FORM 372

JAN 24 1935

JAN 22 1935

1103.1

TA	JAN -7 '35	Ja
WW	JAN -8 '35	WW
FBA		FBH

January 2, 1935.

Dear Hale:

McDowell came up from Philadelphia today and I was delighted to have an opportunity of a long talk with him, and to learn how interested he is in the problem and how well everything seems to be going. I can only hope that the group at Pasadena is as pleased with the way in which he is taking up the work as he is interested in it. It seems to me his general plan of procedure is excellent, and that he is most businesslike in the concreteness of his thought.

By utilizing your many friends and the many contacts you have already made, as well as his own unusual knowledge of men in the engineering and construction field, I am sure McDowell is going to be able to obtain the very valuable informal study and advice which these men can give. Most of this will be obtained on the basis of scientific interest in the procedure and of a friendly and scientific interest in the undertaking, and indeed perhaps the most valuable of advice comes in this manner. At specific stages leading toward decision there will no doubt be the desirability of consultation services on a definitely professional basis, and I feel that McDowell has just the right idea toward these two types of assistance. While I do not believe that he has plans looking to really large expenditures in this direction, there certainly will be no disposition on our part to question expenditures made at this time for obtaining definite and valuable opinions on design and construction. This is really a new undertaking, and we would all be happy as we have been in the past to see that as much advance as is

possible is made in the art of telescope building, and the mounting is certainly an involved and difficult part of the problem. I think we all feel that every dollar expended in advance of decision is likely to save many-fold that amount in later construction processes, to the end that this somewhat experimental proceeding may be rendered as safe as possible before it is entered into.

We talked briefly on the automatic following possibility, and while I realize it is far from evident that this lies in the realm of possibility I think it would well pay McDowell to talk with Bush. I am not familiar with the sensitivity of modern sensitive cells. If the radiation from a guiding star is not sufficient, then of course the situation is impossible. Otherwise, the rather remarkable work they have done at the Massachusetts Institute of Technology would seem to lead to possibilities for the telescope. If this be possible there would be an added interest in an attempt to compensate for temperature changes in the tube, which would throw the plate out of focus.

What I really wanted to write you about was to complain bitterly because neither you nor Day will stir up anybody to see whether vibration (possibly of supersonic frequency) may not appreciably change the annealing time for glass. I have a conviction, which is positive because it is based on no knowledge, that it will have a really great effect. Of course it is too late for particular application to the 200-inch, but I am just recalling your promise that you would stir up some graduate student to try it on a very small scale.

Cordially yours,

MAX MASON

Dr. George E. Hale,
California Institute of Technology,
Pasadena, California.

1103.1

JAN - 8 1935

CALIFORNIA INSTITUTE OF TECHNOLOGY
PASADENA

ASTROPHYSICAL OBSERVATORY

January 3, 1935

1103 JAN -7 35

Mr. W. W. Brierley
Secretary General Education Board
49 West 49th Street
New York.

My dear Mr. Brierley:

Please accept my thanks for your kind letter of December 19, informing me that the General Education Board has released a further sum of $128,347.33 to the California Institute for the 200-inch telescope project, corresponding to the request expressed in our budget for the period from January 1 to December 31, 1935.

With continued appreciation, and best personal wishes for the New Year, I am

Yours very sincerely,

GEH:G

JAN 22 1935

1103.1

mm – mm
TA – JA
WW – WW
FBH – FBH
DRB – ✓

CORNING GLASS WORKS
CORNING, NEW YORK

DEVELOPMENT AND RESEARCH DEPARTMENT

EXECUTIVE COMMITTEE
ALANSON B. HOUGHTON
ALEXANDER D. FALCK
GEORGE B. HOLLISTER

In reply refer to:
Dr. G.V. McCauley.

Jan. 8, 1935.

Dr. Max Mason,
The Rockefeller Foundation,
49 West 49th Street,
New York City.

Dear Dr. Mason:-

Thank you for your very kind letter of January 2. We were disappointed that you could not be with us at the time the large disc was poured.

We note your comments regarding the appointment of Captain C. S. McDowell as overseer in charge of the mounting and dome construction for the large telescope. We will be pleased to have Captain McDowell visit us at Corning and are looking forward with pleasure to his coming.

The large disc is reposing in the annealing kiln at its constant soaking temperature. It will remain there for still another two weeks before starting downward on the cooling schedule.

Very truly yours,

Geo. V. McCauley

Physical Laboratory,

md.

FORM 372

JAN 22 1935

JAN 24 1935

1103.1

JA		Ja

January 2, 1935.

Dear Mac:

We have been through our busiest month or I would have written to you long before giving my hearty congratulations on the new pouring of the 200-inch. You have done a fine piece of work, and created a remarkable example of really scientific technology.

Now that the mirror is assured the further work for the telescope can go on with speed. The Telescope Committee at Pasadena has appointed Captain C. S. McDowell of the Navy to be a sort of engineering entrepreneur in charge of the mounting and dome construction. We are all very much pleased with the appointment, since McDowell showed his scientific and engineering acumen during the war as Executive Secretary in charge of the Experimental Station where I worked at New London, and has had since then such a vast and varied experience along exactly the lines that are necessary for this last step.

McDowell has been a month in the West at Pasadena becoming familiar with the situation there, and will be in the East for a month or two before returning. During that time I know he plans to visit Corning, so that this may serve

as an informal letter of introduction.

With cordial greetings,

Sincerely yours,

MAX MASON

Dr. George V. McCauley,
Corning Glass Works,
Corning, New York.

MM:AEB

JAN 24 1935

JAN 22 1935

1103,1

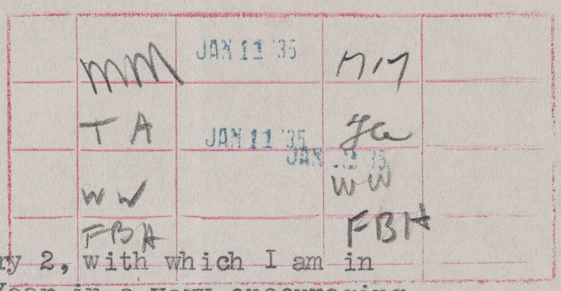
CALIFORNIA INSTITUTE OF TECHNOLOGY
PASADENA

Air Mail

ASTROPHYSICAL OBSERVATORY

January 8, 1935

Dr. Max Mason
President Rockefeller Foundation
49 West 49th Street
New York.



Dear Mason:

Your welcome letter of January 2, with which I am in complete agreement, starts off the New Year in a very encouraging way. McDowell is doing a splendid job, just as you predicted, and it was a great piece of good fortune to get him. He has made a fine impression with everyone here, and his recent talks with the Westinghouse people and with Ford are especially promising.

As I told him before he left, I thought he should go to see Bush and others at M.I.T., and he writes that he will do so. We are sending him additional data on the brightness of the very faint guiding stars available for use with a photoelectric cell. Fortunately we are in a very favorable position to estimate the chances of success, as work with the most sensitive known cells, used in vacuo with amplifiers, has opened up a whole new field of research with the 100-inch telescope. This was one of the first moves I made when I outlined a program for the development of new auxiliary apparatus for the 200-inch, and nothing has proved more fruitful. You may be sure that we will neglect no opportunity of this kind.

Just after my return from the east I took up with Millikan the plan you proposed for hastening the annealing of glass. He found that the supersonic apparatus we got here during the war for submarine detection experiments was no longer as suitable for this purpose as another type more recently developed, and he has been endeavoring to get the parts needed. You may count on us to push forward this work, as both Millikan and I think it has possibilities, at least for prisms and lenses of moderate size. I was impressed when you proposed it with its probable value for prisms, for which thoroughly homogenous glass is very hard to get.

I was pleased to hear from Brierley that our budget with the $10,000. you were thoughtful enough to add, was duly approved. I am confident it will take us through this year, unless extra expenses on account of the 200-inch mounting should be necessary. As I fully agree that it will pay to continue all promising preliminary studies through McDowell, and to obtain any expert advice needed on any features of the design, we shall continue this policy.

With best regards,

Yours very cordially, George E. Hale

GEH:G

P.S. I enclose copy of a telegram sent by Anderson to McDowell today.

COPY OF TELEGRAM

Pasadena, California, January 8, 1935

Captain C. S. McDowell, U.S.N.
2109 Porter Street
Philadelphia, Pa.

Tell Bush guide star will often be as faint as fifteenth magnitude Stop The corresponding energy collected by the two hundred inch is four millionths of an erg per second.

J. A. Anderson

January 8, 1935.

To the Honorable Secretary of the Navy
Washington, D. C.

Dear Mr. Secretary:

I am writing this letter to express outappreciation to the Navy for giving leave to Captain C. S. McDowell for the sake of enabling him to assist the California Institute of Technology in its very important task of designing and constructing the mounting and the dome for its new giant telescope. The significance and the magnitude of this enterprise is not commonly fully appreciated. It is far and away the largest and most important astronomical undertaking ever attempted. The mere slab of pyrex glass, out of which the mirror is made, will weigh approximately sixteen tons. When this telescope is completed it should bring into view a volume of space twenty-seven times larger than that now available for photographic studies of the stars by the largest telescope now existing, which is the 100" reflector of the Mount Wilson Observatory. The time, which was originally estimated for for getting this new telescope into operation, was twelve years, and the cost approximately $6,000,000. No such monumental undertaking in the interests of astronomical science has ever before been attempted.

The reason, then, that we have sought aid from and cooperation with the Navy in this undertaking, is, that so far as we know there is no other organization, institution or individual possessed of such an experience in the design and construction of heavy, precision instruments. In the work with its heavy gun mounts the Navy has had problems of an allied kind. Furthermore, Captain McDowell has spent the greater part of his life, either as an inspector for the Navy in connection with its large engineering enterprises of a similar nature, or else in the scientific research and developmental activities of the Navy as illustrated in the work of the New London Experiment Station during the War.

From our point of view, therefore, it is of the utmost importance to be able to utilize the experience and

the skill of the Navy in this new enterprise, for which we, at the California Institute of Technology, have the responsibility and we know of no one in the Navy whose experience and contacts with the heavy manufacturing industries of the United States makes him more suitable for this work than Captain C.S.McDowell.

I am writing this letter for the sake of making official acknowledgement on the behalf of the Trustees of the California Institute of Technology, of our indebtedness to you for this service, as well as of our hope and expectation that the interests, both of the Navy and of the California Institute of Technology, will be served through this cooperation.

Very sincerely yours,

RAM:VH

Robert A. Millikan

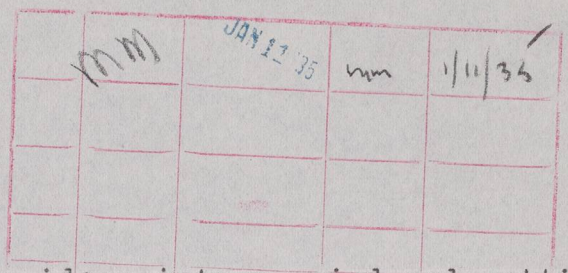
JAN 24 1935 JAN 22 1935

1103.1

2109 Porter St.,
Philadelphia, Pa.

January 10, 1935.

Dr. Max Mason, Pres.,
Rockefeller Foundation,
49 West 49th St.,
New York City.



Dear Max,

I am still soaking ideas into my mind and getting as much constructive criticisms and comments as I can obtain from everyone who I can find has something to contribute. I had a very nice day with Doctor Johnston and Doctor Bain, of the United States Steel Research Laboratory, and they referred me back to Mr. Butler of the Budd Company as the best man to discuss manufacturing aspects of the problem. Butler is an old friend of mine, and I had already had considerable discussion with him, so I was pleased that Johnston and Bain should feel that he was the best man to discuss this with. I have spent the last two days with Butler, Russell and Eksergion, of the Budd Company, and Mr. Llewellyn, who is Research Engineer of the U.S.Steel, and it looks to me that they might develop a tube at least which would be very modern and sightly as well as light and stiff.

Following my visit with you I spent the next day with Hannibal Ford and was very much pleased to see his latest development on control for turrets and guns. It seems to me that the development work that he has done fits right in to our problem on control, and that we can take this and adapt the things that are already in existence to our problem. If you should have a free day before I again come to New York, I believe you would be very much interested in seeing Ford's demonstration of this equipment which he has set up in his plant in Long Island City. However, if you do not make it before I come up, I would like to get you to go over it with me.

The early part of next week I am planning on going to Washington and I might run over to New York at the end of the week, that is Thursday or Friday, if nothing else develops in the meantime.

I asked Anderson about the Guide Star and its

Dr.Max Mason 10 Jan. 1935.

possible use, as suggested by Bush, and he has wired me that the Guide Star will often be as faint as the fifteenth magnitude and the corresponding energy collected by the 200-inch telescope will be four-millionths of an erg per second. I have given this information to Bush and have also told him that I expected to be in Boston the latter part of this month.

With best regards,

Very sincerely,

Dandy

C.S.McDowell

FORM 372

JAN 24 1935

JAN 22 1935

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WW		WW
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1103,1

January 11, 1935.

Dear Sandy:

Your letter is very interesting, showing as it does how well things are falling together.

I had a letter from Hale today in which he said how pleased he was with the way everything was going. He also sent a group of black loose-leaves, about 12" by 14", which look as though they might be used for mounting photographs. I am holding them here, thinking that perhaps they are for you.

Next Friday I am tied up all day with meetings. Thursday I could be free after one o'clock, and would very much enjoy running out to Ford's place, if that would give us time enough. If not, we can do it some other day.

Cordially yours,

MAX MASON

Captain C. S. McDowell,
2109 Porter Street,
Philadelphia, Pennsylvania.

MM:AEB

FORM G24

JAN 12 1935

1103.1

January 11, 1935

My dear Mr. Fleming:

I have read the memoranda you left when you were in the office last week, and I am in no position to comment thereon. I am therefore returning the memoranda inasmuch as there are attached lists indicating to whom copies had been or are to be sent.

I am sorry it will not be possible for me to see you. I am sure you will appreciate what it means to be in the midst of preparing for a meeting of our Board next week. All of my time will be required in conference and for maturing items which are to be presented.

Sincerely yours,

W. W. BRIERLEY

Mr. Arthur H. Fleming
c/o Mrs. Lloyd Smith
10 Gracie Square
New York City

WWB:KEO

1103.1

JAN 28 1935

CORNING GLASS WORKS
CORNING, NEW YORK

DEVELOPMENT
AND
RESEARCH
DEPARTMENT

January 16, 1935

EXECUTIVE COMMITTEE
ALANSON B. HOUGHTON
ALEXANDER D. FALCK
GEORGE B. HOLLISTER

MM		177
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FBI+	JAN 28 '35	FBI+
DLB pl.		✓

Dr. Max Mason
President, The Rockefeller Foundation
49 West 49th Street
New York City

Dear Dr. Mason,

Replying to your kind letter of January ~~10~~ 11, we have received a letter from Captain McDowell stating that he would like to visit Corning either the week of January 28 or February 4. I have advised him that as far as we can now tell either week will be convenient for us.

Dr. McCauley is now ill but we have every reason to believe that he will be back at work within the next week. I am rather hoping that he will decide to take a vacation in order that he may recuperate thoroughly for, as you know, he has been under a tremendous strain for the last year. He has done a wonderful job on the disk project and is surely entitled to an extensive vacation if he can be persuaded to take it.

We will be delighted indeed to cooperate to the fullest extent with Captain McDowell. It is possible that with our experience in building up glass-to-metal structures, we may be able to be of some real assistance to him.

With kind regards, I remain

Yours very truly,

J.C. Hostetter

J.C. Hostetter
Director, Development & Research

JCH:FRF
cc- GVM

FORM 372

JAN 22 1935

JAN 24 1935

T A	JAN 13 35	
WW		WW
PBK	JAN 13 35	FBH

1103.1

January 11, 1935.

Dear Mr. Hostetter:

We were of course all delighted at the successful pouring of the 200-inch.

I expect you know that Captain C.S. McDowell of the Navy has been granted leave for a time to work with the Pasadena group on the mounting and dome for the telescope. He will act as a sort of scientific and engineering entrepreneur. He has spent a month in Pasadena, and is back in the East for a time discussing design and manufacturing facilities.

With your remarkably successful development work on the mirror, the center of difficulty now shifts to the mounting design, and we are very happy over the progress that is being made in this particular.

McDowell plans to visit Corning before long and looks forward to the opportunity of meeting your group, seeing the set-up there, and discussing with you some of the aspects of the mirror mounting.

With cordial greetings,

Sincerely yours,

MAX MASON

Mr. J. C. Hostetter,
Corning Glass Works,
Corning, New York.

MM:AEB

C. S. Mc DOWELL
2109 PORTER STREET
PHILADELPHIA, PA.

January 20th

1103.1

Dear Mac

I am going to Boston tonight and expect to spend Monday and Tuesday there then Wednesday in Schenectady which should put me in New York Wednesday night or Thursday morning and if convenient to you we might go over to see Ford Thursday. At any rate I hope to find you with some free time either Thursday or Friday -

Best regards.

Sincerely

Donaldson

FORM 372

JAN 31 1935

1103.1

January 18, 1935.

