ESReDA

European Safety, Reliability & Data Association

Newsletter

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Fusion Energy – Recent Success Stories

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If fusion energy (FE) is ever to become a reality, FE science & technology must make great stride facing the following two critical challenges:

- Maintaining plasma active for at least 20 minutes (100s ignition and plasma self-heating start up, 1000s nominal continuous energy generation, and 100s loss of plasma self-heating capacity)
- Developing and validating Magneto-Hydro-Dynamic Stability models describing large scale plasma dynamics for industrial fusion reactors.

Maintaining plasma active for at least 20 minutes

China's Experimental Advanced Superconducting Tokamak (EAST) has succeeded in maintaining the plasma self-heating steady-state stable for 1056 seconds, setting a record for long-pulse operation on the night of 30 December 2021[1]. The EAST experiments have demonstrated that such technical and scientific challenges can be resolved. Hence, the Race for longer plasma self-heating steady-state is open.

On 12 February 2025, the CEA's WEST machine[2], was able to maintain a plasma for more than 1337 seconds. The CEA's achievement demonstrates a certain maturity of the FE Science & Technology knowledge in plasmas control. It accredits the FE community's hope that plasmas for FE applications can be stabilised for longer plasma steady-state times in machines such as ITER[3] and after for the DEMO[4].

In fact, the technical control of the plasma stability duration can't be achieved without developing and validating robust Magneto-Hydro-Dynamic (MHD) Stability models that describe the turbulent plasma flow in the plasma vacuum chamber of the tokamaks.

Advanced Magneto-Hydro-Dynamic (MHD) models

A milestone is achieved in predicting turbulence in fusion plasmas, by a research team working in the IPP (Institute of Max Planck for Physics, GE). The plasma is storming inside the donut-shaped vacuum chamber, without contact with the chamber wall. This is to sustain the plasma self-heating steady-state as long time as possible and to retain as much energy as possible. The plasma flow is highly turbulent and that negatively affects Plasma properties and stability. A recent study by the IPP's scientific team has reported about a significant breakthrough in understanding turbulence in fusion plasmas. For the first time, a comprehensive agreement between experimental results and computer simulations has been satisfactorily achieved. The team simultaneously compared seven key plasma turbulence parameters, significantly more than in previous studies. The study has been published, March 2025, in the scientific journal *Nature Communications*[5]. The IPP core research team utilized the world's unique diagnostic equipment at the IPP fusion device ASDEX Upgrade. This allowed the team to precisely measure the properties of the multi-million-degree plasma during two discharges with different settings.

[1] https://www.iter.org/fr/node/20687/east-demonstrates-1000-second-steady-state-plasma
[2] https://www.cea.fr/english/Pages/News/nuclear-fusion-west-beats-the-world-record-for-plasma-duration.aspx
[3] https://www.iter.org/
[4] https://euro-fusion.org/programme/demo/
[5] https://doi.org/10.1038/s41467-025-56997-2

Energy – Wind & Environment

By B. Weteringe and J.A. Stoop

Large-scale offshore wind farms have an impact on the atmosphere and can therefore also contribute to (regional) climate change.

Dr. John Stoop
KINDUNOS Safety Consultancy Ltd

Clouds above seas and oceans have a major impact on the global climate. This was recently demonstrated by researchers from the Alfred Wegener Institute and the European weather research center ECMWF. In a recent article in the journal Science, the researchers showed that the above-average warm year 2023 can largely be attributed to a reduced cloud cover above the oceans, which allowed more sunlight to warm the oceans. Large-scale offshore wind farms have an impact on the atmosphere and cloud formation and can therefore also contribute to (regional) climate change.

Bert Weteringe
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Source: NOAA Climate.gov [https://www.climate.gov/]

Complex air flows

Extremely complex air flows occur in the Earth's atmosphere. The main driving force behind these air flows is the transport of warm air from the equator towards the poles. These air flows contain a lot of kinetic energy, which can be converted into electricity by wind turbines. However, with the exponential growth in the number of wind turbines on land and at sea, more and more energy is being harvested from the boundary layer, the lowest layer of the atmosphere. For the energy balance in the atmosphere, this energy must be replenished from the higher layers of the atmosphere. This influences the air flows in the atmosphere up to greater heights.

Observations and simulations

With the increasing scale of wind energy, it is therefore becoming increasingly important to gain insight into the consequences of these atmospheric disturbances. Observations from aircraft and fishermen have already shown that wind farms at sea can cause cloud formation under stable atmospheric conditions.

These atmospheric influences are recognized by researchers from Delft University of Technology and the KNMI, the Dutch weather institute, who have been working with project partner Whiffle, a spin-off of Delft University, on a project called WINS50 – the impact of large-scale wind energy on the atmosphere in recent years. The aim of this project was to reduce uncertainties about the interactions between the large-scale deployment of wind energy in the North Sea and the atmosphere. The simulation results indicate that in the 2050 scenario large parts of the North Sea are affected by so-called wake effects of wind farms, areas where the wind speed has decreased, and which extend up to 150 km behind a wind farm. They also show that the increased vertical mixing of the air because of the many wind farms affects the temperature and humidity profiles of the air up to 3000 meters altitude.

Lower yields

The atmospheric effects of the use of wind energy also have consequences for the efficiency of wind turbines. This decreases as the use of wind energy increases in scale. These decreases in yields are likely to play an important role in the upcoming transition to a renewable energy system. A recent study by Agora Energiewende et al. (2020) showed how, taking these effects into account, the expected yields of offshore wind energy could fall by a third or more in realistic energy scenarios for the year 2050 for Germany.

These lower yields at sea are not only the result of the wake effects caused by wind turbines, but also of the atmospheric limitations determined by physical principles known from meteorology and geophysics. A publication in the meteorological journal of the Max Planck Institute in 2021 shows that energy from higher air layers can only supplement a small part of the energy extracted by the wind turbines. This leads to the energy yields of areas with wind turbines of more than one hundred square kilometers being up to twelve times lower than those of small wind farms in prominent locations, regardless of the technological progress of the wind turbines. Nature seems to be setting limits to the further roll-out of offshore wind, as there is no profit to be made with such low yields. It is already becoming clear that the actual yields of offshore wind are much lower than the theoretically determined yields. While the Dutch research institute TNO, among others, assumes a capacity factor of over 50% for offshore wind, figures from CBS Statistics Netherlands show that the total capacity factor for offshore wind in the Netherlands was 37%, both in 2021 and 2022 (the capacity factor is a measure of the productivity of a wind turbine, the higher the more yield).

