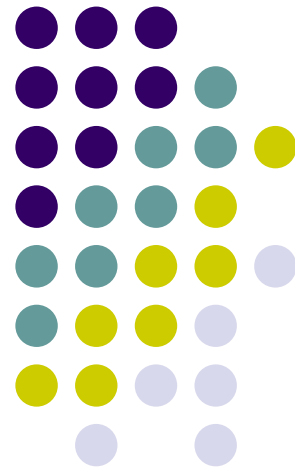


# The Grand Challenge

## AN INVESTMENT MAGNET FOR S.O.C. DESIGN

David Rees  
National Microelectronics Institute  
1st April 2003



# UKDF Meeting 1/4/03

## Agenda

**Problem statement**

**Root cause**

**Solution = an investment magnet**

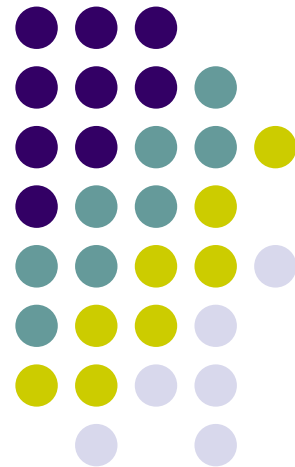
**UK paradigm shift consortium**

**Status and launch schedule**

**10-year goal for UKpsc**

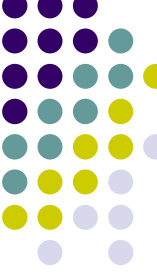
**Research theme/focus for UKpsc**

**Summary**



**UKpsc**

**UK Paradigm Shift Consortium**

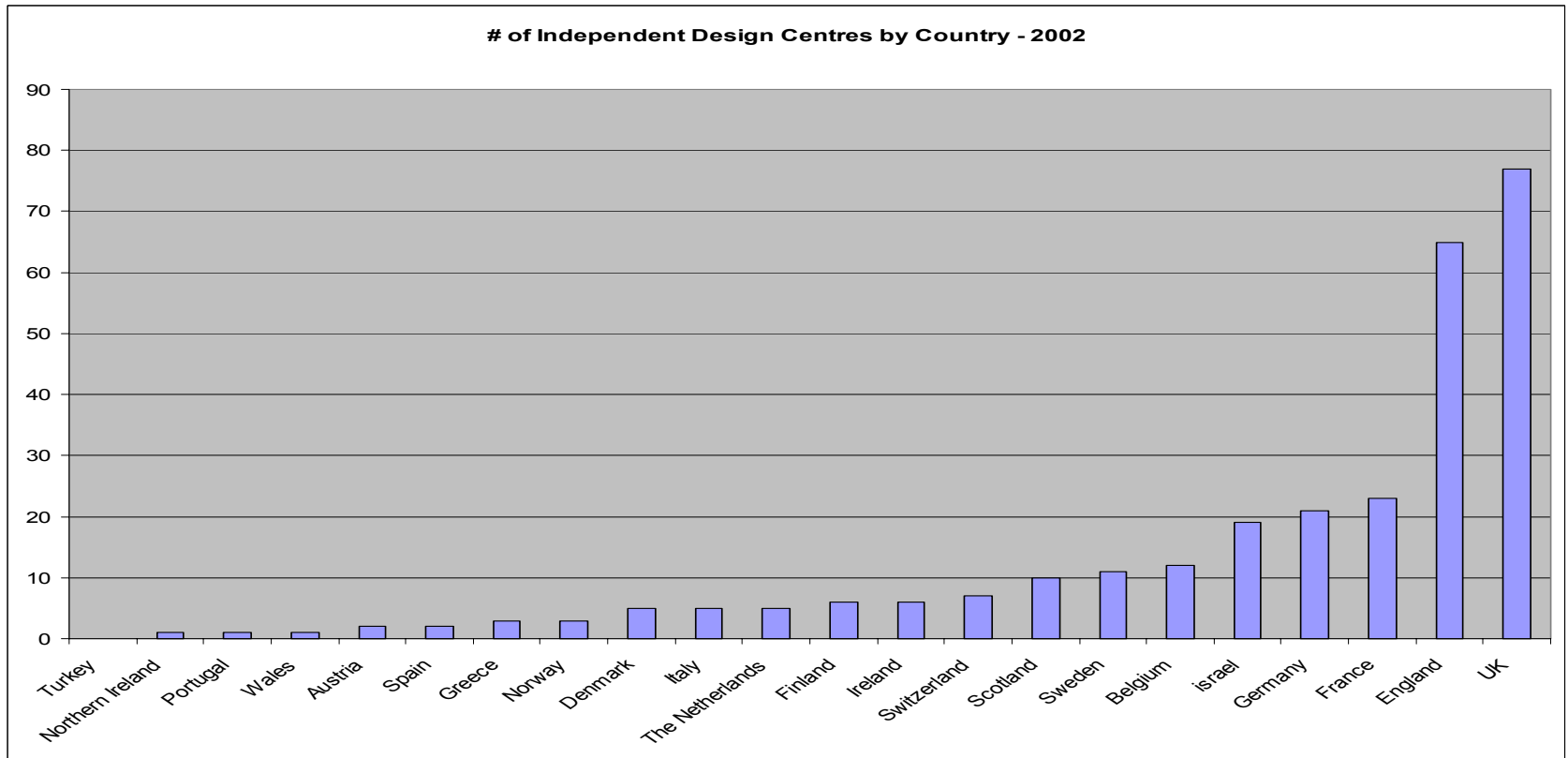
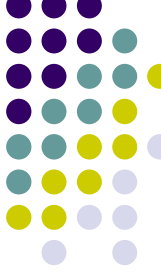


