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## Donald O. Thompson: A remembrance

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## Donald O. Thompson: A remembrance

### Abstract

This paper was developed from the remarks delivered to honor Don Thompson by the banquet speakers at the 40th QNDE meeting, July 2013. Don died peacefully at his home just days later on July 29th after a two year battle with cancer. "Don was a tenacious fighter for what he believed in, and his vision and perseverance did much to establish NDE in both the US and wider global R&D community. He will be greatly missed by his many friends and colleagues in the NDE community".

### Disciplines

Other Mechanical Engineering

### Comments

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# Donald O. Thompson: A Remembrance

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**Abstract.** This paper was developed from the remarks delivered to honor Don Thompson by the banquet speakers at the 40<sup>th</sup> QNDE meeting, July 2013. Don died peacefully at his home just days later on July 29th after a two year battle with cancer. “Don was a tenacious fighter for what he believed in, and his vision and perseverance did much to establish NDE in both the US and wider global R&D community. He will be greatly missed by his many friends and colleagues in the NDE community.”

**Keywords:** NDE, Donald O. Thompson

## INTRODUCTION

This proceedings mark the 40<sup>th</sup> Review of Progress in Quantitative NDE (QNDE), the 15<sup>th</sup> Workshop of the World Federation of NDE Centers (WFNDEC) and the 10<sup>th</sup> International Conference on Barkhausen and Micromagnetics (ICBM).—It is a meeting series which was established as an Air Force – DARPA activity in the 1970’s.

Don (Donald O. Thompson) was the founder of the meeting series, and led the developing QNDE activities, initially at the Rockwell Science Center and then as the founding director of Iowa State University’s Center for Nondestructive Evaluation (CNDE). “He was a tenacious fighter for what he believed in, and his vision and perseverance did much to establish NDE in both the US and wider global R&D community. He will be greatly missed by his many friends and colleagues in the NDE community.” He was a pioneer in the field of nondestructive evaluation (NDE), moving NDT to a more quantitative and science based approach for analyzing the condition of materials and safe life for structures. He joined ISU and Ames Laboratory in 1979. He was also part of ISU’s Institute for Physical Research and Technology (IPRT) since its inception in 1987. With IPRT, he initiated the creation of CNDE – an NSF Industry University Cooperative Research Center - devoted to researching, teaching and practicing NDE. Through a collaboration between CNDE and ISU’s College of Engineering, Thompson helped develop a fully accredited minor in NDE within the college – a first-of-its-kind program.

Don began a phased retirement in early 1997. In 1999, he accepted a position as Scientific Advisor to IPRT’s Director. Until his death he remained President of QNDE Programs the entity, which together with CNDE, organizes the Annual Reviews of Progress in Quantitative NDE. He helped develop the program for the 2013 meeting and one of his last goals was to attend, at least part of, the 40<sup>th</sup> QNDE meeting (July 21-26). At the meeting he was recognized for his contributions and role in developing the meeting and the field of NDE.

Prior to joining ISU, Don worked in a variety of positions for Rockwell International Science Center, Thousand Oaks, California. He was also a group leader in radiation effects at the Solid State Physics Division of Oak Ridge National Laboratory, and at the Air Force Cambridge Research Center, Atomic Effects Directorate. He was a member of the National Academy of Engineering, an Anson Marston Distinguished Professor, and a Fellow of the American Physical Society and the Institute of Electrical and Electronics Engineers (IEEE). He had earned B.A., M.S. and Ph.D. degrees in physics from the University of Iowa.

This paper is organized in four sections as follows. The text from three presentations at the QNDE Banquet: (i) A VISION FOR QNDE: George Alers; (ii) A STROLL ON QNDE MEMORY LANE: J. Achenbach; and (iii) TALES FROM EARLY PROCEEDINGS: Les Schmerr, and a final section, an Appendix, which for the record provides Don Thompson’s CV.

