

35th Anniversary of the German-Turkish Project (1988-1996) for Establishment of Welding Technology and Nondestructive Testing Research and Application Center

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Abstract. The Welding Technology and NDT Research/Application Center (WTNDT) was established via a bilateral project between Turkey and Germany (1988-1996). It takes its legal entity from the Middle East Technical University (METU, Ankara). BAM-Berlin, DGZfP, and SLV actively participated in the project by providing training in Germany and sending short- and long-term German experts to METU. Since 1988, WTNDT has contributed to the Turkish industry in the training and certification of NDT experts, welders, and welding engineers, as well as in the application of NDT and welding techniques, and academia through MSc and Ph.D. theses, and research studies. This paper presents a 35-year history of this Center.

1. Introduction

The Welding Technology and NDT Research/Application Center (WTNDT) was founded within the frame of a bilateral project between the Turkish and German governments. Germany actively contributed to this project between 1988 and 1996 by providing training and sending short- and long-term experts. The project is summarized in Table 1 to Table 4. The Federal Ministry for Economic Cooperation and Development (BMZ, Germany) granted 10.5 Mio DM. About 50% of this sum was invested in the equipment of the workshops and laboratories while the remaining was invested in the specialized continued education of collaborators of METU and the Turkish industry. 20 staff from METU and from industrial partners was trained (290 months in total), qualified, and certified in non-destructive testing and welding technology in Germany. The Chamber of Metallurgical Engineers and the Chamber of Mechanical Engineers were among the partners in Türkiye.

WTNDT takes its legal entity from the Middle East Technical University (METU), and it is directly administered by the Office of the President. Since 1988 METU has been making very important contributions to the Turkish industry in the training and certification of NDT experts and welding engineers, and also, for the application of NDT and welding techniques. The total number of participants in the NDT courses is about 3,850, and about 2,200 in the international welding engineer courses.



Table 1. Contracts and agreements (1988-1996)

27.07.1987	Letter of German Ambassador to the Foreign Ministry of Turkish Republic
24.03.1988	Letter of the Foreign Minister of TR to the Ambassador of Federal Republic of Germany
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 GmbH (DTA) Helmstedt
May 1989	Agreement between BAM-Berlin and SLV-Fellbach
14.03.1990	Agreement for Establishing Cooperation between METU and DVS in Düsseldorf/BRD
Aug. 1990	Agreement between BAM und SLV München
28.08.1990	Continuation agreement between PTB and BAM regarding initial agreement dating 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 Jan. 1992	Supplementary agreement dating 28.08.1990/15.11.1990 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 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" PTB-Braunschweig, BAM-Berlin
15 Apr.1987	Agreement: PTB Braunschweig & Bundesministerium für technische Zusammenarbeit
Feb. 1988	First NDT course in Ankara (<i>before beginning of the project</i>)
25 May 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	GOPP- 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.
Nov. 1996	First independent IWE course at METU

Table 3. The German experts contributing to the project (1988-1996)

Long Term Experts	
NDT	Friedrich Mischke - DGZfP (1988-90, 24 months at METU) Dieter Janke - DGZfP (1991-93, 30 months at METU)
Welding	Zwicker - SLV Fellbach (1989-90, 12 months at METU) F. Greiner - SLV Munich (1990-93, 36 months at METU)
Short Term Experts	
DGZfP	Dr. Pohl, Dr. Schmidt, R. Holstein, W. Pfister, L. Semienuk, Sy, F. Schur, Hildmann, Berg, Niehus, Luckow, Lutz, E. Schulz,
BAM-Berlin	NDT: Prof.Dr. D. Schnitger, Dr. A. Erhard, Dr. Steffen, Dr. J. Thiele, E. Nabel, Malitte, M. Stadthaus Welding: Prof.Dr. Krause, Dr. F. Florian, Fichter, Noack, Grewe
SLV-Münich/Halle	Prof.Dr. D. Böhme, Prof.Dr. D. Paulinus, Dr. Welz, G. Wackerbauer, W. Pupp, Kleinert, G. Weinhhammer