## **The problem statement**

- **The UK has the lion's share of I.C. Design houses and designers....**

# UKpsc

# UK Paradigm Shift Consortium

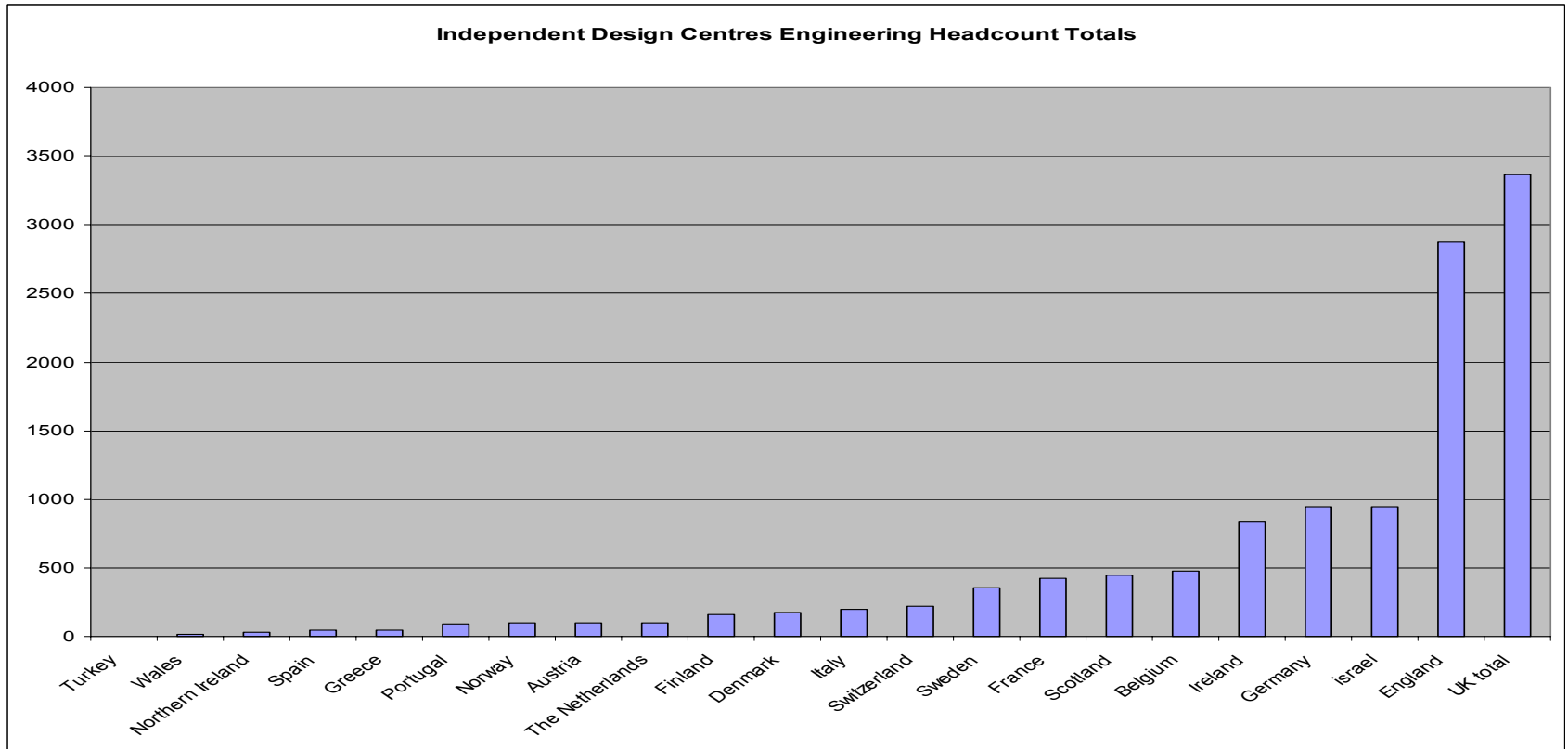
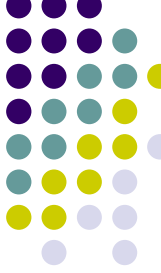