Temperature increases on land

For onshore wind, the atmospheric effects of large-scale wind energy are different. This is because the air flow on land is much more turbulent, for example due to the rough earth surface with buildings and vegetation, but also due to convection, caused by warming up of the earth surface during day times. This turbulence has a local influence on the wind climate and the efficiency of closely positioned large wind turbines.

With large onshore wind farms a different phenomenon may occur, namely that the (soil)temperature in and close to a windfarm may rise, as demonstrated by several research projects worldwide (https://clintel.nl/windturbines-en-temperatuur). These effects are not incorporated in environmental impact statements.

The need for a broader perspective

All this information shows a need for a broader perspective to evaluate the large scale harvesting of wind energy. This concerns not only the driving forces and transitions of inbound radiation solar energy in atmospheric air flows, but also the harvesting from the atmosphere by wind turbines and the inherent atmospheric and climatologic impacts.

Acknowledgements

This article was published in Dutch in Jan 2025 by the Clintel Foundation (https://clintel.org/france/) aiming at raising discussion about the validity of assumptions, models, theories, consequences and the strengths, weaknesses, opportunities and threats of harvesting wind energy on a large scale. As such, it fits in with the work of the ESReDA Project Group on Foresight in Safety: ***Enhancing Safety, the Challenge***

of Foresight and the work of the ESReDA Project Group on Managing Risks with Knowledge, From Risk imagination to safety Intervention.

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UK Nuclear Energy: Sizewell C reports project progress to parliament

Source: Friday, 31 January 2025, Nuclear World News (NWN)
https://world-nuclear-news.org/articles/sizewell-c-reports-project-progress-to-parliament

Reported by: Mohamed EID for ESReDA NL

NWN reported on January 2025 that the Sizewell C nuclear power plant project in the UK is "on time and on budget" and is "the best prepared nuclear project in modern nuclear history".

The progress report was delivered to MPs in the first annual progress update on the project. It was delivered by Julia Pyke and Nigel Cann, Sizewell C's joint managing directors, at the beginning of *Nuclear Week* in Parliament.

The independent due diligence commissioned for the HSBC bank by consultancy firm Enco praised the project's progress, stating that "**Sizewell C is likely the best prepared nuclear project in modern nuclear history**".

The EDF-led plan is for Sizewell C to feature two EPRs producing 3.2 GW of electricity, enough to power the equivalent of around six million homes for at least 60 years. It would be a similar design to the two-unit plant being built at Hinkley Point C in Somerset, with the aim of building it more quickly and at lower cost.

"Sizewell C has a stable cost base. That's in no small part because of the exact use of the same reactor design as Hinkley Point C. That means recycling the research and innovation that had already been done.

"Sizewell C is the most important energy project that the UK is likely to undertake in the next two decades, and its benefits will be felt in every constituency across the country."

The project received an additional GBP2.7 billion in funding from the government in the 2024 Budget and is due to receive its Final Investment Decision in the upcoming Spending Review.

Some facts about Sizewell C

- 3.2GW power station is on time and on budget
- Nearly £1bn of cost savings have been identified so far
- Over £100bn of UK economic benefits over the lifetime of the project
- The project will eventually support over 70,000 jobs across the UK
- Significant support from trade unions and public

More details can be read on:

https://www.sizewellc.com/news-views/mp-update-shows-sizewell-c-the-best-prepared-nuclear-project-in-modern-nuclear-history/

ESReDA's Open Data Initiative

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Developed countries are facing a nascent digital revolution fueled by human-like artificial intelligence, bioinspired engineering, and deeply intelligent robots, where humans and digital assets will work together within a large smart ecosystem.

The built environment, particularly industrial and civil infrastructure, will certainly be part of this revolution since infrastructures (roads, railways, cities, energy facilities, etc.) are the foundation upon which this future smart ecosystem will be based. Deep integration of smart technologies into infrastructure has the potential to reduce European spending on infrastructure asset management while significantly increasing reliability and resilience.

However, achieving this advanced level of digitalization requires learning from and responding to high-quality data. The creation, updating, and refinement of predictive models for smart digital twins demands substantial amounts of high-value data.

Anyone working with digital twin technologies may already recognize the limitations posed by insufficient data to train and test these systems effectively. When available, data are often siloed within specific applications or components, making it difficult to use for training decision-making models across pervasive systems commonly found in industry and infrastructure.

In light of this, this is an opportunity for ESReDA to become a key player in providing open, high-value datasets related to asset management, reliability, and maintenance of physical and digital assets across various industries.

An Open Data Initiative at the core of ESReDA would align seamlessly with the Open Data and Open Science European policies, and particularly with the Horizon Europe provisions on Open Science. Of course, implementing such an initiative would come with challenges, like long-term data availability and curation, clear metadata specification and its connection to findability, data protection and use of European regulations, among others.

Nevertheless, these challenges should not obstacle an initiative with transformative potential for research and development. More efficient and resilient research and technological advancement can be achieved through global scientific and technical collaboration, which is only possible through sharing of scientific knowledge, but also high-value data.

Call for Expressions of Interest: To all ESReDA members and EU experts in the field, if you are willing to participate actively in the **Open Data Initiative**, please, send your expression of interest to Dr. Manuel Chiachío (mchiachio@ugr.es) and Dr. Antonio J. Guillén (ajguillen@ucm.es).

I-Risk Initiative: To Build a European network in the field of natural mass-driven hazards

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I-RISK is a national network in the field of natural, mass-driven hazards. It gathers companies, research laboratories and universities working in the field of landslides, rockfalls, mudslides, torrential floods, and avalanches. I-RISK is placed under the auspices of the National Pole Infr@2050. I-RISK organises strategical workshops on various topics to increase the resilience against mass-driven hazards:

- management and resilience against exceptional natural hazards
- dynamic behaviour of structures subjected to natural hazards
- snow cover in the climate change context
- the role of water in landslides
- impacts of permafrost melting on mountain infrastructure.