## A VISION FOR QNDE – George Alers

I am flattered to be asked to report on the beginnings of this meeting - now in its 40th year. It all began when Don Thompson and I were graduate students sharing a lab in the basement of the physics building of the University of Iowa (not Iowa State University) in 1952-4. His expanding apparatus for monitoring dislocation motion in zinc single crystals crowded my ultrasonic apparatus into a small corner until he got his PhD and went away to the Cambridge Air Force Laboratories in Massachusetts. Then I took over the whole place and got out the following year. It was all so long ago that we used slides rules for data analysis and a strip chart recorder to collect the data. That chart recorder spewed out long strips of paper that caused his son to note the similarity to a roll of paper in the family bathroom.

The reason this history of QNDE begins with my working with him in graduate school is because we got to know each other well enough to collaborate on a couple of papers supported by our different employers in the time period from 1954-1964. In 1968 (45 years ago), Don hired me into his new group doing metal physics in the basic research labs of North American Aviation in Thousand Oaks, California.. This laboratory was later acquired by Rockwell International and became the birthplace of Quantitative Nondestructive Testing. When basic research in industrial labs became unfashionable, Rockwell instructed its research managers to begin supporting themselves with funds from the profit center divisions of the company as well as directly from the government. That meant focusing our research programs on problems of great importance to the corporation instead of important to the advancement of science. As a Group Leader, Don had already begun this transition by establishing relationships with the Quality Assurance branches of the Rockwell Divisions. He argued that the nondestructive testing techniques being used at that time were far too empirical in nature and that their effectiveness could be improved by investigating the basic physics on which they were based. As an example, disbonds in honeycomb structures were located by tapping a coin on the surface and listening for a dull thud. Adding basic science was at first surprising to the QC managers but it quickly gained their support when they could see why and how a particular procedure really worked. I was able to assist Don in this transformation of Nondestructive Testing (NDT) into Nondestructive Evaluation (NDE) by accompanying him on visits to the operating divisions to learn what was being done and where a more basic approach could yield substantial improvements.

This concept made good sense to everyone in manufacturing but it took Don Thompson's relentless effort to make it a viable field of academic interest. Financial support from the Rockwell Divisions was constrained by their yearly budgets and only token sums could be released to perform specific research projects. Funding by the government demanded the proposal of detailed engineering programs with a narrow focus and serious time constraints. Undaunted by this picayune response to his efforts, he expanded on his dream of a Center for NDT that operated at either an industrial laboratory or a university that could coordinate and fund programs that would develop a scientific foundation for nondestructive testing. This transfer of technology path appealed to the National Science Foundation who (after some prodding by D.O. Thompson) consented to fund a workshop at the Rockwell Science Center to bring together academic scientists and Quality Assurance managers in order to better define a larger program. The publication of the proceedings of this workshop in 1973 [1] became the first of the series now known as "*Review of Progress in Nondestructive Evaluation.*" The year was 1973 -- 40 years ago.

Even then, Don's long range goal was to create a Center for NDE that funded programs at universities and applied physics laboratories designed to improve the art of nondestructive testing by putting NDT on a rigorous quantitative foundation. The NSF workshop met its goal and DARPA began funding a program at the Science Center of Rockwell International that would coordinate and fund sizeable efforts in advanced NDE techniques at a few universities and industrial research laboratories (Note that the acronym had changed from NDT to NDE). When the first annual report was due at DARPA, Don was faced with consolidating a diverse set of individual reports into one cohesive document. The DARPA/AFML program manager, Mike Buckley, suggested and got approval for convening a meeting of all the participants at which each gave an oral report on his work during the past year. With the stipulation that the reports also be submitted as written technical papers, the collection of these papers would be accepted as the final report for that year. Thus was born the first large scale publication of QNDE papers under the title "*Proceedings of the ARPA/AFML Review of Progress in Quantitative NDE.*" The year was 1975 -- 38 years ago.

