



ADVISE

Advanced Inspection of Complex Structures



The project leading to this application has received funding from the Euratom research and training programme 2014-2018 under grant agreement No 755500.



ADVISE at a glance



H2020 Euratom research project



Coordinated by EDF (Andreas SCHUMM)



13 partners from 6 European countries



4,55 M€ budget with 4,17 M€ EU funding



Started on 1 Sep 2017, lasting 48 months

ADVISE context

Article 8c of the amended Nuclear Safety Directive: a licence holder must re-assess systematically and regularly the safety of the nuclear installation

A need to keep on improving Generations II and III reactors' safety and reliability

Addressing specific issues:

Increasing concern for safe long-term operation of existing European nuclear power plants

Plant owners **wishing to replace radiographic inspection by ultrasound** as a less disruptive, safe and faster technique

Ultrasonic inspection of corrosion resistant alloys used in nuclear plants **being a long standing issue** in the field of nuclear NDT/NDE

ADVISE overall objectives



To enhance – and in some cases to enable for the first time – the ultrasonic inspection of complex structured materials



Optimising the performance of existing ultrasonic inspections, where better signal-to-noise ratio, deeper penetration depth and more reliable diagnostics are required.



Applying ultrasound to cases where it cannot be applied today and where the industry currently must resort to radiography, which is highly disruptive and has certain imminent dangers due to the radiation used.



ADVISE technical objectives

1

Increase the comprehension and modelling of complex structures

2

Develop new tools for material characterisation and input data

3

Provide advanced inspection methods

4

Provide defect evaluation methods and assisted diagnostics

ADVISE expected results



A step change improvement in performance in terms of inspectable depth, defect detection and characterisation accuracy

- Delivery of a **set of techniques and methods** answering the industrial and European endeavour to keep on improving and maintaining power plants safety and reliability across its territories
- For austeno-ferritic cast components, **an increase of the inspectable depth** of 70 to 85 mm is aimed for
- **In-situ characterisation for specific inspections** will provide the confidence needed to make **safe decisions from measured indications** without the significant conservatism that is needed in many cases currently

ADVISE specific results

Methods to:

- Measure the properties of NPP materials
- Simulate ultrasound propagation, attenuation scattering and interactions with defects in the materials,
- Optimise the performance of ultrasound system

Tools dedicated to complex materials:

- Simulation tools
- Imaging tools
- Diagnostic tools (software and hardware)

Physical demonstration examples:

- Using real materials and representative target defects,
- Showcasing the new methods and optimised NDE capabilities

2 natural receptacles of project results: CIVA platform and M2M acquisition system:

- CIVA will be enriched with new functionalities, simulation codes
- Imaging and diagnostics tools will be integrated in the M2M portable acquisition system (online applications) or connected to CIVA (offline applications)

ADVISE approach & strategy

Strategy based on two key ideas:

1

ADVISE recognises the potential of **computer modelling of non-destructive examination** to assist in inspection technique design and in the evaluation of results

ADVISE will provide **model-assisted inspection enhancement and diagnostics tools**

- to allow the iterative optimisation of customised transducers and associated excitation signals to specify the most appropriate inspection approach, as well as
- to fully exploit the information contained in full matrix capture (FMC) acquisitions, using adaptive imaging methods, backscatter filtering and inversion strategies

2

ADVISE proposes to use for the first time **in-situ characterisation techniques** to gain additional and current information about the actual structure to be inspected

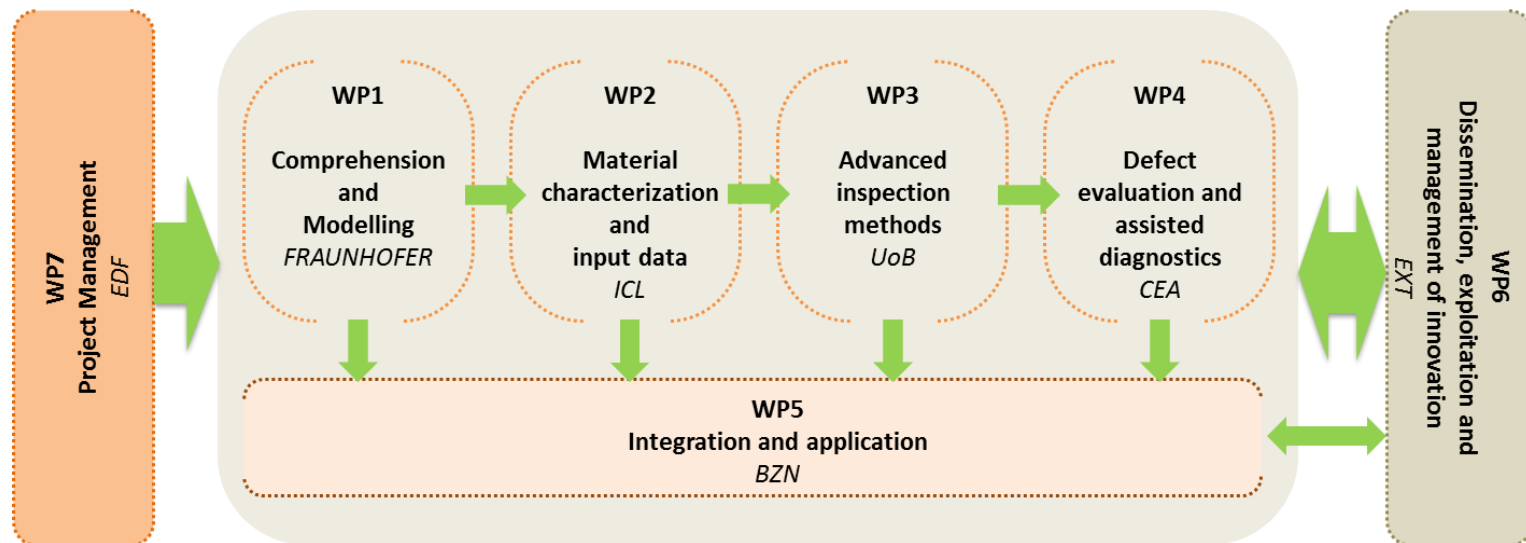
To be used in **model-assisted inspection optimisation tools**

