The Age of Systems Challenges

Alan Harding CEng FIET

INCOSE UK President

Rational Systems and Software Engineering **Symposium**

Presentation Structure

1. Today's global systems challenges
2. The systems we produce
3. Today's systems engineering approaches
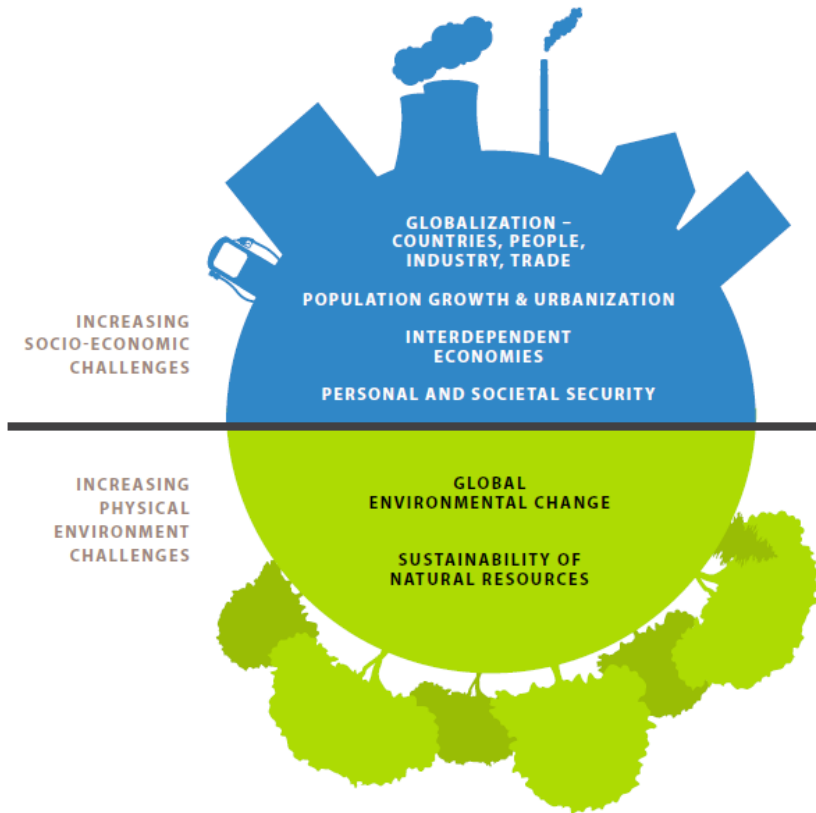4. Summary

1. Today's global systems challenges

Global Challenges

- Human needs stable over centuries
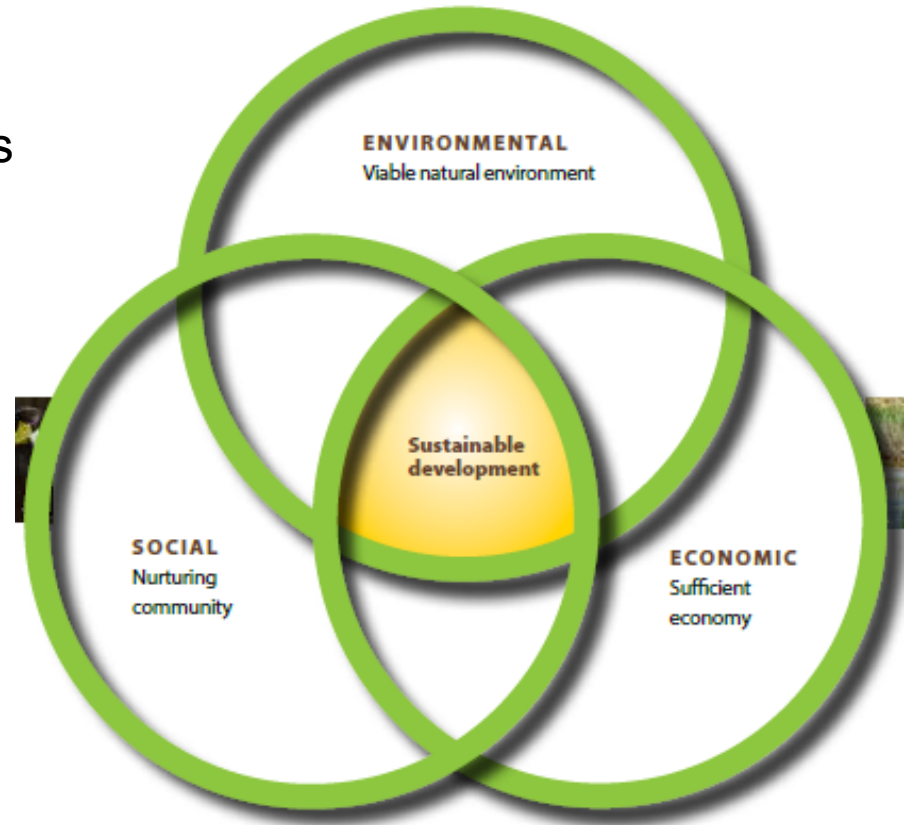- Societal needs similar globally
- Systems must respond to needs