Source - Future Horizons 2002

**Data is flawed - only independent design houses....**

# UKpsc

# UK Paradigm Shift Consortium

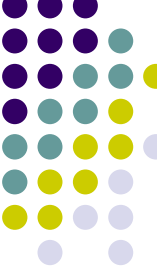


Source - Future Horizons 2002

**Part of the service economy?**  
**Entrepreneurial spirit?**

# UKpsc

# UK Paradigm Shift Consortium



## The problem statement

- The UK has the lion's share of I.C. Design houses and designers
- **I.C. Manufacture has been exported to lower wage economies**
  - Move further up the value added chain
  - Implies a high “barrier” to entry
  - Flawed logic - there is no real barrier
  - Design is labour intensive and can be exported

UKpsc

# UK Paradigm Shift Consortium

 Reed Electronics Group  
www.electronicweekly.com

18/12/2002

No. 2081

# Electronics WEEKLY

## UK needs centre to keep lead in design, says Lords report

**Richard Ball**

TO MAINTAIN its world leadership, the UK needs a national centre for the development of intellectual property, such as microprocessor architectures, and research into system-on-chip design.

The recommendation comes in a report on the UK chip industry published by the House of Lords Science and Technology Committee.

Lord Wade of Chorlton, chairman of the inquiry, told *Electronics Weekly*: "Our pre-

sent ability to continue Moore's Law cannot carry on due to physical affects... There is an opportunity for the UK to take a more important role in the future."

But this is not through chip manufacturing, which Lord Wade points out is too expensive and risky, but through innovative design.

"In embedded design we are already leading the field. We need to fund research and help commercialise the technology," he said.

A UK centre would bring

academics and engineers into contact with the legal and financial resources needed to grow business.

"Companies need a range of skills that are necessary for them to grow and expand," he said. "There are clear opportunities here - a lot of excellent work is being carried out."

The *Chips for Everything* report also suggests a "champion" for UK R&D might help in promoting the country's expertise. "Some leadership is necessary," said Lord Wade.

One problem identified by

the committee is the direction of research funding, which Lord Wade said is "the wrong way around". Lots of money goes into CMOS development, but the UK has almost no CMOS manufacturing.

Government money would be better spent on IP, algorithm and architecture development, he said, along with alternatives to CMOS.

"We also need to make non-London research more accessible to venture capitalists, especially at the early stage."

Lord Wade was impressed

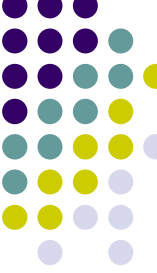
with overseas centres such as IMEC in Belgian, which started with Government money, but now receives a good slice of funding from industrial investment.

He also applauded the practice of keeping R&D in the UK, while setting up headquarters in the US, where the market and money is centred.

However, there is concern about poor UK take-up of European funding, either by universities or companies. Greater participation should be encouraged, said the report.

# UKpsc

# UK paradigm shift consortium

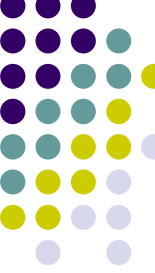


## The Problem Statement

- The UK has the lion's share of I.C. design houses and designers
- I.C. manufacture has been exported - design is going the same way
- **NMI = National Microelectronics Institute (Design) charter IS to solve this problem**
  - ➔ **What is the Root Cause?**