Table 4. The Turkish group trained and certified in Germany (1988-1996)

Surname, Name	Affiliation	Period of stay in Germany (months)	Qualification
Adigüzel, Ayfer	Industry ⁵	15	UT3, RT3, MT3, PT3
Akçam, I. Özgür	METU ⁴	17	SFI (IWE)
Akyüz, Serdar	Industry	17	UT3, RT3, PT3, MT3
Aygün, Hacer	METU ³	26	UT3, RT3 MT3, PT3
Batigün, Caner	METU ¹	22	SFI (IWE)
Bingöldag, Murat	Industry	15	PT3, MT3
Doyum, A. Bülent	METU ²	12	UT3, RT3, PT3, MT3
Doyum (Emren), Birnur	METU ²	23	UT3, RT3, MT3, PT3
Filiz, Zafer	METU ¹	24	SFI (IWE)
Geniş, Kadir	METU ³	23	SFI (IWE)
Gümrükçüoğlu, Murat	Industry	17	UT3, RT3, PT3, MT3
Güngör (Dikmen), Deniz	METU ⁵	21	UT3, RT3, MT3, RT3, ET3
Gür, C. Hakan	METU ¹	21	UT3, RT3, PT3, MT3
Mahmutyazicioglu, Neslihan	Industry ⁴	15	UT3, RT3, PT3, MT3, ET3
Tansal, Mehmet	METU ¹	23	SFI (IWE)
Yilmaz, Ertugrul	METU ⁴	15	UT3, RT3, PT3, MT3, ET3

¹⁾still at METU; ²⁾retired; ³⁾working in industry; ⁴⁾founded own company; ⁵⁾changed the profession

WTNDT Center has been continuing its activities since 1988. Following the founding director of the Center (Prof.Dr. Alpay Ankara, 1988-2007) Prof.Dr. C. Hakan Gür was appointed as the director in 2007. Then, the laboratories and equipment of the Center have been renovated and upgraded by using the income of the Center. WTNDT is a full Member of IIW (International Institute of Welding) and has also led the establishment of the Turkish NDT Society, and the Turkish Section of the American Society for NDT (approved by ASNT in November 2008).

1. Training, Certification, and Testing Activities

The NDT section of the Center offers training courses on UT, RT, MT and PT (since 1988); VT (since 2016); and digital RT courses (since 2018). The on-line NDT training courses started in 2019 under the brand-name iNDTokulu, as the first internet-based NDT courses in Türkiye (<https://indtokulu.com>). 3,834 participants have attended NDT level 1,2, and 3 courses (Fig. 1).

In 2002 METU established the NDT Personnel Certification Center. Then, it was accredited by Turkish Accreditation Council (TÜRKAK) in November 2004 and started to give its own certificates instead of DGZfP certificates. In 2010, welder certification schemes

were added to the accreditation scope. It was re-accredited in May 2011 with its new name and scope “METU - Welding and NDT Personnel Certification Center”. Currently, it acts as an accredited personnel certification body (AB-0002-P) according to EN ISO 17024, EN ISO 9712 (UT, film and digital RT, MT, PT, VT for levels 1, 2, and 3), EN ISO 9606-1 and -2 (steel welder, aluminum welder).