I-RISK also helps to adapt training offers responding to the needs expressed by the concerned Industrial sectors and end-users. It supports the development of specific and oriented training sessions for natural mass-driven risk practitioners and other stakeholders. The last two new professional educational offers and a summer school series were for Swiss I-Risk partners.

Besides, I-RISK conducts a series of webinars to shed light on, and share within the community, the tools and knowledge developed by the companies and the laboratories who are members in its national network.

Still, I-Risk is launching its new initiative to “Build a European network in the field of Natural Mass-Driven Hazards”.

Why this initiative

The initiative aims at:

- Promoting and stimulating interactions between research and private stakeholders.
- Extending the existing I-Risk Network to the European sphere to foster multi-collaborative EU actions between different EU partners.
- Contributing into the development and the design of technical standards and recommendations.

We recognize the necessity to build a European partnership to answer EU Research & Innovation calls for projects, regularly emitted by the EC. We are convinced that we should improve our collective practices by exchanging on the different above-mentioned goals, and especially by changing the scale at which we organize these exchanges.

Next steps and proposed organisation

Setting up a European network will start with a first exchange with all potential partners through brain-storming meetings and discussions to build up a common shared ambition.

The next steps, including the creation of specific working groups, will be structured according to the outputs of the preceding phase of exchanges and consultations with other EU entities who will express their interest. Basically, the timeline could be as follows:

- Regular meetings (video and face-to-face if necessary) between all the partners engaged in the network - about 3 per year to share information on specific actions of interest, opportunities to build projects, etc. One of these meetings will be devoted to the strategy purposes for the coming year, including specific events to be conducted and related funding matters.
- Workshops to work on a specific topic.
- Organization of specific events to disseminate and share widely the problems encountered and the innovations obtained or participation of the collective in partner events.

Expression of interest

You are interested to get more information or want to contribute to the birth of the EU I-Risk Collaborative Network in the field of natural mass-driven hazards, please, contact julien.baroth@univ-grenoble-alpes.fr, with i-risk@i-risk.fr in Cc.

Forthcoming ESReDA Seminars

The 66th ESReDA Seminar

66th ESREDA Seminar

Transformative safety and resilience models in a smart digital and sustainable world
May 22nd – 23rd, 2025, University of Salento, Italy

Pr. Maria Grazia Gnoni
Full professor
Innovation engineering Dpt.

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Brief description

Several factors are contributing to increase dynamism and complexity of current approaches to prevent accidents and to guarantee business continuity: one critical factor to evaluate is the massive diffusion of digital technologies, which is forcing the adoption of new models to prevent accidents and to support more effective resilience models. Briefly, from one side, digitalization is characterized by a transformative potential mainly oriented to improve operational performance, reduce accidents and increase system reactiveness through several ways. One example could be related to the enabling effectively the potential of acquiring in real time and huge quantity of safety data – also related to early warning signals – which will be treated and analysed by AI models for extracting knowledge to prevent accidents. New risk management models and approaches are, thus, required. Moreover, from another side, digitalization is the source of new emerging risks, e.g. due to the massive use of intelligent robotics systems interacting directly with humans (like collaborative robots), to the use of decision support systems (e.g. based on algorithmic management) that provide automatic feedback to humans, e.g. workers as well as safety managers and/or analysts.

Similar conditions could be outlined in the resilience field, where digital technologies are contributing to increase also forecast capabilities and preparedness in complex systems, like critical infrastructures and complex organizations, thus transforming traditional approaches, tools and organizational models. Digital technologies could help to apply more proactive methods, e.g. to predict insight of what in the process can go wrong because of internal or external disruptive disturbance. In addition, the increasing attention towards sustainability issues is transforming safety and resilience approaches by adding new factors and impacts to be evaluated in an effective and holistic way.

Knowledge and experiences about these topics will be shared in a seminar organized by ESREDA and University of Salento from 22nd to 23rd May 2025 in Lecce (Italy). This seminar is aimed at addressing current and future challenges, tools and new approaches for accompanying the digital and the sustainable transformation in safety ad resilience models applied in complex systems.

The program will be soon available on ESReDA website.

65th ESREDA Seminar

From risk imagination to safety intervention - Managing risks with knowledge, 14-15 November 2024, National Center for Scientific Research "Demokritos", Athens, Greece

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National Center for Scientific Research "Demokritos"

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ESReDA's 'Risk, Knowledge, Management' (RKM) project group (PG) addresses the intricate relationships between risk, knowledge and management, aiming to find new ideas for preventing accidents and improving safety management with better use of knowledge. The RKM PG organises the 65th ESReDA seminar to foster an exchange of ideas and expert debate. The National Centre of Scientific Research Demokritos in Athens will provide the forum.

Theories, concepts, and experiences of enhancing the use of knowledge for better risk analysis, management and governance were discussed between the gathered experts. The seminar has gathered some 60 participants: researchers, engineers, risk analysts and managers, and post-doctoral fellows, coming from different industrial and research sectors. During these two-day one-session seminar, about 21 oral presentations, including 5 keynotes, in 5 sessions were proposed.

The breakdown of the participants per EU country is shown in figure 1, below.

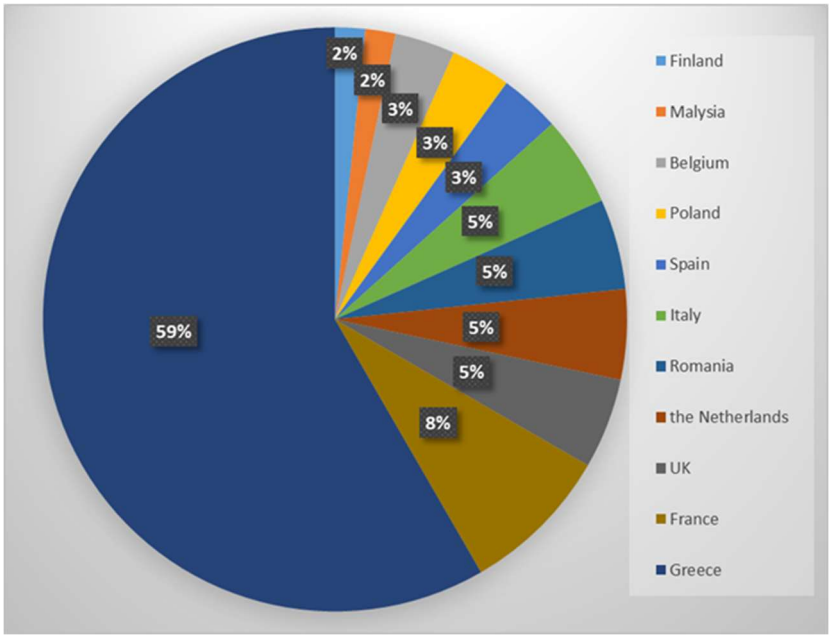

Figure 1: The breakdown of the participants per EU country

Though we are told we live and work in "information and knowledge" society, preventing accidents and enhancing resilience, through the use of relevant safety knowledge and expertise is not granted and requires continuous efforts to overcome the hurdles in an "age of uncertainty".