- to identify and fine-tune the best suited inspection parameters while in the field

Integration of the acquisition system in the overall optimisation scheme, by relocating appropriate parts of the in-situ acquisition algorithms, imaging and signal processing into the acquisition system

ADVISE work plan

- Divided into 7 work packages (WP)
- WPs 1 to 5 are dealing with the technical aspects
- Separate horizontal work packages (WP6 and WP7) are dedicated to the training, the dissemination and the exploitation activities, as well as to the project strategic and operational management tasks
- The sequential order of the different work packages reflects the step-wise approach required to successfully implement the project strategy

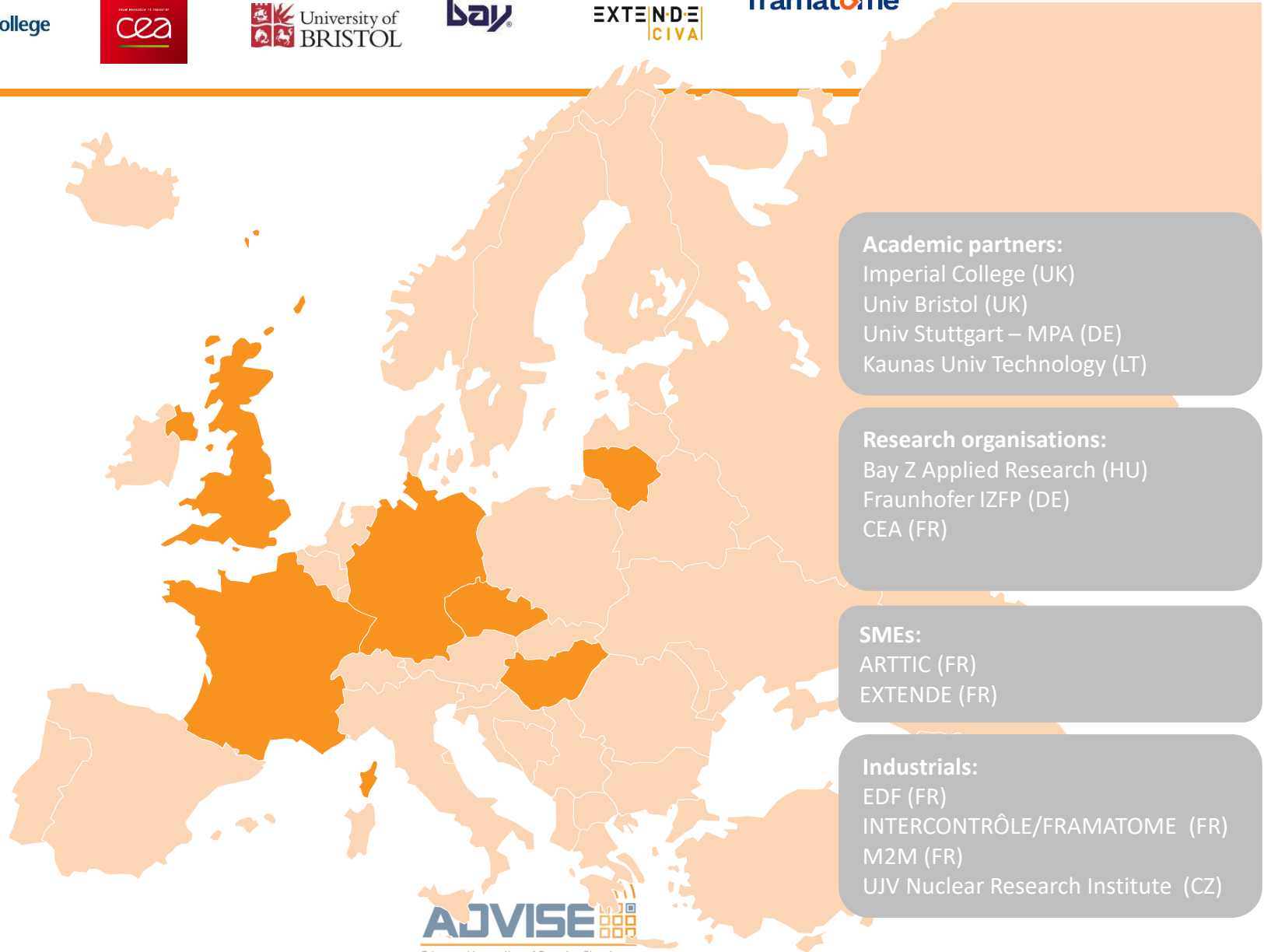


ADVISE Consortium

- **ADVISE** brings together **13 organisations** from **6 European countries**
- A **multidisciplinary team** with complementary expertise uniting
 - *industrial stakeholder* covering construction, operation and maintenance of nuclear plants,
 - *academic and national research institutions* with specific knowledge,
 - *acquisition equipment manufacturer,*
 - highly visible *NDE software distributor* and
 - *service provider*
- Collaboration for **new nuclear power constructions, maintenance of ageing power stations** and **safe operation of plants** at end of life, addressing both Western European and Russian designs



Imperial College
London



Academic partners:
 Imperial College (UK)
 Univ Bristol (UK)
 Univ Stuttgart – MPA (DE)
 Kaunas Univ Technology (LT)

Research organisations:
 Bay Z Applied Research (HU)
 Fraunhofer IZFP (DE)
 CEA (FR)

SMEs:
 ARTIC (FR)
 EXTENDE (FR)

Industrials:
 EDF (FR)
 INTERCONTRÔLE/FRAMATOME (FR)
 M2M (FR)
 UJV Nuclear Research Institute (CZ)

ADVISE Industrial Advisory Board

- Purpose:
 - Support the adoption of the project results by the industry thus positively impacting on nuclear power in Europe
 - Ensure the industrial applicability of the methods and tools developed in ADVISE
 - Assess the results of the project
- Role:
 - Provide inputs on requirements, constraints and future needs, in complement to those exposed by the ADVISE partners
 - Provide advice to the consortium on specific technical/scientific issues which are of importance to them, in particular for adoption of the ADVISE techniques by the industrial community
 - Guide the consortium on nuclear directives/standards (e.g. ESPN...) and on how to implement them from the project early stages
 - Participate to the evaluation of the project methods and tools delivered by the project
