1 The CEN Workshop

Research and standardisation are inter-dependent for two reasons:
- the development of high quality standards requires scientific information to provide the basis for objective decision making
- standardisation can be a very effective (but often neglected) exploitation route for new products, including research results. In the case of research results, this lack of follow-up has meant that much of the progress achieved in EU research has disappeared.

Indeed the following sentence, contained in a Commission document of Apr 2003 /1/ (refs. are in Annex A), recognises this relationship between research and standardization:
“... The two following aspects are particularly relevant to research and innovation: first, resources need to be made available to fund the research required for completing the development of many European standards; secondly, adequate awareness of standards is needed to allow European business, notably SMEs, to take them better in account in their research and innovation projects.”

In research projects co-financed by the EC during the last years, great R&D outputs were produced in the field on structural integrity analysis methods. As a result of those efforts, currently FITNET (Fitness For Service Network of 5th EC Framework Programme for R&D, ref/2/) is developing a comprehensive procedure, built upon the shoulders of the usable best results produced by the last two decades of EU research. The main target of FITNET is to formulate a European Fitness For Service (FFS) Procedure, namely a unified, coherent and harmonised set of guidelines and methods for component integrity analysis, for all industrial sectors, dealing with components containing or subject to development of damage and flaws during service.

This Workshop is intended to prepare, starting from the FITNET views and also supported by parallel FITNET efforts, a CEN Workshop Agreement relating to the use of a harmonised FFS procedure for analysis of the integrity and residual life of components made of metallic materials, at low and high temperatures.

Further detailed technical background is provided at Annex A and a Glossary of Terms at Annex B.

2 Origin of the CEN Workshop Proposal

FITNET is a networking project, running from Feb 2002 to Jan 2006, designed to promote the development of a comprehensive European Fitness For Service Procedure for assessing the structural integrity of metallic welded or non-welded structures transmitting loads. In particular it embodies techniques for dealing with flaws known or postulated to be present in a structure together with the possible growth of such flaws by a range of mechanisms and the assessment techniques required to evaluate failure risk. It is intended to provide an umbrella scheme into which results from EC-funded projects (including those from the European Coal and Steel Committee, ECSC), national programmes...
and in-kind funded contributions are harnessed to the common goal of a fitness-for-service procedure based on European advanced technology. More information on the FITNET network can be found in the FITNET web site: www.eurofitnet.org. Moreover, other relevant information on these topics is also in the web site of the European Pressure Equipment Research Council, EPERC: http://www.eperc.bam.de.

Within the FITNET work programme, the work package 7 on Standardization has the following objectives:
- to promote efforts to develop a European Fitness-for-Service Standard, in particular via the appropriate CEN committees,
- to monitor international developments for Fitness-for-Service standards,
- to assess the further needs for standards implementation.

The activity carried out by the Work Package 7 in the first period of FITNET was therefore aimed at defining the possible and best routes on which a possible standardisation of the FFS procedure under development within FITNET might be placed. The analysis consisted in an intense activity of discussions, with CEN persons (including chairpersons of some CEN TCs), persons of National Standardisation Bodies (NSB), and explorations of other experts (in the EC and in EPERC environments mostly).

In particular, a first exploratory discussion over standardisation matters in EC projects, including perspectives of FITNET standardisation, was held on 21 May 2002 in Brussels, hosted by CEN/STAR Secretary (A. Pirlet), in the presence of the EC Officer responsible for some projects for test methods Codes of Practice developments (M. Facchini). In addition, on 29 Jan 2003 a dedicated FITNET meeting, specifically focussed on FITNET standardisation issues, was hosted at the CEN Management Centre in Brussels; that meeting was attended by (among others) CMC representatives including a CMC Director (J. Van Herp), an EPERC representative, a few CEN TCs members, experts involved in previous FFS activities within CEN, and of course key FITNET representatives (FITNET coordinator M. Kocak and WP7 leader V. Bicego).

