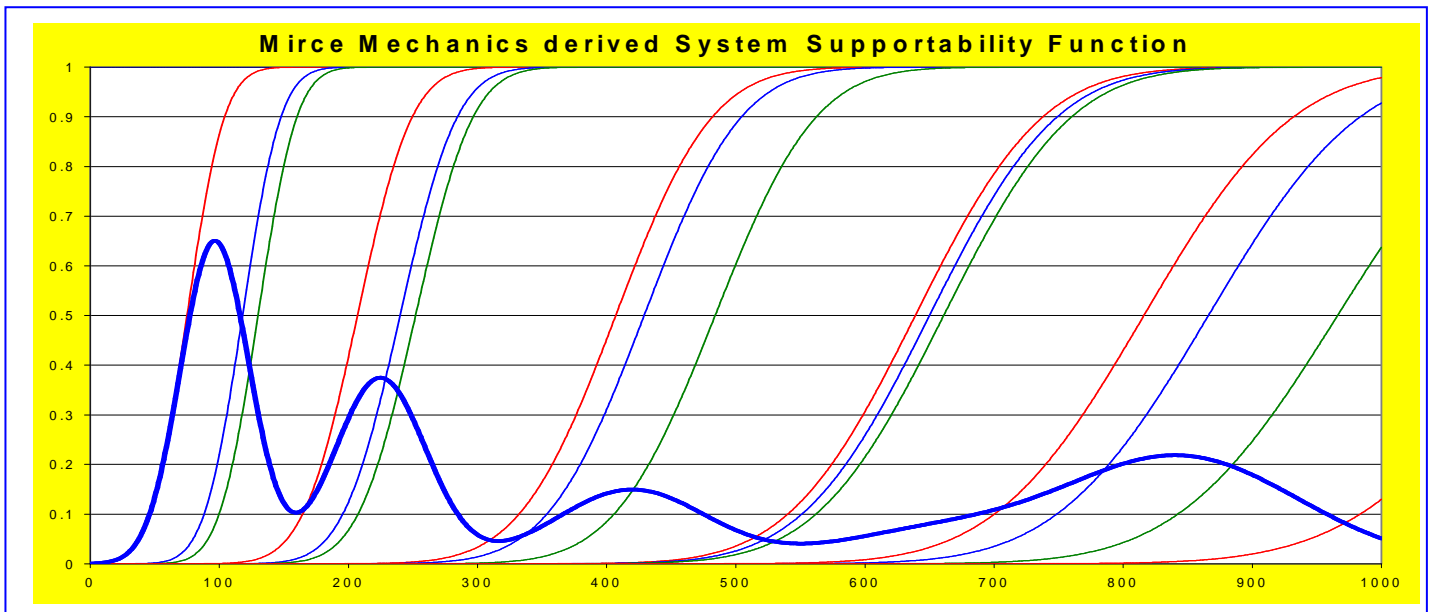


# The MIRCE Akademy International Summer School

## Mirce Supportability Equation for ILS & Managers & Supportability Engineers 7 – 11 July 2015, Woodbury Park, Exeter, UK



All engineering disciplines have been developed, several decades or even centuries, after the development of the relevant science discipline. Thus, mechanical, electrical, nuclear, chemical, aeronautical and other types of well recognised and proven engineering disciplines have grown on the foundations made of mechanics, electrodynamics, fluid mechanics, thermodynamics, quantum mechanics and similar scientific disciplines, fully defined by the proven laws and equations named after their creators like Newton, Maxwell, Hamilton, Lagrange, Euler, Bernoulli, Boltzman, Planck and other scientists.

However, the story of ILS Managers and Supportability Engineers is completely the opposite. They came on the scene in the second half of twentieth century in direct response to the customers' demands for supportable in-service systems, which existing engineering disciplines were not able to deliver. Under those circumstances thousands of dedicated professionals within aerospace and defence industries tried to do their best to rise to the challenge. Industrial standards were created, best practices were observed and prescribed to satisfy contractual requirements, but no significant progress has been made in establishing it as a well-recognised and proved discipline of engineering. Hence, for the first time in history, supportability engineering has been put on a par with other proven and respected engineering disciplines, with its own, science based, equations, terminology, definitions, physical units and prediction accuracy for each of feasible support options and strategy.

