系統識別號:C09006248

行政院所屬各機關因工出國人員出國報告書
(出國類別：會議及研習)

「地下管線腐蝕防制及洩漏偵測研討」

服務機關：中油公司煉製研究所
出國人職稱：技術服務組工程師
姓　　名：翁文宏

出國地點：美國
出國日期：90/10/7~90/10/20
報告日期：90/11/6

系統識別號:C09006248

公 務 出 國 報 告 提 要

頁數: 44 含附件: 是

報告名稱:
地下管線腐蝕防制及洩漏偵測研討
主辦機關:
中國石油股份有限公司
聯絡人／電話:
戴曉璐／87258420
出國人員:
翁文宏 中國石油股份有限公司 煉製研究所 機械工程師
出國類別: 研究
出國地區: 美國
出國期間: 民國 90 年 10 月 07 日 -民國 90 年 10 月 20 日
報告日期: 民國 90 年 11 月 16 日
分類號/目: I0／綜合（科學類） I0／綜合（科學類）
關鍵詞: 腐蝕, 硫化氫,材料,檢測,NDT
內容摘要: 此次奉派赴美參加「地下管線腐蝕防制及洩漏偵測研討」主要參加 PVRC（Pressure Vessel Research Council）在德州休士頓(Houston) 舉辦之硫化氫環境下之設備完整性研討會(即 Managing Integrity of Equipment In Wet H2S Service),會中來自多國石化業界(包括 Chevron、Exxon Mobil、Shell、Shell Canada BP Amoco..）及檢測服務公司之檢測及材料專家共同參與相關問題之討論及經驗交換，會後甚感收穫不少，對於相關材料問題處置及檢測技術之應用觀念上也獲得許多澄清及經驗交流。另外於會後順道轉往 Columbus 市(Ohio)參加 ASNT(美國非破壞檢測協會) Fall Conference，除聽取論文發表外、參觀會場各類 NDT 檢測儀器之展示，並收集當前檢測技術之發展資訊，以掌握可應用於石化業領域之檢測技術。回程加州洛山磯(LAX)時並參訪 Spectrum 及 INOVX 公司時，了解新型簡便之 TOFD 儀器及雷射掃描 3D 影像應用於石化業設備管理上之技術發展,明瞭儀器發展及可利用之檢測及設備管理工具，對於未來技術引進應用之評估有不少之助益。

本文電子檔已上傳至出國報告資訊網

摘　要

此次奉派赴美參加「地下管線腐蝕防制及洩漏偵測研討」主要參加PVRC（Pressure Vessel Research Council）在德州休士頓(Houston)舉辦之硫化氫環境下之設備完整性研討會(即Managing Integrity of Equipment In Wet H_2S Service)，會中來自多國石化業界（包括Chevron、Exxon Mobil、Shell、Shell Canada BP Amoco..）及檢測服務公司之檢測及材料專家共同參與相關問題之討論及經驗交換，會後甚感收穫不少，對於相關材料問題處置及檢測技術之應用觀念上也獲得許多澄清及經驗交流。另外於會後順道轉往Columbus 市(Ohio)參加ASNT(美國非破壞檢測協會) Fall Conference，除聽取論文發表外、參觀會場各類NDT檢測儀器之展示，並收集當前檢測技術之發展資訊，以掌握可應用於石化業領域之檢測技術。回程加州洛山磯(LAX)時並參訪Spectrum 及 INOVX 公司時，了解新型簡便之TOFD儀器及雷射掃描3D影像應用於石化業設備管理上之技術發展，明瞭儀器發展及可利用之檢測及設備管理工具，對於未來技術引進應用之評估有不少之助益。

關鍵詞：腐蝕、 硫化氫、材料、檢測、NDT

地下管線腐蝕防制及洩漏偵測研討出國報告

目次

一、 前言

硫化氫環境下設備材料之劣化問題及處置對策適當否？一直是本公司煉製設備常會面臨之問題，對於因 H_2S 環境引起的材料裂紋該如何處置？又有何 NDT 技術能有效檢測之？各廠之處理經驗也不盡相同。而美國 Pressure Vessel Research Council（簡稱 PVRC）於 2001 年 10 月 10~12 日，於德州休士頓舉行有關硫化氫環境下設備完整性之研討會(workshop)，會中將研討相關之課題，與公司煉製設備常面臨之處理問題有甚多關聯，因此職等奉派前往參加研習，以期吸收國外相關經驗，有助於未來現場設備材料破損問題處理；會後並順道參加 ASNT Fall Conference 檢測技術研討，以掌握檢測業界研究趨勢及應用儀器之最新發展，並收集相關檢測技術資訊，回程並順道參訪參訪 Spectrum Eng. 檢測公司及 INOVX 公司，了解目前業界使用之簡便之 TOFD 儀器之發展及雷射掃描 3D 影像應用，希望對於新檢測技術之選用及引進有所助益。

二、 行程及工作摘要

時 間	行 程	地 點
10/7	啟程飛往美國 Houston	Houston, TX
10/8~12	參加 PVRC's Workshop 研習有關 Managing Integrity of Equipment in Wet H_2S Service	Houston, TX
10/13~14	與 Equilon Enterprises 公司 David Wang 博士討論檢測技術之發展	Houston, TX
10/15~16	參加 ASNT 檢測技術研討並收集相關檢測技術資訊	Columbus, Ohio
10/17	由 Columbus, Ohio 搭機轉至 Los Angeles,CA.	Los Angeles

		, CA
10/18~20	參訪 Spectrum Eng.檢測廠商並與拜訪 Mobil 公司黃福祥先生討論並交換材料破損經驗	Los Angeles , CA
10/21~22	搭機返台	Los Angeles , CA
		Taipei

三、參加 PVRC「硫化氫環境下之設備完整性研討會」

本次之 workshop 在德州 Houston 舉行，會場飯店如圖（一）所示，主要針對石化業界最常面臨之硫化氫環境下之材料裂化機構與處置及檢測方法進行研討，研討會為期三天，每天皆有專人分項負責報告主講，主講人皆是學有專精，且在業界有豐富工作經驗者，討論之 Topic 包含下列主題：

a. An Owner-user Experience with Wet Hydrogen Sulfide Cracking.

b. Industry Positions on Metallurgical Factor and Specifying Materials.

c. Effects of Environments on wet H2S Cracking.

d. Ultrasonic Inspection of Sulfide Stress Cracking for Equipment in Wet H2S Service.

e. HIC Assessment with AE and AUT

f. AUT HIC Examinations

g. Non-Intrusive vs. Internal Inspection.

h. NDE Input to FFS Decision Making.

i. Where and Why Crack Propagate.

j. Treating Wet H2S Damage Using API 579

k. Test Method for Material Ranking.

l. Repair & Remediation.

m. Application of Hydrogen Flux Monitoring to Assess Equipment Operating in Wet H2S Service.

n. How has Industry Dealt with Wet H2S Cracking ：Focus on Inspection

o. API Risk Based Inspection Program

p. Experience in Applying Expert Systems Case Study on wet H2S Crack

q. Wet H2S Cracking：Critical Issues Needing Resolution

參加之人員有來自 Shell、Shell Canada、Exxon Mobil、BP Armco、Chevron 等國際大油公司人員，檢測服務公司，亞洲國家公司參加者則有 C.P.C、High Pressure Institute of Japan、Phillips Petroleum、等，詳細名單如附件說明，討論會除專人報告外，另有時段開放互相交換經驗，增長見聞。

會後整理整個研討有幾項重點：

1. Wet H2S 環境下材料之破壞機構說明，即包括 Blistering、HIC、SOHIC、SSC 等，一般依嚴重性分為五級。
2. Blistering、HIC 雖常面臨到，但依經驗尚未有造成大災害者，該小心的應是 SOHIC 及 SSC，其容易發生在焊道附近。

3. 依經驗 1985 年前舊鋼材發生有 HIC 時一般會伴隨有 SOHIC 及 SSC Crack；但之後生產的鋼材則不盡然。

4. 在檢查前之表面處理程序一般建議： white metal grit blasting, UHPWB, and baking soda / calcium carbonate slurry blasting

5. 內部檢查HIC、SOHIC及SSC常用之工具是: WFMT (AC Yoke), flapper wheel grinding, field metallographic replication(金相複製), and ACFM.

6. 外部檢查常用之方法為：External ultrasonic testing (S/B, S/W, AUT)

7.裂紋之修補，有人則建議將裂紋鏟掉，但不用焊補，但不管有無焊補，之後的 PWHT 程序非常重要，且不可省，若裂紋嚴重時再作 FFS 適用性評估。

8. 預防 WHSC 產生，可選用 HIC resistant steels，依經驗效果不錯，若有較多量之氫環境則建議用不銹鋼 Cladding。

9. 目前性評估 WHSC 裂紋之 FFS 可採用 API579 做依據，依收集之資料顯示，市面上也有些商業化之軟體可購得，請參考附件。

綜合檢查之方法如表（一）所示。

在德州休士頓期間，也利用空檔時間拜訪 Equilon (Shell)公司的 David Wang 博士，並參觀其 NDT 實驗室，並討論石化業相關檢測技術及目前 API 在推廣的石化界 NDT 檢測人員檢定之事宜。

四、參加 ASNT Fall Conference

今年之 ASNT Fall Conference 於 Ohio State 的可倫波市舉行，見圖（二）~圖（六）所示，除了有技術論文發表外，尚有儀器展覽，儀器展覽除靜態說明外，並有某時段進行現場實作展示(Test Show)，另外會場邊另有 ASNT 協會展示之技術文獻、書籍，很值得參觀。此次儀器參展廠家逾百家，不過參訪者比較上少了一點，推測應該多少與美國 911 恐怖事件有關，一般民眾若絕非必要，這段時間皆減少出門，因此與會者就少了些，不過展覽內容還是有可看性。例如 Russell 及 Testex 公司皆有展示新型鍋爐管檢測儀器，前者是利用 Remote Field ET 原理，可從內外管兩邊皆可檢查；而後者採用低頻 ET 原理 ，可直接量測鍋爐管壁之變化，是不錯的工具。另外現場也有多家展示 PMI 所需之合金辨識儀，如本組早期購買之 TN Tech. 公司之合金辨識儀，也有新型號之產品展出，在資料處理上更數位化及方便。另外也有多家展示紅外線測溫儀，其它另有傳統 U.T 測厚、探觸儀。比較先進之儀器有更新型方便的 ACFM 儀器，比本組早期購買之舊機型更輕巧，軟體功能也更強。另外一家韓國公司(註: 技術與美國西南研究所合作)也展示 pipe Guided Wave 儀器，依型錄說明其利用 wave mode 已將 Torsion mode 納入。比較新奇的是現場也有展示利用 U.T 技術外加影像處理，可以很容易掃描混泥土內鋼筋影像的儀器組合。其它收集的廠商儀器料請參考附件資料。

在技術論文方面，職等主要選擇與石化業界相關之檢測論文聽取，發現 EMAT 技術應用及研究似乎是蠻熱門，單單有關 EMAT 之技術就有專門的 session，由於其探頭不需有耦合劑，因此就有一篇

論文比較其與傳統U.T測厚之準確性及穩定度，其結論是可相媲比，因其檢測時間的縮短，不失為可引進之新測厚技術。另外在Pipe與 supporter 間之Corrosion檢測上也有兩篇發表，本公司曾有因氫氣管線在其supporter處腐蝕造成破管氣之工安事件，此項技術也是值得引進，相信對本公司之管線檢測上應有所幫助。另外在鍋爐管檢測方面也有利用EMAT原理檢測之應用論文發表。

五、參訪 Spectrum Eng. 及 INOVX 公司

回程加州洛山磯(LAX)有機會參訪Spectrum Eng.公司，負責人為華裔Danny Wang, 其人積極進取，專長為fitness for Service, 因其多年石化界NDT檢測經驗，改良傳統TODF儀器之不便, 開發輕便易操作的機型，(請參考附件內資料)，價格也頗具競爭性，經現場demo，確實有其輕便性，單人操作即可，且影像處理之功能也不差，若要添購引進此類儀器是值得參考的選擇。除此之外經詢問討論，該公司也有能力組合EMAT儀器應用，因此未來若有意引進此技術，就多了一家參考的廠商。

此外另經介紹安排參訪了INOVX公司，此為一家以軟體技術為主幹的服務公司，其技術主要利用3D laser掃描 配合軟體技術，可將工廠設備之實際配置圖轉換成3D影像，並有zoom in、 zoom out 、rotation、tilt功能，若配合設備檢查資料庫，在設備管理上是一相當新奇及有效的工具，一些國外石化煉油廠已有應用實例，此技術在現場設備管理上是值得推廣的，詳細資料請參考附件內資料。