The seminar's program is available on:
https://drive.google.com/file/d/1TDbAxLmKLnNXq_T_kClvC4lB1bp5CKtP/view?usp=sharing

The official proceedings will be edited and be available, for free downloading within 6 months.

To follow the ESReDA mi-annual seminars, you are invited to visit its site on:
http://www.esreda.org/

ESReDA Project Group on Risks, Knowledge and Management

In 2020, ESReDA launched a project group to address the relationships between risks, knowledge and management. The scope defined is of interest to system designers, operators, managers, maintenance, lawyers, insurers, regulators, and many others working on safety and security including natural hazard management. The scope covers the safety, reliability and security related

to multiple hazards and threats (natural, high-risk industry, critical infrastructure, communication and transport systems over different territories etc.) involving all stakeholders (public, operators, regulators and government).

Risk management integrates all activities and disciplines related to assessment, identification of early warning signs and emerging risks, foresight, investigation of events and lessons to be learned, management of barriers and lines of defence, reliability, and change of policies and culture. In this context, the keyword knowledge defines the main topic of the project: the endeavour to use knowledge to improve the management and governance of risks (from design to operation and dismantling/decommissioning).

To join ESReDA project group on RKM, you can write to the project leader *myrto@ipta.demokritos.gr* and express your interest. RKM-PG as all other ESReDA PGs is open to all EU experts, researchers and engineers working in the field. **It is not required to be ESReDA member to join any of ESReDA PGs.**

The 64th ESReDA Seminar

64th ESReDA Seminar on

Digital Maintenance in the Digital Twin Era.

30-31 May 2024, Universidad de Deusto, Bilbao – Spain.

Organiser
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Digital Twins (DT) technology has become indispensable for understanding and deciphering the utility of current developments, unlocking the potential of digital transformation.

It operates like the keystone in an arch, seamlessly bringing together diverse elements of digital technologies and modeling techniques. This synergy creates a unified structural entity, crucial in the emergence of new and complex System of Systems (SoS) structures.

One of the most significant areas where this transformation is expected to make waves is **Digital Maintenance**. Analyzing how maintenance can benefit from this evolution is essential. The advent of new technologies has made the maintenance landscape more intricate, requiring efficient management of vast information and predictive alarms within dynamic schedules.

However, the complexity of the maintenance management process often hampers the technology's impact on organizations. Conventional maintenance practices persist, causing delays in embracing digitalization and hindering the expected return on investment for companies undergoing the digital transformation effort.

Furthermore, **the role of individuals in the context of maintenance digitalization** is critical. Embracing digital transformation offers an opportunity for human evolution, leveraging the expertise and experience of employees in the new digital environment. This provides a competitive edge in driving innovation and technological progress.

Join us at the 64th ESReDA seminar, where researchers, practitioners, and experts from various disciplines converge to share insights and advancements in the realm of digital maintenance and its relationship with digital twins, complex systems, and human resources. Topics include, but are not limited to:

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1. Advancements of Digital Twins in Complex Systems Generation.
2. Current Barriers in Implementing Technologies for Real Maintenance Evolution.
3. The Role of Human Resources in the Context of Digital Maintenance and Digital Twins.

Bilbao, Spain, hosted the 64th ESReDA Seminar on **May 30th and 31st**, **2024**. Nestled along the Nervión River, Bilbao seamlessly blends rich history with cutting-edge architecture, epitomized by the iconic Guggenheim Museum designed by Frank Gehry. Participants will have the chance to immerse themselves in the lively Old Town, savor exquisite Basque cuisine, and explore a city that

exudes charm at every turn. Join us for an event that marries knowledge exchange with the cool vibe of Bilbao.

The 64th ESReDA Seminar final proceedings is in processing and will be soon issued.




ESReDA members' external running-projects

Medelia Chair: Probabilistic fatigue analysis of steel structures

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The ageing of structures in France and around the world means that plant managers have to choose between several scenarios: extending their service life on an unchanged basis, repairs, reinforcements, or even complete replacement. The financial stakes are often very high, given manufacturing and construction costs, as well as operating losses during shutdowns. As a result, plant managers need as much information as possible to assess the residual service life and level of risk associated with each of the above scenarios.

In this context, the Medelia Chair, sponsored by SPRETEC [1] (Artelia Group [2]), created by the Foundation Grenoble INP [3], aims to improve the safety and durability of hydraulic structures. It will focus on the study of steel welded connections in non-standard engineering structures such as hydroelectric power plants and dams. The Chair's researchers will be working on new fatigue calculation methods to improve models for predicting the service life of structures. This work will enable more accurate estimates of damage and service life, helping managers to make informed decisions.

Julien Baroth, associate Pr. at Grenoble-Alpes Univ., co-holder of this chair, has recently presented it during the 63rd ESReDA seminar in the JRC Ispra (IT), he will contribute to the project group « Resilience Assessment of Critical Infrastructure ».

A thesis began in November, directed by Julien Baroth, 3SR [4], and Rafael Estevez , SIMAP [5], same university, with doctoral student Kamal Harb, entitled "Probabilistic fatigue analysis of mechanically-welded steel structures".