Dear Captain McDowell:

Mr. Mason asked me to write you that either of the times you suggest for your visit in New York will be convenient for him. He came to the office to-day for some Executive Committee meetings, but went home soon afterwards, as he still is not well.

Yours very truly,

Secretary to Mr. Mason,

Captain C. S. McDowell,
2109 Porter Street,
Philadelphia, Pennsylvania.

JAN 31 1935

C. S. Mc DOWELL
2109 PORTER STREET
PHILADELPHIA, PA.

January 17th

Dear Mac

I am sorry that you are under the weather but this is a bad day underfoot and I believe you were wise to stay in -

I have two impending trips one to Cleveland to see Warner and Harvey stopping off at Corning on the way back and the other to Boston returning by way of Schenectady. I am inclined to go to Cleveland first leaving here this Sunday evening (the 20th) and could be in New York either on the 24th or 25th or I could go to Boston this Coming week and stop off going or Coming. The Boston trip will probably be the shortest and the week

I make that would be the best to spend some time in New York.

So if you could let me know not later than this Sunday morning how you are tied up for the two weeks I will make my plans accordingly.

I had a nice trip to Washington and saw Dr. Day among others.

Best regards

Cordially

Sandy

FORM 372

FEB 28 1935

1103.1

WW	FEB 11 '35	WW
TA	FEB 14 '35	JW
FBH	FEB 14 '35	FBH AMJ

February 7, 1935.

Dear Hale:

I had another visit with McDowell, and visited Hannibal Ford's factory with him. Ford's work is interesting, and it may well be that he can make some suggestions of value on control mechanisms.

We happened on Bush at the Hotel, and had a short talk with him. He had been figuring on the possibilities of automatic control, and said he would be most happy to do everything he could in a study of the situation.

I was interested in Bush's response to the general question of possibilities. He stresses the thought that automatic control would be highly desirable not merely for the purposes of relieving man hours, but because it is much more accurate than human control, since the reaction time of the servo-mechanism is much shorter than human reaction time. He said that preliminary study indicated that a guide star of 15th magnitude was about at the limit of possibility.

Of course I understand that it is very improbable that practicalities will result from this sort of study. But no harm can be done by it, and it maintains the attitude of looking for every advance in astronomical procedure.

A short time ago we received from your office a set

of black loose-leaves, presumably for mounting photographs.

I wonder if these were intended for McDowell.

Cordially yours,

MAX MASON

Dr. George E. Hale,
California Institute of
Technology,
Pasadena, California.

MM:AEB

CALIFORNIA INSTITUTE OF TECHNOLOGY
PASADENA
ASTROPHYSICAL OBSERVATORY

February 9th

Dear Max

I thought I would be over to U.C. before this again but came back from Corning direct to Philadelphia and am now planning to get away for Pasadena on Thursday the 14th. So unless you would like pertaining to see me will not get over again.

After I left you that morning two weeks ago I saw Jewett for a few minutes and he thought it would be of interest for me to see Hovey who used to be chief engineer of American Bridge. It turned out that Hovey came down here this last week and we spent a day together. He also was staying for the yoke type of mount rather than the fork type. Also saw Homer Ferguson who is President

of Newport News Shipbuilding Co. and Isaac Hunter who is Vice President of Babcock and Wilcox Co., both of whom have promised to go over our plans and give us comments and suggestions.

I found the Warner & Swasey people very cooperative and my visit there was worth while in seeing how they were handling the McDonald observatory. Mr. Swasey, Bliss and Burnes were all very kind and seemed anxious to help with comments regardless whether they got any business. Maybe they still hope to get something to do but I doubt it.

Spent a day and a half at Corning and enjoyed meeting McCauley and Hostetter. They are interested in finding out what to do with the other mirror.

I was interested in learning that Corning were planning on making

some 20" mirrors of the same type of construction as ours to fill an amateur demand. This would fit in with my thought of making a 1/10th model of the telescope which could be used for checking deflections and I hope also used as a guide telescope. The astronomers may knock holes in this idea but I hope it has merit. The Budd Co. and also U. S. Steel have both checked separately the question of using Stainless Steel in the tube or the mount and have both reported that they couldn't give us good engineering reasons for using it.

Spent one day this week with Baldwin Locomotive Co. and find the same interest there as elsewhere. Monday I am spending with the Sun Shipbuilding Co. and then another day with Westinghouse and one with the

Baldwin people on the question of deflation measurements in models - Between times hope to get my stuff backed up - Expect to stop off for one day in Washington - Will try to get a note off to Brook but I always forget your home address. At any rate hope you will tell her how much I enjoyed my visit and too that I hope to see you both in California this Spring or Summer -

Will try to keep you fairly well informed on developments and progress and probably will find it desirable to get back East within a few months -

With best to both

Cordially

Sandy

FORM 372

MAR 15 1935

February 13, 1935.

Dear Sandy:

I am rushing to get off to the South for ten days or two weeks, leaving Saturday. I was very much interested in your letter. The contacts you have been making are extraordinary.

Please don't have bread and butter notes on your mind. There is hardly any time when we force ourselves into it, and I passed on your message.

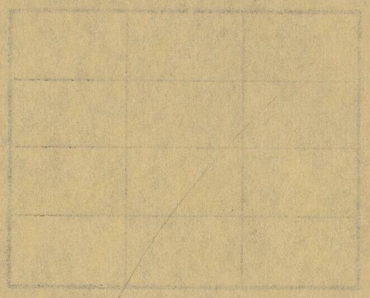
I hope things go well with you, and shall look forward to your next trip east.

Cordially yours,

MAX MASON

Captain C. S. McDowell,
2109 Porter Street,
Philadelphia, Pennsylvania.

MM:AEB



CALIFORNIA INSTITUTE OF TECHNOLOGY
PASADENA

ASTROPHYSICAL OBSERVATORY

February 12, 1935

Dr. Max Mason
The Rockefeller Foundation
49 West 49th Street
New York.

Dear Mason:

Thanks for your letter of February 7, which has just arrived. I am very glad indeed to hear of Bush's response, as of course we want to use his automatic control if possible. Perhaps it may even be feasible to test it on one of the Mount Wilson telescopes - the best plan with all of these new devices, provided they can be easily adapted to the instrument in question. It was only in this way that we were able to develop the Ross zero-corrector, the Rayton short-focus spectrograph objective, etc.

We have had several valuable reports from McDowell, who writes that he will soon be back in Pasadena. All goes well here, and we expect that the definitive design of the mounting can be tackled soon after he returns.

I told Weaver when I was in New York that I would send some black loose leaves for mounting additional photographs in the album I brought you. These are the ones you have received.

With best regards,

Cordially yours,

George E. Hale

GEH:G

CALIFORNIA INSTITUTE OF TECHNOLOGY
PASADENA

ASTROPHYSICAL OBSERVATORY

ans ack. 3/5

February 28, 1935

Dr. Max Mason
President Rockefeller Foundation
49 West 49th Street
New York.

Dear Mason:

We are glad to see Captain McDowell back and to hear his valuable and comprehencive report. I think we are likely to adopt his recommendation that we obtain a careful analysis and detailed report on the two possible types of mounting from Lessell, formerly Chief Engineer of the British Rolls Royce Company and later of the Westinghouse Company; Kabrolitz, Professor at Columbia; and Timoshenko, Professor at Michigan and friend of von Karman of the California Institute. Timoshenko is now giving a few lectures here. They are accustomed to working as a consulting group, and their price of $1500. for this job seems moderate to McDowell and to us.

You will be interested in the enclosed clipping, which seems to leave no doubt that Strong can aluminize the 200-inch mirror. Even after his marked success with the 36-inch Crossley mirror of the Lick Observatory, of which I think I sent you an account, we did not feel safe in advancing in a single jump to the 200-inch, as such a high vacuum is required, beyond the capacity of any available pumps. The present pumps, built in our shop after Strong's design, are the best yet made, I think, for high vacuum on such a large scale. As I believe you know, the aluminum surface opens up an extensive new and unworked region in the ultraviolet of stellar spectra.

One of Millikan's men is working on your method of annealing prisms, and I hope we can give you a report before long.

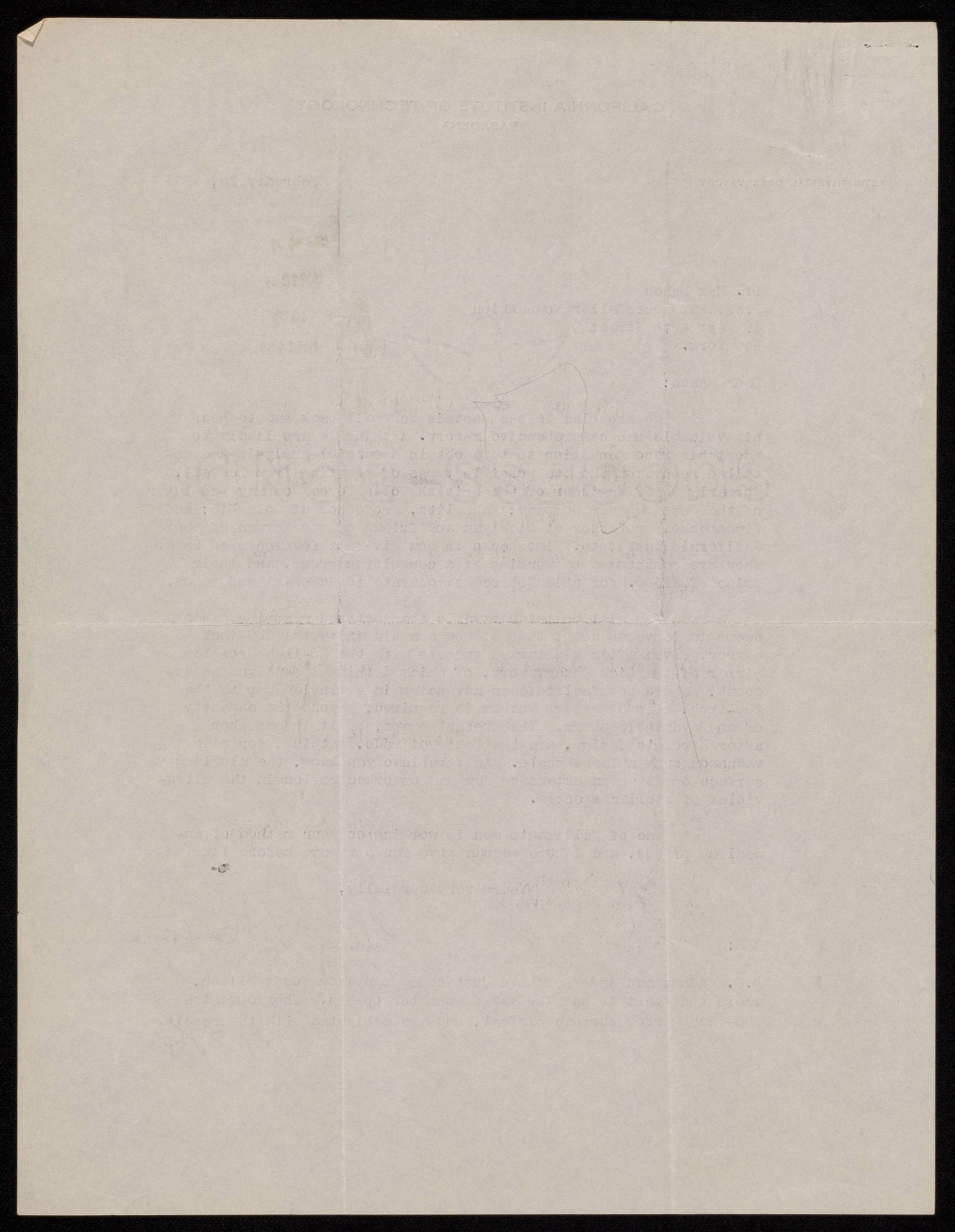
Yours very cordially,

Geo. E. Hale

GEH:G

P.S. Adams and Anderson have just come down from Mount Wilson, where they went to see the vacuum chamber opened. They found the 100-inch mirror surface perfect, and are delighted with the result.

G. E. H.



APR - 9 1935

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CALIFORNIA INSTITUTE OF TECHNOLOGY
PASADENA

ASTROPHYSICAL OBSERVATORY

March 20, 1935

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	TA	APR-9 '35	Ja	

Dr. Max Mason, President
The Rockefeller Foundation
49 West 49th Street
New York, N. Y.

Dear Max:

I should be a better correspondent than I am. Itis hard to realize that I have been here for over three weeks and have not written to you. I had a delightful trip across, and happened to strike good weather all the way, which, with the really excellent roads by the southern route, made the going no trick at all. I found the people here generally in good order, although our particular group is somewhat laid up; Dr. Hale has been having a rather bad set-back, but apparently is coming through all right now. Porter has been off for some weeks due to a heart attack which, apparently, is going to make him be careful in the future; believe he will be back within the next week. I do not know if you have ever met him, but no doubt you have heard of him. He is a real asset on this project. Dr. Pease is also in the hospital for an operation but he will come along in another sixweeks, and, in the meantime, I hope to have the thing so organized that his niche will be organized so that there will be no friction. There has been so much talk as to possible complications with Pease on the job that I lookedforward to an encounter with him when I returned this time, but found that he apparently was willing to cooperate although he has some set ideas and will go to the bat for them.

In the few conferences I have been able to have with Hale and also with the Observatory Council, the question has been coming up a number of times of what your attitude was on a particular subject. So far these have been subjects which I had discussed with you, and I could truly say that you approved of the action which was being proposed. It mightbe that something will come up and I will take your name in vain, but I will ~~truly~~ try not to get you involved in anything in which there might be any serious doubt as to what your action would be.

I have obtained my estimator from Mare Island, Navy Department, and have him working now, and we hope to have in the course of time some fairly approximate ideas of the costs of the various items of the project. I have also arranged for a consulting firm, Lessells and Karelitz, and they will make a study of the tube and mount and report their findings to us. These were two particular items that I referred to about that you had approved of the action proposed. I have also availed myself of the promises of the various people I met in the east, and am sending out six sets of drawings of the tube and mount for some study and report. I was in San Francisco the end of last week and spent sometime with Dr. Durand. Although he will be fairly busy on his new job as chairman of a committee to study the lighter than air situation, I did get some thoughts from him, and hope to get more as his time will permit.

I am hoping that we will be able definitely to determine on the type of the mount within another month. Then I want the Council to approve our making a model to a one-tenth scale, or something like that, of the tube and mount. I developed quite a strong feelingthat this was desirable in my various contacts with the people in the east, and in my discussions with Dr. Durand he felt this was practically a necessity. If this strikes any response in your mind, or at least if you have no objection to it, I would be glad to have your approval, because I find, as I mentioned before, the Council sort of asks the question whether I think it would meet with your wishes. In this discussion, I do not want to be throwing things back to you all the time, but the Council has sort of a feeling that they would not authorize anything that might not be sanctioned by you. Possibly I am over-stressing this, and expect really that they know that anything they do would meet with your general approval.

I find that the general wish on the part of the people connected with this project is that you would come out to pay us a visit. I personally feel that as soon as we have some idea of the various costs of the items in the picture as we have outlined it, that you would be interested in being here to discuss the whole thing. I do not know just what your plans are for the next

few months, but if you can come at all, I believe that it would be a benefit to the Rockefeller Foundation for you to actually visit us here. In between times I have been house-hunting, and believe that I have now found a house which will not be too large so that I would feel lost in it and still large enough to take care of you and the others when I can persuade you to come out, and so I am looking forward to having you and Brook visit me.

I have had a letter from Ford sayingthat he expects to be able to get out here about the middle of April and spend a few days with us. I am counting very much on his help for the development of the control and driving mechanisms of the Telescope. I have written him suggesting that he try to get in touch with you before he leaves New York.

With best regards to both of you, I am

Very sincerely,

C.S. McDowell
Supervising Engineer
200-inch Telescope

FORM 372

APR - 9 1935

TBa

1103.1

WW	MAR 29 '35	WW
TA	APR-9 '35	Ja
FBH		FBH
AMJ		AMJ

March 26, 1935.

Dear Sandy:

I was very glad to get your letter and to learn of the progress at Pasadena. I had not known that Hale had another setback. I heard recently that he was planning to spend the summer in England this year.

We must, of course, officially, at the office, be in sufficient touch with the general situation so that we can recommend to the Trustees the appropriations necessary to cover the budgets submitted by the Observatory Committee. That means we must understand the general significance and importance of the broad features of operations which are proposed, but this would be the action as taken by administrative officers and not by people participating in the details involving technical knowledge. Of course in our conversations we go beyond this, because we understand each other, and all of us have a great personal interest.

I am saying all this just to indicate to you that we would not think for a moment of putting a veto upon specific proposals which do not involve major sums in the budget and which are along the general line of attack which we understand to be the plan of the Observatory Council, and I should hate to feel that the Pasadena group would be constantly thinking in their plans of whether or not a given step would be approved by us. Such an item would be, for example, the making of a model to a one-tenth scale, or something

like that. Neither Weaver nor I, I am sure, have the faintest knowledge on which we could base an opinion even if such were desirable, and we would never give approval or withhold approval of a type of that kind, but would be completely confident that if you made that proposal it was on the basis of a real importance and desirability.

