

Evaluation of the Turkey-Germany Project "1988-1996: Establishment of Welding Technology and NDT Center at METU" Status after 25 Years

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Abstract. Welding Technology and Non-Destructive Testing Research/Application Center (WTNDDT) takes its legal entity from the Middle East Technical University (METU, Ankara), and it is directly administered by the Office of the President. WTNDDT was founded within the frame of a bilateral project between Turkish and German governments. BAM-Berlin, DGZfP and SLV-München have actively contributed to this project between 1988 and 1996 by training the Turkish group and sending short- and long-term German experts. Since 1988 METU has played an important role in the training and certification of level 1 and 2 NDT experts, welders and welding engineers; and has also contributed to Turkish industry for effective utilization of NDT and welding techniques. This paper presents a 25-year overview of the historical development and the contributions of this Center.

1. History

The Welding Technology and Non-Destructive Testing Center (WTNDDT) was founded as part of a technical cooperation project between Turkish and German governments at the Middle East Technical University. BAM_Berlin, DGZfP and SLV-München have actively contributed to the project between 1988 and 1996 by providing training in Germany, and sending short- and long-term German experts (Table 1 and 2). WTNDDT Center has been continuing its activities successfully without any interruption since 1988. After the retirement of the first director of the Center “Prof.Dr. Alpay Ankara”, Prof.Dr. C. Hakan Gür was appointed as the director of WTNDDT in 2007. In the last 5 years, the premises and laboratories of the Center were renovated and upgraded by the resources of the Center. A new research and development group was established in order to improve industrial relations. The Center is a full member of International Institute of Welding, Educational Institution Member of American Welding Society, and Corporate Partner of American Society for NDT. WTNDDT led the establishment of the Turkish Section of the American Society for NDT in 2008.



Table 1. Contracts and agreements (1988-1996)

27.07.1987	Letter of German Ambassador to the Foreign Ministry of TR
24.03.1988	Letter of the Foreign Minister of TR to the Ambassador of FRG
16.06.1988	Bilateral agreement between governments of FRG and TR on technical cooperation
01.07.1988	Administrative agreement between PTB and BAM
Nov./Dec. 1988	Agreement between FRG and Deutschen Technischen Akademie (DTA) Helmstedt
May 1989	Agreement between BAM and SLV in Fellbach
14.03.1990	Agreement for Establishing Cooperation between METU and DVS in Düsseldorf/BRD
August 1990	Agreement between BAM und SLV München
28.08.1990	Continuation agreement between PTB and BAM regarding initial agreement 01.07.1988
Dec. 1990	First amendment of the agreement between BAM and SLV München
Feb./March 1991	Amendment of 01.12.1988 agreement between BAM and DTA
Nov. 1991	Supplementary agreement dating 28.08.1990/15.11.1990
Jan. 1992	on administrative agreement dating 01.07.1988 between PTB and BAM
April 1993	Report on progress review of the Project on foundation of a center for welding technology and materials testing in METU
Feb/March 1994	Supplementary agreement for the time period 1994 and 1996 between PTB and BAM
17.06.1994	Contract between DGZfP Berlin and METU
October 1994	Contract between BAM and SLV Berlin

Table 2. Chronological overview of the project (1988-1996)

1988 – 1991 1st Phase	
Jan. 1987	Proposal: "Development of norms and quality control in Turkey within the framework of a bilateral technical cooperation" Physikalisch Technische Bundesanstalt (PTB) Braunschweig - Bundesanstalt für Materialforschung und -prüfung (BAM) Berlin
15.04.1987	Agreement: PTB Braunschweig & Bundesministerium für technische Zusammenarbeit
Feb. 1988	First NDT course in Ankara (<i>before beginning of the project</i>)
25.05.1988	Publication of agreements of German and Turkish Ambassadors in the Official Gazette)
July 1988	Beginning of the project
Nov. 1988	The first long-term expert from Germany in Ankara
Nov. 1988	Agreement between BAM and DTA
May 1989	Protocol between BAM and SLV-Fellbach
Jan. 1989	Beginning of equipment delivery
July 1989	Completion of the first welding hall
Sept. 1989	The first Turkish NDT trainee group in Germany
March 1990	Protocol between METU and DVS
March 1990	Beginning of Welding Teacher Course in Ankara
Apr. 1990	The first Turkish NDT trainee group having their first NDT certificates
Apr. 1990	The first Turkish welding trainee group in Germany
Aug. 1990	Protocol between BAM and SLV-München
Nov. 1990	The first Turkish group having the welding engineer diploma
1991 – 1993 2nd Phase	
Jan. 1991	Delivery of mobile NDT laboratory van
May 1992	Beginning of the first IWE (International Welding Engineer) course in Turkey
Jan. 1992	Examination of the first Welding Teachers trained in Turkey
June 1992	Opening ceremony of x-ray shelter for high radiation
Sept. 1992	Completion of the second welding hall
Apr. 1993	Evaluation of the project
July 1993	(ZOPP) Goal Oriented Project Planning seminar in Ankara
1994 – 1996 Follow-up (monitoring) phase	
Feb. 1994	Continuation agreement for the follow-up phase of the project
June 1994	Protocol between METU and DGZfP
Feb. 1995	First independent NDT course at METU
Nov. 1996	Accreditation of NDT Lab. and Hardness Test Lab. by German Accreditation Body
Nov. 1996	First independent IWE course at METU

