

Image Cover Sheet

CLASSIFICATION

SYSTEM NUMBER

511876

UNCLASSIFIED



TITLE

Unit Overview - A R&D Project to Improve the Way We Do NDT

System Number:

Patron Number:

Requester:

Notes: Paper #2 contained in Parent Sysnum #511874

DSIS Use only:

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UNIT Overview - A R&D project to improve the way we do NDT

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ABSTRACT

We will present the results of an on-going research program to create an augmented reality for nondestructive evaluations where a CAD representation of the part or structure under inspection is augmented with a real-time display of the robot and display of the inspection results from a viewpoint and at a scale selected by the inspector. This graphic display aims at providing a unique workplace metaphor for the inspector more suited to the inspection environment than the desktop metaphor prevalent in most interfaces.

The project applies the tools of data representation and robot control in conjunction with application specific tools for ultrasonic and eddy-current inspection and data processing. Intelligent systems technologies is applied in the areas of automation of probe manipulation for data acquisition and the data processing, interpretation and display.

The robot vehicle will attach to surfaces in any orientation on both magnetic and non-magnetic materials with self-locomotion independent of attachment tooling and articulation assemblies. It is designed to be applicable to a wide range of well-defined requirements within the scope of motion confined to a surface with 3D topology.

UNIT

Universal Nondestructive Inspection Tool

Michel Brassard

Project Aim

- Increased Inspection Reliability
- Increased Inspection Productivity

How can we do this?

- Increased Inspection Reliability

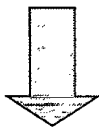


Reduce the dependence on the operator for subjective decisions

Providing the data in a form that makes the interpretation easier

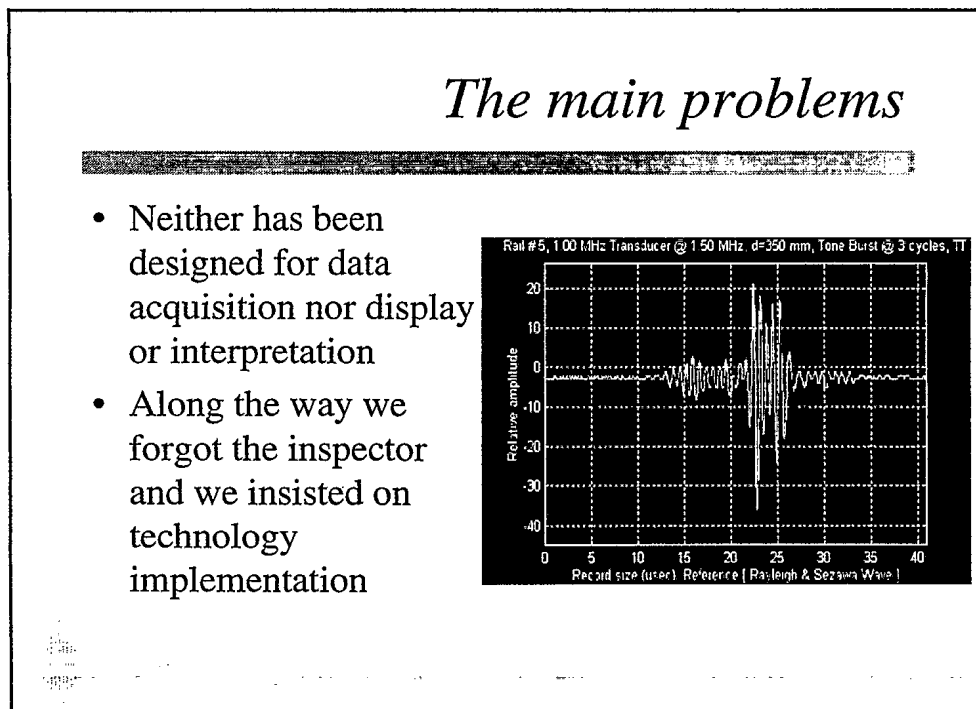
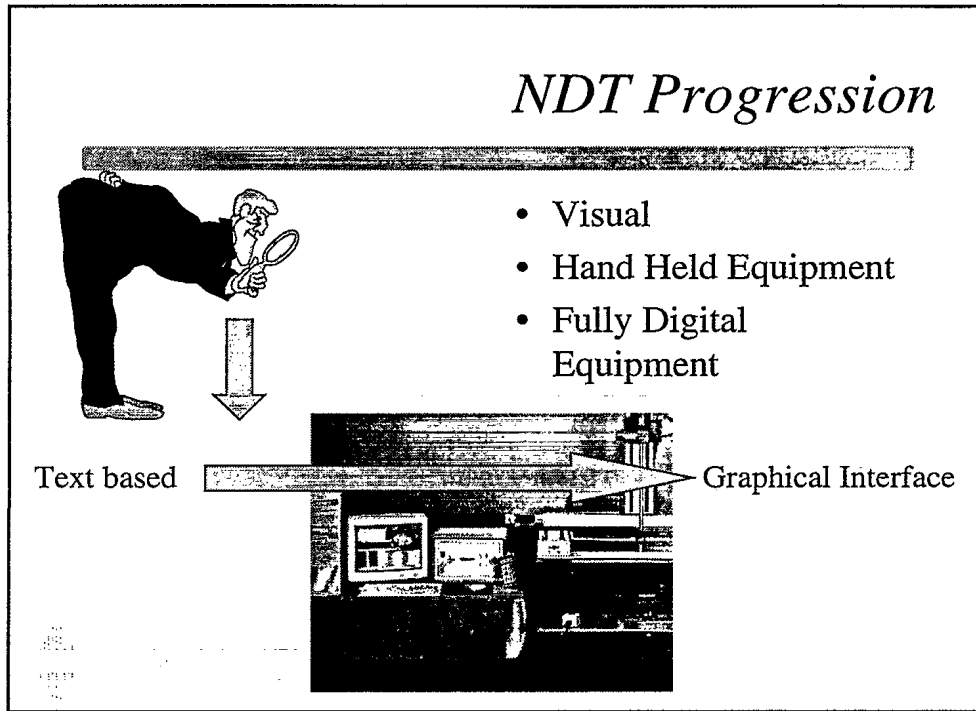
How can we do this?

