KAMAN

Aerospace

HIGH QUALITY TOOLING SOLUTIONS
KAMAN Tooling are fully capable of providing our partners with full turn-key and innovative tooling solutions from concept to completion, while also providing a built to print service all within our new 64,000sq/ft purpose built facility in Burnley, UK, Committed to providing the highest level of service to all our customers through excellent CRM

Engineering competencies:

- In house Tool Design – capable of providing innovative solutions when integrated at the concept development phase of new projects / programs
- Turnkey solutions & Concurrent & reverse engineering
- Engineering – consultancy
- Project & Program Management

Manufacturing competencies:

- Large and small assembly systems, inc automation – robotic interface
- Mould Tools - Tool try out – Spring back testing - Process development / validation / FAI
- 3 & 5 axis CNC machining capability (21.5m x 3.3m 1.5m))
- Conventional Toolmaking - Patternmaking
- Fabrication, Fitting & Assembly
- Ground Support Equipment, inc WSTGE
- Lifting & Handling Solutions
- Onsite Installation – Tool Maintenance & Lifecycle Management
KAMAN Tooling are fully capable of providing our partners with full turn-key solutions from concept to completion, as well as build to print projects,

Specialist areas of expertise are in, Tool Design, and the manufacture of mould tooling along with large complex assembly systems inc automation,

- Aerospace Trained Design Team (Multiple Seats)
- Stress Analysis
- CATIA V4 - V5
- Unigraphics
- Air Gap Main Frame Secure/Encrypted FTP Protocols
- STEP and IGES Translators
- RTM (Real Time Machining)
- C E Marking & Technical Files
- Operator User Manuals
KAMAN Tooling’s philosophy is to deliver all projects on time and within budget & quality.

Microsoft Project Plan:  All stakeholders in agreement of deliverables/milestones
SWIP Plans:  Status of Work In Progress

Five Box Reporting:
I. Achievements:  Progress made since the previous issued report
II. Risks & Changes:  Project/program and design
III. Issues:  Identify issues - barriers
IV. Support required:  Identified stakeholder actions
V. Next Steps:  Outstanding tasks inline with the MPP

RAG Flags:
Red:  Highlighting of Issues/Barriers
Amber:  In progress and on schedule
Green:  Task completed

Effective project management tools and communication

Project Management: Single point of contact

Epicor capacity & resource planning

KAMAN Core Processes
Kaman Tooling has a comprehensive Quality & HSE Management System in place designed to ensure systematic controls are in place in order to guarantee our customer quality requirements are consistently met.

Quality Approvals:
- AS EN 9100 & BS EN 9001: REV C
- ISO 14001
- ISO 18001
- BAe Systems: Method 1 Approval (Direct to line delivery)

DEA Delta Slant CMM: Checking envelope
- X: 6.3m
- Y: 3m
- Z: 2.0m

A new performance standard in gantry CMMs, that excels in the high-accuracy inspection of large machined parts due to ACTIV® structural multi-sensor temperature compensation, while being fully enclosed within it's own climate controlled environment control set at 20°C
### Examples of recent programs

#### PROGRAM EXPERIENCE:

**Airbus Group:**
- A320 NEO: Over Wing - Under Wing - Fairing Mould Tools
- A320 NEO: Engine Panels/Fairing
- A330: Wing Panel Mould Rate Tools
- A350 - 900: FLE J-Nose Mould tools
- A350 - 900: FLE Automated Assembly Jigs
- A350 - 900: Integration Straps Lay up Tools
- A350 - 900: FLE Bird Strike Test Tool
- A400M: Mould & Trim Tools
- A380: Wing Skin Shot Peen Fixtures (42m)
- INOFLE Transportation Jig / Shot Peen Fixtures
- Satellite Assembly / Test Jigs & Fixtures

**BAe Systems:**
- TARANIS UAS: Mould Tooling
- Typhoon: Mould, Trim & Assy Tools + GSE
- Hawk: Mould, Trim & Assy Tools + GSE
- F35: Mould, Trim & Assy Tools

**Bombardier:**
- LJ85: Cabin PAX & OWEED Tooling
- C-Series: Composite Wing Tooling
  - H‘Stab Mould Tools
  - Global Express: Belly Fairings

**Textron-Bell:**
- AH-1Z: Main Fuselage & Canopy Assy Tools inc rate

**Embraer:**
- KC-390: Cargo Ramp (FAL)

**Lockheed Martin:**
- F35: STOVL, CTOL & CV - Mould, Trim & Assy Tools

**Gulf Stream:**
- G280: Winglet & Aileron Tooling

**Rolls Royce:**
- A350 XWB: Nacelle Handling & GSE

**MBDA:**
- Missile Fairing Mould Tools

**British Airways:**
- B737 / B777: Inner Wall Repair Bond Tools & Jigs
Manufacturing Capabilities & Tooling Types

CNC Machining

Conventional Toolmaking

Patternmaking

Fitting

Welding & Fabrication

Invar – Steel – Aluminium - Stainless Steel – Carbon Fibre
3 & 5 Axis CNC Machining

