21st **MIRCE** International Symposium

5 – 7 December 2011, Woodbury Park, Exeter, UK

MIRCE Mechanics*

- *The Key for Effective In-service Support*

MIRCE Akademy

Public Sector Reality:

"*Britain will be forced to temporarily mothball 40 out of 67 WAH-64 attack helicopters because training delays mean insufficient aircrew will be ready to operate the type. Mid-2004 will see at its peak 40 WAH-64 in storage following delivery. This is primarily because problems in development of the full mission simulator resulted in the start of main pilot conversion program being delayed from September 2001 to September 2003. Aircraft have already begun to be stored at the RAF site at Shawbury, and this will continue at least until 2006*" (Aviation Week & Space Technology, 4.11.2002)

Business Sector Reality:

"Sipping a cold beer in the transit lounge of Kisumu Airport, Mr A.W.Sambu, a Nairobi businessman, said: *"It appears that I shall be here for two weeks. Our Kenya Airways flight to Berlin could not take off because as we boarded her the plane developed a flat tyre. The ground staff tried to reinflate it with a bicycle pump – but all in vain. I think it is disgraceful that our national carrier planes should operate without spare tyres."*

The main objective of the Symposium is to facilitate annual exchange of experience and knowledge among supportability engineers and managers that are responsible for the creation of support systems by addressing the following type of challenges:

- **Should commercial aircraft be designed to fly with or without spare tyre?**
- **What is additional training time induced by designing a unique cockpit layout?**
- **How much commonality should be designed in a new system?**
- **Should Simplified Technical English be used in all Maintenance Publications?**
- **How many special tools are acceptable for a news System?**
- **How the shape of components impact packaging and transportation process?**
- **How standardisation reduces obsolescence problems?**

The answers to the above type of questions directly determine the speed and the cost of the motion of functional system through functionability process and they come directly from principles, methods and formulas of **MIRCE Mechanics.**

* **MIRCE Mechanics** is a body of scientific knowledge for **M**anaging **I**n-service **R**eliability, **C**ost and **E**ffectiveness.

Monday 5th December 2011	
0830- 0900	**Registration and welcome coffee, Woodbury Park Hotel, Colin Chapman Room**
0900 - 0905	**Welcome by Dr Jezdimir Knezevic, Founder & President, Mirce Akademy, UK**
0905 - 0945	**Key Note: Presentation** **Delivery of Urgent Requirements - The Supportability Challenge** Mark Willis, LSC Group, Lichfield, UK (www.lsc.co.uk)
0945-1030	**Supporting Supportability:** Chris Swallow, Technical Specialist, PTC, USA Focus on both, industrial, and militaristic, development and deployment of techniques and strategies to contribute towards solving current Supportability Engineering. Challenges.
1030-1100	**Morning Coffee**
1100-1130	**Use of Simulation for Determination of In-service Requirements** **Phil Sturgess, Systecon, UK (www.systecon.se)**
1130-1215	**Numerical Predictions of the Motion of Spares through Logistics Support Process** Antonello Marras, NATO Maintenance and Supply Agency, NAMSA, Luxembourg
1215-1300	**Mirce Mechanics Based Studies of Virgin Galactic In-service Support** Stuart Peake, Doctoral Diploma Student, MIRCE Akademy, UK
1300 -1400	**Lunch**
1400-1530	**Master Class: Support Task Dynamics** Dr J. Knezevic, MIRCE Akademy, UK
1530 -1600	**Afternoon Tea**
1600 -1730	**Master Class continuation**
1830 -2000	**2011 MIRCE Akademy Annual Lecture** **The Last AF447 Flight - Mirce Mechanics Perspective** **Antonello Marras, Master of Mirce Mechanics, NAMSA, Luxembourg**

