



UNITED STATES
ATOMIC ENERGY COMMISSION

OAK RIDGE OPERATIONS
P.O. BOX E
OAK RIDGE, TENNESSEE 37830

717309

1250R

Ralph Elson, Director, Contract Division

REQUEST FOR CONTRACT ACTION

It is requested that you take the necessary steps to process the following described contract action (CA):

1. Nature of Action Requested:

- Selection of New Contractor and/or Negotiation of Contract
Number:
Contractor:
- Modification of Contract
Number: AT-(40-1)-3945
Contractor: Duke University

2. Nature of Services To Be Covered by Contract: Research

Title: "Project to Develop Phantoms for Scanning"

3. Type of Contract:

- Support Agreement
- Cost Type
- Other

4. Amount of AEC Funds To Be Obligated by this CA: None

5. AEC Percentage of Est. Total Cost To Be Shown by this CA: N/A

6. Description of Other Changes To Be Covered by this CA:

Modify contract to extend period thereunder to February 29, 1972, without additional funds. There will be no significant change in the scope of the work during the extended period.

7. Authority:

Form AEC-481 (Cont. Auth.) fr J. R. Totter to S. R. Sapirie dated Oct. 28, 1971

REPOSITORY Oak Ridge Operations Herman M. Roth, Director
 FILE: EMM Records Holding area Laboratory and University Division
 COLLECTION Documents 1944-94
 BOX No. A-31-1 73-28 2 of 4 Bldg. 2714-H
 FOLDER Backup - Contract No. AT-(40-1)-3945 Duke Univ.

1117375

Duke University Medical Center

DURHAM, NORTH CAROLINA

October 13, 1971

DEPARTMENT OF RADIOLOGY
DIVISION OF NUCLEAR MEDICINE

POSTAL CODE 27706
TELEPHONE 919-684-2466

Dr. C. S. Shoup
Laboratory and University Branch
Oak Ridge Operations Office
U. S. Atomic Energy Commission
Oak Ridge, Tennessee 37830

Re: Contract # AT-(40-1)-3945

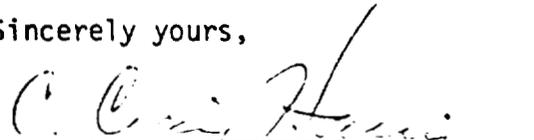
Dear Dr. Shoup:

We find it necessary to ask for an extension of time, without additional funding, on this project. The work for the current period has been completed, but more time is needed to prepare the Progress Report and Renewal Proposal.

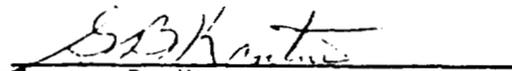
The chief reason for the necessity for this time extension, other than the press of clinical teaching duties, is a series of renovations that have our own and neighboring services in a state of upset and confusion.

It is believed that an additional period of 90 days should be quite adequate for the completion of the necessary reports. Please telephone me collect or FTS as soon as you have a decision on this (Area Code 919, 684-2466).

Sincerely yours,



C. Craig Harris
Assistant Professor of
Radiology (Medical Electronics)



George B. Kantner
Coordinator, Sponsored Programs

CCH:cmb

CC: Mr. George Kantner
Mr. Eston Betts

5114
OCT 14 1971

1117377



UNITED STATES
ATOMIC ENERGY COMMISSION

DAK RIDGE OPERATIONS
P O BOX E
DAK RIDGE, TENNESSEE 37830

Ralph Elson, Director, Contract Division

REQUEST FOR CONTRACT ACTION

It is requested that you take the necessary steps to process the following described contract action (CA):

1. Nature of Action Requested:

Selection of New Contractor and/or Negotiation of Contract
Number:
Contractor:

Modification of Contract
Number: AT-(40-1)-3945
Contractor: Duke University

2. Nature of Services To Be Covered by Contract: Research

Title: "Project to Develop Phantoms for Scanning"

3. Type of Contract:

Support Agreement Cost Type Other

4. Amount of AEC Funds To Be Obligated by this CA: \$1,091.00

5. AEC Percentage of Est. Total Cost To Be Shown by this CA: N.A.

6. Description of Other Changes To Be Covered by this CA:

Modify contract to reduce AEC Support Ceiling from \$6,202 to \$5,203.56 for the period May 1, 1969 through July 31, 1970, and to increase the AEC Support Ceiling from \$3,764 to \$5,853 for the period August 1, 1970 through November 30, 1971.

7. Authority:

Certified Statement of Costs from Contractor dtd 3-5-71 &
TWX from ~~JRF~~ to ~~SES~~ dtd 6-18-71. *Herman M. Roth*
NFS HmR

Herman M. Roth, Director
Laboratory and University Division

OLE:EMM

1117378

REL

JUN 10 11 42 AM '71

BY _____

RX3 0447 1036 1036

|| P BY1 ADMU 0860 JUN 18, 71

BX3

ZNR UUUUU

P 181530Z JUN 71

FM USAEC N F SIMPSON WASHDC

TO USAEC H M ROTH OAKRIDGE TENN

|| AE

BT

UNCLAS RE CONTRACT AT(40-1)3945 WITH DUKE UNIVERSITY. A SUPPLEMENT IN THE AMOUNT OF \$1,091.56. HAS BEEN APPROVED FOR THIS CONTRACT IN ORDER TO MAINTAIN THE APPROVED SUPPORT LEVEL OF \$5,354 FOR THE CURRENT PERIOD. CONTRACT AUTHORIZATION BM-71-19B WILL BE FORWARDED AS SOON AS POSSIBLE. RMPC:EAH.

BT

||

NNNN

||

1117379

(5061

JUN 18 1971

AECPR 9-4.81

U. S. ATOMIC ENERGY COMMISSION CONTRACT AUTHORIZATION		1. DATE JUN 18 1971	2. AUTHORIZATION NO. BM-71-19B
3.A. TO S. R. Sapirie, Manager Oak Ridge Operations Office		3.B. FROM <i>John R. Totter</i> John R. Totter, Director Division of Biology and Medicine	
4.A. CONTRACTOR (Name, Address, Department, etc.) DUKE UNIVERSITY Durham, North Carolina		4.B. PRINCIPAL INVESTIGATOR(S) C. CRAIG HARRIS	
5. <input type="checkbox"/> NEW CONTRACT <input type="checkbox"/> RENEWAL <input checked="" type="checkbox"/> OTHER		6. TERM OF CONTRACT 8/1/70 thru 11-30-71	7. CONTRACT NUMBER AT(40-1)3945
8. RECOMMENDED TYPE OF CONTRACT: <input type="checkbox"/> FIXED PRICE <input type="checkbox"/> OTHER <input type="checkbox"/> COST REIMBURSEMENT <input checked="" type="checkbox"/> SPECIAL RESEARCH SUPPORT AGREEMENT (SRSA)		9. EQUIPMENT TITLE TO VEST IN: <input type="checkbox"/> AEC <input checked="" type="checkbox"/> CONTRACTOR	10. SECURITY CLASSIFICATION: Work to be performed is under category <u>I</u> as defined by AEC Manual Appendix 3401.