The following outcomes are summarised from that FITNET meeting at CMC:
- the Fitness For Service initiative, which was ongoing within TC121 (weldments; within WG14 /3/) at the time when the FITNET proposal was prepared, has now arrived at its end, and apart the production of a Technical Report on the FFS state of the art /3/, no further FFS standardisation work would be carried there; TC121 is not willing to raise any further FFS initiative at this moment within its committee.
- It was agreed that FFS, being a horizontal, technology related issue, is not specific for a single product only (e.g. for pipes, or for headers, or rotors, or wings, or rill axles…) but it would impact on likely more than 10 CEN TCs.
- While there is no envisaged mechanism within the CEN TCs structure to manage widely horizontal, “trans-TCs” standardisation initiatives, the CMC Director presented the remaining possibilities of starting a new FFS initiative in order to get a FITNET standardisation. He finally concluded that neither the creation of a specific Work Item inside one of the several CEN TCs potentially relevant, nor the creation of a new CEN TC (e.g. focussed on service integrity of plant in operation) was appropriate, and he recommended the CEN Workshop (WS) mechanism as the most promising route for FITNET standardisation.

The proposal of this WS is the outcome of that FITNET standardization strategy analysis. The following organizations support the proposed Workshop:

FITNET, the European Fitness For Service Network, partly funded under FMP5 of EC
EPERC, European Pressure Equipment Research Council, Technical Task Force 5 (Integrity During Operation)
UNI, the Italian national standards organization, as a Member of CEN, is offering to hold the Secretariat of the Workshop, subject to the Kick-Off meeting’s confirmation.
CESI, the Centro Elettrotecnico Italiano G. Motta SpA (national institute for research in power industry sector) was the main drafter of this Business Plan (BP); in addition to offering to assist UNI in the Secretariat work, CESI proposes its expert (V. Bicego, also Chair of EPERC TTF5) as Workshop Chair, subject to the endorsement of the Kick-Off meeting.

In addition the following proposers within the FITNET partnership have been involved in review and
discussions by which this BP was drafted and have expressed their intention to support the Workshop’s activities:

Corus Group Ltd, Moorgate Rotherham, UK: S. Webster (also proposed as Convenor of Work Package 2 of this WS)
Caterpillar, Grenoble, France: J.-J. Janosch (also proposed as Convenor of Work Package 3 of this WS)
British Energy Generation Ltd, Gloucester, UK: R. Ainsworth (also proposed as Convenor of Work Package 4 of this WS)
Shell Global Solutions, Amsterdam, NL: R. Koers (also proposed as Convenor of Work Package 5 of this WS)
Institute de Soudure, Paris Villepinte F: D. Chauveau (also proposed as Convenor of Work Package 6 of this WS)
Alstom Power, Rugby, UK: S. Holdsworth (also proposed as Convenor of Work Package 7 of this WS)
GKSS Geesthacht GmbH, D: M. Kocak (FITNET Coordinator; also proposed as Convenor of Work Package 8 of this WS)
TWI Ltd, Great Abington Cambridge, UK: H. Pisarski (also proposed as Convenor of Work Package 9 of this WS)
VTT Industrial Systems, Espoo, FIN: K. Wallin (also proposed as Convenor of Work Package 10 of this WS)
EC-JRC-IE, Institute of Energy, Petten, The Netherlands: N. Taylor (also proposed as Convenor of Work Package 11 of this WS)
Kielce University of Technology, Poland: A. Neimitz

3 CEN Workshop Market Overview

Flaws (such as cracks, welding defects and corrosion) and damage can arise during the manufacture and/or use of metallic components. For safety-critical items such as aircraft, metallic structures in civil engineering, pipelines and pressure vessels, the failure of a single component due to the presence of a flaw can threaten human life, as well as having severe economic and environmental consequences. Other flaws may be harmless, as they will not lead to failure during the lifetime of the component. Replacement and/or repair of such flaws is economically wasteful.

The annual world sales of steel components are well in excess of 2 billion Euros, with a comparable figure for maintenance/refurbishment. Non-validated design and uninformed maintenance can result in the premature failure of components and the need to replace them at an earlier period in time than anticipated. The cost associated with critical component failure in power plant can amount to a figure of the order of 1m Euro per day of full outage of a large plant.

A practical example may be given of the potential cost savings. The procedures utilising accurate FFS methods of analysis can provide proper judgement of the in-service brittle fracture risk for critical components such as high-pressure steam turbine rotors. Without accurate and reliable FFS assessment, conservative embrittlement behaviour has to be assumed, leading for example to the need to spend time (e.g., 2 days) for pre-heating the large rotors during all cold starts (to minimise occurrence of large thermal stresses at temperatures below the DBTT, Ductile to Brittle Transition Temperature, i.e. in the brittle condition for the material). The result is a cost penalty of 400 kEuros for a typical 320 MW group: this penalty will occur at each cold start. On the other hand, a state-of-the-art FFS analysis would be possible within ¼ of that cost, with its result been taken valid for years ahead (as new FFS analysis is not needed at each shutdown, if no significant crack growth can be concluded from that analysis).

