The Advantages of DR Amorphous Silicon Flat Panel Systems in comparison to Film for NDT

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Parameters for Evaluation

1. Storage Space or Footprint
2. Portability & Transportation
3. Ecological Friendliness
4. Image Quality
5. Savings in Time
6. Savings in Costs
7. Adaptability for Field Use
8. Documentation and Data Base Management
9. Data Transfer and Sharing
10. Ease of Use/User Interpretation

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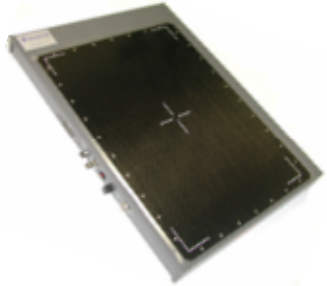
What is DR – Amorphous Silicon Flat Panel Systems?

- Advanced Imaging Technology that is Mature & Market Sellable
- Digital Imager which is Thin & Flat
- High Quality Images – Excellent Dynamic Range and Resolution
- Digital Image Received Immediately to a PC or Laptop Computer



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Flat Panel המבנה הפנימי של

X-Ray

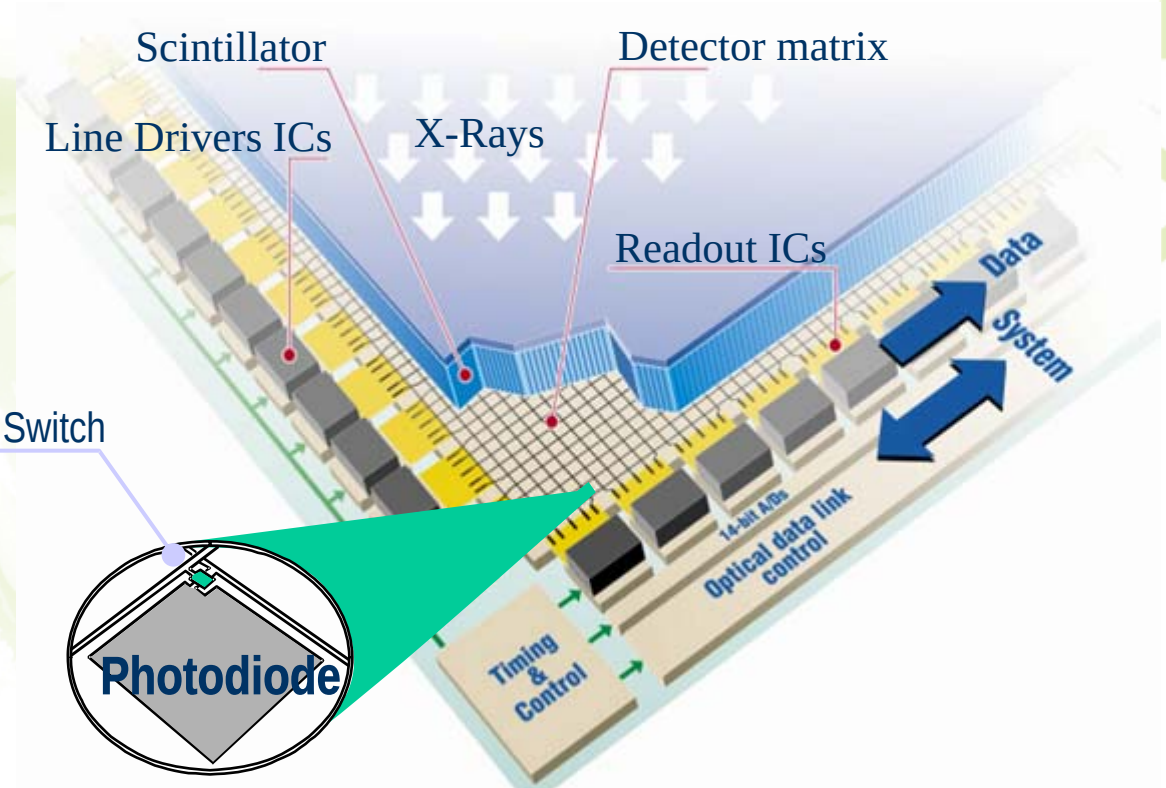
Scintillator

Matrix of Pixels

Electronic Modules

Electronic board

System Interface



Thales Electron Devises

1. Dramatic Savings in “Footprint” or Space

- DR Images are saved as electronic files and are easily stored on HDD’s, CD’s or DVD’s
- No Need for special or controlled storage conditions as with film
- Dramatic Space Reduction both in pre and post imaging materials
- No “shelf life” problems for extended storage – as with film life both prior and post imaging