11. PROJECT TITLE **PROJECT TO DEVELOP PHANTOMS FOR SCANNING**

12. HEADQUARTERS TECHNICAL CONTACT *W. Weyzen*
Walter H. Weyzen

13. FINANCING

A. OPERATING EXPENSES

New AEC Funds	\$ 1,091.56
Estimated AEC Balance From Prior Term, if any	\$
.....	\$ 1,091.56
Estimated Contractor Contribution, On Proportionate Sharing Basis, if any	\$
Estimated Project Cost, For Pertinent Budget Period	\$ 1,091.56
Budget and Reporting Classification: 06 03 01	
Allotment Transfer: 06-11-91(24)	

B. PLANT AND CAPITAL EQUIPMENT

Budget and Reporting Classification:

Allotment Transfer:

14. SPECIAL PROVISIONS AND INSTRUCTIONS:

The technical aspects of the proposed work have been reviewed and are approved. A need currently exists for the results of the research or other work that is to be undertaken. None of the AEC funds shall be used to enter a fellowship.

Please keep us informed as to any problems encountered in your negotiations, as well as the date of execution of this contract and the amount of funds obligated. If the budget as negotiated differs substantially from that in the proposal, please forward a copy of the revised budget to Headquarters.

If not already submitted, a 200-word summary of the proposed work should be forwarded by the contractor as soon as possible after negotiation of the contract.

15. SCOPE OF WORK

Developments of phantoms which will produce scan-images of normal and abnormal clinical conditions.

C 5107
JUN 21 1971

1117380



UNITED STATES
ATOMIC ENERGY COMMISSION

OAK RIDGE OPERATIONS
P. O. BOX E
OAK RIDGE, TENNESSEE 37830

AREA CODE 615
TELEPHONE 483-4411

Aug. 18 1970

J. R. Totter, Director, Division of Biology and Medicine, HQ

**CERTIFIED EXPENDITURE STATEMENT UNDER CONTRACT NO. AT-(40-1)-3945
WITH DUKE UNIVERSITY**

Enclosed is a copy of the certified expenditure statement submitted by the above institution covering the period ended July 31, 1970, and a summary of contract obligations and expenditures follows:

AEC's Obligations for Period	<u>5-1-69</u>	thru	<u>7-31-70</u>
Anticipated Total Project Cost			<u>\$,202.00</u>
New Funds Provided			<u>6,202.00</u>
Residual Funds			<u>0</u>
AEC Support Ceiling			<u>6,202.00</u>
Percentage of AEC Support			<u>100</u> %*
Actual Expenditures for Period	<u>5-1-69</u>	thru	<u>7-31-70</u>
Total Project Cost			<u>\$,203.56</u>
AEC's Share Based on Percentage*			<u>5,203.56</u>
AEC's Support Ceiling			<u>6,202.00</u>
Actual Residual Funds			<u>998.44</u>
AEC's Obligations for Period	<u>8-1-70</u>	thru	<u>7-31-71</u>
Anticipated Total Project Cost			<u>\$,854.00</u>
New Funds Provided and Current Support Ceiling			<u>3,764.00</u>
Estimated Residual Funds			<u>2,090.00</u>
Total Anticipated AEC Support			<u>5,854.00</u>
Percentage of AEC Support			<u>100</u> %

Y 1661

1117381

J. R. Totter

2

MAR 18 1971

In view of the preceding summary, it appears that the action indicated below is necessary:

- No action required; funding and expenditures were as contemplated.
- Contractor reports \$ _____ unexpended, which was not considered in renewal. Advise disposition of these funds.
- Contractor estimated \$ 2,090.00 in unexpended funds at time of renewal. The actual balance was \$ 998.44, which is less than the amount estimated. We need \$ 1,091.56 additional funds to increase support ceiling to the amount contemplated in Appendix "A" to contract.
- Contractor estimated \$ _____ in unexpended funds. The actual balance was \$ _____, which is \$ _____ in excess of anticipated balance. Advise disposition of latter amount.
- No renewal contemplated; residual funds retained in ORO.

Herman M. Roth
 Herman M. Roth, Director
 Laboratory and University Division
 Oak Ridge Operations

OLE:BLJ

Enclosure:
Statement

cc w/encl.
W. H. Henderson

Johnson
 Adm. Ser. Br.
 Johnson:jeb
 3-16-71
 3/17/71

Res. Contr. Br.
C. S. Sheaf
 3-12-71

* We are advising contractor that additional funding is not available.

1117382

APPENDIX "C"1

U. S. ATOMIC ENERGY COMMISSION

Statement of Annual Costs

1. Name and address of Contractor: Duke University, Durham, N. C. 27706
2. Contract Number: AT-(40-1)-3945
3. Contractor's Account number: 323-0019
4. Beginning and ending date of pertinent contract period: 5/1/69-7/31/70
5. Support ceiling for the pertinent contract period: \$6,202.00
6. Costs incurred during the pertinent contract period.

<u>Cost Categories</u>	<u>Amount</u>
a. <u>Salaries and Wages</u>	<u>\$1,873.70</u>
Dr. C. C. Harris, Principal Investigator (10% of time)* 2 Co-Investigators (5% of time)* Technician (30% of time) Clerical Help (5% of time)	
* Contributed by other sources and not included in above costs	
b. <u>Employee Benefits</u>	<u>\$ 186.03</u>
c. <u>Supplies and Materials</u>	<u>\$1,465.49</u>
Cobalt-57, material for phantoms and storage shields (lead and cadmium or tin), and general items	
d. <u>Publications and Communications</u>	<u>\$ 141.73</u>
e. <u>Travel</u>	<u>\$ 506.08</u>
Total Direct Expenditures	<u>\$4,173.03</u> ✓
f. <u>Indirect Charges</u>	<u>\$1,030.53</u> ✓
/ (55% of Salaries and Wages)	
Total Costs	<u>\$5,203.56</u> ✓

C-1

1117383

C 1871

MAR 10 1971

3-5-71

I hereby certify that this report is true and correct to the best of my knowledge and belief and that the costs and commitments listed herein were incurred during the period indicated, in connection with the performance of the research provided for under this contract and in accordance with the terms and conditions set forth therein.