In the field of Fitness For Service analyses of components and structures, methods of various nature, pedigree, complexity are used. The several procedures for FFS analysis are different in various aspects:
- technical methods (methodologies adopted),
- types of life limiting, damaging factors (some procedures are limited to low temperature damage only, others do tackle crack initiations only, or are extended to macrocrack growth, some methods do address pitting, some are restricted to iron alloys...
specific peculiar issues of a particular industrial sector might be only addressed (petrochemical, pressure equipment, nuclear, rail, aero transport...).

In addition to the referenced codes, e.g. the standards or recommended national procedures (e.g. API579 /4/, BS7910 /5/, R5 /6/, R6 /7/, RCC-MR /8/, ETM model /9/, SA/FoU /10/, EXXON /11/), or well documented methods e.g. from important EC projects (SINTAP, HIDA), quite often other self-made, home-made, informal, undefined methods are used too. As a result of the lack of uniformity (and sometimes also of transparency), a rigorous, thoroughly applied, comprehensive, coherent method for an assessment problem demanding a particular FFS analysis may have difficulties in being correctly perceived by a client. A low level, simplistic approach can be commercially felt equivalent to an accurate method, therefore being always preferred. In many cases a simple method might be an appropriate solution, but in other cases it might be not, and users should have the possibility to choose among clear options, understanding what cost they are asked to pay, and also the value of the service they buy.

The foremost aims of European standardization are to ensure a high level of safety and to facilitate the exchange of goods and services though the elimination of technical barriers to trade. The use of standards by industry and the social and economic partners is always voluntary, however, European standards are sometimes related to European legislation (Directives), and conformity to such standards may constitute a presumption of conformity to the legal requirements of the Directives.

A CEN Workshop Agreement containing a unified/harmonised European FFS Procedure is therefore aimed to become a reference, a benchmark in the market of FFS services. Several approaches and methods might continue to exist, but they will be comparable, everyone will be free to buy/sell everything, but the exact content and value of the good will be clearly understandable. The clients will be able to compare different offers; the FFS providers shall be committed to delivering precisely defined contents for their FFS services. End users will be able to choose among options, on the basis of actual need: solution of a legal dispute, scheduled routine minor check, avoidance of a major outage for maintenance, possibility to postpone long term investment for a new plant, etc.

In the field of users (plant operators, etc.), FFS is a key ingredient of the plant operation business, providing other options instead of simply retiring components of unknown state of damage, to be replaced by potentially non necessary new equipment. The CWA to be developed in the present Workshop require high level technical input, but once it is available and become standardised and routine, its application for plant integrity analysis is economically worthwhile. The successful completion of this programme will contribute to increasing the competitiveness of the heavy engineering, power and process industries in the world market place. The harmonisation objective of this WS is important here since it makes FFS more effective and the results more reproducible and precise. The better the FFS procedure is defined and the better a FFS analysis can be performed, the more reliably the results can be understood and utilised.

For service providers, the development of the FFS procedure along with the harmonised CWA route increase the potential for these organisations to partner with industry in development of accurate advanced methods and applications for equipment integrity assessment. The foreseeable expansion of the number of research institutions/universities becoming involved in FFS analyses will support industry in concentrating on its core business. It is clear that FFS procedure standardisation may be also closely favouring the progressive diffusion of Quality Assurance practices, like in most other fields where provision of immaterial products (e.g. testing results, conformity analyses, residual life predictions) are involved. In the absence of a European reference grid, it will be increasingly difficult for European FFS operators to continue to work with their domestic methods, sometimes with uncertain pedigree, uncertain reference to recognised methods, no perception of the value by the clients. In a sense, it would be like insisting in Italy to sell good Italian wine in anonymous, non-labelled bottles: the good reputation and tradition of Italy might help, as well as proximity, same language, patriotic feeling... but in the long term, a good European recognised system of quality assurance and traceability of product is becoming the needed key for success.

Finally a European-wide European Fitness for Service (FFS) procedure is essential to regulators, especially as they are now faced with an increase in multi-national owners and operators of industrial systems. By the same token industries will benefit from having at their disposal a tool for cross regional benchmarking and to provide increased flexibility in choosing their suppliers as all can work to the same basis and calculations/solutions can be re-used for similar components. Also, in this age of
increasing globalisation, it is a tremendous advantage for European industry to develop their own world leading method which is used internationally rather than have US or Japanese methods imposed upon them.