I am sure you know our general feeling that in a project of this kind we do understand the necessity and desirability for adequate planning, preliminary testing, model building, or anything else which those technically competent feel would safeguard the enterprise and in the long-run give good construction combined with economical production, and by that I mean true economies when total final costs are considered.

Hannibal Ford dropped in yesterday, and we had lunch together. He said he was planning to leave for Pasadena, and hopes that he can make it. I think it is a fine idea to have him come out, for in no other way than by observation can he get a feel for requirements; and inviting him there is exactly in keeping with my idea of obtaining the best of advice in a truly scientific way at a cost that is very small compared with the results. Here is an example of a statement which is completely personal and absolutely not official. I mean that it is a statement of interest in Ford's visit, which has nothing to do with the Foundation's attitude in such matters, but is just between you and me.

We are busy working for our April meetings, and will be for some weeks to come. Your suggestion of coming out is awfully

interesting. I wish I could make it. I am certainly going to bear it in mind, and it may turn out to be possible in the late spring, but it does not look very probable now.

Cordially yours,

MAX MASON

Captain C. S. McDowell,
California Institute of
Technology,
Pasadena, California.

MM:AEB

CALIFORNIA INSTITUTE OF TECHNOLOGY
PASADENA

ASTROPHYSICAL OBSERVATORY

March 25, 1935

Dr. Max Mason
President Rockefeller Foundation
Rockefeller Center
New York.

Dear Mason:

Captain McDowell, who is making good progress, says there is some chance of your going to China this summer. If you do go, I hope you will plan to stop at Pasadena, as we want to get your advice on several matters. I may go abroad early in August, partly to look up some instrumental questions and partly for a rest. So I trust it will be convenient for you to stop on your way west.

Photographic tests made with the 100-inch telescope since the application of the aluminum coat have demonstrated some of its great advantages. For instance, the close companion of Sirius, which has been so hard to photograph because of the scattered light due to the fine scratches inevitable on a silvered surface burnished with even the finest washed rouge, is now easily shown on a much clearer background. The greatest advantage of aluminum, however, will be in the ultra-violet of stellar spectra, as illustrated by Wright in the paper I sent you some time ago (Publications of the Astronomical Society of the Pacific).

Hoping to see you before August and with cordial regards,

Yours ever,

Geo. E. Hale

GEH:G

FORM 372

1103.1

APR 12 1935

WW	APR-5 '35	WW
TA	APR-8 35	Ja
FBH	APR 12 '35	FBH
AMJ	APR 12 '35	AMJ

April 4, 1935.

Dear Hale:

If there is any chance of getting West I shall be delighted to do so, and to stop at Pasadena. My plans for China are still completely vague.

Your comments on the tests with the aluminum coat are very interesting. What enormous progress has been gained in astronomical art since your original plans were formulated for the 200-inch! It has been a fine story of cooperative interest.

I hope very much you are feeling fit and now getting the benefit of the operation.

With cordial greetings,

Sincerely yours,

MAX MASON

Dr. George E. Hale,
California Institute of
Technology,
Pasadena, California.

MM:AEB

APR 12 1935

March 29th

1103.1

CALIFORNIA INSTITUTE OF TECHNOLOGY
PASADENA

mm mm 4/4
APR-2 '35

ASTROPHYSICAL OBSERVATORY

Dear Max

I am enclosing copy of a memo that I am giving to the Observatory Council on the subject of the engineering staff for this job. Have an idea that this will cause some discussion and that there may be a question as to whether they have provided for these positions in this budget. I have the feeling that we have got to make some headway now if we are to be ready with the tube, mount, dome, etc. by the time the mirror is ready. These men are necessary in my opinion if our motto is to be "Forward".

Best regards

Cordially

Sandy

FORM 372

APR 12 1935

1103.1

WW	APR-[illegible]	ww
TA	APR-8 '35	ta
FB	APR 12 '35	FBH
AMJ	APR 12 '35	AMJ

April 4, 1935.

Dear Sandy:

I was glad to hear of your organization plans. I do not think that the question of the budget submitted for the year, and for which appropriation was made by the General Education Board, should influence decision as to desirable proceedings.

The Executive Committee meetings of the General Education Board are held monthly, with the exception of two or three months in the summer. A suggestion for addition on the basis of organization could be acted upon rapidly.

I have no right to say that it would be favorably considered, but I have no reason to believe there would be anything but appreciation of the desirability of thorough planning, and consequent appropriation for the purpose. We all understand the tentative character of budget planning, and the probability of readjustment at any time.

Cordially yours,

MAX MASON

Captain C. S. McDowell,
California Institute of
Technology,
Pasadena, California.

MM:AEB

APR 12 1935

1103.1

March 29, 1935

To: Observatory Council

From: Captain C. S. McDowell

Subject: Engineering Staff, Organization and Increase of it

In developing the design, manufacturing the apparatus and installing and testing the finished project of the two hundred in h Telescope, the work broadly falls under the following divisions, viz.:

(a) Dome structure and structure of other auxiliary buildings, foundations for these buildings and for telescope mount.

(b) Telescope tube, telescope mount and auxiliary attachments.

(c) The electric control and drive of the Tube, Mount, Dome and auxiliary apparatus.

(d) Optical Systems, mirrors, etc.

It is recommended that the following three engineering positions be authorized to head up the first three divisions:

Associate Construction Engineer (P-3-810)

Associate Mechanical Engineer (P-3-825)

Associate Electrical Engineer (P-3-812)

These titles are those established by the Federal Classification Board. The General Specification for Associate Engineer is as follows:

Grade 3

P-3-800 D. Duties and Responsibi ities: Under general supervision, with considerable latitude for independent or unreviewed action or decision, to perform responsible professional work of moderate difficulty and importance in the investigation or development of engineering projects, the design, construction, inspection, testing operation, or maintenance of engineering works or equipment, or in scientific engineering research, in that field or branch of engineering indicated by the title of the class; and to perform related work as assigned.

P-3-800 Q. Minimum Qualifications: Training equivalent to that represented by graduation in engineering from a college or university of recognized standing, with major work in courses supporting that field or branch of engineering work indicated by the title of the class; not less than three years' post-graduate study in that field of engineering indicated by the title of the class, which must have fulfilled the requirements for the degree of Ph.D. or D.Sc., or three years' professional experience in such field of engineering, which must have involved the successful development of one or more engineering projects and thepreparation of complete engineering plans or full reports of work accomplished and which has demonstrated initiative and resourcefulness, and the meeting of the substantive technical responsibilities with success, and a capacity for increasingly difficult and important assignments; good knowledge of the principles of that field of engineering indicated by the title of the class, and of the sources of information involved; ability to plan working details, andto supervise and coordinate engineering work and to prepare engineering plans and reports; for those engineering positions where the duties are largely research in character, demonstrated capacity for the independent prosecution of productive research and ability to analyze data, draw logical conclusions therefrom, and present results in the form of reports or monographs; proven capacity for independent professional work in engineering; in some cases proficiency in the use of drafting instruments; instruments of precision, and mathematical tables required in the performance of professional work in engineering."

The importance of the Telescope project and the type of work involved, requires, in my opinion, that we have men who can meet the above minimum specification.

In expanding the Navy Civilian Force last year at the New York Shipbuilding Company, I added four associate engineers meeting the above specifications, and the work required of them was not of as important a character as will be demanded of these men.

The Federal Schedule of Wages for this position start at $3200.00 a year. At the present time there is a 5% reduction in effect on Federal salaries, but this reduction is to be eliminated on July first of this year. In checking several men who appear

qualified for these positions I find that they are either now employed by some branch of the Federal Government as Associate Engineer at the above rate of pay or are getting equal pay from Commercial employment.

It is, therefore, recommended that these three positions be authorized at $3200.00 per annum with reduction in pay of 5% until restored by the Federal Government to its employees.

It is recommended that Mark Serrurier be appointed to the position of Associate Construction Engineer, his education, training, experience on structural work, and his familiarity with this project qualify him under the given specifications. It is hoped to find two other men equally good to fill the other two positions, if they are authorized.

1103.1

MM APR 26 '35 MM
TA APR 29 '35 TA
WW MAY 13 '36 Noted PR
FBH FBH
WW WW

April 26, 1935

Dr. J.A. Anderson
California Institute of Technology
Pasadena, Calif.

Dear Dr. Anderson,

We were somewhat surprised to learn from your letter of April 12 that the list of auxiliary mirrors for the 200-inch telescope submitted to us some time ago was merely tentative and not final. After thoroughly searching our files, we have concluded that this statement is literally correct. On the other hand, our conversations with different members of the Mount Wilson staff on occasions when they visited Corning gave us the impression that the blueprints submitted in September and October of 1933 represented the auxiliary mirrors, and we proceeded to make them up in accordance with this understanding. Perhaps we moved too rapidly on this phase of the project, but on May 15, 1934, we received a wire from Dr. Pease asking "were small mirrors and plugs for two hundred inch poured at same time as large mirror and if so when can we expect them?" This wire arrived during my absence from Corning and Dr. McCauley replied as follows on the same date: "Regarding yours Hostetter away small discs and plug for large telescope cast from same melt as two hundred inch stop these not yet annealed stop for lack of kiln facilities these will not be completed for approximately five months stop sample blocks to test grinding of supports for one twenty inch placed in annealer this week and shipped about July one."

Accordingly, we cast the auxiliary disks and at the moment the status of this phase of the project is as follows:

Mirror 26" x 37", Drawing No. 200-0-6, and the 36" Coelostat mirror, Drawing ST46, were cast, annealed and shipped via Erie Railroad freight collect to Pasadena on March 1, 1935.

The following disks have already been cast but are not annealed:

41½" mirror
36" Coude
40½" plug, 7¾" thick.

In the meantime the design for the plug was changed and the new type of plug 27" thick has been cast but is awaiting annealing.

With reference to your new requirements calling for three 45" disks, these can be cast from a small furnace and this operation will present no unusual difficulty. However, this diameter is several inches too large to permit annealing in our small cubical annealer. Therefore these disks will have to be annealed in the small circular kiln in which the University of Michigan disk is now being annealed.

Our annealing schedule on this particular disk calls for completion between September 15 and October 1. We assume that, roughly, two months will be required to anneal each 45" disk. Therefore at the earliest we could ship one 45" disk to you in December, 1935. In outlining this tentative schedule I am assuming that we will be permitted to postpone the annealing of a 61½" disk for Harvard until after your first 45" disk is annealed. The Harvard disk will require the use of the annealer for approximately 3½ months. Following this disk we would then anneal the second 45" having it available for shipment, let us say, April 1, 1936. The third 45" disk would then follow 2½ months later.

We assume that additional auxiliary mirrors will be less than 40" in diameter. If this is the case, these can be annealed in our cubical annealer.

With reference to your question as to the shipping date for the 40" plug, I regret to advise that there is a slight complication in annealing. As you will note above, we have cast one plug 7¾" thick in accordance with the original design and also the 27" thick plug but these have not been annealed. The complication arises in that the thickness of the second plug is so great that we have no suitable annealing equipment except the large 200" annealing kiln. Logically, therefore, the annealing of the plug 27" thick would follow the completion of the annealing schedule on

the 200". It probably would not be necessary to give this plug a precision annealing but even so the annealing period will require three months. The annealing schedule for the 200" disk will terminate about November 1. We estimate that it will require a period of some weeks to remove the cores and crate the disk for shipment. Depending on how rapidly this work proceeds, the plug can be shipped with the 200" disk, or will follow within one month or six weeks.

We are also considering another plan by which the 200" kiln would be used for annealing a number of disks simultaneously. If this plan is followed the 27" plug, the two other 45" disks, and perhaps other auxiliary disks will be annealed by about April 1, 1936.

Obviously, if the original design plug of 7½" thickness can be used we can anneal it in our cubical annealer and hence be quite sure that this will go forward with the 200" disk.

I believe that the above outline covers the points you have in mind but if there are further questions please do not hesitate to command us. I have outlined rather fully the situation in regard to auxiliary disks in order that you may consider using those now available in your new design. However, disks up to 40" in diameter can be readily handled with our available annealing equipment and the production of your auxiliary disks will be a relatively simple procedure, if this diameter is not exceeded.

The annealing of the 200" disk is progressing according to schedule.

Dr. McCauley joins me in sending you our kind regards and best wishes.

Sincerely yours,

J.C. Hostetter
Director, Development & Research

JCH:FRF
cc- Dr. Max Mason
Dr. A.L. Day

CALIFORNIA INSTITUTE OF TECHNOLOGY
PASADENA

ASTROPHYSICAL OBSERVATORY

May 3, 1935

Dr. Max Mason
President Rockefeller Foundation
49 West 49th Street
New York.

Dear Mason:

I was glad to receive your last letter, but have delayed writing you until we could see our way more clearly here. You will recall that in our last budget estimate there was included the following statement: "Telescope mounting and building not included here as reliable estimates are not yet available."

As matters have developed, McDowell feels the need of more assistance in design, as he has written you, and there will be some other items which we must submit to your group before you break up for the summer. Some of these McDowell is not yet prepared to present, so I must ask you what will be the latest date on which the Executive Committee could act on them. I hope we may be able to send our request considerably before that final date, because it will save expense to go ahead here as rapidly as possible.

I am delighted with Ford, who has one of the keenest of minds. He is studying everything carefully, and will doubtless tell you his impressions after he returns.

McDowell is splendid, and as reports from Corning are very satisfactory, I think there can be no doubt that we shall have by far

the most thoroughly studied plan in the history of telescope construction. Revised estimates of cost, received from McDowell today, are also very satisfactory.

With best regards,

Yours ever,

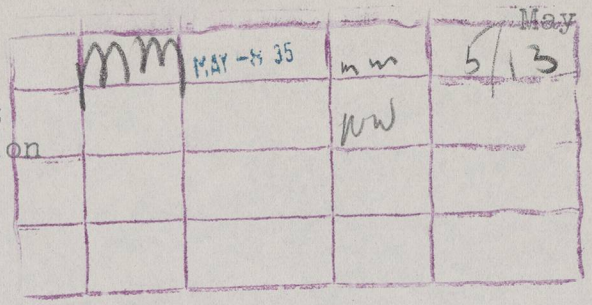
George E. Hale

GEH:G

CALIFORNIA INSTITUTE OF TECHNOLOGY
PASADENA

ASTROPHYSICAL OBSERVATORY

May 4, 1935



Dr. Max Mason, President
The Rockefeller Foundation
49 West 49th Street
New York, N.Y.

Dear Max:

Hannibal Ford has been out with us for the past two weeks and will remain about a week longer. I feel that his visit is going to be of the greatest value to us, particularly in our development of a fine control system for the precise movements of the telescope and dome. I believe that Hale, Adams, and the rest of them have been very much impressed with Ford and with his explanation of what can be accomplished, using elements which have already been developed.

We have not yet definitely approved wither type of mounting but I have received comments and opinions from the General Electric Co., Westinghouse Corp., Babcock & Wilcox Co., Mare Island Navy Yard and Dr. Durand, and there is practically unanimous agreement from these people that the yoke is preferable over a fork. We have not received the comments yet of the consultants who are making detailed study of this question, and I am also expecting to receive some comments from the Bethlehem Steel Company and the Newport News Shipbuilding Company. I am hoping to have this all in shape for definite action by the council inside a couple of weeks so that the detailed design may be proceeded with. As I mentioned, I think, before, it is my opinion that a model to about one tenth scale of the telescope should be built, and I think that such a model will have considerable use as an actual instrument. Perhaps you would like to have it mounted on top of the Rockefeller Centre - but, seriously, I think that its need is great, in order to determine definitely certain arrangements, as well as obtain a practical check on our calculated deflections. Durand, for instance, told me that he felt that this was practically a necessity.

I have had some correspondence with Johnston of U.S. Steel on the subject of low coefficient alloy for tube and mirror supporting cell. Johnston's interest has been wonderful, and for a time it looked as if we might have International Nickel furnish necessary raw materials because of the uniqueness of the undertaking, but apparently they have decided not to, and I question that we could justify the considerably greater expense that would be involved in using such material where ordinary carbon steel would do. It looks perfectly feasible to correct for the difference in expansion of the mirror, tube and cell with far less expense, than to install material that will all expand together.

Dr. Hale remains about the same. Some days he is feeling pretty well and then he has a temporary set-back. It is a great shame that his physical stamnia is not as great as his mental activity. We

May 4, 1935

Dr. Max Mason - 2

are having some difficulty in getting the San Diego County supervisors to get work actually started on the approach roads to the mountain. There is nothing for you to worry about in connection with this, except you may be interested, and possibly Hale has already mentioned this to you. The present situation, which is likely to change within the next few days, is that they have two roads under consideration and part of the supervisors want one, and part the other and the thing is at a stale mate. Hale tells them they need not count on the telescope being installed on Palomar until we see some action on getting roads. As soon as this is cleared up I expect to get some work started on the mountain in installing water supply, and probably the first building to take care of resident inspectors during the construction of the dome and other construction work at the sight. Ford can give you his impressions in person when he returns, and I am going to ask him to take advantage of an opportunity to see you when he does get back.

I am still hoping that you will find it convenient to get out here this spring or summer, because I feel that such a visit would be of great benefit to us and I believe too, of considerable interest to you.

I am enclosing a sketch of the telescope, which although probably not what will actually be constructed, is somewhat along the lines that we are now thinking.