**UKpsc**

**UK paradigm shift consortium**



## **The Root Cause**

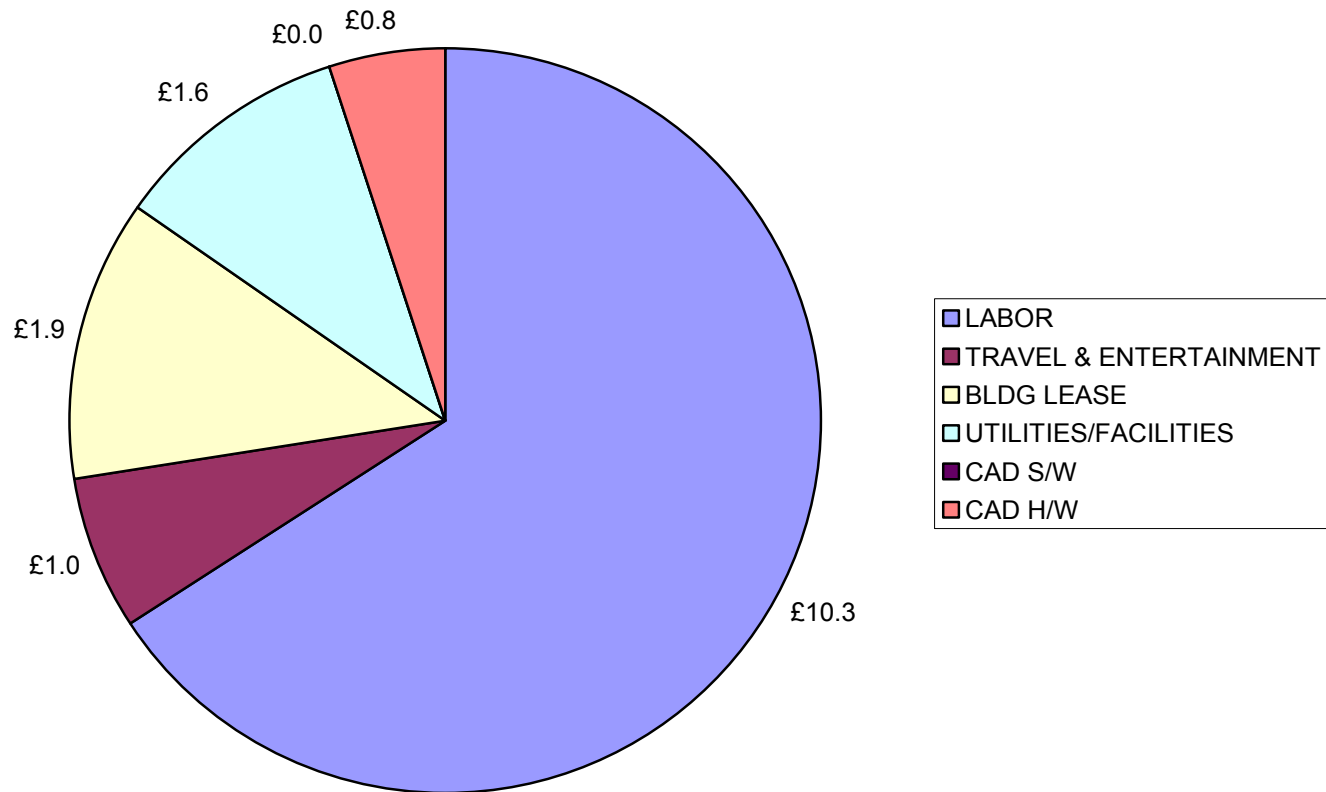
- **Labour costs in the UK are higher than in developing countries....**

# UKpsc

## UK paradigm shift consortium

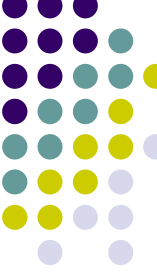


UK vs India Cost Delta per Engineer per Quarter (Total = £15.6k)



# UKpsc

# UK paradigm shift consortium



## The Root Cause

- Labour costs in the UK are higher than in developing countries
- The ROI of UK I.C. Design/EDA research is very low
- We have no magnet to attract and keep the designer jobs in the UK

→ What is the Grand Challenge?

# UKpsc

# UK paradigm shift consortium

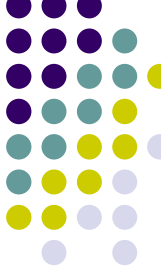


**The GRAND CHALLENGE is to maintain and increase the investment in S.O.C. design by -**

- **Building on the UK advantage of having more design houses**
- **Reducing the impact of lower wage costs in developing countries**
- **Reducing the impact of labour cost on the total cost of a project**
  - **If % of project cost represented by labour reduces**
  - **Then advantage of moving to a low wage economy is lost**
  - **Example = mask costs sub-\$100k are now sub-\$1m for deep sub-micron**

# UKpsc

# UK paradigm shift consortium



The **GRAND CHALLENGE** is to maintain and increase the investment in S.O.C. design by -

- Building on the UK advantage of having more design houses
- Reducing the impact of lower wage costs in developing countries
- Reducing the impact of labour costs on the total cost of a project
- Creating a “**magnet**” to maintain and increase investment

→ What should this **magnet** attract?

# UKpsc

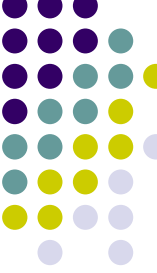
# UK paradigm shift consortium



- The **magnet** must attract or enable:
    - Inward Investment – new investment, expand existing investment ...
    - Improved UK Competitiveness – wealth creation, job creation, job retention, ...
    - World Class Leadership – keep ahead of competitors, R&D commercialisation ...
- What is the **magnet**?

