

UK CORROSION '94 - EUROCORR '94

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Intelligent hypermedia corrosion information tools

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Intelligent hypermedia corrosion information tools

What is a hypermedia system?

- the basic concepts of hypermedia
- why use hypermedia for corrosion engineering?

The Active Library[®] on Corrosion

- the goal of the system
- an overview of its functionalities

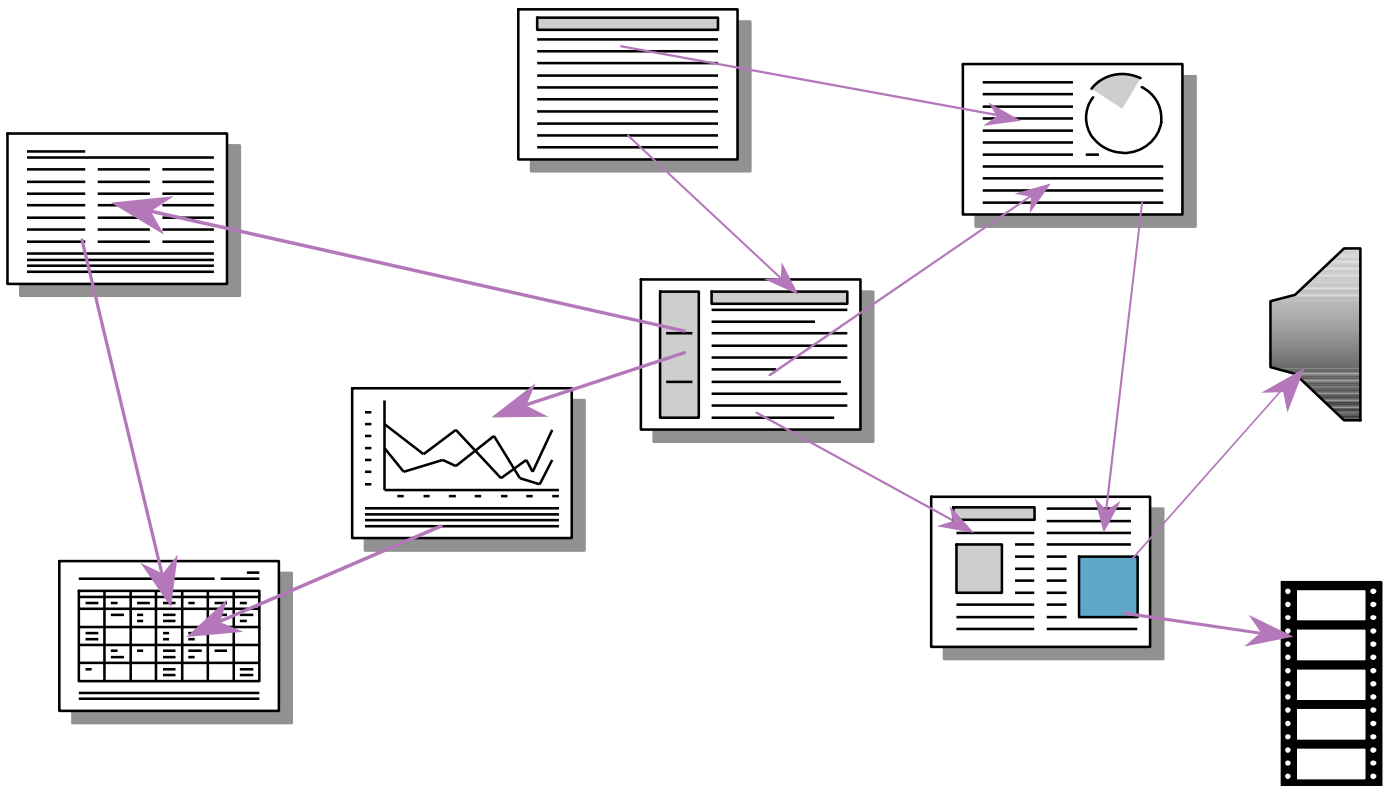
The GRACE[™] system

- the goal of the system
- an overview of its functionalities

Conclusions

WHAT IS A HYPERMEDIA SYSTEM?

The basic concepts of hypermedia



Hypermedia = hypertext + multimedia

- hypertext = nodes + links
 - non-linear vs. linear
 - navigation vs. query
- multimedia
 - images, sounds, video, ...

WHAT IS A HYPERMEDIA SYSTEM?

Why use hypermedia for corrosion engineering?

Corrosion engineering

- *corrosion diagnosis* based on the consultation of many different and dispersed information sources
- *corrosion recognition* is based on a visual comparison with corrosion phenomena identified in related incidents
- *corrosion prevention* requires the identification of the correct measures for a given material / environment / corrosion type
- *materials selection* is based on the careful examination of relevant criteria from a vast assortment of materials data

Hypermedia support

- swift and intuitive access to different information sources
- capability of displaying high resolution corrosion pictures
- capturing the relatedness between materials information
 - è greater interactivity in the retrieval of the appropriate data
 - è intelligent support for typical corrosion engineering tasks

The Active Library® on Corrosion

The goal of the system

System design objectives:

to build an easy to use CD-ROM based hypermedia system for providing access to corrosion prevention documents and materials engineering data, that can be used by both beginning and expert materials engineers

System information functionalities:

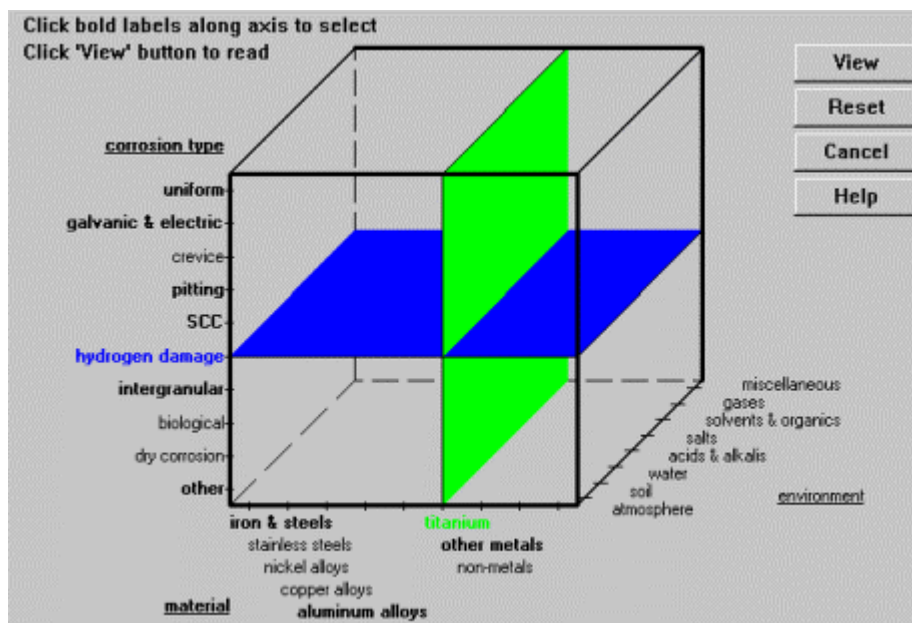
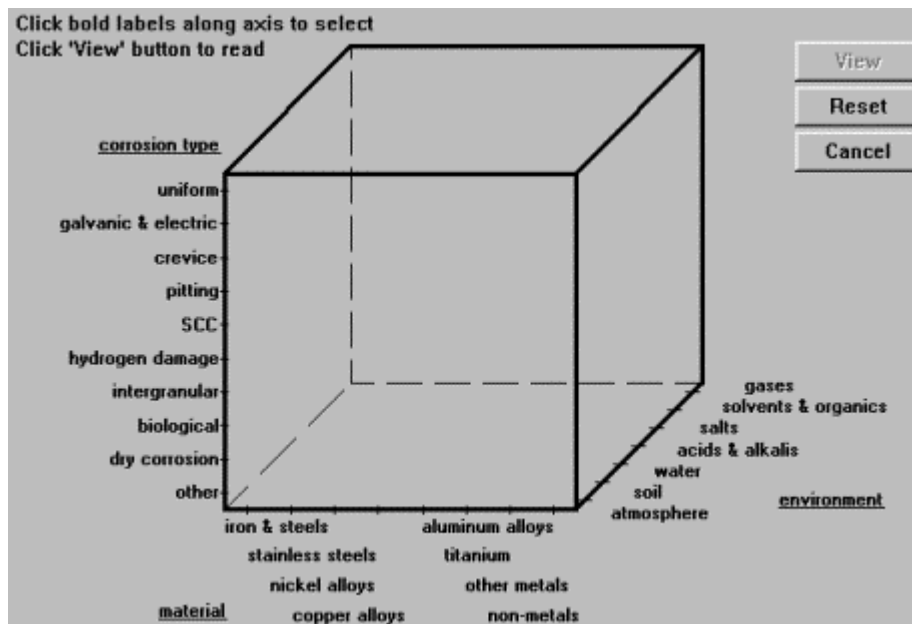
- 3-D Cube of Contents
- Corrosion Atlas
- NACE International books
- NACE International and Elsevier Science journals
- Databases (NACE International's COR.SUR ® and COR.SUR2 ® materials selection databases)



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Functionalities

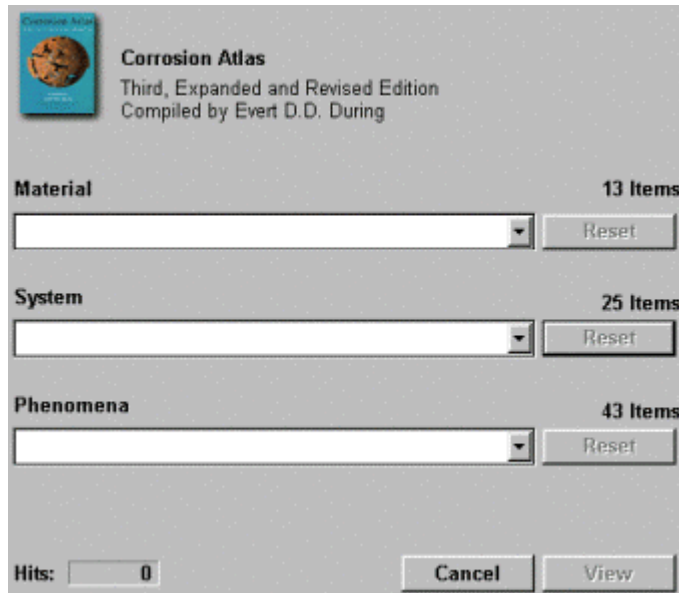
3-D Cube of Contents



The Active Library® on Corrosion

Functionalities

Corrosion Atlas



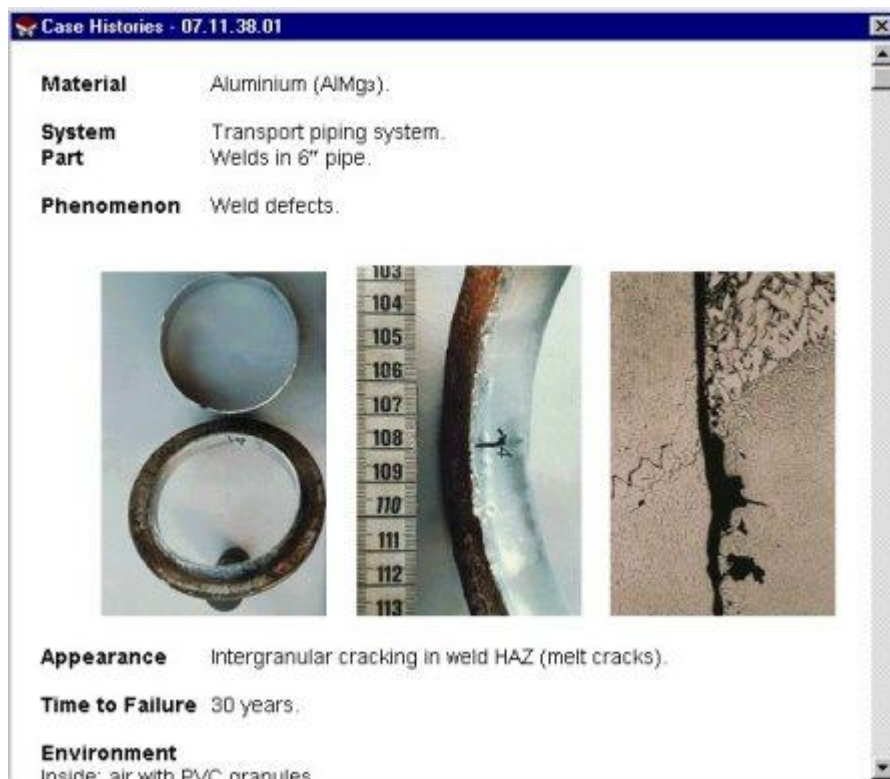
Corrosion Atlas
Third, Expanded and Revised Edition
Compiled by Evert D.D. During