Table 3. Short- and long-term German experts contributing to the project in the NDT field

DGZfP		
Long Term Experts	1988-90 1991-93	Friedrich Mischke (24 months at METU) Dieter Janke (30 months at METU)
Short Term Experts	1988-96	Pfister, Hildmann, Berg, Semienuk, Sy, Schur, Niehus, Luckow, Lutz, Schulz, Dr. Pohl, Dr. Schmidt, R. Holstein
BAM - Berlin		
Short Term Experts	1988-96	Prof.Dr. D. Schnitger, Dr. Steffen, Dr. Erhard, Dr. Thiele, E. Nabel, Malitte, Stadthaus, Lehmann

Table 4. Short- and long-term German welding experts contributing to the project

Long Term Experts	Zwicker - SLV Fellbach (1989-90, 12 months at METU) Greiner - SLV München (1990-93, 36 months at METU) Dr. D. Paulinus – SLV Berlin (1994-96, 11 months at METU, intermittent)
BAM - Berlin	Dr. Florian, Fichter, Noack, Grewe
SLV München	Prof.Dr. Böhme, Dr. Welz, Wackerbauer, Pupp, Kleinert, Weinhhammer

Table 5. The Turkish group trained and certified in Germany (1988-1996)

Surname, Name	Affiliation	Period of stay in Germany (months)	Qualification
GÜR, C. Hakan	METU ¹	21	ZU, ZR, ZE, ZM
DOYUM, A. Bülent	METU ¹	12	ZU, ZR, ZE, ZM
DOYUM (EMREN), Birnur	METU ²	23	ZU, ZR, ZM, ZE
AYGÜN, Hacer	METU ³	26	ZU, ZR, ZM, ZE
YILMAZ, Ertugrul	METU ⁴	15	ZU, ZR, ZE, ZM, ZW
GÜNGÖR (DIKMEN), Deniz	METU ⁵	21	ZU, ZR, ZM, ZR, ZW
FILIZ, Zafer	METU ¹	24	SFI
TANSAL, Mehmet	METU ¹	23	SFI
BATIGÜN, Caner	METU ¹	22	SFI
GENIS, Kadir	METU ³	23	SFI
AKCAM, I. Özgür	METU ⁴	17	SFI
ADIGÜZEL, Ayfer	Industry	15	ZU, ZR, ZM, ZE
AKYÜZ, Serdar	Industry	17	ZU, ZR, ZE, ZM
GÜMRÜKCÜOĞLU, Murat	Industry	17	ZU, ZR, ZE, ZM
BINGÖLDAG, Murat	Industry	15	ZE, ZM
MAHMUTYAZICIOĞLU, Neslihan	Industry	15	ZU, ZR, ZE, ZM, ZW

¹⁾ Still at METU; ²⁾In pension; ³⁾Working in industry; ⁴⁾Established own company; ⁵⁾Changed the field

Following a cooperation period with Chamber of Metallurgical Engineers, METU established its own Personnel Certification Center “METU NDT Personnel Certification Center” in 2002 which is independent from NDT training activities; and started to give its own certificates instead of DGZfP certificates. METU-NDT Personnel certification Center was accredited by Turkish Accreditation Council (TÜRKAK) in November 2004. At the end of 2010, steel and aluminum welder certification schemes were added to the personnel certification system; and it was re-accredited in May 2011 with his new name and scope “**METU - Welding and NDT Personnel Certification Center**”. Today, it acts as an accredited personnel certification body (AB-0002-P, Rev.08) according to EN ISO/IEC 17024, EN ISO 9712 (UT, RT, MT, PT, VT level 1 and 2), EN ISO 9606-1 (steel welder), and EN ISO 9606-2 (aluminum welder). Currently, the director of the Personnel Certification Center is Prof.Dr. Bülent Doyum, and Vice Director is Dr. Caner Batıgün.

