Welcome and Introductory Remarks

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WELCOME AND INTRODUCTORY REMARKS

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D. O. Thompson : It's a pleasure to welcome you to the ARPA/AFML Review of Progress in Quantitative NDE. I'm Don Thompson, Director of the Materials Science Center, and have the privilege of serving as the Program Manager for the Program in Quantitative NDE which is under discussion for the next three days here. I'd like to introduce Prof. Herbert H. Johnson, Director of the Materials Science Center at Cornell University, and our host for the next three days. Herb, I'm sure that Dr. Peter Cannon, Vice President of the Science Center, Mrs. Diane Harris, who has served as our conference coordinator, myself, and all my colleagues join to thank you and your staff--Mr. Noel Desch, Mrs. Sharon Wells, Ms. Kris Molt, and many others--for all the cooperation you have given us. Special mention should also be given to Prof. J. A. Krumhansl for taking the initiative in suggesting that this meeting be held at Cornell.

We appreciate the many courtesies and hospitality that you at Cornell have shown us.

H. H. Johnson: On behalf of the Materials Science Center and the University in general, we're very pleased that you've chosen to come here for your review meeting. For the last two or three years the Materials Science Center has been trying to encourage the holding on campus of major meetings in materials and materials related topics so that when Jim Krumhansl came and said, "Why not have the NDT meeting here?" it seemed to be a natural. Consequently, we plunged right in.

We hope you enjoy your stay. In view of the fact that we're starting just a little bit late, I don't think I'll say any more just now. I hope you have a good meeting.

D. O. Thompson: Thank you very much, Herb. The good will and the courtesies that you have extended are much appreciated. Before proceeding with a program summary, I'd like to recognize two guests from overseas who are with us. They are Prof. Höller, Director of the NDE Institute at Saarbrücken, West Germany, and Mr. Robert Dokes of the British Navy Admiralty Materials Laboratory. We're glad that you could join us in this review.

I'd like to take a few minutes to tell you a little bit about the program. During it's three-year history, the ARPA/Air Force program has pursued four objectives. I think it's worth-while to take a brief look at them so one can better measure over the next three days where we are, what we have done, and where we have come from over these last three years. The objectives are:

- To pursue advanced research in selected areas.
- To establish a focal point for NDE research.
- To enhance communication between the research community and the NDE user.
- To improve the scientific base for NDE in selected areas.

The research referred to in the first objective has been divided into three projects. These projects are:

1. Flaw characterization by acoustic techniques.
2. Bond strength of bonded materials.
3. NDE characterization of failure related material properties.

Projects 2 and 3 have lately been combined under the heading of strength-related properties. Approximately two-thirds of our efforts have been spent in the ultrasonic topic, that is, the first one, and the remaining one-third in projects two and three.

I think that a number of exciting things have developed in these projects over the three years. Two related approaches have been pursued in Project 1 in an effort to develop a quantitative capability. The first is an ultrasonic scattering approach which has involved the development of new samples suitable for scattering experiments, theoretical treatments of the scattering which are amenable both to ultrasonic system design and to the development of a physical "feeling" of the behavior of scattering, experimental verification of these theories, and inversion procedures for the deduction of quantitative results from ultrasonic signals. The second approach has emphasized acoustic imaging and a transference of work from the medical imaging field into the material NDE area. Underlying these efforts (and a necessary adjunct to them) are a number of ultrasonic improvements that also possess a stand-alone identity. These include a transducer characterization capability which provides a convenient method for the characterization of NDE transducers and two new options for inverse filtering to provide ways to improve transducer fidelity. The new technology of non-contact transducers has been significantly advanced. As a result of the work done to date, a number of applications are now in progress. Several software packages have also
been produced which aid significantly in the
improvement of ultrasonic responses. Two other
important applications areas have been generated
from the ultrasonic scattering work in this pro-
ject. These are a candidate procedure for ultra-
sonic standards and developments in the ultrasonic
NDE of ceramic materials. As you recall, one of
the program objectives is aimed at the improvement
of the scientific base for NDE. As a physicist,
I am particularly pleased with the closure that
has been obtained in the ultrasonic work. By
closure is meant the cycle whereby well charac-
terized scattering samples were designed and
fabricated, ultrasonic scattering theories were
developed to describe them, the theories were
independently experimentally verified, and the
results then inverted to extract quantitative
parameters which agreed reasonably well
with the known parameters. The successful develop-
ment of this loop required other noteworthy
advances, as indicated above, and, I believe,
represents the first time in ultrasonic NDE that
this traditional scientific loop has been closed.

In Projects 2 and 3 we have several other
successes. These include the development of NDE
procedures for the characterization of strengths
in simple (single-phase) adhesively bonded
materials. Another is a technique for the
measurement for moisture in composites. Advances
have also been made in the analysis of acoustic
emission signals from which they can be correlated
with the strength of the composite. Techniques
for residual stress detection in ferrous materials
utilizing the non-contact transducer technology
is also ready for an application.

I would like to say a few words about the
nature of the work in these projects that will
be reported in the next three days. Our efforts
have been aimed primarily at the generic core
that underlies and is common to many specific
applications. We believe that this is the most
cost-effective way to spend the major part of
the research funds entrusted to us. Specific
application problems can then be addressed utilizing
this knowledge.

Finally, I'd like to make some comments about
work that supports the last three objectives.
As of January, 1977, the program had produced
some 55 technical papers, and another eleven or
twelve had been submitted to editors. Program
participants had given 67 seminars and professional
society papers, as of that time, and ten patent
disclosures as of that time had been written.
That number will probably be doubled when every-
thing is caught up. There have also been some
fifteen or more graduate students involved in our
work, a very important element of bringing new
thoughts into the NDE area. Two special journal
issues have been produced, and a number of review
papers are in preparation. One of the major
points of the program has been the annual meetings,
like this one. They have grown from about 65
attendees at the first to about 200 at this one.
We appreciate very much the cooperation demon-
strated by colleagues doing related research at
these meetings and from users who need new tools.
This cooperation has aided significantly in
establishing a focal point for NDE research
activities.

Again, I welcome and thank you for coming
to the meeting. I sincerely hope that you'll
find it worthwhile, and that you will contribute
freely to an exchange of ideas and information.