WILLIAM M. BROBECK & ASSOCIATES
A CALIFORNIA CORPORATION
ENGINEERING RESEARCH • DESIGN • DEVELOPMENT
950 GILMAN STREET • BERKELEY, CALIFORNIA 94710 • 415-524-8664 • TWX 415-891-9564

Brcow Need

7019

September 3, 1965

File: 131-1, 4.1
Contract NAS3-8146

Mr. Myron A. Pollyea
National Aeronautics and
Space Administration
Lewis Research Center
21000 Brookpark Road
Cleveland, Ohio 44135

Dear Mr. Pollyea:

We are transmitting herewith 20 copies of the final submission of our Report No. 131-1-R2, "Preliminary Engineering Report for the Modification of the Material and Stress Building 60-Inch Cyclotron." Twenty additional copies will be forwarded on Tuesday, September 7.

We are also mailing separately reproducible sepia prints of the full-size drawings 131D8 through 131D14.

Very truly yours,

William M. Brobeck

William M. Brobeck

WMB:svb
Enc: As noted (20)

cc: Mr. M. A. Pollyea (4)

49-2

Bob - Johnny -
For your info
7007
Dayton 9/8

September 3, 1965

Dr. Henry G. Blosser
Michigan State University
East Lansing, Michigan

Dear Dr. Blosser:

We wish to acknowledge your kind permission for the use of information on the drawings of the Michigan State University 50 MeV cyclotron in planning and estimating the cost of the conversion of the 60-inch cyclotron at the Lewis Research Center, Cleveland, Ohio, to an AVF machine.

Mr. Myron A. Pollyea of the Research Center Facilities Engineering Division, who is the NASA technical representative on our contract for the study and Preliminary Engineering Report, expects to visit your laboratory sometime in the next few weeks.

With best regards,

William M. Brobeck

WMB:ys

CC: M. A. Pollyea

CNAS 3-8141

The Lewis Research Center of NASA has been authorized to examine the technical alternatives that are involved in the modification of the present 60-inch conventional cyclotron to a variable energy AVF cyclotron. In considering these alternatives we are forced to consider our unique boundary conditions. We now have a cyclotron, power supplies, vacuum pumps, heat exchangers, beam optics, and a building; and the new cyclotron has to fit at least the building and preferably more.

It being easier to copy than to design a completely new machine we have looked at several of the first-generation AVF cyclotrons as possible models.

There are to our knowledge two conversion plans for what were (or are) 60-inch conventional cyclotrons, Davis and Brookhaven. We do not wish to follow either of these two conversions. The Davis route is a little too rich for our blood and the Brookhaven design has some deficiencies which are important to us, in particular the upper limit

of 40 MeV for proton energy. There exists one cyclotron that appears feasible to copy and that is the machine at Michigan State University. However, even this cyclotron has some features with which we are unhappy, in particular the unavailability of ^{3}He energies between 40 and 60 MeV.

The present request for proposal is in two parts, the first being a study of alternative designs and the second the preparation of a preliminary engineering report.

I. The study shall consider the following alternatives

a) A cyclotron that shall be "copy" of the MSU cyclotron, however utilizing as many components of the existing machine as is feasible and reasonable.

b) The two-dee cyclotron "copy" of part (a) modified to have an oscillator that shall cover a frequency range of 10.75 to 21.5 MH_z. Among the several possibilities we particularly wish to have studies made of a system that tunes with a combination panel and shorting bar

arrangement using an aluminum RF tank with no liner. The DC power input to the final amplifier is limited to 17.5 kV at 30A.

c) A cyclotron that shall be a scaling of the MSU magnetic field to the 72" pole root diameter of the NASA cyclotron and design of a suitable RF structure for providing continuous coverage of all particle rotation frequencies.

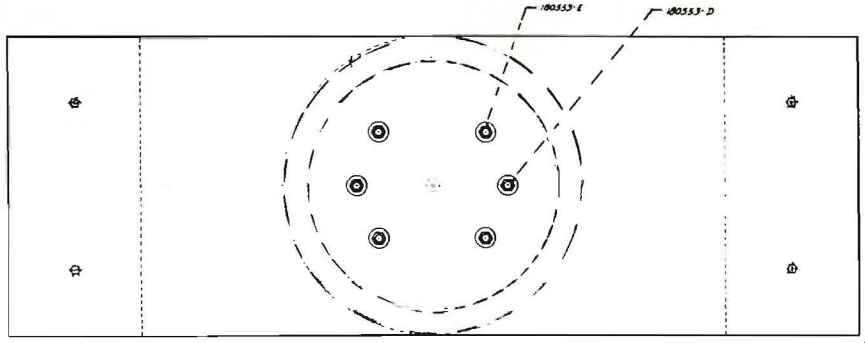
When we speak of a copy we do not mean an identical cyclotron but rather a cyclotron embodying the essential features but containing any improvements made in the design either at MSU or at Princeton and deviations from the MSU design when in the opinion of the MSU group their design is not optimal. In all cases the designs have to be matched to existing building and equipment.