Tuesday 6th December 2011	
0830– 0900	**Registration and welcome coffee,** Woodbury Park Hotel, Colin Chapman Room
0900 – 1000	Kay Note Address: **Impact of No Fault Found (NFF) on Through Life Engineering Services** Wing Commander Chris J. Hockley OBE, CEng, MRAeS, RAF(Rtd), EPSRC Centre for Innovative Manufacturing in Through-Life Engineering Services, Cranfield University, Shrivenham, UK
1000 – 11.00	**Impact of Commonality on Effective In-service Support ,** **The New Boeing 787 Dreamliner Story** Dr J. Knezevic, MIRCE Akademy, Exeter, UK (www.mirceakademy.com)
11.00– 1130	**Morning Coffee**
1130 – 1300	**Total Life Cycle Systems Management and Performance Based Logistics (PBL)** Charles O. Coogan, CPL. Acquisition Logistics Engineering, *Worthington,* Ohio, USA
1300 – 1400	**Lunch**
1400 – 1530	**Master Class** ASD-STE100 **Simplified Technical English**, Orlando Chiarello, SECONDO MONA S.p.A., SOMMA LOMBARDO (VA), Italy
1530 – 1600	**Afternoon Tea**
1600 – 1730	**Master Class: Continuous**
1930 – 2130	**Symposium Dinner**
2130 – 2230	**MIRCE AKADEMY Ceremonies:** **Master and Doctoral Diploma Graduation and Fellowship Award**
2230 – 2300	Formula 1 Reliability & Effectiveness Centre, of the MIRCE Akademy Announcement and Award of the • **2011 Formula 1 Driver Reliability Chapion** • **2011 Formula 1 Team Reliability Champion** In accordance to the calculations based on the Mirce Mechanics

Wednesday 7th December 2011	
0830– 0900	***Registration and welcome coffee*** ***Woodbury Park Hotel, Colin Chapman Room***
0900– 1030	**Can We Adequately Model Stock Levels to Maintain System Availability?** **John Thompson, Science Fellow, MIRCE Akademy, UK**
1030 – 1100	**Morning Coffee**
1100 – 1200	**Guaranteed In-service Support Cost - Marketing Propaganda or Engineering Reality ?** Dr J. Knezevic, MIRCE Akademy, UK
12.00 -13.00	**"Should Wind Turbines be prepared for winter or left to their own devices?"** Dr John Crocker, Science Fellow, MIRCE Akademy, UK
1300 – 1345	**Lunch**
1345 – 1500	Visit **to F1RE Centre** of the MIRCE Akademy (F1 Reliability & Effectiveness) and **Nigel Mansell World of Racing,** ,where the remarkable Life Story of the 1992 F1 World Champion and 1993 Indy PPG World Champion, is presented trough original: racing cars, winning trophies, technical data and numerous memorabilia
1500 – 1530	**Afternoon Tea and Departure**

The Symposium will be held at **Woodbury Park Hotel, Golf and Country Club**, 8 miles from Exeter. 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 fast service is available to and from Exeter (St David's Station) and London (Paddington or Waterloo Station , both connected o Euro Star).

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. Those wishing to take advantage of preferential room rates should contact Woodbury Park Hotel.

For reservations, quote 'MIRCE'.
Woodbury Park Hotel, Golf and Country Club, Woodbury, Exeter, EX5 1JJ, UK

phone: 01395 233 382, fax; 01395 233 384 web: www.woodburypark.co.uk, email: enquiries@woodburypark.co.uk

Exhibitor:

LSC Group is a provider of technical through-life support solutions to the Defence and Energy markets working with our clients to enhance their critical decision-making capabilities. Our technology solutions and technical service expertise enable our customers to make better decisions regarding their platforms, equipment and business processes throughout the life-cycle. Our expertise is drawn from a blend of background and experience from the MOD, industry and academia. With a number of engineering and technology specialists we are able to work with our customers to deliver a range of capabilities predominantly within the Supportability Engineering and Information & Knowledge Management arenas.

Supportability Engineering
Also known as Asset Management Engineering Services in the Energy market, Supportability Engineering covers a range of disciplines associated with developing and delivering appropriate support solutions for assets such that the owner can derive desired availability and performance for minimum cost; these services can be deployed at any stage in the asset lifecycle

Information and Knowledge Management
Information and Knowledge Management (IKM) is the delivery is in Information Technology products and services to support the through-life management of assets. IKM could generically be described as the effective gathering, organisation, storage, dissemination, flow and exploitation of information and knowledge within and between organisations.