C. Craig Harris, Assistant Professor of Radiology
Name and title of Principal Investigator

C. Craig Harris
Signature

March 5, 1971
Date

S. C. Harward, Assistant Treasurer
Name and title of business officer

S. C. Harward
Signature

March 5, 1971
Date



UNITED STATES
ATOMIC ENERGY COMMISSION

OAK RIDGE OPERATIONS
P. O. BOX E
OAK RIDGE, TENNESSEE 37830

APR 28 1971

Ralph Elson, Director, Contract Division

REQUEST FOR CONTRACT ACTION

It is requested that you take the necessary steps to process the following described contract action (CA):

1. Nature of Action Requested:

Selection of New Contractor and/or Negotiation of Contract
Number:
Contractor:

Modification of Contract
Number: **AT-(40-1)-3945**
Contractor: **Duke University**

2. Nature of Services To Be Covered by Contract: Research

Title: "Project to Develop Phantoms for Scanning"

3. Type of Contract:

Support Agreement Cost Type Other

4. Amount of AEC Funds To Be Obligated by this CA: None

5. AEC Percentage of Est. Total Cost To Be Shown by this CA: N/A

6. Description of Other Changes To Be Covered by this CA:

Modify contract to extend period thereunder to November 30, 1971, without additional funds. There will be no significant change in the scope of the work during the extended period.

7. Authority:

Form AEC-481 (CA) frm John R. Totter, HQ,
dtd 4-21-71.

Herman M. Roth, Director
Laboratory and University Division

CLE EMM

1117385

ORIGINAL

1570

AECPR 9-4.81		U. S. ATOMIC ENERGY COMMISSION CONTRACT AUTHORIZATION		1. DATE APR 21 1971	2. AUTHORIZATION NO. EM-71-19A
3.A. TO S. R. Sapirie, Manager Oak Ridge Operations Office		3.B. FROM <i>W. W. Surr Jr. for</i> John R. Totter, Director Division of Biology and Medicine			
4.A. CONTRACTOR (Name, Address, Department, etc.) DUKE UNIVERSITY Raleigh, North Carolina		4.B. PRINCIPAL INVESTIGATOR(S) C. CRAIG HARRIS			
5. <u>4 mo. ext. w/o funds</u> <input type="checkbox"/> NEW CONTRACT <input type="checkbox"/> RENEWAL <input checked="" type="checkbox"/> OTHER		6. TERM OF CONTRACT 8-1-71 thru 11-30-71		7. CONTRACT NUMBER AT(40-1)3945	
8. RECOMMENDED TYPE OF CONTRACT: <input type="checkbox"/> FIXED PRICE <input type="checkbox"/> OTHER <input type="checkbox"/> COST REIMBURSEMENT <input checked="" type="checkbox"/> SPECIAL RESEARCH SUPPORT AGREEMENT (SRSA)		9. EQUIPMENT TITLE TO VEST IN: <input type="checkbox"/> AEC <input checked="" type="checkbox"/> CONTRACTOR		10. SECURITY CLASSIFICATION: Work to be performed is under category <u>I</u> as defined by AEC Manual Appendix 3401.	

11. PROJECT TITLE
PROJECT TO DEVELOP PHANTOMS FOR SCANNING

12. HEADQUARTERS TECHNICAL CONTACT
Walter H. Weyzen *Weyzen*

13. FINANCING

A. OPERATING EXPENSES

New AEC Funds	\$ - 0 -
Estimated AEC Balance From Prior Term, if any	\$ _____
.....	\$ - 0 -
Estimated Contractor Contribution, On Proportionate Sharing Basis, if any	\$ _____
Estimated Project Cost, For Pertinent Budget Period	\$ = 0 -

Budget and Reporting Classification: 06 03 01
Allotment Transfer: 06-11-91(24)

B. PLANT AND CAPITAL EQUIPMENT

Budget and Reporting Classification:

Allotment Transfer:

14. SPECIAL PROVISIONS AND INSTRUCTIONS.

The technical aspects of the proposed work have been reviewed and are approved. A need currently exists for the results of the research or development work that is to be undertaken. None of the AEC funds shall be used to confer a fellowship.

Please keep us informed as to any problems encountered in your negotiations, as well as the date of execution of this contract and the amount of funds obligated. If the budget as negotiated differs substantially from that in the proposal, please forward a copy of the revised budget to Headquarters.

If not already submitted, a 200-word summary of the proposed work should be forwarded by the contractor as soon as possible after negotiation of the contract.

Extension necessary to allow for completion and evaluation of phantoms before submission of renewal proposal.

15. SCOPE OF WORK

Developments of phantoms which will produce scan-images of normal and abnormal clinical conditions.

APR 23 1971
C-3318

1117386

Duke University Medical Center

DURHAM, NORTH CAROLINA

April 6, 1971

DEPARTMENT OF RADIOLOGY
DIVISION OF NUCLEAR MEDICINE

POSTAL CODE 27706
TELEPHONE 919-684-2466

Herman N. Roth, Director
Laboratory and University Division
Oak Ridge Operations
United States Atomic Energy Commission
P. O. Box E
Oak Ridge, Tennessee 37830

Re: Contract No. AT-(40-1)-3945

Dear Dr. Roth:

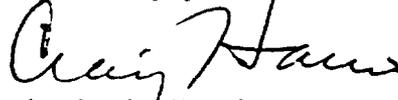
I am in receipt of your letter of April 2, 1971 inviting my attention to the submission of the renewal proposal and progress report which will be due May 1, 1971. E.M.

I would like to request that you obtain for me permission to extend the period of this contract, without additional funds, for 120 days. Chief of among the several reasons for this request is the fact that I have been invited by the Atomic Energy Commission to represent the United States at an IAEA Thyroid Uptake Procedure Committee in mid-May. The IAEA has asked that each participant prepare one or more working papers to expedite the conduct of their meeting on thyroid uptake. This travel and the preparation for it must necessarily come at the expense of work I had planned to do on this contract.

While we have several phantoms in design and construction at this point, the interruptions for the Vienna meeting and for the Los Angeles meeting of The Society of Nuclear Medicine will necessarily delay completion and evaluation of those phantoms until July. We have sufficient funds available to complete this phase of the work, which I would like very much to do before considering the renewal proposal.

It would be a pleasure to hear from you at your earliest convenience regarding permission to extend this contract as requested.

