Evolvable Assembly Systems
Towards Open, Adaptable and Context Aware Equipment and Systems

EPSRC Grant EP/K018205/1

S Ratchev, A Popov, D Axinte, P Benardos, N Krasnogor, B Logan, S Sharples, E Kelly, D Sanderson, J Chaplin, L De Silva and O Bakker
Towards collective emergence of products, processes and manufacturing systems

• Vision: A *new platform for open, adaptable, context-aware and cost effective production* based on *multi-agent swarm intelligence and self-adaptation*.

• Some of the key research questions:
  – What is the **optimum manufacturing system morphology**?
  – How can we support distributed hierarchical decision-making?
  – How can we achieve **resilience, robustness and adaptability**?
  – How will the human operators participate in **hybrid decision-making**?
Current progress

- A generic architecture and semantic model for future evolvable systems.
- Resource object-based morphology
- Swarm intelligence behaviour model and real-time awareness methodology
- Initial model instantiations at fixture, device, and workstation levels
Evolvable Assembly Systems
Experimental testbeds

Plug and Produce Assembly Cell
- Plug and Produce hot-swap modularity
- Twin-Robot setup for resource failure testing
- Remote access to simulate lights-out operation

SMART Demonstrator
- Complete assembly demonstrator: feeding, transport, testing, storage, labelling, packing, palletisation.
- Agent communication environment.

FA³D
- Data-driven: networked resources, intelligent agent control, RFID tagging.
- Uncertainty aware fixturing.
- Rapid reconfiguration.
- Smart working.
Institute for Advanced Manufacturing

www.nottingham.ac.uk/manufacturing