Rolls-Royce Civil Nuclear

A J Storer
Programme Director

Rolls-Royce

Our four core areas of expertise….

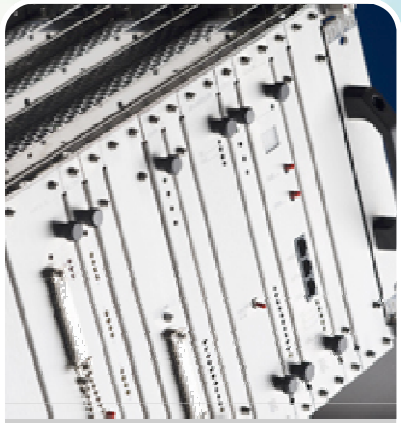
Serve two key markets: New Build and In-Service Support

Safety, Licensing & Environmental Engineering

Authorship
Analysis
Assessment
Review
Manage

Systems & Component Engineering

Analysis
Design
Manufacture
Procurement
Technical Support



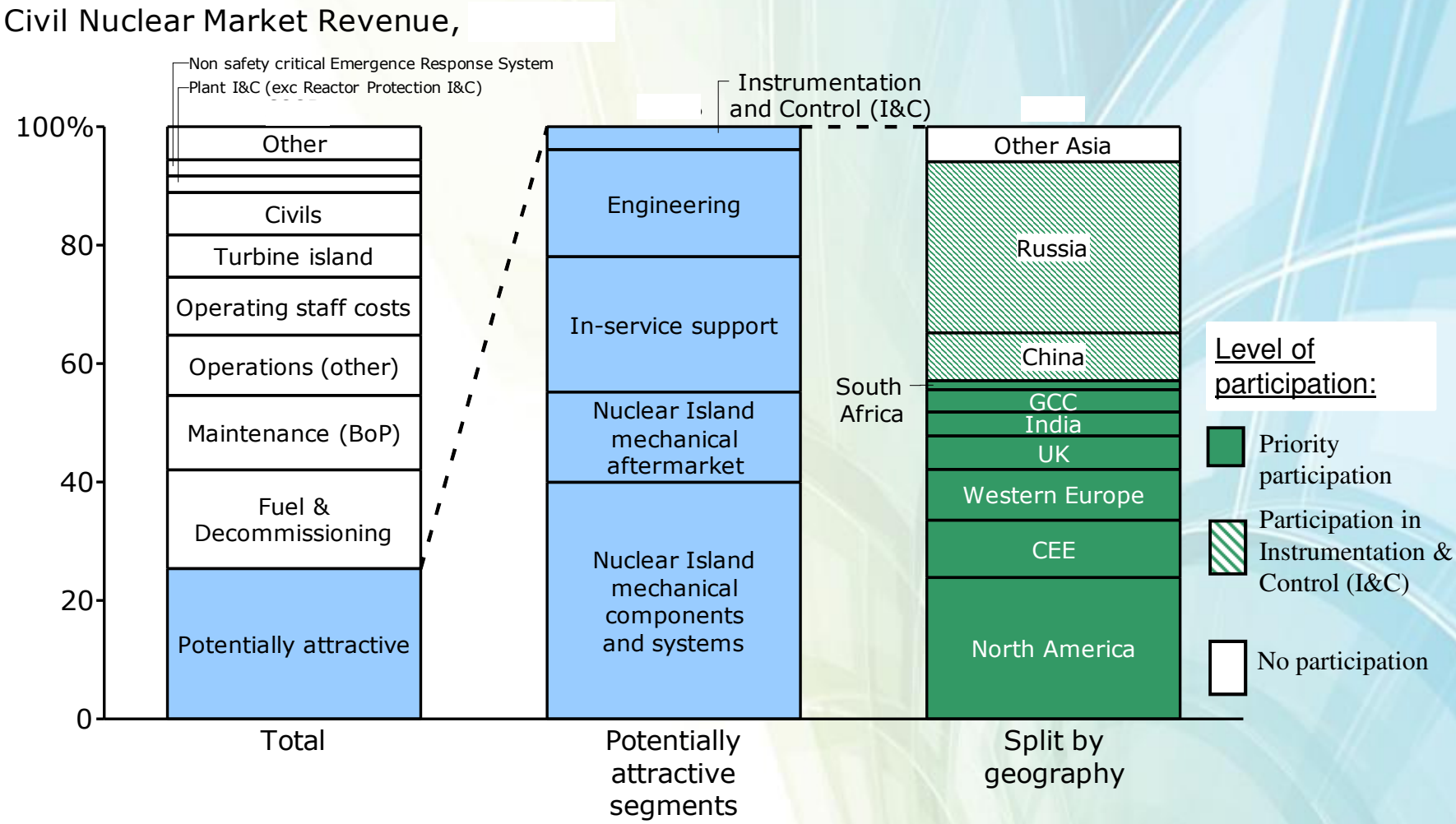
Instrumentation & Control

Design
Manufacture
Supply
Install
Support
Manage
Monitor

Commissioning & In-Service Support

Analyse / Monitor
Inspect / Sample
Repair/Replace/Refurb
Asset Management
Solution Engineering
Technical Support

Addressable market in 2016, including mission-critical mechanical components, I&C, engineering and service