2. PRESENT SITUATION

The organization chart of the Center is given in Figure 1. Today the Center continues its activities successfully in the following issues:

- Training and certification: International Welding Engineer/ Technologist/ Specialist/Practitioner; Welders and welding operators; NDT operators (according to EN ISO 9712 and ASNT SNT-TC-1A);
- Mechanical tests and Non-Destructive tests for industry;
- Failure analysis;
- Research studies (MS and PhD studies) and industrial projects.

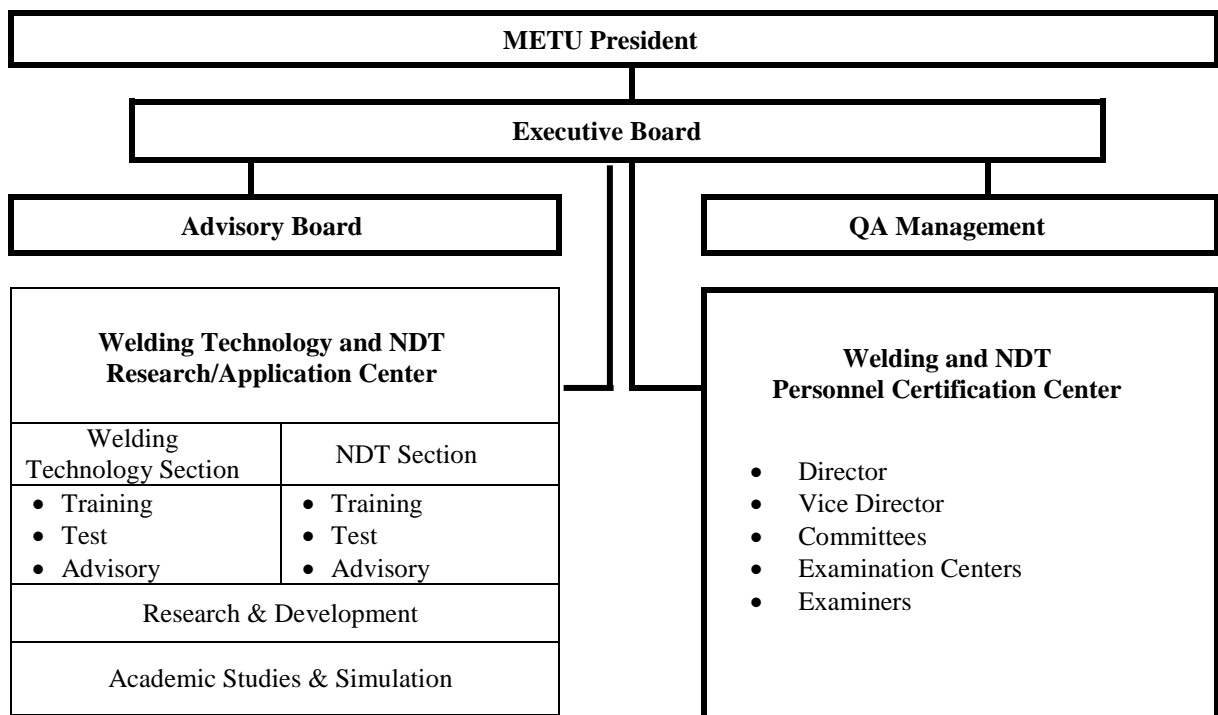


Figure 1. Organization chart

2.1 Training and Certification

More than 200 NDT courses have been organized with more than 2,400 participants (Figure 2 and Figure 4).

More than 1,100 international welding engineers and 4,500 welders have been trained and certified. WTNDT acted as the recognized ATB and examination center of GSI-SLV Munich. After recognition of Turkish ANB (ANB-TR) by IIW, WTNDT started to give IWE diploma through ANB-TR since April 2011 (Figure 3).