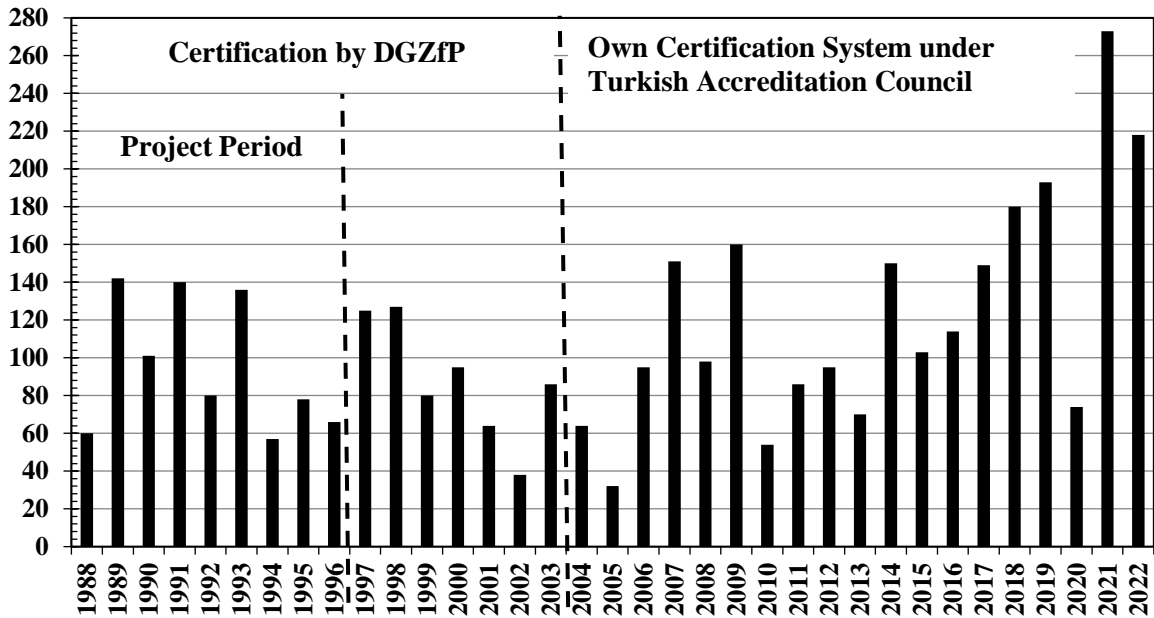


Fig. 1. NDT courses at METU (1988-2022), Total number of participants = 3,834

In the welding technology field, WTNDT initially acted as the recognized ATB and examination center of GSI-SLV-Münich. After the recognition of the Authorized National Body of Türkiye (ANB-TR) by IIW, WTNDT has started to give IWE diplomas through ANB-TR since April 2011 (Fig. 2). 2,171 international welding engineers have been trained and about 5,500 welders have been certified, by the end of 2022.