六、心得與建議

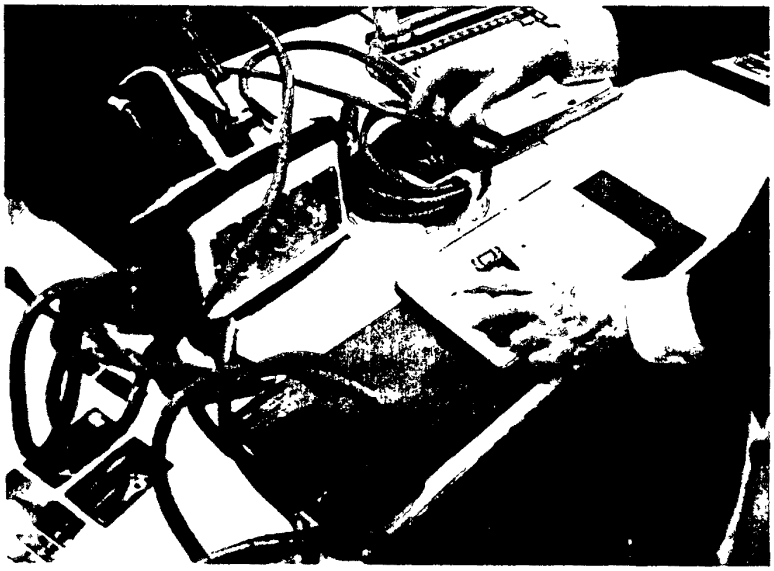
此次奉派出國赴美參加研討會，實覺穫益良多，在研討會內獲取了一些寶貴知識及經驗外，並認識一些相關領域專精人士 ，同時參訪了 NDT 儀器設備展，收集相關的資料，相信對於未來相關之檢測技術引進有所助益。唯出國時適逢美國 911 事件後之恐怖事件未了，美國境內搭機多了一些煩瑣安檢程序，不過幸好一切平安，順利完成全部旅程。此次參加研討會深覺國外相關之會議及研討資訊很多，可惜本所出國機會仍嫌太少，往往無法掌握最新最快的資訊，相信如何掌握資訊應是未來增進競爭力不可缺之條件，閉門造車不如多派人出去增廣見聞。

圖(一)PVRC 開會所在之飯店外觀
Sheraton Suites Houston Galleria

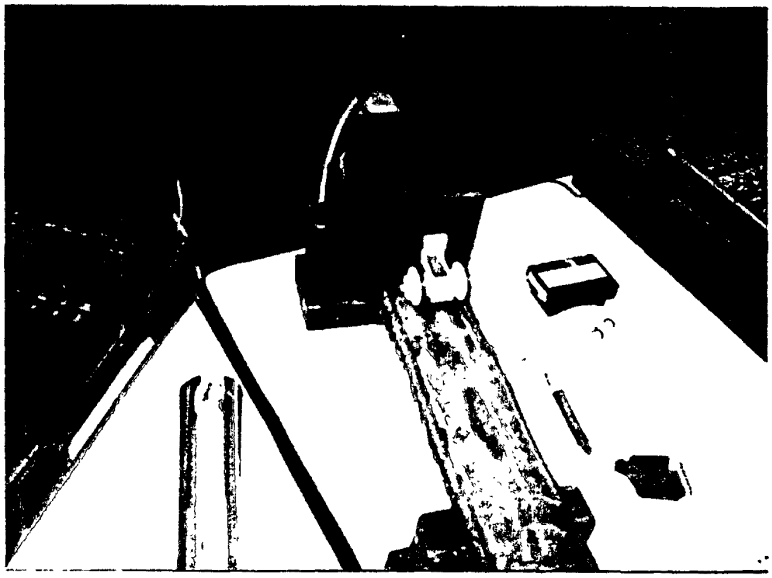
圖(二)ASNT conference 現場(註冊處)

圖(三)ASNT conference 現場(圖書展覽處)

圖(四) ASNT 儀器展入口



圖(五)ASNT 儀器展 現場(ACFM儀器)



圖(六)ASNT 儀器展現場(Boiler Tube Inspection)

附件

PVRC研討會內容
及
出版的相關技術文獻

PVRC WORKSHOP ON MANAGING INTEGRITY OF EQUIPMENT IN WET H_2S SERVICE

Intended for Upstream and Downstream Applications
Guidance for Decisions on Inspection, Materials, Operation, and Repair

October 10-12, 2001
Sheraton Suites Houston Galleria
Houston, TX

PROGRAM

Day 1 - Wednesday, October 10, 2001

8:30 A.M. *SESSION 1 – STATE-OF-THE-ART AND PERSPECTIVES*

Conference Objectives and Issues in Managing Integrity
Martin Prager (MPC) and David Wang (Equilon Enterprises, LLC

An Owner-User Experience With Wet Hydrogen Sulfide Cracking
John Reynolds (Shell Global Solutions/Equilon Technology Center)

Q & A DISCUSSION

BREAK

Industry Positions on Metallurgical Factors and Specifying Materials
Martin Prager (MPC)

Effects of Environments on Wet H_2S Cracking
Dick Horvath (Equilon Enterprises, LLC

Q & A DISCUSSION

LUNCH

1:15 P.M. ***SESSION 2 – HOW TO OBTAIN THE MOST ECONOMICAL AND EFFECTIVE NDE***

Ultrasonic Inspection of Sulfide Stress Cracking for Equipment in Wet H_2S Service
J.W. Krynicki (ExxonMobil)

HIC Assessment with AE and AUT
Martin Peacock (Matrix Inspection & Engineering Inc.)

AUT HIC Examinations
David Bajula (Longview Inspection)

BREAK

Non-Intrusive vs. Internal Inspection
David Wang (Equilon Enterprises, LLC)

NDE Input to FFS Decision Making
C.P. Hsiao (Chevron Research & Technology)

Q & A ON DETECTING/SIZING AND APPLICATION

NETWORKING TIME – RECEPTION – ALL INVITED PVRC HOSTED

DAY 2 - THURSDAY, OCTOBER 11, 2001

8:00 A.M. ***SESSION 3 – FITNESS-FOR-SERVICE***

Where and Why Cracks Propagate
Gerrit Buchheim (M&M Engineering)

Treating Wet H_2S Damage Using API 579
David A. Osage (M&M Engineering)

Test Methods for Materials Ranking
Russell D. Kane (InterCorr International, Inc.)

BREAK

Repair & Remediation
J.E. Sims (Consulting Engineer)

Application of Hydrogen Flux Monitoring to Assess Equipment Operating in Wet H_2S Service
Russell D. Kane (InterCorr International, Inc.)

Q & A

LUNCH

How Has Industry Dealt with Wet H_2S Cracking: Focus on Inspection
Gerrit Buchheim (M&M Engineering)

API Risk Based Inspection Program
Lynne Kaley (M&M Engineering)

Experience in Applying Expert Systems: Case Study on Wet H_2S Cracking
Richard Brodzinksi (BP) and Gerrit Buchheim (M&M Engineering)

BREAK

Other Approaches to Managing Integrity – Round Table

Wet H_2S Cracking: Critical Issues Needing Resolution
David Cooke (Chevron Research & Technology)

RECOMMENDATIONS – Q & A

ADJOURN

PVRC 參加者名單;公司及聯絡 email

	First Name	Last Name	Company	e-mail
Mr.	Frank J.	Vacha	A I.R. / Shell Canada	vachaf@bantrel.com
Mr.	Richard B.	Allsup	APTECH Engineering Services, Inc.	rallsup@aptecheng.com
Mr.	Robert E.	Moyer	Aramco Services Co.	robert.moyer@aramcoservices.com
Mr.	Chris	Payton	BP	paytoncj@bp.com
Mr.	Lee	Valentine	BP	valentll@bp.com
Dr.	Richard	Brodzinski	BP Amoco	brodzirp@bp.com
Dr.	S. J. (Jim)	Ibarra	BP Corporation	ibarraj@BP.com
Mr.	Tim	Munsterman	Capstone Engineering Services Inc.	tmunsterman@cap-eng.com
Mr.	Bill H.	Zhu	Capstone Engineering Services, Inc.	billzhu@cap-eng.com
Mr.	Tim	Gaustad	Cenex Harvest States	tgaustad@cenex.com
Dr.	Chia-Pin	Hsiao	Chevron Research & Tech. Co.	hsia@chevron.com
Mr.	David L.	Cooke	Chevron Research & Technology Company	dcoc@chevrontexaco.com
Mr.	James W.	Skogsberg	Chevron Texaco	jwsk@chevrontexaco.com
Mr.	Mark	Butts	Chicago Bridge and Iron	mbutts@chicagobridge.com
Mr.	Chun-Chi	Su	Chineese Petroleum Corp.	succ2@rmrc.gov.tw
Mr.	Weng	Wen-Hung	Chineese Petroleum Corp.	wengwh@rmrc.gov.tw
Mr.	Clinton J.	Schulz	CITGO Refining & Chemicals	cschulz@citgo.com
Mr.	Philip R.	Eckhardt	Coastal Aruba Refining Co. N.V.	phil.eckhardt@elpaso.com
Mr.	H. Chong	Rhee	Conoco Inc.	h.chong.rhee@conoco.com
Mr.	Pete	Fox	Conoco Inc.	pete.b.fox@conoco.com
Mr.	Lawrence	Hovey	Conoco, Inc.	lawrence.hovey@conoco.com
Mr.	Cheng-Yi	Chang	CPC, TAIWAN	116149@cpc.com.tw
Mr.	Norman K.	Keller	Cytec Industries, Inc.	norm_keller@fo.cytec.com
Mr.	Steve	Weichel	Det Norske Veritas	Steve.Weichel@dnv.com
Ms.	Carmen	Fonseca	Det Norske Veritas	carmen.fonseca@dnv.com
Mr.	Robert E.	Smallwood	Det Norske Veritas	robert.smallwood@dnv.com
Mr.	George	Malone	Equilon Enterprises	ghmalone@equilontech.com
Mr.	Dick	Horvath	Equilon Enterprises LLC	rjhorvath@EquilonTech.com
Mr.	Ramiro	Estenssoro	Equilon Enterprises LLC	rgestenssoro@equilon.com
Dr.	W. David	Wang	Equilon Enterprises, LLC	wdwang@equilontech.com
Dr.	Don S.	Kim	Equilon Enterprises, LLC	dskim@equilontech.com
Mr.	John T.	Reynolds	Equilon Enterprises, LLC	jtreynolds@equilontech.com
Mr.	Ron	Kastner	ExxonMobil Research & Engineering	ron.e.kastner@exxonmobil.com
Mr.	Joseph W.	Krynicki	ExxonMobil Research & Engineering Co.	joseph.w.krynicki@exxonmobil.com
Mr.	Barry	Messer	Fluor Daniel	barry.messer@fluor.com
Mr.	Yvette	Yin	Fluor Daniel	yvette.yin@fluor.com
Mr.	Kenneth	Kirkpatrick	Fluor Daniel	Kenneth.Kirkpatrick@Fluor.com
Mr.	Terrell T.	Phillips	Fluor Daniel Inc.	terry.phillips@fluordaniel.com
Mr.	George A.	Miller	Fluor Daniel, Inc.	george.miller@fluor.com
Mr.	Jeffrey	Pfeifer	Fluor Daniel, Inc.	jeff.pfeifer@fluor.com
Mr.	Greg	Little	GDS Engineering	greg.little@gdseng.com
Dr.	Takayasu	Tahara	High Pressure Institute of Japan	hpi2518@mx1.alpha-web.ne.jp
Dr.	Russell D.	Kane	InterCorr International, Inc.	rkane@intercorr.com
Dr.	Francesco	Bresciani	Istituto Italiano Della Soldatura	francesco.bresciani@iis.it
Mr.	James E.	Sims	J. E. Sims, Consulting Engineer	cbijim@aol.com
Mr.	Victor M.	Romero	Koch Petroleum Group, L.P.	romero3v@kochind.com
Mr.	David	Bajula	Longview Inspection	dbajula@lii-nde.com
Mr.	Doug	Gary	Lyondell - Citgo Refining LP	doug.gary@lyondell-citgo.com
Ms.	Lynne	Kaley	M & M Engineering	lynne_kaley@mmengineering.com
Mr.	Gerrit	Buchheim	M&M Engineering	gerrit_buchheim@mmengineering.com
Mr.	David A.	Osage	M&M Engineering	david_osage@mmengineering.com
Mr.	David L.	Bryan	Marathon Ashland	dlbryan@mapllc.com
Mr.	Stephen	Salyer	Marathon Ashland Petroleum	srsalyer@mapllc.com
Mr.	Martin	Peacock	Matrix Inspection & Engineering, Inc.	martinp@matrixie.com
Mr.	Martin L.	Lemoins	Motiva Enterprises LLC	mllemoins@motivaenterprises.com
Mr.	W. J.	Stikvoort	N. A. M. BV	w.j.stikvoort@nam.nl
Mrs.	Halimah	Pit	NAM (Naderlandse Aardolie Maatschappii)	h.b.pit@nam.nl
Mr.	Bruce	McCain	Oxy Permian	bruce_mccain@oxy.com
Mr.	Antonio	Seijas	PDVSA / INTEVEP	seijasat@pdvsa.com
Mr.	Stuart L.	Wilson	Phillips Petroleum	swilson@ppco.com
Mr.	J. Edward	Cantwell	Plumlee Associates	cantwellje@home.com
Mr	Sheldon	Boullion	PREMCOR	sheldon.boullion@premcor.com
Mr.	Martin	Prager	Pressure Vessel Research Council	mprager@forengineers.org
Mr.	Alex	Romanow	Ranger Inspection Ltd.	alex@rangerinspection.com
Mr.	Zbyszek F.	Matyja	Sasol Technology Ltd.	zbyszek.matyja@sasol.com
Mr.	Larry	Manley	Shell Canada Limited	larry.manley@shell.ca
Mr.	Roy	Schubert	Shell Canada Limited	roy.schubert@shell.ca
Mr.	Dwayne	Burton	Shell Canada Ltd.	dwayne.burton@shell.ca
Mr.	Kenneth A.	Miozza	Shell Chemical	kamiozza@shellus.com
Mr.	Leslie D.	Alexander	Shell Chemical Company	ldalexander@shellus.com
Mr.	Craig	Cole	Shell Oil / Equilon	jccole@shell.com
Mr.	Murthy	Madapura	Shell Oil / Equilon	msmadapura@shell.com
Ms.	Tracy	Unger	Syncrude Canada Ltd.	unger.tracy@syncrude.com
Mr.	Brian	Lucas	Syncrude Canada Ltd.	lucas.brian@syncrude.com
Mr.	Jason	Hornick	Syncrude Canada Ltd.	hornick.jason@syncrude.com
Mr.	Billy G.	Smith	Texas Oil Tools	bgsmith@tuboscope.com
Mr.	John	Harston	UOP Limited	jharston@uop.com
Mr.	Roger G.	Esteves	Valero Refining Co. - Louisiana	estevesr@valero.com
Mr.	George A.	Antaki	Westinghouse Savannah River	george.antaki@srs.gov

wengwh

寄件者: Hsiao, Chia-pin (HSIA) <HSIA@chevrontexaco.com>
收件者: <succ2@rmrc.gov.tw>; <wengwh@rmrc.gov.tw>
傳送日期: 2001年10月22日 23:14
主旨: FFS Software

Mr. Su & Mr. Weng,

Regarding your question on FFS software, there are four choices I am aware of.