By 1980 (33 years ago), the program had outgrown its birthplace crib at Rockwell and Don moved it to Iowa State University accompanied by Bruce Thompson and Otto Buck. A year earlier, I had moved to Rockwell's *Albuquerque Development Laboratory* in New Mexico to focus on a product of the original QNDE program, the Electromagnetic Acoustic Transducer or EMAT. I am happy to report that Don and Bruce Thompson's early investigations into the basic mechanism of electromagnetic transduction of ultrasonic waves have now grown into a commercial product for inspecting buried natural gas pipelines. The company that gambled on this new transducer

was Rosen Engineering of Geneva, Switzerland. It is now the largest pipeline inspection company in the world. All this is based on Don's pure science EMAT that he used to study radiation damage in copper single crystals at the Oak Ridge National Laboratory in the late 50's plus his vision of putting basic science behind conventional nondestructive testing techniques.

One of the great secrets I have kept since our graduate school days is what the O in Donald O. Thompson's name stands for. There have been many guesses proposed over the years but I happen to know that it stands for *Obstinate* - a name applied by his grade school teachers to describe his single minded approach to realizing his goals. I think it is a feature of Don's personality to which we who are gathered here tonight are greatly indebted. It is the property that kept him pushing for a Center for Nondestructive Evaluation to bridge a major gap between science and practical applications.

## A STROLL ON QNDE MEMORY LANE – J. Achenbach

We are celebrating the 40<sup>th</sup> Anniversary of the Annual Review of Quantitative Nondestructive Evaluation. The Meeting is a robust and healthy 40 years old, which is still young, and all indications are that it has a long and productive life ahead. Yesterday Mike Farley discussed forty years of progress in NDE, and Leonard Bond invited us to look into the future of the field. Tonight George Alers already covered some distance on QNDE Memory Lane. I would like to talk a bit more about the early years of QNDE and the Annual Reviews, and about Don Thompson's seminal leadership.

The early years of the Annual Reviews should be placed against a back ground of important and exciting events and developments in analytical, numerical, and experimental techniques in engineering. The nineteen-sixties were a period of significant developments in the finite element method, the establishment of fracture mechanics, methods to determine material behavior, and the development of electronic equipment for data collection and analysis. These developments made it possible to greatly improve engineering analysis and design of structures. For example it was now possible to predict the size of a crack that would give rise to failure.

Somewhere on the sidelines lingered the field of nondestructive inspection, NDI, which had existed for many years and could provide information on whether there was a defect of some kind in a component. Don recognized the implications of the new developments of the sixties for NDI, particularly NDI of safety critical structures such as aircraft, nuclear reactors and bridges. If structures were going to be designed better, they should be inspected better. He had the vision that the time had come to use more advanced methods to develop *Quantitative* inspection procedures for both diagnostics and prognostics.

So what I will really talk about is a celebration of Don's achievements as a visionary, a pioneer and a leader in the transition from NDI to NDE, to QNDE, and to SHM.

In the early nineteen seventies Don was the leader of a group of outstanding applied scientists at the Rockwell International Science Center in Thousand Oaks, California. The group included Bruce Thompson, Otto Buck, George Alers, Bernie Tittman, John Richardson, Chris Fortunko, and others. Don recognized that it was essential that Non-destructive inspection should include evaluation and that the Q had to be added for Quantitative Nondestructive Evaluation. The Defense Advanced Research Projects Agency (DARPA) which then funded and still funds cutting edge research, agreed with Don's vision, as did the Air Force Materials Laboratory, and before long Don was in charge of a large research program. This program included, in addition to the Rockwell Science group, participation from several universities, like Stanford, Cornell, Ohio State and a little later Northwestern and Wayne State, and also researchers from National Laboratories. There were annual review meetings, which spawned the first of the Annual Reviews of QNDE. Don told me once that as a younger man he played clarinet in a jazz band that frequently performed in the midwest. Clearly he was a good team player. He probably became the leader of the band before he showed his leadership qualities in science and engineering.