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7<sup>th</sup> - 11<sup>th</sup> July, 2015, Woodbury Park, Exeter, UK

## Past: ILS Management

Integrated Logistics Support (ILS) has been introduced into defence procurement process in mid 1980s with great expectations. For example: a significant reduction of Life Cycle Cost, massive improvement of Reliability and overall Operational Effectiveness have been expected by the Department of Defence in the USA. To facilitate this process Military Standards, like 1388 in USA and 00-60 in UK, have been launched.

In response to the ILS based contractual requirements defence industry world wide, trained thousands and thousands of people to master the art of performing Logistics Support Analysis (LSA), and populating Logistics Support Data Records (LSAR). The whole processes have been championed by the professional society, which at that time was known as Society of Logistics Engineers (SOLE). Enthusiasm for ILS lasted a good 15 years during which, everybody was working so hard to implement it, that hardly anybody checked what it was producing.

Then, when the “harvesting” time came, very little had been delivered. The reason is very clear, the ILS methods and tools where meticulously delivering information required, but that process had very limited impact on the supportability performance of the weapon systems in-service.

Consequently, the ILS methods, deeply rooted in acquisition processes and tools, were “re-named” as the Supportability Engineering methods and tools, with the same people doing the same jobs under the new name. Today the number of those people has been drastically reduced due to retirement or lack of jobs. The research performed at the MIRCE Akademy, since 1999, has culminated into creation of the science based method which enable project ILS objectives to be, fully met, at least cost.

## Future: Supportability Engineering

Demands for the reduction of the Life Cycle Cost and improvements in operational readiness through effective in-service logistics support, of all defence systems are higher then ever. Sadly, today logistics profession have neither logistics professionals nor accurate and reliable methods to offer to Defence Community to more efficiently and less costly serve their masters – the front line.

Consequently this Summer School has been designed with objectives to expose you to the principles, methods and tools that have been developed during last decade at the MIRCE Akademy in UK, which will enable the migration of the ILS management professionals to system engineering process with unique responsibilities for the designing in-service support process, tasks and resources. These will finally, enable the delivery of all logistics engineering aspirations defined and written down by logistics professionals in: MIL STD 1388 1-A.

The knowledge presented in this programme is based on the scientific principles and as such does not:

- Belong to the Defence Industry only, others are benefiting too
- Have expiry date
- Have national boundaries

The unique knowledge presented in this programme is the foundation of the supportability engineering profession, which has always been in demand by the front line, but never had roots in the design offices, Engineering Colleges or University curriculum.

Above all, doing this job is great fun!

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7<sup>th</sup> - 11<sup>th</sup> July, 2015, Woodbury Park, Exeter, UK

## Programme

### Day One

Focuses on the scientific understanding of the system in-service processes and mechanisms that cause the demand for supportability tasks and resources. Occurrences of demand events results from complex interactions between the weapon systems physical properties, natural environment and human actions. Thus, each non-satisfied demand phenomena can prevent the effective operation of a weapon system potentially leading to material losses and lives. Hence, the imperative of all supportability engineering designs decisions is accurate predictions of demands which goes far beyond any reliability predictions currently performed in defence industry. Consequently, the major part of day one is dedicated to understanding the meaning and limitations of existing measures of supportability and corresponding values of reliability data, which are exclusive drivers of all supportability related decisions .