Correanayak Versa M-215:
5 Axis CNC Milling Machine

Cutting envelope:
X: 21.5 m  Y: 3.25m  Z: 1.5m
Tolerance: .1mm /20m
KAMAN Tooling, are recognised as market leaders in the manufacture of production mould tooling, using various materials such as nickel, steel, aluminium, CFC and Invar in utilising either billets, plate or castings,

- Being part of KAMAN Aerospace Group, gives us access to a large number of autoclaves (largest - 13m x 3.125m) which enables us to provide a full turn-key solution in product development:

- Testing
  - FAI - Spring Back Testing (Prior to delivery)
  - Process Development
  - Helium Leak Detect System
KAMAN Tooling have Designed & Manufactured a large range of Drill & Rout Tooling:

- Simple hand file bench tools
- 5 Axis Tools (single - multi parts)
- Vacuum Assist
- Vision Cam Alignment
- Indexed Palletised Sub-Frames / Wixroyd location for high volume multipart loading
Project Example 1: Embraer KC-390 Cargo Ramp

Cargo Ramp assembly line was designed to maximise build efficiency by operating as a pulse line with a minimised takt time, all while providing an ergonomic and safe operator environment.

- Design, Manufacture
- Assembly Tooling System
- Transportation Trolleys
- Lifting Frames
- Onsite Installation
**Project Example 2: A350 (FLE): Automated Drill - C’sk & Assembly Jigs**

**Inboard / Middle / Outboard Spars:**
- Air Guided Vehicle moveable work stations (8m x 3m x 2m)
- Build to Print complete at KAMAN
- Full onsite support and tool Installation

**Project Example 3: A380 Wing Skin Shot Peen Fixtures**
- Design partner
- Manufactured in modules (42m)
- Installed onsite at Airbus (UK)
Kaman Tooling is an ITAR approved company, and have long been involved in the design and manufacture of various tooling packages in support of the Lockheed Martin F-35 Development & Production, including all the “In Flight Opening Doors”

BAe Systems (UK): / Lockheed Martin
**Rear Fuselage - HTP - VTP**
- Invar Mould Tools,
- Vacuum Router Tools
- Bonding Fixtures
- Final assembly Fixtures
- Lifting Equipment

TERMA AS (Denmark) / Northrop Grumman:
*Gun Pod Mandrel Tool*
- Invar Mould Tools,
- Vacuum Router Tools
- Bonding Fixtures
- Final assembly Fixtures

Fokker Aerostructures (Netherlands):
*All In Flight Opening Doors: CTOL - STVOL - CV*
- Invar Mould Tools,
- Vacuum Router Tools
- Bonding Fixtures
- Final assembly Fixtures

EDM Ltd (UK):
- Full scale (Replica) working doors – Training solutions

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**No Tooling pictures are available due to ITAR Restrictions:**

- A. Lift Fan Upper
- B. Auxiliary Air Intake
- C. Lift Fan Exhaust
- D. Roll Nozzle Ducts
- E. Main Landing Gear
- F. Lift Fan Lower
- G. Nose Landing gear
- H. In Flight Re-Fuelling
Project Example 5: Satellite Build & Test Equipment

- Design & Manufacture
- Detail - Main & Sub Assembly
- Project Management
- Onsite Installation - Calibration

Satellite Test Equipment
(Integrated laser positioning)
**Project Example 8:** Bombardier LJ85 PAX & OWEE Doors

**Design and Manufacture:**
- Mould tools
- 5 Axis rout fixtures
- Sub & Final Assembly jig
- CMM Checking fixture
- NDT & Test Fixtures

**Project Example 9:** Gulfstream G280: Winglets - Ailerons

**Design and Manufacture:**
- Mould tools (L/R)
- 5 Axis rout fixtures (L/R)
- Sub & Final Assembly jig (L/R)
- CMM Checking fixture (L/R)

The Winglet is a co-cure /co-bonded assembly: Consisting of several individual carbon parts integrated within both the Inner & outer skins with a NOMEX Honeycomb Core,
It was KAMAN’s ability and past performance on this large program of rate tooling, that gave our customer the confidence to place the complete package as a single source based on our:

- Engineering
- Project Management
- Manufacturing capability
KAMAN Tooling manufacture a diverse range of Ground Support Equipment

In support of both the civilian and defence sectors:

- Protective covers
- Flight Line Maintenance
- Nacelle Handling,
- Lifting & Jacking Solutions

Actuator Installation & Removal

Canopy Stays

Vac Formed & Rubber Cover Kit Sets

Landing Gear Locks

Fin Installation & Removal
GSE: Handling, Lifting & Transportation

**Rolls-Royce**
Trent 1000 XWB
C-Duct Handling

**In house design – Build to Print**
- Proof loading certified
- C E Marking
- Operator user manuals

**A380**
Transportation Fixture / Trailer
Inner Outer Fixed Leading Edge (IOFLE)
(12m x 4m) Metallic Structure

Multi-purpose Lifting
Vacuum Assisted
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