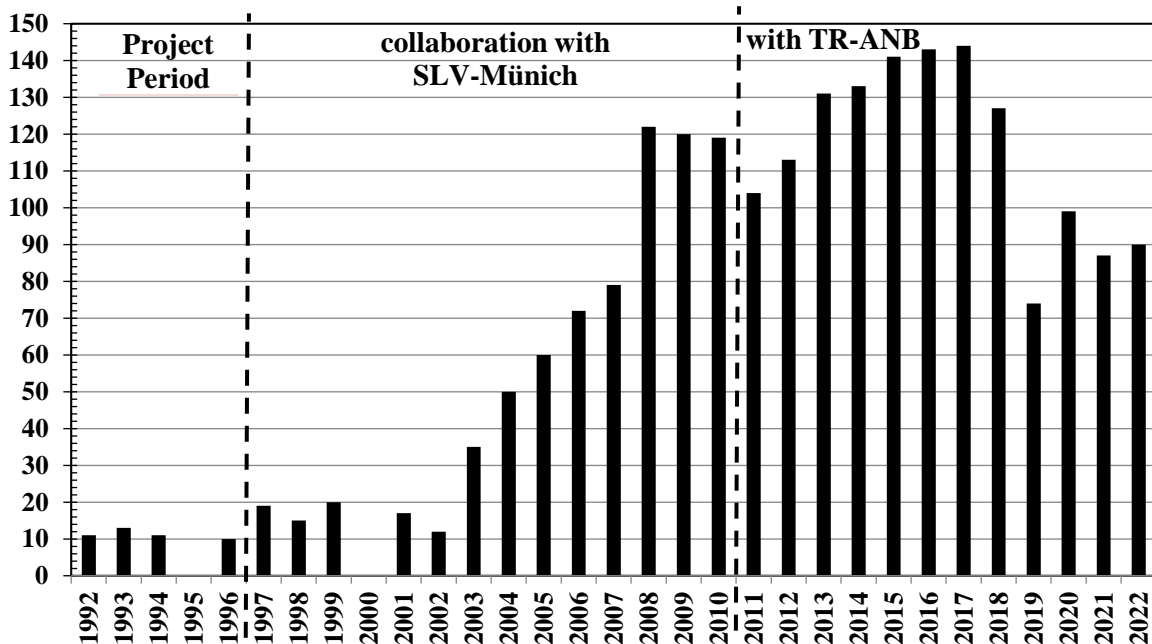


Fig. 2. International Welding Engineer courses at METU (1992-2022), Total number of participants = 2,171

WTNDT has been working under accreditation according to EN ISO/IEC 17025 since 2015 (TURKAK, AB-0943-T). The accreditation scope covers tensile test, high-temperature tensile test, hardness test, Charpy impact toughness test, bending test, nick-break test, CTOD fracture toughness test, macroscopic examination, and radiographic examination. For instance, between 2016 and 2018 the WTNDT provided about 90% of the structural integrity and mechanical testing requirements of the TANAP “Trans-Anatolian Natural Gas Pipeline” (1,850 km long, Azerbaijan-Georgia-Türkiye to Europe) project which is globally the biggest pipeline constructed under one management agent.

2. Research and Academic Activities

WTNDT gives laboratory/elective course support (Fig. 4) to the undergraduate and graduate programs of the Department of Metallurgical and Materials Engineering. The total number of publications in international journals and congresses exceeded 70. The list of the selected MSc/Ph.D. theses related to NDT is given in Table 5. For about 10 years, the research scope has been expanded to the aerospace and defense industries by focusing on welding simulation, fatigue/creep behavior of weldments, wire-arc additive manufacturing of stainless steels and Ti-alloys, and non-destructive characterization of additively manufactured Ti6Al4V, IN718, and maraging steels.

Table 5. Selected MSc and Ph.D. theses in the NDT field completed at METU

2022	Nondestructive Evaluation of the Effects of Carburizing Process Parameters on Microstructure and Residual Stress State of SAE 9310 Steel via Magnetic Barkhausen Noise Method, Z. Yıldırım
2018	Determination of Shot Peening Effect on Fatigue Behaviour of AISI 4140 Steel by Non-Destructive Measurement of Surface Residual Stresses, S. Çalışkan
2017	Non-Destructive Evaluation of Residual Stress State in Carburized AISI/SAE 8620 Steel, T. Kaleli
2016	Nondestructive Monitoring of Variations in Microstructure and Residual Stress in Carburized Steels, H. Hızlı
2015	Investigating the Reliability of Ultrasound Phased Array Method for Detection of Defects in Austenitic Stainless Steels and Evaluation of Probability of Detection, B. Akgün
2014	Comparison of the Flaw Detection Abilities of Phased-Array and Conventional Ultrasonic Testing Methods in Various Steels, M. Yalçın
2013	Investigating the Effect of Deformation and Annealing Texture on Magnetic Anisotropy in Low-C Steel Sheets by Magnetic Barkhausen Noise, F.Ü. Akçaoğlu
2012	Non-Destructive Evaluation of Residual Stresses in the Multi-Pass Steel Weldments, G. Erian
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
2006	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
2004	Computerized Test Procedure for Industrial Radiographic Examination of Metallic Welded Joints, E.E.Güneş
2003	Detection and Monitoring of Surface-Breaking Fatigue Cracks in Al 2024-T3 by Ultrasonic Methods, F. Sonat
2002	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
2000	Effect of Microstructure and Hardness on Acoustic Properties of Hypoeutectoid Plain-C Steels, Y.Keleş
	Determination of Graphite Morphology, Nodularity & Matrix in Nodular Cast Irons by Ultrasonic Techniques, B.Aydnmakina
	Determination of Microstructural Properties of PM Al-SiC Composites by Ultrasonic Techniques, E.Ataş



Fig. 4. Some photos of the NDT laboratories at METU