Presented by Professor Arie Dubi, Grand Fellow of the MIRCE Akademy

With introduction by Dr Jezdimir Knezevic, Director of the MIRCE-Mechanics Laboratory

A five day intensive *HANDS-ON* course for professional engineers, managers, analysts and other decision-makers.

Includes a copy of Professor Arie Dubi's recently published book – Predictive Modelling and Simulation for Maximizing System Performance – plus SPAR^{TM} Demo Version Software

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MIRCE Engineering School

17th International Summer School

Predicting In-Service Reliability, Cost and Effectiveness
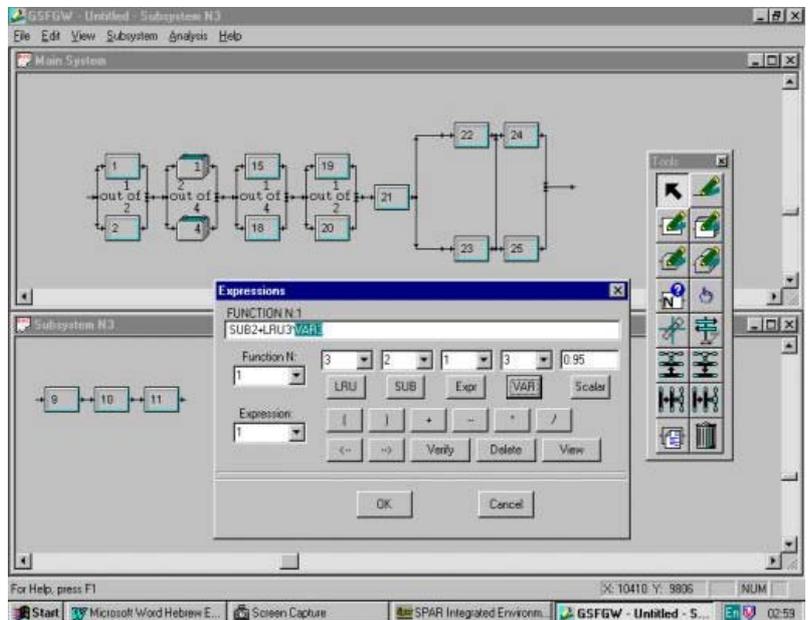
A Systems Approach to Products and Processes using SPAR^{TM} Simulation Technology

3 – 7 July 2006, Woodbury Park, Exeter, United Kingdom

MIRCE Akademy

What's in it for me and my sponsoring organisation?

Interested in getting better answers to these and many other similar questions by learning how to use a tool that enables more accurate predictions?

- **What will the system availability be?**

- **What will the operational reliability be?**

- **What will the operational revenue be?**

- **What will be the expected cost of the operational system?**

- **How many repair teams will be needed?**

- **How durable will the system be?**

- **How many and what types of failures will occur?**

- **When should the system be maintained?**

- **Which spares should be ordered, when and how many?**

- **Where should repairables and consumables be kept?**

- **Where should repair facilities be located?**

If your answer is yes, enrol now because the Summer School is for you!

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A Practical Tool for Engineering and Management

This Summer School has been developed to enable participants to obtain solutions to engineering and management problems using the features of SPAR^{TM} as a basis of modelling.

SPAR^{TM} is more than just a software – it is a model development platform for customised applications. SPAR^{TM} technology consists of numerous extensions to traditional Monte Carlo techniques. These extensions were designed to model real-world phenomena such as age and aging, capacity, demand profiles, time delays, induced behaviour, maintenance, inspection, spare parts, repair and overhaul. SPAR^{TM} creates a model of the specific system under consideration that can be used for accurate analysis and prediction.

Where participants have particular interests in a specific types of systems or modelling problems every attempt will be made to incorporate and /or stress these subjects during the Summer School.

Day One
Modelling Component and System

Systems Engineering

- Overview
- Modelling and learning from analysis
- Reliability, Availability, Performance

Modelling A Single Component

- Analysing availability
- Aging and partial repair
- Aging and partial repair impact on availability

Participants will create and analyse suitable models to understand how to build and study a model using SPAR^{TM}.

Modelling A System

- Building a general Reliability Block Diagram (RDB) for a multi-component, repairable, system
- Output structure of SPAR^{TM} – Availability, Sensitivity
- Models related to failure detection – Line Replaceable Unit (LRU) level, system level, continuous monitoring, periodic inspection etc.
- Profile states – various modes of operations of a system with different failure rates or distributions
- Example of an aircraft squadron – rest mode, sorties, pre-flight check-up mode etc.

Day Two
Default Model of SPAR ™

Default model of SPAR^{TM}

- Failure data and repair data
- Repair versus replacement
- The repair cycle
- Spare parts and the basic logistic environment

- Throughput
- Production and warranty of production levels
- Modelling Response functions
- Subsystems
- Histograms related to warranty

The default model will be introduced through a case study or studies.