With best regards to Brook,

Cordially yours,

Sandy

C.S. McDowell
Supervising Engineer
200-inch Telescope

McD:hb

Encl.

FORM 372

MAY 20 1935

1103.1

T A MAY 16 '35		Ja
WW	MAY 16 '35	was noted PK
FBK		FBK

May 15, 1935.

Dear Sandy:

Your letter of May 4th telling me of your progress is most interesting, as is also the sketch of the mounting. I have no comment on the proposed one-tenth scale model. This would be a question of the estimation of the value to be obtained against the cost. Would it be planned to be a complete working model obtaining the degree of precision required in the final instrument in its drive mechanism? It certainly is an interesting proposal.

I had a letter from Hale this morning telling me that the yoke type had been formally approved. The way seems certainly to be clear for going right ahead now, and it all looks fine.

My plans are still uncertain. I am quite sure I shall not go to China this year. A visit to the West is not impossible. I shall keep it in mind, and hope that things might break that way.

I shall be interested to see Ford when he comes back and hope he will have some time to tell me all about it.

Cordially yours,

MAX MASON

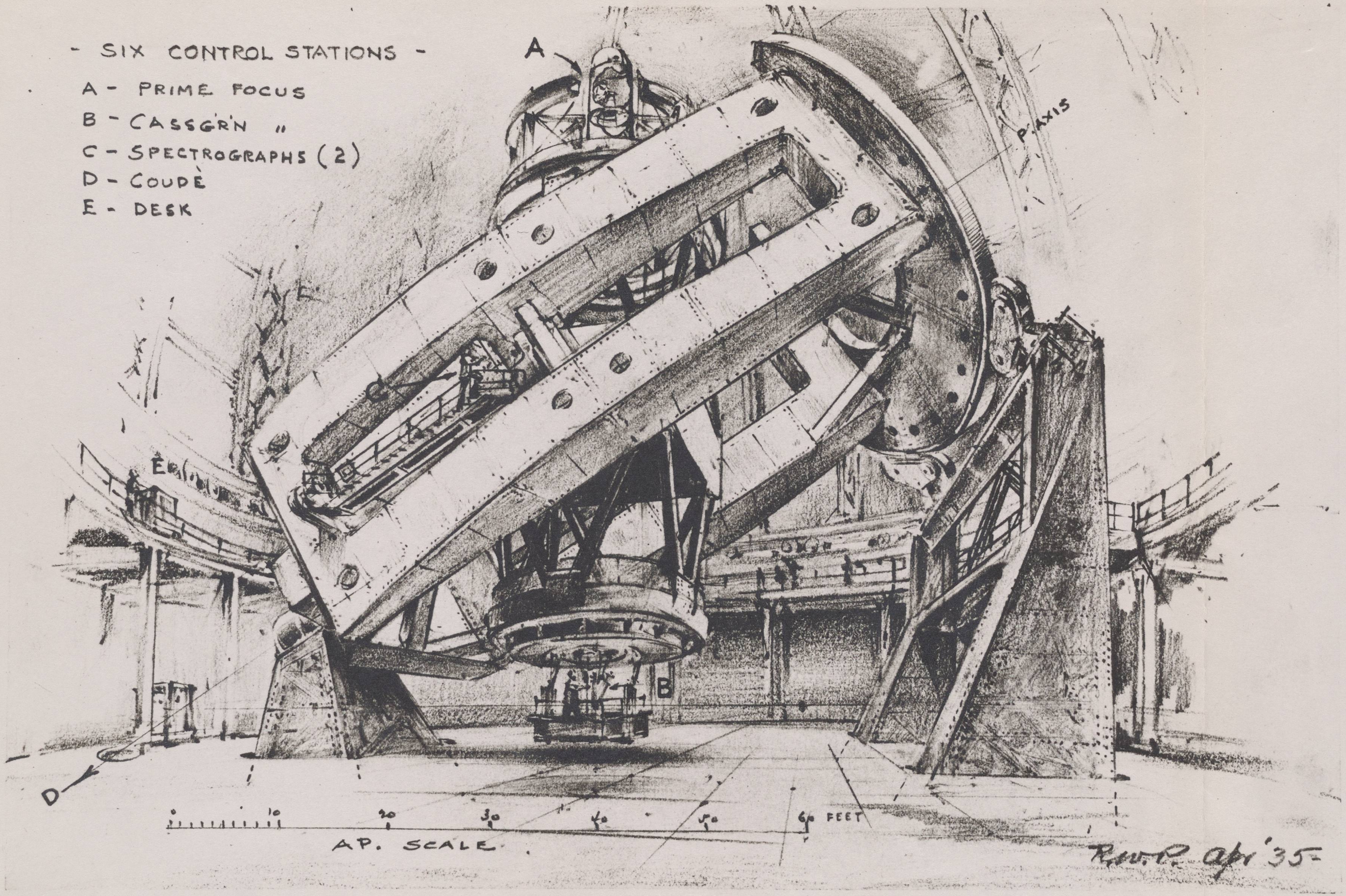
Captain C. S. McDowell,
California Institute of
Technology,
Pasadena, California.

MM:AEB

1103.1

- SIX CONTROL STATIONS -

A - PRIME FOCUS
B - CASSGR'N "
C - SPECTROGRAPHS (2)
D - COUDÈ
E - DESK



Rev. P. Apr '35

Sent by C. L. McDowell
5/4/35

CALIFORNIA INSTITUTE OF TECHNOLOGY
PASADENA

ASTROPHYSICAL OBSERVATORY

May 11, 1935

Dr. Max Mason
President Rockefeller Foundation
49 West 49th Street
New York.

My dear Mason:

As I have not heard from you in reply to my letter of May 3, I fear you have been away or for some other reason have not received my letter. Air mail does not invariably go through, so I quote the principal paragraph:

"As matters have developed, McDowell feels the need of more assistance in design, as he has written you, and there will be some other items which we must submit to your group before you break up for the summer. Some of these McDowell is not yet prepared to present, so I must ask you what will be the latest date on which the Executive Committee could act on them. I hope we may be able to send our request considerably before the final date, because it will save expense to go ahead here as rapidly as possible."

I also mentioned the fact that the last budget contained a statement to the effect that no allowance was made for the telescope mounting and building, in theabsence of reliable estimates.

If you have returned and can conveniently wire me, I shall be greatly obliged. We settled yesterday the general type of the 200-inch mounting, (adopting the "yoke" or two support plan advocated by McDowell and our various advisers) and we can probably send by the middle of next week estimates to cover the necessary additions to the last budget.

With best regards,

Yours very sincerely,

George E. Hale

GEH:G

FORM 372

MAY 20 1935

1103.1

JA MAY 15 '35		Ja
WWB	MAY 16 '35	hwb noted PH
WW		
KTD		KTD

FBH

FBH

WW

May 13, 1935.

Dear Hale:

I wired you to-day regarding the last meeting of the Executive Committee in response to your inquiry of May 3rd. I am sorry for the delay in answering.

I have, of course, been much interested in the progress on the mounting design and all other phases of the work, and very glad to know, as your letters indicate, that McDowell has been a real help to you.

Ford is certainly quite a genius and I should expect his advice and comments to be very valuable.

It is interesting to know that you have settled on the yoke type of mounting. I knew that at first rough examination most of the engineers consulted seemed to favor that plan, and it is interesting to know that careful study indicates its desirability. It certainly appeals to the layman.

Cordially yours,

MAX MASON

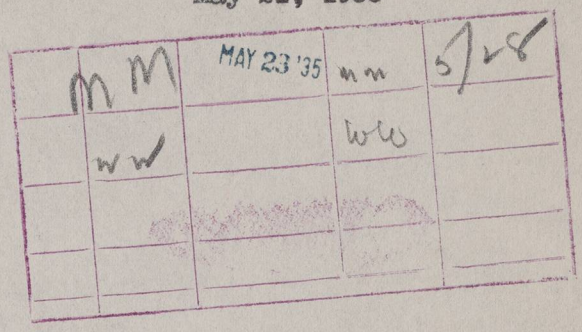
Dr. George E. Hale,
California Institute of
Technology,
Pasadena, California.

MM:AEB

CALIFORNIA INSTITUTE OF TECHNOLOGY
PASADENA

ASTROPHYSICAL OBSERVATORY

May 21, 1935



Dr. Max Mason
President Rockefeller Foundation
49 West 49th Street
New York.

Dear Mason:

The Observatory Council met on Saturday, just before Adams left for Europe, and discussed the report of the Advisory Committee and the various budget items submitted by McDowell.

The result was the enclosed supplementary budget, which I am sending to you and Arnett, with a copy of some of the preliminary reports on the design of the mounting.

We think it necessary, after a study of sources of water supply and possibilities of disturbance by lights etc. by adjoining property owners, to purchase additional land as indicated. However, as San Diego County has agreed to build the expensive road to the top, our expenditures for road and site will be much below our original estimates.

I do not know whether your Executive Committee can act before the date of the last meeting given in your recent welcome letter, but I shall be obliged if you or Arnett will wire me as soon as action is taken, as McDowell is very anxious to go ahead.

With best regards,

Yours very sincerely,

Geo. E. Hale

GEH:G

FORM 372

JUL 2 - 1935 TBa

1103.1

WW	JUN - 4 '35	noted PT
FBH		FBH
WW		WW

May 28, 1935.

Dear Hale:

Thank you for sending me a copy of your letter to Arnett regarding the budget for the remainder of the year, and for the copy of the preliminary reports on the telescope mounting.

Hannibal Ford dropped in the other day and gave me a most interesting account of his visit. He is much impressed by all he saw and eagerly desirous of being of any possible assistance.

I note your last paragraph inquiring whether the Executive Committee can act before June 21st, which is the date I gave you. Arnett has wired you in regard to this.

Have your plans matured for the European trip? I would like very much to see you on your way through if that is possible. McDowell has suggested my coming out there, and I certainly would greatly appreciate the opportunity of getting up to date and of a visit. However, my program has been somewhat complicated, and I am afraid that this will be impossible in the near future.

With cordial greetings,

Sincerely yours,

MAX MASON

Dr. George E. Hale,
California Institute of Technology,
Pasadena, California.

1103.1

CALIFORNIA INSTITUTE OF TECHNOLOGY

Astrophysical Observatory

Supplementary budget for the year 1935

II	OPTICAL SHOP			
	104-inch grinding tool		2,000.00	
III	EXPENSE OF LAND AND LAND IMPROVEMENTS			
	Land for Observatory Site (This tract decided to be necessary to afford adequate protection)	25,000.00		
	Preliminary land surveys for contour maps, etc.	1,200.00		
	Surveys for foundations	2,000.00		
	Dwelling for Superintendent at site (to be used later as part of the permanent plant)	7,500.00		
	1,000,000 gallonground storage reservoir	9,000.00		
	Elevated steel tank for auxiliary water supply	9,000.00		
	Fuel oil tank supply	2,200.00		
	Grading and excavating at site	5,000.00		
	Wells at water supply site	2,000.00		
	Pumping plant, pumps, piping etc.	5,500.00		
	Miscellaneous	8,000.00	76,400.00	
IV	EXPENSE OF BUILDING AND TELESCOPE MOUNTING			
	Design (salaries to Dec. 31,1935 of Irwin, Gee; part time of two draftsmen, and of Timoshenko from Aug. 15, 1935 to Feb. 15, 1936	9,000.00		
	Base of 200-inch telescope tube (which will be used also to support the 200-inch mirror while grinding and polishing)	11,000.00		
	One-tenth size model of 200-inch telescope and testing (exclusive of shop time, provided in previous partial budget for 1935)	5,000.00		
	Miscellaneous	6,600.00	31,600.00	$110,000.00

May 21, 1935.
G.E.H.

1103.1

May 20, 1935

Mr. Trevor Arnett
President General Education Board
49 West 49th Street
New York.

My dear Mr. Arnett:

You may remember that our requested budget for 1935 was incomplete, and contained the clause

"Telescope mounting and building not included here as reliable estimates are not yet available".

Captain McDowell, who has proved to be an ideal choice as Supervising Engineer for the 200-inch telescope, has lost no time since his appointment. As the result of his extensive studies and inquiries among the ablest engineers and constructors in the country, we have now decided upon the type of mounting to be constructed, as soon as a one-tenth scale model can be built in our own shop and subjected to rigorous tests under the eyes of expert engineers. The final detailed drawings, with any such minor modifications as the tests and studies of the mounting may demand, will then be completed.

Meanwhile Captain McDowell has made careful studies of the proposed site, and of such questions as power and water supply, roads, means of transportation, etc. As money now can be saved by early action, I therefore hope that the Executive Committee can allot soon an additional sum of $110,000., covering the balance of 1935. This supplementary budget, together with the partial budget authorized last autumn, should therefore complete our requests for allotments to be expended during the current year.

I enclose the supplementary budget, giving our estimates, as approved by the Observatory Council, under their respective heads. I am also sending a copy to Dr. Mason.

With kind regards,

Yours very sincerely,

George E. Hale

GEH:G

1103.1

COPY

LESSELLS and KARELITZ

April 4, 1935

PRELIMINARY REPORT NO. 1 on 200" TELESCOPE MOUNTING

The weights and deflections are now being checked but based on the preliminary analysis it is our opinion that while the fork type of mounting seems more elaborate it is a design which will give quite a lot of trouble. The weight is double that of the yoke type, and the weight cannot be substantially reduced since the internal steel structure is necessary in order to carry the two arms. The above is not so bad but the fitting of the two arms will be a very difficult job.

Do we understand that it is proposed to set up the arms in position, fit all the turned bolts in reamedholes, lay out the housing for the two declination bearings, dismantle the arms, machine them as laid out and reassemble the arms? It appears to us that the above procedure is impossible of execution without a final misalignment of the declination bearings.

On the other hand the yoke seems to be much easier to handle. The trusses can be welded up and assembled on pins (rivets or bolts), machined accurately for the bearing housings, declination and polar axis; dismantled and reassembled without danger of misalignment. With such a mounting the transportation problem would also be much simpler.

In view of the above remarks, we would ask you to send us by air mail such details of the yoke as are available showing the proposed design of the piece connecting the trusses to the south bearing of the polar axis. We would also like to receive the details of the connection of the trusses to the plate of the north end horseshoe plate.

It would also be of assistance to receive data of the possible variation of temperature in fork or yoke. Is there any possibility of the sun shining directly on parts of the mounting?

Conversations have been held with Mr. Harter of the B.& W. Co. and it appeared that he was at first much in favor of the fork type, but when he was shown what it actually involved he agreed completely that the yoke type appears the proper engineering solution. An endeavor was made to estimate the comparative cost of the two types and that leads us to believe that the fork type would cost about $50,000 more. This figure is probably greatly under estimated, probably a cost of $0.40 per pound for the yoke type and $0.50 per pound for the fork type may be nearer the truth. This would make a difference of $140,000 in manufacturing costs.

Lessells and Karelitz
Consulting Engineers
Swarthmore, Pa.

Signed: John

COPY

LESSELLS and KARELITZ

1103.1

May 4, 1935

PRELIMINARY REPORT NO. 2

We have nearly finished our investigation of the mount, and you may expect the report in ten days or two weeks (after this letter). But you will be interested in the findings and may have some questions or suggestions as to the material of the final report.

I am now completely convinced that the fork type is misleading in its apparent advantages. The merit of the mount should be judged by the rigidity of the support it gives to the declination bearings. When the declination axis is normal to the meridian (tube in meridian), everything is satisfactory, but when the axis is in the meridian (tube East to West) the arms deflect over three minutes. This is not very good for the bearings; to be sure, I consulted Dr. Styri of the S.K.F. and he was also doubtful about the effect of this misalignment on the smooth operation of the bearings.

I went therefore deeper into the deflections of the yoke type as designed. It was necessary to estimate the comparative supporting value of the various members. Again, with the declination axis normal to the meridian, everything is symmetrical. With the declination axis in the meridian, the horseshoe takes very little load and the cross trusses come into play. They should be made somewhat heavier. Anyway, the resulting skewing of the declination bearings is of the order of .5 minutes, which is much better. An important point is that the skewing of the declination bearings imposes a strain on the declination belt of the tube, which must be watched in order to keep the optical system in alignment.

In so far as the deflections go, the general design 200 G-1 A can be considered satisfactory, with such modifications as would be indicated by further detailed study of the system. But the structure is distinctly weak in torsion. In fact, it could not transmit any torque. I do not know how the "Torsional Stiffness of Yoke (200 G-1A)" was obtained and this is the only suspicious figure. I discussed this with Timoshenko and he agrees that the torsional strength must be improved. We will recommend the introduction of torque members of box section, approximately 36" x 36", to replace the longitudinal straight 14 I-beams of the trusses (see hand sketch). This will make the structure sufficiently rigid in torsion, to limit the twist of the structure at the declination axis to one minute approximately. These torque tubes will, in addition, help somewhat the deflections and support the upper horseshoe end from sagging.

The yoke design 200 G-109 does not appeal to me. It is rigid in torsion, but is probably less rigid in bending than the trusses. However, I have not looked into this as yet. I suspect that the truss design is the only reasonable one for a structure of this size. The horseshoe was strengthened in this design which is right and we will recommend that this be done.

