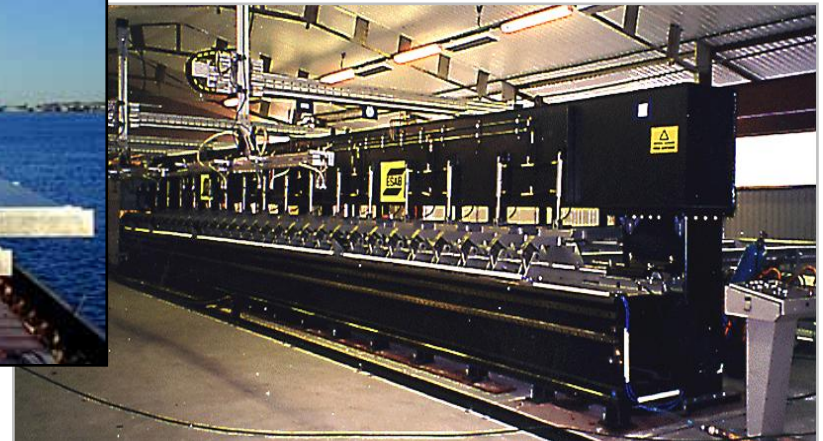
Delivered to **TWI**, UK for laboratory purpose and prototype work

Application area

Maritime/Railway/Subway cars



- First with FSW production, Marine Al, Norway, 1996.
- Mainly Al 6xxx and 5xxx series.
- Panels and extrusions for hulls, platforms, etc.



Application area

Panel production Maritime/Railway/Subway cars

Joining of extrusions at Sapa in Finspång Sweden



Universal panel welding machine
From single skin or double skin extrusions.
Equipped with 3 welding heads

Max. welding length is 14.5 m

Application area

Automotive/Component production



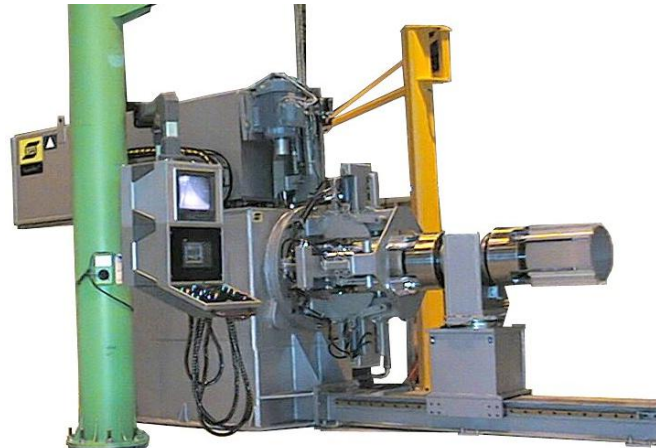
Sapa Finspång, Sweden

This welding machine is designed for straight welding of double skin extrusions using two heads.



Hydro Aluminium Profiler a.s, Norway

Plant for welding of medium size electric motor housings

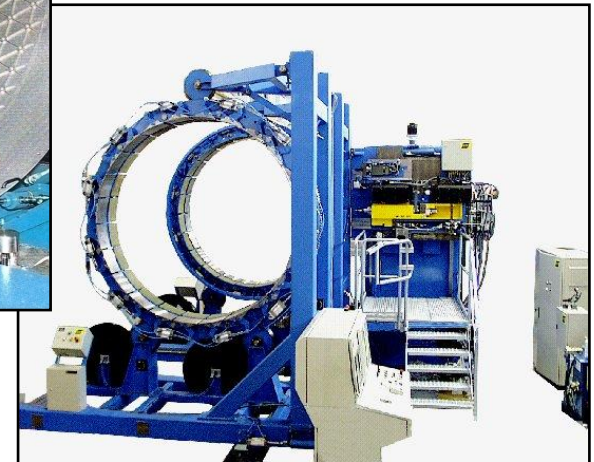
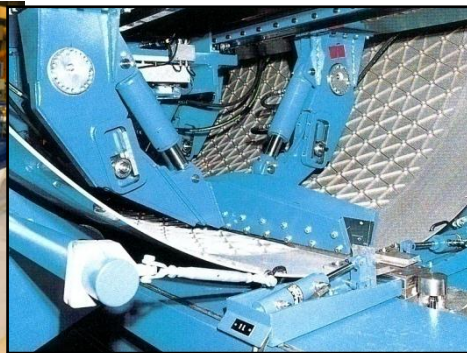