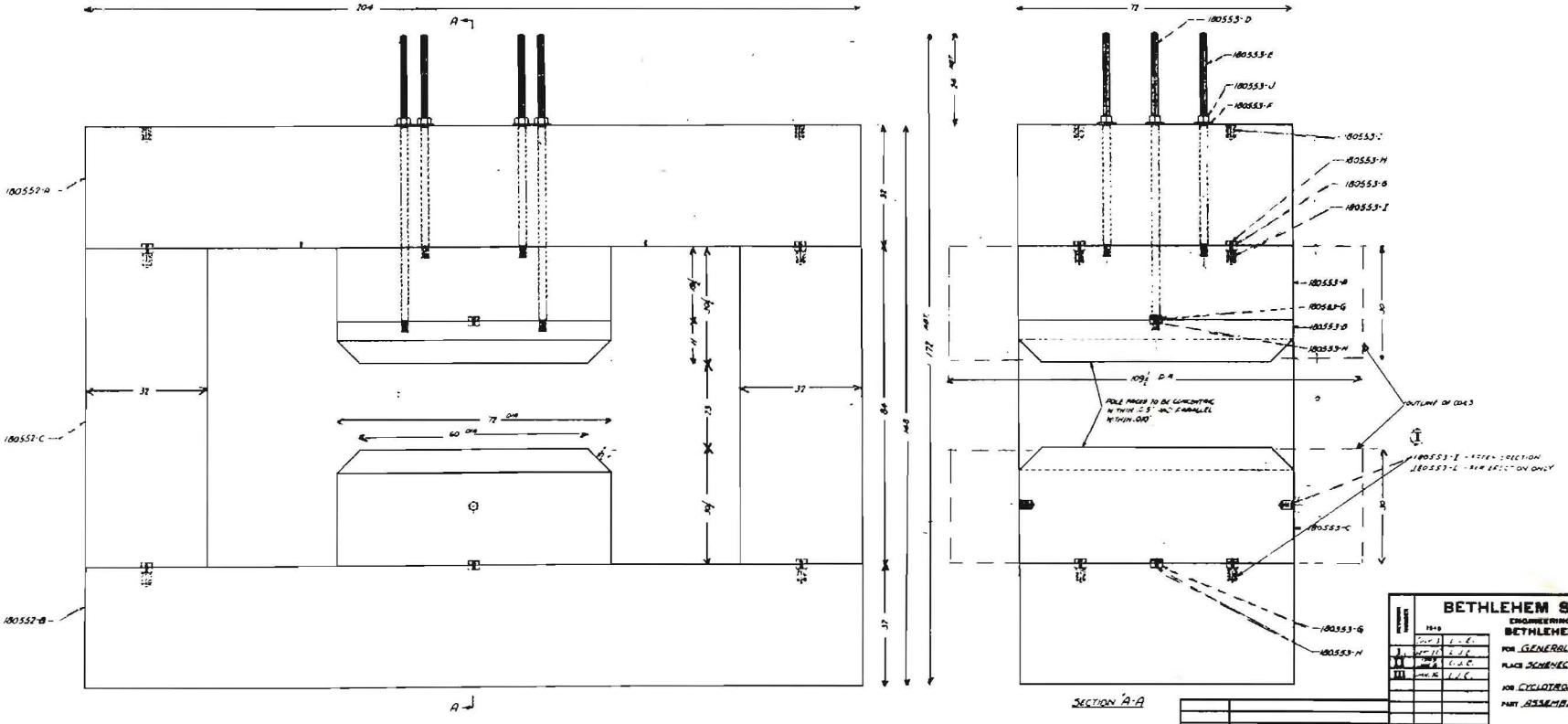
The study is designed to produce only that necessary cost and feasibility information required to permit us to make an informed decision. The accuracy of the estimates should be $\pm$ 10%.