Sincerely yours,


C. Craig Harris

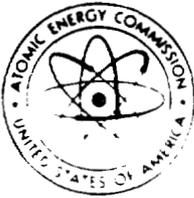
CCH: cmb

CC: Mr. S. C. Harward
Mr. Eston Betts
Dr. C. S. Shoup

APR 1

C-2902

1117387



UNITED STATES
ATOMIC ENERGY COMMISSION

OAK RIDGE OPERATIONS
P. O. BOX E
OAK RIDGE, TENNESSEE 37830

JUL 23 1970

Ralph Elson, Director, Contract Division

REQUEST FOR CONTRACT ACTION

It is requested that you take the necessary steps to process the following described contract action (CA):

1. Nature of Action Requested:

Selection of New Contractor and/or Negotiation of Contract

Number:

Contractor:

Modification of Contract

Number: AT-(40-1)-3945

Contractor: Duke University

2. Nature of Services To Be Covered by Contract: Research

Title: PROJECT TO DEVELOP PHANTOMS FOR SCANNING

3. Type of Contract:

Support Agreement

Cost Type

Other

4. Amount of AEC Funds To Be Obligated by this CA: \$3,764.00

5. AEC Percentage of Est. Total Cost To Be Shown by This CA: 100%

6. Description of Other Changes To Be Covered by This CA:

Modify contract to provide for the performance of additional research to be completed during the period 8-1-70 - 7-31-71. The AEC support ceiling for the extended period is \$3,764. It is now estimated that \$2,090 in unexpended funds will be added to the support ceiling. Title to equipment shall vest in the contractor under authority of PL 85-934.

Note

7. Authority:

Form AEC-481 (CA) fr J. R. Totter
dated July 15, 1970.

OLE: EMM

Herman M. Roth
Herman M. Roth, Director
Laboratory and University Division

1117388

APPENDIX "A"

For the Contract Period August 1, 1970 through July 31, 1971.

A-I RESEARCH TO BE PERFORMED BY CONTRACTOR

The Contractor will continue studies and design for the development of phantoms for medical radionuclide imaging that will produce pictures similar to those from clinical studies. These phantoms, in the prototype stage, will be used for standardising recording techniques, checking the imaging equipment for malfunction, for student training, and for the assessment of imaging-data-processing techniques useful in nuclear medicine.

Dr. C. Craig Harris, Principal Investigator, expects to devote approximately 10% of his time or effort to the contract work.

A-II WAYS AND MEANS OF PERFORMANCE(a) Items Included in Total Estimated Cost:

(1) <u>Salaries and Wages:</u>	\$2,320.00
Technician	
Clerical Help	
(2) <u>Employee Benefits:</u>	234.00
(3) <u>Supplies and Materials:</u>	1,400.00
Cobalt-57, material for phantoms and storage shields, and general items.	
(4) <u>Publications and Communications:</u>	100.00
(5) <u>Equipment to be Purchased or Fabricated by the Contractor:</u>	0
<u>a</u> Equipment Estimated to Cost Less than \$1,000:	
None	
<u>b</u> Equipment Estimated to Cost in Excess of \$1,000:	
None	
(6) <u>Travel:</u>	500.00
(6) <u>Indirect Costs</u> (Fixed at 56% of Salaries and Wages):	1,300.00

(b) Items, if any, Significant to the Performance of this Contract, but Excluded from Computation of Support Cost and from Consideration in Proportioning Costs:

(1) Items to be Contributed by the Contractor:

Approximately 5% of time for two co-investigators and fringe benefit and overhead thereon.

(2) Items to be Contributed by the Government:

None

(c) Time or Effort of Principal Investigator(s) Contributed by Contractor, but Excluded from Computation of Support Cost and from Consideration in Proportioning Costs:

Approximately 10% of time by Principal Investigator and fringe benefits and overhead thereon.

A-III The total estimated cost of items under A-II (a) above for the contract period stated in this Appendix "A" is \$5,854.00; the Commission will pay 100% of the actual costs of these items incurred during the contract period stated in this Appendix "A", subject to the provisions of Article III and Article B-XXVII. The estimated AEC support cost for the contract period stated in this Appendix "A" is \$5,854.00.

The estimated AEC support cost is the basis for calculating the payments provided for in Article B-XI. In view of the amount of AEC funds tentatively estimated to be remaining in the contractor's hands from previous periods under this contract, the additional funding to be added to the letter of credit at this time is \$3,178.60. AEC funds remaining from previous periods not to exceed \$2,090.00 are hereby authorized to be applied to the current period above.

U. S. ATOMIC ENERGY COMMISSION
CONTRACT AUTHORIZATION

1. DATE

JUL 15 1970

2. AUTHORIZATION NO.

BM-71-19

3. A. TO

S. R. Sapirie, Manager
Oak Ridge Operations Office

3. B. FROM

John R. Totter
John R. Totter, Director
Division of Biology and Medicine

4. A. CONTRACTOR (Name, Address, Department, etc.)

DUKE UNIVERSITY
Raleigh, North Carolina

4. B. PRINCIPAL INVESTIGATOR(S)

C. CRAIG HARRIS

5.

NEW CONTRACT RENEWAL OTHER

6. TERM OF CONTRACT

8-1-70 thru 7-31-71

7. CONTRACT NUMBER

AT(40-1)-3945

8. RECOMMENDED TYPE OF CONTRACT:

FIXED PRICE OTHER

COST REIMBURSEMENT

SPECIAL RESEARCH SUPPORT AGREEMENT (SRSA)

9. EQUIPMENT TITLE TO VEST IN:

AEC

CONTRACTOR

10. SECURITY CLASSIFICATION:

Work to be performed is under category I
as defined by AEC Manual Appendix 3401.

11. PROJECT TITLE

"PROJECT TO DEVELOP PHANTOMS FOR SCANNING"

12. HEADQUARTERS TECHNICAL CONTACT

Walter H. Weyzen

WH Weyzen

13. FINANCING

A. OPERATING EXPENSES

New AEC Funds \$ 3,764

Estimated AEC Balance From Prior Term, if any \$ 2,090

..... \$ 5,854

Estimated Contractor Contribution, On Proportionate Sharing Basis, if any \$

Estimated Project Cost, For Pertinent Budget Period \$ 5,854

Budget and Reporting Classification: 06 03 01 *20*

Allotment Transfer: 06 ~~02~~ 91 (24)

B. PLANT AND CAPITAL EQUIPMENT \$

Budget and Reporting Classification:

Allotment Transfer:

14. SPECIAL PROVISIONS AND INSTRUCTIONS

The technical aspects of the proposed work have been reviewed and are approved. A need currently exists for the results of the research or other work that is to be undertaken. None of the AEC funds shall be used to confer a fellowship.

Please keep us informed as to any problems encountered in your negotiations, as well as the date of execution of this contract and the amount of funds obligated. If the budget as negotiated differs substantially from that in the proposal, please forward a copy of the revised budget to Headquarters.

If not already submitted, a 200-word summary of the proposed work should be forwarded by the contractor as soon as possible after negotiation of the contract.

15. SCOPE OF WORK

Developments of phantoms which will produce scan-images of normal and abnormal clinical conditions.