2. Portability and Easiness of Transportation

US Air Force & Air Expeditionary Force Battlelab Study on Portable DR had very clear findings – Portable DR could provide:

97% Reduction in Equipment Footprint

Traditional Film Based Equipment

Portable DR System on Pallet

3. Disposal and Processing of Hazardous Materials

DR is Environmentally Friendly:

- No Storage and Handling of Chemicals
- No Need for Disposal of Waste Materials
- No Purchase of Associated Supplies & Maintenance Costs

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4. Image Quality
5. Savings in Time
6. Cost Savings

These parameters were evaluated in two separate independent studies:

1) US Air Force Battle Laboratory Digital X-ray Initiative (Short 5 minute video)

2) Selected Slides from Boeing Commercial Aircraft Presentation: Reliability & Cost Study of Digital Radiography, Film and Radioscopy

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USAF Expeditionary Battlelab Movie

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Reliability and Cost Study of Digital Radiography, Film and Radioscopy

ASNT Digital Imaging Topical VI

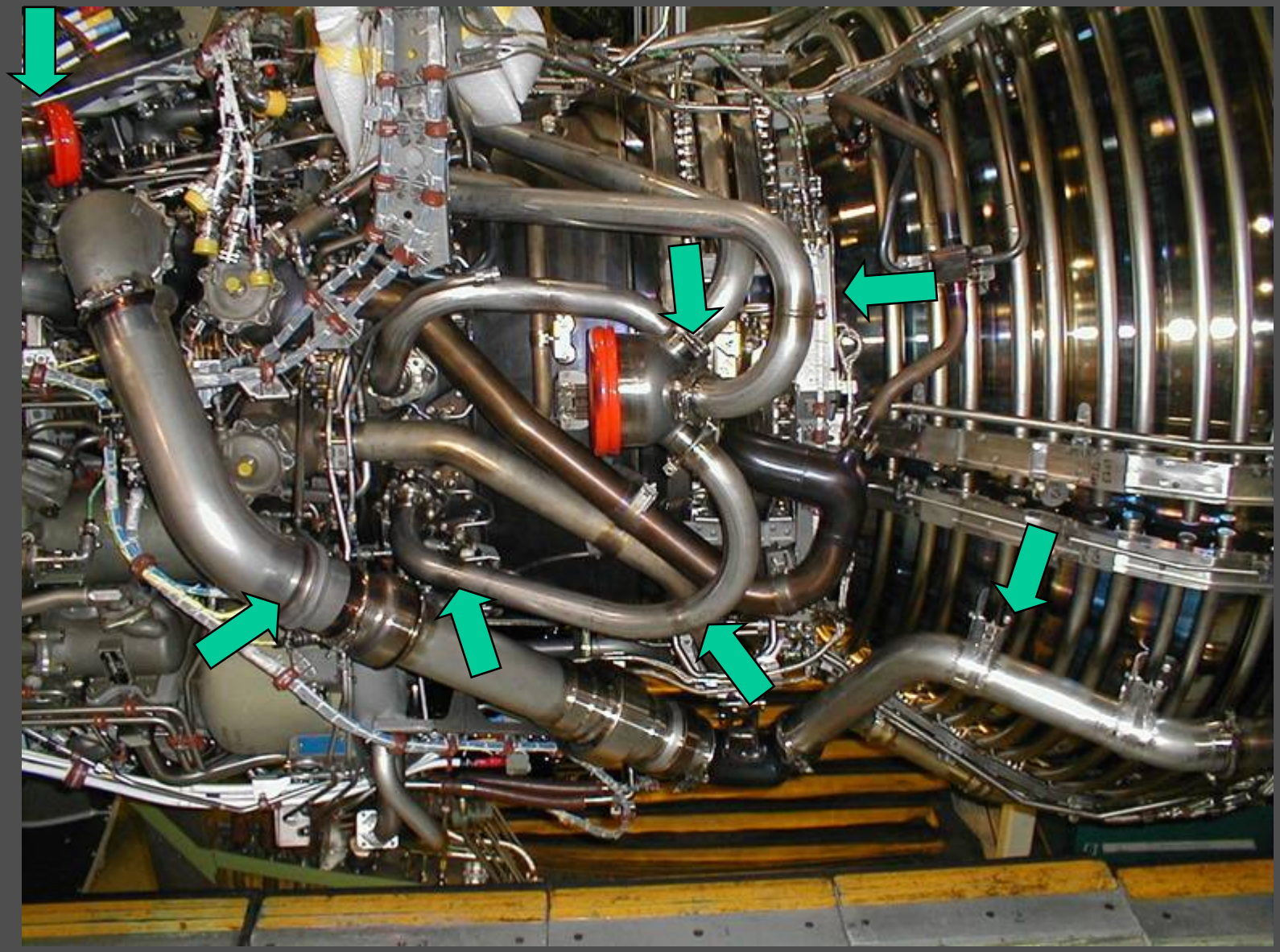
July 28, 2003

Bill Meade, Clay Kidwell, Greg Warren

Boeing Commercial Aircraft

Product

Inconel Ducting: Class A welds (100% inspection required)
Controlling Specification BAC5975