1. A software package called FFSAnalysis developed by FFS Analysis. Dr. Will Carter is also offering the training class. He is a past ASME Code Committee chairman and taught ASME classes and API classes (Codewest) for several years (stooped in 2000).

http://ffs-analysis.com/

2. M&M engineering has a software package called VCESage. This is based on the code Dave Osage developed when he was with BP. Osage and Bucheim also teach RP-579 classes for API.

http://www.mmengineering.com/

3. MPC developed a software package called PREFIS through Ted Anderson. You need to be a member of the FFS JIP in order to get a copy of the software. You may have to pay fees for the previous phases and the total cost can be quite high.

4. Ted Anderson also market a software package called FractureGraphics using code developed under the FFS JIP. It is more fracture mechanics oriented, rather than implementing all the modules in RP-579.

http://srt-boulder.com/

Among these 4 packages, my personal preference is FFSAnalysis because it procedurized the modules in RP-579. As such, it takes care of some of the ambiguities in RP-579. Contact me if you have any more questions.

C. P. Hsiao
ChevronTexaco Energy Research & Technology Company
Phone (510) 242-7217; Fax (510) 242-4614
EMAIL hsia@chevron.com

ASNT Conference
研討會內容
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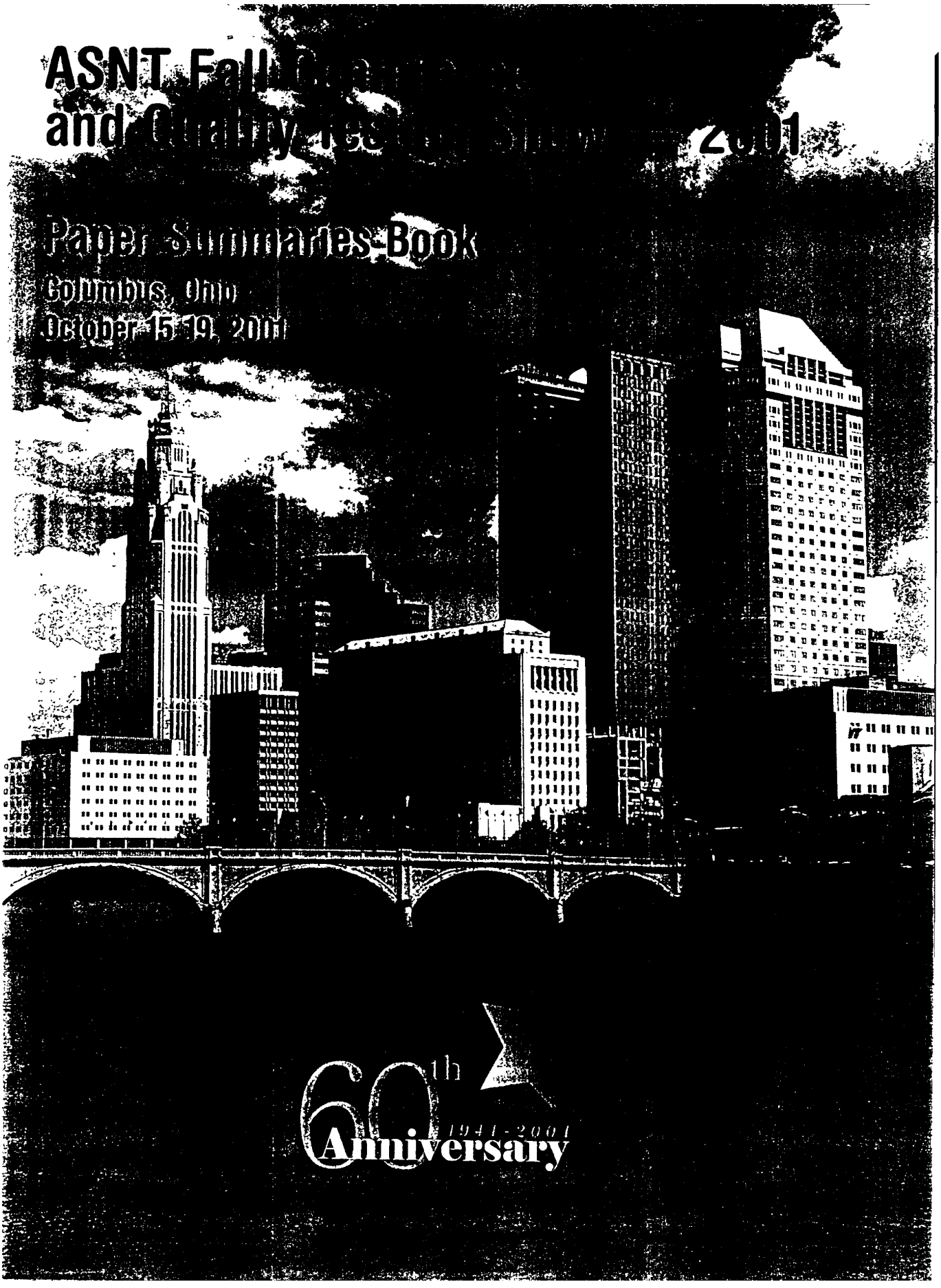
ASNT Fall
and Quality
Paper Summaries Book
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October 15-19, 2001
60th
1941-2001
Anniversary

Professional Program

Aerospace Track

History of NDT

The Evolution of the Digital Flaw Detector
J. Cuffe and M. Feydo, Krautkramer

Advancements in Remote Visual Inspection Technology
R. Lindner, Everest VIT

Brief History of Magnetic Particle Inspection
G. Monks, Q.C. Technologies

Rivet Coatings and Their Effect on Sliding Probe Inspection
S. Enzukewich and A. Howard, Boeing

Advances in Eddy Current Technologies
F. Spears, Zetec

The History & Future of Non-Film Radiography
W. Meade, Boeing Company

The History of Penetrants
S. Robinson, Sherwin

Physical Health Monitoring

Accuracy Analysis of Eddy Current Inspection for Hidden Corrosion in C/KC-135 Fuselage Skins and Lap Joints
P. Whaley and J. Riggs, ARINC

Surface Mounted MWM-Eddy Current Sensors for Structural Health Monitoring
N. Goldfine, V. Zilberstein, D. Schlicker, K. Walrath, A. Washabaugh, JENTEK Sensors; T. Yentzer, Robins Air Force Base; S. Kramer, Raytheon Aircraft Integration Systems

An Edge-of-Light Inspection Unit for Corrosion Assessment of Aircraft Structures
M. Brassard, A. Chahbaz, S. Sreng, Tektrend International; D. Forsyth, National Research Council (Canada)

Positrons Annihilation a Nondestructive Method for Materials Characterization
N. Meyendorf and G. Dlubeck, University of Dayton

Overview of IR Applications in the Aerospace Industry
J. Snell and R. Spring, Snell Infrared

Engine NDT

Fatigue Life Determination in the Blade of a Gas Turbine via NDT
M. Riahi, Iran University of Science and Technology (Iran)

Condition Assessment of Engine Component Materials Using MWM-Eddy Current Sensors
N. Goldfine, V. Zilberstein, D. Schlicker, Y. Scheiretov, A. Washabaugh, JENTEK Sensors; P. Khandelwal, Rolls Royce; R. Wood, J. Price Naval Aviation Depot

High Resolution Pulsed Thermographic NDT of Large Area Structures
S. Shepard, D. Wang, J. Lhota, T. Ahmed, B. Rubadeux, B. Chaudhry, Thermal Wave Imaging

Probability of Detection (POD) Assessments of FPI and MPI Processes at Delta Air Lines
D. Piotrowski, L. Clements, S. Vandiver, Delta Air Lines; W. Rummel, D&W Enterprises

Revolutionary Method to Measure Crack Depths Using Polarized UV Light While Performing Fluorescent Penetrant Inspections
E. Donahue, Holores Corporation

Novel Eddy Current Techniques

High-resolution Eddy Current Sensor Arrays with Inductive and Magnetoresistive Sensing Elements

D. Schlicker, Y. Sheiretov, A. Washabaugh, N. Goldfine, JENTEK Sensors

Introduction to a Pulsed Eddy Prototype for the Inspection of Multi-layer Aircraft Structure

M. Brassard and A. Chahbaz, Tektrend International; D. Forsyth and B. Lepine, National Research Council; S. Dubois, Royal Military College; S. Giguere, Department of National Defense (Canada)

Unique Inspections with Eddy Currents Utilizing Array Technology

S. Galberg, R/D Tech (Canada)

Eddy Current Testing with "Eddy Vision"

B. Goranson, M. Gehlen, J. McDaniel, Uni West

Laser Methods in Aerospace

High Strength Sandwich Construction Inspection

R. Gregory, Laser Testing Instruments (England)

Comparison of NDT Methods for the Inspection of Honeycomb Sandwich Panels

J. Gilbert, ClearImage NDT

Digital Shearography NDT of Aerospace Composite

J. Newman, Laser Technology

Shearography Inspection in Safety Critical Tire Applications

B. Feferman, Laser Technology

Composite Inspections Using Three NDE Methods: Sherography, Thermography, and Ultrasound

C. Davis and F. Santos, National Space and Aeronautics Administration; P. Vanaria, United Space Alliance

Combined Thermal/Shearography NDT Systems for Large Aerospace Structures

D. Burleigh, Laser Technology

General NDT Topics and Applications Track I

EMAT Applications to Industrial Inspections

Electro-Magnetic Acoustic Transducers (EMAT) Based Production Inspection Systems

K. Camplin, MAST Automation

Application of EMATs to Fossil Fueled Boiler Inspection

R. Murphy, Babcock & Wilcox; S. Clark, G. Gordon, J. Hancock, D. MacLauchlan, McDermott Technology

EMAT Thickness Measurement for Tubes in Coal Fired Boilers

M. Bergander, L. Levesque, W. Hryn, Scientific Technologies

Application of EMATS to the Inspection of Pipes and Tubular Products

R. Alers, Sonic Sensors

A Quantitative Method for Measurement of Corrosive Wall Loss in On-Stream Piping Resting on Pipe Supports

P. Davidson, WIS Inc.

EMAT Applications to Complex Materials and Materials Characterization

Elements of Defect Sizing in a Wave Guide Using SH Guided Waves

J. Rose, G. Zhao, Pennsylvania State University

Probing Fiber Orientation in Composite Laminates Using EMATs

D. Fei and D. Hsu, Iowa State University

An EMAT for Inspecting Wire Cables

G. Alers, National Institute of Standards and Technology; M. Chenoweth and R. Shoureshi, Colorado School of Mines

Noncontact Measurements with Electromagnetic Acoustic Resonance and Materials Characterization: Fatigue Damage Monitoring

M. Hirao and H. Ogi, Osaka University (Japan)

Guided Waves EMATs for Crack Detection and Imaging of Multilayere Aircraft Structure

A. Chahbaz, A. Cyr, M. Brassard, Tektrend International; R. Sicard and J. Goyette, Universite du Quebec a Trois-Rivieres (Canada)

Use of EMATs for Characterization of IIW Type Reference Blocks

G. Alers, National Institute of Standards and Technology

NDTMA Management Issues

NDT Resources on the Web

W. Blum, Bright Technical Services; T. Grybäck, CSM Materialteknik AB (Sweden); C. Cowen-Lyman, CS Publications

Meeting the Needs of NDT Training in the New Millennium

J. MacMillan, Delta Air Lines

How to Conduct High Value Low Cost Inspection Reliability (POD) Studies

R. Singh and D. Locke, Karta Technologies

Managing Change

B. Phelan, Agfa Corporation

Economics of Computed Radiography

F. Morro, Fuji NDT Systems

Chemical and Petroleum

Nondestructive Evaluation and Monitoring of Urea Reactor

P. Shah and G. Patel, Gujarat Narmada Valley Fertilizers (India)

NDT Practices Adopted in Petrochemical Industry—A Review

C. Gandhi, M/S Narmada Chematur Petrochemicals (India)

Predictive Models for the Determination of Pitting Corrosion in the Piping Systems of Petrochemical Plant Based on the Routine Practices of NDT

M. Riahi, Iran University of Science and Technology (Iran)

ASME Code Case 2235 TOFD Inspection

E. Sjerve, Canspec Group Inc. (Canada)

Inspection of Thin-Walled Pipe and Shell for Environmental Cracking

M. Lozev and B. Grimmett, Edison Welding Institute

General NDT Topics and Applications Track II

Magnetic Particle and Liquid Penetrant

Continuous Improvements in FPI

S. Vandiver, Delta Air Lines

Clean or Unclean—Consequences of Improper Penetrant Inspection Post Cleaning

J. Waugh, Lockheed Martin

The "Credit Card Ketos" for Magnetic Particle Inspection

B. Chedister, Circle Systems

Comparisons of the Magnetic Field Distributions in Magnetic Particle Inspection Systems Using FEA and Measurement Techniques

D. Carpenter, Vector Fields; V. Frankfurt, American NTN Bearing, Inc.

Panel Discussion: Magnetic Particle/Liquid Penetrant Open Forum

This Panel Discussion will be moderated by Jim Waugh of Lockheed Martin and will end at 5:00 p.m.