In conclusion:
- there is an obvious economic benefit in application of FFS assessment methods,
- standardisation of an advanced, harmonised and agreed FFS procedure will accelerate its application, resulting in vastly improved efficiency in maintenance of industrial plant equipment with reduced failure risks,
- ageing infrastructure in a range of industries will become more manageable and less failure prone,
- costs associated with acquisition of the know-how are modest and will further decrease with standardisation, opening up opportunities for a range of owner-operator and service organisations.

4 Objectives of the CEN Workshop

This WS is made of a single project, aimed at delivering a reference document (CEN Workshop Agreement (CWA) for FFS assessment of flaws and damage in structural metallic, welded and unwelded components of all sectors where structural integrity is an issue. It is intended that the technical activities leading to the production of such a comprehensive document will be strongly supported by an existing EC network, FITNET. This WS is therefore intended:
- to create a wider circulation, criticism resolutions, leading to broad consensus, by providers, users of FFS methods, component owners, inspection bodies, and legislators,
- to eventually lead to a FFS standardisation.

A European fitness for service procedure is of course an enormous task. It would be an exaggeration to claim that any existing CEN committee (more than 10 CEN TCs do exist, potentially covering areas where FFS procedures have to be dealt with) can be a suitable platform for such a complex task. The task is complex not only because the in-kind work capacity would be insufficient within a single TC, but also the trans-collaboration of more than 10 TCs committed to work jointly within a coordinated initiative is definitely far from the typical CEN style of work (made of component-focussed TCs, product specific, not technology based).

The CWA will be a technical agreement, developed by an open workshop structure within the framework of CEN, CEN holding the exploitation rights of the CWA. This CWA reflects the consensus of identified individuals and organizations responsible for its contents. The market players wishing to participate to this WS will not be limited to the geographical confines of Europe: the conditions are deliberately light to facilitate collaborations as widely as possible. However, in order to set up a procedure, robust and usable, emphasis will be given to the harmonisation and coherence of the various approaches: therefore the existing view within the European Research Area will be primarily considered.

Therefore an appropriate degree of consensus will have to be reached from WS participants on the final CWA document, as judged by the chairman assisted by the WP leaders, who will be the focal points to coordinate the preparation of the CWA sections, after having coordinated the balloting phase with the resolution of possible disputes.

5 CEN Workshop Work Programme

The WS is intended to be made of a single project, namely a programme of activities intended to deliver, after the completion of a number of steps (hereafter called “work packages”), WP1 to WP10, the final document, the CWA. The technical contents of, and the results intended from, the individual Work Packages activities are in Table 1 below; Table 2 contains a summary of the Workshop timetable. The full Action Plan is shown in Figure 1.
Table 1: The FITNET Workshop technical activities and outputs in the envisaged WPs.

<table>
<thead>
<tr>
<th>Activities</th>
<th>Outputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Secretariat</td>
<td>Liaison with CEN Management Centre, provision of final CWA for publication, etc.</td>
</tr>
<tr>
<td>Assistance to Secretariat</td>
<td>Workshop web pages, formal documents, minutes, post-Workshop maintenance strategy</td>
</tr>
<tr>
<td>WP1     WS coordination</td>
<td>Business Plan proposal, CWA drafting, dissemination, overall progress control/management of WPs</td>
</tr>
<tr>
<td>WP2     working group on Fracture</td>
<td>Fracture procedures</td>
</tr>
<tr>
<td>WP3     working group on Fatigue</td>
<td>Fatigue procedures</td>
</tr>
<tr>
<td>WP4     working group on Creep</td>
<td>Creep procedures</td>
</tr>
<tr>
<td>WP5     working group on Corrosion</td>
<td>Corrosion and Environment ass. cracking procedures</td>
</tr>
<tr>
<td>WP6     working group on NDE</td>
<td>NDE compendium</td>
</tr>
<tr>
<td>WP7     working group on Materials data</td>
<td>Material curves compendium</td>
</tr>
<tr>
<td>WP8     working group on Weldments and residual stresses</td>
<td>Welded parts assessments and residual stress profiles</td>
</tr>
<tr>
<td>WP9     working group on Stress Intensity Factor solutions</td>
<td>SIF compendium</td>
</tr>
<tr>
<td>WP10    case studies</td>
<td>Validation of the proposed methods, also tutorial</td>
</tr>
<tr>
<td>WP11    new and deviating issues, managing links to non-FITNET methods (integration, harmonisation, addition of special methods in API579, RCC-MR, RTD, ASME)</td>
<td>Special FFS methods</td>
</tr>
<tr>
<td>WP12    CWA: overall document structure and editing, IPR matters and links to CEN</td>
<td>CWA production and final delivering through secretariat to CMC</td>
</tr>
</tbody>
</table>

Following approval of the CEN Workshop Business Plan at the Kick-Off Meeting, interested parties must register at the CEN Workshop Secretariat. Participation in the CEN Workshop will remain open to all registered participants, free of charge and will remain open to new interested parties until the final draft is made available.