WTNDT gives laboratory support for the welding and NDT undergraduate and graduate courses in the departments of Metallurgical and Materials Eng. and Mechanical Eng. at METU. More than 30 MSc and PhD theses (Table 6) on welding and NDT have been completed; the total number of publications in journals and conferences is about 60.

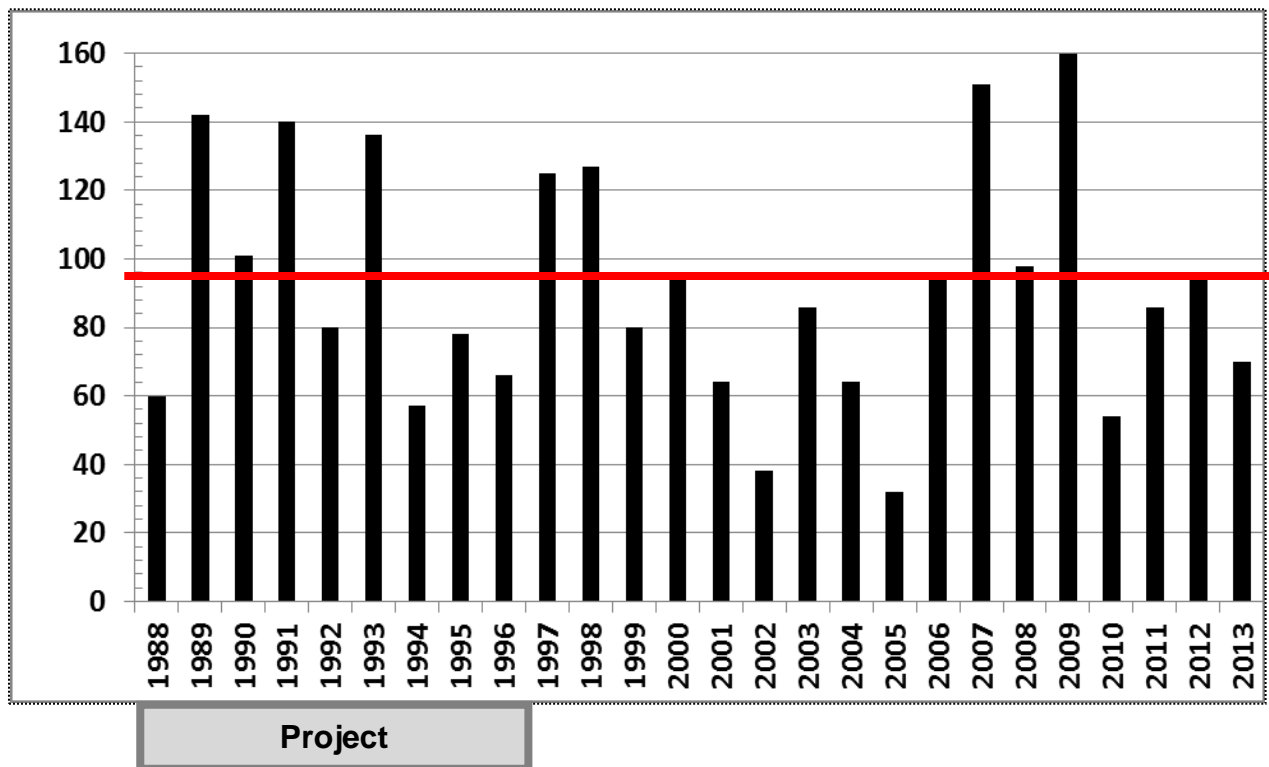


Figure 2. NDT courses at METU (1988-2013)
 Total number of participants = 2380; General average = 92 participants/year
 Average of last 5 years = 93 participants/year