 - Monitor the general scientific and industrial evolution outside of the consortium at European and international level as compared to the objectives and targets of the ADVISE project
- IAB members:
 - **EDF, UJV** and **INTERCONTRÔLE** from the consortium
 - **EPRI, Framatome, Rolls-Royce** and **Westinghouse Germany** as external members



Collaboration

- **With important stakeholders**

- NUGENIA (Nuclear Generation II & III Association)
- IAEA (International Atomic Energy Agency)
- SNETP (Sustainable Nuclear Energy Technology Platform)

- **With related H2020 Euratom projects**

- NOMAD (Non-destructive Evaluation (NDE) System for the Inspection of Operation-Induced Material Degradation in Nuclear Power Plants) <http://www.nomad-horizon2020.eu/>
- TeaM-Cables (European Tools and Methodologies for an efficient ageing management of nuclear power plant Cables) <http://www.team-cables.eu/>
- SOTERIA (Safe long-term operation of light water reactors based on improved understanding of radiation effects in nuclear structural materials) <http://www.soteria-project.eu/>



Collaboration with NOMAD

- NOMAD: Non-destructive Evaluation (NDE) System for the Inspection of Operation-Induced Material Degradation in Nuclear Power Plants
<http://www.nomad-horizon2020.eu/>
- Coordinated by FRAUNHOFER Institute For Non-destructive Testing (Madalina RABUNG)
- Funded under the same H2020 Euratom call NFRP-2016-2017-1 “Continually improving safety and reliability of Generation II and III reactors” as ADVISE
- Project objective: To assess in-situ the material degradation induced by neutron irradiation in RPV steels using a multi-parameter non-destructive tool
- Potential synergies for dissemination and training activities:
 - Joint technical workshops
 - Joint mid-term and/or final public workshops

ADVISE foreseen events

Training school

- **When:** towards the end of the project
- **Why:** to educate early career scientists and engineers
- **To whom:** those wanting to improve their understanding of ultrasonic inspection of complex structured materials and its impact on the safe long term operation of nuclear power plants

Final workshop

- **When:** at the end of the project
- **Why:** to share information about the technical tasks and the work progress, and to disseminate the project results
- **To whom:** end-users, participants from the international nuclear safety scientific and industrial community

As far as possible, both these initiatives will be organised in connection with major events in the field such as MAI (Materials Ageing Institute) or the NUGENIA forum in order to be both cost-efficient and highly visible

Contacts

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