Once finalised by the WS, the draft of the FITNET CWA will be made available on the interactive website for public comment for 60 days.

The WS is intended to be mostly developed within the timescale of the FITNET project of EC, this being also appropriate to have the help of FITNET in providing the necessary labour assistance for the WS technical needs. The action plan is shown in Fig.1. In Table 2 the summary timetable of this WS is given.

Table 2  Summary timetable

<table>
<thead>
<tr>
<th>Event</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kick Off meeting</td>
<td>Nov 2004</td>
</tr>
<tr>
<td>Produce 1st draft FFS procedure</td>
<td>Beginning March 2005</td>
</tr>
<tr>
<td>First CEN Workshop Plenary Meeting</td>
<td>End March/April 2005</td>
</tr>
<tr>
<td>Produce final draft of CWA,</td>
<td>Dec 2005</td>
</tr>
<tr>
<td>The draft is sent to CMC, and put in the www site of the CEN Member secretary of the WS (and in the www site of CMC too, possibly) for the external enquiry</td>
<td>Dec 2005</td>
</tr>
<tr>
<td>60 days commenting phase</td>
<td>Dec-Feb 2006</td>
</tr>
<tr>
<td>Publication by CEN of CWA</td>
<td>Early in 2006</td>
</tr>
</tbody>
</table>
CESI submits a request to CMC to develop a WS, based on a drafted Business Plan

CMC informs CEN national members and announces the CEN WS on CEN website (BP + registration forms)

WS establishment and expansion phase: organisations wishing to take part must return the registration forms to CMC invitations

First Plenary Meeting (to be decided-confirmed at K.O.)

Solution of problems arisen from this launch phase, adoption of the final work programme

WS running: document sections circulations, criticisms, inputs to CWA

Chair seeks final consensus on draft CWA: consensus reached?

No

CWA is made available to public enquiry (60 days commenting phase)

(Final plenary meeting if needed by the WS) Workshop resolves expressed comments, reaches final consensus on CWA

CMC publish the CWA

FITNET parallel activity in support

2nd FITNET training seminar

Draft FITNET Procedure ready

3rd FITNET training seminar

FITNET open workshop

Final FITNET Procedure

FITNET END: Jan. 2006

Fig. 1 The WS action plan
6  CEN Workshop Structure and Resource Requirements

The WS structure proposed here is intended to offer a reliable and effective way of reaching the CWA target, by:
- minimizing work dispersions and staying adherent to the comprehensive FFS procedure as discussed by FITNET, based on the best state of the art as developed in Europe through several recently concluded R&D projects in the field,
- providing an efficient, low cost coordination of the WS, taking profit from the FITNET schedule of work.

Such criteria are meant to be achieved by:
- coordination and secretariat roles concentrated and working close together, of the same nation, Italy, increasing WS coordination efficiency and decreasing WS operation costs,
- a WS technical work structure largely supported by FITNET, taking benefit from the direct, enthusiastic, committed, mostly voluntary supports of organizations and persons having leading roles in the same technical fields of analysis as in FITNET,
- a time schedule adherent to the FITNET needs and development milestones.

The WS structure is shown in Table 3.

| Table 3  The FITNET CEN Workshop proposed structure. |
| Roles | Proposed lead | man-days |
| Secretariat offered by UNI | 40 |
| Assistance to Secretariat CESI | |
| WP1  WS coordination V. Bicego (CESI, I) | 20 |
| WP2  working group on Fracture S. Webster (CORUS, UK) | 20 |
| WP3  working group on Fatigue J. Janosch (CATERPILLAR, F) | 20 |
| WP4  working group on Creep R. Ainsworth (BRITISH EN., UK) | 20 |
| WP5  working group on Corrosion R. Koers (SHELL (NL) | 20 |
| WP6  working group on NDE D. Chauveau (IdS, F) | 20 |
| WP7  working group on Materials data S. Holdsworth (ALSTOM, UK) | 20 |
| WP8  working group on Weldments and residual stresses / Annex 3 M.Kocak (GKSS (D) | 20 |
| WP9  working group on Stress Intensity Solutions / Annex 4 H. Pisarski (TWI, UK) | 20 |
| WP10 case studies K. Wallin (VTT, FIN) | 20 |
| WP11 new and deviating issues, managing links to non-FITNET methods (integration, harmonisation, addition of special methods in API579, RCC-MR, RTD, ASME) N. Taylor (EC-JRC-IE) | 20 |
| WP12 CWA: overall document structure and editing (with help from FITNET), IPR matters and links to CEN WS secretariat | included in secretariat |