Find out more by visiting LSC Group's website: www.lsc.co.uk

Delivery of Urgent Requirements - The Supportability Challenge
Mark Willis, LSC Group, Lichfield, UK (www.lsc.co.uk)

In supporting the Afghanistan operation, a great deal of equipment has been purchased and provided under Urgent Operational Requirements. The Miltary should be congratulated for getting much needed equipment into the Theatre of Operation in such a timely manner and the benefits to the troops on the ground has been immense. Now the operation is looking to decrease in intensity over the next few years, the challenge is to recover as much of this equipment as possible, undertake repair and reconditioning programmes and then prepare it for the next operation. In the urgency to provide and deploy the equipment to Theatre, the amount and location of the equipment is not known, support publications are lacking, forward and reverse supply chains have not been established, effective repair loops do not exist, items have not been codified and spares have not been properly ranged and scaled. In short, there is a supportability mess to sort out.

In meeting the Urgent Requirements of an operation should the MoD forget all that they have learnt over the years about supporting equipment. Clearly, the MoD is rightly saying that their focus was on supporting the front line; however, as the cost of the operation is calculated should the cost of putting in place those supportability elements be attributed to the cost of the operation - someone has to pay! This presentation draws on work that has been carried out with a number of MoD Project Teams in order to scope the foregoing problem prior to addressing it.

Supporting Supportability:
Chris Swallow, Technical Specialist, PTC, USA
This presentation focuses on both, industrial and militaristic, development and deployment of techniques and strategies to contribute towards solving current Supportability Engineering. Challenges

Numerical Predictions of the Motion of Spares through Logistics Support Process
Antonello Marras, NATO Maintenance and Supply Agency, Luxembourg

This paper presents the new method that has been developed at NAMSA for the purpose of comparing different logistics support alternatives regarding the development of the effective spare provisining policy. It quantitatively answers the questions of the following type: What operational availability will be if:

- x spares are addded to the stock ?
- spares are transported by special currier of normal transportation ?
- cetralised spare depot is replced with regional spare depots ?

Unquestionably, accurate answers are imperative for the effective management of the motion of spares through logistivs support process in order that maximum levels of the fleet availability is achieved for a given operational budget.

Mirce Mechanics Based Studies of Virgin Galactic In-service Support

Stuart Peake, Doctoral Diploma Student, MIRCE Akademy, UK

The goal of the Virgin Galactic Company is to provide suborbital space flights to the paying public, sub orbital scientific missions and launches of small satellites. The operation will utilize a small number of reusable craft that will take off and land from a single location. The key to continued future business will be to achieve safe, reliable and economic flights, similar to any other business in reality. The key for the effective management of all three factors is the understanding of the complex interactions between their aircraft, support system (operational and maintenance resources) and the operational environment through time.

This presentation will provide an insight of the initial research performed by the author regarding the inherent supportability characteristics of the Virgin Galactic craft and expected support infrastructure that is initially focused on the operation from one launch site and later concepts that envisage multiple launches from multiple sides located all over the world.

Master Class: Support Task Dynamics

Dr J. Knezevic, MIRCE Akademy, UK

The objective of this Master Class is to present a scientifically derived method for the quantitative calculation of the duration of support tasks of any type and complexity. The prediction method is based on: the physical structure of the task, resources required for its successful completion, expected environment. and organisational rules and regulations. The method developed enables the impact of the human, natural and organisational environment on the duration and quality of support task to be considered in a quantitative manner.

As support tasks are “the building blocks” of a support processes of any system, the ability to accurately calculate their performance measures, cost and effectiveness, could be beneficial to supportability engineers and ILS managers, especially as the accurate calculations are possible at the planning stages when any changes could be implemented at minimum time and cost.