[1] https://www.spretec.fr/
[2] https://www.arteliagroup.com/
[3] https://fondation-grenoble-inp.fr/en/
[4] https://3sr.univ-grenoble-alpes.fr/en/3sr-lab
[5] https://simap.grenoble-inp.fr/en/about-simap

Horizon EU Project: BAG-INTEL

BAG-INTEL relocates one of its use cases to Milan Linate Airport

By Klaudia dos Santos,
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BAG-INTEL relocates one of its use cases to Milan Linate Airport
The EC-funded BAG-INTEL project, which has just reached its midterm, has made a strategic decision to relocate its Use Case III from Madrid Barajas Airport in Spain to Milan Linate Airport in Italy for the second half of the project. This relocation underscores the consortium's ongoing efforts to validate the system's adaptability across diverse airport layouts and operational challenges.

Milan Linate Airport presents a unique opportunity to test the BAG-INTEL system in a configuration where the baggage carousels are in close proximity to the baggage insertion point, but space constraints necessitate innovative system placement. This offers the project an ideal scenario to demonstrate the flexibility and modularity of the BAG-INTEL solution. "Milan Linate's unique layout presents an exciting opportunity to demonstrate the adaptability of the BAG-INTEL system," said Henrik Larsen, BAG-INTEL Project Coordinator. "This relocation underscores our commitment to addressing real-world challenges in diverse airport environments, including the demanding context of the upcoming Milano Cortina 2026 Olympic Winter Games."

The use case at Milan Linate will comprise a setup of the full BAG-INTEL system. The project will leverage an existing X-ray/CT scanner and integrate AI-powered cameras for advanced luggage tracking, including reidentification at the customs area near the baggage claim exit. Initially, this use case will be based on a non-integrated scanner/handling system, demonstrating the versatility and effectiveness of the BAG-INTEL solution across different airport layouts. In a fully operational phase, additional components, such as sniffer dogs and the integration of external data sources, may be implemented to further enhance system capabilities. "We are thrilled to partner with BAG-INTEL to explore innovative solutions for enhancing baggage handling and customs operations," said Michele Sibio, Officer at the Customs Controls Office, Italian Customs Agency. "This collaboration aligns with our vision of leveraging advanced technologies to improve our operations and the effectiveness of customs controls."

The Milan Linate use case is particularly significant as the BAG-INTEL system is expected to be operational during the Milano Cortina 2026 Olympic Winter Games. With passenger traffic expected to surge, the system will play a crucial role in enhancing customs controls of incoming baggage. This adjustment highlights BAG-INTEL's readiness to tackle real-world challenges faced by the customs teams and its ability to deliver impactful solutions tailored to various operational environments.

The Newsletter (September 2024) is available at the following link:
https://bag-intel.eu/2024/09/16/bag-intel-at-the-88th-thessaloniki-international-fair/
Project website: www.bag-intel.eu
email: info@bag-intel.eu
LinkedIn
X: @BAGINTEL
Project videos: www.bag-intel.eu/videos

News from ESReDA Project Groups

Vytis Kopustinskas
ESReDA PG Leader
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ESReDA Project group on Resilience Assessment of Critical Infrastructure

The ESReDA project group on Resilience Assessment of Critical Infrastructure, active since June 2023, has organised two special sessions at the ESREL 2024 conference, held in Cracow, June 23-27, 2024. The special sessions are focused on resilience assessment in electricity sector (session 1) and critical infrastructures in general (session 2). The eight papers submitted are authored by the ESReDA members: JRC, University of Nottingham, Kaunas University of Technology & 'Horia Hulubei' National Institute of Physics and Nuclear Engineering (the latter two applied for ESReDA membership in 2023) and ESReDA partners: University College Dublin, German Aerospace Centre, ETH Zurich.

ESReDA Project group on Resilience Engineering and Modelling of Networked Infrastructure

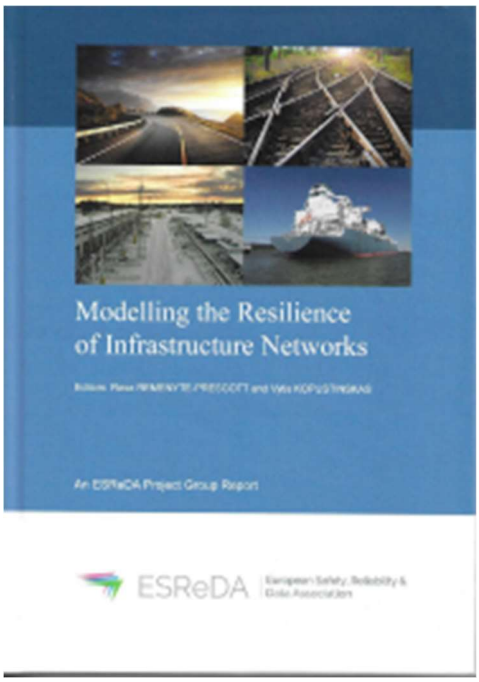
Rasa Remenyte-Prescott & John Andrews

University of Nottingham, UK

Findings from the project group have been published in a book entitled "Modelling the Resilience of Infrastructure Networks", edited by Rasa Remenyte-Prescott and Vytis Kopustinskas.

This book is a selection of contributions written by members of the Project Group and concentrates on the themes of transportation and utilities. The papers intend to provide an insight into the state of the art of resilience modelling with a focus on Networked systems. The book is aimed at both an industrial and academic readership with interests in the resilience of engineering systems.

We would like to thank the authors for their contributions to this publication, and our colleagues at DNV for their practical support with printing and distribution.



For information on how to purchase a copy please contact ajguillen@us.es ESReDA General Secretary, Antonio J. Guillén (Ingeman, Spain).

ESReDA RKM project group: Risk, Knowledge, and Management

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The Risk Knowledge and Management Group is continuing its activities. During the last group meeting on the 22nd of February 2023 there was a shift-over of the Group Leader from Eric Marsden to Myrto Konstantinidou and an updating on the status of the discussion papers.

Currently, we have 14 discussion papers under preparation and another 6 under discussion. One is ready to be published in June 2023 and the rest will be published eventually until February 2024. The first one is entitled "Delegation of safety oversight" and it has been prepared by Eric Marsden. We are also planning to host a workshop and ESReDA Seminar in 2024, probably in Athens.