Rolls-Royce UK manufacturing capabilities

Design & Manufacturing capabilities

- Vessels

  (in-house vessels up to and including pressuriser size)
- RPV, Steam Generators, reactor cores (Submarines)
- RPV internals
- Heat Exchangers
- Valves
- Control Rod Drive Mechanisms
- Ion Exchange Columns
- Primary Circuit Filters
- Pumps
- Valve Operating Water Flasks
- Coolers & Minor Vessels
- Pipework
- Fuel Handling System
- Effluent Treatment System

Rolls-Royce manufactured equipment and vessels including the pressuriser, conducted RPV inspection and performed technical design reviews for Sizewell B

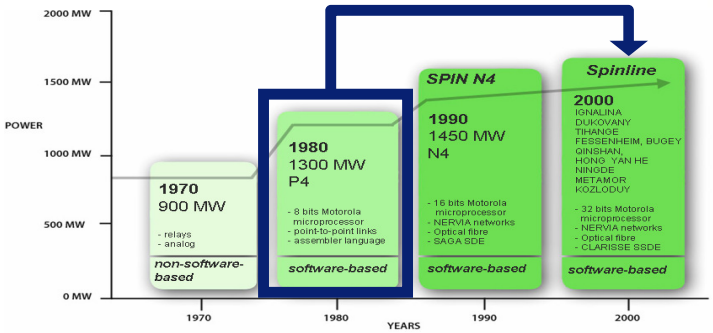
Rolls-Royce is investing in a new Civil Nuclear Manufacturing Facility in the UK