I have been told that the first Annual Review was in Don and Barbara's backyard in Thousand Oaks in 1973. The first annual review in QNDE I attended was in 1977, this meeting has become the fourth of the string of 40 QNDE meetings. The year before, Y-H. Pao, Harry Tiersten, and I had organized an NSF sponsored workshop titled "Application of Elastic Waves in Electronic Devices, Non-Destructive Testing and Seismology"[4]. An ambitious title. Those were good years for wave propagators. Many interesting problems to be done. Bruce (Thompson) presented a paper at the Workshop on the need for Quantitative NDE. I think this workshop was the first significant interaction between the wave propagation community in the field of mechanics and the budding QNDE field. At the time I was in the process of developing a theory on edge diffraction from crack edges, and after the workshop Don invited me for the 1977 Annual review of QNDE. This fourth Annual Review was held at Cornell University. It was held in a classroom, attended, if memory serves me well, by some 25 to 30 people. At the meeting Don introduced me



to Laszlo Adler, a physicist from Ohio State. Laszlo had started experimental work on edge diffraction and Laszlo and I subsequently cooperated for many years on joint theoretical/experimental work.

For the DARPA/AFML program Don assembled the finest group of applied physicists and engineers from all over the country I have ever been part of. He ruled this group firmly, but cordially. Several areas of QNDE were included. Don's own group from the Science Center was outstanding, with Bruce and Otto, and others I mentioned earlier. The contingent from Cornell, which was led by James Krumhansl, and included his former students Jim Gubernatis and Etan Domany, was expert in quantum mechanics, but they quickly came up with an exact statement of the equations governing scattering by an elastic inclusion in an elastic solid. Following a well-known approach in quantum mechanics, they introduced the Born approximation, and this approximation and its improvements were thoroughly explored.

From Stanford Bert Auld explored the use of reciprocity. Gordon Kino and K. T. Khuri-Yakub explored sundry topics, including transducer design and acoustic microscopy. Matters with considerable mathematical content, such as inverse problems were also explored in detail by John Richardson, Jim Rose and others. Otto Buck did pioneering work on the use of second harmonics. Laszlo Adler and I developed crack detection and characterization by the crack edge diffraction method.

The meetings of Don's research program were exciting, with much discussion among the group's members, who all knew each other personally. A few years after the Cornell meeting the Annual Review was still in a single room, but now a much larger one, the auditorium of the Scripps Institute in La Jolla. Much of the work of those early years became fundamental for later developments. After a few more years the Annual Review became a large general meeting with several parallel sessions.

In 1980 Don moved from the Rockwell Science Center to Iowa State. Bruce and Otto came along. Connections with Academia also remained intact. Soon Don established the Center for Nondestructive Evaluation, with large funding from NIST, and after the Aloha Incident, from the Federal Aviation Administration. The Center, which has its own building, has strong connections with industry and is now the organizer of the Annual Reviews of QNDE.

Let me end on a personal note. Don has been a very significant person in my life. He has been the best boss I ever had, and I have dealt with several presidents, deans and department chairs in my more than fifty years at Northwestern University. Over the years I have been the recipient of a good many National Recognitions. I know that I owe much to the opportunities that Don offered me on the DARPA, AFML, NIST and FAA programs. Many thanks Don for your friendship, encouragement, support and leadership.

## **TALES FROM EARLY PROCEEDINGS – Les Schmerr**

As many of you know, the QNDE conference existed even before Volume 1 [2] was published. It was a technical review of a DARPA/AFML program that Don led. The conference proceedings were published as a technical report in these yellow volumes [1].

In the early years it was held in La Jolla. It was a much smaller conference and Don always had a keen sense of what was important. Don realized that the real value in those meetings was not only in the content of the papers but in the discussions that followed, so he hired a stenographer to record those discussions and they were published in the technical reports.

I want to give you a sampling of the outstanding quality of those discussions. I have redacted the names of the speakers so if any of you were at those early meetings you have nothing to fear, .....maybe.

The first discussion is on a pulsed eddy current paper.

First audience member: The previous speaker mentioned that pulsed eddy current measurements were not reproducible. I am not an expert – in fact, I don't know very much about eddy currents at all-- but the question I have is, " Why is that so? What is the cause of this irreproducibility?"