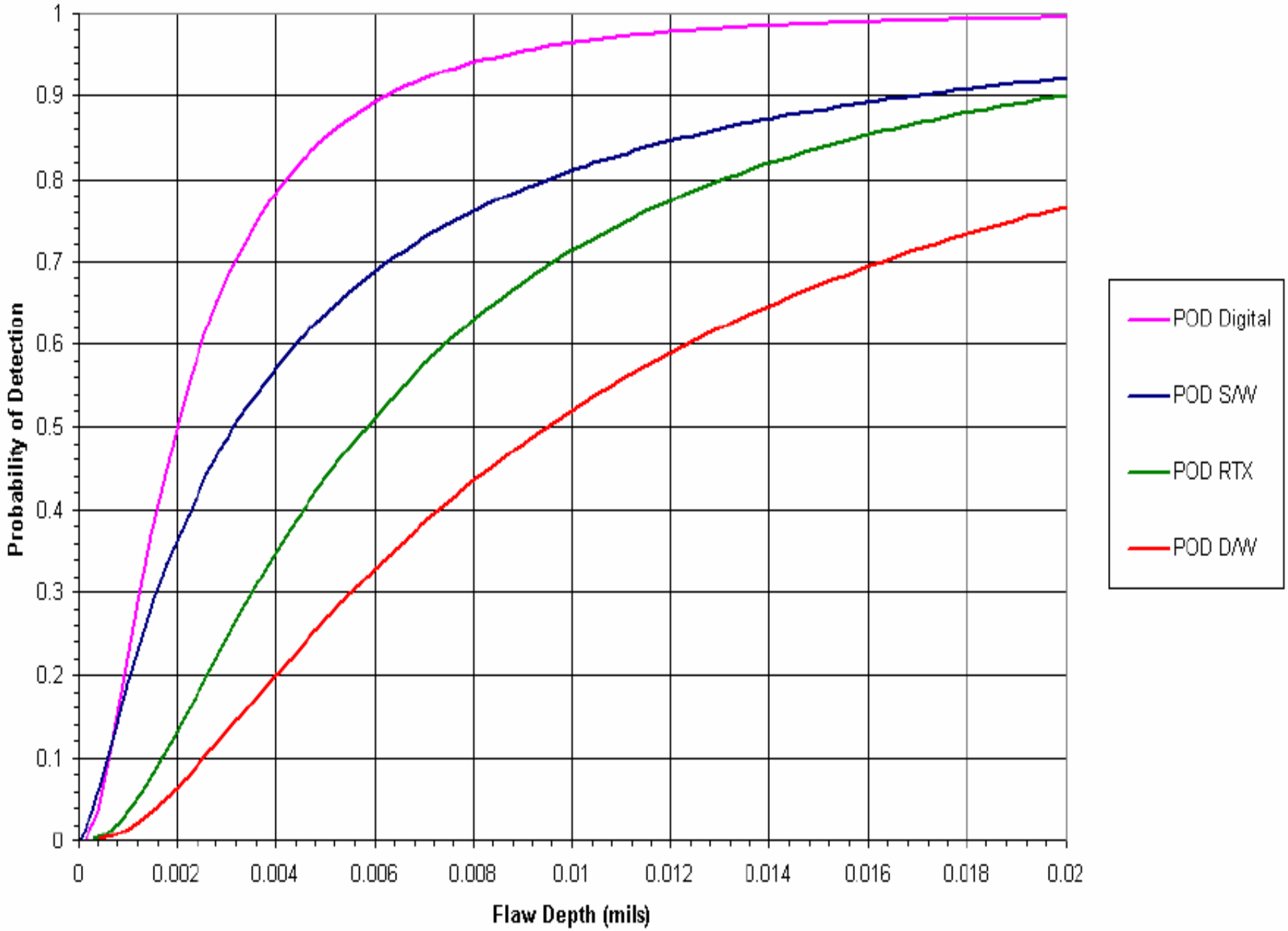


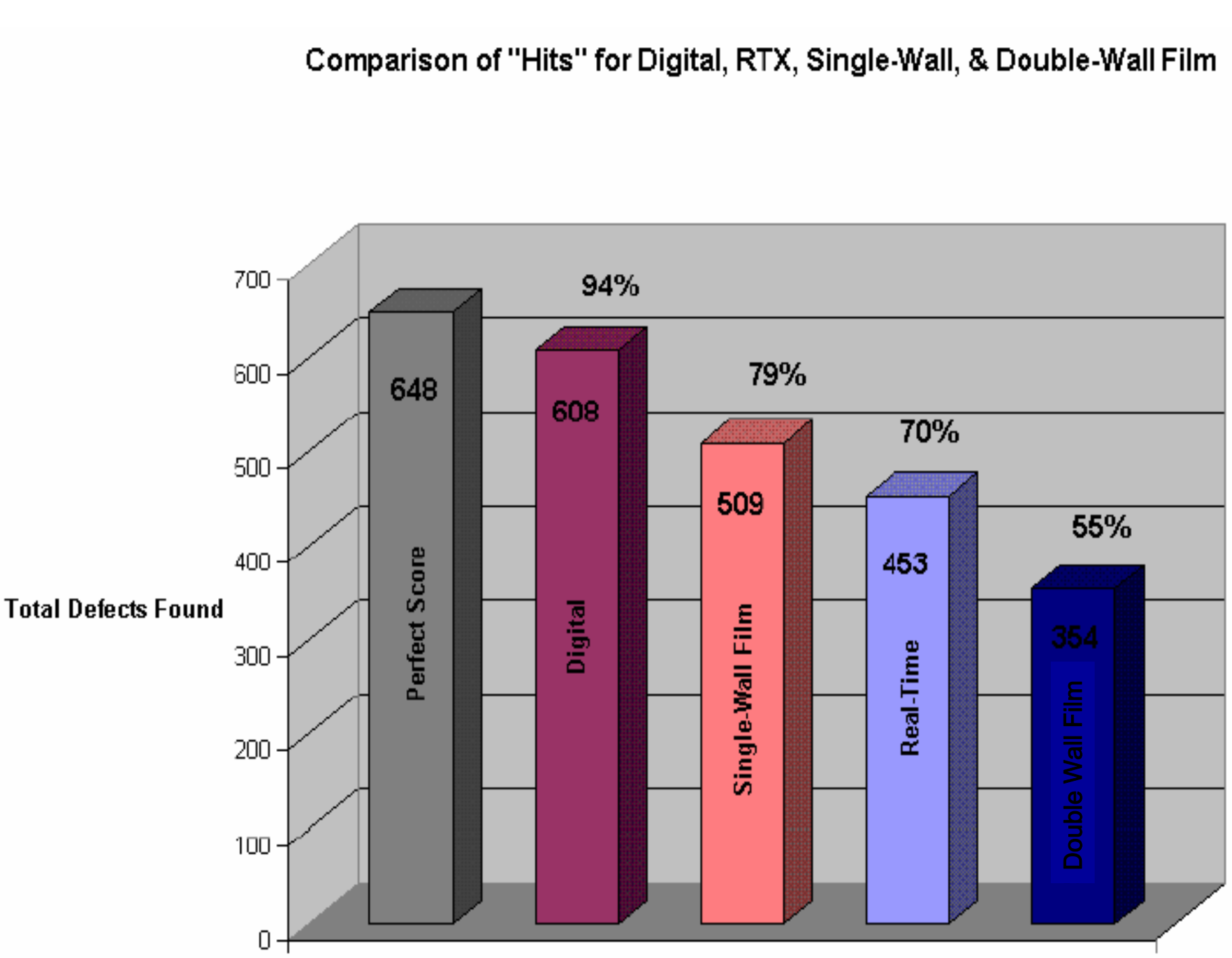
POD Study - Experiment Design

Objective: Compare inspection reliability of film, real time and digital radiography