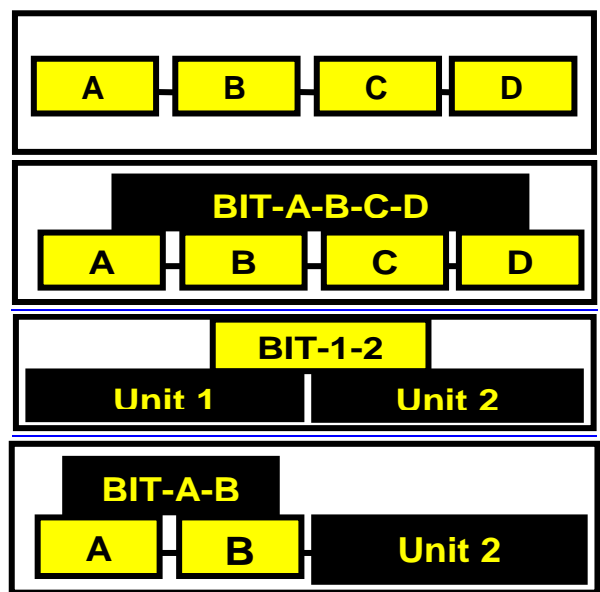
### Day Two

Focuses on the understanding of the system in-service measures and their the mathematical formulations, which quantitatively define the complex relationship between system inherent properties, from the design, with expected operational scenarios, applied maintenance policies and chosen support strategy. This evaluation of the time-dependent complexity is made possible by the development of Mirce Mechanics equations for the system in-service predictions as a function of weapon system reliability, maintainability and supportability related properties on one hand, and the expected front line life on the other. All of this became possible by considering a life of a weapon system as a sequence of in-service events, some of which are, of course, driven by the timing of the demands for and provisioning of logistics support resources like, trained and adequate personnel, as well as: required tools, equipment, material, facilities, technical information , energy and so forth.

### Case Study: System Support Design

**Best Weapon System Alternative** is one that provides the best compromise among all aspects of system life cycle process, regarding the functionality and functionability performance of the system considered against defined operational requirements and regulations. Certainly, some of them are directly related to the occurrences of **supportability events** that **require resources necessary to ensure a continuous provision of weapon system functionality through time or mission**. For the educational purpose, in this case study, it has been assumed that all system design alternatives, shown below, are fully compatible with its functionality performance of this. Thus, the participants will be actively engaged in the evaluation of all of them, from the point of view of supportability engineering, with the objective of addressing the following type of questions:

- **Which** is the best solution for the given design requirements and budget, **why** and by **how much**?
- Would you have chosen the same alternative, for example, for **Nigeria and Siberia**?
- Would you have chosen the same alternative, for example, for **Siberia in summer and winter**?



**Legend:** A, B, C, D, Unit1 and Unit2 are Line Replaceable Units and BIT is Built-In-Test devise that identifies a failed LRU.

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7<sup>th</sup> - 11<sup>th</sup> July, 2015, Woodbury Park, Exeter, UK

## Day Three

Fundamental principles of Mirce Mechanics are addressed here, in general, with a specific emphasis on the supportability engineering related issues. The participants will be introduced to the Mirce Mechanics formulas that defined the motion of a system “machine” through functionability/supportability states in respect to time. Guiding measures of supportability engineering decision making, like expected: total time in support, number of support tasks, duration of support tasks and similar will be explained and mathematically formulated, which enables evaluation of the impact of each supportability engineering decision on the in-service performance of the system considered.

## Day Four

Focuses on the demonstration of practical application of developed methods and technologies for the application of Mirce Mechanics Formulas to the tasks/activities of Supportability Engineering process to enable the integrated design team to predict the motion of supportability relevant events through each feasible design alternatives, starting from the conceptual stage of design, when changes are possible at no extra cost during a short period of time. The fundamental principles of supportability engineering, based on the Mirce Mechanics methods and algorithms are illustrated through the Case Study 1 (see the page above).

## Winter School - Special Feature

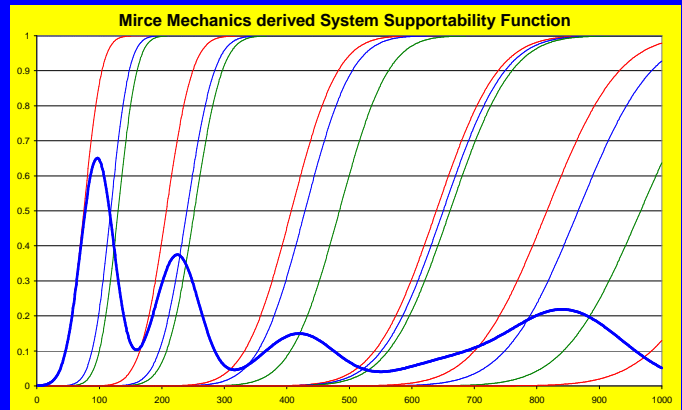
### Mirce Mechanics Based Studies of Virgin Galactic In-service Support

The objective of the Virgin Galactic company is to provide sub-orbital space flights to the paying public, sub-orbital science missions and small satellite launches.