FOOD AND SHELTER

CLEAN WATER

HEALTHY (PHYSICAL) ENVIRONMENT

ACCESS TO HEALTH CARE

ACCESS TO INFORMATION, COMMUNICATION, EDUCATION

TRANSPORTATION AND MOBILITY

ECONOMIC SECURITY AND EQUITY

SECURITY AND SAFETY

Global Trends

- New demands on systems
- Impact of technology developments
- Demands of the global community
- Interdependencies

GLOBALIZATION –
COUNTRIES, PEOPLE,
INDUSTRY, TRADE

POPULATION GROWTH & URBANIZATION

INTERDEPENDENT
ECONOMIES

PERSONAL AND SOCIETAL SECURITY

INCREASING
SOCIO-ECONOMIC
CHALLENGES

INCREASING
PHYSICAL
ENVIRONMENT
CHALLENGES

GLOBAL
ENVIRONMENTAL CHANGE

SUSTAINABILITY OF
NATURAL RESOURCES

Sustainability

- Systems must meet conflicting needs
- Our professional responsibilities
- Possible barriers to sustainability

ENVIRONMENTAL
Viable natural environment

Sustainable development

SOCIAL
Nurturing community
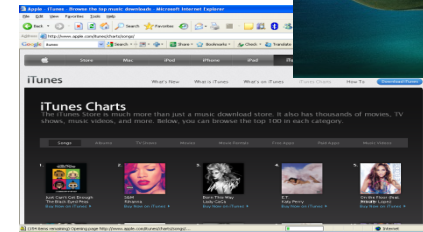
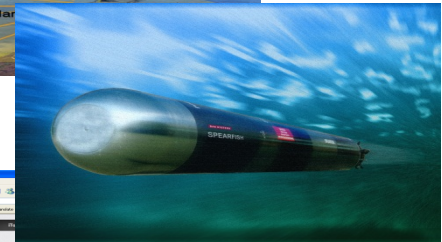ECONOMIC
Sufficient economy

2. The systems we produce

Types of Systems we engineer

- Enterprise – redesign of organisations
- Capability – integrating systems and services
- Product – set of integrated systems and subsystems
- Service – integrating existing and newly delivered systems
- Systems of Systems – combinations of existing and modified systems

# Domains where Systems Engineering is applied

- Aerospace and Defence
  - Traditional domains
  - Bespoke products

- Steady wider adoption
  - Adaptation
  - Diversification
  - Sharing good practice
  - Increasing product focus
  - Need clear value proposition