II. A preliminary engineering report covering the cyclotron chosen is to be prepared as a supporting document for the requesting of monies from the Congress. This will include a scientific justification (prepared by

LeRC), the engineering approach,which will be selected by Lewis after examination of the feasibility study (Part I), more complete costing than the study, time schedules, details of the distribution of the work, and similar items. It shall be ready for submission to the Congress by January 1966.

DIMENSIONS IN INCHES





SECTION A-A

RMS VALUE OF FINISH SYMBOLS

1	32	500
8	63	1000
16	125	2000
	250	

NO.	REQD.	REFERENCE

NO.	DATE	BY	CHK'D
	1949		
I	SEPT 15	L.J.C.	
II	JAN 6	L.J.C.	
III	JAN 16	L.J.C.	

BETHLEHEM STEEL COMPANY,
ENGINEERING DEPARTMENTS
BETHLEHEM, PA., U. S. A.

FOR GENERAL ELECTRIC CO.
PLACE SCHENECTADY, N.Y.
JOB CYCLOTRON MAGNET 60"
PART ASSEMBLY
SCALE 1/4" = 1 FOOT
JOB NO. 180558

DRAWN BY ... CHKD BY A.M. TRACED BY ...

Gentlemen: { Catalytic Construction Co 528 Walnut St Phila Pa. Attn: Mr Earle Smith
William M. Brobeck & Assoc - 1930 Park Blvd Oakland Calif.

Subject: Request for Proposal C-
Engineering Services for
(a) Phase I - "Study of Alternate Designs"
(b) Phase II - "Preparation of a Preliminary Engineering Report (PER)"
for the Modification of the Materials and Structures Building Cyclotron.

PR # 47810

You are invited to provide the Lewis Research Center with a proposal for furnishing Engineering Services for
(a) Phase I - "Study of alternate Designs"
(b) Phase II - "Preparation of a PER"
for the proposed Modification of the M&S Bldg Cyclotron

The services to be performed are stated in the enclosed work statement and the preparation of the PER shall be in accordance with the enclosed instructions.

The completed PER is required on or before Dec 1, 1965.

Your proposal should be submitted in quadruplicate setting forth therein the names and qualifications of key personnel to be assigned to this task and a detailed cost breakdown which includes hourly time estimates, hourly labor rates, other direct costs, overhead and profit. Also, your proposal shall contain a statement as to the minimum calendar days you would require to perform the work.

It is anticipated that a fixed price contract will result from this solicitation. Any contract awarded as a result of this negotiation will be prepared on NASA Forms 765 and 765-3, copies of which are enclosed. Also, the contract will include the enclosed General Provisions, NASA Form 755-2 which will be amended to delete the "Nondiscrimination in Employment" clause and substitute therefor the latest version of the "Equal Opportunity" clause.

Work Statement
for
Study of Alternate Designs
and
Preliminary Engineering Report
for
Modification of the 60 inch Natural Sthenic Poly Cyclotron

General Description:

The present machine was built and installed, starting in 1948, by the General Electric Co. ~~Its~~ specifications are:

1. Particle and Energy:	protons (accelerated as H_2^+)	10.5 MeV
	deutron	21 MeV
	alpha particle	42 MeV
2. Internal deflected	beam current	100 μa
3. External beam		5 μa
4. Energy stability		0.5%

It is the intent of this project to up-date this machine so that the research programs undertaken can be at the frontier of the state-of-understanding. The proposed modifications shall make this cyclotron more versatile by providing new particles, higher energy

particles, particles of a selectable energy and more intense beam currents.

Scope:

The Contractor shall prepare:

(a) Phase I - "Study of Alternate Designs"
The study shall consider the following alternates:

(1) A close copy of the MSU cyclotron using the maximum number of components of the present machine.
A close copy is a cyclotron embodying the essential features of the original machine but containing any changes that operating experience has shown to be useful.

(2) A two-dee cyclotron patterned after (1) above, but modified to have an oscillator and resonant cavity that shall cover a frequency range of 10.75 to 21 MHz. One

of the systems to be studied shall include tuning with a combination panel and shorting bar arrangement using an aluminum RF tank with no liner; the DC power input to the final amplifier is limited to 17.5 KV at 30 A.

(3) A cyclotron that shall be a scaling of the MSU magnetic field to take advantage of the available pole diameter of the Lewis cyclotron and the design of a suitable RF structure for providing continuous coverage of all particle rotation frequencies.

The designs of (1), (2) and (3) shall be matched to the existing building and equipment. In all cases the existing magnet core, coils and power supply and the oscillator anode power supply shall be used.

This study is intended to produce only the necessary costs and feasibility

information required to permit the Government to make a selection.