8 5096

~~XXXXXXXX~~

JUL 16 1970

1117391



UNITED STATES
ATOMIC ENERGY COMMISSION

OAK RIDGE OPERATIONS
P O BOX E
OAK RIDGE, TENNESSEE 37830

AREA 101
TELEPHONE 534-4444

May 27, 1970

John R. Tetter, Director, Division of Biology and Medicine, HQ
RENEWAL OF CONTRACT NO. AT-(40-1)- 3945 WITH DUKE UNIVERSITY

We are submitting for your review and appropriate action the following information concerning the contract which will expire on **July 31, 1970:**

- | | | |
|------------------------|-----|------------------------------|
| 1. Renewal Proposal | (4) | included in Renewal Proposal |
| 2. Progress Report | (4) | |
| 3. Financial Statement | (4) | |
| 4. 200-Word Summary | (3) | |

We shall appreciate your advising us of your decision so that we may proceed with the necessary contract action at the earliest possible date.

Herman M. Roth, Director
Laboratory and University Division
Oak Ridge Operations

OLE: EMM

Enclosures:
As Listed Above

BC: D. S. Zachry, w/2 cys Progress
Report & cy Form AEC-427
C. S. Shoup, w/cy encls.
→ Alice Brown

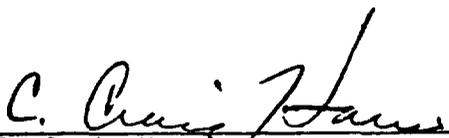
1117392

RENEWAL PROPOSAL
AEC CONTRACT AT-(40-1)-3945

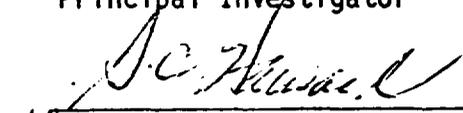
PROJECT TO DEVELOP PHANTOMS FOR SCANNING

Division of Nuclear Medicine
Department of Radiology
Duke University Medical Center
Durham, North Carolina 27706

1 May, 1970



C. Craig Harris
Principal Investigator



H.S. C. Harward
Assistant Treasurer

1117393

1117393

MAY 25 1970

RENEWAL PROPOSAL
AEC CONTRACT #AT-(40-1)-3945

"PROJECT TO DEVELOP PHANTOMS FOR SCANNING"

Division of Nuclear Medicine
Department of Radiology
Duke University Medical Center
Durham, North Carolina 27706

C. Craig Harris, Principal Investigator

Project Abstract:

The purpose of this project is to develop phantom targets for medical radionuclide scanning and imaging. By the development of these phantom targets, it is hoped to produce a general improvement in the reliability and efficacy of imaging techniques in clinical nuclear medicine and thus promote the delivery of better health care to the general public.

Background Information:

This material was supplied in the original proposal along with the personnel qualifications.

Status:

The present status of this project is described in the accompanying progress report which describes the set of normal brain scan phantoms that have been produced to date.

PROPOSAL:

It is proposed that the contract be renewed to permit a continuation of this development, and to obtain the benefit of the initial effort thus far expended. Results to date include the satisfactory promulgation of suitable sources of radioactivity for this type of phantom. In addition, a basic type of phantom has been successfully constructed. Further support is requested to:

- (1) Perfect and simplify the templates for normal brain scan images.
- (2) Construct a second set of brain scanning phantoms to simulate abnormal conditions including tumors.
- (3) Extend this principle to phantom targets suitable for simulation of other organ scans, notably liver-spleen, lungs and kidneys.
- (4) Modification of the foregoing to allow the slab sources to be filled with a solution of Tc-99m instead of Co-57. Daily filling of the slab sources with Tc-99m may be considerably more useful in those institutions using molybdenum-technetium generators and would, in general, lessen the radiation level from the slab sources themselves in periods of non-use.

It is believed that the results of this study so far are useful and that the continuation will be even more productive. It is believed that these studies will be of considerable usefulness to the field of nuclear medicine and contribute materially to the public welfare.

PROPOSED BUDGET

Personnel:

Project Director	10%	-----
Co-investigator	5%	-----
Co-investigator	5%	-----
Technician	30%	\$1,800
Clerical	10%	520
Fringe benefits, 10.1% of S.&W.		234

Supplies:

25 mCi Co-57	\$1,000
Material for phantoms and storage shields to be constructed at Duke University	200

General	200
---------	-----

Publications and Communications:	100
----------------------------------	-----

Travel:	500
---------	-----

TOTAL DIRECT COSTS	\$4,550
--------------------	---------

Indirect costs at established rate of 56% S. & W.*	1,300
--	-------

\$5,854

*Resulting from negotiations based on Defense Contract Audit Agency Audit Report No. 122-01-9-0321, dated 23 May, 1969 covering the fiscal year ending June 30, 1968.

1117396

Budget Explanation:

The request is slightly less than the amount requested for the first year in projection of the needs for the second year.

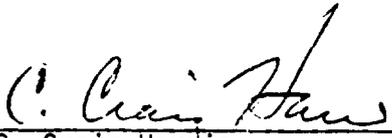
The changes in salaries and wages reflect changes in wage scales at Duke University. The price of Co-57 is less currently than was anticipated at the outset of this project. Funds for construction are reduced because of the successful completion of the source construction phase of the project. It is expected that this project will be successful enough that papers will be presented at the meeting of the Southeastern Chapter of the Society of Nuclear Medicine in Cincinnati in October and that the Annual Meeting of the Society of Nuclear Medicine in Los Angeles in June of 1971. The request for travel funds accordingly has been left at the level of the first year.

1117397

FINANCIAL REPORT
AT-(40-1)-3945

ITEM	BUDGET	BALANCE Apr. 30, 1970	ESTIMATED BALANCE July 31, 1970
Salaries & Wages	\$2,130.00	\$2,130.00	\$ 730.00
Fringe benefits	200.00	200.00	60.00
Supplies	2,000.00	1,322.84	800.00
Publications and Communications	200.00	102.60	100.00
Travel	500.00	176.25	0
Indirect Costs	1,172.00	1,172.00	400.00
	<hr/>	<hr/>	<hr/>
	\$6,202.00	\$5,103.69	\$2,090.00

The estimated balances for April 30, 1970 are based on our Division records and are subject to correction by final statement. The projections to July 31, 1970 are based on current and approved future salary rates, and the estimated activity level for this time period.



C. Craig Harris
Principal Investigator

1117398



UNITED STATES
ATOMIC ENERGY COMMISSION

OAK RIDGE OPERATIONS
P O BOX E
OAK RIDGE, TENNESSEE 37830

FEB 13 1970

Ralph Elson, Director, Contract Division

REQUEST FOR CONTRACT ACTION

It is requested that you take the necessary steps to process the following described contract action (CA):

1. Nature of Action Requested:

Selection of New Contractor and/or Negotiation of Contract
Number:
Contractor:

Modification of Contract
Number: AT-(40-1)-3945
Contractor: Duke University

2. Nature of Services To Be Covered by Contract: Research

Title: PROJECT TO DEVELOP PHANTOMS FOR SCANNING

3. Type of Contract:

Support Agreement Cost Type Other

4. Amount of AEC Funds To Be Obligated by this CA: None

5. AEC Percentage of Est. Total Cost To Be Shown by This CA: N/A

6. Description of Other Changes To Be Covered by This CA:

Modify contract to extend period thereunder to July 31, 1970, without additional funds. There will be no significant change in the scope of the work during the extended period.