- Make experiment statistically robust
- Use actual production techniques & practices for existing methods
- Use certified Level II inspectors

POD Study Results:


Probability of Detection
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
0.002
0.004
0.006
0.008
0.01
0.012
0.014
0.016
0.018
0.02
Flaw Depth (mils)
POD Digital
POD S/W
POD RTX
POD D/W


Comparison of "Hits" for Digital, RTX, Single-Wall, & Double-Wall Film
Total Defects Found
700
600
500
400
300
200
100
0
648
Perfect Score
94%
608
Digital
79%
509
Single-Wall Film
70%
453
Real-Time
55%
354
Double Wall Film

Predicted Savings Using Digital Radiography w/Robotic Manipulator

Example 312U2331-37 (6” diameter Inconel -10 Welds)

- Current film process:
  - 2-3 hours
- Current radioscopy inspection:
  - 35-40 minutes
- Digital w/robotic part manipulation (est.*)
  - 12 minutes 10 seconds

7. Excellent Results in the Lab, however is DR Suitable for Field Work?

Previous Limitations of Lab DR Systems:

1) A Desktop PC was required working on AC and using a special Frame Grabber for the Panel
2) A thick Data Cable linking between the computer and the imager with a maximum length of only 9m
3) A large and heavy power supply connected to an AC outlet with a maximum connecting cable to the panel of only 1.5m
4) Cumbersome System Set-up and Operation

Truly Portable a-Si Flat Panel X-ray Inspection Systems

*f*oX-Rayzor System (2003)

Flat *f*oX-17 System (2001)

- **Battery Operated**
- **50m Lightweight Cable** (or wireless system)
- **Laptop Operated**

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Vidisco Portable Flat Panel Systems

- Excellent Dynamic Range and Resolution – 14 Bit Systems (16,384 grey levels) with up to 4 lp/mm
- Choice of Imagers – Flat *fo*X-17 Large Format 12”x16” (same imager that was used in the Boeing Evaluation) or Super Thin (13mm) and light *fo*X-Rayzor 8.5” x 9” Imaging Area
- Fast Set Up and Immediate Imaging with the entire system housed in one suitcase
- One 50m cable on Removable Reel with optional 50m extension or Wireless Operation
- 800% Non-Digitizing Zoom, One Touch ROI Window Leveling, Built-In Data Base in the Field

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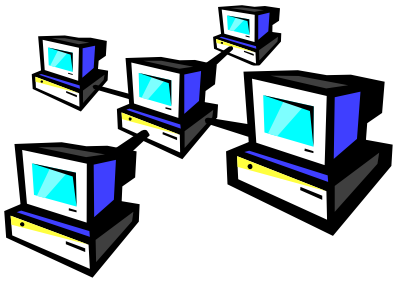
8. Documentation and Info. Management

The X-ray image is saved as a “RECORD” Encompassing all the attached documentation (most of which is automatic): User Name, Date, Time, Place, Type of X-ray source used, KV, Exposure time, Description, etc.

9. Data Transfer and Sharing

The image is saved in the System Database which can be queried and sorted for fast image retrieval (seconds) using any of the parameters. As the images are digital files, they are easily stored & transferred to colleagues on CD or DVD media, or even through the internet.



10. Ease of Use/User Interpretation

The Vidisco systems come with a wide range of image enhancement tools built-in to the program, meaning no outside modules are required.

Fast Set Up, Fast Imaging, Image Quality & Versatility Rivaling Film

Flat *f*ox-17 Imager used on F-15

Tripod Mounted
Flat *f*ox-17 Imager

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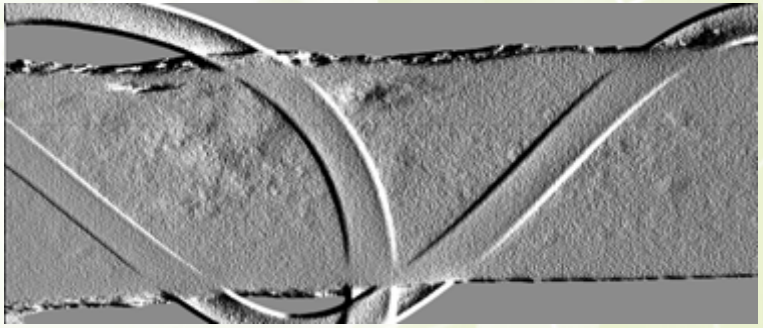
Petrochemical Applications