The Speaker: Well, I am not an expert on pulses or experimental things either, but it is my impression that you get heating of the sample and of the coil.

Second audience member: I don't know much about eddy currents either, but I had trouble using eddy currents with heating effects.

And so it went. Now my question to this audience is: Is anyone willing to say they now know anything about pulsed eddy currents?

Moving on to the second discussion, which was on an overview talk. It went like this.

Audience member: You mentioned the Russian equipment as being rather superior. How do the Russians handle their equipment inspection problems?

The speaker: Sir, I did not mention it as superior. I mentioned it as improving rapidly, as becoming competitive. The Department of Defense would be loathe to admit that the Russian equipment was superior, and if I were to make such a statement I should promptly and deservedly be shot by my bosses.

In those early days the meeting was held at the Scripps Institute, right on the beach, a beautiful setting. But, there was also a dark side. It is the only time we ever lost an attendee, who literally vanished from the meeting and from the face of this earth.

I can confirm that there is absolutely no truth to the rumor that he was the only one who had not paid his registration fee. Incidentally, I have calculated the POD (that is the probability of disappearance) for the conference, and found it is  $7.764 \times 10^{-5}$ .

Anyway, perhaps to be safer, Don subsequently moved the conference up the hill to the university..... This had the added advantage of being somewhat closer to Black's beach, the local nudist beach.

But there was danger lurking at the University also. One conference several very large football players attending a summer camp were helping themselves to the break refreshments and goodies. Being a decisive leader, Don swept into action--- and told the women on the support staff to shoo them away.

With a rise in elevation for the conference also came increasing recognition. I can prove this.

The following is a true recounting.

Two women were sitting in a bar in La Jolla:

*First woman:* I was up on the University campus today and there were signs everywhere saying they were holding a conference on NDE. Do you know what NDE stands for?

*Second Woman:* No, I don't.

*First woman:* It stands for Nondestructive Evaluation.

*Second woman:* Oh, how so Californian, to have a whole conference devoted to how to evaluate people without destroying them.

Seriously, in the forty years of the QNDE conference it has truly gained international recognition for what it really is – the premier meeting for the NDE field. Please join me in recognizing Don for making the meeting a success over these many years and for leading the effort to make NDE a quantitative, scientific field of endeavor.

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**Appendix A.**

***DONALD O. THOMPSON***

***Anson Marston Distinguished Professor Emeritus, Aerospace Engineering & Engineering Mechanics  
Principal Scientist and Program Director, Ames Laboratory  
Director Emeritus Center for Nondestructive Evaluation***

**EDUCATION**

B.A., 1949 Physics with Highest Distinction, University of Iowa, Iowa City  
M.S., 1950 Physics, University of Iowa, Iowa City  
Ph.D., 1953 Physics, University of Iowa, Iowa City

**PROFESSIONAL EXPERIENCE**

**Iowa State University 1979-2013**

- Scientific Advisor, Institute for Physical Research and Technology (1997-2013)
- Distinguished Professor Emeritus of Engineering, Department of Aerospace Engineering & Engineering Mechanics (1999-2013)
- Distinguished Professor, Department of Aerospace Engineering & Engineering Mechanics (1993-1999)
- Professor, Department of Mechanics and Engineering Science, Iowa State University, (1979-1993)
- Founding Director and Director, Center for Nondestructive Evaluation (1985 to 1997)
- Director, FAA/Center for Aviation Systems Reliability (1990 to 1993)
- Principal Scientist and Program Director, Ames Laboratory, Applied NDE Programs (1979 to 1997)

**Rockwell International Science Center, 1964 to 1979**

- Director, Structural Materials Department
- Manager, Technical Staff
- Group Leader, Structural Materials
- Member, Technical Staff
- Member of Divisional Executive Staff for Manufacturing (Aerospace and Electronics)
- Rockwell International Corporate Panelist for NDE and Structures
- Materials Consultant, Electronics Group (Autonetics), Rockwell International Corporation
- Materials and NDE Consultant, Aerospace Group (Los Angeles Aircraft Division, Space Division, and Tulsa Division; B-1 , Apollo, Shuttle, and Shuttle Main Engine Programs) , Rockwell International Corporation