SYSTEMS ENGINEERING IS PRACTICED DIFFERENTLY ACROSS MANY APPLICATION DOMAINS

Application Domains

Information

Energy

Aerospace and Defense

Transportation

Public Policy

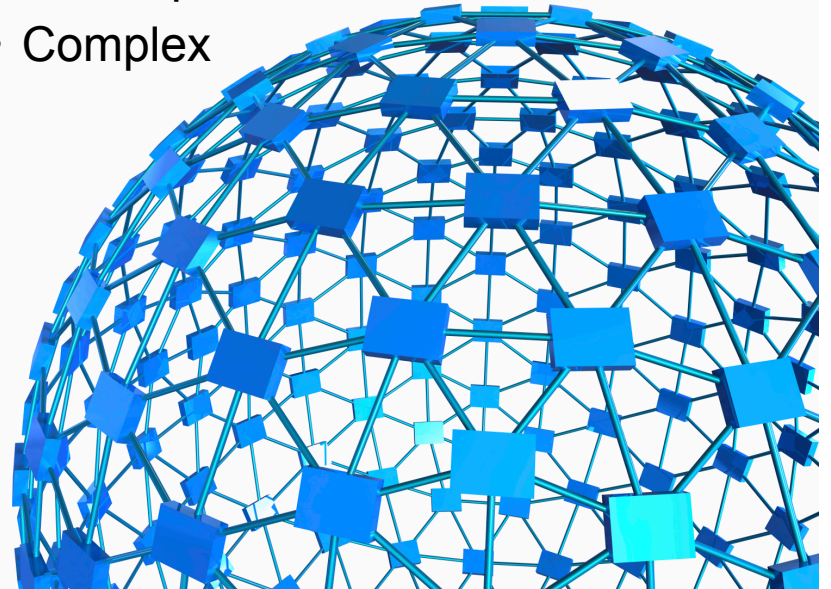Automotive

Biomedical

Consumer Electronics

System characteristics our stakeholders require

- Sustainable
- Scalable
- Safe
- Smart
- Stable
- Simple
- Secure
- Socially Acceptable
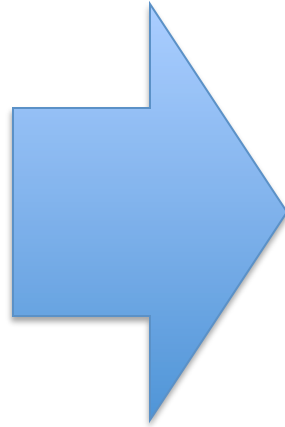
- Interconnected
- Interdependent
- Complex

3. Today's systems engineering approaches

Organisational Systems Engineering Capability

- Variety of organizations that use SE or provide SE services:
  - Business with multiple project teams
  - Project that spans multiple businesses
  - SE team within either of the above
  - Business with a single project team
  - SE service supplier

- Variation - product types, domain, country, maturity levels, commercial context …

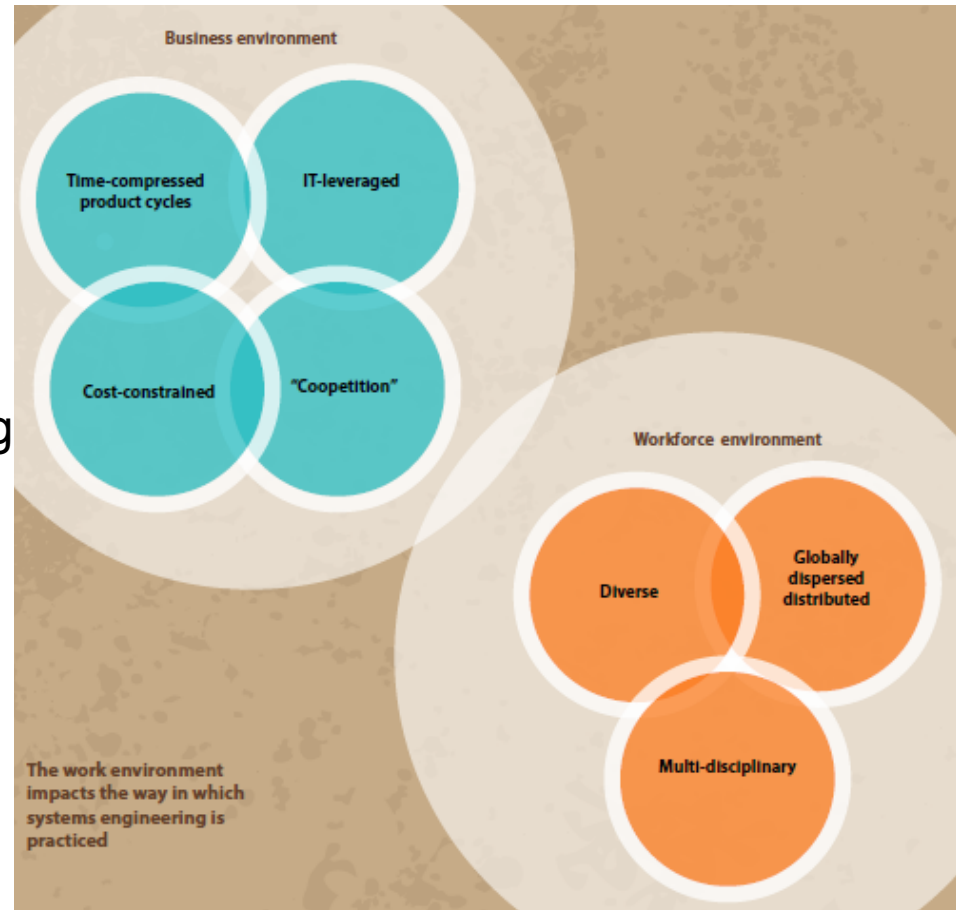|	
Organisation & Culture	Knowledge & Information
People	Process
Methods and Tools	Enabling Infrastructure