This Case Study presents the results of the theoretical analysis of the demand for the maintenance and support resources required to deliver continuous level of despatch reliability and safety, necessary for the realisation of the profit, at the level expected.

## Mirce Supportability Equation

Mechanical, electrical, nuclear, aeronautical and many other types of engineers for centuries has been designing various types of machines based on the proven scientific knowledge and formulas of dynamics, fluid mechanics, thermodynamics, quantum mechanics, electronics, hydro-mechanics, quantum electrodynamics and similar. However, none of them are suitable for addressing supportability engineering related issues, which was the main reason for inability of ILS initiatives to deliver expected improvements related to weapon systems in-service performance. All predictable and deliverable engineering creations are based on scientific theories and principles, and supportability engineering could not have been exception.



Fully aware of this fact, the research activities at the MIRCE Akademy have been focused on this issue since 1999. It is our great pleasure to inform you that a science based knowledge relevant to the supportability engineering issues has been developed as part of the Mirce Mechanics, by Dr Knezevic. The motion of a system “machine” through the supportability states is fully defined by the following expression (see figure above).

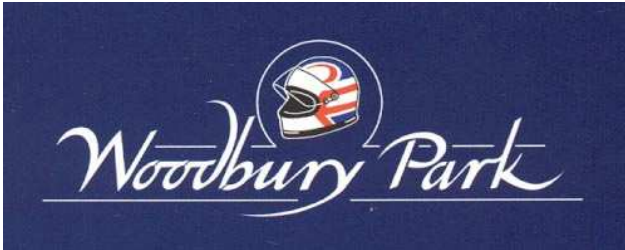
$$\omega(t) = P(NFS_s @ t) = \sum_{i=1}^{\infty} [F^i(t) - S^i(t)]$$



# The MIRCE Akademy – Summer School

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## Venue



Woodbury Park is a magnificent 500 acre leisure and sporting complex set among green rolling hills above the South West English coastline, only a few miles from the ancient city of 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 Station).

**By air**, Exeter Airport, which offers regular flights to many British and Continental destinations is 5 miles from Woodbury Park.

Travel between Exeter and Woodbury requires a car or taxi and takes about thirty minutes. Among the outstanding leisure facilities at Woodbury Park are two golf courses including the magnificent Oaks Championship course, tennis courts, a swimming pool, spa, sauna and fully equipped keep fit centre.



## Host

### Dr Jezdimir Knezevic



Researcher, educator and entrepreneur with numerous publications disseminated world-wide through books, handbooks, papers, monographs and reports are attributed to his name. In addition, he has delivered hundreds of technical presentations, key note addresses and speeches; has been congress, conference, symposium chairman, track leader, workshop presenter, and round table moderator on many hundreds of international events which took part in all continents.

Dr Knezevic is the father of **Mirce Mechanics**, the science theory of the motion of in-service systems through Mirce-space in respect to time. He is the Founder and President of MIRCE Akademy, an independent research and educational institution based in UK.

His multi-disciplinary theoretical knowledge, considerable "hands-on" practical experience and endless passion for the subject have attracted over 7000 engineers, managers and students to his courses and educational programmes in over 40 countries in Europe, North and South America, Asia, Australia and Africa, at universities, professional institutions, industry and government.

Dr Knezevic has worked in the field of the science based system reliability, maintainability and supportability theory and its applications to engineering and management for over 35 years, in academia and in industry.

# The MIRCE Akademy – Summer School

7<sup>th</sup> - 11<sup>th</sup> July, 2015, Woodbury Park, Exeter, UK

## Key Information

### Price (GB Pounds £)

| Package Type  | Fee    | VAT    | Total   |
|---------------|--------|--------|---------|
| Participant   | 975.00 | 195.00 | 1170.00 |
| MIRCE Fellow  | 925.00 | 185.00 | 1110.00 |
| MIRCE Member  | 900.00 | 180.00 | 1080.00 |
| MIRCE Student | 750.00 | 150.00 | 900.00  |

### The Price includes:

- Tuition
- Study Materials
- Lunches
- Light Refreshments (coffee/tea)
- Summer School Dinner on 10<sup>th</sup> June
- Free parking at the Woodbury Park Hotel

### Group Discounts for Standard Participants

Groups of 3 or more booking at the same time from the same organisation will receive a 15 % and for 5 or more there will be a 25% discount.