Topics to be covered during the presentation:

- System Support: Process and Tasks:
- Support Task Performance Measures
- Analysis of Support Task Duration Based on In-service Data
- Prediction of Support Task Duration Based on Mirce Mechanics Method
    - Sequential Support Tasks
    - Simultaneous Support
    - Complex Support Tasks
- Human Impact on Support Task Dynamics

- Environmental Impact on Support Task Dynamics
- Organisational Impact on Support Task Dynamics

Impact of No Fault Found (NFF) on Through Life Engineering Services

Wing Commander CJ Hockley OBE, CEng, MRAeS, RAF(Rtd)
EPSRC Centre for Innovative Manufacturing in Through-Life Engineering Services, Cranfield University, Shrivenham, SN6 8LA, UK

Past experience and studies have shown that the cost of removal of individual items, components and Line Replaceable Units (LRUs) can be huge where subsequently nothing has then been found wrong and the same fault re-occurs in the next or a subsequent mission. Despite much research and solutions in various sectors, such costs continue to drive up the cost of Through-life Engineering Services. Solutions are sometimes appropriate to particular engineering sectors or organisations, but best practice is not being transferred successfully across sectors or industries.

There are many and varied causes for NFF ranging from organisational, procedural, process and even behavioural issues together with the more obvious ones that have usually been given more attention; these fall into several classes such as:

- Intermittent faults. A fault is indicated but is not replicated either due to changed usage or operational conditions or cannot be replicated during maintenance either within the host system or when tested on the test bench.
- Integration faults. A component or sub-system works correctly on test but shows faults when incorporated with other systems or in the host system.
- BITE (Built-in-Test Equipment) indicates a fault but there is insufficient information available to locate the exact fault or unit to be replaced.

The presentation will describe the current assessment of NFF problems that are disrupting many new solutions for delivery of cost-effective through-life engineering services. It will describe the current research activity now underway to address the problem across many sectors over the next 3 years in the newly created EPSRC Centre for Innovative Manufacturing Engineering Through-Life Services based at Cranfield.

Impact of Commonality on Effective in-service Support - The Boeing 787 Dreamliner Story

Dr J. Knezevic, MIRCE Akademy, Exeter, UK (www.mirceakademy.com)

Commonality is a mechanism of Supportability Mechanics that refers to the similarity between products. It significantly impacts on the motion of a product through the in-service support process by reducing variability, simplifying operations, improving product reliability, reducing training demands for operation and maintenance personnel, eliminating the need for special tools and equipment and other logistics support resources, which increases product operability and consequently increases revenues.

To achieve in-service commonality with the Boeing 777, the 787 Dreamliner team had to make sure the new airplane "felt" like a 777. In the flight deck, for example, commonality is created simply by where displays, switches and controls are located. One of the most notable decisions was to retain the traditional wheel-and-column mechanism. Although Boeing studied other control mechanisms including a side stick, the team's analysis found that the wheel-and-column arrangement "provides the feedback and the awareness pilots need to make and execute decisions during critical periods." as its controllers

- Are cross-linked between pilots to avoid confusion.
- Have large ranges of motion for improved peripheral cueing.

- Are back-driven to give pilots better visual and tactile understanding of what either the auto-flight system or the other pilot is doing.

However, there's more to it than just the flight deck physical layout. Advanced systems are the real key to ensuring that the feel of the airplanes are the same. B777 and B787 are nearly 15 years apart, and "it would be short-sighted to not take advantage of new technologies," said Mike Sinnett, chief engineer for 787 Systems. "However, with advanced systems, we can make those differences nearly invisible to the flight crew. We have digitally recreated the feel and functionality of the 777 but we use more efficient and modern approaches."

BOEING GRAPHIC

Pilots have applauded the flight deck of the Boeing 787 Dreamliner.

Total Life Cycle Systems Management and Performance Based Logistics (PBL)

Charles O. Coogan, CPL, Acquisition Logistics Engineering, *Worthington,* Ohio, USA

- **Introduction to Performance Based Logistics**
- **Common Misconceptions about PBL**
- **Developing Metrics for Supply Chain PBL**
- **A case study: F-16 Radar Modernization**

SIMPLIFIED TECHNICAL ENGLISH Specification ASD-STE100

The international specification for the preparation of maintenance documentation in a controlled language

ASD-STE100 MASTER CLASS
Orlando Chiarello

The Master Class has the purpose of introducing ASD Simplified Technical English, Specification ASD-STE100 (STE), as a standard recognized and used worldwide. It will include a brief history of the STE specification within the aviation industry, its range of applications, a summary of its structure, the overall principles and rules. The focus will be put on the fact that STE is regarded as an important and valuable resource for technical writing to simplify the correct understanding of the maintenance instructions by the operators and remove the linguistic barrier. Controlled grammatical structures and vocabulary – on which STE is based – have the purpose of producing texts that are easily understandable and, consequently, errors during the maintenance tasks and Human Factors risks can be dramatically reduced.