Material 13 Items
[Dropdown] [Reset]

System 25 Items
[Dropdown] [Reset]


Phenomena 43 Items
[Dropdown] [Reset]

Hits: [Cancel] [View]



Case Histories - 07.11.38.01

Material Aluminium (AlMg3).
System Transport piping system.
Part Welds in 6'' pipe.
Phenomenon Weld defects.



Appearance Intergranular cracking in weld HAZ (melt cracks).
Time to Failure 30 years.
Environment Inside: air with PVC granules.

The Active Library® on Corrosion

Functionalities

COR.SUR ® database

Cor*Sur

Press 'Corrosive' and 'Metal' button to select

Press 'Return' to exit

Return

Lock

Corrosive

Metal

Units

*F *C

mpy mm/y

< 2

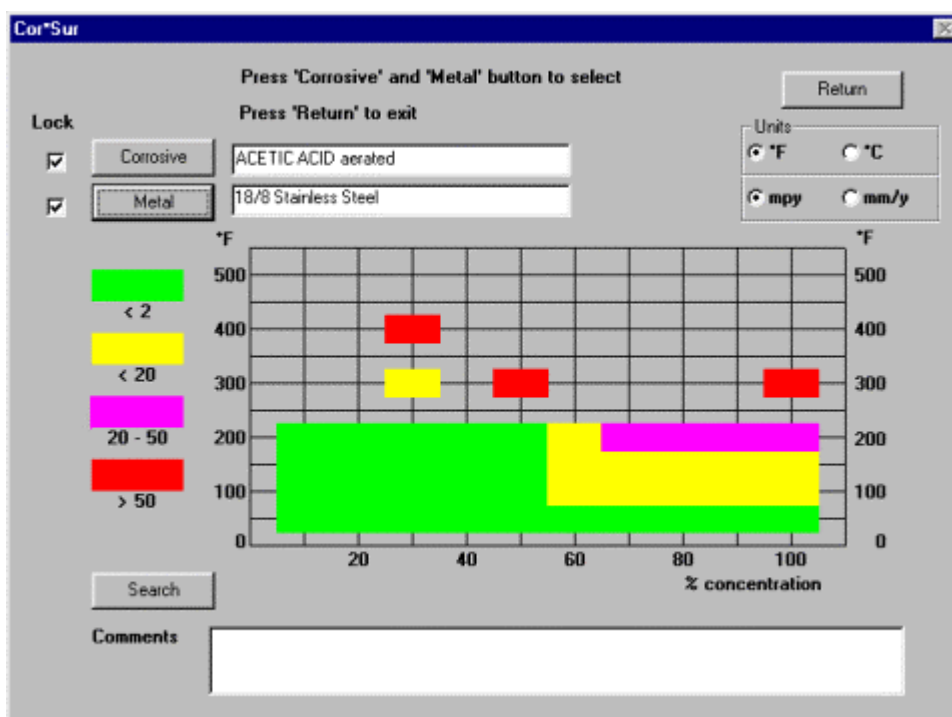
< 20

20 - 50

> 50

Search

Comments



The GRACE™ system

The goal of the system

System design objectives:

to build an on-line hypermedia system using the World-Wide Web for providing access to materials engineering data and support from intelligent corrosion assistants

System information functionalities:

- **Global** : available to anyone with Internet access
- **Reading** : storage and sharing of data and documents
- **Accessing**: smart retrieval of relevant data and documents
- **Corrosion** : corrosion and materials engineering information
- **Expertise** : virtual, on-line centre of corrosion competence

System modules under development:

- Reference Manual on Corrosion Engineering
- Failure Analysis Assistant acting as a “virtual expert”