# UKpsc

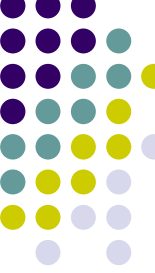
# UK paradigm shift consortium



- **A world-class research institute playing a key role in creating and maintaining a collaborative community in S.O.C. design/architecture**
  - **World-class**
  - **Collaborative**
  - **System on Chip - definition must not be limiting**

# UKpsc

# UK paradigm shift consortium



- A world-class research institute playing a key role in creating and maintaining a collaborative community in S.O.C. design/architecture
- **The UK paradigm shift consortium**

**→ What does this mean?**

# UKpsc

## UK paradigm shift consortium



- The UK paradigm shift consortium (**UKpsc**) is about building and maintaining a community of researchers in many fields **BUT** with a single unifying focus related to **design productivity**
  - Design productivity is a world wide problem
  - Helping to solve it would be a natural magnet
  - Solving it would reduce project labour cost

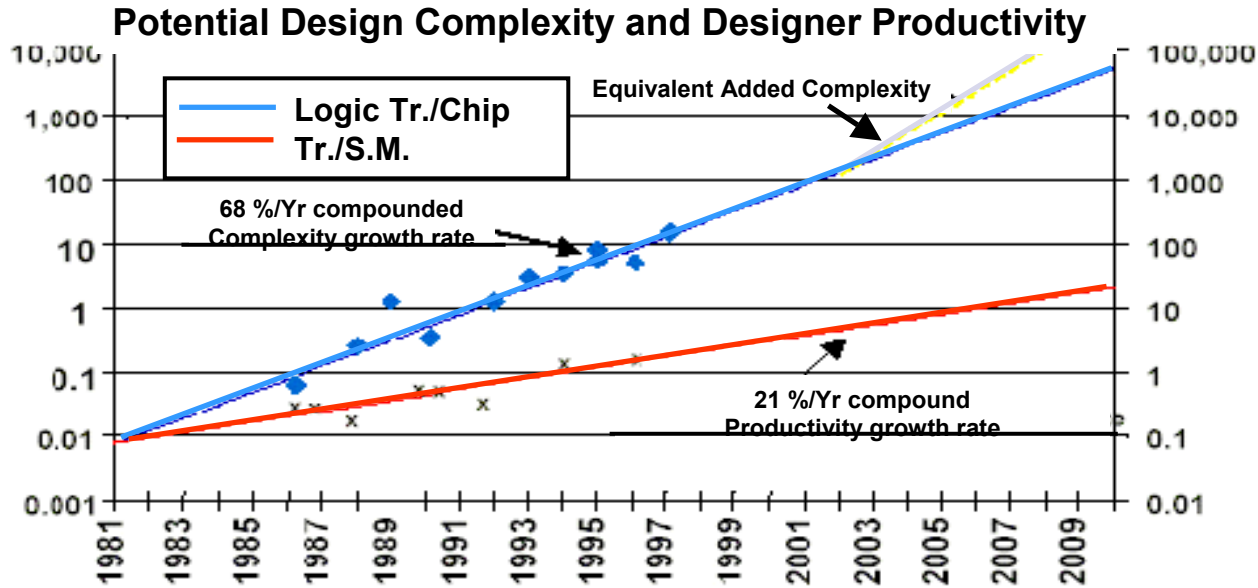
→ What is a “paradigm shift”?

# UKpsc

# UK paradigm shift consortium



Logic Transistor per Chip (M)



Productivity (K) Trans./Staff - Mo.

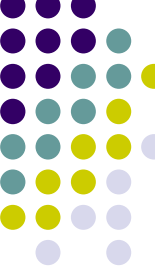
<u>Year</u>	<u>Technology</u>	<u>Chip Complexity</u>	<u>Frequency</u>	<u>3 Yr. Design Staff</u>	<u>Staff Cost*</u>
1997	250 nm	13 M Tr.	400 MHz	210	90 M
1998	250 nm	20 M Tr.	500	270	120 M
1999	180 nm	32 M Tr.	600	360	160 M
2002	130 nm	130 M Tr.	800	800	360 M

\* @ \$ 150 k / Staff Yr. (In 1997 Dollars)