14.00 – 15.30

Introduction: General presentation
- What is ASD Simplified Technical English? (ASD-STE100)
- Why do we need a controlled language?
- Who uses ASD-STE100?
- History, background and philosophy of ASD-STE100
- The ASD-STE100 Specification: Part 1 Writing Rules
- Overall overview of the writing rules
- Part 2 ASD-STE100 Dictionary - How to use the dictionary

16.00 – 17.30

Brief tutorial of the Writing Rules
- Section 1 - Words (approved words, Technical Names, Technical Verbs, Part of Speech given)
- Section 2 - Noun Phrases (noun clusters, article and demonstrative adjective)
- Section 3 - Verbs (forms and tenses, active and passive voice)
- Section 4 - Sentences (short and one topic sentences, tabular layout, connecting words)
- Section 5 - Procedures (sentence length, verbs)
- Section 6 - Descriptive Writing (sentence length, paragraphs)
- Section 7 - Warnings, Cautions and Notes
- Section 8 - Punctuation and Word Count (punctuation marks, parentheses)
- Section 9 - Writing Practices (different constructions, word combination, dictionary)
- Section 10 - Questions and answers

Master Class Presenter:
Orlando Chiarello,
Chairman of the STE Maintenance Group (STEMG)
STE National Coordinator for AIAD - Italy
Product Support Manager,
SECONDO MONA S.p.A.
Via Carlo del Prete, 1, 21019 Somma Lombardo (VA), Italy

Can We Adequately Model Stock Levels to Maintain System Availability?

John Thompson, Science Fellow, MIRCE Akademy, UK

This presentation represents a mathematician's view on capability of mathematics to adequately predict demands for spares of real functional systems in real support processes. The presentation will cover the following topics:

- Why use maths models.
- Possible models
- Markov chains, Poisson, Halls Theorem and Graph theory.
- Real world challenges
- Are failure rates constant?
- Is cost a variable?
- How to account for human actions.

The author of the paper, as a mathematician, has spend over 30 years in engineering departments of the world leading aerospace companies,

Guaranteed In-service Support Cost - Marketing Propaganda or Engineering Reality ?

Dr J. Knezevic, MIRCE Akademy, UK

Mechanical, electrical, aeronautical, nuclear and other types of engineers convert product specifications, promised by marketing people, into in-service reality on a regular basis.
Unfortunately, during the last 50 years, Logistics and Supportability Engineers were not that successful in converting promises, made by marketing people, into physical deliverables.
Evidential data, from western defence industries, shows that the most accurate Life Cycle Cost prediction was 200% out of target and there are products whose Life Cycle Cost predictions have exceeded it targets by over 3000%.
The main objective of this presentation is to:

- Examine some of the causes of such mismatch between customer's expectations and producers capabilities to deliver it.
- Offer some solutions for narrowing the gap between promises and reality.

As this presentation is aimed at Supportability Engineers and ILS Managers, rather then t economist and business analysts, it addresses the cost in its simplest form, as a product of unit price and quantity. C=UP*Q, in order to demonstrate how engineering design decisions dominate in-service generated quantities, and as such are the main drivers of the Life Cycle Cost.

"Should wind turbines be prepared for winter or left to their own devices?"

Dr John Crocker, Science Fellow, MIRCE Akademy, UK

Deep sea wind farms in very high latitudes face a "winter" that typically lasts for around 6 months during which time the seas around them are likely to be frozen making them inaccessible during this period. At other times, they may also not be particularly easy to reach due to bad weather conditions ranging from thick fog to gale-force winds making approaching these remote farms very hazardous. If a wind turbine fails during the winter, it will therefore be unproductive until a support vessel can reach it which could be up to 6 months. However, support vessels will generally have limited capacity and there may also be restrictions on how long crews of mechanics can stay at sea (or inside a wind turbine) so it may not be possible to service every wind turbine within a farm at the end of a summer. The question this paper attempts to answer is what the optimum opportunistic/preventative maintenance policy is given limited resources and limited accessibility.