CEN Workshop Secretariat
UNI, the Italian national standards organization, assumes this role, subject to confirmation at the Kick-Off meeting. The following activities will be carried out by the WS Secretariat:
- circulating WS documentation to participants
- managing meeting preparations, minutes, mailing lists, new registrants, recording, Business Plan updates
- monitoring progress on WS deliverables
- providing Administration support
- preparing the draft CWA (with help from FITNET)
- collating comments on the draft CWA
- providing proof and editing support
- keeping CMC informed of progress
- managing the web page
- linking to CMC, editorial work in line with CEN rules, copyright matters considerations etc.

The costs are being met by the proposers. UNI would be assisted throughout by CESI personnel, including the above proposed WS Chair.

CEN Workshop Chairman
Valerio Bicego, CESI Italy, the person chairing in FITNET TN the work package on Standardization, was appointed at the K.O. meeting as the chairman of this WS. His responsibilities would include:
- chairing the CEN Workshop (kick off and plenary) meetings
- representing the CEN Workshop in outside meetings in cooperation with CMC and with the WS Secretariat,
- monitoring progress of the CEN Workshop deliverables,
- chairing the process of technical-scientific disputes resolution.

WP Convenors
Within the panel of proposers, key scientists have been chosen to chair the groups tackling the issues which are specific for the several areas of the WS. Their responsibilities will include:
- brief the CEN Workshop Chairman and the CEN Workshop Secretariat on the progress of the project
- ensure that all deliverables are completed on time and conform to the schedule as indicated in the Business Plan
- help solutions of disputes within their areas of work
- assist the WS chairman in final assessment of consensus over the drafted CWA to be transmitted to CMC

CMC Services
Guidance on how to use the CEN Workshop process
Guidance in drafting and executing the CEN Workshop Business Plan
Organization of the Kick-Off Meeting
Regular follow-up and monitoring of the CEN Workshop Progress, via the WS Secretariat.
Publication of the CWA
The CMC Director will maintain these facilities in liaison with the CEN Workshop Secretariat. Note: the archives of the CWA are maintained by the CEN Workshop secretariat. CMC is expected to retain the list of registered participants who have supported (or not supported) the consensus.

Project WPs
The working style of the WS will be flexible. Namely depending on the different natures of the WPs, the WS participants might choose to contribute to several WPs: e.g. it is realistic to envisage that the WPs 2 to 5 would be worked out by distinct panels of experts in the WS, working in parallel, as these WPs demand focussed and distinct scientific skills, so that an expert should be contributing to one of them only; whereas participation to the WP10 to 12 would be likely relying on the whole WS participants.

The experts activities in the WPs, particularly the Convenors, would be self-supported; on the other hand the great synergy/overlapping with FITNET (FMP5 EC project) would provide consistent help to participants un-funded voluntary supports.

No special meetings are envisaged, apart from the kick off, first plenary and perhaps a final meeting; however, it is possible that needs for technical discussions will be found within the WPs activities, so the leaders might decide to arrange special meetings as appropriate. On the other hand it is envisaged that most discussions will be managed entirely via web and e-mails. As far as the WS meetings of Kick off, WS initial plenary and final meetings are of concern, the envisaged sites will be at CMC and at the Secretariat site.

Language
The language of the CEN Workshop and its documentation will be English.

Interactive website: Deliverables
Initial design of website Nov 2004
Documents and response forms available on website Mar 2005
Links page available on website Mar 2005
7 External Liaisons

A CEN Workshop has the advantage of being very flexible and is therefore the preferred initial option. Later it may be upgraded into an EN Standard.