- Increased Inspection Productivity



Increase speed of inspection

Speed of set-up, avoid need for re-inspection, easier reporting



Performance Targets

- Develop an immersive virtual/augmented reality man-machine visualization interface for the inspection workplace
- Develop the support technologies required to implement this IVIE (Integrated Virtual Inspection Environment) interface
- Integrate this workplace interface with automated data acquisition tools into a Universal Nondestructive Inspection Tool (UNIT)

Work Modules

- User Centered Specification
- Interface
- Workplace CAD Models
- Data Management
- Flaw Modeling
- Manipulators
- Embedded Electronics
- End Application Integration
- Positioning

User Center Specifications

- User Interview
 - Issues of concern
 - Issues relate to the task analysis, the user as well as organizational and environmental profiles.
- Application centered specifications

Some of the items discussed

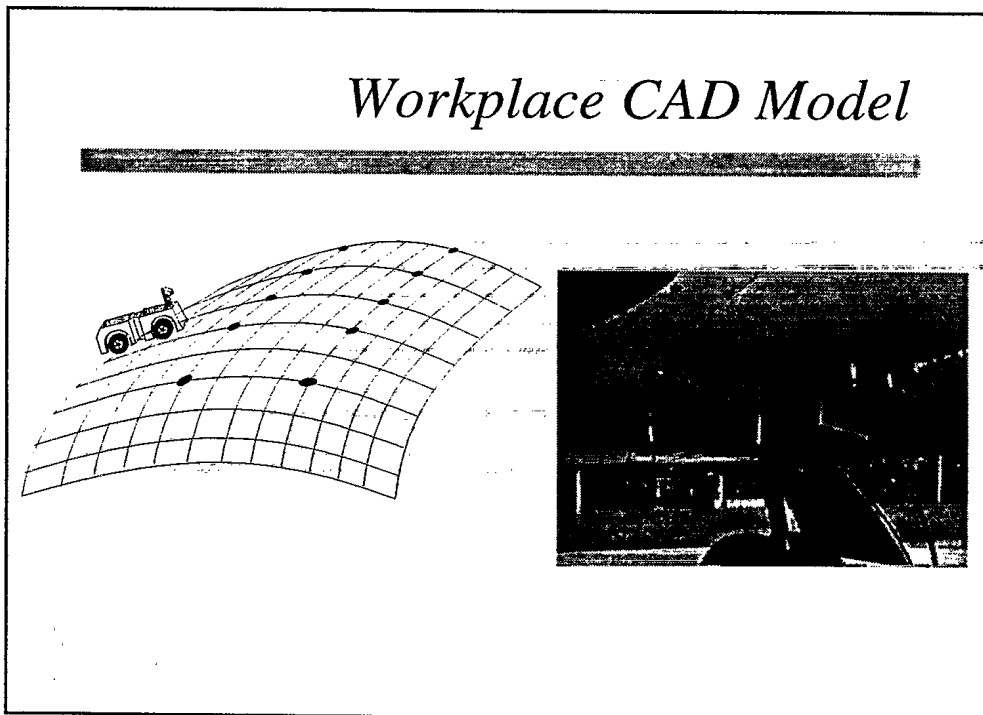
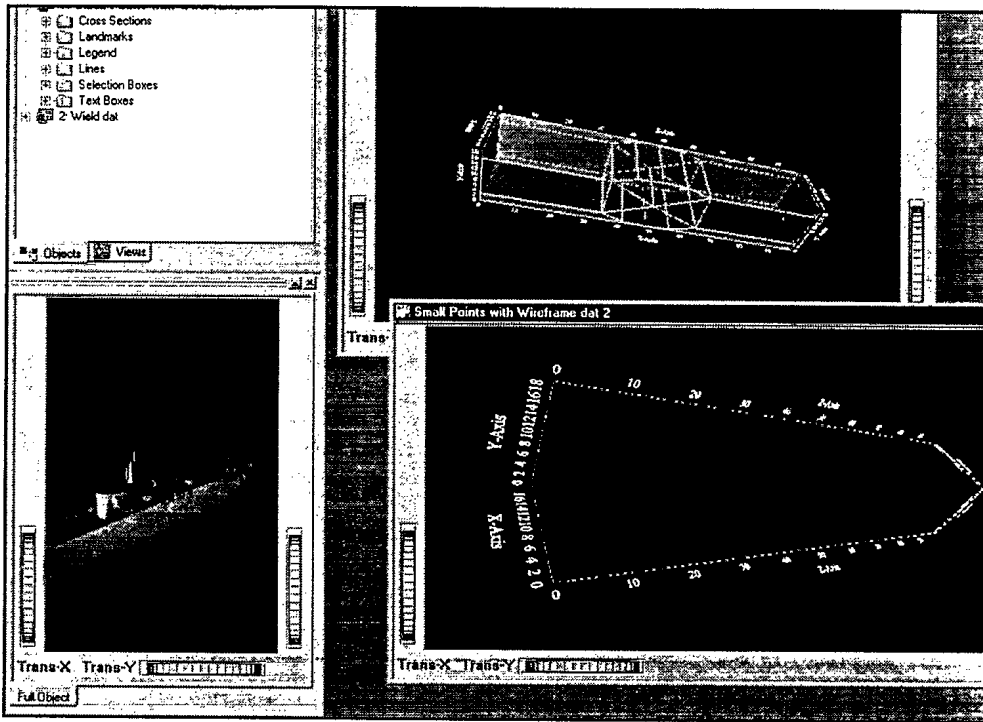
Who does what ?

Procedures, norms and guidelines.

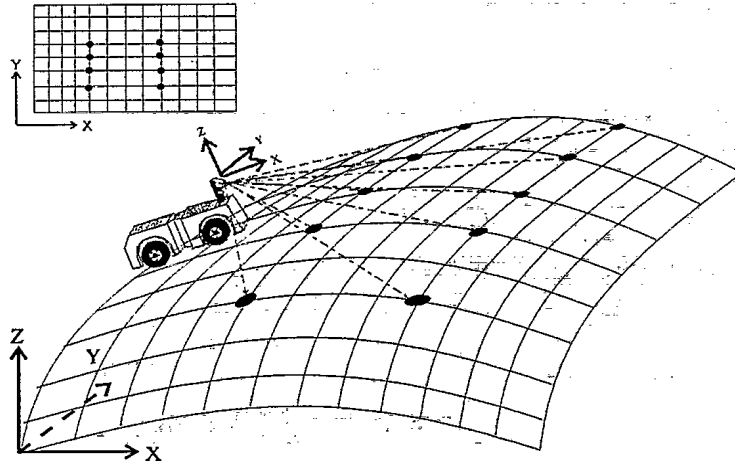
What are the performance requirements?