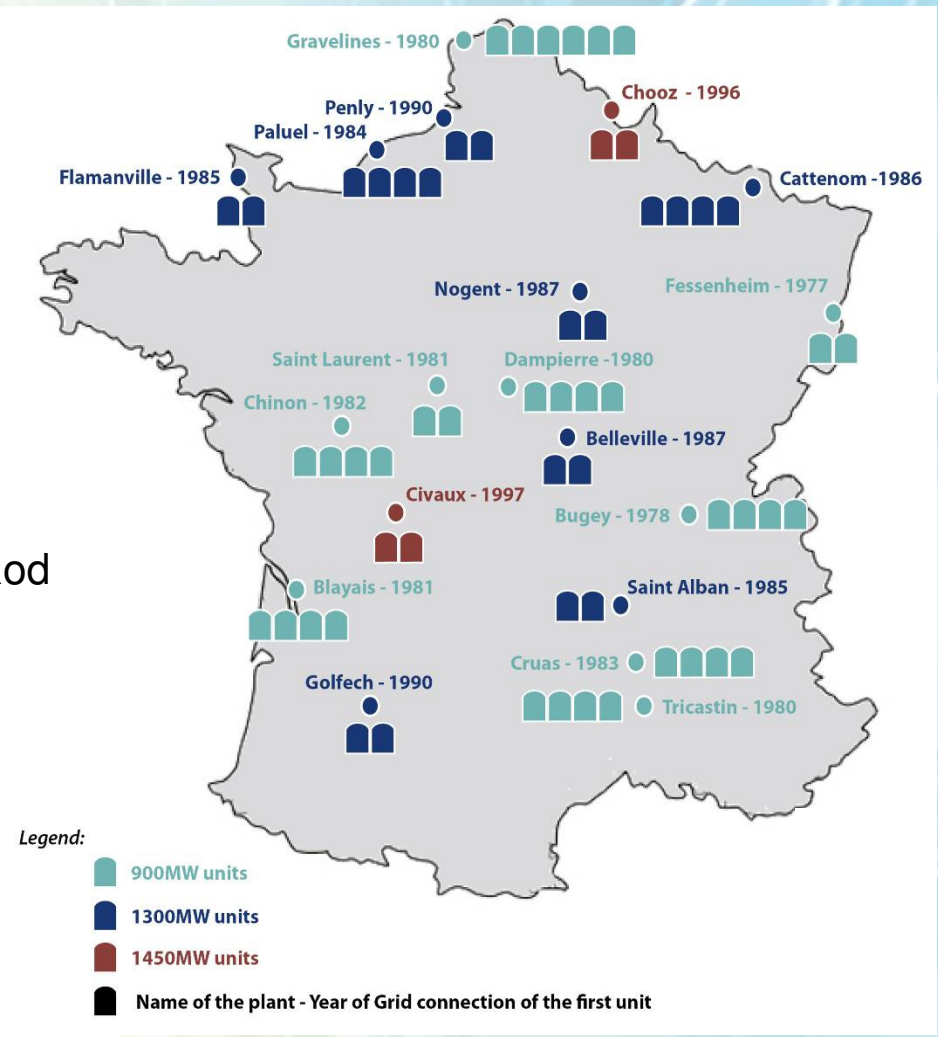
- Capable to manufacture Pressure Vessels to 250 tonne capacity Typical examples being:-
  - Pressurisers / Accumulators
  - RPV Internals
  - Heat Exchangers
  - Other high integrity components (High Pressure Tanks, CRDMs and Casks etc)

- Location: UK
- Size: 13500 m^2 / 4 bays
- People: Circa 180,000 direct man-hours throughput.
  - Includes Machinist, Platers, Welders, Fitters etc
- Transport from site: 5m x 5m x 30m Long x 250 Tonne

French 1300MW Fleet
I&C Modernisation

- **EDF Fleet – 20 Units 1300MW**
  - 'VD3' – 3rd decade upgrade
- **Modernisation of all 1300MW units**
  - Reactor Protection System (RPS)
  - Neutron Instrumentation System (NIS), including Neutron detectors
  - Rod Control System (RCS), including Rod Position Indication System
- **We are the OEM**





Rolls-Royce Canada

- **35 yrs experience** as a 100% Nuclear Company
- **Market sectors** include New Build, Inspection & Maintenance, Refurbishment, Waste Handling Processing, Transportation & Storage
- **Specialty expertise** in Design, Engineering, QA, Production, Assembly & Testing.
- **Impressive history** of successful projects

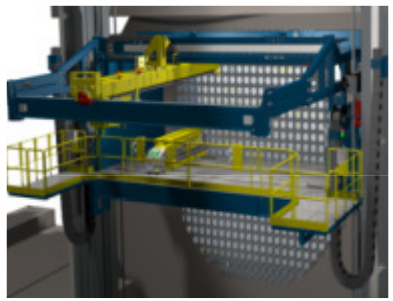
Rolls-Royce Canada

Capabilities

- Multi Discipline Engineering & Design
- Manufacturing, Assembly & Test
- Nuclear QA Program
- Regulatory Body Interface

Strategic Focus

- Custom Design/Build Projects
- Remote Handling Systems & Tooling
- Custom Process Systems & Components
- Waste Management Equipment
- Installation Inspection and Surveillance
- Engineering and Site Support