Source: SEMATECH

# UKpsc

# UK paradigm shift consortium



- **A Consortium ....**

- **GigaScale Research Consortium (GSRC) 2002  
headcount ....**

# UKpsc

# UK paradigm shift consortium

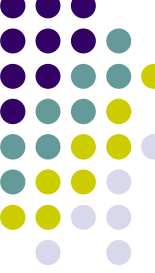


	2000			2001			2002		
	faculty	students	researcher	faculty	students	researcher	faculty	students	researcher
CMU	5	8	1	6	16	1	6	16	2
Michigan	1	3	0	4	5	0	4	5	0
MIT	0	0	0	1	0	0	1	0	0
Penn State	0	0	0	1	3	0	1	3	0
Princeton	2	3	0	3	6	0	3	7	0
Purdue	1	1	0	1	2	1	1	2	1
Stanford	2	7	1	4	5	0	4	6	0
UCB	7	18	5	10	31	7	10	31	7
UCLA	2	5	0	2	4	1	2	6	1
UCSB	2	5	2	2	7	3	2	7	4
UCSC	1	3	0	1	4	0	1	4	0
UCSD	1	2	0	1	2	1	1	2	1
UT Austin	0	0	0	1	2	1	1	2	1
Wisconsin	0	0	0	1	1	0	1	1	0
<b>Total</b>	<b>24</b>	<b>55</b>	<b>9</b>	<b>38</b>	<b>88</b>	<b>15</b>	<b>38</b>	<b>92</b>	<b>17</b>

GSRC Research Staff: 2000- 2002

# UKpsc

# UK paradigm shift consortium

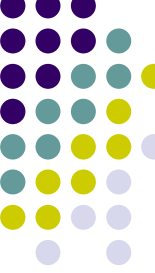


- **A Consortium ....**

- GSRC 2002 headcount = 147
- IMEC has 1200 staff (but a broader research remit)
- No single UK institution has enough resources
- Cannot compete if we have 3 guys in a portakabin in the car park

# UKpsc

# UK paradigm shift consortium



- **A Consortium with one objective - hence focus**
  - **Unifying 10-year goal statement**

# UKpsc

# UK paradigm shift consortium



## Overall Program Goals

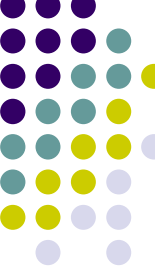
- > 1 Billion transistor chip
- In a technology < ~~0.1~~ micron **50nm**
- Using IP from several sources (mixed-signal)
- Running at > ~~2~~ GHz on-chip **10GHz**
- With a team of < 30 designers
- In < 6 months
- With competitive cost and power-delay-area product



Proposed GSRC 10-Year Goal, November 1997

# UKpsc

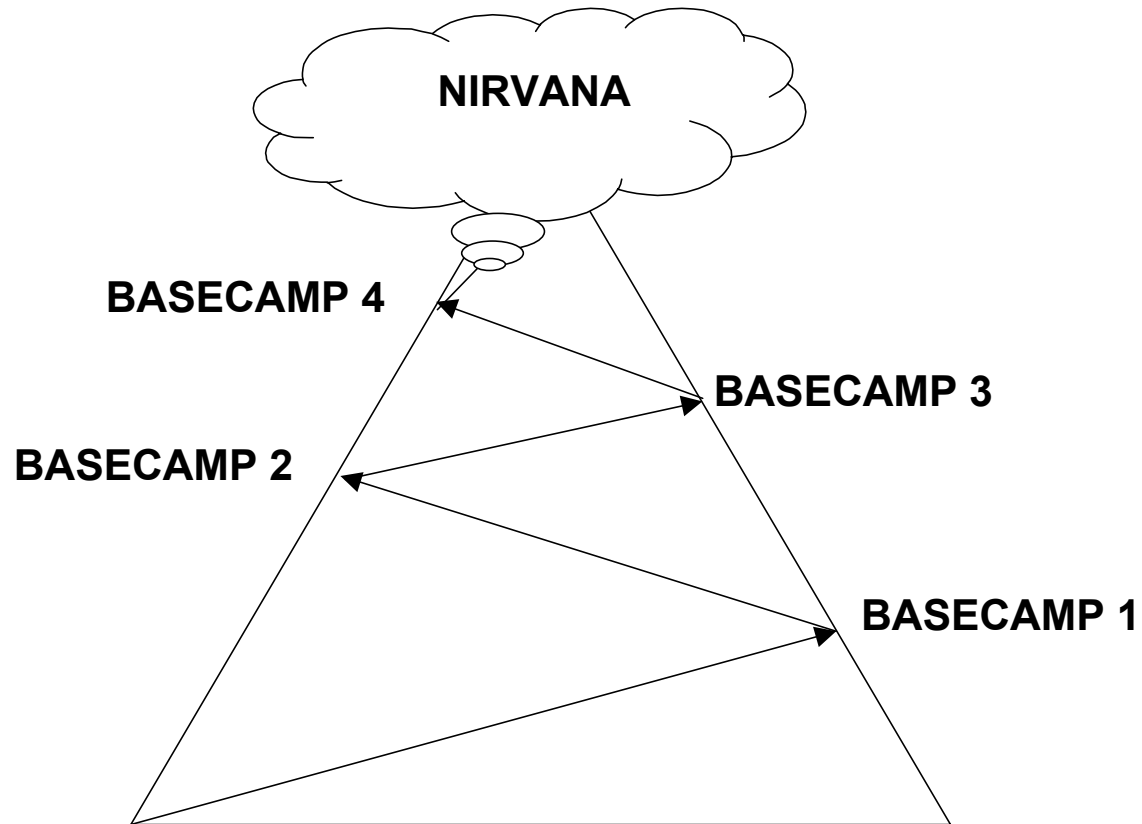
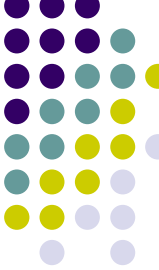
## UK paradigm shift consortium