In particular, this WS intends to address the CEN Technical Committees dealing with industrial products to which this FFS technology is targeted: primarily those of the PED sector (as also mentioned in previous Section 3), CEN/TC 269 (boilers), TC 54 (unfired pressure vessels), but also others, dealing with economically important (usually large) structural items in engineering and civil sectors: TC 23 (transportation gas cylinders), TC 57 (Central heating boilers), TC 74 (flanges), TC 110 (heat exchangers), TC 267 (industrial piping) and TC 269 (shells and water-tube boilers). As this FFS technology is however of wider application, i.e. not product-specific, other CEN TCs on products and safety technologies will be approached and invited to contribute, particularly TC 121 (welding), TC 138 (non destructive testing), TC 12 (materials for petroleum and gas).

In addition relevant liaisons are intended with other parallel European initiatives (several WS proposers in the list above are already much involved in them too) which are running or are expected to be started soon (therefore possibilities of liaisons will need to be matched with actual schedules).

  in the field of direct damage assessment in components. FITNET WS would consider recommendation of that new technique among the available/recommended list of non invasive / non destructive tools in FFS analyses.

- FITNET (i.e. the network, www.eurofitnet.org , bearing the basic effort for the production of the drafts in FITNET WS) is already in liaison with ECCC, in particular WG1.2 (crack initiation methods) and WG4 (component assessments in creep range).

- In the frame of COST (http://ue.eu.int/cost/default.asp), a new action COST 538 (“High Temperature Plant Lifetime Extension”) has produced a Memorandum of Understanding, including an activity (WG1, “Condition Monitoring”) relevant to FFS topics.

It was mentioned that this WS proposal is supported by EPERC, http://www.eperc.bam.de : therefore this is not really an “external” liaison, but a direct participation. This network was recently having the passage of the Operating Agent, from JRC to BAM. The main EPERC frameworks for this are TTF5 (Service Integrity During Operation; FITNET WS discussions were started there) and particularly TG2, being the body linking EPERC to DG Enterprise, and CEN (CEN-STAR, linking research to standardization).

Via EPERC, EPERC TG2, having signed a formal agreement with those institutions, the WS will maintain links (invitations) to PVRC, JPVRC.

8 Contact Points

Chair of the CEN Workshop
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Tel: +39 02 700 24 445 Fax: +39 02 701 06 106 E-mail: Giovanni.Micciche@uni.com

CEN Advisor
James Boyd
CEN Workshop Manager (Contact Point), CEN Management Centre (CMC), European Committee for
Annex A

Technical background

Currently the design codes and standards (e.g. DIN, ASME, API, AFNOR...) provide rules for the
- design
- fabrication
- inspection, and
- testing

of new pressure vessels, piping systems, storage tanks, other components. These codes do not
address the fact that equipment degrades while in service and deficiencies due to degradation or from
original fabrication may be found during subsequent inspections, before or beyond nominal design life.

Fitness-For-Service (FFS) assessments are quantitative engineering evaluations which are performed
to demonstrate the structural integrity of a component, containing a flaw or damage. The procedures
may be applied to flaws that are discovered during pre-service or in-service inspections. The objective
is to decide whether a flaw is innocuous and will never affect the integrity of the structure, whether
remedial action can be deferred until some time in the future or whether repairs are needed
immediately. The procedure may also be applied at the design stage to hypothetical flaws, in order to
set inspection sensitivity or to check that a proposed component is tolerant to flaws.

On a world scale, the three most diffused procedures are API RP 579, R6 and BS7910. Recently, in
Europe a novel procedure (SINTAP) was formulated; this led to advances including a number of
aspects later inserted in BS7910. Each procedure has own overall structure, safety criteria, extent of
application, and scientific methods, e.g.:
- These procedures (API RP 579, R6 and BS7910) allow 3 levels of FFS analysis, of increasing
  complexity. The level when entering the analysis is not fixed, i.e. it can be different from
ground level. The choice will depend on each specific case, from decision of the involved
parties, sound agreed evaluations, cost considerations, criticality of the component.
- The SINTAP procedure (not yet standardised), considered in the Thematic Network FITNET
  extensively mentioned in this document, as a basis for the construction of a global European
FFS procedure, suggests several levels, and sub-levels. The user is suggested to start from
the ground (simple, basic, grossly conservative) level, and if the result does not satisfy the
objectives/wishes of the user, then an improved accuracy can be obtained by entering the
upper (more expensive) levels, and stopping the process when a satisfying conclusion is
reached (the flaw is demonstrated to be tolerable).