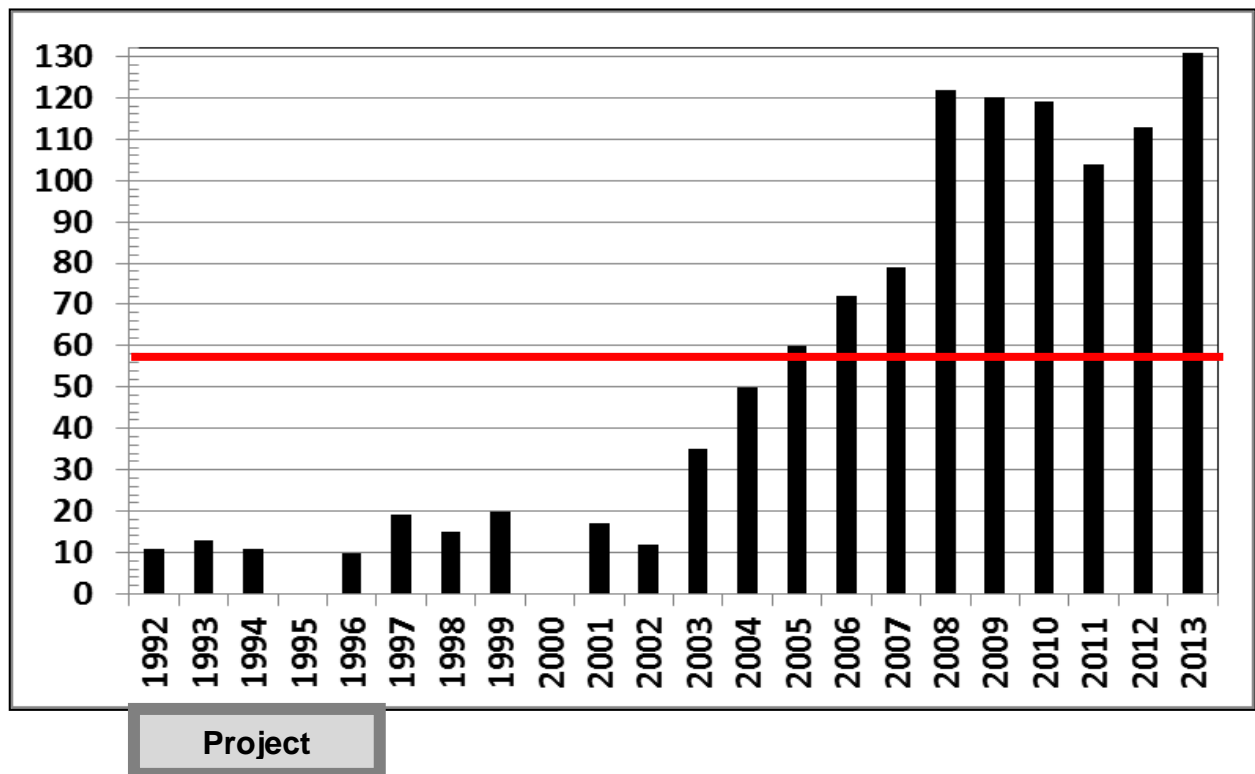


Figure 3. International Welding Engineer courses at METU (1992-2013)
 Total number of participants = 1133; General average = 57 participants/year
 Average of last 5 years = 117 participants/year