Application area

Aerospace/Transport

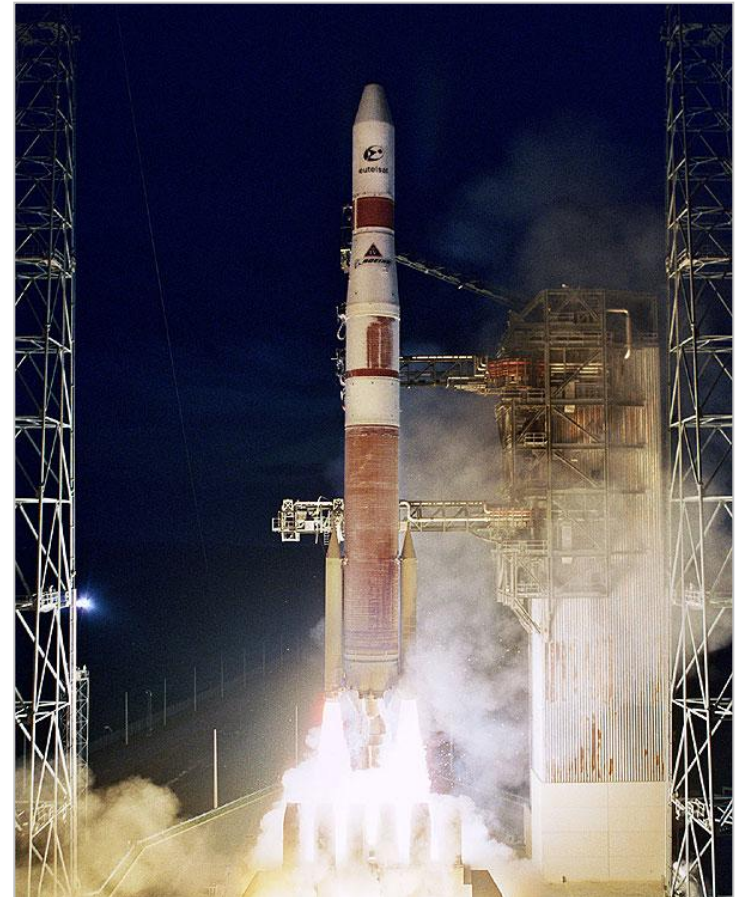


- Commercially successful. Welding since 1998.
- Adopted by both space and aircraft industries.
- Typically 2xxx and 7xxx series.
- Welding of fuel tanks, panels, stringers, etc.



Friction Stir Welding used in the Aerospace Industry

Cape Canaveral Air Force Station,
Fla., Nov. 20, 2002



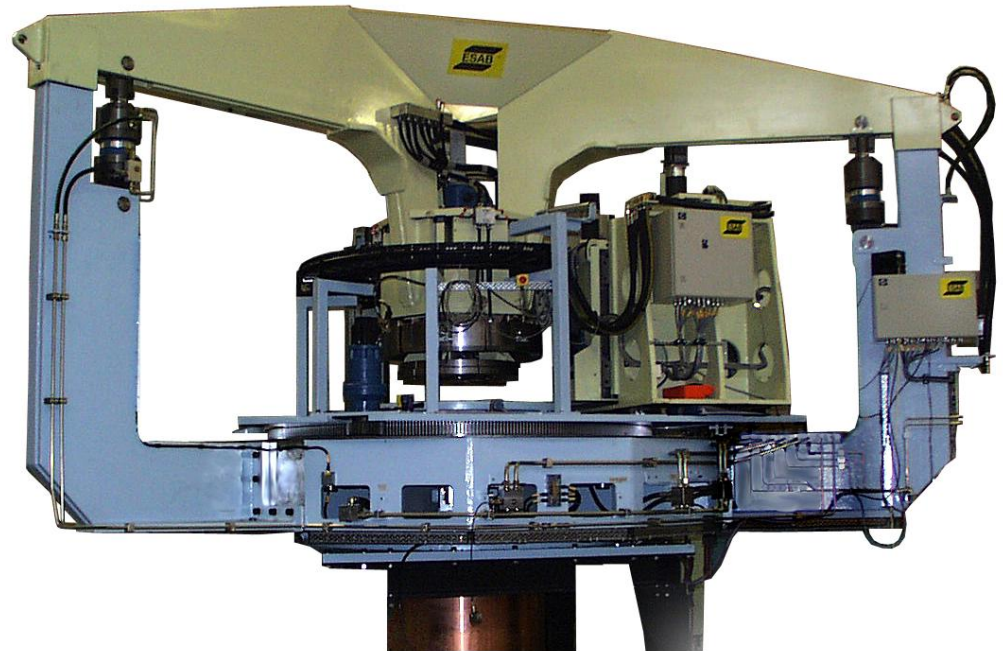
ESAB SuperStir™

Special machines for one purpose only



Installed at [SKB](#), Sweden
(Swedish Nuclear Fuel and Waste Management Co)

FSW 8CA ESAB SuperStir™
plant is designed to produce
50 mm thick seal welds on a
copper canister



ESAB SuperStir™

Aerospace Industry (Rocket fuel tanks)



- For the SLS project to be delivered to Boeing/NASA, USA

The **Vertical Assembly Center (VAC)**, where domes, rings and barrels will be joined together to complete the tanks or dry structure assemblies.

The VAC, measuring 170 feet (52 m) tall 78 feet (24 M) wide, is one of the world's largest welding tools. It is anticipated to be completed in 2014

<http://www.nasa.gov/centers/marshall/news/news/releases/2013/13-080.html>
<http://weldingdesign.com/processes/largest-welding-machine-planned-build-new-nasa-rocket>



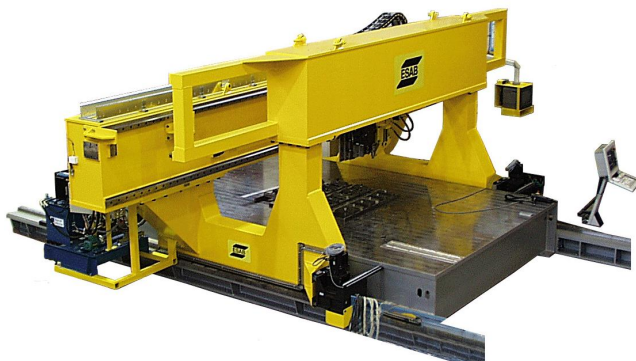
FSW from ESAB

Conclusion



Machines in Production

- Started with Customized machines 1996 **SuperStir™**
- Standardized module concept since 2003 **LEGIO™**
- Robotic solutions 2009 **Rosio™**





Thank you for your attention

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