A FFS procedure should allow flaws to be evaluated consistently and objectively, using fracture
mechanics principles. Although several FFS procedures already exist, e.g. /4-11/, they tend to be
aimed at a particular industry sector, or a single failure mode, or are national documents. There is
therefore a need for an agreed European procedure, which could ultimately become a European
(CEN) standard. In addition, in the last 10 years the EU has been much advancing the methodologies
of fracture analysis, component stability assessments, residual life prediction. Noticeable examples of
recent advances are the Time Dependent Failure Assessment Diagram considered in last issue of R5
/6/, the German Two Criteria Diagram /12/ approaches to high temperature flaw stability analysis, the
weld mismatch models for flaws in welds (SINTAP /13/, creep-fatigue modelling /14/ in high
temperature cracking, constraint models in fracture theories /13/, ... There is clearly much scope for
developing an overall modern European FFS procedure, and putting it forward as a standard.

Two reports by JRC-Petten have been released as FITNET public reports for dissemination /15,16/.
The first was surveying, via a questionnaire, the R&D activities and their delivered products in the FFS
field. The latter report was investigating the views to existing FFS scenario of methods and needs, via
a survey on "Current application and future requirements for European FFS Technology" distributed in
late 2002 to a number of organizations that use FFS procedures.
a) It came out that FFS assessments are mainly conducted during service (re-rating, life
assessment), by in-house engineers. Regarding the procedures, the most popular are the BS7910
(or the precursor PD6493), followed by R6, ASME /17/ and SINTAP, with a fairly large number of
organizations relying on application-specific, in-house developed procedures.
b) A number of technical issues were also investigated. Namely, the major difficulties encountered in
applying FFS assessments were found to be the estimation of the residual stresses and of the
applied loads/loading history of the components. Guidance on selection of adequate material properties was also recognized important. On the other hand NDE reliability and NDE guidelines were not considered a priority needing urgent improvement, at least in the large and medium-size organizations. A need for training to FFS procedures (also via e-learning tools) was felt important; whereas online condition monitoring ranked lowest in the priority list for training items. The possible development of a professional qualification for competence in the application of FFS technology was viewed positively by 2/3 of the survey sample, other 1/3 fearing it could become a legal requirement as opposed to simply an indication of professional quality.

c) In the choice of a particular procedure, the majority of respondents put 'wide recognition' and familiarity first whereas some indicated accuracy as very important, with also acceptance by a notified body being a fairly good reason for selecting a FFS procedure. This shows the challenge ahead of having harmonized standards, winning acceptance and underlines the importance of taking action to promote their usage at every level. The need for a European FFS Code was strongly pointed at by 90% of the respondents.

Any project intended to develop/advance over existing methods of FFS, has to consider task areas addressing: weld strength mis-match, failure of cracked components, probabilistic methods, residual stresses, and procedure development. Advances are to be built based on (starting from) the current status of procedures e.g. in BS 7910, R6, R5, the Engineering Treatment Model (ETM), API RP 579, RCC-MR, and experience of large scale tests (e.g. wide plate, pipes...). The final procedure must always include a range of route options of varying complexity, with selection being made by the user, on the basis of data quality, purpose of assessment, type of structure, and user knowledge.

References
/14/ HIDA Project Task 1 Report No.1702/TG1/1, Dec.1996.

Annex B

Glossary of terms

API American Petroleum Institute
ASTM American Society for Testing Materials
BAM Federal Institute of Materials Research and Testing (Operating Agent of EPERC)
BP Business Plan
BE British Energy Generation Ltd, UK (a partner of FITNET)
CAT Caterpillar FR (a partner of FITNET)
CESI Centro Elettrotecnico Sperimentale Italiano, I (Standardisation WP leader in FITNET)
CEN Centre Européenne de Normalisation
CMC CEN Management Centre
CoP Code of Practice
CORUS Corusgroup UK (a partner of FITNET)
CWA CEN Workshop Agreement
EC European Commission
EPERC European Pressure Equipment research Council
ESIS European Society for Structural Integrity
FFS Fitness For Service
FITNET Fitness For Service Assessment Thematic Network of EC
FMP Framework Programme of EC
GKSS Forschungszentrum Geesthacht GmbH, D (the FITNET Coordinator)
ISO International Standards Organisation
JRC EC-DG12-IAM Petten NL (a partner of FITNET)
SHELL Shell Global Solutions NL (a partner of FITNET)
TWI The Welding Institute UK (a partner of FITNET)
UNI Italian national standards body
UNICAN Uni. Cantabria ES (a partner of FITNET)
VAMAS Versailles Treaty
VTT VTT Industrial Systems, FIN (a partner of FITNET)
WS CEN Workshop