Acquisition of Brooks

Domestic Engineering & Inspection Services provided to 67 plants in the USA in cooperation with Westinghouse Electric, NNS, Bechtel & SGT

- Areas of primary focus:
- Steam Generators
- Foreign Object Search and Retrieval (FOSAR)
- Component assessment inspections
- BOP (SUMPS, FW Hx)
- Reactor Services (RVPH to & bottom head)
- New Fuel Inspections (Columbia, SC.)
- RSG's (piping closeout Inspections)

International

Brooks has brought this same level of service and innovative technology to customers around the globe in countries such as:

Korea	Japan
Germany	England
France	Taiwan
Spain	Belgium
Mexico	Canada

We will develop new technologies using the new Nuclear Advanced Manufacturing Research Centre (NAMRC)

AMRC
(Advanced Manufacturing Research Centre)

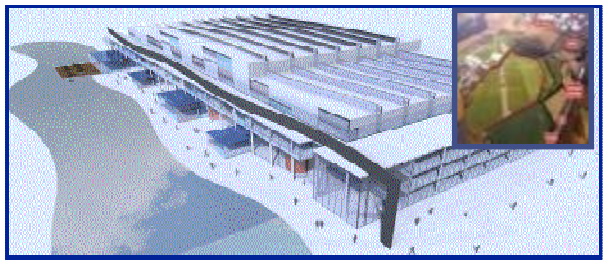
- Location - Sheffield UK
- Subject – Machining & Measurement

PTRC
(Process Technology Research Centre)

- Location - Singapore, A Star & RR Site
- Subject – Surface Conditioning Processes

AFRC
(Advanced Forming Research Centre)

- Location - Glasgow UK
- Subject – Forging & Forming



MTC
(Manufacturing Technology Centre)

- Location - Ansty UK
- Subject – Automation, Fixturing, Joining, etc

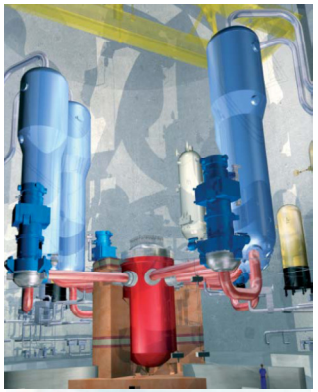
NAMRC
(Nuclear Adv Manufacturing Research Centre)

- Location - AMP Sheffield & Manchester University
- Subject – Manufacturing Technology, training & accreditation

CCAM
(Commonwealth Centre for Adv Manufacturing)

- Location - Crosspointe Virginia USA
- Subject – Surface Engineering, Manufacturing Systems

Rolls-Royce Activities in the NAMRC will Focus Key Process Development & Skills Enhancement



- Rolls-Royce policy is all new factories and processes go through the MCRL programme
- Modernisation of processes and techniques
- Development and qualification of manufacturing improvement programme
  - Narrow-gap welding technology
  - Electro-slag welding – cladding
- Development of specialist civil nuclear skills
- Training of skilled manufacturing workforce
- Benefits of collaborating with plant designers and UK supply chain
- Opportunity to achieve significant leverage