7. Authority:

Form AEC-481 (Cont. Authr.) from J. R. Totter to S. R. Sapir
dated February 5, 1970.

OLE: EMM

Herman M. Roth
Herman M. Roth, Director
Laboratory and University Division

1117399

4853

Duke University Medical Center

DURHAM NORTH CAROLINA

January 14, 1970

DEPARTMENT OF RADIOLOGY
DIVISION OF NUCLEAR MEDICINE

POSTAL CODE 27706
TELEPHONE 819-684-2400

Herman N. Roth, Director
Laboratory and University Division
Oak Ridge Operations
P. O. Box E
Oak Ridge, Tennessee 37830

Reply To:
C. Craig Harris
Duke University Medical Center
Box 3504
Durham, N. C. 27706

Subject: RENEWAL OF CONTRACT NO. AT-(40-1) - 3945

Dear Dr. Roth:

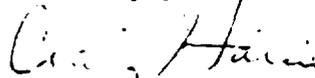
Thank you for your letter of January 8 pertaining to the submission of a renewal proposal and progress report, due February 1, 1970.

I hereby request an extension of this contract, without additional funding. The performance of this contract is running behind schedule for a number of reasons. Nearly two months of the contract period had elapsed before we received firm notification that the award had been made. This in turn interacted with the scheduling of our research technicians and student help. Further, we experienced a considerable delay in an order for lead foil which had to be specially rolled and prepared.

At this time, however, work on the contract is proceeding quite well. An extension of 3 months, delaying the end of the current granting period from April 30 to July 31, 1970 would, I believe, enable us to bring the work on this contract up to schedule.

We therefore request of the Commission a 3 months extension without additional funding. We would be pleased to hear from you at your earliest convenience.

Sincerely yours,



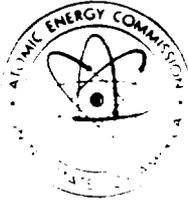
C. Craig Harris

CCH:cmb

CC: Dr. C. S. Shoup
Mr. Stephen C. Harward
Mr. George Kantner

1117401

B 323



UNITED STATES
ATOMIC ENERGY COMMISSION

OAK RIDGE OPERATIONS
P O BOX E
OAK RIDGE, TENNESSEE 37830

Ralph Elson, Director, Contract Division

REQUEST FOR CONTRACT ACTION

It is requested that you take the necessary steps to process the following described contract action (CA):

1. Nature of Action Requested:

- Selection of New Contractor and/or Negotiation of Contract
Number: AT-(40-1)-3945
Contractor: Duke University
- Modification of Contract
Number:
Contractor:

2. Nature of Services To Be Covered by Contract: Research

Title: "Project to Develop Phantoms for Scanning"

3. Type of Contract:

- Support Agreement Cost Type Other

4. Amount of AEC Funds To Be Obligated by This CA: \$6,202.00

5. AEC Percentage of Est. Total Cost To Be Shown by This CA: 100%

6. Description of Other Changes To Be Covered by This CA:

New contract to provide for the performance of research to be completed during the period May 1, 1969, through April 30, 1970. The AEC has approved a support ceiling of \$6,202. Title to equipment, if any shall vest in the contractor under authority of Public Law 85-934. Designate Dr. C. Craig Harris as Principal Investigator. *[Signature]*

7. Authority:

Form AEC-481 (Contract Authorization) from J. R. Totter to S. R. Sapirie dated April 30, 1969.

Herman M. Roth
Herman M. Roth, Director
Laboratory and University Division

OLE: EMM

1117402

APPENDIX "A"

For the Contract Period May 1, 1969, through April 30, 1970.

A-I RESEARCH TO BE PERFORMED BY CONTRACTOR

The Contractor will conduct research directed at the development of phantoms for use in the testing and adjustment of nuclear medical scanning equipment, thus assisting physicians in scanning procedures. These phantoms will help portray selected clinical conditions by permitting adjustment of instrumentation prior to patient use.

It is expected that the Principal Investigator will devote approximately 10% of his time or effort to the project.

A-II WAYS AND MEANS OF PERFORMANCE(a) Items Included in Total Estimated Cost:

- | | |
|--|------------|
| (1) <u>Salaries and Wages:</u> | \$2,130.00 |
| Dr. C. C. Harris, Principal Investigator
(10% of time)* | |
| 2 Co-Investigators (5% of time)* | |
| Technician (30% of time) | |
| Clerical Help (10% of time) | |
| *Contributed by other sources and not included in above costs. | |
| (2) <u>Employee Benefits:</u> | 200.00 |
| (3) <u>Supplies and Materials:</u> | 2,000.00 |
| Cobalt-57, material for phantoms and storage shields
(lead and cadmium or tin), and general items | |
| (4) <u>Publications and Communications:</u> | 200.00 |
| (5) <u>Travel:</u> | 500.00 |
| (6) <u>Indirect Costs (55% of Salaries and Wages):</u> | 1,172.00 |

(b) Items Significant to the Performance of This Contract, But Excluded From Computation of Total Cost and From Consideration in Proportioning Costs:

None

(c) Time or Effort of Principal Investigator To Be Contributed by Contractor:

None under this paragraph.

A-III The total estimated project cost of A-II (a) above for the contract period stated above is \$6,202.00.

1117403

RESEARCH PROPOSAL
Duke University
November 6, 1968

A Proposal to the Division of Biology and Medicine
United States Atomic Energy Commission

PROJECT TO DEVELOP PHANTOMS FOR SCANNING

C. Craig Harris
C. Craig Harris, M.S.
Principal Investigator

11/7/68
RTR

S. C. Harward
S. C. Harward
Controller

1117405

A 4310

Abstract

The Division of Nuclear Medicine, Department of Radiology, Duke University Medical Center proposes a program of development of phantom targets for medical radionuclide scanning and imaging. There is a need for simple but clinically related phantoms for use in standardization of recording parameters, for use in evaluation of scanner performance, to assist in rapid assessment of suspected malfunction under clinical conditions, and for physician and technician teaching.

To fill this need in our own work, we have invented a new concept that shows promise toward competent but inexpensive commercially available phantoms. We feel that such phantoms would be particularly useful in the small hospital where service and engineering expertise are difficult to obtain, and where a scanner may receive only occasional use. Where scanners are not operated continuously, malfunction may not be detected until after the patient has been injected with the radioactive tracer material. In such situations a preliminary scan of a "clinical phantom" would either detect malfunction or reaffirm scanner readiness and recorder settings. Thus needless exposure of the patient to radiation would be avoided.

