INDUSTRIAL RESPONSE TO 
RF POWER REQUIREMENTS

David M Wilcox
High Power RF Engineering Faraday Partnership UK
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Overview

• RF hardware
• Industry’s contribution so far
• Technology from other sources
• Future industrial response and challenges
• Preparing industry for the challenges
• Conclusions and recommendations
RF hardware

- RF System comprises
  - Power supply (power conditioning)
  - RF source and amplifier
  - Monitoring and protection
  - Passive components
  - Control system
  - Accelerator cavity with coupler and window
Industry’s contribution so far - 1

- Products purchased in open competition
- Specifications devised by machine designers
- Products based on technology developed for other purposes.
- Special bespoke devices in small numbers
- Increasing use of devices manufactured for terrestrial broadcast TV
Industry’s contribution so far -2

- Little time to consider before tendering
- Learning curve steep
- Frequent problems
- High risk of cost and time over-run
- Little if any long term business
- Expensive after-sales technical support

Companies are wary of accepting low volume, high risk contracts
Technology from other sources

Examples of technology being developed by industry for other applications

• Silicon carbide active devices
• Matrix converter technology derived from motor drive R&D
• IOT technology from TV broadcast extended to 1.3 GHz
• Gyro-Travelling Wave Amplifier
Future response -1

Basic assumptions

• The business must be profitable
• The business must be as beneficial to the company as other opportunities
• The business must be positive in its contribution to the company’s business strategy
Future response -2

• Risk
  – Technical
  – Financial
  – Commercial
  – Other

• Disruption to routine business
  – Drain on engineering and manufacturing resources
  – Long term support commitment

• Beneficial legacy
  – Spin-off benefits
Challenges

Major challenges for large machines

• The scale is far greater than anything before
• The frequency, voltage and power density demand higher standards of manufacture
• The cost targets are much more challenging
• The timescales will be difficult to achieve
• Close technical support will be needed during machine lifetime
Preparing industry -1

Prerequisites

• Involvement by industry vital in the pre-construction phase of the machine
• Any nation that expects to receive contracts in return for supporting the project must possess suitable industrial capability
• Only components that meet the minimum acceptable standard can be considered
• A commercially “level playing field” must be assured
Preparing industry -2

Industry needs people, time and money to develop

• Its knowledge
  – Learning
  – Teaching
  – Training

• Its manufacturing capability
  – Processes
  – Capital equipment
  – Manpower
Preparing industry -3

• Early participation
  – Time to learn and understand
  – Contribute to manufacturing design detail
  – Eliminate risks and reduce cost

• Access to funds for
  – Developing capability
  – Technical risk reduction projects
  – Prototyping

• Workable business environment
  – Juste retour
  – The “Level Playing Field”
  – Price comparison
Conclusions/recommendations - 1

• Increased manufacturing capacity will be needed
• This must be paid for by the projects
• Industrial process development, prototyping and life testing must be funded
• Industry cannot be expected to take on cutting edge, risky business without support
Conclusions/recommendations -2

• Industry should have an input to cost estimates as well as design detail
• The budget for each tendered task should be stated in the tender documents
• For “fair play” between bidding nations, “ex-works” prices should be the basis for comparison
Conclusions/recommendations -3

• Establish industrial construction team well before construction phase
• If multiple suppliers are needed, provide each one with the same opportunities and support
• Collaboration between manufacturers may be more beneficial than competition?
Conclusions/recommendations - 4

Major projects must succeed first time

There may not be a second chance
Finally

Industry will play its part if it is able to participate as a full and equal partner within the project team
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