I understand that the declination bearings for the yoke type will be the same deep groove 700m/m bore bearing as were contemplated

for the fork type, and that the more complicated suspension shown in the earlier drawings is obsolete. This suspension would impose too much strain on the tube structure. This was also the impression of Dr. Styri.

We will recommend that after all opinions and suggestions have been compiled, and the yoke type approved, (as I expect) the final design should be made on paper and a model built to 1/10 or 1/12 full size, following dynamic similarity, and that the deflections and twist be carefully checked. This would not cost much and would give a good idea where to strengthen or make lighter the yoke and tube. The size would be convenient for measurements and alterations, and would not be too small for normal welding.

As to manufacturing, it seems advisable to weld the four trusses, upper and lower, as separate pieces, then weld the connecting elements in as large parts as possible, and assemble the whole structure, together with the horseshoe and south bearing, at the manufacturer's plant on fitted bolts with rimmed holes. Of course the welded parts would be annealed thoroughly before machining. After complete assembly the separate parts would be shipped and reassembled on site, using bolts .0005" to .001" heavier than originally. I asked both Mr. Harter of B. & W. and Mr. Brinton of W.E.M. Co. and they agree that the distortion would not be large, and minor shimming of the bearings would be necessary to have the assembly lined up satisfactorily. The joints must be designed in a way that the bolts are working as rivets, connecting struts to girders. This design is so much easier of execution than the fitting of the arms over the stubs. (In fact it is something feasible vs. something hardly possible.) I do not forsee any insurmountable difficulties in shipping the pieces to the West Coast, or with the machining of the horseshoe diameter.

Yours very sincerely,

Signed: G.B. Karelitz

1103.1

COMMENTS ON TYPE OF MOUNTING
Extracted from Isaac Harter's letter
Dated April 19, 1935
Babcock & Wilcox Co., N.Y.

Dear Sir:

"It seems to Trainer and to me quite easy to discard the truss type in favor of the girder, and especially so if it is possible to transport each of the two girders as a unit piece from San Diego to destination. If we were to build these girders we would do so at our Marine Shop at Bayonne, and we would do the work in all probability in collaboration with Baldwin-Southwark on the machining. Floor plates would be set temporarily in the floor of the Bayonne Shop, and Southwark would send over floor type machines, and the finished job could be loaded from our craneway to a barge for alongsider delivery onto the ship.

The problem of doing stress annealing can be handled by using a panel type furnace built around the piece right in the shop, and we have established means of regulating temperature in such a furnace for a job of this kind with a maximum variation of not exceeding 10° F., having in mind that each annealing operation might take a week.

As an alternate case under this general design, each of the two girders could be made in two halves, and the pieces fastened together with pins, using exactly the practice that we have developed at Boulder Dam. The beauty of this pin method is that the joint could be made up and taken down, and when remade would be identical, so that machine centers and axes would not be distrubed. If the job were done in this way, we would undoubtedly make the quarter parts at Barberton and ship the pieces to Philadelphia for finishing.

Referring now to the cone (fork) type, and considering not merely the drawing above referred to of the cone type, but the more detailed cone type drawings which Professor Karelitz showed me, it seems to me that the design would have very grave questions of alignment of the two projecting arms, and that the cone structure itself, with its internals split up into segments, would be tremendously expensive. I would also be a little suspicious of the relative rigidity of this type as against the girder type for anything approaching equal weights."

Very truly yours,

Signed: Isaac Harter

Vice President

COMMENTS ON TYPE OF MOUNTING
Taken from H. D. Strong's letter
Dated April 18, 1935
Central Station Dept. of G.E.

"Mr. Stevens also states that after our Engineering organization has had a number of conferences regarding the two types of mounting proposed for the telescope, that is, the yoke type and the fork type, they believe the yoke type of mounting is by far the best, and that a design of that type can be worked out which will be perfectly satisfactory. In addition, the design shown for the telescope tube itself meets with their approval, although they suggest that some details of that design should be checked over for welding with some of the engineers of the company which will undertake its fabrication.

While the general construction of the yoke type of mounting is satisfactory, they are of the opinion that the rectangular bracing which is used at the two ends of the yoke may not be sufficiently rigid for your purpose. Attached is a rough sketch which I believe will show you the general type of construction which is suggested.

You will note that the above comments are of a general character for our engineers realize that there have been several years of time and study devoted to this design and they are of the opinion that certain details of design should be checked over in a discussion by your engineers and the engineers of whatever company undertakes to build this equipment."

Yours very truly,

Signed, H.D. Strong

CENTRAL STATION DEPT.

COMMENTS ON TYPE OF MOUNTING
Copy of Dr. W. F. Durand's letter
Dated April 4, 1935
Stanford University

Comd'r C. S. McDowell
Astrophysical Laboratory
Calif. Institute of Technology
Pasadena, California

My dear McDowell:

Professor Domonoske, a few days ago, brought over to me the bunch of blue prints relating to the telescope mounting, and I have been looking them over at odd times during the past few days. I,have not of course, attempted any detailed analysis and can only give you a few offhand suggestions which have occurred to me.

1) With regard to a choice between the so-called fork and yoke mounting, I have no definite ideas. Each type apparently has certain advantages. Only an exhaustive analysis would serve to lay a proper foundation for an opinion. In an offhand way I have the feeling that the deflections could, on the whole, be better taken care of by the yoke type than by the fork type. In the former the weight of the tube is carried between two supports. In the latter it is overhung, cantilever fashion. Doubtless either form can be made adequate, but in some way the yoke form seems to suggest a more effective carrying of the weight than the fork form. This seems to be borne out by the figured deflections on the drawings, if I interpret them correctly.

2) I notice that the steel construction, so far as the drawings indicate, seems to be very generally with riveted connections rather than welded connections. I have no doubt that welded construction has, in recent years, made such enormous advances and the technique has been so vastly improved, that this type of construction would certainly warrant the most careful consideration for complicated built up structures of the type with which you are dealing. Generally speaking, I think it is admitted that such a structure can be made stiffer with the same amount of material or lighter with the same degree of stiffness with welded as compared with riveted connections. Likewise there is the matter of cost, and for at least certain parts of the structure, I velieve that the welded construction would prove cheaper than riveted. These remarks apply not only to the dome and general structural features, but also to the telescope tube and mounting - yoke or fork.

3) Bearings. For the bearings at the base of the cone--fork type--or the upper end of the yoke, nothing of course, can be better than the roller type of bearing. For spincle bearings the ball bearing type seems to be indicated. I would here merely call in question whether it might not be possible to obtain better results with a roller type of bearing (Timkin Adjustable) than with the ball type, on the general proposition that line contact is better than point contact. In this same connection I would raise the question as to whether consideration has been given to the possibility, with all such bearings, of enclosing them in such way that they can be flooded with oil under high pressure, constantly forced through by an oil circulating

pump. The nearer we can approach what might be called flotation of the spindle on an oil film, the smoother, of course, will be the motion, and it seems to me worth some investigation as to whether bearings of these types flooded with oil, forced through under very high pressure, might not furnish a nearer approach to such an ideal flotation.

4) A very vital point in the satisfactory working of the mounting, as regards rotation of the polar axis, appears to me to be involved in the accuracy of the large end of the cone (fork mounting) or the upper end of the yoke, resting as they do on rollers and revolving around in order to give the motion desired. You, of course, have fully realized this feature and I only mention it incidentally. It is, however, obvious that this bearing surface should be truly circular to the very highest degree possibly obtainable and likewise that it should move on its supporting rollers with the utmost obtainable smoothness of motion. Perhaps I am over exaggerating the importance of this feature, but as I look at the problem offhand, it seems to me vitally and fundamentally important and worthy of all the attention and study which you can give to it.

These are the only items of special significance which have occurred to me as I have looked over these drawings somewhat hastily. Should anything else occur to me in connection with the matter, I shall be glad to pass the thought along to you.

With kind regards, and wishing you all joy with this fine piece of work which you have in hand, I am,

Sincerely yours,

Signed: W. F. Durand

JUL - 2 1935

1103.1

CALIFORNIA INSTITUTE OF TECHNOLOGY
PASADENA

ASTROPHYSICAL OBSERVATORY

May 23, 1935

JUN 37 '35

Dr. Max Mason, President
The Rockefeller Foundation
49 West 49th Street
New York, New York

Dear Max:

I think there has been some progress here within the last few weeks, as the Observatory Council has given its approval on the yoke type of mount with the bearings north and south end, and have approved the building of a one-tenth scale model, as well as certain other details such as the elimination of the five mirror coudé which will simplify the mirror arrangements.

In addition to this, the road situation seems to be clearing up. We have a promise from San Diego that they will start work again on the approach road up the mountain on the first of June. They also promise to have the road across the mountain by the first of July 1936. I understand that as soon as we are definitely satisfied that the County will keep its promises on the question of roads, also the question of additional land at a reasonable price on the top of the mountain, that the Council will definitely adopt Mt. Palomar as the site.

I have outlined certain work to start on Palomar just as soon as we know that it is going to be the site of the telescope, and funds are available. This is the jist of the work for development: satisfactory water supply and putting up certain water tanks; start on a permanent reservoir and building of a house on the site which will be used temporarily for our resident inspector and for such parties as we may send down for surveys, etc. and will be part of the permanent layout when the whole thing is completed. I have spent a couple of days on Palomar recently and am becoming enamored of the location. It would not be a bad place for you to take a vacation, although I presume that if you come out we will be bothering you with so many other things that you would have a hard time being left alone.

In building the model, it is in my thought that it will be used as a 20-inch telescope eventually. Where it would be located I couldn't state now, although it might be installed in the north dome here on the Astrophysics Building. However, there is always in my mind some thought that Bush's scheme may eventually develop to the point where we might like to drive the big telescope by means of a smaller one. There doesn't seem to be any real promise of this at the

May 23, 1935

moment however. This model of the telescope would be built in the shops here, and I think the cost will not be very great. Actually, probably it would cost $15,000 but by loading up the shop here with work and assuming that our work force is not increased, we can get out more of its products without very much increase in total cost. I don't think that the model will cost us more than $5,000 in addition to the regular cost of operating the shop. If the model is to be used as a telescope, it will have to have some form of precise drive, but I am not yet certain whether we will try to test it out as a form of the unit that we will use on the big telescope later or not, or whether we will use some relatively simple form of clock drive. It seems that we should be able to get pretty accurate data on the deflection of the model and make any changes that may be necessary to give increased stiffness to the various parts as may be shown desirable from the data, and we can also work out our arrangements for handling the mirrors, etc., quite well I believe, from the model, or check our plans which we have developed.

I haven't heard from Ford since he returned to New York. I hope that he has found time to see you and tell you his impressions. I feel that the method of drive on the telescope both right ascension and declination as we discussed with Ford, will prove to be very satisfactory. There are certain details that will have to be worked out and discussed back and forth, but as a whole the instruments that Ford has already developed are suitable for our purposes without much change.

Dr. Hale seems to be greatly improved, and I believe that now he expects to see you in New York sometime late this summer. The trouble with him though, is that as soon as he picks up in strength he tries to go so much more into detail that he wears himself out again. Our efforts are directed toward trying to save him from a lot of thought on details.

I note that there is still a possibility of your coming out, and I hope that you keep dwelling on this as a possibility so that it will eventually come to pass. It certainly would be great to see you out here.

With best regards,

Cordially,

Dandy

Capt. C.S. McDowell, USN
Supervising Engineer
200-inch Telescope

CSMcD:hb

CALIFORNIA INSTITUTE OF TECHNOLOGY
PASADENA

ASTROPHYSICAL OBSERVATORY

June 5, 1935

Dr. Max Mason
President Rockefeller Foundation
49 West 49th Street
New York.

Dear Mason:

Thanks for your letter of May 28. McDowell, who has a commendable desire to push forward rapidly, is very anxious to begin work at once on Palomar Mountain, and therefore wanted earlier action on the supplementary budget. But it would be unwise to begin work there before we have disposed of several complications which still stand in the way. Thus, the San Diego County Supervisors have not yet completely settled the question of the best route for the new road up the mountain, though they are continuing work on one of the three or four routes, which are almost equally satisfactory to us. The property owners on the top of the mountain have agreed among themselves that they will not sell to us for less than a certain amount per acre, which the Observatory Council refuses to pay. However, we have agreed to give half as much if all other matters, including road, water rights, etc., are satisfactorily settled, and our arrangement with the San Diego Supervisors is based upon their agreement to pay the balance of the cost of the land in case the present property owners continue to hold us up. As the negotiations are in the hands of the ablest lawyer in Los Angeles, for many years a member of the C.I.T. Trustees and their principal legal adviser, you may be sure of a sound and satisfactory outcome. I don't blame McDowell for being in a hurry, but we must not spend money before it is allotted to us, and it would not be good strategy to play into the hands of the Supervisors and property holders until everything can be effectively and certainly cleared up. It will take a couple of weeks more, as matters now appear, to accomplish this, so your meeting will be in time, as I wired Arnett.

All of these points, and others as well, could be better explained to you in person, and I am sure you would approve our very carefully studied policy. But I cannot leave here before about the end of July, and we plan to sail from Quebec on August 3. We have intended to take the boat train to Quebec directly from Chicago, whence my brother expects to accompany us, but I could come to New York and then go on to Quebec if you think this desirable. However, I don't suppose you are likely to be in New York at that time, though if you should chance to be near Chicago we might meet there.

After a much needed rest, which my wife also needs, we expect to be back in New York before the middle of October. We can then go over all the questions that occur to you.

I am sending some more prints for your album. One of these shows

that our planer is just large enough, when blocked out, for the work of the huge 200-inch grinding machine, which will reach up to the limiting height of the Optical Shop, when completely assembled. One of the other photographs shows this machine under construction, but does not yet include its highest members. Other prints, showing the large vacuum chamber and the aluminizing process used to coat the 60-inch and 100-inch mirrors, will follow soon.

Please don't mention the fact that I plan to go abroad, as I must keep out of various scientific meetings to be held this summer in this country and in Europe. Nevertheless, I expect to pick up some useful points for our work while away.

With best regards,

Yours ever,

GEH:G

George E. Hale

FORM 372

JUL 2 - 1935

TBA

TA	JUN 21 '35	Ja
FBH WW	JUN 22 '35	FBH ww noted PH

1103.1

June 13, 1935.

Dear Hale:

I have your letter of June 5th. I will probably not be in Chicago at the time you are going through, but if it should turn out that I am, I will get in touch with you, just for the pleasure of a brief visit at least. It will be a great pleasure to see you in New York, if you come back this way.

When I say "pleasure", I mean it literally. I think things are going very well, in spite of your difficult negotiations regarding the site. I hope they will soon be settled to your satisfaction.

Thanks for the photographs. They are most interesting, and the professional appearance of the grinding machine and the aluminizing chamber excited my high admiration. I wish I could put a postage stamp on my back and be delivered at Pasadena for the pleasure of a visit, but I do not see it just now.

Cordially yours,

MAX MASON

Dr. George E. Hale,
California Institute of
Technology,
Pasadena, California.

MM:AEB

SEP 22 1936

WW - WW noted #8
~~GEB files -~~
FPH - FBH
PHP - PHP
GEB files - dm 8
1103.1

From: MM's Interviews.

June, 1935.

Mr. O. A. Gage, Corning Glass Works.

Cal. Tech. owns some $50,000 or $60,000 worth of equipment used by Corning in the making of the large mirror. Corning would like to be of service to future observatories in the pouring of lenses, but this is going to be somewhat difficult unless they prepare a special place for the work. Space was available for the Cal. Tech. work because of the depression, but they cannot hold the equipment where it now is, because they need the room. Corning may put up a special building for large mirrors. Gage asked what would be the attitude of the GEB toward allowing the use of the equipment bought for the Cal. Tech. work, for future telescope mirrors.

MM stated that there is no present program in astronomy in the Boards. They could not make a grant of money to purchase this equipment. If Cal. Tech. turned over the equipment to Corning this would be equivalent to a grant in money, and Cal. Tech. is certainly to be considered as obligated for making its own development as inexpensively as possible, that is, to get return value for purchased equipment no longer needed. MM suggested that if Corning decides to go ahead with the project the only possible procedure that he could see would be that they allow the cost of the equipment to be amortized through several contracts for mirrors. It would seem that Cal. Tech. would have to approve this, and the GEB would have to understand and approve it as well. MM could not say that it would be approved, but would be glad to give the matter consideration if Corning desires.

JUL - 2 1935

1103.1

CALIFORNIA INSTITUTE OF TECHNOLOGY
PASADENA

ASTROPHYSICAL OBSERVATORY

June 8, 1935

~~AIR MAIL~~

	MM	JUN 12 '35	MM	4/13
	TA		Ja	
	WW		WW	

Dr. Max Mason, President
The Rockefeller Foundation
49 West 49th Street
New York, New York

Dear Max:

I suppose that this is one of the busy times of your year and possibly you have not yet had a chance to see Hannibal Ford. I haven't heard from either of you, so I don't know whether or not you have received first hand impressions as delivered by Ford.