### Accommodation

The Winter School will be held at **Woodbury Park Hotel, Golf and Country Club**, which is approximately eight miles from Exeter by road.

Participants are responsible for the arrangement and payment of their own travel and accommodation.

**Participants wishing to take advantage of preferential room rates should contact Woodbury Park Hotel Reservations quoting 'MIRCE'.**

The contact details are:

**Woodbury Park Hotel, Golf and Country Club,**  
Woodbury, Exeter, EX5 1JJ, United Kingdom

Tel +44 (0) 1395 233 382  
Fax +44 (0) 1395 233 384  
Email [enquiries@woodburypark.co.uk](mailto:enquiries@woodburypark.co.uk)  
Web [www.woodburypark.co.uk](http://www.woodburypark.co.uk)

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

### Travel

For travel details to Woodbury Park and a map visit our website at [www.mirceakademy.com](http://www.mirceakademy.com).

### Messages

During the Summer School participants may be contacted by telephone on +44 (0) 1395 233 856. Messages will be passed to participants during breaks

### Language

The Winter School language will be English.

### Recommended Attire

Smart casual is recommended dress code for the Summer School and in the in the grounds of Woodbury Park.

No formal dress is required for the Summer School Dinner.

### Smoking

Woodbury Park does not permit smoking in any of the leisure and sport complex facilities and in the hotel.

### Mobile Phones

Out of consideration to speakers and the audience, mobile phones should be switched off during the formal sessions.

### Further Information

☎ +44 (0) 1395 233 856  
✉ [quest@mirceakademy.com](mailto:quest@mirceakademy.com)  
🌐 [www.mirceakademy.com](http://www.mirceakademy.com)

# The MIRCE Akademy – Summer School

7<sup>th</sup> - 11<sup>th</sup> July, 2015, Woodbury Park, Exeter, UK

## Booking Form

Please photocopy for each additional participant

### Terms and Conditions

Substitution of participants may be made at any time. If you intend to do this, please advise MIRCE Akademy 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 event in order to receive a refund of payment. MIRCE Akademy regrets that no refunds will be made after the deadline.

MIRCE Akademy reserves the right to change the advertised programme or location or to cancel the event at its discretion. In the event of cancellation of the event by MIRCE Akademy payments received at the cancellation date will be refunded. All places offered are subject to availability.

MIRCE Akademy is not responsible for any loss or damage as a result of substitution, alteration or cancellation of the event.



### Participant Details

|   |         |
|---|---------|
| Surname   |         |
| First Name  |         |
| Position  |         |
| Department  |         |
| Organisation  |         |
| Address   |         |
|   |         |
|   |         |
| Zip/Post Code   | Country |
|   |         |
| Telephone   | Fax     |
| Email   |         |
| Special Dietary Requirements  |         |
|   |         |
|   |         |
| <i>I understand and accept the terms and conditions and payment as shown.</i> |         |
| Signature   | Date    |

### Payment Method

|   |                               |
|---|-------------------------------|
| <input type="checkbox"/> Cheque   |                               |
| I enclose a cheque for GB £   | payable to Mirce Science Ltd. |
|   |                               |
| <input type="checkbox"/> Bank Direct Transfer   |                               |
| Please contact us for details.  |                               |
|   |                               |
| <input type="checkbox"/> Credit Card  |                               |
| Please debit my credit card <input type="checkbox"/> Visa <input type="checkbox"/> MasterCard <input type="checkbox"/> Amex |                               |
| Cardholder  |                               |
| Card No.  |                               |
| Expiry Date   | Security Code                 |
| Cardholder's Signature  |                               |
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| <input type="checkbox"/> Invoice  |                               |
| Please invoice my organisation:   |                               |
| Department:   |                               |
| For the attention of:   |                               |
| Purchase Order No.  |                               |
| Address (if different from above)   |                               |
|   |                               |
|   |                               |
|   |                               |
| City:   | Zip/Post Code                 |
| Country   |                               |

### Value Added Tax (VAT)

Unless special exemption arrangements exist, under UK Customs and Excise regulations participants from all countries are required to pay UK VAT @ 20 % at the time of publication. Non-UK participants may be able to recover VAT incurred via the relevant tax authority in their country of origin.