Table 6. Welding and NDT related MSc. and PhD. Theses finished at METU

2013	Kinetics and Microstructural Analysis of Fatigue Fracture Progress in Weld Joints of DSS Grade 2205, K. Yurtışık
	Prediction of Crystallographic Texture & Magnetic Anisotropy in Cold Rolled Steels, Ü. Akçaoğlu
2012	Microstructural & Mechanical Characterization of Duplex Stainless Steel Grade 2205 Joined by Hybrid Plasma & Gas Metal Arc Welding, B. Tolungüç
2011	Effect of welding parameters on the hot cracking behavior of 7039 aluminum - zinc alloy, M. Akkus
	Microstructural and mechanical characterization of metal active gas welded joint between cast iron and low carbon steel, M.T. Ertürk
2010	Monitoring Variation of Surface Residual Stresses in the Shot-Peened Steel Components by Magnetic Barkhausen Noise Method, S. Savaş
2009	Determination of Residual Stress State in Steel Weldments, H. I. Yelbay
	Characterization of Ultra-Fine Grained Steel Samples Produced by High Pressure Torsion via Magnetic Barkhausen Noise Analysis, S. Bayramoğlu
	Effect of filler material on hot cracking susceptibility of 5XXX series Al-Mg alloys, S. Tirkeş
2006	Effect of Welding Parameters on the Susceptibility to Hydrogen Cracking in Line Pipe Steels in Sour Environment, Ö.Yavaş
	Estimation of Heights of Surface Breaking Cracks Using Ultrasonic Timing Methods, E.Öztürk
	Characterization of Steel Microstructures by Magnetic Barkhausen Noise Analysis, K.Davut
	Characterization of Dual Phase Steels by Using Magnetic Barkhausen Noise Analysis, M.Kaplan
	Microstructural Characterization of Hypoeutectoid Steels Quenched from Ae1-Ae3 Intercritical Temperature Range by Magnetic Barkhausen Noise Technique, B.Boyacıoğlu
2005	Effect of Surface Roughness on Ultrasonic Testing, U.İşleyici
	Determination of Welding Parameter dependent Hot Cracking Susceptibility of 5086-H32 Aluminum Alloy with the Use of MVT Method, PhD, C.Batıgün
2004	Computerized Test Procedure for Industrial Radiographic Examination of Metallic Welded Joints, E.E.Güneş
	Effect of Spheroidizing on Machinability Characteristics & Microstructure of Medium-C Steels, E.Yanardağ
	Determination of Relationship between Weld Quality & Mechanical Strength in Different Steels, O.A. Soyulu
2003	Effect of Gap Distance on the Mechanical Properties and Cross-Sectional Characteristics of the MIG-MAG Butt Welds, İ.Kaşıkcı
	Detection and Monitoring of Surface-Breaking Fatigue Cracks in Al 2024-T3 by Ultrasonic Methods, F. Sonat
	Effect of Solid Couplants Made of Hydrophilic Polymers in Ultrasonic Testing, M.İ.Çetin
	Defect Assessment of Spot Welds by NDI, O.O.Koçak
2002	Correlation between Ultrasonic Properties and Heat Treatment Conditions for Some Steels, C.V.Bozay
	Investigation of Effect of Titania Additions on the Strength and Elastic Modulus of a Mica Glass Ceramic by Bending Test & Ultrasonic Velocity Measurements, A.Dereli
	Computer Modelling for Propagation of Ultrasonic Waves in Solid Polycrystalline Structures, O.Kolankaya
	ND Investigation of Age Hardening of Al-alloys by Sound Velocity and Conductivity Measurements, İ.Yıldız
	Microstructural Characterization of Isothermally Heat Treated Steels by Ultrasonics, B.O.Tuncer
Effect of Microstructure & Hardness on Acoustic Properties of Hypoeutectoid Plain-C Steels, Y.Keleş	
2000	Determination of Graphite Morphology, Nodularity and Matrix in Nodular Cast Irons by Ultrasonic Techniques, B.Aydınmakina
	Determination of Microstructural Properties of PM Al-SiC Composites by Ultrasonic Techniques, E.Ataş
1999	Determination of Hot Cracking Susceptibilities of As-Kaynak Welding Consumables for Austenitic Stainless Steels with MVT Test, H.Enginar
1998	Determination of Spot Welding Parameters of Thick, Heat-Treated SAE 4140 Parts, A.B.Tandoğan
	Manufacture of Special Purpose Ultrasonic Probes, İ. G. Yüksel Ultrasonic Examination of Composite Materials by C-Scan Technique, M. Korkmaz
1997	Nondestructive Inspection of Honeycomb Helicopter Panels, M. Dürer
	Characterization of Directivity Patterns of Ultrasonic Nondestructive Testing Probes, C. Gürkan
1994	Optimization of Laser Beam Welding of Un- and High-Alloyed Steel Sheets, C.Batıgün
	Parameter Optimization in MIG/MAG Welding Processes, F.Raoufi
1993	Determination of Hot Crack Susceptibility of Welding Fillers with Longitudinal Bending Test, K.Geniş



Figure 4. Views from NDT laboratories at METU

2.2 Current Research Studies

Current research topics include phased array applications in steels and composites; non-destructive material characterization and residual stress measurements; hybrid plasma arc welding; friction stir welding; finite element simulation of welding using SYSWELD.

3. Conclusion

The METU - Welding Technology and Non-Destructive Testing Center was founded as part of a technical cooperation project between Turkish and German governments. BAM-Berlin, DGZfP and SLV-München contributed to this project between 1988 and 1996. The Center has been continuing its activities successfully without any interruption since 1988. METU has played an important role in the training and certification of level 1 and 2 NDT experts, welders and welding engineers. The Center has also contributed to Turkish industry for effective utilization of NDT and welding techniques. Today the Center is active in training and certification according to EN ISO 9712 and ASNT SNT-TC-1A; mechanical weld tests, non-destructive tests and failure analysis for industry; research activities (MS and PhD studies) and industrial projects.

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