There is another man in New York who, I am hoping, is going to make a trip out here, and he is George Karelitz of Columbia University. You may remember having met him at the Army and Navy game about three years ago. Karelitz is one of the group of consulting engineers who we had make a report on the type of mounting and is therefor somewhat familiar with our general project. He tells me he is going to attend the Applied Mechanics meeting of Mechanical Engineers to be held at Ann Arbor about the 18th of June, after which, if nothing else turns up, he plans to turn his face westward and drive on out to see me. Although his trip out is primarily a personal one, and I know that all his intelligence and thoughts are at my disposal without any recompense, still I feel that when it comes to questions of loading of bearings, cutting of gears, lubrication, etc., that he is recognized as high in authority. We have quite a lot of these problems facing us, particularly in getting smooth, accurate rotation. I have the feeling that if I can get a couple of weeks intensive study from Karelitz that I should do so, whether paying for his travelling expenses, or without paying anything to him.

I am asking Karelitz to try to see you before he leaves New York, because I think you will be interested in having some first hand information from him regarding the work they did in their study of the mounting. If you do get a chance to see Karelitz, and are impressed with him, and feel that his coming out is a fine thing, or at least of interest, it would help me if you were to drop a note to Dr. Hale saying something to that effect. With best regards,

Very sincerely,

Sandy

CSMcD:hb

FORM 372

JUL - 2 1935

T A	JUN 21 '35	
FBH WW	JUN 22 '35	
AMJ	JUL - 2 '35	

1103.1

June 13, 1935.

Dear Sandy:

We have been getting ready for the Executive Committee meeting and I have let my correspondence accumulate, hence no answer to your letter of May 23rd.

I hope the Palomar situation is clearing up, as this seems to be the only possible fly in the ointment. The cost of the model is much lower than I had anticipated, and certainly the experience gained will undoubtedly be most valuable. I think it is a wise move.

I had a fine visit with Ford. He was most enthusiastic over the whole set-up, and said he had had a grand time. His coat was off mentally, and he was going to do a lot of thinking on drive mechanisms. He told me in detail of his visit, and I enjoyed his description greatly.

I hope he is getting in touch with Bush. He told me that he wished to, as he had the intention of giving Cornell one of Bush's differential analyzers, making it of course himself. The Foundation has just made an appropriation to the Massachusetts Institute of Technology for the planning and development of a new and enlarged, and improved, differential analyzer; so probably Ford will hold off, and will make the best one available, in the meantime getting in touch with Bush and giving him the benefit of his experience. I wrote to Bush and he responded that he would be delighted to see Ford and

cooperate with him in every way. I am anxious to see what will come from getting these fellows together. It seems to me that they have hold of the two handles of the differential analyzer and the servo-mechanism game, and their combined facilities and abilities ought to mean a lot.

Your letter of June 8th came in yesterday. I remember Karelitz very will, and will be very glad to talk with him. I understand you have suggested that he come around, so I will leave the initiative to him. If case he does so, I will be glad to drop a note to Hale as you suggest.

Cordially yours,

MAX MASON

Captain C. S. McDowell,
California Institute of
Technology,
Pasadena, California.

MM:AEB

Caleb Gordon

FBH FBH SEP 24 1935 1103.1

INTER-OFFICE CORRESPONDENCE

	WW	JUL 19 35	WW	
	TA	JUL 26 35	JA	
	GEB files		amy	

From MM's interviews.

June 13, 1935.

Professor George Karelitz.

Discussion of some of the features of construction of the telescope mounting, particularly the stress on the bearing at the north end of the mounting. Karelitz may go out to Pasadena and would seem a competent informal adviser.

FORM 106

JUN 24 1935

CHARGE TO THE ACCOUNT OF GENERAL EDUCATION BOARD 49 W 49 STREET

1103.1

CLASS OF SERVICE DESIRED			
DOMESTIC		FOREIGN	
TELEGRAM		FULL RATE CABLE	
DAY LETTER	X	DEFERRED CABLE	
NIGHT MESSAGE		NIGHT CABLE LETTER	
NIGHT LETTER		WEEK-END CABLE LETTER	
SHIP RADIOGRAM		RADIOGRAM	

Patrons should check class of service desired, otherwise message will be transmitted as a full-rate communication

Postal Telegraph

THE INTERNATIONAL SYSTEM

Commercial Cables | All America Cables | Mackay Radio

TELEGRAMS CABLEGRAMS RADIOGRAMS

RECEIVER'S NUMBER

CHECK

TIME FILED

STANDARD TIME

Send the following message, subject to the terms on back hereof, which are hereby agreed to

Form 2-C

JUNE 21, 1935

DOCTOR GEORGE E. HALE
CALIFORNIA INSTITUTE OF TECHNOLOGY
PASADENA CALIFORNIA

EXECUTIVE COMMITTEE MADE AVAILABLE TO CALIFORNIA INSTITUTE ADDITIONAL SUM OF ONE HUNDRED TEN THOUSAND DOLLARS FOR OBSERVATORY PROJECT IN ACCORDANCE WITH YOUR LETTER OF MAY TWENTIETH OFFICIAL LETTER GIVING DETAILS FOLLOWS

W.W. BRIERLEY

POSTAL TELEGRAPH-CABLE COMPANY

TRANSMITS AND DELIVERS THE WITHIN MESSAGE SUBJECT TO THE FOLLOWING TERMS AND CONDITIONS:

To guard against mistakes or delays, the sender of a message should order it REPEATED; that is, telegraphed back to the originating office for comparison. For this, one-half the unrepeated message rate is charged in addition. Unless otherwise indicated on its face, THIS IS AN UNREPEATED MESSAGE AND PAID FOR AS SUCH, in consideration whereof it is agreed between the sender of the message and this Company as follows:

1. The Company shall not be liable for mistakes or delays in the transmission or delivery, or for non-delivery, of any message received for transmission at the UNREPEATED MESSAGE rate, whether caused by the negligence of its servants or otherwise, beyond the sum of FIVE HUNDRED DOLLARS; nor for mistakes or delays in the transmission or delivery, or for non-delivery of any message received for transmission at the REPEATED-MESSAGE rate, beyond the sum of FIVE THOUSAND DOLLARS; nor for mistakes or delays in the transmission or delivery, or for non-delivery, of any message received for transmission at the SPECIALLY VALUED MESSAGE rate, beyond the sum at which such message shall be valued, in writing, by the sender thereof when tendered for transmission and for which payment is made or agreed to be made of the amount of the repeated-message rate and an additional charge equal to one-tenth of one per cent of the amount by which such written valuation shall exceed five thousand dollars; nor in any case for delays arising from unavoidable interruption in the working of its lines, or for errors in cipher or obscure messages.

2. The Company is hereby made the agent of the sender, without liability, to forward this message over the lines of any other company or by any other means of communication when necessary to reach its destination.

3. Domestic messages and incoming cable messages will be delivered free within one-half mile of the Company's office in towns of 5,000 population or less, and within one mile of such office in other cities or towns. Beyond these limits the Company does not undertake to make delivery, but will, without liability, at the sender's request, as his agent and at his expense, endeavor to contract for him for such delivery at a reasonable price.

4. No responsibility attaches to this Company concerning messages until the same are accepted at one if its transmitting offices; and if a message is sent to such office by one of the Company's messengers, he acts for that purpose as the agent of the sender.

5. The Company shall not be liable for damages or statutory penalties in any case where the claim is not presented in writing within sixty days after the message is filed with the Company for transmission.

6. It is agreed that prompt and correct transmission and delivery of this message shall be presumed in any action for recovery of tolls thereto; subject, however, to rebuttal by competent evidence.

7. Special terms governing the transmission of messages under the classes of messages enumerated below shall apply to messages in each of such respective classes in addition to all foregoing terms.

8. NO EMPLOYEE OF THIS COMPANY IS AUTHORIZED TO VARY THE FOREGOING.

POSTAL TELEGRAPH-CABLE COMPANY
CLARENCE H. MACKAY, PRESIDENT
A. H. GRISWOLD, EXECUTIVE VICE-PRESIDENT

CLASSES OF SERVICE

DOMESTIC MESSAGES

FAST TELEGRAMS. A full-rate expedited service.

DAY LETTERS. A deferred day service at rates lower than the fast telegram rate. One and one-half times the Night Letter rate for the transmission of 50 words or less, and one-fifth of the initial rate for each additional 10 words or less.

SPECIAL TERMS APPLYING TO DAY LETTERS. In further consideration of the reduced rate for this special "Day Letter" service, the following special terms in addition to those enumerated above are hereby agreed to:

(a) Day Letters may be forwarded by the Telegraph Company as a deferred service and the transmission and delivery of such Day Letter is, in all respects, subordinate to the priority of transmission and delivery of full rate telegrams.

(b) This Day Letter is received subject to the express understanding and agreement that the Company does not undertake that a Day Letter shall be delivered on the day of its date absolutely and at all events; but that the Company's obligation in this respect is subject to the condition that there shall remain sufficient time for the transmission and delivery of such Day Letter on the day of its date during regular office hours, subject to the priority of the transmission of full rate telegrams under the conditions named above.

NIGHT MESSAGES. Accepted up to 2.00 a. m. at reduced rates to be sent during the night and delivered not earlier than the morning of the ensuing business day. Night messages may at the option of the Telegraph Company be mailed at destination to the addressee, and the Company shall be deemed to have discharged its obligation in such cases with respect to delivery by mailing such Night Messages at destination, postage prepaid.

NIGHT LETTERS. Accepted up to 2.00 a. m. for delivery on the morning of the ensuing business day, at rates still lower than night message rates, as follows: The fast telegram rate for 10 words shall be charged for the transmission of 50 words or less, and one-fifth of such rate for 10 words shall be charged for each additional 10 words or less.

SPECIAL TERMS APPLYING TO NIGHT LETTERS. In further consideration of the reduced rate for this special "Night Letter" service, the following special terms in addition to those enumerated above are hereby agreed to:

(a) Night Letters may at the option of the Telegraph Company be mailed at destination to the addressee, and the Company shall be deemed to have discharged its obligation in such cases with respect to delivery by mailing such Night Letters at destination, postage prepaid.

CABLE MESSAGES

FULL RATE MESSAGES receive regular and prompt service in their order of filing. Code language permitted.

DEFERRED RATE MESSAGES at one-half of the full rate to follow full rate messages. Must be in plain language of country of origin, or of destination, or in French. Full particulars as to countries where this class of service is effective will be furnished upon application to any Postal Telegraph office.

NIGHT CABLE LETTERS at reduced rates. Must be in plain language of country of origin, or of destination, or in French where transmitted by telegraph to destination. Subordinated to the priority of transmission of full and deferred rate messages. May be posted, when sender so directs, to countries where this service is not available, at tariffs to countries from which such messages are posted. Under latter circumstances, messages must contain complete mailing address including chargeable posting instructions (i. e., "Post London," etc.). Minimum word basis of twenty to twenty-five words applied. Code addresses may be used except for messages delivered by post. Figures explained by text admitted. Indicator "NLT" required and charged for as one word. For further particulars apply at any Postal Telegraph office.

WEEK END CABLE LETTERS at exceptionally low rates. Accepted under conditions applicable to Night Cable Letters, excepting that Week End Cable Letters will be accepted during the week up to midnight Saturday for telegraphic delivery on the following Monday morning. Indicator "WLT" required and charged for as one word. For further particulars apply at any Postal Telegraph office.

NO EMPLOYEE OF THIS COMPANY IS AUTHORIZED TO VARY THE FOREGOING.

airmail

JUL - 1 1935

1103.1

CALIFORNIA INSTITUTE OF TECHNOLOGY
PASADENA

ASTROPHYSICAL OBSERVATORY

WWB JUN 26 '35
MM JUN 24 1935
WW JUN 27 35
TA
Ack
AMJ

June 22, 1935

Dear Mr. Arnett -

I was much pleased yesterday, to receive Mr. Brierley's telegram ~~lately~~, and appreciate heartily the prompt and favorable action taken at our request. The San Diego County Supervisors are still hampered by the fact that they are endeavoring to get a state or federal grant to build a road across the top of Palomar, which they cannot do if they have already signed an agreement to give us a complete road from the valley clear to our site. They are already building the road up the side of the mountain, and we hope to see their request for the road on the summit promptly granted! Meanwhile we have their verbal promise to see us through, but we must have the final agreement. With sincere thanks and kindest regards

Yours very cordially

George E. Hale

1103.1

JUN 26 1935

DHS JUN 25 '35 AHS

CALIFORNIA INSTITUTE OF TECHNOLOGY
PASADENA

MM		MM	
WW	JUN 25 '35		
TA	JUN 25 '35	Ja	copy sent 6/25
AMJ	JUN 25 '35	amj	

ASTROPHYSICAL OBSERVATORY

June 22, 1935.

Dear Mason -

Many thanks for your letter and for the favorable action of the Executive Committee yesterday. We are pushing things as fast as possible, and earnestly hope to get everything straightened out within a very short time.

I will send you word as soon as we know when we can reach Chicago (my wife's feet are only slowly improving after a severe operation), and hope very much to have the good luck to see you there.

I trust you understand that our delay is due to a determined effort to save money in the 200 inch fund. Even if we were to pay for the cost of the road across the top of the mountain promised, and the full cost of the land, we could stay well within our estimates. But we mean to get most of the cost out of the San Diego county authorities. They are already building the road up the side of the mountain.

With best wishes for a fine summer

Yours ever

Geo. E. Hale

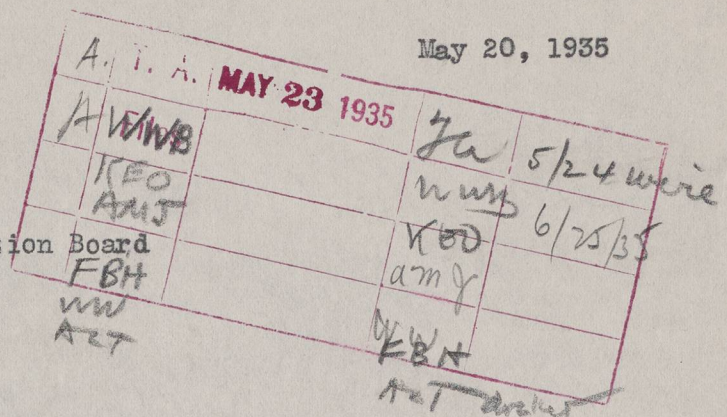
1103.1

JUN 27 1935

CALIFORNIA INSTITUTE OF TECHNOLOGY
PASADENA

ASTROPHYSICAL OBSERVATORY

May 20, 1935



Mr. Trevor Arnett
President General Education Board
49 West 49th Street
New York.

My dear Mr. Arnett:

You may remember that our requested budget for 1935 was incomplete, and contained the clause

"Telescope mounting and building not included here as reliable estimates are not yet available".

Captain McDowell, who has proved to be an ideal choice as Supervising Engineer for the 200-inch telescope, has lost no time since his appointment. As the result of his extensive studies and inquiries among the ablest engineers and constructors in the country, we have now decided upon the type of mounting to be constructed, as soon as a one-tenth scale model can be built in our own shop and subjected to rigorous tests under the eyes of expert engineers. The final detailed drawings, with any such minor modifications as the tests and studies of the mounting may demand, will then be completed.

Meanwhile Captain McDowell has made careful studies of the proposed site, and of such questions as power and water supply, roads, means of transportation, etc. As money now can be saved by early action, I therefore hope that the Executive Committee can allot soon an additional sum of $110,000., covering the balance of 1935. This supplementary budget, together with the partial budget authorized last autumn, should therefore complete our requests for allotments to be expended during the current year.

I enclose the supplementary budget, giving our estimates, as approved by the Observatory Council, under their respective heads. I am also sending a copy to Dr. Mason.

With kind regards,

Yours very sincerely,

George E. Hale

GEH:G

CALIFORNIA INSTITUTE OF TECHNOLOGY

Astrophysical Observatory

Supplementary budget for the year 1935

II	OPTICAL SHOP		
	104-inch grinding tool		$ 2,000.00
III	EXPENSE OF LAND AND LAND IMPROVEMENTS		
	Land for Observatory Site (This tract decided to be necessary to afford adequate protection)	25,000.00	
	Preliminary land surveys for contour maps, etc.	1,200.00	
	Surveys for foundations	2,000.00	
	Dwelling for Superintendent at site (to be used later as part of the permanent plant)	7,500.00	
	1,000,000 gallon ground storage reservoir	9,000.00	
	Elevated steel tank for auxiliary water supply	9,000.00	
	Fuel oil tank supply	2,200.00	
	Grading and excavating at site	5,000.00	
	Wells at water supply site	2,000.00	
	Pumping plant, pumps, piping etc.	5,500.00	
	Miscellaneous	8,000.00	76,400.00
IV	EXPENSE OF BUILDING AND TELESCOPE MOUNTING		
	Design (salaries to Dec. 31,1935 of Irwin, Gee; part time of two draftsmen, and of Timoshenko from Aug. 15, 1935 to Feb. 15, 1936	9,000.00	
	Base of 200-inch telescope tube (which will be used also to support the 200-inch mirror while grinding and polishing)	11,000.00	
	One-tenth size model of 200-inch telescope and testing (exclusive of shop time, provided in previous partial budget for 1935)	5,000.00	
	Miscellaneous	6,600.00	31,600.00 $110,000.00

May 21, 1935.
G. E. H.

