



THE QUEEN'S AWARDS  
FOR ENTERPRISE:  
INTERNATIONAL TRADE  
2004



THE QUEEN'S AWARDS  
FOR ENTERPRISE:  
INNOVATION  
2005

**TMD**  
**INDUSTRY DITANET**  
**PRESENTATION**

*Howard Smith*  
*April 2009*

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- What do TMD do (Market)
- R & D in General
- Specific Development Example

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# TMD Product



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# TMD Product



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# Electron Guns



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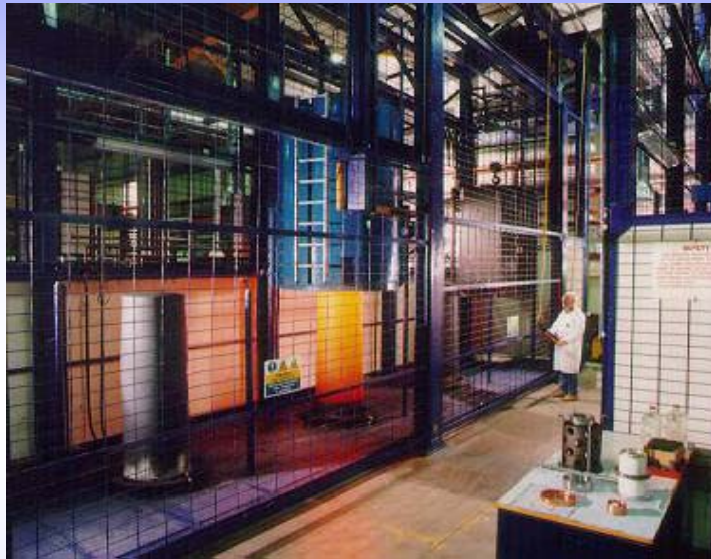


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# Tube Manufacturing



Cleaning



Welding



Plating

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# *R&D General*

## **INVESTMENT OF**

- Cash
- Engineering Resources
- Infrastructure
  - Management
  - Other technology experts

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# *R&D General*

## **RISKS**

- Market Risk
- Technology Risk
- Competitive Risk

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# R&D General

## TIMESCALE

- Find, Develop & Generate Revenue 7 yrs
- Production Phase 5 yrs
- Maintenance Phase 10 yrs
- All Time Buy 3 yrs

**THUS MUST LOOK FORWARD AT LEAST 25 YEARS**

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# SPECIFIC DEVELOPMENT EXAMPLE

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# Chapter 1

## The Market

- Ultra Low Noise Transmitter
- Doppler processing
- Low, & Medium PRF
- Free Range PRF
- Battlefield & AI

**Significant Company PV  
Investment Agreed**

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# Chapter 2

## Development

### Three increments to achieve performance required:

- Random -145 dBc/Hz
- Spurious -100 dBc
- 60 kHz PRF
- 200  $\mu$ sec pulse length

**Much Flag Waving!**

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# Chapter 3

## Find A Customer

- Major Customer found
- But customer decides to use solid state and develop their own TWT transmitter as a back up
- A few smaller customers, but sales do not return the investment

**Howard Smith in Big Trouble!**

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# Chapter 4

## HELP!

### Prime Contractor Finds That:

- Solid state will not meet specification
- Customer own developed TWT transmitter unreliable

**Eureka!**

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# Chapter 5 Competition

## Shoot out between US company & TMD

- Three month delivery to customer spec
- US company delivers on time
- TMD two weeks late

**Bugger!**

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# Chapter 6

## High Noon

### US company:

- Product only meets 70% of specification
- Unit blows up after 10 hours

### TMD:

- Product meets 95% of specification!
- Unit works reliably!

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**Wild Party!**

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# Chapter 7

## End Game 1

- Fix last 5% of performance
- Risk analysis
- Qualify unit
- HALT Test & Step Stress
- ESS (to precipitate 98% faults)
- High temperature burn-in
- End User field trials

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# Chapter 8

## End Game 2

- Problem found with Prime contractor system
- Specification changed
- Back to the drawing board!
- New Risk analysis
- Qual, HALT, step stress & high temp burn-in

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**Fecit!**

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# Chapter 9

## End Game 3

- Start Production
- Another problem found with Prime contractor system
- Stop production
- Specification changed again

**Will This Never End!**

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# Chapter 10

## End Game 4

- Back to drawing board again!
- Risk analysis
- Modify manufactured units
- Qual, HALT & Step Stress
- High temp burn-in
- Start production again
- Wind up to full speed to catch up

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# Chapter 11

## Catastrophe

- Units failing in ESS
- Beard turns grey
- Plunge head in bucket of water
- Consider Euthanasia
  
- Root cause analysis instead

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# Chapter 12

## Root Cause

- Design
- Build standard
- Components
- Test

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# Chapter 13

## Root Cause

- Check everything
- Everything is OK
- But something must be wrong
- HALT unit is first production unit & is OK
- All other production units fail!

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# Chapter 14

## Root Cause

- Took two weeks to find
- Was a **counterfeit** component
- Provided by a subcontractor
- In an encapsulated assembly

**Now back in full production**

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# Questions?

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