We seek support for the development of our ideas on phantoms into practical reality from the Division of Biology and Medicine of the United States Atomic Energy Commission. We respectfully submit that such support would be complementary to its support of the "Development of Adequate Phantoms for Brain Scanning with Technetium-99m Pertechnetate" through AEC Contract No. AT-(40-1)-3716 with the Radiation Laboratory, School of Engineering, Tulane University. We further suggest that if this support is granted the work of the two programs be coordinated for maximum effectiveness.

1117406

Introduction

We have noted the Tulane effort with considerable interest; working independently through the initial period of that research, we have been persuaded that clinically oriented phantoms are of especial value. Our own clinical scanning operations already have been enhanced by applying the concepts of the Tulane development, especially with regard to recording parameters even though we took a different approach in phantom construction. We used a clinically oriented phantom to establish a practical and simple formula for setting scanner speed and recording controls to obtain reproducible scan images. The other advantages noted in the Abstract became known as a result of using the phantoms for recording applications.

The salutary effects of the use of our first, crude phantom compels us to propose further development aimed at low cost, simplicity and greater usefulness. In addition, we propose extension of this principle to scanning of organs other than the brain.

Description of the Proposed Phantom Construction

Our proposed construction is an invention of the (would-be) principal investigator and is related to the blotting-paper phantoms reported by Hidalgo.* It differs, however, in that instead of consisting of an inhomogenous activity pattern it consists of a homogenous slab of radioactive material with an attenuating overlay to define the apparent activity pattern. Our experimental brain phantom consists of a liquid-filled slab source overlain with contoured patterns of one or more layers of 0.005-inch lead foil to produce spatial variation of counting rates similar to those in a clinical brain scan.

*The Use of Phantoms in Developing and Refining Scintillation Scan Procedures, in Scintillation Scanning in Clinical Medicine, James L. Quinn, III, Editor, W. B. Saunders, 1964.

A Proposal

We propose that the Commission support our development of this type of phantom, and that we coordinate our efforts with those of the Tulane group. We believe that the dual approach to the problem of phantom production may well reduce the lead time in availability for use in general clinical nuclear medicine. We propose that our effort be directed initially at construction of prototype brain phantoms. We would use quantitative data from our own clinical work and from the first year of the Tulane project to make attenuator sheets for normal anterior, posterior and lateral brain scans. When the attenuator configurations have been determined a suitable means of fixation or stabilization, such as lamination in plastic will be perfected. The development would not necessarily preempt refinements in manufacturing methods that could be made by industry, but it would be directed at low cost and simplicity to provide maximum usefulness to small institutions using scanning in the general patient-care situation.

The attenuator sheets would probably be made of lead, but as fluorescent x-rays from the lead are annoying, graded absorbers of cadmium (or tin) and copper would be investigated to optimize the design. Plastic laminants or doping agents would be studied for suitability and the most practical choices determined.

When suitable designs had been developed they would be published. Even as this approach is a divergence from the blotting-paper phantoms, alternate approaches or methods may emerge during the development. In this event, each alternative having sufficiently special attributes would also be published.

1117408

Subsequent developments would logically include, at first, attenuator sheets with built-in abnormal clinical conditions. Some of these could, by design, be marginally detectable by ordinary interpretative means for the purpose of checking the results of computer scan record analysis as well as the teaching of scan interpretation. Still later developments would be the design of attenuator sheets to simulate activity patterns of other organs, both normal and abnormal.

Possible Additional Benefits of This Development

Inasmuch as this development would require the manufacture of a homogeneous slab source, the source could be made large enough to serve as a photon source for transmission imaging with both rectilinear scanners and stationary imaging devices. Transmission imaging as described in the literature by David Kuhl, Alexander Gottschalk and Hal Anger seems to have interesting possibilities not only for body outlining for recording patient position but important clinical diagnostic uses as well. When performed on stationary imaging devices such as the Anger scintillation camera, either a systematically moving source or a large homogeneous source is required. There is no reason why the unattenuated source for the phantoms could not also serve as a transmission-imaging source. As activity levels might tend to be somewhat high when the source is loaded for this purpose, suitable shields or "cassettes" for housing the source should be developed.

Flat phantoms made either by the blotting-paper method or by the method proposed here should make excellent teaching aids when placed in an opaque covering to serve as "unknowns." A "library" of attenuating patterns could eventually be made up to simulate almost all clinical situations, normal and abnormal.

In addition to the function of serving as a check source for computer-processed scan data, clinical phantoms of this type could be useful in the further development of on-line, or live-time, scan recording systems.

Administrative Note

There is some relationship between the rationale of this proposal and the image-analysis aspects of AEC Contract #AT-(40-1)-3550, "Myocardial Scanning of Mongrel Pigs and Chronic Cardiac Patients with Cs-131 in Combination with Selective Coronary Angiography," Jack K. Goodrich, M.D., Principal Investigator.

Personnel

Principal investigator will be C. Craig Harris of the Division of Nuclear Medicine, Department of Radiology, Duke University Medical Center. Co-investigator in the development will be Jack K. Goodrich, M.D. Associate Professor and Director, Division of Nuclear Medicine. Both are identified with the phantom development in the reference (Hidalgo) already cited. The other co-investigator will be Robert H. Wilkinson, Jr., M.D., Associate, Division of Nuclear Medicine.

Biographical sketches of these investigators are attached.

BIOGRAPHICAL SKETCH

Name: C. Craig Harris

Title: Assistant Professor of Medical Electronics
Duke University

Birthdate: [REDACTED]

Place of Birth: [REDACTED]

Present Nationality: U.S.

Sex: Male

Education:

Honors:

Tau Beta Pi (Engr.); Eta Kappa Nu (Elec. Engr.); Who's Who in American Education; American Men of Science; Who's Who in Atoms; Honorary Member, Southwestern Chapter, Society of Nuclear Medicine

Societies:

American Association of Physicists in Medicine

Society of Nuclear Medicine

Member, Board of Trustees	1959 - 1962
Secretary	1962 - 1965
Vice-President-elect	1965 - 1966
Vice-President	1966 - 1967
President-elect	1967 - 1968
President	1968 - 1969

Major Research Interest:

Instrumentation for Nuclear Medicine

1117411

Research and/or Professional Experience:

Research Staff Member, Oak Ridge National Laboratory
1950 - 1967

Group Leader, Medical Nuclear Instrumentation Group, Thermo-
nuclear Division, Oak Ridge National Laboratory
1962 - 1967

Assistant Professor of Medical Electronics, Duke University
1967 - present

Consultantships:

National Consultant in Electronic Detection Equipment, to Surgeon
General, United States Air Force.
1960 - 1962

Consultant to Division of Nuclear Medicine, Vanderbilt University
1964 - 1966

Consultant to Division of Nuclear Medicine, Department of Radiology,
Duke University Medical Center
1966 - 1967

Special Consultant to Department of Diagnostic Radiology, Clinical
Center, National Institutes of Health
1966 - 1967

Consultant to Division of Nuclear Medicine, Clinical Center,
National Institutes of Health
1967 -

Advisor to nuclear medical programs at:

The University of Tennessee Memorial Research Hospital,
Knoxville
1965 - 1967

Ochsner Foundation Hospital, New Orleans, Louisiana

Radiation Research Section, Tulane University, New Orleans,
Louisiana

Medical Division, Oak Ridge Associated Universities, Oak
Ridge, Tennessee
1956 -

BIOGRAPHICAL SKETCH

Name: Jack K. Goodrich, M.D.