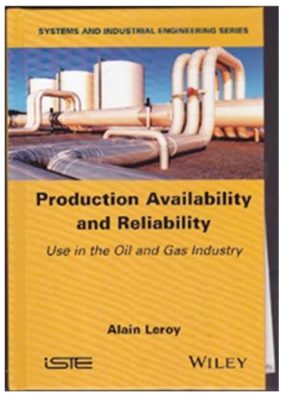
Delegation of safety oversight is a discussion paper on Risk, Knowledge and Management (RKM). It aims to share information on ongoing work undertaken in the context of the RKM project group.

The Delegation of Safety Oversight can directly be obtained from Eric Marsden (eric.marsden@foncsi.org).

ESReDA community recommended books:

PRODUCTION AVAILABILITY AND RELIABILITY. Use in the Oil and Gas Industry.

Dr. Alain Leroy



https://iste.co.uk/book.php?id=1327

The aim of the book is to provide all the information requested for an efficient specification, assessment, follow-up and management of production availability and reliability characteristics of petroleum systems (upstream, midstream, downstream and petrochemical industries). However, nearly all parts of the book can be used in most of the industries, the "oil" taste being mainly on the examples of use provided. Whenever available proofs of validity of basic concepts (e.g. does the bathtub curve exist in the true life?) and of reliability assessments are given. Numerous true case studies are provided, all being based on author's experience. The chapters are grouped in sections.

- Fundamentals are given in the first section. Definitions as well as mathematics are kept at the minimum vital. Nearly all the mathematics used in this book is given in Chapter 2. Basic formulae for assessing the availability and reliability of standard systems are given in Chapter 3.
- Modelling techniques are provided in Chapters 4 and 5 and Appendix 2. Failure mode and effects analysis, reliability block diagram, fault trees and Monte Carlo simulation are described in Chapter 4. Chapter 5 is dedicated to Petri nets, and Markov chains are given in Appendix 2. Comparison of results of calculations made using Markov chains, Monte Carlo simulation and Petri nets is provided in Appendix 3.
- Chapters 6, 7 and 8 explain the ways to obtain reliability data. One chapter on sources of reliability data (with a detailed description of the OREDA project since the beginning of the 80's), one on methods for obtaining data from reliability tests and field and one on the use of expert judgment.
- Techniques that can be considered as a support to the other ones of the book are in Chapter 9. Origin of common cause failures and the existing methods for their analysis are presented and a review of existing data sources performed. Review of reliability engineering of electronics items and reliability engineering of mechanical pieces are the other topics considered.
- The methodologies for the assessment of system production availability and of system reliability characteristics are explained in chapters 10 and 11. Chapter 12 is on production availability and reliability management.

Alain Leroy started his career in an offshore engineering company then he joined a major oil and gas company. Within this company he was given the responsibility of developing and implementing tools of risk analysis, mainly gaseous explosion and heavy gas dispersion modelling as well as reliability engineering methods. He focused mainly on the implementation and use of novel approaches and techniques. He was chairman of the Steering Committee for the OREDA Interim Phase. Then he headed the engineering subsidiary of an insurance group. By the turn of the century, he funded and managed his own consulting company Fractal Systeme. He has delivered courses on reliability theory and practice at both basic and high levels.

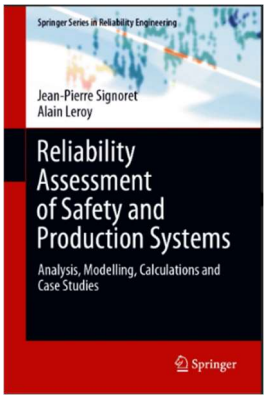
Reliability Assessment of Safety and Production Systems Analysis, Modelling, Calculations and Case Studies

Jean-Pierre Signoret et Alain Leroy

This book provides, as simply as possible, sound foundations for an in-depth understanding of reliability engineering with regard to qualitative analysis, modelling, and probabilistic calculations of safety and production systems.

Drawing on the authors' extensive experience within the field of reliability engineering, it addresses and discusses a variety of topics, including:

- Background and overview of safety and dependability studies.



- Explanation and critical analysis of definitions related to core concepts.
- Risk identification through qualitative approaches (Preliminary hazard analysis, HAZOP, FMECA, etc.).
- Modelling of industrial systems through static (fault tree, reliability block diagram), sequential (Cause-consequence diagrams, event trees, LOPA, bowtie) and dynamic (Markov graphs, Petri nets) approaches.
- Probabilistic calculations through state-of-the-art analytical or Monte Carlo simulation techniques.
- Analysis, modelling and calculations of common cause failure and uncertainties.
- Linkages and combinations between the various modelling and calculation approaches.
- Reliability data collection and standardization.

https://link.springer.com/book/10.1007/978-3-030-64708-7

The book features illustrations, explanations, examples, and exercises – based on the demo version of the GRIF software (https://grif.totalenergies.com) – to help readers gain a detailed understanding of the topic and implement it into their own work. Further, it analyses the production availability of production systems and the functional safety of safety systems (SIL calculations), showcasing specific applications of the general theory discussed. Given its scope, this book is a valuable resource for engineers, software designers, standard developers, professors, and students. Issued in 2021, it is rather well received by the community of reliability engineers as more than 50 000 individual chapters had been downloaded at the end of 2024.

A MOOC in French (90 of course hours split in 4 units) has been developed from this book and issued in 2024 (https://seamonline.insa-toulouse.fr/). The English version is scheduled for the beginning of 2026.

Alain Leroy started his career in offshore engineering and was for ten years with the insurance industry. However, he has worked for most of his career in reliability engineering, focusing mainly on the implementation and use of novel approaches and techniques for assessing dependability parameters in the oil and gas industry. He has delivered courses on reliability at both basic and high levels.

Jean-Pierre Signoret has been in charge of the research and development of methods and tools in reliability engineering, as well as of practical studies related to reliability modelling. He develops the first versions of the GRIF (Graphical Interface for Reliability Forecasting) software continuously extended and improved over the past 40 years. He was former chairman of ESRA and vice-chairman of ISdF (French Institute for Safety and Dependability) now IMdR. He is still involved in the development of several international standards, including IEC and ISO, related to dependability, functional safety, reliability data collection, and production assurance. As a member of TPA (TOTALEnergies Associate Professors), he gives short courses in various universities on these topics.