- Inspection and maintenance applied to ageing components in a production system

Day Three
Modelling Passive and Active Relations

Defining basic logical and contingencies in systems – Passive active relations

- Critical role and necessity in a logical modelling language

- Logical points and conditions and actions: passivate, activate

- Example – An elaborate communication system with active and back up passive elements

- How to define "Master slave relations"

- Symmetric "passive backup"

- Optimisation of spare parts – a detailed case study

- Introduction and use of "operational clocks"

Day Four
Modelling – Actions and Conditions

Advances in the use of the "Actions and conditions language"

- Continuation of the optimisation of spare parts

- Adding repair team considerations:
  - Number of repair teams required
  - Performance impact of number of available repair teams
  - "Idle time" of teams

- New modelling features:

  - Dynamic changing of the recycling time (False removal and condemnation decision made at the repair depot, probability that a failed unit can be either "Repaired on site", "condemned on site" or recycled)

  - Cost considerations
  - Life cycle cost
  - Cost of spares
  - Cost of failures
  - Cost of system "down time"
  - Dynamic changes in failure rates
  - Use of variables to record data and apply complex conditions

These features will be introduced through the analysis of a military system including attrition and additional emergency situation features.

Day Five
Modelling – Additional Features

Additional Modelling Features

- Introduction of User arrays and dynamic arrays for modelling dynamic systems features:
  - Multistage repair processes
  - Multistage preparation of system for activation

- Additional modelling features:
  - Induced failures (a failure in a component may cause a failure in other parts of the system)
  - Protection mechanism with periodic inspection
  - Tallies
  - History counters
  - Freezing components upon failure

- Summary Exercise of a production system with many modelling features. Starting from creating the model through optimising spare parts allocation, optimising maintenance and inspection intervals (versus total life cycle cost)

The Summer School is focused on a HANDS-ON approach to System Modelling. Analytical explanations are used only when it is essential for the understanding and interpretation of various models.

Professor Arie Dubi

Professor Dubi is a world leader in the application of Monte Carlo simulation to System Engineering and is the author of the SPAR^{TM} technology. Arie Dubi is a professor in the Nuclear Engineering Department of the Ben-Gurion University and is the Chief Scientific Officer of Clockwork Solutions Ltd.

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Schedule

Each day will start at 0900 and will involve some evening activities including practical hands-on exercises, a technical visit to the Nigel Mansell World of Racing and the Summer School Dinner. There will be coffee and tea breaks in the mornings and afternoons and lunch is provided.

Full joining instructions will be issued to participants approximately two weeks before the event.

Cost

The Summer School package includes – presentations, one copy of the book Predictive Modelling and Simulation for Maximizing System Performance by Professor Arie Dubi plus SPAR™ Demo Version Software, supporting programme, lunches, light refreshments and the Summer School Dinner. There will also be a technical visit to the Nigel Mansell World of Racing. Please note that the cost of accommodation is not included.

The cost of the full Symposium Package is just £1750.00 + UK Value Added Tax £306.25 = £2056.25 per person.

A downloadable Booking Form is available at – www.mirce.com

MIRCE Akademy

MIRCE Akademy is an independent science-based organisation that specialises in developing knowledge, people, processes, methods and tools for managing in-service reliability, cost and effectiveness of technical systems.

We help our customers to improve system design and operation through –

- Research and analysis
- Educational programmes
- Training programmes
- Publications
- Software
- Conferences

Our knowledge and skills have benefited designers, manufacturers, constructors, operators, service-providers, regulators and others in the aerospace, automotive, communication, construction, defence, transport, service, utility sectors and other areas of business and government. Our customers include organisations such as Airbus, Alenia, Augusta Westland, BAE Systems, Dassault, EADS, Cosworth, Hagglunds, Lockheed Martin, Rolls-Royce, Saab, Selex, Thales, and other organisations and agencies world-wide.

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SPAR™ Technology

SPAR™ Technology is the proprietary software of **Clockwork Solutions Ltd**. Clockwork Solutions is a leading services and applications providers of asset management solutions to help decision makers meet business objectives by improving performance and reducing life cycle costs of complex expensive assets.

SPAR-based technology is applied in the areas of **Life Cycle Management** (LCM), **Performance Based Logistics** (PBL), **Contractor Logistics Support** (CLS), **Readiness Based Sparing** (RBS), **Reliability, Availability, and Maintainability** (RAM), **Design for Supportability**, **System of Systems**, **Fleet Management**, **Risk Based Inspection** (RBI), and **Condition Based Maintenance** (CBM).

Past and present users of SPAR™ and clients of Clockwork Solutions include the US Army, Lockheed Martin, American National Power, BP Amoco, US Airforce, ABB, DOW Chemical, UK Ministry of Defence, GE Power Systems, GE Aircraft Engines, Raytheon, The Federal Aviation Administration, and over 100 other enterprises worldwide.

For further information visit – www.clockwork-solutions.com

Venue

The Summer School will be held at Woodbury Park, which is approximately eight miles from Exeter by road.

Communication between Exeter and other parts of the United Kingdom are excellent. By road, the M5 motorway links Exeter to London, the Midlands, Scotland and Wales. Regular rapid coaches run services to and from London and Heathrow Airport. By rail, a regular service is available to and from Exeter (St David's Station) and London (Paddington Station). By air, Exeter Airport offers regular flights to many British and Continental destinations and is situated near to Woodbury Park. Travel between Exeter and Woodbury normally requires a car or taxi.

Delegates are responsible for the arrangement and payment of their own travel and accommodation. Delegates wishing to take advantage of preferential room rates should contact Woodbury Park Hotel Reservations quoting 'MIRCE Akademy'.

A list of alternative accommodation in other hotels and guesthouses in the vicinity is available from MIRCE Akademy on request.

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