FORM G24

JUN 27 1935 6/26

1103.1

GJB	Mail	JW
AGA		a/s

June 25, 1935

My dear Doctor Hale:

At a meeting of the Executive Committee of the General Education Board held June 21, 1935, the officers presented your letter of May 20th submitting a supplementary budget for the calendar year 1935 amounting to $110,000. It was noted that the progress made during the first part of this year in the designing of the mounting for the telescope makes it possible to proceed more rapidly with the work of construction than was anticipated when the first budget was submitted.

I have the honor to inform you that the Committee acted favorably on your request and released to the Board of Trustees of the California Institute of Technology $110,000, or as much thereof as may be needed, for the purpose stated above.

Payments will be made as heretofore by the Auditor.

A copy of this letter is being sent to Doctor Millikan for his information.

Sincerely yours,

W. W. BRIERLEY

Doctor George E. Hale
Chairman of the Observatory Council
California Institute of Technology
Pasadena, California

WWB:KEO

COPY TO DR. MILLIKAN

FORM 372

SEP 24 1935

1103.1

WW FBH TA	JUL -2 '35 JUL -3 '35	WW FBH JA

June 27, 1935.

Dear Hale:

I had a talk the other day with Professor George Karelitz of Columbia, and was impressed by his knowledge and acuity. I believe it is going to be possible for him to get out to Pasadena on one of McDowell's brain-robbing raids.

I like the way that McDowell is getting so much special advice so cheaply, and feel that it is fine to have men of the type of Karelitz and Ford show so much interest. I think it would be amply justifiable to pay their expenses, since they give so much to the problem.

I am sorry I will miss seeing you this summer, but hope for a meeting in the fall.

With cordial greetings,

Sincerely yours,

MAX MASON

Dr. George E. Hale,
California Institute of
Technology,
Pasadena, California.

MM:AEB

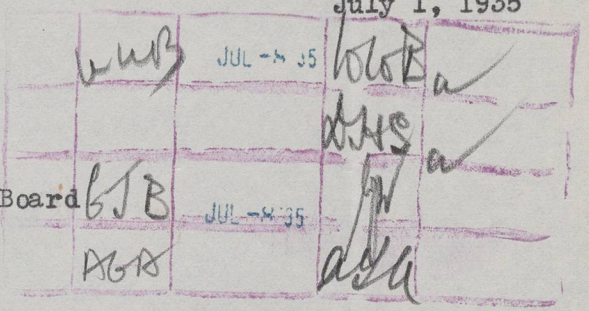
1103.1

JUL 10 1935

CALIFORNIA INSTITUTE OF TECHNOLOGY
PASADENA

ASTROPHYSICAL OBSERVATORY

July 1, 1935



Mr. W. W. Brierley
Secretary, General Education Board
49 West 49th Street
New York.

My dear Mr. Brierley:

I owe you my thanks for your very kind telegram and also for your letter of June 25, informing me that the Executive Committee of the General Education Board acted favorably on our request of May 20, and released to the Board of Trustees of the California Institute of Technology $110,000., or as much thereof as may be needed, for the purposes mentioned in our supplementary budget.

Assuring you of our cordial appreciation, I am

Yours very sincerely,

Geo. E. Hale

GEH:G

CALIFORNIA INSTITUTE OF TECHNOLOGY
PASADENA

ASTROPHYSICAL OBSERVATORY

July 9, 1935

Dr. Max Mason, President
The Rockefeller Foundation
49 West 49th Street
New York, New York

Dear Max:

O'Melveny, Anderson, and I were again down with the San Diego Supervisors yesterday, and I believe that now all of the outstanding questions about the roads and the necessary land at Palomar have been settled, with the result, I hope, that the Observatory Council will, at the end of this week, give their definite approval on the Palomar site so that some of our contemplated work for this Summer and Fall can proceed. Unfortunately Hale has had another set-back which came on a couple of days ago and for a while looked as if it might be serious, but I believe he is now rousing from it and we have hopes that he will be out again shortly. I understand that he has cancelled all of his arrangements for going abroad this Summer and I think that this is a very wise decision.

I had been anxious to get Timoshenko out here so that he could be available in a consulting capacity on the structures of the tube and mounting. As Millikan and Hale thought that this was a good idea, discussions were taken up with Timoshenko. Originally it had been my thought that, if the Institute would pay one-half of his salary the Observatory Council could afford to pay the other half for the next couple of years as his consulting work should make us doubly satisfied with our plans. At present Timoshenko gets $8,000 a year at the University of Michigan which would mean that we would have had to pay $4,000 a year from the Council funds. Apparently Millikan did not find it possible to put up the other $4,000 and so our original scheme fell through. According to the original idea, Timoshenko would give a series of lectures, also be available at all times for consultation on the telescope design. Then there was sort of a compromise of the situation by suggesting that Timoshenko come for one term or six months, and that we would pay $4,000 out of the Council funds. Millikan saw Timoshenko in Washington, as they are both members of the Navy Board on Lighter Than Air Craft, and this compromise seemed satisfactory to all concerned and we were going ahead with that understanding. However, Hale, being most conscientious, felt that as it was the Council's funds that were wholly involved, our letter to Timoshenko, offering him the position, should definitely state that his work was primarily to be in connection with all of the details of the telescope design.

Timoshenko, being equally conscientious, felt that, under the circumstances, this would require all of his time if he were to be held responsible for all the details, and that he would have to drop his present work of the series of lectures he is interested in giving, and so felt it necessary to decline the offer.

Actually, we proposed to use Timoshenko in a consulting capacity on the telescope, but not utilizing all of his time, not requiring him to sit down at a drafting board to check all details, but allow him time to carry on some of his regular work.

Due to this misunderstanding, apparently we will not be able to get Timoshenko out here now for the first term. Karelitz, who is here now, saw Timoshenko in Ann Arbor and brought me a message from him which explained why he did not accept the offer, and it is as given above. Since this message was given, we have communicated with him informally and find that he would be delighted to come out provided he could operate as he had originally understood, that is as consultant and also giving the series of lectures. However, this cannot be accomplished this Fall term, but I believe we could get him for the February term. This raises the question of whether or not, operating under such an arrangement, we would be takihg advantage of the Rockefeller Foundation, and I am wondering if you want to give me your thought on the matter. I am not certain whether or not you know Timoshenko but I do believe that Weaver knows him.

Although at times, I have been quite upset at the slowness of things getting under way, I see some signs of real progress now and I hope that the schedule I have prepared showing the various steps in the program, is going to be met. I am still hoping that you will find it possible to get out here this Summer or Fall, although I realize that this is only one of your many problems. I don't know when I am going to be back east. I had thought that it would be by this time, but so far there has been nothing that I could see that would really require my coming back.

From the papers I note that there has been some hot weather in the east, and for your guidance I might mention that it is rather pleasant here.

With best regards to Brook and yourself,

Cordially,

Dandy

CSMcD:hb

(Copy sent Mrs (Estelle Campbell))

1103.1

Dr. Mason

July 11, 1935

Dr. George E. Hale
Mt. Wilson Observatory
Pasadena, California

Dear Dr. Hale:

You no doubt have read press accounts of the severe floods in this district which have caused great damage along the Chemung river and tributaries. The flood waters reached levels considerably higher than previously recorded, inundating our "caves" and basements. Our greatest concern was, of course, for the 200 inch disc and I am writing to assure you that it is safe.

As soon as there was an indication as to the severity of the flood, steps were immediately taken to protect the rooms housing the electrical annealing equipment. Tile and wood barriers were erected and these reinforced by sand bags and clay, some fifty tons of sand being used. Pumps were connected, not only our own, but two fire engines from the City. The water rose with extreme rapidity, however, and notwithstanding these efforts we could not prevent the water from rising in this area. We therefore decided to move the electrical equipment to a higher level to prevent damage and this was done successfully. This necessitated disconnecting the annealer and of course we lost some temperature. Based on Dr. Mc Cauley's calculations, this loss in temperature could not possibly cause damage to the disc. The temperature is being brought up at the same rate as it was lost, and when regained the disc will be cooled according to schedule. This will extend the annealing time somewhat, possibly a week or so, but the ultimate degree of annealing should not be affected.

At the peak, the flood water was still some seven feet below the bottom surface of the disc. The bed plate of the hoist was thus some four or five feet above the water and consequently this equipment suffered no damage. Altogether we consider that we were fortunate in having passed through this emergency without loss of the disc and equipment. For this we are grateful to Dr. Mc Cauley and the workmen who gave their

best in averting a real catastrophe.

With kind regards and best wishes, I remain

Sincerely yours,

J. C. Hostetter

cc. Captain C.S. McDowell
Dr. Max Mason
Dr. A.L. Day
Dr. G.V. McCauley
Dr. O.A. Gage

CALIFORNIA INSTITUTE OF TECHNOLOGY
PASADENA

ASTROPHYSICAL OBSERVATORY

September 6, 1935

Dr. Max Mason, President
The Rockefeller Foundation
49 West 49th Street
New York, New York

Dear Max:

I imagine that you are about getting back to New York, and hope that you have had a pleasant vacation. Most of the people here are getting back; Hale is again in Pasadena, and this should mean increased activity.

My program of the things that I felt should be accomplished during this fiscal year is well along and, I believe, will be completed on schedule. This will mean that I will have water storage in, pump and pipe line, house completed for our resident inspector on the spot to look out for the rest of the building, and some fairly good idea as to the foundation conditions for the dome. We have completed an accurate survey of all the essential part of our holdings, and as you know, I believe we have obtained all the land it seems we would need. The road situation seems to be cleared up: the road up the mountain and across the mountain, are both going forward.

The one-tenth scale model is progressing and the tube is about completed. We will soon have to be thinking as to who will manufacture the tube and mounting and under what arrangements. There is one combination very much interested, and that is, Babcock & Wilcox Company and the Baldwin-Southwark Company. The general managers of both of these companies have been out together with their consulting engineers, and this particular combination is at present making the mirror cell for us - which is needed soon because it is also used as the table for the 200-inch grinding machine. Another logical company, because of location, experience, and facilities, is the Westinghouse Company. Their president Mr. Merrick, was out here about a month ago. Mr. Hodgkinson, their chief consulting engineer, and Ormondroyd in charge of their mechanical research laboratories, are arriving on Saturday, 7 September. These visits have a dual purpose; first, we get considerable advice and information from them, second, we give them a fairly good picture of the problem so that they can understand what would be involved in case they should become a manufacturer of parts.

I think that when we get into our tests on the model, and are developing a final design based on these tests, or rather, modifying the design from which the model is made, by these tests, it will be desirable to have a representative of the company that will eventually manufacture, working with us. Therefore, sometime within the next six months, it will probably be necessary to determine who is to be the manufacturer of the tube and mounting.

9-6-35

So far as I know, it is the desire of the people here, that is, Hale, Millikan, etc., for me to stick on this job and I understand from the Navy Department, unofficially, that there should be no difficulty in my getting another year's leave. If there is any thought in your mind to the contrary, I would like to get it. I don't know whether or not you feel like writing anything in connection with this to the Secretary of the Navy, but I think it might help if you could. I think that Millikan spoke, either to the Secretary or to Admiral Stanley, on his last visit in Washington - or, he may have been in such a jam that he did not have a chance to do so. It seems to me that it would be desirable for such requests to be made prior to my officially asking for extension of leave, so that they would form a basis for it. I will speak to Millikan about it shortly. There is no great hurry about this, as my present leave extends to 19 November, but I think my request for another year should be in at least a month in advance. You know of course, that I have enjoyed this very much and will be delighted to continue.

We have a house under way on Palomar Mountain, which will have a spare room in it, and I am hoping that you may find an opportunity to come out to see us, also to make use of this room and see the mountain. Everyone who has been up there has come back quite enthusiastic as to the surroundings. I have no certain plans as to coming east. So far, there have been so many little details coming up that I felt it unwise to leave here for any length of time. Also, there has been no pressing reason for my going east.

I don't know just how much Hale has been able to keep you informed of the progress, but if you feel that you are a little out of touch, I will try to go into more detail at intervals.

Dr. Edwin P. Hubble leaves for the east in a day or two. I think that you have met him, though possibly only casually, and I have suggested to him that he drop in to see you. He is to give a series of lectures at Yale, so will be in that vicinity for some weeks. Hubble is not very familiar with the various details of our program, but he is one of the best informed astronomers on the general problem of the 200-inch, and I am sure that you will enjoy seeing him.

In a previous letter I presented the thought of getting Timoshenko out here for the second term. Since then, von Karmon has seen Timoshenko in the east, and finds that he (Timoshenko) will be in Europe the second term and therefore not available. So you may forget this inquiry of mine.

With best regards to both.

Sincerely,

Sandy

P.S. Bo is out with me for the month, and I manage to see him once in a while between his going hither and thither. He still likes the Academy and is developing into a rather nice youngster.

Copy sent mm - Settle Crawford

1103.1

Copy for: Messrs. G.V. McCauley
O.A. Gage
A. Houghton
A.L. Day
Max Mason ✓

OCT 16 1935

SEP 17 35 OCT - 4 '35 OCT 15 '35

CALIFORNIA INSTITUTE OF TECHNOLOGY
PASADENA

September 10, 1935

Dr. J.C. Hostetter
Corning, N.Y.

Ref. Your letter 5 September 1935

Subject: 200-inch Telescope, Crating of disc for shipment, and disposal of first 200-inch disc.

Dear Dr. Hostetter;

We have checked over McCauley's report of 30 August, forwarded with your above reference letter, and feel that the plans you are now making for the crating and shipping of the 200-inch disc is satisfactory. I presume that we will have someone at Corning before shipment is actually made, but at any rate the crating will be carefully checked by you and any changes that seem necessary will be made before shipment.

Regarding disposition of the first 200-inch disc, I have discussed this with Anderson and we feel that final disposition of this disc cannot be determined at this time. It seems logical to place this at some semi-permanent location where it will not need to be moved again in the near future, and to hold it there until work is well along on the present disc. This would indicate that it should be held at Corning for at least a couple of years, although I presume we would be interested if you ever have any suggestion to make as to permanent disposition of it.

With best regards.

Very sincerely,

C.S. McDowell

FORM 372

OCT 16 1935

WW	OCT-4 '35	WW
TA	OCT-3 '35	TA
FBH	OCT-9 '35	FBH

110 3.1

October 3, 1935.

Dear Sandy:

Your letter of September 6th was good reading and gave a picture of substantial progress that was most encouraging. I assure you that there is no thought in anybody's mind here, except an ardent hope that nothing will interfere with your continued activity on the telescope project.

It is too bad that Timoshenko cannot be out there. I do not know him, but from what you and others have told me, I should think he would be most valuable as a consultant.

We had a very quiet summer in Rhode Island, with lots of out-doors, including golf.

Your description of affairs at Pasadena makes me want to come right out, but I doubt very much if I am going to be able to make it. We are going to be very busy this fall preparing for the December meeting, but if there should be a let-up, and other business in the district there should develop, I am keeping it very definitely in mind as a possibility.

I am very glad to hear that Bo is getting on well at the Academy. I wonder if he is going to follow the engineering footsteps of his parent.

The Science Advisory Board, on the request of Secretary Roper, appointed a committee to discuss safety at sea. Jewett is chairman, Millikan is a member, though he has not attended the meetings as yet, and so am I. I have enjoyed thinking along these lines very much indeed. The committee includes Captain Fried, who is a fine fellow, King of the Lighthouse Service, and Hooper, as representative of the Navy. Ruble

has met with us, and we see him fairly often. Hooper told me he had been selected as liaison officer, so your long-continued campaign has borne fruit of a kind.

We had a long meeting in Washington, and since that time I have been at Boston twice, going through the work of the Sub Signal with Fay, and making one trip in their experiment launch. I also made a trip in the lighthouse tender, to study the Nantucket lightship gadgets, and went out with Jewett, Fay, Ruble and Hooper on the "Semmes", which is detailed for experimental work and bases at the submarine base. It all seemed a great deal like old times, and I enjoyed it a lot.

Hooper asked me at the end of this last trip how I felt about the progress that had been made since the war, to which I returned a very evasive answer. Just between you and me I was bitterly disappointed that there has not been more done, and particularly that there has not been a systematic drive at fundamental information necessary for both naval and commercial marines. Of course, it is not fair to judge peace-time activity with the immense stimulation which you and the special committee gave to the Committee in the war. Still seventeen years is a long time.

With cordial greetings,

Sincerely yours,

MAX MASON

Captain C. S. McDowell,
California Institute of
Technology,
Pasadena, California.

MM:AEB

1103.1

CALIFORNIA INSTITUTE OF TECHNOLOGY
PASADENA

ASTROPHYSICAL OBSERVATORY

9 October 1935

Dr. Max Mason, President
The Rockefeller Foundation
49 West 49th Street
New York, New York

Dear Max:

I plan to start east about the 18th or 20th of October, going first to Philadelphia. I want to check on the machine work that the Baldwin Company is doing on the mirror cell; from there to see Zworykin of RCA at Camden; then, perhaps to SKF regarding bearing matters; last to discuss possible arrangements with Westinghouse company. I presume all of this will take four or five days, and then I will come on to New York to see you and Ford, etc. I plan to return west via Corning, Cleveland and Detroit; will probably pick up a new Ford in Detroit to drive back from there.