The GRACE™ system

Reference Manual on Corrosion Engineering

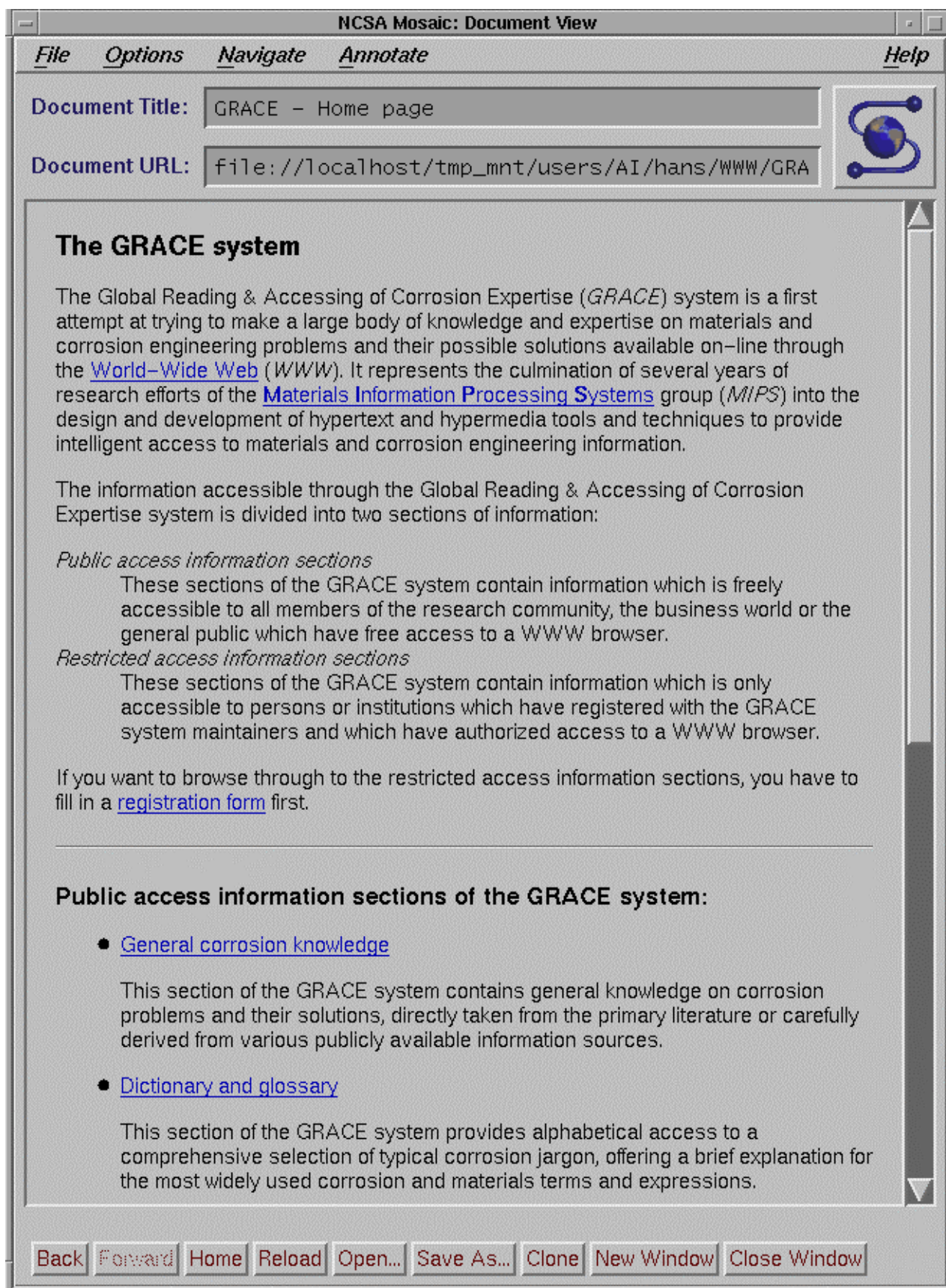
Goal:

- to extend the functionalities of the ALC
- to facilitate typical materials engineering tasks
- to experiment with knowledge-based hypermedia

Design:

- hypermedia documents generated “on the fly”
- using domain knowledge: corrosion and materials expertise
- responsive to reader (beginner, professional, expert) and task (recognition, diagnosis, treatment, prevention) profile

The GRACE™ system



The screenshot shows the NCSA Mosaic web browser window titled "NCSA Mosaic: Document View". The menu bar includes "File", "Options", "Navigate", "Annotate", and "Help". The "Document Title" field shows "GRACE - Home page" and the "Document URL" field shows "file:///localhost/tmp_mnt/users/AI/hans/WWW/GRA". A globe icon is visible in the top right corner. The main content area features the heading "The GRACE system" followed by a paragraph describing the system as a first attempt at making materials and corrosion engineering knowledge available online through the World-Wide Web. It mentions the Materials Information Processing Systems (MIPS) group. Below this, it states that the information is divided into two sections: "Public access information sections" and "Restricted access information sections". The public access sections include "General corrosion knowledge" and "Dictionary and glossary". At the bottom of the browser window, there is a toolbar with buttons for "Back", "Forward", "Home", "Reload", "Open...", "Save As...", "Clone", "New Window", and "Close Window".

The GRACE system

The Global Reading & Accessing of Corrosion Expertise (*GRACE*) system is a first attempt at trying to make a large body of knowledge and expertise on materials and corrosion engineering problems and their possible solutions available on-line through the [World-Wide Web](#) (*WWW*). It represents the culmination of several years of research efforts of the [Materials Information Processing Systems](#) group (*MIPS*) into the design and development of hypertext and hypermedia tools and techniques to provide intelligent access to materials and corrosion engineering information.

The information accessible through the Global Reading & Accessing of Corrosion Expertise system is divided into two sections of information:

Public access information sections

These sections of the GRACE system contain information which is freely accessible to all members of the research community, the business world or the general public which have free access to a WWW browser.

Restricted access information sections

These sections of the GRACE system contain information which is only accessible to persons or institutions which have registered with the GRACE system maintainers and which have authorized access to a WWW browser.

If you want to browse through to the restricted access information sections, you have to fill in a [registration form](#) first.

Public access information sections of the GRACE system:

- [General corrosion knowledge](#)

This section of the GRACE system contains general knowledge on corrosion problems and their solutions, directly taken from the primary literature or carefully derived from various publicly available information sources.

- [Dictionary and glossary](#)

This section of the GRACE system provides alphabetical access to a comprehensive selection of typical corrosion jargon, offering a brief explanation for the most widely used corrosion and materials terms and expressions.

The GRACE™ system

The screenshot shows the NCSA Mosaic web browser interface. The title bar reads "NCSA Mosaic: Document View". The menu bar includes "File", "Options", "Navigate", "Annotate", and "Help". The "Document Title" field shows "GRACE - Home page" and the "Document URL" field shows "file:///localhost/tmp_mnt/users/AI/hans/WWW/GRA". A small globe icon is visible in the top right corner of the browser window.

Public access information sections of the GRACE system:

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This section of the GRACE system contains general knowledge on corrosion problems and their solutions, directly taken from the primary literature or carefully derived from various publicly available information sources.
- [Dictionary and glossary](#)
This section of the GRACE system provides alphabetical access to a comprehensive selection of typical corrosion jargon, offering a brief explanation for the most widely used corrosion and materials terms and expressions.
- [Background information and help](#)
This section of the GRACE system contains background information on corrosion and materials engineering, and offers help on the use of the GRACE system and the different information sources contained in the GRACE system.

Restricted access information sections of the GRACE system:

- [Cube of Contents](#)
This section of the GRACE system provides a three-dimensional table of contents, where you can specify a combination of corrosion, material and environment to locate a specific document in the GRACE collection of documents.
- [Failure Analysis Assistant](#)
This section of the GRACE system provides access to a "virtual expert" which will assist you in the interactive analysis of the possible causes of a materials failure. The Assistant will systematically guide you through the analysis process.
- [Quick reference](#)
This section of the GRACE system contains an extensive set of valuable look-up tables with corrosion and materials background information, such as various conversion tables and detailed information on widely-used standards.