The MIRCE Akademy 2011 Annual Lecture

18.30, Colin Chapman Suite, Woodbury Park, Exeter, UK, 5th December 2011

The Last AF447 Flight - Mirce Mechanics Perspective

Antonello Marras, Master of MIRCE Mechanics, NAMSA, Luxembourg

On 1st June 2009, Airbus A330 on Air France Flight 447 disappeared in the mid-Atlantic Ocean.

Now, with the release of a third interim report by the French BEA (accident investigation bureau) is pretty clear what happened. On 16th August 2011 Peter Garrison wrote in Los Angeles Times "The big twin jet was inadvertently mishandled by the pilot who was flying it. He got it into an extremely unusual position, and neither he nor the other two pilots with him could figure out what was happening or how to fix it. For the next three minutes the airplane, its fuselage slightly nose-high as though approaching a landing, dropped toward the sea while the baffled and terrified pilots struggled to make sense of the indications on their instruments. But they never did what they needed to do — get the nose down, so that the airplane would be pointing in the direction it was going — to allow the Airbus, which was perfectly sound and intact, to recover and continue on its flight from Rio de Janeiro to Paris."

Complex and continuously changing relationships between: aircraft technical capabilities, existing flying conditions, human ability to fly and "to see the whole picture", named as functionability in Mirce Mechanics., is the main subject of this Lecture. However, the impact of the transition from mechanical to digital flight controls on ability of pilots to "feel the aircraft" in the conditions when functionability phenomena go beyond ability of aircraft to fly itself by computers is the main focus of this Lecture. Thus the question of effectiveness of training programmes on ability of pilots to "intuitively" deal with these low probability functionability events will be discussed here.

The Lecture is dedicated to the memory of all 228 people whose lives have ended with the last, uncontrolled touchdown, of flight AF 447. They were citizens of: Argentina, Austria, Belgium, Brazil, Canada, China, Croatia, Denmark, Estonia, France, Gabon, Germany, Hungary, Iceland, Ireland, Italy, Lebanon, Morocco, Netherlands, Norway, Philippines, Poland, Romania, Russia, Slovakia, South Africa, South Korea, Spain, Sweden, Switzerland, Turkey UK and USA.

Admission Free, all welcome, R.S.V.P. by 1st December

21st MIRCE International Symposium, 5 - 7 December 2011

THIS FORM MAY BE COPIED

Registration Form

Email: quest@mirceakademy.com
Phone: +44 (0) 1395 233 856
Mail: MIRCE Akademy, Woodbury Park, Woodbury, Exeter, EX5 1JJ, United Kingdom

Symposium Fees (in GB Pounds £)			
	Fee	VAT	Payable
• **Participants**	575.00	115.00	**690.00**
• **MIRCE Members**	525.00	105.00	**630.00**
• **MIRCE Students**	475.00	95.00	**570.00**

The Symposium Fees includes:

- Attendance
- Supporting Materials
- Lunches
- Light Refreshments
- Symposium Dinner on the 6th December
- Visit to Nigel Mansell World of Racing

Value Added Tax (VAT)

Unless special exemption exists, under UK Customs and Excise regulations delegates from all countries are required to pay UK VAT @ 20 % on all courses taking place in the UK. Non-UK delegates may be able to recover VAT incurred via the relevant tax authority in the country of origin of the delegate.

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Terms and Conditions

Substitution of participants may be made at any time. If you intend to do this, please advise the MIRCE Science ('the organiser') as soon as possible. Cancellation of a booking must be received in writing by the organiser at least 14 days before the commencement of the Symposium. MIRCE Science regrets that no refunds or credits will be made after the deadline unless the organiser cancels the Event.

The organiser reserves the right to alter the programme or cancel the Summer School at its discretion. All places offered are subject to availability.