Individual Systems Engineering Competency

- Systems engineer is the lynchpin
- Must lead/influence decision-making
- Vital to balance soft and hard skills
- T-shaped individual
- Competency is key
  - Specialist SE skills
  - Wider general understanding
  - Leadership and soft skills
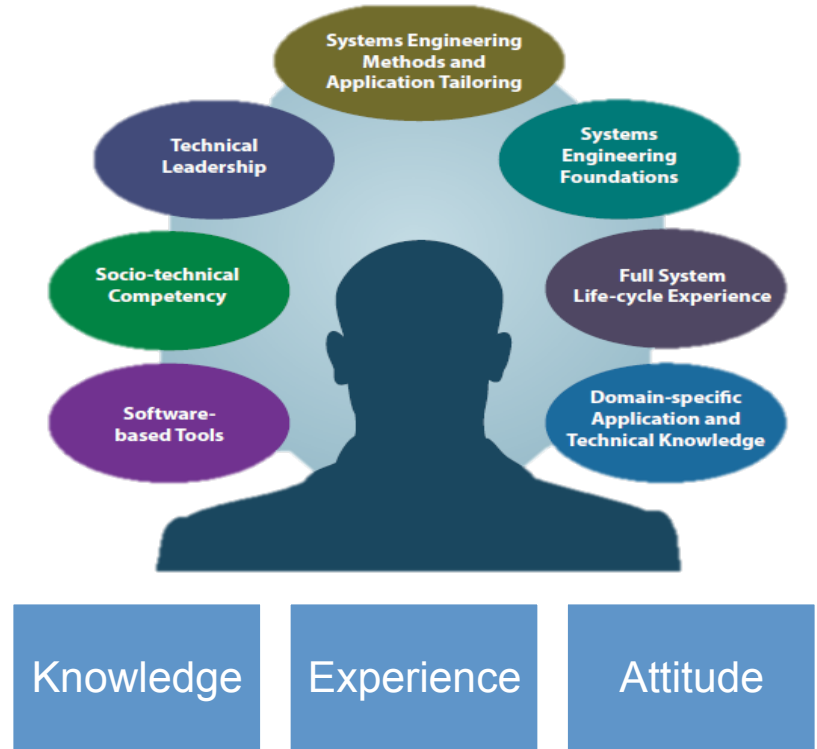
Drivers for change

- Need to adapt our approaches
- Need for agility
  - Agile products
  - Agile product development
- "Just enough" systems engineering
  - Influence early decisions
  - Ensure successful delivery
- Enablers
  - Model-based approaches
  - Tool interoperability
  - Standards

Business environment

Time-compressed product cycles

IT-leveraged

Cost-constrained

"Coopetition"

Workforce environment

Diverse

Globally dispersed distributed

Multi-disciplinary

The work environment impacts the way in which systems engineering is practiced

4. Summary

Summary

- The global context for systems engineering is ever-more complex
- Sustainability a mainstream issue
- Systems engineering practiced ever-more widely
- Differing challenges in traditional and newer domains
- Systems approaches must evolve to meet these challenges
- Systems engineers must evolve also

Questions

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