At the bottom of the browser window, there is a toolbar with buttons for "Back", "Forward", "Home", "Reload", "Open...", "Save As...", "Clone", "New Window", and "Close Window".

The GRACE™ system

NCSA Mosaic: Document View

File Options Navigate Annotate Help

Document Title: GRACE - Registration form

Document URL: file:///localhost/tmp_mnt/users/AI/hans/WWW/GRA

Registration form

The Global Reading & Accessing of Corrosion Expertise (*GRACE*) system is frequently updated and improved. If you want to be notified of all recent changes and want to enjoy continued access to the restricted access information sections of the GRACE system, please fill in the following registration form:

- Name:
- Position:
- Department:
- Organisation:
- Address:
- Post/zip code: Country:
- Telephone: Fax:
- E-mail:
- Type of access: Public access Restricted access
- How did you find out about the GRACE system? (check all that apply):
 - By browsing around on the WWW
 - By reading about the GRACE system
 - By hearing about the GRACE system

The GRACE™ system

NCSA Mosaic: Document View

File Options Navigate Annotate Help

Document Title: GRACE - Cube of Contents

Document URL: file:///localhost/tmp_mnt/users/AI/hans/WWW/GRA



Cube of Contents

The Cube of Contents of the Global Reading & Accessing of Corrosion Expertise (*GRACE*) system is an intelligent interface to all the information (data, tables, figures, etc.) available in the GRACE system. It allows you to have direct access to any document in the GRACE system for a given combination of phenomenon, material and environment.

From the available information in the GRACE system, a careful selection will be made of information that best satisfies your reader, task and document profile

PROFILE:

Type of **reader**: beginner professional expert

Type of **task**: recognition diagnosis treatment prevention

Type of **document**: data table figure background case study

REQUEST:

Type of **phenomenon**:

Type of **material**:

Type of **environment**:

The GRACE™ system

The screenshot shows the NCSA Mosaic web browser interface. The title bar reads "NCSA Mosaic: Document View". The menu bar includes "File", "Options", "Navigate", "Annotate", and "Help". The "Document Title" field contains "GRACE - Background document" and the "Document URL" field contains "file:///localhost/tmp_mnt/users/AI/hans/WWW/GRA". The main content area displays the following text:

Pitting Corrosion of Stainless Steel in Salt Water & Seawater

The behaviour of stainless steel in contact with salt water, and seawater in particular, is apt to be erratic, with corrosion often taking the form of pitting rather than general attack.

The chromium–nickel steels of the 18–8 type are the members of this class which have been most extensively used for piping materials, and their failures have been the most spectacular.

Influencing factors:

- When these alloys are fully submerged, they are not apt to corrode seriously, provided that the water is well aerated and is moving vigorously enough to keep the metal surface scrubbed clean. If the exposure is only partial, pitting may be encountered adjacent to the water line, and, when the exposure is intermittent, pitting is apt to occur at scattered points on the periodically exposed surface. If the surface is allowed to dry between periods of exposure, pitting is apt to develop beneath clumps of salt crystals which may appear after evaporation of the water.
- Accumulations of solid materials, organic or inorganic, which adhere to the metal surface may encourage pitting of the metal beneath such deposits. The presence of corrosion products or other solid material may cause the setting–up of oxygen concentration cells which enhance extremely rapid (pitting) corrosion and eventual perforation of the wall. In general, it should be permissible to use stainless steels with salt water under controlled conditions which do not involve any of the hazards mentioned above.

Examples:

- [Corrosion by Halides of Stainless Steel in Cooling Water Systems](#)

See also: [Pitting Corrosion of Stainless Steels in Water](#)

Navigation controls include a "BACK" button and a set of four arrow buttons with "2 of 3" in the middle. The bottom status bar contains buttons for "Back", "Forward", "Home", "Reload", "Open...", "Save As...", "Clone", "New Window", and "Close Window".

The GRACE™ system

Failure Analysis Assistant

Goal:

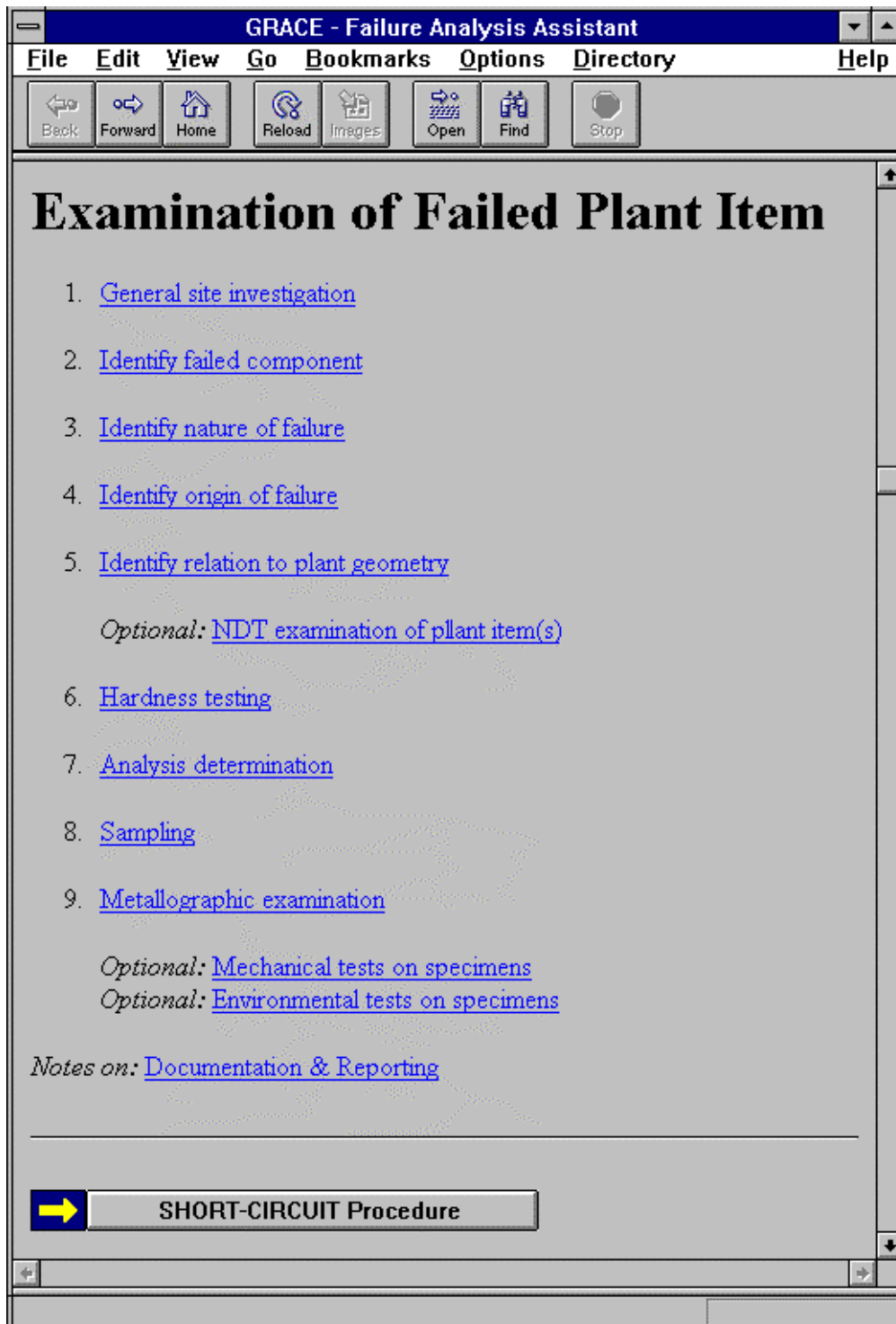
- ad-hoc availability of corrosion failure expertise
- valuable independent second opinion
- interactive “check-list”