Radiation Safety

Radiation Safety Incident Prevention

T. Scales, Saudi Aramco (Saudi Arabia)

The Importance of Training

J. Lang, General Dynamics Electric Boat

What I Wished I Had Known about the DOT But Was Afraid to Ask

G. Balestracci, General Dynamics Electric Boat

Radiography Exposure Device and Shipping Container Testing

K. Roughan and M. Trembley, AEA Technologies QSA

Transportation Incidents

D. Cochrane, Canadian Nuclear Safety Commission (Canada)

Piping and Tubing NDT

The Use of Magnetic Flux Leakage for the Detection of Corrosion in Pipelines Over Water

J. Drury, Silverwing (United Kingdom)

Helium Leak Detection in Industry

O. Knarr, Midwest Helium Leak Detection

The Evolution and Worldwide Acceptance of Automated Ultrasonic Girth Weld Examinations for Onshore and Offshore Pipeline Installations

R. Trude and G. Prentice, Shaw Pipeline Services

Identifying Concrete Deterioration Using Ground Penetrating Radar Technology

A. Tarussov, R. Roberts, Geophysical Survey Systems; G. Roberts, New Hampshire Department of Transportation

Pipeline Girth Weld Inspection Using Automated Digital Radioscopy

J. Pursley, Envision Product Design

Ultrasonic Phased Array Approach for the Evaluation of Electrofusion Joint of Polyethylene Gas Piping

H. Shin, INDE System; J. Kwan, Korea Gas Safety; S. Song, Sungkyunkwan University (South Korea)

Vision-based Corrosive Measurement on In-service Pipelines

C. Reichert, Edison Welding Institute

Ultrasonic Techniques I

Acoustography: A Simple, Low-cost Ultrasonic Testing Method

J. Sandhu and H. Wang, Santec Systems; P. Sincebaugh, U.S. Army Research Laboratory

Nonlinear Acoustical Methods of Evaluating Strength and Fracture Parameters of Concrete

I. Shkolnik and H. Aktan, Wayne State University

Ultrasonic Characterization of Elastomers and Elastomeric Composites

J. Dick, T. Craychee, J. Du and B. Tittmann Pennsylvania State University

• ***Year 2000 Fellowship Award Paper*** •

Remote Detection of Fatigue Cracking in SH-60 Seahawk Helicopter Transmission Beams Using Ultrasonic Guided Waves

T. Hay, Pennsylvania State University

Using Resonant Inspection to Determine Product Quality

M. Grace, Zonic Corporation

Ultrasonic Inspection Using a Digital Phased Array System

P. Meyer, Krautkramer

Ultrasonic Techniques II

Digital Acoustic Tap Testing—An Investigation in Determining Impact Damage in Composite Sandwich Structure

R. Melcher, Wichita State University

Rapid Composite Inspection Using a Novel Ultrasound Camera

R. Lasser, M. Lasser, J. Kula, S. Pantano, Imperium; W. Tolotta, Boeing

In-plane Stiffness Monitoring of Environmentally Degraded Composite Laminate Under Fatigue Loading

C. Mattei and F. Hyllengren, CSM Materialteknick AB (Sweden)

Novel Method for Corrosion Gaging Through Coatings

T. Carodiskey, Krautkramer

Development of Ultrasonic Techniques to Characterize Vertical Defects in Rails

S. Singh and R. Clark, Sperry Rail Service

Role of NDT in the Condition Monitoring of Corrosion

M. Riahi, Iran University of Science and Technology (Iran)

Continuous On-line Monitoring of Corrosion Rates at 315°C in Candu-PHW Primary Heat Transport System Pipes

P. Kielczynski and J. Aikens, Research and Productivity Council

Radiography and Weld NDT Track

Neutron Radiography

Emerging Neutron Radiographic Techniques and Applications

H. Berger, Industrial Quality

Characterization of Beams Used for Neutron Imaging

J. Brenizer, Pennsylvania State University

Characteristics of Neutron Radiography Facilities Used by Nray Services

M. Branecki, G. MacGillivray, R. MacGillivray, Nray Services (Canada)

Neutron Radiography System at Pantex Using Californium

W. Sievers, BWXT-Pantex; J. Barton, NRE; A. Rogers, Synergistic Detectors Designs

Neutron Radiology Applications at the UCD/MNRC

W. Richards and K. Shields, SM-ALC/TI-1

Image Quality Indicators

R. Tsukimura, Aerotest Operations

NDT of Welds

Implanting Controlled Flaws in Weldments to Verify and Demonstrate NDT Capability

G. Pherigo and A. Pherigo, FlawTech

Weld Failures — A Continuous Improvement Approach

N. Khan, Descon Engineering Limited (Pakistan)

Computer Code for Radiographic Testing of Welds

B. Tabakova, Technical University of Sofia; R. Kasarov, Lukoil Neftohim-Burgas (Bulgaria)

Flaw Detectability Study in Austenitic Steel Welds Using Different Ultrasonic Transducers

T. Balasubramaniam and S. Baby, Regional Engineering College; R. Pardikar, Bharat Heavy Electricals (India)

Visualization and Localization of Defects in Ultrasonic Control of Welds

B. Tabakova, Technical University of Sofia; R. Kasarov, Lukoil Neftohim-Burgas (Bulgaria)

Reconstructed Digital Images—Radiography I

Examples of Film Replacement with Digital Radiography at Los Alamos National Laboratory

D. Fry, S. White, J. Lucero, J. Martinez, N. Trujillo, Los Alamos National Laboratory; A. Davis, Hytec

Digital Radiography Applications and Implementation Issues

M. Negley, Boeing

Influences of Scatter in Digital Radiography

D. Wysnewski, Agfa

Field-portable X-Ray Systems for Inspection of Munitions Design, Development, and Field Experience

T. Roney, R. Pink, T. White, Idaho National Engineering and Environmental Laboratory; M. Smith, Idaho State University; F. Noo and R. Clackdoyle, University of Utah

Time Gated X-ray Imaging Using Ultra Short Pulsed X-rays

R. Tanenhaus, Information Management International

Full Volumetric X-ray Imaging Using a Digital Flat Panel Detector

R. Schulte, Industrial Quality

Film Radiography—Radiography II

The Structurix eco Film System Revolutionary Cascade Fixing Technology

R. Kochakian, Agfa NDT USA; B. Vaessen, Agfa NDT (Belgium)

Analog Film Radiography Technology Advancements

K. Marstboom, B. Vaessen, P. Willems, Agfa (Belgium); R. Kochakian, Agfa NDT USA

Quality vs. Costs — Some Technical Guidelines

B. Lombardo, Fuji NDT Systems

Harmonization of Film System Classification in Industrial Radiography

Y. Morin and M. Holloway, Kodak

Aerospace X-Ray

G. Strabel and F. Norris, Howmet Castings

Alternate Discharge Compliance Mechanisms

S. Noble, Photo Marketing Association International

Please see the On-Site Program for dates and times of these presentations.

NDT 廠商型錄
(ASNT 儀器展)

Metallurgist Pro Benchtop Option

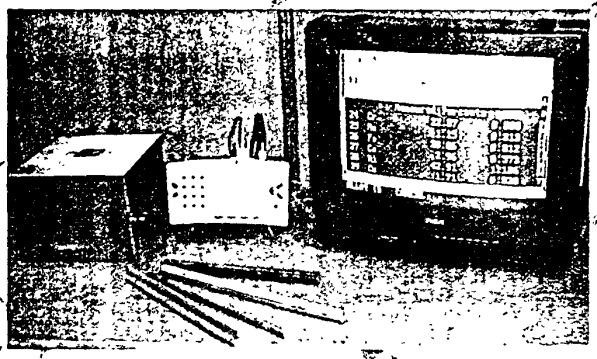
Customers who use the Metallurgist Pro primarily on the bench will appreciate this new option from Thermo MeasureTech. This package provides an external feed of the display to a common television with a video input jack. With a 20 inch television mounted on a wall above the work area, visibility is great to 20 feet. The Metallurgist Pro electronics can be positioned conveniently to the operator. Thermo MeasureTech will provide exterior dimension drawings of the probe so that an appropriate hole can be cut into the workspace. Parts slide to the flush probe window surface on the work space providing extreme efficiency.

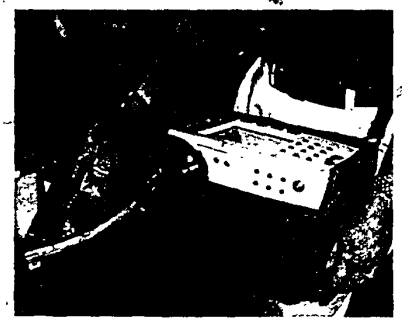
The Benchtop Package

- Steel Bench-top covers probe and holds parts up to 10 lbs.
- Special VGA outputs from the electronics
- Signal converter to display full screen

We can also supply, if desired:

- A separate large TV monitor to see results as far as 15 feet away
- A wall bracket for the monitor that tilts 0°, 5°, or 10° and rotates 180°





Versatility to go in the field

The Metallurgist Pro, can easily and quickly convert to a hand held, portable, field instrument. For the field, simply disconnect the monitor, pull the probe and go.

Thermo MeasureTech
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14 Gormley Industrial Ave. #14
Gormley, Ontario L0H 1G0
(905) 888-8808
(905) 888-8828 (fax)

Themo MeasureTech Europe
Basicweg 20
3800 BN Amersfoort
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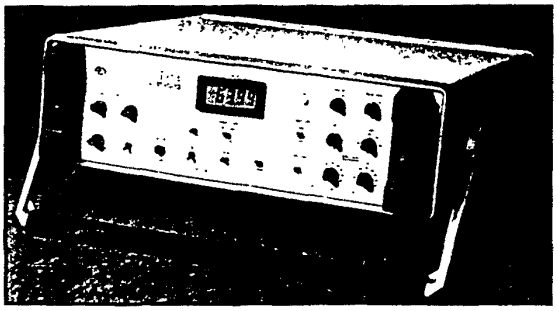
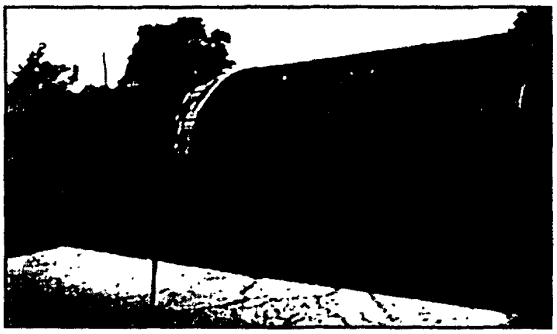
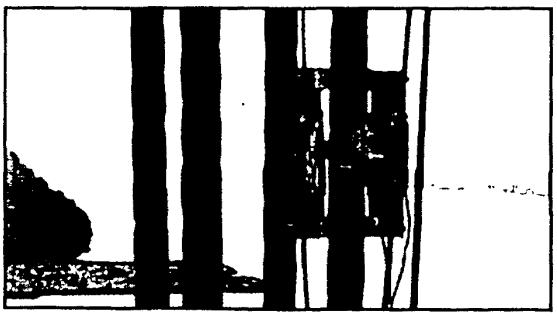
New Approach to NDE of Large Structures

MsSR-2020, Long-Range Guided-Wave Instrument for Research & Industrial Applications

MsSR-2020 is a new state-of-the-art instrument for research and industrial applications of low-frequency (1-250 kHz) guided waves. The instrument, based on patented magnetostrictive sensor (MsS) technology, is applicable for both ferrous and non-ferrous material and is excellent for long-range global inspection and monitoring of large structures.







RESEARCH AREAS

- Wave propagation properties
- Materials properties
- Wave interaction with defects or geometric change
- Nondestructive evaluation (NDE)
- Industrial measurement applications (position, length, temperature, vibration, etc.)
- Fracture, shock waves, and acoustic emission

MsS PROBE FEATURES

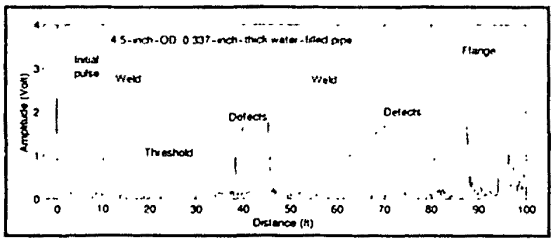
- Noncontact
- Broadband
- Versatile
- Easy to use and inexpensive
- Rugged

STRUCTURES THAT CAN BE INSPECTED

- Rod / cable, pipe / tube, plate / sheet
- Storage tank, containment linear, pressure vessel
- Airplane fuselage, wing
- Bridge girder, suspension bridge cable
- Ship hull

APPLICABLE WAVE MODES

- Torsional, longitudinal and flexural wave for cylindrical structure
- Shear-horizontal, symmetric and antisymmetric Lamb wave for plate structure



Other Products

- 64, 96, 128 array Ultrasonic Transducers
- Multi Channel ECT instrument
- Dry Couplant UT Concrete Tester
- Half-Cell Concrete Rebar Corrosion Tester

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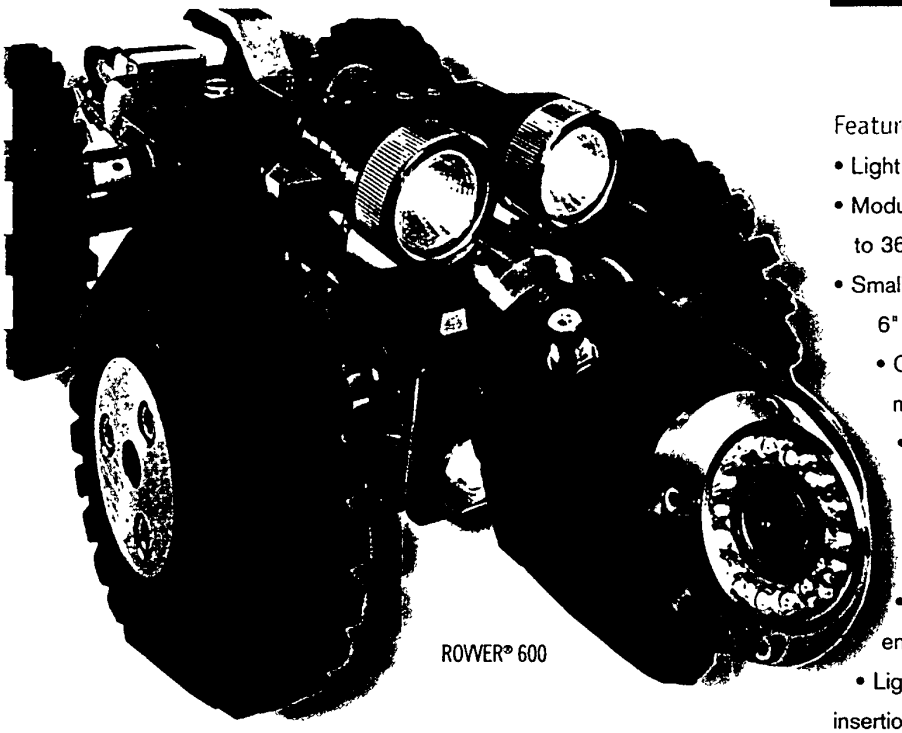
The fast, portable solution for industrial pipe inspections.