Title: Associate Professor and Director, Division of Nuclear Medicine
Duke University

Birthdate: [REDACTED]

Birthplace: [REDACTED]

Present Nationality: U.S.

Sex: Male

Education:

[REDACTED]

Honors:

Alton Ochsner Medical Foundation Award for Excellence in Medical Writing - 1960

Societies:

- North Carolina Radiological Society
- Society of Nuclear Medicine
- Southern Radiological Conference**
- Southern Medical Association
- American College of Radiology
- Radiological Society of North American

Major Research Interest:

Instrumentation for Nuclear Medicine

1117413

Professional Experience:

Instructor, Department of Radiology, University of Mississippi
1960

Assistant Professor, Department of Radiology, University of
Mississippi
1961

Associate Professor, University of Mississippi Medical Center
1965

Associate Professor, Department of Radiology, Division of Nuclear
Medicine, Duke University Medical Center
1965 - present

Diplomate of American Board of Radiology
1961

BIOGRAPHICAL SKETCH

Name: Robert Holden Wilkinson, Jr.
Title: Associate, Division of Nuclear Medicine
Duke University
Birthdate: [REDACTED]
Place of Birth: [REDACTED]
Present Nationality: U.S.
Sex: Male

Education:

[REDACTED]

Board Certification:

Certified by the American Board of Radiology, December, 1965

Medical Licenses:

Missouri - July, 1958
Virginia - December, 1964
North Carolina - April, 1967

Societies:

The American College of Radiology
Medical Society of Virginia
Virginia Radiological Society
Tidewater Radiological Society
Portsmouth Academy of Medicine

1117415

Major Research Interest:

Clinical Nuclear Medicine

Professional Experience:

- Active duty as Medical Officer, United States Navy
1959 - 1961

Instructor, Department of Radiology, Medical College of Virginia
1964 - 1965

Private practice of radiology as an associate with Drs. Hargroves, Padgett, and Carr at the Portsmouth General Hospital, Portsmouth, Virginia and the Maryview Hospital, Portsmouth, Virginia 1965 - 1967

Associate, Division of Nuclear Medicine, Department of Radiology,
Duke University Medical Center
1967 - present

PUBLICATIONS RELATING TO THE PROPOSED WORK

"Problems Encountered in In Vivo Localization of Radioactivity and Solutions to a Few of Them," C. C. Harris, J. E. Francis, Jr., and P. R. Bell, Proceedings of the 2nd Annual Texas Conference on the Utilization of Atomic Energy, Texas Engr., Expr. Sta. E 72-60, November, 1959.

"Collimators for Radioisotope Scanning," C. C. Harris, P. R. Bell, J. E. Francis, Jr., M.D. Satterfield, J. C. Jordan and J. P. Murray, Jr., Chapter 2, pp. 25-65, Progress in Medical Radioisotope Scanning, Edited by R. M. Kniseley, G. A. Andrews and C. C. Harris, Oak Ridge, U.S.A.E.C., 1963. TID 7673 - Proceedings of a symposium, Medical Division of The Oak Ridge Institute of Nuclear Studies, Oak Ridge, Tennessee, 22-26 October, 1962.

"Data Recording for Radioisotope Scanning," C. C. Harris, P. R. Bell, M. M. Satterfield, J. C. Jordan, J. E. Francis, Jr., Chapter 3, pp. 66-104, Progress in Medical Radioisotope Scanning, U.S.A.E.C., 1963. TID 7673, op. cit.

"Certain Fundamental Physical Considerations in Scanning," C.C. Harris, Chapter 1, pp. 1-15, Scintillation Scanning in Clinical Medicine, based on a symposium by the Department of Radiology of the Bowman Gray School of Medicine, Winston-Salem, N.C., January 30-31, 1964. Edited by James L. Quinn III, M.D., W.B. Saunders Company, 1964.

"The Design and Performance of A Large High-Resolution Focusing Collimator," C. C. Harris, P.R. Bell, M.M. Satterfield, D.A. Ross and J.C. Jordan, Medical Radioisotope Scanning, proceedings of a symposium on scanning, Athens, Greece, April 20-24, 1964, IAEA, Vienna, 1965, Vol. 1, pp. 193-208.

"Moving-Detector Scanners Vs. Stationary Imaging Devices," C.C. Harris, P.R. Bell, D.A. Ross and M.M. Satterfield, in Fundamental Problems in Scanning, based on a symposium held in Chicago, May 8-9, 1965. Edited by A. Gottschalk and R.N. Beck. Charles C. Thomas, Springfield, Ill., 1968.

"Cardiac Scanning and Low Energy Collimators," J.K. Goodrich, F.S. Hill, Jr., and R.W. Hill, in Symposium on Computers and Scanning, edited by John U. Hidalgo, Society of Nuclear Medicine, 1967, pp. 75-88.

"Clinical Applications of Low Energy-High Transmission Collimators," J.K. Goodrich, H.L. Stone, R.W. Hill, and C.C. Harris, Journal of Nuclear Medicine, June, 1965.

1117417

PROPOSED BUDGET

Personnel:

Project Director	10%	-----
Co-investigator	5%	-----
Co-investigator	5%	-----
Technician	30%	\$1,650
Clerical	10%	480

Fringe benefits, 9.9% of S. & W.		200
----------------------------------	--	-----

Supplies:

25 mCi Co-57		1,200
Material for phantoms and storage shields to be constructed at Duke University		500
General		300

Publications and Communications:		200
----------------------------------	--	-----

Travel:		500
---------	--	-----

TOTAL DIRECT COSTS		\$5,030
--------------------	--	---------

Indirect costs at established rate of 55% S. & W.* \$1,172

\$6,202

*Resulting from negotiations based on Defense Contract Audit Agency Audit Report No. 122-01-05-8-0255, dated 24 April, 1968 covering the fiscal years ending June 30, 1965 and June 30, 1966.

1117418