- **A Consortium with one objective - hence focus**
  - **Uses the NMI/CEESI collaborative business model**
  - **mostly academic work but with industrial oversight**
  - **potentially multiple avenues for research**
  - **10 year goal with staged “basecamps” offering useable results**

# UKpsc

# UK paradigm shift consortium

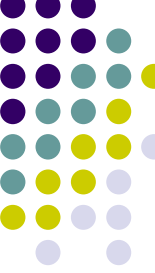


- **BASECAMP**

- delivery of useable work product
- opportunity for review and plan next stage

# UKpsc

## UK paradigm shift consortium



- A Consortium with one objective - hence focus
  - Uses the NMI/CEESI collaborative business model
  - mostly academic work but with industrial oversight
  - potentially multiple avenues for research
  - **10 year goal with staged “basecamps” offering useable results**
    - Opportunity to demonstrate success
    - Opportunity to ask for increased support and investment
    - Opportunity to re-evaluate the 10 year goal
    - Opportunity to stop research that is failing

# UKpsc

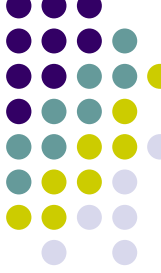
## UK paradigm shift consortium



- **A Consortium with one objective - hence focus**
  - Uses the NMI/CEESI collaborative business model
  - mostly academic work but with industrial oversight
  - potentially multiple avenues for research
  - 10 year goal with staged “basecamps” offering useable results
  - **minimal up-front investment - needs only researchers time and computers - no fab plant or materials**
  - **additional funding (£10M/year over 10 years?) used for additional researchers - critical and competitive mass**
  - **government funded - later industrial money for commercialised results**

# UKpsc

# UK paradigm shift consortium



## Status

- The NMI is driving the idea into UK companies, universities and government. Reaction to date has been very positive
- EPSRC proposal - fund the development of the 10 year business plan which is expected to be ready by July 2003
- The initial members of the advisory board who will help to define the business plan have signed up
- The board is a mix from industry, academia and government
- The first meeting of the board was on March 24 2003
- The 10 Year Goal Statement is published today at the 2003 UKDF meeting for review and feedback

# UKpsc

# UK paradigm shift consortium



## Advisory Board

- David Rees (Cypress)
- Steve Beaumont (ISLI)
- Peter Ivey (Innotec)
- Hilton Kirk (Philips)
- Ian Barton (Motorola)
- Ian Page (Celoxica)
- Hilary Kahn (Manchester University)
- Chris Nott (EPSRC)
- Simon Jones (Bath University)

## External Advisors

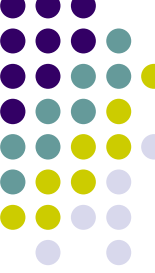
- Luke Seed (Sheffield University)
- Gerry Edwards (National Semiconductor)
- Tim Reynoldson (D.T.I.)