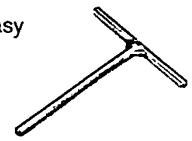
The ROVVER® 600 is the most portable and versatile inspection crawler on the market today. It is ideally suited for many applications due to its modular design and its ability to inspect inside pipes with diameters ranging from 2 to 36 inches. It is the smallest crawler in its class, thereby giving it the ability to pass through restricted pipe, large offsets, and protruding pipe taps. The ROVVER's remote pendant gives you the ability to control focus, lighting and to steer the crawler when obstacles such as debris or offsets are present.



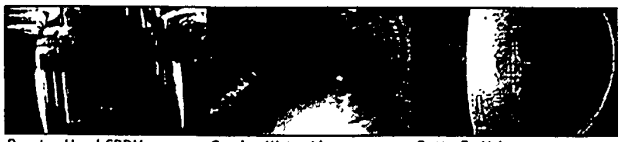
ROVVER® 600

Features/Benefits

- Light and portable system for easy deployment
- Modularity allows a single system to view 2" to 36" pipes
- Small profile allows for long run and pan & tilt in 6" to 36" ID pipe
- Quick disconnect allows for easy use, low maintenance and time savings
- Hand-held pendant for user-friendly control of lighting, focus, speed and steering
- Rack-mount control unit can integrate into existing vehicle
- Waterproof for humid, damp and underwater environments
- Lightweight crawler for easy insertion and removal



All Everest VIT crawlers and cameras can be connected to each other and the cable with the simple twist of this T-bar tool.



Reactor Head CRDM - Weld Inspection

Service Water Line - Baseline Inspection

Butterfly Valve - Monitor Operation

Everest VIT INC
CREATING WHAT'S NEXT IN REMOTE IMAGING

www.everestvit.com

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inspect water wall tubes without scaffolding

detect and size internal pits and external soot blower erosion

Boiler Water Wall Crawler
Features :

1. Magnetically adheres to the water wall.

2. Climbs the full height of the wall.

3. Performs condition evaluation on (up to) three tubes at once.

4. Provides 16 channels of data.

5. Data analysis on the spot.

6. Report generated as data is analyzed.

7. Differentiates I.D. from O.D. loss.

8. Use to plan boiler rehab work.

9. Prevents forced outages due to tube failures.

Research and Development

Unusual Problems Solved

Software Development

Systems Design

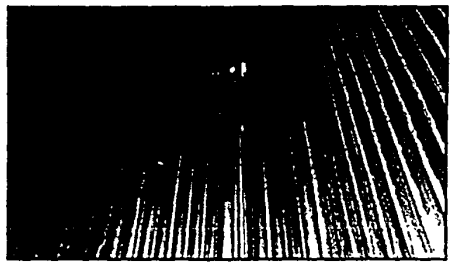
Electronics Design

Link to On-Line Support

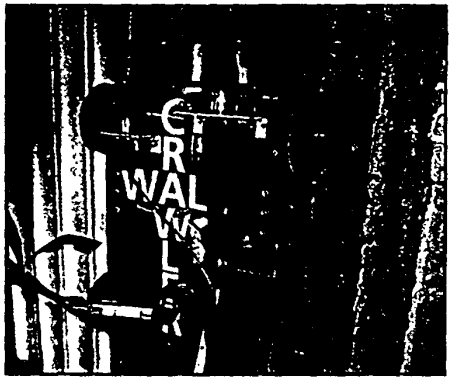
Links to Industry Experts

RUSSELL
NDE SYSTEMS INC

Boiler Water Wall Inspection Crawler



solutions ... now



4909 - 75 Avenue
Edmonton AB T6B 2S3
Toll Free: 1-800-661-0127
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Fax: (780) 462-9378

how to plan your boiler turnaround

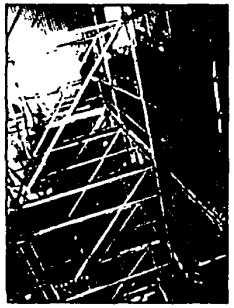
A unique opportunity exists to use the Wall Crawler to scan the water wall tubes when the boiler is shut down because of an auxiliary equipment failure.

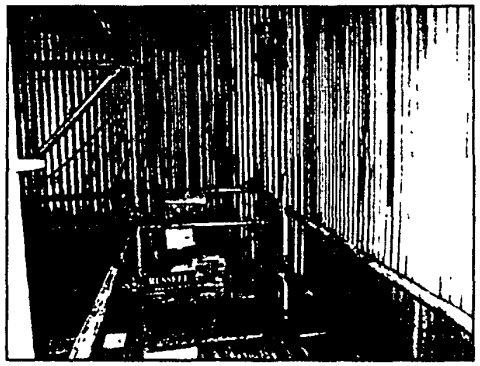
1. Determine which areas have excessive erosion and plan where repair welding is needed.

2. Determine if caustic gouging or internal pitting is eating away your boiler tube wall thickness.

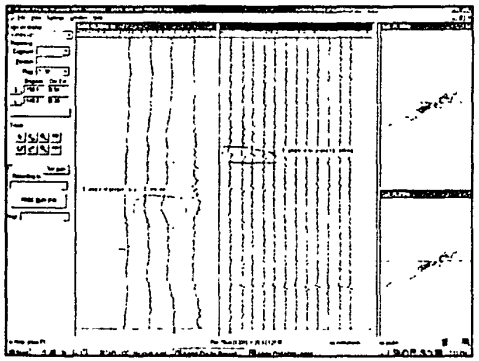
3. Map results for easy identification of defect elevations.

4. Avoid need of expensive scaffolding to provide access for inspection.





Crawler being used from scaffold in boiler during outage.



Data showing external erosion (red) and internal pits (blue).

Russell NDE Systems Inc.

Russell

Solve

Russell NDE Systems Inc. has over 30 years of experience in non-destructive evaluation.

Our team consists of experienced engineers and technicians who provide original thinking to develop innovative solutions for our valued clients.

Russell is a world leader in the application of "remote field technlology" (RFT) to the inspecton of carbon steel tubes and pipes.

Russell spear-headed the development of A.S.T.M. Standard Practice E2096-00 for RFT.

Russell is ISO 9001 registered since 1999.

develop **solutions ...**

RFT Inspection

RUSSELL

Alternating current field measurement

TSC Inspection Systems has developed a new electromagnetic inspection technology, alternating current field measurement (ACFM). Initially introduced to the oil and gas industry in 1991 for the inspection of welded joints on offshore platforms and process plant, the technology is used by a range of industries, including nuclear, offshore, petrochemical, power generation and aerospace. The technique provides reliable detection and sizing of cracks in metallic components and can be used through paint and coatings up to several millimetres thick. High temperature probes can also be used to avoid the need to shut down process plant.

ACFM provides a permanent record of inspections. These can be stored on floppy disks and can be replayed, audited and produced in hard copy for report purposes.

A wide range of plant and components have been inspected using ACFM. These range from welded joints on pressure vessels to welded joints made for use in space. The development of multi element array probe technology now enables the rapid scanning of welds or plate, both topside and underwater.

The use of an array probe instead of conventional single element probes provides a larger area of coverage beneath the probe and hence gives rapid inspection. Proven application areas include:

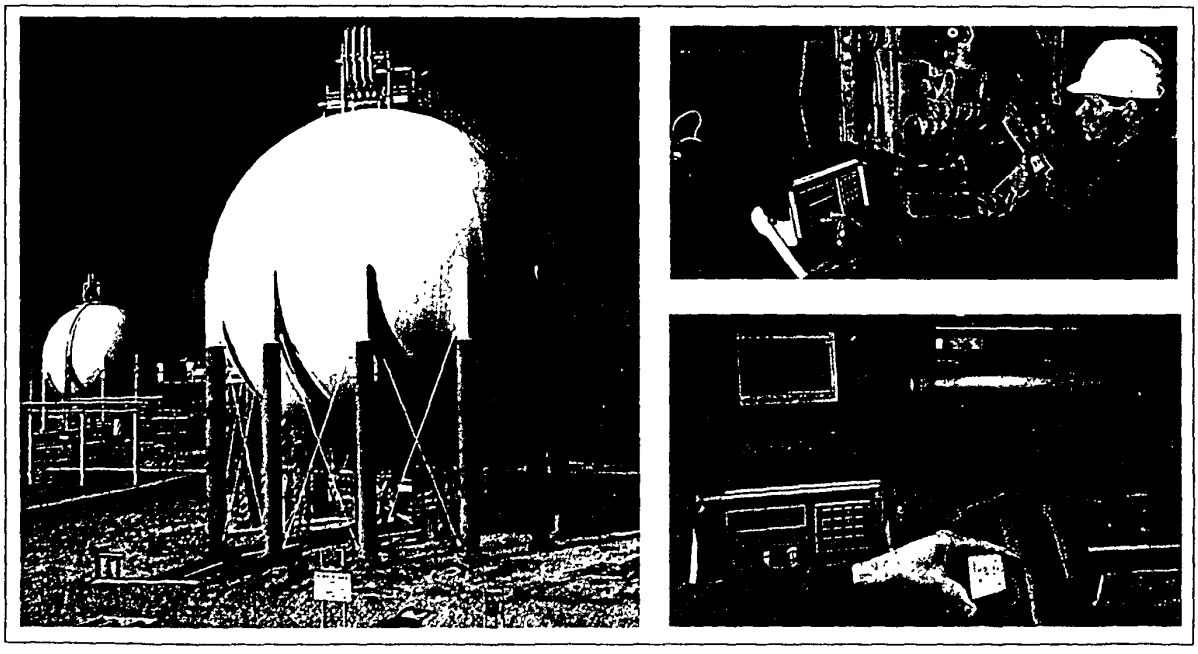
- thread inspection
- ship hull inspection
- tank wall and floor inspection
- titanium risers

The probes can be used manually, mechanically driven or used with a manipulator.

ACFM is now being used in public utility areas such as bridge inspections, and the inspection of highly engineered theme park rides.

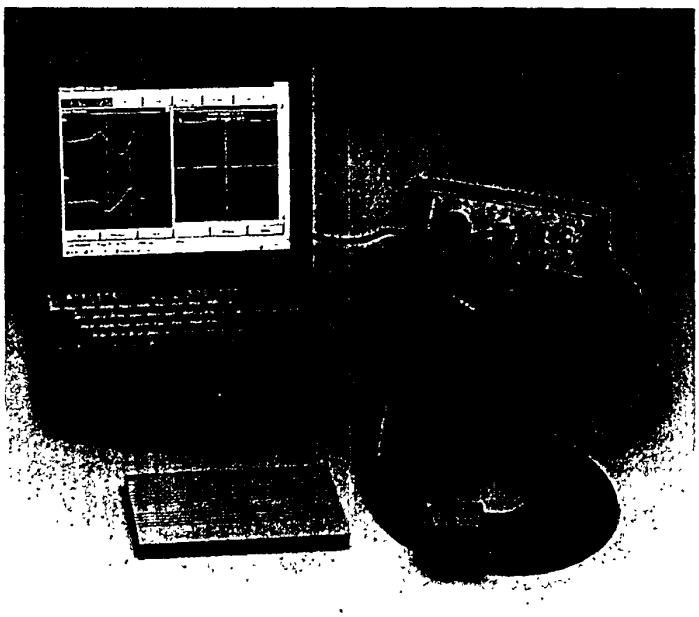
ACFM systems have now been extended to include a gauge to measure the thickness of coatings either man made or natural, such as marine growth, up to 350mm thick. This system employs TSC's novel ACFM lift-off sensors.

Use of ACFM has been approved by ABS, Lloyds Register, DNV, Bureau Veritas and OCB Germanischer Lloyd.



INTRODUCING THE AMIGO

A new, User-Friendly, ACFM instrument for Crack Detection and Sizing



TSC Inspection Systems is the sole supplier of the Alternating Current Field Measurement (ACFM) technology. Its latest product, the AMIGO, is a new lightweight, multi-frequency site instrument capable of supporting ACFM array technology.

ACFM was initially introduced into the Oil and Gas Industry in 1991 for the inspection of welded joints on offshore platforms and process plant. ACFM provides reliable detection and sizing of cracks in metallic components and can be used through paint and coatings. High temperature probes can also be used to avoid the need to shut down process plant. It has now replaced MPI and dye penetrants in many cases. ACFM provides a permanent record of inspections, which can be stored on floppy disks and can be replayed, audited and produced in hard copy for report purposes.