(b) Phase II - "Preparation of a PER."
After completion of Phase I - "Study of Alternate Designs" and selection, by the Gov't, of the specific design, the Contractor shall prepare a PER to support the Fiscal year 1967 Construction of Facilities Budget Requirement. The PER shall:

(1) develop the project (which embodies the most economical and engineeringly sound method) for fulfilling the functional requirements

(2) provide data, including cost estimates, drawings and plans, and time schedules, to support budgetary submissions; and

(3) be the basis or foundation for the preparation of final plans and specifications.

The PER shall be prepared in accordance with Appendix I.

In the preparation of the PER, planning and design criteria as outlined in the NASA Manual of Design Criteria and Construction Standards (NPC 345-1) shall be utilized to the maximum possible extent.

The Requirement Statement to be

incorporated in Section I of the PER will be prepared by the Government.

Cooperation:

The Government will cooperate with the Contractor to the fullest extent practicable in order that the work can be done completely and expeditiously. It is expected that the Contractor will reciprocate.

Copies of Minutes and Reports:

(a) Five copies of minutes of meetings, or telephone conversations shall be forwarded to the Contracting Officer's Representative for review. If the Government does not concur with the minutes it will so notify the Contractor in order to effect resolution.

(b) Five copies of the preliminary report shall be submitted for review and concurrence.

(c) Ten copies of the final Study Report (Phase I) and twenty copies of the final Preliminary Engineering Report (Phase II) shall be submitted.

Private Nature of the Work:

Since this work is being performed prior to submittal to the Congress for authorization and appropriation, information regarding this work is not available for dissemination to the public in general and should be confined to those persons only who need to know.

1st Rough Draft

Gentlemen

Subject Request for Proposal C-
Engineer Services for
(a) Phase I - "Study of Alternate Designs"
(b) Phase II - "Preparation of a Preliminary Engineering Report (PER)"
for the Modification of the 6 inch Material and Stress Building Cyclotron.

You are invited to provide the Lewis Research Center with a proposal for furnishing Engineer Services for
(a) Phase I - "Study of alternate Designs"
(b) Phase II - "Preparation of a PER"
for the proposed Modification of the M & S Bldg Cyclotron

The services to be performed are stated in the enclosed work statement and the preparation of this RFP shall be in accordance with the enclosed instructions.

The completed RFP is required on or before Dec. 1 1965 this

Your proposal should be submitted in a triplicate manner setting forth therein the names and qualifications of key personnel to be assigned to the work and a detailed cost breakdown which includes hourly direct salaries, hourly labor rates, direct material costs, overhead and profit. Also, your proposal shall contain a statement as to the minimum calendar days you shall require to perform the work.

Rev. Draft

Work Statement
for 60 inch
Modification of the Material & Stresses Bldg. Cyclotron

General Description:

The present machine was built and installed, starting in 1948, by the General Electric Co. ~~Its~~ specifications are:

1. Particle and Energy:	protons (accelerated as H_2^+)	10.5 MeV
	deutron	21 MeV
	alpha particle	42 MeV
2. Internal deflected beam current		100 μa
3. External beam		5 μa
4. Energy stability		0.5%

It is the intent of this project to up-date this machine so that the research programs undertaken can be at the frontier of the state-of-understanding. The proposed modifications shall make this cyclotron more versatile by providing new particles, higher energies

(1) develop a project (which embodies the most economical and engineeringly sound method) for fulfilling the functional requirements

(2) provide data, including drawings and plans, cost estimates and time schedules to support budgetary submissions; and

(3) be the basis or foundation for preparation of final plans and specifications.

The Preliminary Engineering Report format shall be in accordance with NASA PER requirements.

The permits & justification to be incorporated in the PER will be generated by the Govt.

Cooperation:

The Government will cooperate with the Contractor to the fullest extent practicable in order that the work can be done completely and expeditiously. It is expected that the Contractor will reciprocate.

Copies of Minutes and Reports:

(a) Five copies of minutes of meetings, or telephone conversations shall be forwarded to the Contracting Officer's Representative for review. If the Government does not concur with the minutes it will so notify the Contractor in order to effect resolution.

(b) Five copies of the preliminary report shall be submitted for review and concurrence.

(c) Ten copies of the final Study Report (Phase I) and twenty copies of the final Report shall be submitted. Preliminary Eng'g (Phase II)

Private Nature of the Work:

Since this work is being performed prior to submittal to the Congress for authorization and appropriation, information regarding this work is not available for dissemination to the public in general and should be confined to those persons only who need to know.