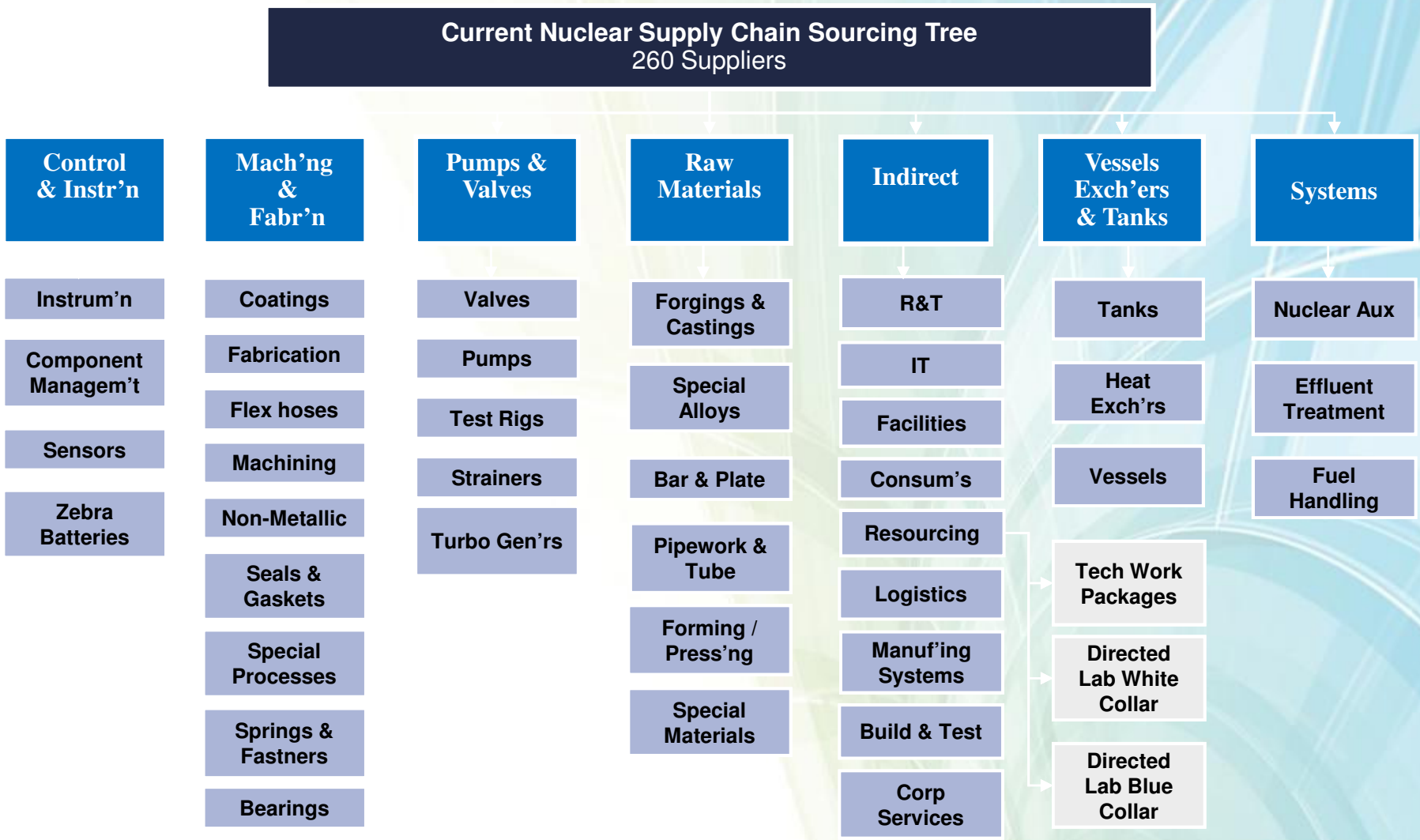
Rolls-Royce can supply the complete nuclear island through manufacture or procurement

- **Global Purchasing & Supply**
  - Operates a £4bn + international Supply Chain
  - Delivers 95% purchase business turnover via circa 700 suppliers
  - Established UK Nuclear Chain
- **Nuclear Supply Chain Capability**
  - Sizewell Pressure Vessels material & equipment supply
  - 50 years experience of light water Naval Nuclear material equipment supply
  - Oil and Gas material and equipment supply experience
  - Earlier nuclear programme material and equipment supply
- **Structured Quality products and processes, supporting:**
  - Make or buy decision making
  - In-house manufacture and assembly
  - Supplier selection, through accreditation, maintenance and execution

Nuclear Supply Chain experience:

- Project and programme based experience through to construction
- An extensive nuclear quality culture
- Strengths in availability capability & relationship maintenance and management
- Use strategic partners to sustain industrial long-term capability
- Unique project procurement background and skill-sets
- Recognised as being a sector lead by the UK supply chain

Our nuclear supply chain strategy is a commodity driven approach



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