The rapid and reliable inspection capability of ACFM has led to it being used in the public safety areas of theme park roller coaster rides and bridge inspection, where large cost savings were recorded. It is also used in the road and rail transport area, and nuclear, power generation, and aerospace industries.

New probe and instrumentation development has allowed TSC to introduce a lightweight, rugged ACFM instrument with long battery life, the AMIGO, with many features. For example, TSC's Fast Area Scan and Track NDT (FAST-NDT) system, based on ACFM array technology, is now available in the AMIGO.

FAST-NDT uses the TSC multi-element array technology, which allows rapid scanning of wide cap welds and plate, both topside and underwater, and has been applied to:

- Drillstring Thread Inspection
- Ship Hull Inspection
- Theme Park Rides
- Titanium Risers
- Nuclear Installations
- Tank Floor and Wall Inspections
- Outer Space Applications
- ROV Weld Inspection

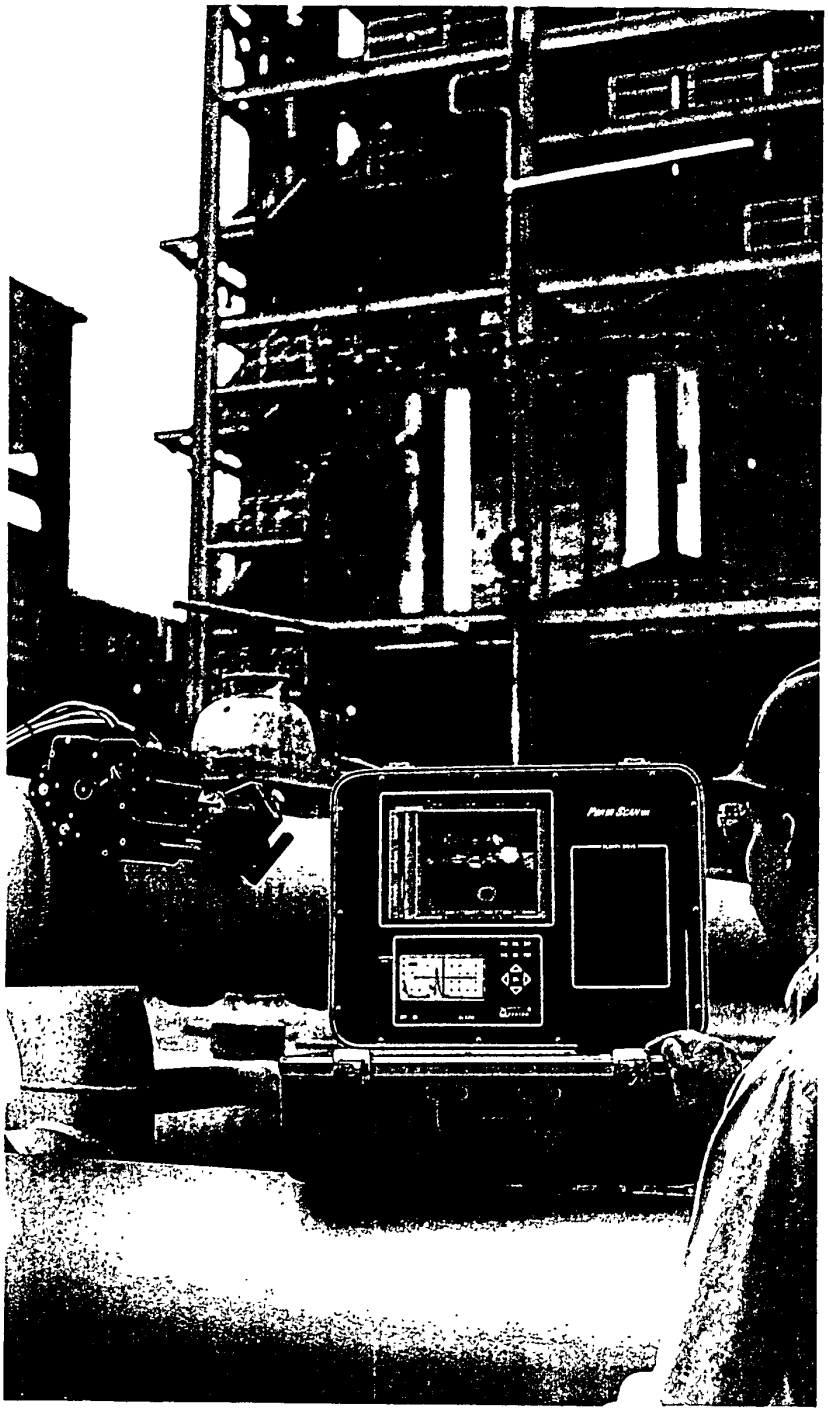
TSC INSPECTION SYSTEMS

PortaScan 007

Portable Corrosion Mapping System

Ultrasonic, Eddy Current and Bond Color Scan Imaging

PortaScan 007

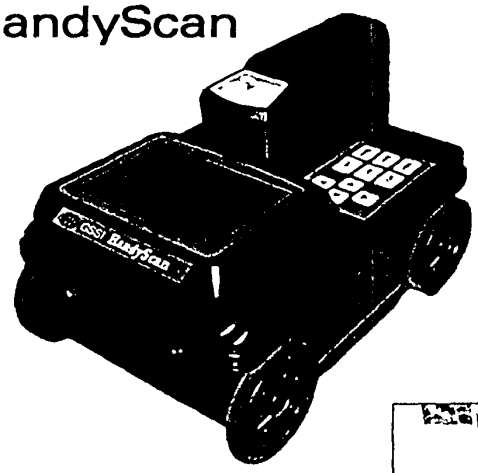


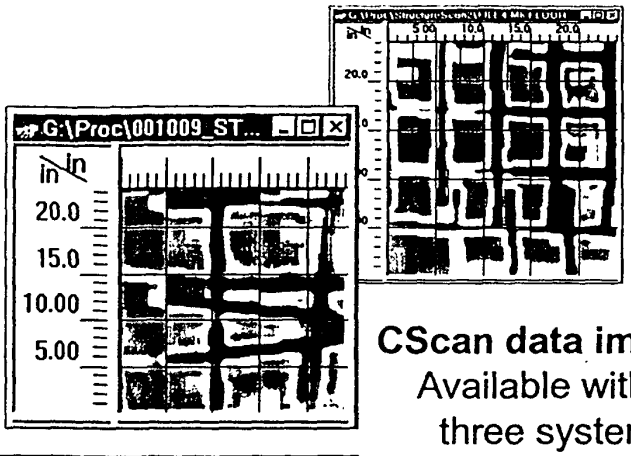
- Truly Portable & Easy to Use
- High Resolution Imaging of Ultrasonic Thickness/ Amplitude Data
- Optional Automatic or Manual Scanners
- Non Invasive
- Non Destructive
- Scan Flat, Curved and Moderately Irregular Material
- Eddy Current Phase Plane Analysis (Optional)
- Mechanical Impedance Plane Bond Analysis (Optional)
- Detect Pitting, Corrosion, Laminations, Cracks
- Thru Paint and Coating Measurement Capability

NDT Systems, Inc.
Worldwide Excellence In Ultrasonics

Concrete NDT Market

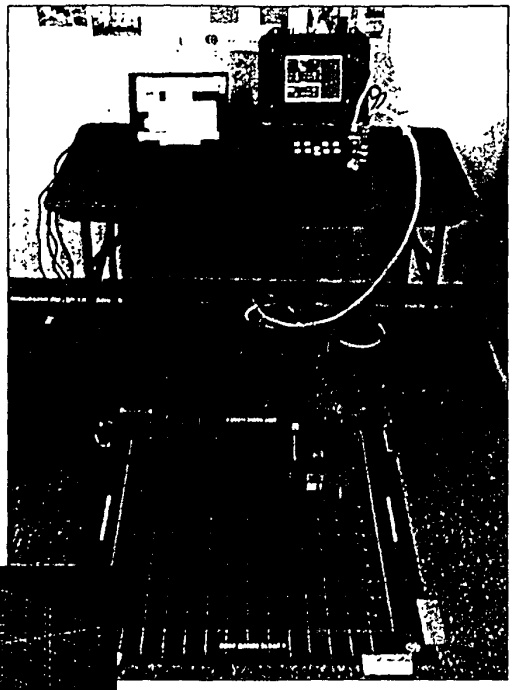
HandyScan

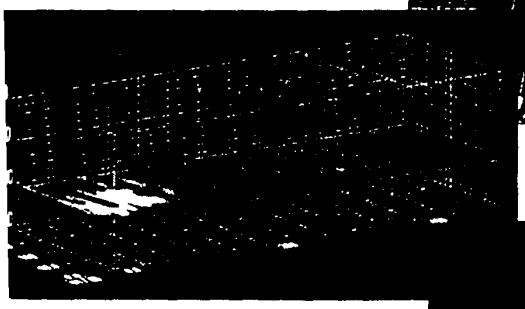


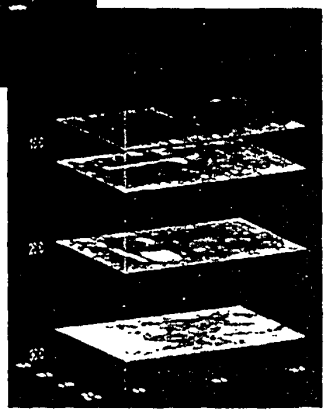


CScan data images:
Available with all three systems

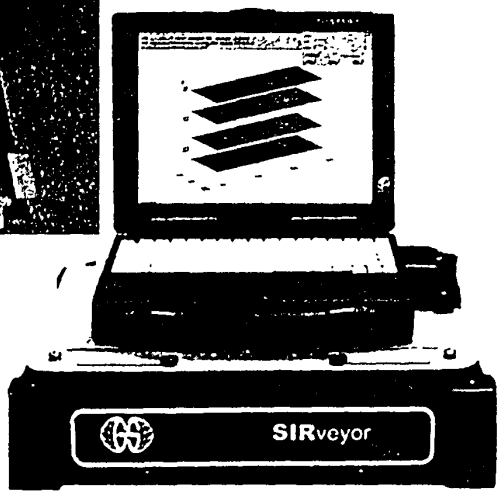
StructureScanII







3D QuickDraw data images:
Available with all systems



StructureScan III

Geophysical Survey Systems, Inc.
13 Klein Drive, PO Box 97
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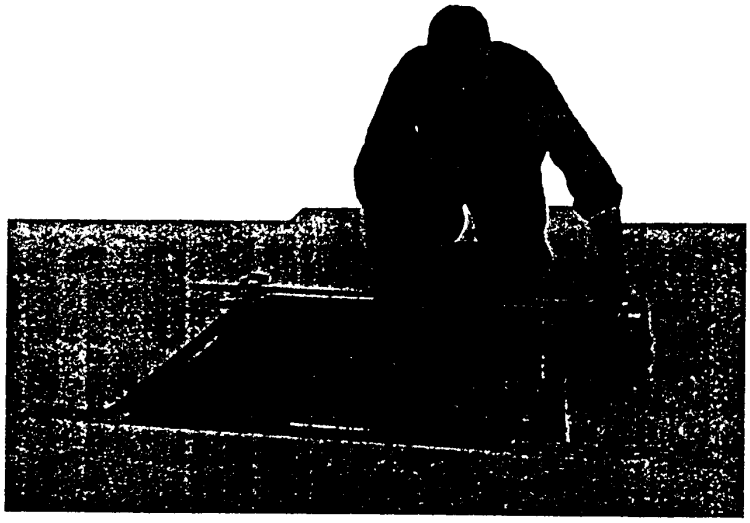
www.Geophysical.com

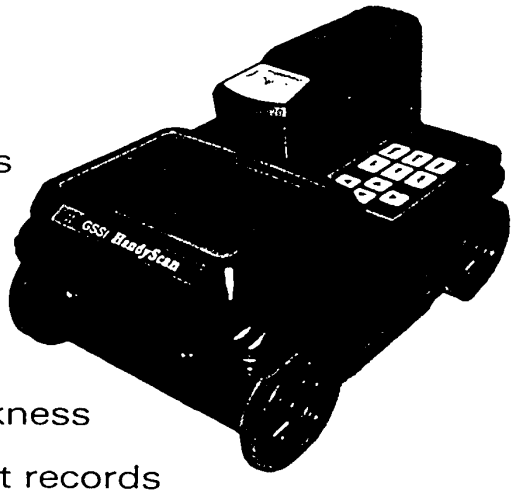
HandyScan from GSSI



First All-In-One GPR system for use in the repair and maintenance of concrete buildings and structures

Lowest cost GPR system

Main display and antenna are combined in a single unit for easy one-handed operation.



- Detects wire mesh, rebar, and pipes (metal and fluid-filled PVC)
- Depth of penetration 1/4" to 8"
- Collects 50 feet of information
- Measure asphalt and concrete thickness
- Download data to PC for permanent records
- Numerous Quality Assurance uses
- Obtain C-Scan (3D) image with optional software

We Provide Complete Survey Solutions

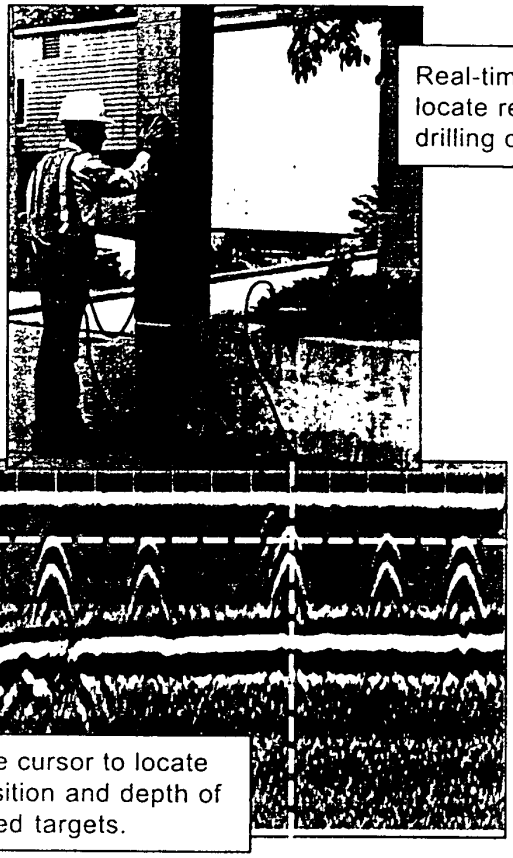
Information People Can Use

Geophysical Survey Systems, Inc.