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From Risk to Resilience:
Towards Sustainable Development for All in a COVID-19 Transformed World
Global Platform for Disaster Risk Reduction- UN DRR

Proceedings of the Seventh Session, Bali, Indonesia, 23-28 May 2022

The Seventh Session of the Global Platform for Disaster Risk Reduction (GP2022) was a decisive moment for re-thinking our approach to managing risk. It was the first such gathering since the beginning of the COVID-19 pandemic and, despite the challenges, the Global Platform, which took place in a hybrid format, saw a record level of participation, with 5,000 participants from a total of 185 countries. It was also the most inclusive and accessible Global Platform to date, with over 200 persons with disabilities participating in person.

The outcomes of the Global Platform are captured in The Bali Agenda for Resilience. Its seven recommendations call to first, reconfiguring risk governance to ensure that management of risk is a shared responsibility across sectors. Second, funding for disaster risk reduction to be written

into laws and included in integrated national financing frameworks. Third, it calls upon governments to honour the COP26 Glasgow commitments to drastically enhance financing for adaptation and resilience. Fourth, it calls for empowering those most at risk under the motto of "nothing about us without us". Fifth, it expresses support for the call by the United Nations Secretary-General that early-warning systems cover every person on Earth within five years. Sixth, that the world applies the lessons of the pandemic to build back better, greener, and equitable. Seventh, that all Member States, regional organizations, and stakeholders robustly engage in the Midterm Review of the implementation of the Sendai Framework.

(extracted from the introduction of Mme Mami Mizutori, Special Representative of the UN Secretary-General for Disaster Risk Reduction)

Proceedings are available for downloading at:

https://www.undrr.org/media/83505/download?startDownload=true

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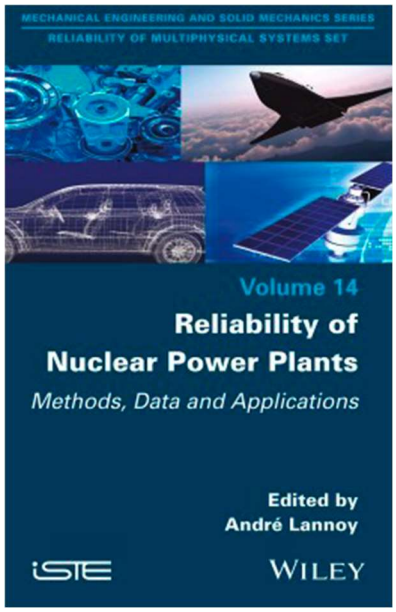
Reliability of Nuclear Power Plants Methods, Data and Applications



Edited by André Lanoy, Abdelkhalak El Hami
Prposed by Jean-François Raffoux

Since the 1970s, the field of industrial reliability has evolved significantly, in part due to the design and early operation of the first-generation nuclear power plants.

Indeed, the needs of this sector have led to the development of specific and innovative reliability methods, which have since been taken up and adapted by other industrial sectors, leading to the development of the management of uncertainties and Health and Usage Monitoring Systems.

In this industry, reliability assessment approaches have matured. There are now methods, data, and tools available that can be used with confidence for many industrial applications. The purpose of this book is to present and illustrate them with real study cases.

The book addresses the evolution of reliability methods, experience feedback and expertise (as data is essential for estimating reliability), the reliability of socio-technical systems and probabilistic safety assessments, the structural reliability and probabilistic models in mechanics, the reliability of equipment and the impact of maintenance on their behavior, human and organizational factors, and the impact of big data on reliability.

Finally, some R&D perspectives that can be developed in the future are presented.

Written by several engineers, statisticians and human and organizational factors specialists in the nuclear sector, this book is intended for all those who are faced with a reliability assessment of their installations or equipment: decision-makers, engineers, designers, operation or maintenance engineers, project managers, human and organizational factors specialists, experts and regulatory authority inspectors, teachers, researchers, and doctoral students.

ESReDA Honoray President
Jean-François Raffoux

The book can be ordered here.

Modeling Remaining Useful Life Dynamics in Reliability Engineering,
CRC Press, June 2023.
Pierre Dersin

Pierre Dersin

Consultant en System Safety, Reliability, and Maintenance Modelisation & Analysis

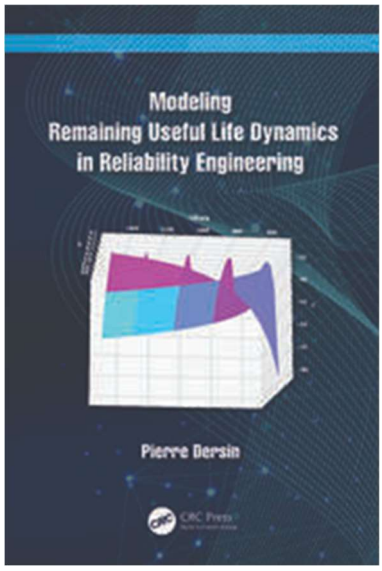
This book applies traditional reliability engineering methods to prognostics and health management, and specifically Remaining Useful Life (RUL) dynamics.

In the context of the digital transformation, the last two decades have witnessed a significant evolution in the theory and practice of industrial maintenance : information and communication technologies now make it possible to replace traditional maintenance (i.e. scheduled preventive and corrective) with predictive maintenance, based on estimation and prediction of individual asset state of health.

To that end, an invaluable decision support tool is the estimation of asset remaining useful life (RUL). RUL is a function of time ; it is also stochastic since it is affected by observation errors, variability of environmental conditions and mission profiles, and imperfect knowledge of degradation mechanisms .

Taking that uncertainty into account is essential for sound risk management . Failing to do so will generally lead to inappropriate maintenance decisions.

Methods used to estimate RUL are numerous and diverse and, broadly speaking, fall into three categories: model-based, data-driven, and hybrid. The author starts by building on established theory and looks at traditional reliability engineering methods through their relation to Prognostics & Health Management (PHM) requirements and presents the concept of RUL loss rate.



Following on from this, the author presents an innovative general method for defining a nonlinear transformation enabling the mean residual life (MRL) to become a linear function of time, which leads to explicit analytical results, for instance for RUL confidence intervals and RUL probability distribution.

He applies this method to frequently encountered time-to-failure distributions, such as Weibull, gamma and lognormal, and first-hitting times of stochastic processes such as the Wiener or gamma process, used to model degradations .