Design:

- based on MTI “Atlas of Corrosion and Related Failures”
- analysis steps cross-linked to general corrosion information
- generic approach, extendible to other materials problems
e.g. paint failures

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Failure Analysis Assistant - Step 1



The GRACE™ system

Failure Analysis Assistant - Step 2

GRACE - Failure Analysis Assistant

File Edit View Go Bookmarks Options Directory Help


Back Forward Home Reload Images Open Find Stop


3. Identify Nature of Failure


FINDINGS:

Failure is

- restriction or blockage
- swelling or other form of distortion
- fracture or leak originating from wall thinning or other form of distortion
- leak ...
- fracture in a previously undistorted wall
- blind crack, pit or cavity, possibly detected by NDT
- no failure detected, but further investigation is instructed ...

 NEXT Procedural Step

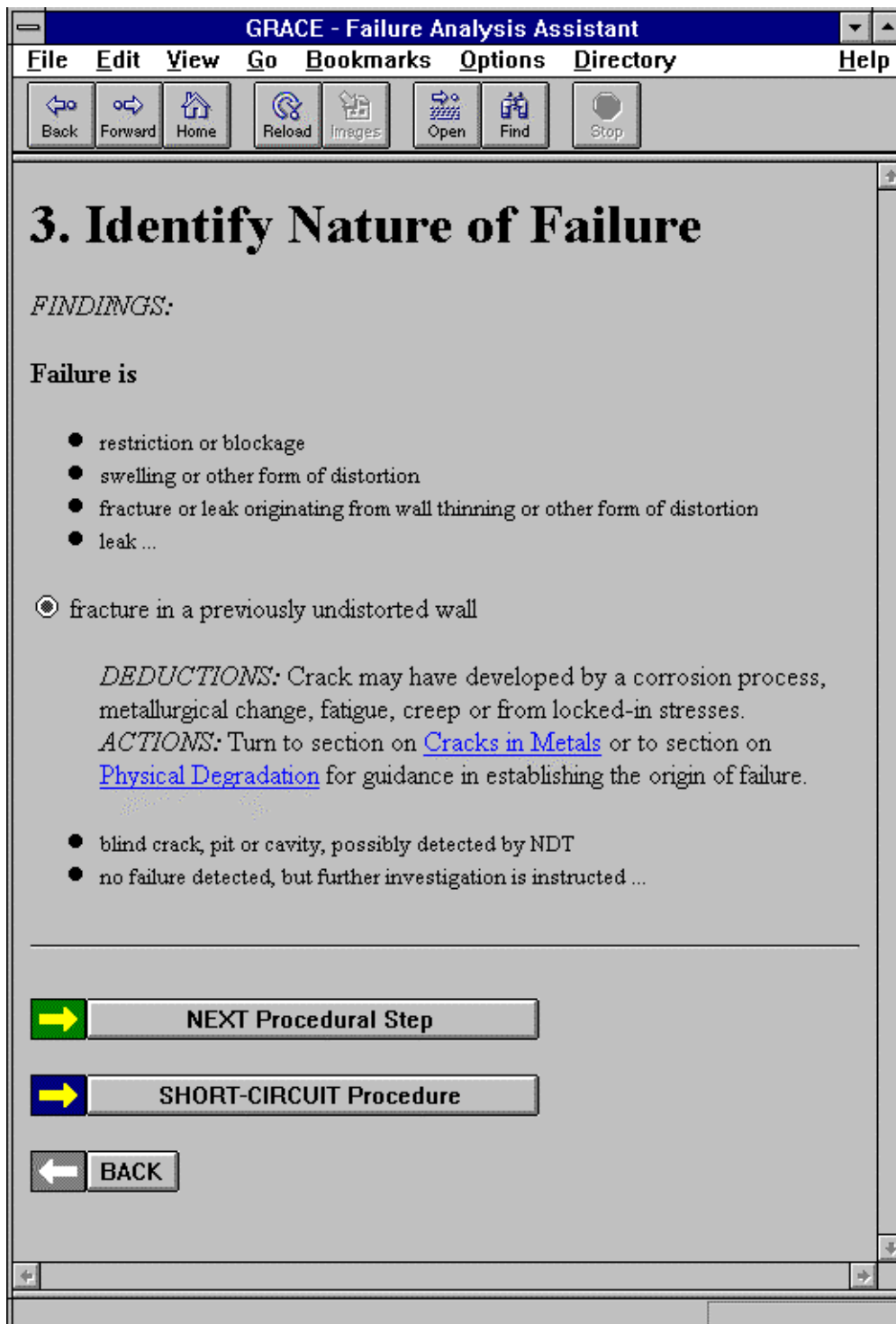
 SHORT-CIRCUIT Procedure

 BACK

Document: Done

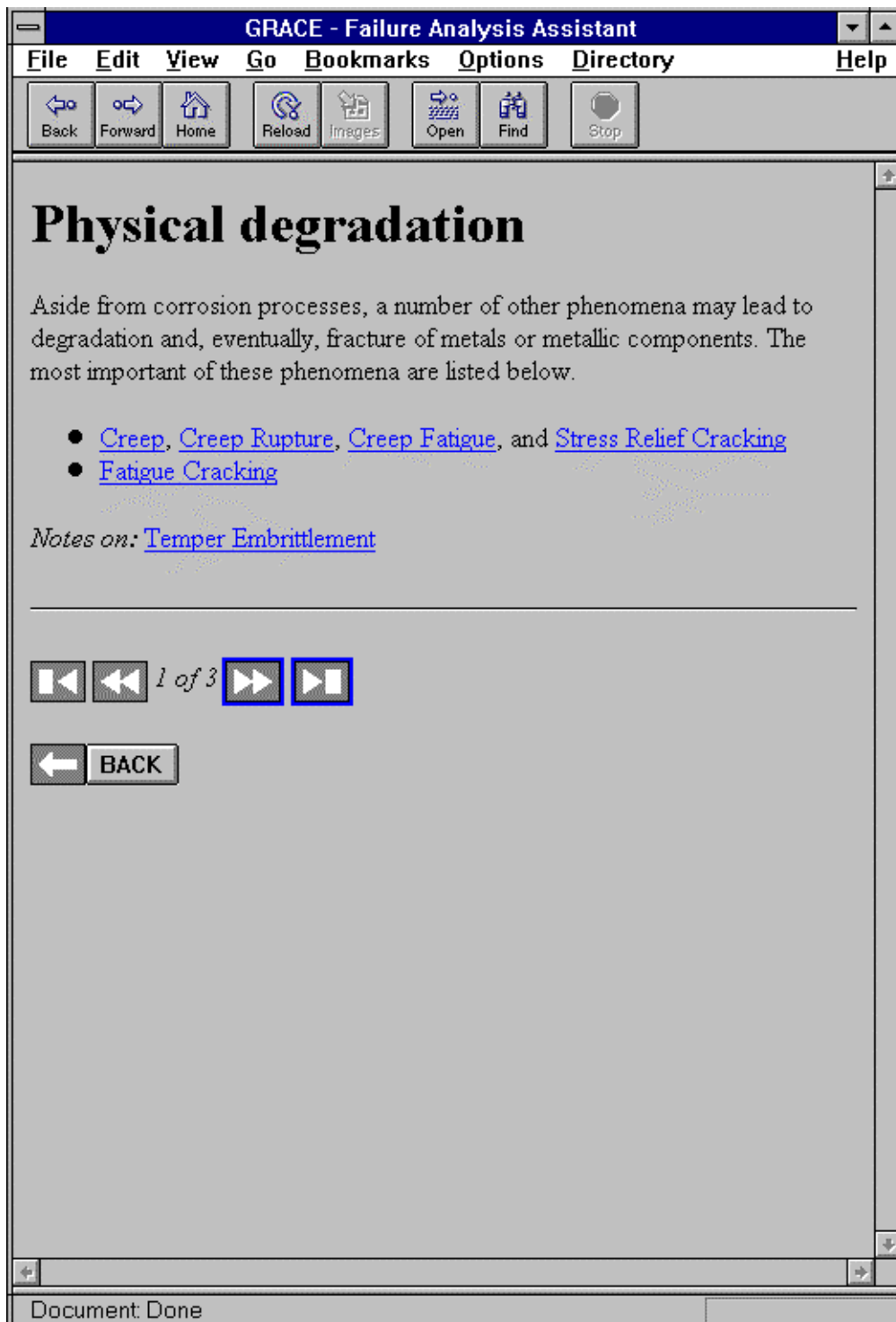
The GRACE™ system

Failure Analysis Assistant - Step 3



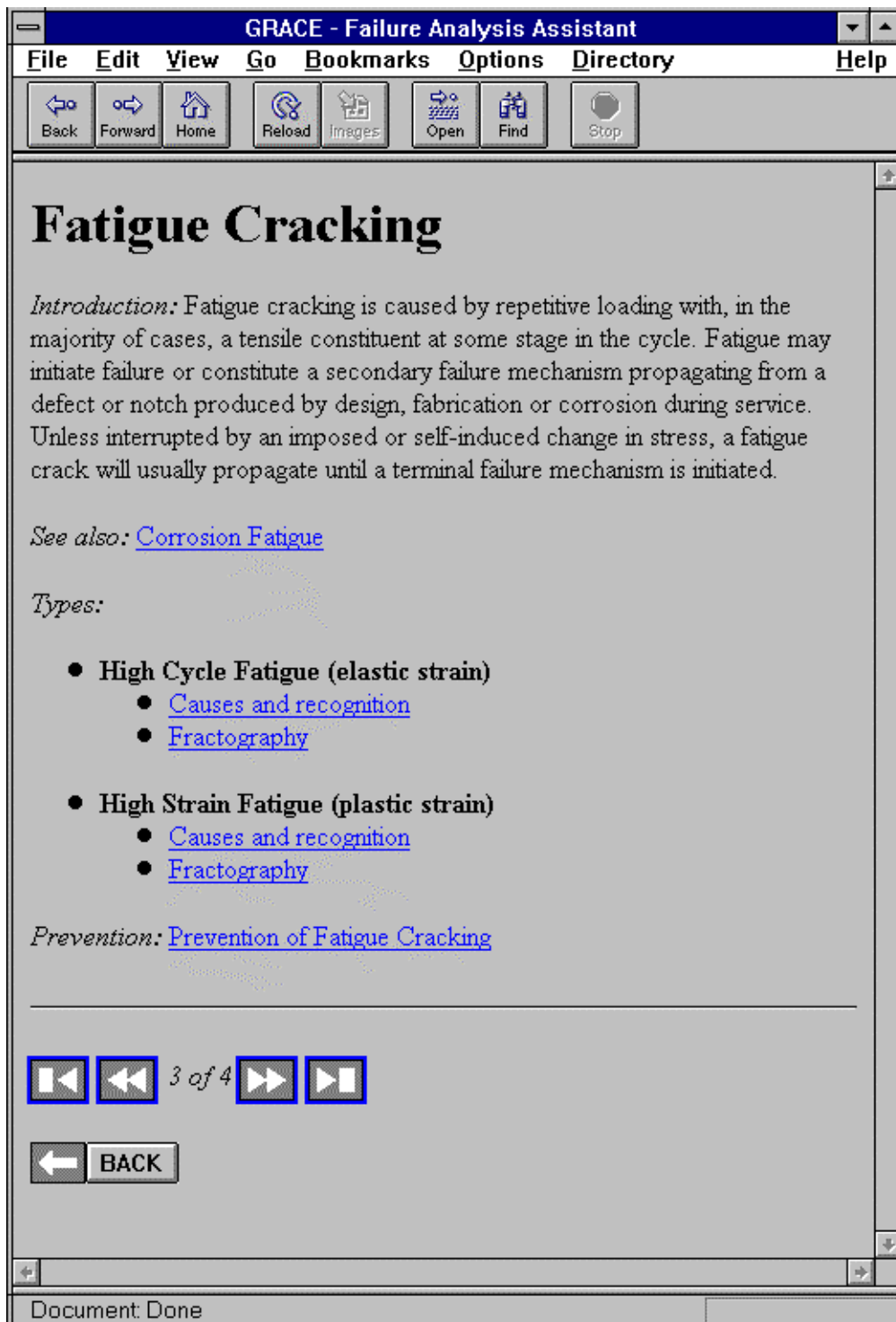
The GRACE™ system

Failure Analysis Assistant - Step 4



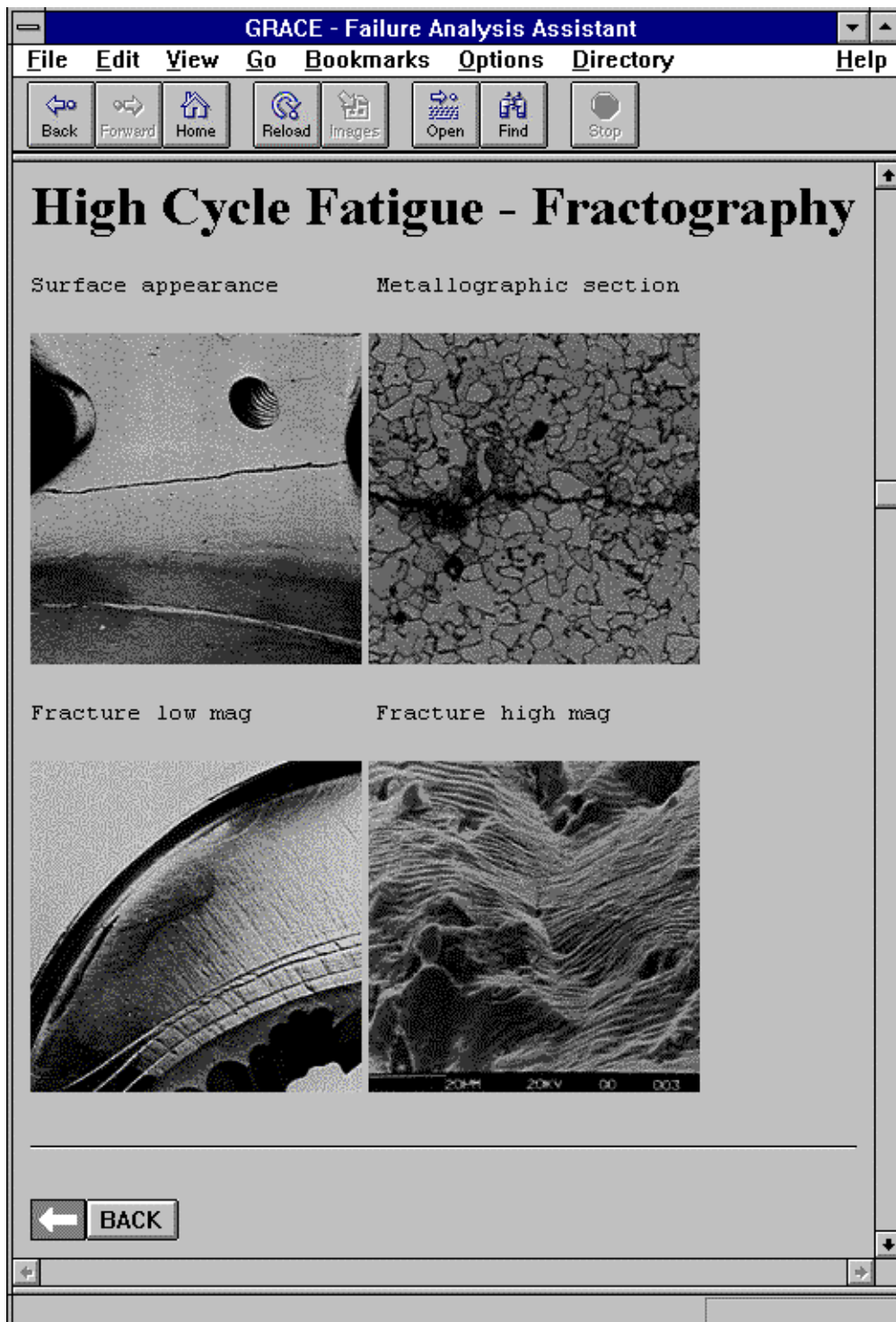
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Failure Analysis Assistant - Step 5



The GRACE™ system

Failure Analysis Assistant - Step 6



CONCLUSIONS

Using hypermedia for corrosion engineering

The Active Library[®] on Corrosion

- + proof of suitability of hypermedia for corrosion engineering
- lacking true intelligent support for navigation and retrieval

The GRACE[™] system

- + broadening access and extending functionality of the ALC
- gathering / validating of general and industry-specific data

Future developments:

- second edition of the Active Library[®] on Corrosion
 - ÿ new information: water treatment, oil and gas industry
 - ÿ new books & primary literature (e.g. “Corrosion Science”)
- public availability of the GRACE system
 - ÿ basic research into intelligent hypermedia navigation
 - ÿ first attempt to build a virtual community of corrosion experts

<http://www.mtm.kuleuven.ac.be/MIPS/GRACE/>