StructureScan Applications

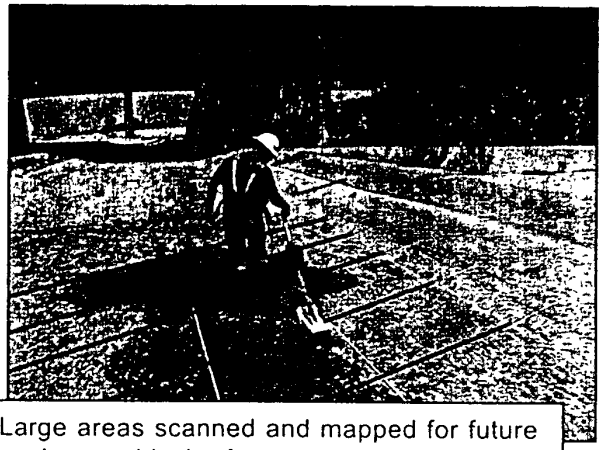
From small to large areas, StructureScan is your choice for real-time target location

- Digitally archived survey grid data
- Post-processing for concrete condition assessment or very detailed inspections



Use the cursor to locate the position and depth of identified targets.

Real-time scanning over small areas to quickly locate rebars, conduits or tension cables before drilling or boring.

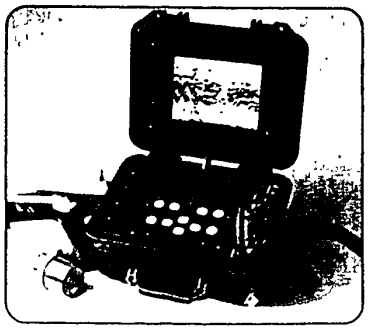


Large areas scanned and mapped for future work or archival reference. Locate targets with respect to known reference points on a survey grid.

Configuration

StructureScan is a complete system configured for indoor or portable use with a variety of power supply options.

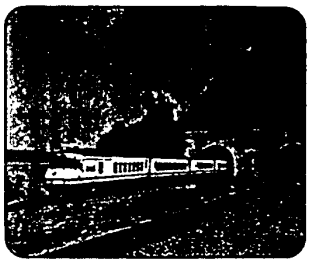
- 110AC to 12DC power supply converter for indoor use
- 12VDC adapter cables for lighter or clips to a battery
- 12VDC (2) batteries with cables
- Battery charger
- Data collection unit
- 1.5 GHz data collection antenna
- Encoded survey wheel with handle



Geophysical Survey Systems, Inc.

StructureScan

by GSSI



Tunnels

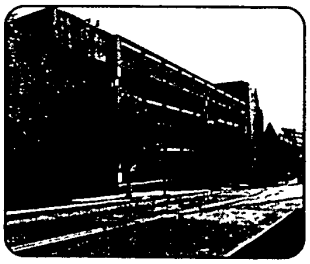
Balconies

Walls/Floors

The latest application of our subsurface radar to non-destructively inspect the interior of concrete structures.

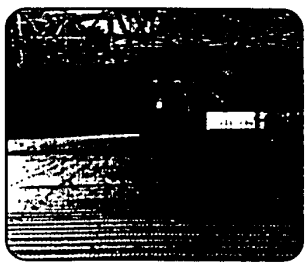
Finally, a quick, easy, safe and effective way to locate buried obstructions in concrete structures prior to drilling, boring or coring.

- Inspect walls, floors, decks, slabs, tunnels, balconies, garages.
- Locate rebar, tension cables, conduits, voids, measure slab thickness.
- Thousands of square feet of concrete can be inspected in a day.
- Locate targets to a depth of 12 inches and more.
- Detect and map the relative concrete condition for rehab planning.
- Hundreds of jobs can be stored for later processing.



Garages

Slabs/Voids



Rebar/Cables

Geophysical Survey Systems, Inc.
www.structurescan.com

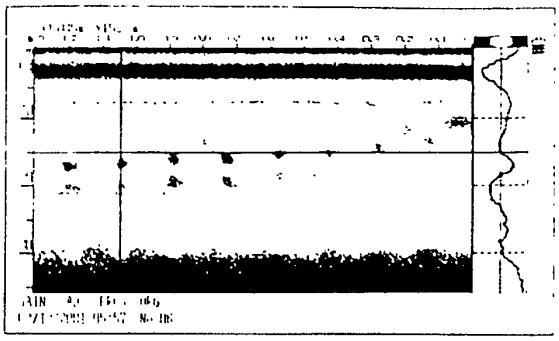
13 Klein Drive, North Salem, NH 03073-0097
Tel: (603) 893-1109 Fax: (603) 889-3984
Email: sales@geophysical.com

0010

HandyScan

Basic Model

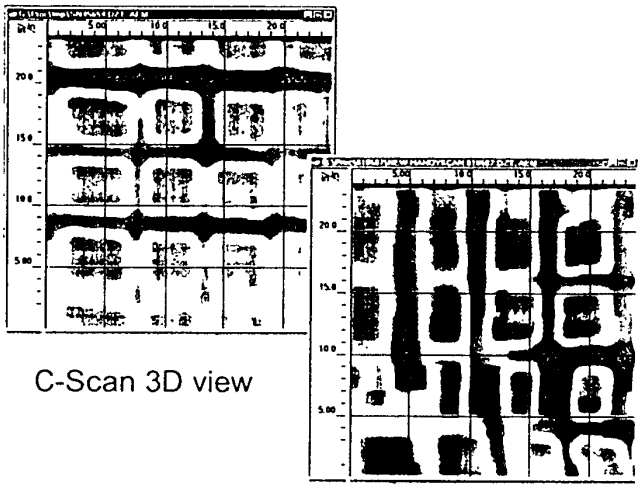
- Data collection instrument
- Carrying case
- Three batteries
- Battery charger
- Printer and cable
- Recording paper (5) rolls
- Instruction manual



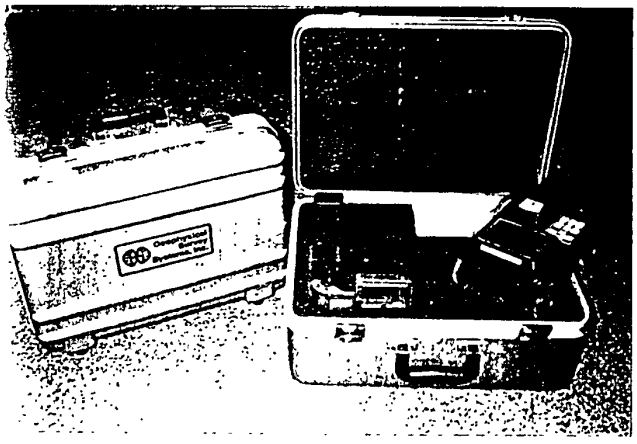
Data collected on concrete floor showing wire mesh 6" apart and 6" deep. System displays both B-Scan (left) and A-Scan (right) image of data.

Advanced Model

- All componenets included in the Basic Model, plus:
- Serial data transfer cable
- Data collection pad
- Paper pad (20 sheets)
- Post-processing software for Windows NT or 2000 (for use on customer's computer)



C-Scan 3D view



HandyScan Specifications

- Dimensions: 6" wide x 5.8" high x 8.5" long
- Weight: 2.4 lbs
- Display type: LCD, B &W with back lighting
- Battery life: 2 hours

Geophysical Survey Systems, Inc.

13 Klein Drive, PO Box 97
North Salem, NH 03073-0097
Tel: (603) 893-1109 Fax: (603) 889-3984
sales@geophysical.com
www.StructureScan.com

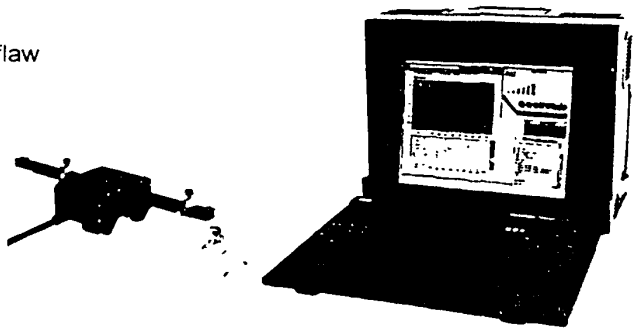
輕便型ACFM型錄
及
INOVX公司技術介紹型錄
(L.A.X)

UltraScan 3

ULTRASONIC INSPECTION AND ANALYSIS SYSTEM

FEATURES

- Portable computer for field inspection
- Windows applications with user-friendly interface
- Detect pitting, corrosion, laminations, and cracks
- Real-time A-scan display and oscilloscope display
- TOFD, A, B and C-scan mapping of corrosion and flaw
- Record A-scans for offline recreation of C-scans
- Easy data analysis and flaw sizing
- 3D display for better prospective view
- High resolution scanner for pipes and flat surfaces
- Automatic report generation with any kind of printer
- Support foreign languages other than English
- Affordable ultrasonic inspection systems
- Free one-year software upgrade
- Mouse scanner for pipe elbow and reducer scanning



DESCRIPTION

The **UltraScan 3** is an Ultrasonic Inspection and Analysis System. The system includes:

- an inspection scanner
- a portable computer which contains a pulser/receiver card and a high speed digitizer card

There are three programs for the system. The first one is for thickness mapping; the second one is for flaw mapping when the sound beam along the X axis; and the third one is also for flaw mapping when the sound beam along the Y axis. The user interface includes A-scan, B-scan, C-scan, signal scope, real time mini-scope, 3-D display, and control panel. Under the data analysis mode, one can recreate C-scan display by changing the gate settings. One A-scan can have different gate settings from others. 3D display of any C-scans can be generated by a couple of mouse clicks.

The system can generate a report with the following selections:

- A cover page including project titles and the date when the report is printed
- A table of contents which lists all the file descriptions and page numbers for each file
- Project information including project name, directory, start time, end time, and user entered project descriptions and inspection log
- All the B and C-scan maps with the user defined scales

The software is designed to simplify the operating procedures such as detecting the scanner attached to the system and set up the parameters automatically.

A special file is provided to translate all the text to a language other than English if the language is supported by MS Windows so that all the displays and dialog boxes show the language that the user is familiar with.

HS212 and HS226 are X-Y coordinate scanners which can be used to inspect flat surfaces as well as pipes. The minimum diameter of pipe could be as small as 2 inches, and 0.5 inches with add-on wheels. Their magnetic wheels are ideal for quick setup on steel materials. Our optional scanner tracks can be used to inspect non-magnetic materials by using four suction cups to attach to the test materials.

Although HS100 is a single axis scanner, it also can be to used to generate C-scan map with the help of the software.

Other accessories include coupling kit and long cables. The coupling kit consists of water compressor bottle, tubing, a Y connector, and a flow control valve. The 100-foot and 200-foot cables are built with differential line drivers and receivers which ensure the encoder signal travel long distance without losing any information.

(Continued...)