Corrosion Damage



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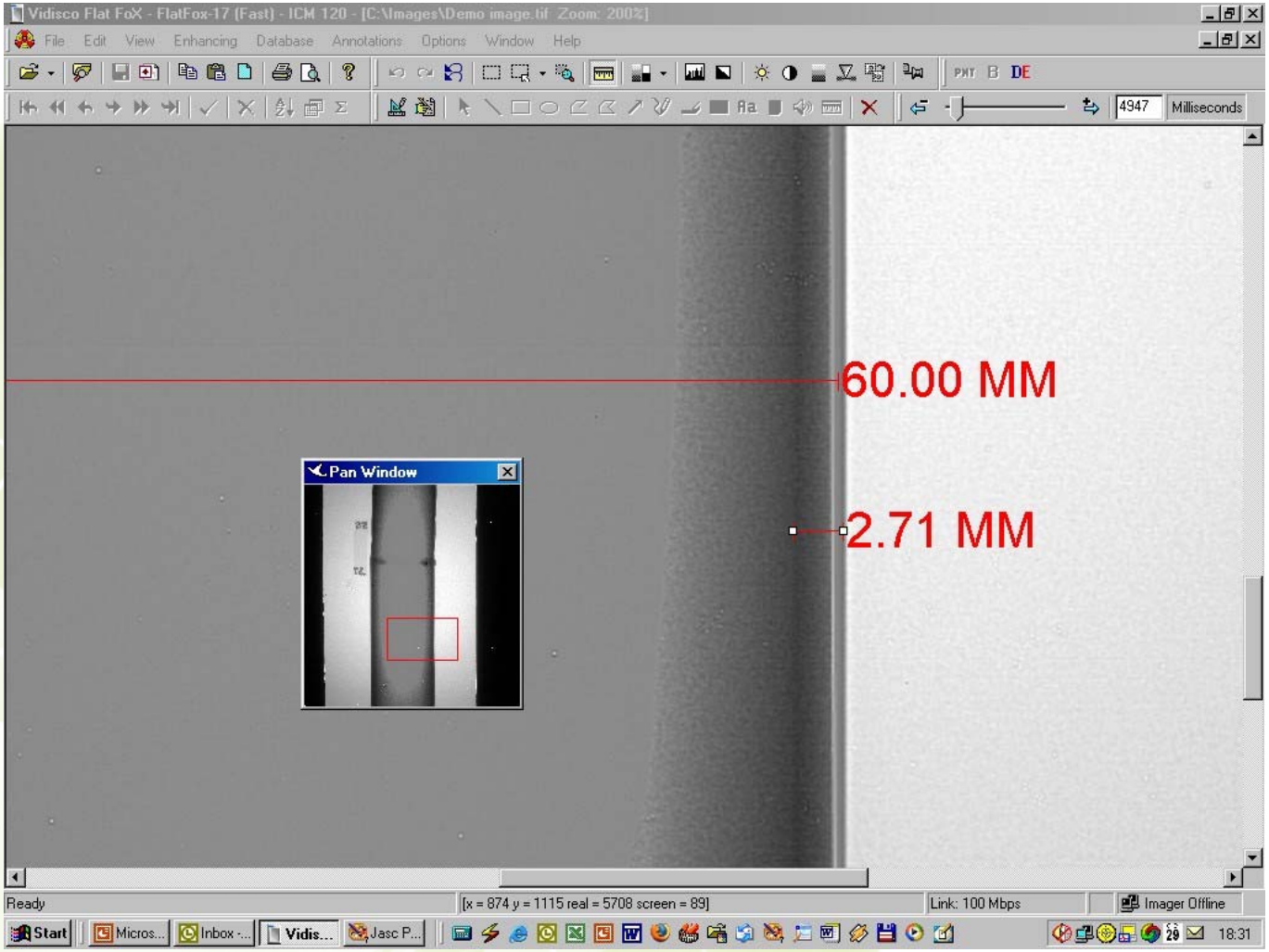
Petrochemical Applications