Latest research results, including the author's (some of which were previously unpublished), are drawn upon and combined with very classical work. A complete chapter is devoted to the examination of the properties of the time transformation that allows for the linearization of the MRL. Statistical estimation techniques are then presented to estimate RUL from field data

Finally the use the results for maintenance support and in particular predictive maintenance, is discussed. A risk-based method for predictive maintenance optimization is presented.

The book ends with suggestions for future research, including links with machine learning.

Industrial applications are described and every chapter is followed by a series of exercises.

The book is of interest to engineers, researchers and students in reliability engineering, prognostics and health management, and maintenance management.

https://www.taylorfrancis.com/books/mono/10.1201/9781003250685/modeling-remaining-useful-life-dynamics-reliability-engineering-pierre-dersin

James (Jim) Reason Has Passed Away

By
René Amalberti, Director of Foncsi
Jean Pariès, Former Scientific Director of Icsi and Foncsi

An influential and essential figure in the field of industrial safety, known for his "Swiss cheese" model, James Reason passed away on February 5, 2025. A tribute by Jean Pariès and René Amalberti from the French Foundation for an Industrial Safety Culture, FonCSI, who worked with James Reason on different projects.

René Amalberti, Director of Foncsi

He would have turned 87 in May 2025. In the late 1980s, he simply redefined the way in which we think about industrial safety. Though his contributions concern the organizational and human factors of safety management, rather than the more technical dimensions of reliability, many ESReDA members will be familiar with Reason's "Swiss cheese" model of accident causation. His reputation is global and extends beyond the field of industrial safety, reaching into methods and applications.

Jim Reason was not a consultant; he was a researcher and professor, a scientist recognized by his peers. His citation index is worthy of a Nobel Prize. However, he did not revolutionize scientific knowledge or establish an entirely new theory.

In the first, lesser-known part of his academic career, he focused on motion sickness, publishing at the highest level, but soon found the potential applications disappointing. He then shifted his focus to explaining and categorizing "domestic" human error.

In the later phase of his career—the one that made him famous—he again completely redirected his academic work, aligning it with the growing focus on industrial safety. The two decades of the 1970s and 1980s were marked by disasters such as Tenerife, Three Mile Island, Bhopal, Chernobyl, Piper Alpha, and Challenger. The issue of managing the threat posed by "human error" to the safety of high-risk productive organizations had become urgent.

Jean Pariès, Former Scientific Director of Icsi and Foncsi

Jim Reason had an extraordinary sense for the pressing issues of his time. He became an expert in "human error" and could have simply capitalized on that. However, after his decisive encounter with the cognitive systems engineering researcher Jens Rasmussen, he had the insight to move beyond an accident causality split between technical failure and human failure. He skilfully developed and illustrated an integrated framework, repositioning human reliability within a more systemic vision of safety. To achieve this, he synthesized the creative contributions of scholars such as Norman, Kahneman & Tversky, Leplat, Westrum, Perrow, Weick, Rochlin & La Porte & Roberts, and especially Jens Rasmussen.

Moreover, he had an exceptional talent for popularization. A vigorous yet nuanced writer, sharp yet subtle, literary yet accessible to all, he was a master of brilliant metaphors and an equally clear orator.

So how does Jim Reason's legacy fit into "modern" industrial safety management? His impact is immense. The distinction between errors and violations, as well as between errors, violations, and faults; the differentiation between slips, lapses, and mistakes; the distinction between latent and active errors; the concept of organizational accidents and their metaphorical representation as slices of "Swiss cheese"; his contribution to the spread of the concept of safety culture—one that he advocated as fair, learning-oriented, and flexible; the numerous event analysis methods inspired by the "Swiss cheese" model (HFACS, ALARM, etc.); and the proactive safety culture diagnostic tools (Tripod Delta, MESH, etc.) based on generic failure type indicators—all of these remain fundamental elements of safety management across various industries worldwide.

From the 2000s onward, industrial safety management shifted toward an increasingly managerial perspective, emphasizing formal management systems (SMS) and leadership (safety leadership) rather than focusing on organizational design, high-level strategies, structures, and resources. The behaviour of frontline operators was an object of renewed attention. Jim Reason himself had identified some risks of a shift minimizing operator responsibility, writing in 1997:

"The pendulum may have swung too far in our present attempts to track down possible errors and accident contributions that are widely separated in both time and place from the events themselves."

He was well aware of the limitations of practitioners' use of simplified models. He was not dogmatic, always ready to question and refine his ideas, and conscious of the complexity of the relationship between safety performance and management practices.

Meanwhile, in the field of “safety science” research, the main development involved expanding the concept of organization (and organizational accidents) into that of complex adaptive sociotechnical systems. In this new paradigm, safety became a matter of adaptation—at different time horizons—to external or internal variations and disturbances affecting the entities in question. Safety became a dynamic and nonlinear concept due to feedback loops and various “butterfly effects” involved. It became difficult to represent it as a succession of static barriers, even if the holes representing failures were to be imagined as moving. Jim Reason himself had invoked the metaphor of immunity to describe safety and often spoke of “pathogens”. However, he did not fully integrate this metaphor, particularly its recursive nature—the idea that defences themselves are generated by attacks, forming a memory, both innate and acquired, generic and specific, of past threats.

Still, he was well aware of the limitations of his “Swiss Cheese Model”. In 2004, invited by the Eurocontrol Experimental Centre in Brétigny (France) to present a reanalysis of the 2002 Überlingen mid-air collision using his own model, he arrived at the meeting with his characteristic sharp humour and a presentation titled: “Überlingen: Is Swiss cheese past its sell-by date?” He had neither the desire to reanalyse Überlingen nor to discard his model.

Twenty-one years have passed since that anecdote, and Jim has left us. But the holes in his Emmental continue to feed thousands of accident and safety analyses worldwide, confirming Paul Valéry’s famous maxim: “Everything simple is false, but everything that is not simple is unusable.”

ESReDA Members, you are kindly invited to contribute to the ESReDA newsletter sharing news, announcement of events, your experiences, ideas, etc. You are supposed to elaborate proposals to create new Project Groups, host ESReDA Seminars or initiate collaborative activities.

ESReDA: European Safety, Reliability & Data Association
Association internationale sans but lucratif, régis par la loi Belge du 27 Juin 1921-Titre III (Registration N°: 0452522618 - Siret:E00005802)
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