US Ultratek, Inc.
Head Office:
2073 Rapallo Way, Bay Point, CA 94565
(925)-458-8078 • Fax: (925)-458-2057
E-mail: sales@usUltratek.com • Web: usUltratek.com

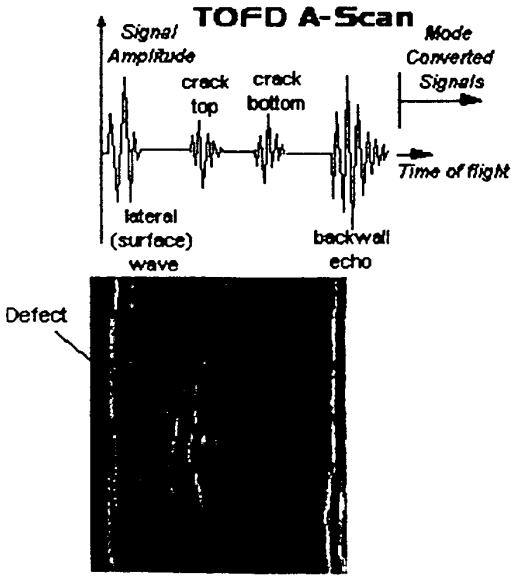
Los Angeles Branch: 1327 Spruce Tree Drive
Diamond Bar, CA 91765
(909)-396-4525 Email: dwang@usUltratek.com

UltraScan 3

ULTRASONIC INSPECTION AND ANALYSIS SYSTEM

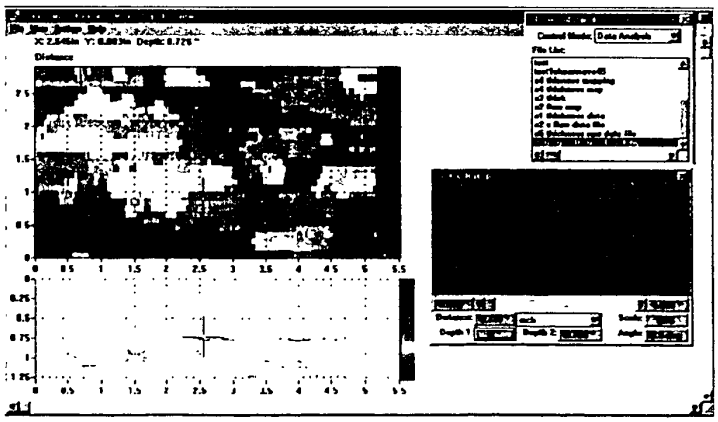
SPECIFICATIONS

Computer	550MHz Pentium III or better 64 MB RAM 6 GB Hard Disk Built-in CD-ROM Drive 800 x 600 Display or better True color TFT Display Connector for external monitor Input: 100/220VAC 50/60 Hz
Maximum C-scan Data Point	Thickness Map: 4,175,000 Flaw Map: 835,000 up to 10 flaws per data point
Sampling Rate	100, 50, 25, 12.5, 6.25, 3.125, 1.5625 MHz, or external clock
Data Resolution	9 bits
Samples	8K samples (0 to 9.5" in steel) or 128K samples (0 to 163" in steel)
A/D Input Range	±1V
Scanner Resolution	**HS212 and HS226** X Axis: 0.002685 inch (0.0682 mm) Y Axis: 0.004027 inch (0.10228 mm) **HS100** (muse scanner) 0.00314nch (0.08 mm)
Scan Range	**HS212:** 8" × 2815' (200 mm × 858 m) **HS226:** 22" ×2815' (560 mm × 858 m) **HS100** (muse scanner): 82,943" (2096 m)
Test Pipe Diameter	HS212 and HS226: ≥2" (50 mm) ≥0.5" (13 mm) with add-on wheels
Options	Coupling kit 100' long cable 200' long cable Add-on wheels for small diameter pipe Scanner tracks Mouse scanner for elbow & reducer



TOFD Scan of Butt Weld and Defect

Corrosion Mapping / HIC Inspection
A, B, and C scan



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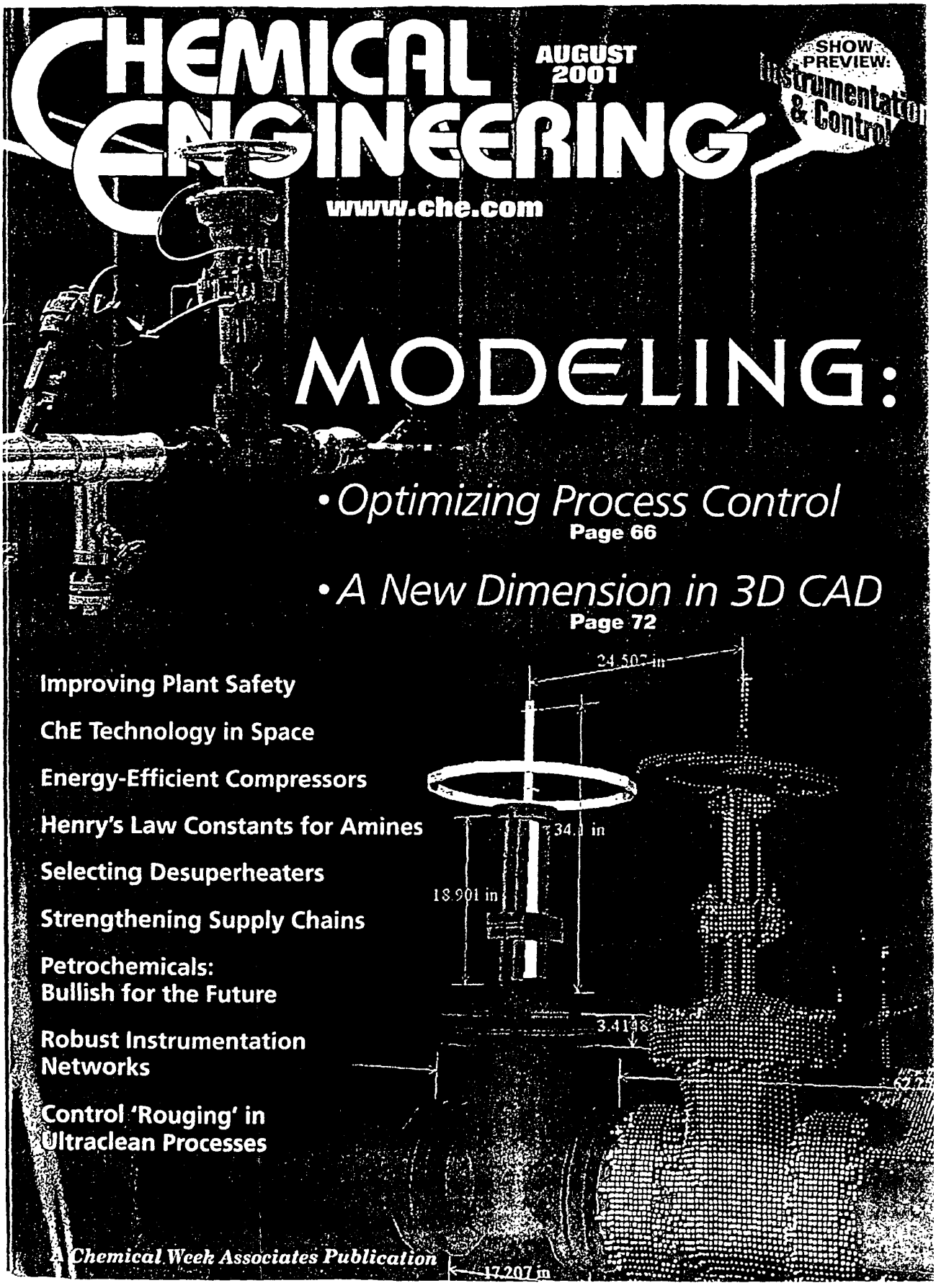
Head Office:
2073 Rapallo Way, Bay Point, CA 94565
(925)-458-8078 • Fax: (925)-458-2057
E-mail: sales@usUltratek.com • Web: usUltratek.com

Los Angeles Branch: 1327 Spruce Tree Drive
Diamond Bar, CA 91765
(909)-396-4525 Email: dwang@usUltratek.com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)W KnowledgeLINx WORKS

/hat is an INOVx Physical Database?

3D CAD model

3D laser scans

Stereo photos

Plant coordinate data

Engineering specifications

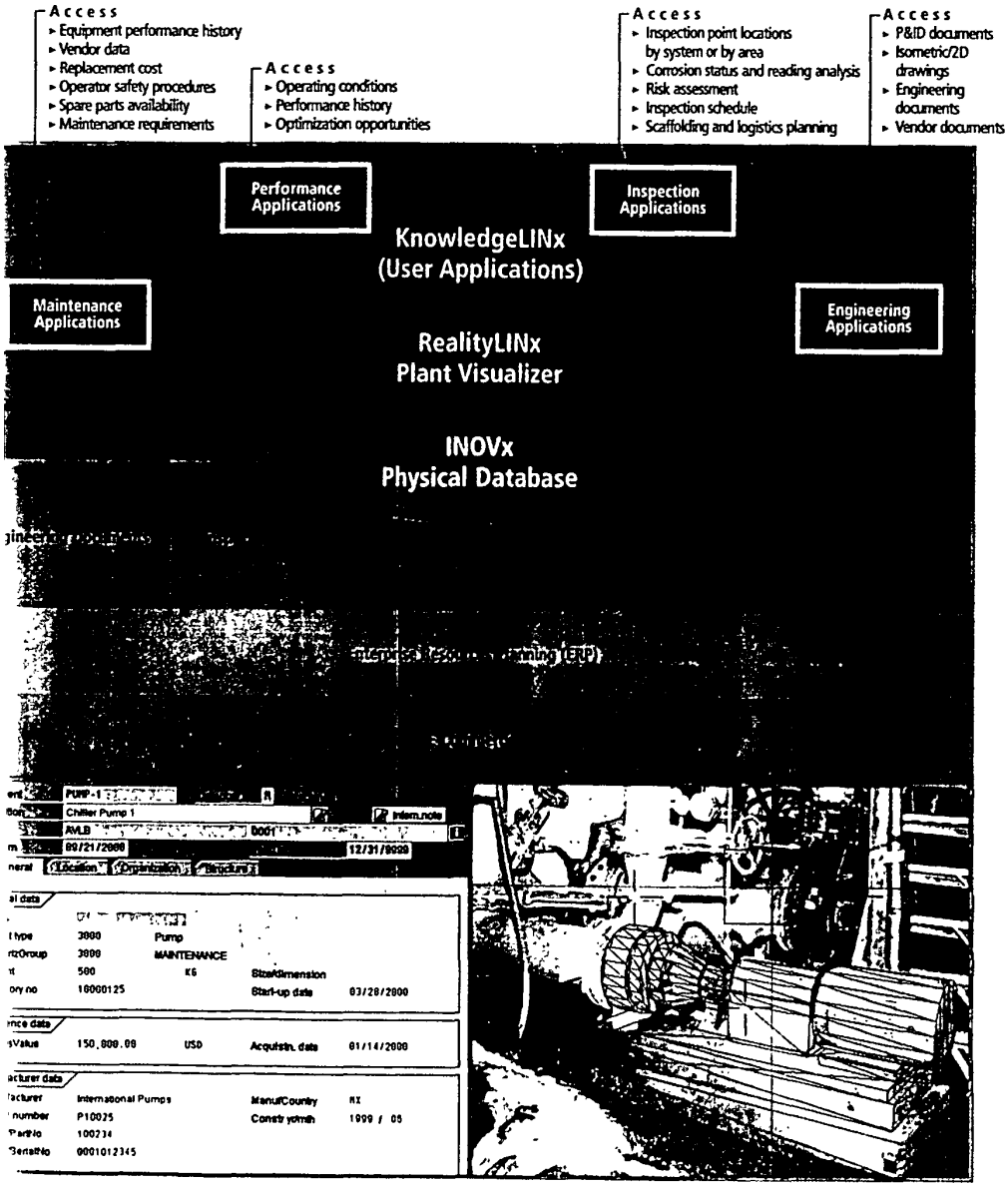
'e RealityLINx data sheet for more information)

Integration Methodology

INOVx has worked closely with industry partners to define the most effective interfaces required by our clients in the areas of engineering, operations, inspection, and maintenance. These interfaces are built directly into the KnowledgeLINx modules for simple integration with RealityLINx and the Physical Database. Integration is accomplished using industry standard connectivity methods including ODBC, OLE DB and RFC.

Integrated Electronic Database for Your Plant

KnowledgeLINx provides plant engineers and managers with an integrated environment to access plant data more quickly and to find accurate information.



ided Minimum System for KnowledgeLINx: Windows NT/2000 • Pentium II, 300 MHz • 128 MB RAM • 8MB AGP Graphics Card

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INOVx Solutions

Toll Free: 1 877 99 INOVx

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e scalable 3-D models of existing facilities

Providing

3-D CAD models

that are affordable,

accurate and

easily accessible

3-D PLantLINx provides the services and software tools required to generate accurate 3-D CAD models of existing plants utilizing the RealityLINx Database.

Totally scalable, the level of details in a 3-D PLantLINx model can be tailored to meet the specific needs of the client. This "fit for purpose" solution allows the creation of cost effective 3-D models that range in complexity from conceptual to fully-detailed.

Benefits

Affordable

3-D PlantLINx is cost-effective, making 3-D modeling financially feasible for revamp and retrofit projects.

Scalable

Plant owners can select the level of 3-D model complexity required for a specific project.

Ongoing uses

With this affordable solution, 3-D models can be employed to facilitate overall plant operations including maintenance and inspections.

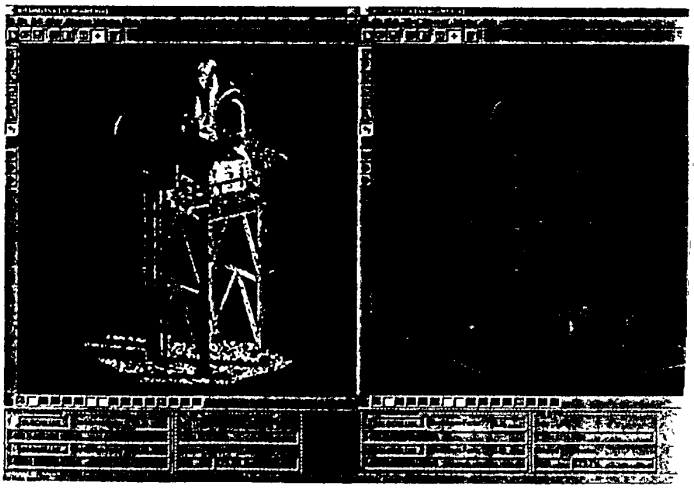
Compatible

3-D PlantLINx models are fully compatible with all major 3-D CAD systems.

3-D Model Options

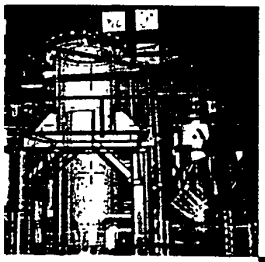
Conceptual Model

Used for front end studies in the earliest stages of a revamp or retrofit project. It includes modeling of all equipment and the basic civil, structural and electrical elements. With the 3-D PlantLINx Visualizer, this model can be used in conjunction with photogrammetry stereo photos and laser-scanned clouds of points to access plant details.



Simple Revamp Model

A level above the conceptual 3-D model. The tie-ins for a revamp project are identified and the basic 3-D model is developed in the vicinity of each tie-in point.



Major Revamp Model

A full 3-D model representation of the RealityLINx Database (physical database).

Intelligent Model

The 3-D model is converted from a graphical representation to a specification driven 3-D model.