Wall Thickness Measurement



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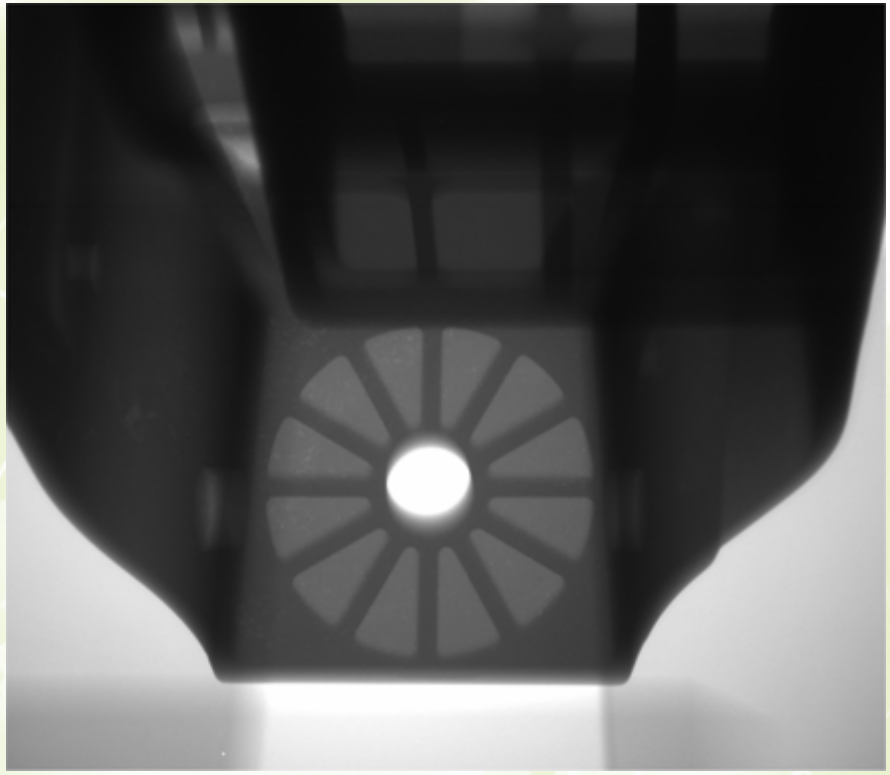
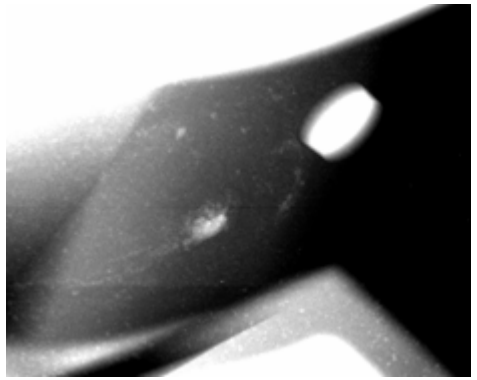
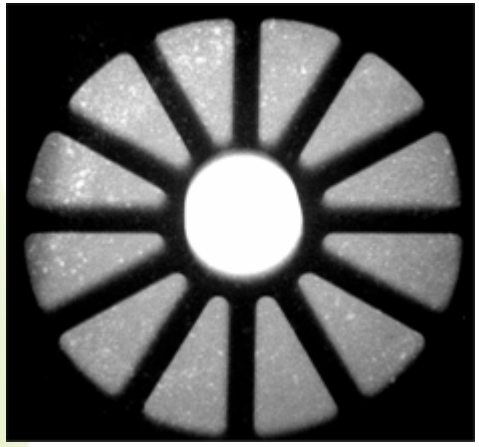
Casting & Forging Applications

Aluminum Casting Defects







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First Ever Battery Operated Portable Dual Energy X-ray Inspection System

- Automatic Software Designates Organic (Drugs and Explosives) & Inorganic Objects
- Dual Energy Split Screen Image Viewing
- One Approach
- No Mechanical Filtering

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Summary of Pros vs. Cons for Portable a-Si Flat Panel Technology

Advantages of this Technology:

1. Storage Space or Footprint
2. Portability & Transportation – Smaller & Lighter
3. Ecological Friendliness – No Chemicals
4. Image Quality – equal to or better than film
5. Savings in Time – No need for developing time
6. Savings in Costs – After initial purchase, “cost free imaging”
7. Vidisco Systems Adapted for Field Use
8. Documentation and Data Base Management – in the field!
9. Data Transfer and Information Sharing
10. Ease of Use/User Interpretation – wide range of tools in the field

Disadvantages:

1. Non Flexible Imager
2. Periodic Calibration Required

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Thank You

(2005)

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