Expert/novice differences.

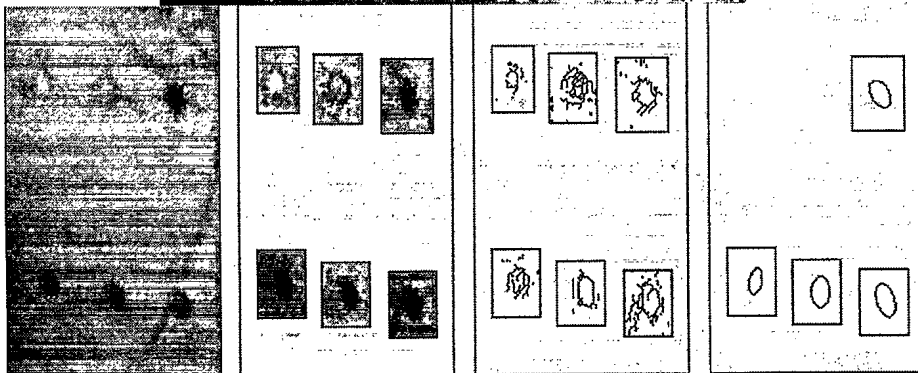
What functions must be supported by the interface?



3D Localization



CAD Image Input



Data Management

- Data acquisition module
 - Based on a client-server architecture
- Formatting and storage module
 - Data compression and optimization
 - Formats definition and compatibility
 - Database management
- Data access module
 - Data retrieving protocols

Flaw Modeling

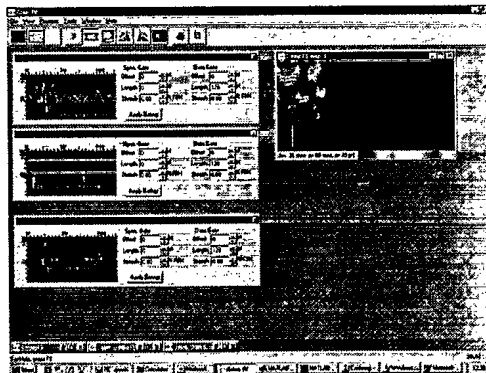
- Post-processing survey and tests
 - Signal filtering
 - Flaw detection & sizing
 - Flaw reconstruction
 - Feature extraction, flaw characterization
 - Volumetric flaw modeling
- Detailed specifications
- Implementation of final algorithms

Signal distortion causes

- Attenuation
- Phase velocity dispersion
- Coherent noise (« Speckle »)
- Diffraction
- Non-linear propagation
- Pulse duration
- Barkhausen effect
- Static Energy Noise

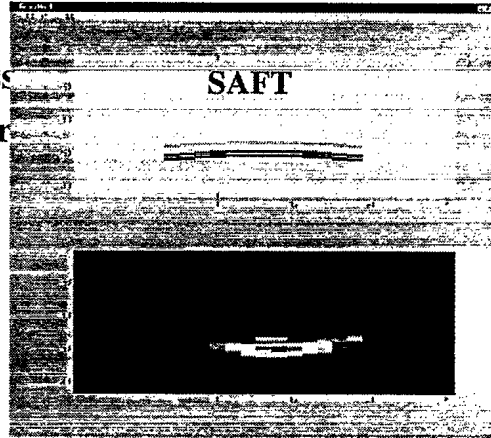
1D Filtering

- Deconvolution techniques
- Wiener Filtering and Spectral Extrapolation
- L1-Deconvolution
- Envelope Estimation
- Parameter Estimation Technique



2D Filtering and Signal Enhancement

- Wavelet Analysis
- Split Spectrum Process
- Median, low-pass filter
- Inverse and noise reduction filtering (Wiener)
- Histogram transformations
- Adaptive filtering, pattern matching



Conclusion

- Developing an inspection metaphor
- Adaptive tools
- All of this is useless unless it makes your job easier. Usability is the key.
- We must therefore improve the relationship between the inspector and the machine.

Conclusion

The research work involves a number of new technologies and others will be added

Computers of the future will also be much more aware of users' needs

"Tagging" technologies are being discussed in the PC world where the computer remembers who you are and what you do and like