**Oak Ridge National Laboratory, Solid State Physics Division, 1954-1964**

- Group Leader, Elastic and Anelastic Effects
- Member, Radiation Effects Group

**AF Cambridge Research Center, Atomic Effects Directorate, and MIT Lincoln Laboratory (Lexington), 1952-1954**

- Group Leader, Radiation Effects
- Member, Electromagnetic Surveillance Group

**HONORS**

- SPIE Lifetime Achievement Award in NDE
- Foreign Associate, Indian National Academy of Engineering
- Honorary Fellow, Indian Society for Nondestructive Testing
- Member, U.S. National Academy of Engineering
- Distinguished Fellow, Rockwell International Science Center
- Fellow, American Physical Society (APS)
- Lifetime Fellow, The Institute of Electrical and Electronic Engineers, Inc. (IEEE)
- Twenty Five Member, The Metallurgical Society (TMS)
- Anson Marston Distinguished Professor of Engineering, Iowa State University
- Phi Kappa Phi Centennial Medalist
- Sigma Xi
- BS degree With Highest Distinction, Physics, University of Iowa
- Phi Beta Kappa
- Phi Eta Sigma
- Phi Mu Alpha

**GRADUATE STUDENTS**

- Kang-Seon Seomun, M.S. - 1986
- Steven Neal, Ph.D. - 1988
- Satish Nair, Ph.D. - 1990
- Erol Uzal, Ph.D. - 1992
- Myung-Hyun Yoon, Ph.D. - 1994

**MAJOR INITIATIVES, INNOVATIONS**

**World Federation of NDE Centers, 1998-present**

In 1998 Dr. Thompson planned and initiated the World Federation of NDE Centers. with colleagues at Iowa State University. The motivation for this Federation was the growing movement in the global economy and the need for harmonization in research and education in quantitative NDE. Membership in the Federation is therefore limited to NDE Centers that have ongoing research and education efforts. Original membership numbered 15 with Iowa State University being named as the permanent home of the Federation.

**NDE Minor, College of Engineering, Iowa State, University, 1994-present**

In collaboration with the College of Engineering's Office of the Dean and colleagues at CNDE, Dr. Thompson initiated plans and obtained approval for the first NDE minor degree in the nation. This degree is unique, for it recognizes the broad, interdisciplinary nature of NDE. It is available to students pursuing a graduate degree in any of the Engineering Departments as well as other selected Departments in the University with a scientific core. The degree offering followed upon several interactive workshops with members of industry and academe to determine the overall form and objectives of the degree. The degree has become popular both with students and industrialists.

**National Science Foundation/Community College in NDE Engineering Education, 1990-1993, ~\$306,000**

In 1990 Dr. Thompson and members of the Dean's Office of the College of Engineering initiated efforts to improve articulation between Community Colleges and 4 year Universities. With NSF funding, cooperative programs were initiated with a number of Community Colleges in the Upper Midwest and the Center for NDE at ISU that resulted in increased cooperation between members and an increase in the number of cooperative projects.

**Center for Aviation Systems Reliability and Engine Titanium Consortium, FAA, 1990-present, \$3M/yr., Founding Director**

After the fatal accident at Aloha Airlines in 1989 that resulted from degradation of the aircraft due to fatigue and corrosion, Dr. Thompson initiated this Center with support from the FAA to perform specific NDE research to improve the safety and reliability of the aging commercial aircraft fleet. The ISU Center enlisted the support of colleagues at Wayne State University and Northwestern University to provide a comprehensive research and technology transfer effort.