## NMI

- John Gaitanos
- Julie Stockwin

**UKpsc**

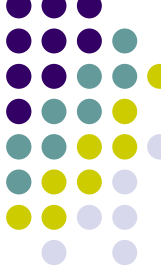
**UK paradigm shift consortium**



**The 10-year Goal for UKpsc**

# UKpsc

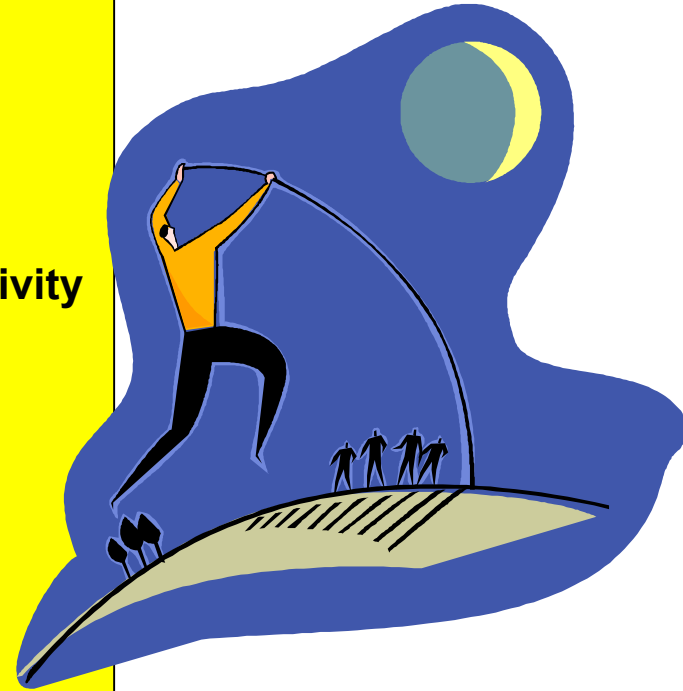
# UK paradigm shift consortium



## Overall Program Goals

**Enable Moore's Law for Design = designer productivity doubles every 18 months = reduce cost of design**

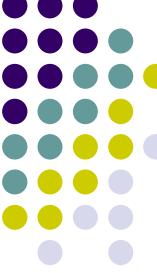
**Improve supply of innovative designers**



**Proposed UKpsc 10-Year Goal, March 2003**

**UKpsc**

**UK paradigm shift consortium**



## **The Research Theme/Focus for Ukpsc**

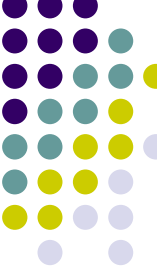
**W.I.P. but -**

**Link to ITRS roadmap**

**Cover the Whole Product Plan**

# UKpsc

# UK paradigm shift consortium

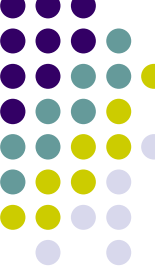


## Summary

- **UKpsc is a collaboration leading to industrially useable results**
  - **Collaboration to get critical mass**
  - **Useable results to attract further investment**

# UKpsc

# UK paradigm shift consortium

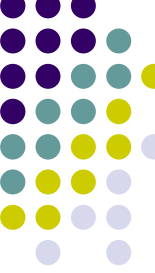


## Summary

- UKpsc is a collaboration leading to industrially useable results
- **UKpsc has a simple focused R&D theme of dramatically improving designer productivity**
  - Investment magnet
  - Reduction of labour content

# UKpsc

# UK paradigm shift consortium

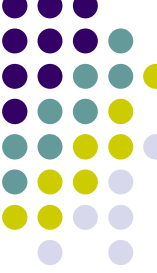


## Summary

- UKpsc is a collaboration leading to industrially useable results
- UKpsc has a simple focused R&D theme of dramatically improving designer productivity
- **UKpsc has a simply stated objective to ensure that UKplc remains the premier I.C. design “house” in Europe**
  - **Need everyone’s support and encouragement**
  - **Improved chance of getting the funding**

# UKpsc

# UK paradigm shift consortium



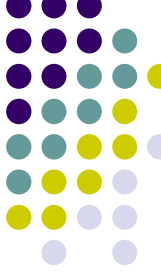
## Summary

- **UKpsc is a collaboration leading to industrially useable results**
- **UKpsc has a simple focused R&D theme of dramatically improving designer productivity**
- **UKpsc has a simply stated objective to ensure that UKplc remains the premier I.C. design “house” in Europe**

*“The only thing necessary for the triumph of evil is for good men to do nothing.” Edmund Burke*

# UKpsc

# UK paradigm shift consortium



## Questionnaire

Name: \_\_\_\_\_ Organisation: \_\_\_\_\_

- Do you agree that there is (or will be) an investment problem? YES/NO
- Do you agree that UKpsc could be (part of) a solution? YES/NO
- Why would a research institute/consortium like UKpsc help to solve the problem? \_\_\_\_\_

- 
- Why do you think that the solution needs to be -
    - a. UK wide? \_\_\_\_\_
    - b. A consortium? \_\_\_\_\_
    - c. Academic work but with direction from Industry? \_\_\_\_\_  
\_\_\_\_\_
    - d. Capable of staged delivery of work-product useable by Industry? \_\_\_\_\_  
\_\_\_\_\_

# UKpsc

# UK paradigm shift consortium



## Questionnaire

Name: \_\_\_\_\_ Organisation: \_\_\_\_\_

● Why is designer productivity the right area to attack? \_\_\_\_\_

● Why is the proposed 10 year Goal the right one? \_\_\_\_\_

● Why should it be a virtual consortium? \_\_\_\_\_

● Why should it have a base? \_\_\_\_\_

● What is missing from the proposal you have heard about today? \_\_\_\_\_

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Will you participate? 1. YES 2. NO