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Major E. F. Redden  
 U. S. Atomic Energy Commission  
 Isotope Power Systems Branch  
 Space Electric Power Office  
 Space Nuclear Systems Division  
 Washington, D. C. 20545

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CLASSIFICATION CHANGED TO: <i>U</i>	BY: <i>W.H. Lawrence</i>
PERSON CHANGING MARKING & DATE: <i>Emelda Sept 11/11/97</i>	RECORD ID: <i>98500541</i>
PERSON VERIFYING MARKING & DATE: <i>Barbara Delyes, 11/11/97</i>	DATED: <i>11/4/97</i>

Dear Gene:

Re: Tyco Laboratories Unsolicited Proposal

Ref: Unsolicited proposal received with transmittal letter,  
 Weinstein to Whiting, dated July 5; 1967

I am taking this opportunity to present my comments and recommendations on the above referenced proposal of which I am enclosing a copy and of which you received a copy on the same date. Comments are not included on tasks that are dependent on the tasks discussed below.

Task I-1

I do not disagree with this task; I feel that there is merit in understanding the solid solubilities of iron in the thermoelectric material and I also feel we should know the eutectic composition in the iron thermoelectric material system, but I disagree that the AEC should sponsor this particular task considering that Tyco has been studying and reporting these same phenomena under a NASA-Goddard contract (NAS5-9149).

Task I-(2,3)

Tyco has been studying both diffusion bonding and braze bonding processes under the AEC Contract AT(30-1)-3605 for two years, implying in the Phase I contract reports that the bonding process was successful and understood. Evaluations made during Phase II indicated that Tyco had only succeeded in attaching the electrode to the element obtaining a low electrical contact resistance with very little strength. I feel that we should not expect miracles from Tyco with this approach especially after two years of study. I cannot recommend further study under this task.

Task III-(1, 2, 3, 4)

The first three subtasks of this group should not be considered for study at Tyco, but should be accomplished under converter development programs.

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*M. SKALKA*  
*11/04/97*  
*W.H. LAWRENCE*

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I feel that these problems are most closely associated with particular designs and should be studied under the particular ground rules of that design.

Since I have been associated with the ultrasonic casting concept, it has become obvious that the processes and results associated with this method are numerous. For example, the process for melting and casting p-type materials is straightforward; one merely introduces the raw materials into the crucible, controls the atmosphere around the crucible, melts and casts. But, if one attempts to apply the same procedure to casting the n-type material, the results would be disappointing. One must first form a master mix of PbTe-PbI<sub>2</sub> because the vapor pressure of the iodine is low enough that it would completely leave the crucible if mixed in elemental form. So, one must develop methods for each different material combinations.

Successful results (i.e., small grain size and 99+% dense) are obtained only when optimum power is transmitted into the melt. This can be obtained only by detecting maximum vibrational displacement and/or designing the crucible so that transmittal losses between generator and melt are kept at a minimum.

I feel that there are some refinements associated with this process that could be obtained through additional effort but these refinements would offer such small improvements in the existing material that the effort described in this task should not be continued.

Task IV

Under the existing AEC contract, the ultrasonically cast material exhibits the following advantages over the existing commercial PbTe materials.

- a. more dense
- b. of lower oxygen content
- c. more ductile
- d. can be machined

Considering these advantages, I am recommending that Task IV be accepted. Commercially available material should be ultrasonically prepared and supplied to AEC contractors (perhaps WANL and General Atomic) for use in their development.

In summary, I am only recommending a small program (around \$25,000) at Tyco Laboratories to ultrasonically cast commercially available materials that will subsequently be supplied to AEC contractors developing converters and/or systems.

Very truly yours,

*Original Signed*  
by

G. H. Whiting  
Advanced Development  
Division 9333

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Enc. with all copies: Proposed Program A-65-44 (CDI)

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Copy to:  
B. W. Colston, SAO, Attn: P. H. Schneider  
A. J. Clark, Jr., 9330  
R. P. Stromberg, 9333

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