**NDE for Life Cycle Engineering, National Institute of Standards and Technology, 1989-1999, ~\$2 M/yr, Principal Investigator**

In 1989 Dr. Thompson established and served as Principal Investigator of the program, NDE for Life Cycle Engineering. This was a program that involved subcontractors at Northwestern University that worked as interdisciplinary team members with scientists at CNDE at ISU and was focused upon the development of computer simulations of the NDE inspection process (ultrasonics, eddy currents, and x-rays), the development of computerized failure programs for selected ceramics and metals, and the overall integration of these efforts with CAD to provide a new capability for the NDE engineer. This highly successful program has resulted in the commercialization of various computer simulation programs.

**Center for NDE, NSF University/Industry Cooperative Research Center**

NSF Industry/University Cooperative Research Centers, Founding Director, 1985-present, ~\$775,000/yr., Founding Director

Dr. Thompson established the **Center for NDE** at Iowa State University in 1985 as one of the **NSF University/Industry Cooperative Research Centers**. This was, and remains, an unique program that is focused on national needs and requires joint support from industry, the university, and the National Science Foundation. Dr. Thompson launched the Center with approximately 15 supporting industries and , under Dr. Thompson's management, grew to about 25. This program is focused on problems supplied by industry in a non-competitive mode; research is performed by faculty, professional scientists and engineers, and graduate students. This Center has served very well as a vehicle both for the performance of research and its transfer to industry; it is also recognized by many as the foremost NDE Center in the world, and has been acclaimed by NSF as one its best Centers.

**NDE Programs, Ames Laboratory DOE Basic Energy Sciences Program, 1980-1991, \$100-250K/yr., Founding Program Director**

Dr. Thompson established and developed NDE Programs at Ames Laboratory and ISU. This was the first of current activities surrounding the Laboratory that utilized basic research input in engineering applications.

**DARPA/AFML Interdisciplinary Research Program in QNDE, 1973-1993, ~\$2M/yr., Founding Principal Investigator and Program Manager**

Dr. Thompson initiated, procured funding, and managed this highly innovative program that is widely regarded as the foundation of modern quantitative NDE technology, a technology that is used in various forms in most high technology industries. It introduced many technical innovations for ultrasonics, eddy

currents, thermal imaging, and x-ray technology - all of which were based on rigid, fundamental scientific approaches. A major programmatic innovation required the formation and management of interdisciplinary teams from various leading academic and industrial institutions. The program set new, unique directions in both NDE technology and in management procedures.

#### **“Review of Progress in Quantitative NDE”, 1974-present**

As a part of the Interdisciplinary Research Program in Quantitative NDE, Dr. Thompson initiated the annual research conference, **“Review of Progress in Quantitative NDE”**, (1974-present) that is international in attendance and is widely regarded as the premier NDE research conference in the world.

#### **"Proceedings of Review of Progress in QNDE", Plenum Press and American Institute of Physics, 1980-present**

The edited and reviewed **Proceedings** of the above Conference are published by the American Institute of Physics. Dr. Thompson is the Senior Editor of this Series.

#### **Structural Materials Department, Rockwell International Science Center, 1973-1978, Director**

Upon his appointment as Director of this department, Dr. Thompson initiated and directed interdisciplinary growth of **Structural Materials Department** from 20 to 60 persons. This growth included the establishment of technical priorities that served Rockwell International overall in specific topics and the acquisition of most of the necessary funding to accomplish this growth. Interdisciplinary growth included new groups in polymeric materials, metallurgy, ceramics, fracture mechanics, and NDE. The Department achieved the highest national departmental technical rating ( Internal Research and Development Program) , for five straight years under Dr. Thompson's directorship.

### **EXPERIENCE HIGHLIGHTS**

Dr. Thompson has extensive experience in research, research management, and teaching in federal laboratories, industry, and academia.

#### **Personal Research**

Dr. Thompson has achieved international recognition for research in several different areas. These include studies of neutron radiation damage in solids and hydrogen embrittlement in metals using elastic and anelastic techniques. In both these topics, primary emphasis was placed on the development of understanding of dislocation interactions with point defects and with hydrogen. Dr. Thompson has also been extensively involved in NDE research, particularly new ultrasonic instrumentation for quantitative NDE. This work takes advantage of many theoretical advances that have been made in elastic inverse scattering, and provides ways to determine a flaw's size, shape, orientation, and composition.

#### **Research Management and Technical Innovation**

Dr. Thompson is experienced in all essential aspects of research management and leadership. These include the identification of key technical issues, the creation of new ideas and approaches to address the issues, development of appropriate funding sources (federal, state, industry), preparation and writing of proposals and their presentation to top-level agency and industrial managers to procure funding, selection and management of top-rated interdisciplinary research teams, and management of technical programs to attain established goals within fiscal planning constraints.

#### **Teaching**

Dr. Thompson has been instrumental in the development and teaching of new NDE courses at ISU. One of these was a seminar course in advanced NDE concepts that was assimilated into other ongoing courses. Another is a new graduate course for NDE with laboratory. He has been active in guiding graduate students both as advisor and committee member.

## **PATENTS: D. O. THOMPSON**

Issued Patent #4,041,774 Acoustic Data Acquisition device (Co-Inv.: W.L. Morris)

Issued Patent #3,688,481 Low Velocity Highly Anisotropic Elastic Materials (Co-Inv.: R. B. Thompson, E. A. Kraut, T. C. Lim)

Issued Patent #4,810,462, Method for Fabricating Prescribed Flaws in Interior of Metals (Co-Inv.: D. K. Hsu)

Issued Patent #4,817,016, Non-destructive Evaluation Means and Method of flaw Reconstruction Utilizing an Ultrasonic Multi-viewing Transducer Data Acquisition System (Co-Inv.: S. J. Wormley), Date of Patent: March 28, 1989

Issued Patent #4,950,990, Method and Apparatus for Photoinductive Imaging (Co Inv. J. Moulder, J. Rose), Date of Patent: August 21, 1990

Issued Patent #4,961,252, Technique for Non-Uniform Polling of Piezoelectric Transducers and Fabrication of Gaussian Probes (Co-Inv.: D. K. Hsu, F. J. Margetan, M. D. Hasselbusch, M. S. Hughes and S. J. Wormley)

Issued Patent #5,269,189, Means and Method of Transmitting and Receiving Broadband, Uni-polar, Ultrasonic Pulses for UT Inspection (Co-Inv.: D. K. Hsu)

Issued Patent #5,199,299, Ultrasonic Unipolar Pulse/Echo Instrument (Co-Inv.: M. S. Hughes, D. K. Hsu and S. J. Wormley), Date of Patent: April 6, 1993

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7. D. O. Thompson, "Amplitude Independent Internal Friction and Examples of its Utility in Diffusion Studies", Proceedings of Internal Friction in Materials, (Polskiej Akademii Nauk, Warszawa, 1968), p. 199.
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82. NSF I/UCRC Director's Meeting, Arlington, VA (January 11-12, 1995). Presented paper entitled, "Comments Relating to Successful Industry/Center R&D Consortia".
83. ISU/Westinghouse Minisymposium, Orlando, FL (November 7, 1995). Presented paper entitled, "Uses of NDE Models for Life Cycle NDE".
84. 14<sup>th</sup> World Conference on Non Destructive Testing, New Delhi, India (December 8-13, 1996), Presented paper entitled "Quantitative Model-Based Approaches to Inspectability and Reliability".
85. IZfP 25<sup>th</sup> Anniversary Event and Höller Memorial, Saarbrücken, Germany (April 9-11, 1997), Presented paper entitled "The Use of Models to Visualize Inspectability and Detectability".
86. Otto Buck Memorial Session, Quantitative Nondestructive Evaluation Conference, Snowbird, UT (July 19-24, 1998), Presented paper entitled "A Review of Selected Contributions to Harmonic Generation and Radiation Damage Research by Otto Buck".
87. 7<sup>th</sup> International Workshop on Modern Acoustic Ultrasonics, Nanjing, China (October 1998), Presented paper entitled "NDE in Product Design and Life Cycle Management".

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