I can come to New York any time after my arrival in the east, so if you have any particular days when your work load is lighter and will let me know, I will accommodate my plans to fit yours. I should arrive in Philadelphia about 24 October, and if I don't have word from you before I leave, I will let you know an address that will reach me there.

Among other things, I am hoping that I may persuade you to come west sometime this winter, if not in the immediate future.

There is no particular news here, except that things are straightening themselves out and some progress is being made.

With best regards.

Very sincerely,

Sandy

CSMcD:hb

1103.1

CARNEGIE INSTITUTION OF WASHINGTON
MOUNT WILSON OBSERVATORY
PASADENA, CALIFORNIA

October 17, 1935

mm OCT 19 '35 mm 10/21 GEH

Dr. Max Mason
President Rockefeller Foundation
49 West 49th Street
New York.

Dear Mason:

At a meeting of the Observatory Council held yesterday a tentative budget for 1936 was discussed. The large items presented by Captain McDowell, covering work on Palomar and the greater part of the construction of the 200-inch telescope mounting (excepting design and Corning, which appear under separate headings) totalled $609,000., making the entire net budget for 1936 about $800,000, with the Corning work fully paid for. These figures may be somewhat altered after McDowell's trip east. He plans to leave tomorrow, and to see you in New York.

My health is improving decidedly, as the result of the treatment I am receiving. However, as this should be coninued without break for some weeks or possibly months, I may not be able to come east this year. I shall come, nevertheless, if this is feasible. McDowell can give you most of the information now available on the situation here and at Palomar.

Kindly let me know the latest date at which our 1936 budget can be presented in time for your December meeting.

Yours very sincerely,

GEH:G

George E. Hale

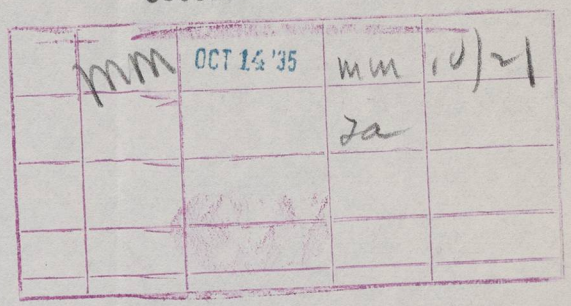
I forgot to say that repeated attacks prevented my trip abroad.
I have also written Arnett as above.
G.E.H.

1103.1

CALIFORNIA INSTITUTE OF TECHNOLOGY
PASADENA

ASTROPHYSICAL OBSERVATORY

October 8, 1935



Dr. Max Mason
President Rockefeller Foundation
49 West 49th Street
New York.

Dear Mason:

A series of attacks of vertigo, which made it necessary to cancel my proposed trip abroad, may prevent me from coming east this autumn. I don't think these attacks are dangerous, but they come suddenly, without warning, and lay me up for some time. So I am hoping that the treatments I am now taking may obviate them in time. If possible, I shall still come on to see you and Arnett before very long.

Meanwhile I am sending you a reprint of a paper on the new Observatory. It was written in March, before we had acquired the property on Palomar, where all seems to be going well. McDowell is doing a first-class job, and I am very glad we got him. He is sometimes inclined to go a little faster than funds or legal arrangements regarding property acquisition allow, and of course he has still to learn some of the astronomical requirements and conditions which Adams and Anderson and I have only acquired by the whole of our experience. But he is an able and conscientious worker, with a host of valuable acquaintances and experiences in the engineering world, and I do not think we could possibly have found a better man for the job. He will probably come east before long and give you many recent details of progress. Perhaps he thinks I am too anxious to check conclusions and to keep costs as low as possible, but we are good friends and have quarreled about nothing. So I sincerely hope the Navy will let him stay here until his work is completed. Progress is necessarily slow on a job of this kind, and I don't blame him for attempting to speed it up, though we have had to learn by bitter experience, both at Yerkes and Mount Wilson, that we can't always push things as fast as we would wish. I greatly hope you will use your influence with the Navy, if necessary, to extend his leave.

We are now working on our budget for next year, and will see that you and Arnett get it in time.

With best regards,

Yours ever,

George E. Hale

GEH:G

P.S. Two corrections were not made in the reprints. Palomar is 5600 ft. high, and Ross's new correcting lens should give photographic star images 0".5 in diameter when the seeing is good.

FORM 372

1103.1

T A		Tda
W W	OCT 24 '35 OCT 26 '35	WW
FBH		FBH
FBB	OCT 28 '35	FBB

October 21, 1935.

Dear Hale:

I was glad to have your letters. I expect to see McDowell in the near future. It will be very interesting to be brought up to date on some of the details of the work, although I feel that you have kept me well informed by your letters, and I only hope that this has not been at the expense of your time and energy.

I enjoyed reading your article on the astrophysical unit very much indeed, and think you did a grand job of exposition, in just the right way. You have now brought out that statement which we discussed long ago in regard to a description of the work on the quartz mirror, and certainly nobody should find fault with it.

I am awfully glad to hear that your health has been improving decidedly. It was naturally a matter of concern when I learned that you had given up your trip abroad.

I think it would be well to have your 1936 budget in hand by the last week of November. It could be crowded under the wire if it came toward the end of the week, but it would be a little more convenient if we had it at the beginning. I am writing this on a guess. Probably Arnett will write you a little more definitely in a day or so. He is not in to-day.

With cordial greetings,

Sincerely yours,

MAX MASON

Dr. George E. Hale,
California Institute of Technology,
Pasadena, California.

MM:AEB

NOV 16 1935

1103.1

CARNEGIE INSTITUTION OF WASHINGTON
MOUNT WILSON OBSERVATORY
PASADENA, CALIFORNIA

Ach RDC 10/19

a	I. A.	OCT 19 1935	TA	10/23
	MM	OCT 23 35	MM	
	WW	NOV -7 35	WW	
	WWB		WWB	

KEO
AMJ
FBH
FGB

October 17, 1935

Mr. Trevor Arnett
President, General Education Board
49 West 49th Street
New York.

Dear Mr. Arnett:

At a meeting of the Observatory Council held yesterday a tentative budget for 1936 was discussed. The large items presented by Captain McDowell, covering work on Palomar and the greater part of the construction of the 200-inch telescope mounting (excepting design and Corning, which appear under separate headings) totalled $609,000., making the entire net budget for 1936 about $800,000, with the Corning work fully paid for. These figures may be somewhat altered after McDowell's trip east. He plans to leave tomorrow, and to see you in New York.

My health is improving decidedly, as the result of the treatment I am receiving. However, as this should be continued without break for some weeks or possibly months, I may not be able to come east this year. I shall come, nevertheless, if this is feasible. McDowell can give you most of the information now available on the situation here and at Palomar.

Kindly let me know the latest date at which our 1936 budget can be presented in time for your December meeting.

Yours very sincerely,

George E. Hale

GEH:G

October 23, 1935

Professor George E. Hale
Mount Wilson Observatory
Pasadena, California

Dear Dr. Hale:

I am very glad to learn from your letter of October 17th that your health is decidedly improving, and I hope that you will soon be entirely well again. I trust that you will feel that the recovery of your health is your most important goal and that you will take the advice of your physicians and not come east this year if in any way the trip would jeopardize or delay your recovery.

I note your statement regarding the tentative budget for 1936 for the 200-inch telescope, which likely will amount to about $800,000. We shall be glad of course to get the exact data as soon as they are ready; however, the latest date we should receive them is the last week in November. Mr. Mason has already written you regarding this matter.

With cordial greetings and all good wishes,
I am

Sincerely yours,

TREVOR ARNETT

TA:RE

October 19, 1935

Professor George E. Hale
Mount Wilson Observatory
Pasadena, California

My dear Professor Hale:

On behalf of Mr. Arnett, who is away on a short trip, I beg to acknowledge receipt of your letter of October 17th with regard to the budget for 1936 in connection with the work of the 200-inch telescope. It will be brought to Mr. Arnett's attention promptly upon his return here next week, and I am sure you will have a reply soon thereafter.

Sincerely yours,

RUTH D. EVANS

Secretary to Mr. Arnett

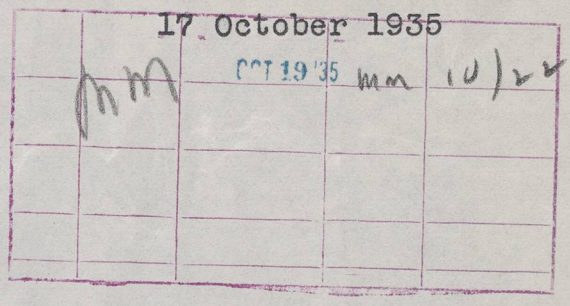
1103.1

NOV - 8 1935

CALIFORNIA INSTITUTE OF TECHNOLOGY
PASADENA

ASTROPHYSICAL OBSERVATORY

17 October 1935



Dr. Max Mason
Rockefeller Foundation
49 West 49th Street
New York, N.Y.

Dear Max:

I am leaving for the east tomorrow, but not making a particularly fast trip so am not certain of arriving in Philadelphia before 24 October, as mentioned in my previous letter. While in Philadelphia I may be reached c/o Mr. G. H. Froebel, Westinghouse Electric & Mfg. Co., Lester Branch P.O., and have thought that I would go to Washington before coming to New York, which would put me in New York on Thursday or Friday 31 October or 1 November. However, I can come into New York on Monday 28 October if that would better suit your plans and go to Washington later.

I thought that I would stay in New York until around the 5th of November and then go to Corning, Cleveland and Detroit.

I am wondering if you and Brook would be interested in going to the Navy Princeton game to be played in Princeton on 2 November. At any rate I have put in for four tickets to be sent to me in your care. Also, I have given your office address so, if any mail comes for me will you have it held?

With best regards.

Very sincerely,

Sandy

AIR MAIL

CSMcD:hb

FORM

NOV - 8 1935

1103.1

October 22, 1935.

Dear Sandy:

I will be mighty glad to see you in New York, and, while you are coming at a rather jammed up time, that does not mean that you should postpone your visit. If things were completely as easy for you, I would be freer after Monday, November 4th, than previously, but I will tell you the story, and you can make your own decision.

I do not believe after all that it is so bad, because there are many meetings of a malaria group here that I would not have to attend. Thursday, the 31st, I will be free. Friday, the 1st, I will probably be busy all day long, for that is the time of the budget meeting of the International Health Division. Saturday, regarding Princeton, I probably can do. The International Health Division continues its meeting, but there is not the necessity of my presence that there is on Friday. Needless to say, I will be pleased to see you whenever you come.

Cordially yours,

MAX MASON

Captain C. S. McDowell,
c/o Mr. G. H. Froebel,
Westinghouse Electric &
Manufacturing Company,
Lester Branch Post Office,
Philadelphia, Pennsylvania.

N.Eng. 95-C

NOV - 8 1935

1103.1

ADDRESS INSPECTOR OF MACHINERY, U.S. NAVY
AND REFER TO NO.

00/McD (2695)

McD/GAG

Enclosures

NAVY DEPARTMENT

BUREAU OF ENGINEERING

OFFICE OF THE INSPECTOR OF MACHINERY, U.S. NAVY
Westinghouse Elec. & Manufacturing Company,
Essington, Pa.

25 October, 1935.

MM OCT 26 '35 pars 10/26

Dr. Max Mason, President,
Rockefeller Foundation,
#49 West 49th St.
New York City, N.Y.

Dear Max:-

As you will note, I have arrived safely in the East. I will be here in Philadelphia and in Washington the rest of this week and the early part of next. I plan to be in New York Thursday morning and if your plans will permit, and you approve of the suggestion, I would like to have you reserve luncheon on Thursday so that we could meet Mr. Merrick, President of the Westinghouse Company and Mr. Robinson, Chairman of the Board of the Westinghouse Co., about one o'clock in the Rockefeller center building.

The Westinghouse Company are, in my opinion, one of the candidates to build the Telescope tube and mounting. Mr. Merrick has been in Pasadena and he is somewhat familiar too with the studies that the Westinghouse engineers have been making here on some of our problems. I do not propose to go into any discussion with them as to the building of the telescope at this time, or involve you in any such discussion, but thought that probably you would enjoy knowing them and see what their attitude was toward undertaking a part of this project.

I will call you up when I arrive in New York and hope that if you cannot make this Thursday meeting that I can arrange to see you at such time as you are going to be ~~over~~ free.

With best regards,

Very sincerely yours,

Sandy

C. S. McDowell.

FORM 372

NOV - 8 1935

1103.1

October 26, 1935.

Dear Captain McDowell:

Mr. Mason is not in the office to-day, but I have talked to him on the telephone, and he asked me to write you that he can conveniently meet you Mr. Merrick and Mr. Robinson on Thursday, October 31st, and will be glad to have you come here for luncheon in the Officers' Lounge at one o'clock.

Yours very truly,

RWB

Secretary to Mr. Mason.

Captain C. S. McDowell,
Westinghouse Electric and
Manufacturing Company,
Essington, Pennsylvania.

1103.1

CALIFORNIA INSTITUTE OF TECHNOLOGY
PASADENA

ASTROPHYSICAL OBSERVATORY

October 29, 1935

Dr. Max Mason
President Rockefeller Foundation
49 West 49th Street
New York.

Dear Mason:

I was much pleased to receive your very kind letter. McDowell expects to be in New York this week, and I hope you and Arnett will tell him of the date when the budget should reach New York, as we need the information McDowell is now collecting in order to check and complete our figures.

You will be glad to hear that the remarkably short-focus spectrograph lens (f/0.36) designed for us by the British Scientific Instrument Research Association has proved to be fully equal to their expectations. It is about four times as fast as the Rayton lens (hitherto unequalled), and for certain classes of work it will be invaluable. It covers a long range of wave-length, its field is flat, and its definition excellent. Its only limitation will be determined by the brightness of the general sky background, which on Mount Wilson is decidedly greater than it formerly was, because of the enormous increase in the number of lights in the Valley. Palomar is free from this difficulty, and the sky is consequently much darker and purer, though in long exposures the continuous aurora may possibly produce an appreciable darkening of the plate near the H and K lines (used to measure the radial velocities of the minute remote extra-galactic nebulae). However, we have certainly made a good investment in this lens.

I have had no more vertigo but doubt whether my physician will let me go east this year.

With warmest regards

Yours very cordially,

George E. Hale

GEH:G

CALIFORNIA INSTITUTE OF TECHNOLOGY
PASADENA

ASTROPHYSICAL OBSERVATORY

October 29, 1935

Mr. Trevor Arnett
President General Education Board
49 West 49th Street
New York.

Dear Mr. Arnett:

Thank you for your very kind letter of October 23. My physician still thinks I should not go east for some time, though I am holding my own, so far without another attack of vertigo, under the special treatment he is giving me.

Captain McDowell should be in New York this week, and I hope you will emphasize to him the importance of reaching here in time to aid us in preparing the definitive budget early enough to meet your needs. He is getting much new information necessary to its completion, and the Observatory Council always endeavors to give you the most reliable figures obtainable.

With cordial regards,

Yours very sincerely,

George E. Hale

GEH:G

1103.1

JAN 30 1936

INTER-OFFICE CORRESPONDENCE

From MM's interviews.

	GEB files JAN 30 '36		dm 8	

October 31, 1935.

Captain C.S. McDowell.

Discussion of the progress made toward determining details of construction of the tube and mounting, and drive mechanism, for the telescope. They are nearly ready to let contracts for the construction of the tube and mounting, and deflection tests at C.I.T. have shown the tube to be satisfactorily designed. Two firms seem competent and desirous of doing the work - Westinghouse, and Babcock and Wilcox.

FORM 106

JAN 22 1936

~~DA~~
~~DHS~~
AMJ. Gm Y

1103.1

WW Diary

Thursday, Oct. 31, 1935

CAPTAIN C. S. MCDOWELL.

Calls briefly to recount recent progress toward the final design for the teloscope mounting and progress in the design of the driving and control mechanism. All facts presented are more completely summarized in later official reports from McD.

WW:FWB

FORM 372

1103.1

NOV 16 1935

T A	OCT 13 '35	
W W	NOV 13 '35	W W
[illegible]	[illegible]	[illegible]
[illegible]		[illegible]

November 4, 1935.

Dear Hale:

We have enjoyed McDowell's visit here immensely and feel that we have been brought thoroughly up to date, and are delighted with the progress.

I have gone over with Arnett again the question of the date at which the budget should be received here. November 25th will be in good time. We will not need it at all before then.

I am particularly impressed by the large array of engineering talent which has been brought to bear on the telescope problem. We are happy to feel that the question of mounting and drive will have been studied in a way commensurate with that in which the whole undertaking has been done. It has been a fine piece of work from the start.

Cordially yours,

MAX MASON

Dr. George E. Hale,
California Institute of
Technology,
Pasadena, California.

MM:AEB

FORM 198

DEC - 2 1935

1103.1

DHS	NOV 23 '35	DHS
WWB	NOV 27 '35	WWB
GJB		GJB
AGA AMJ		AGA AMJ

INTERVIEWS:

Dr. Robert A. Millikan
of the

CALIFORNIA INSTITUTE OF TECHNOLOGY

with Mr. Trevor Arnett

November 13,1935

Dr. Millikan inquired if it would be possible for the California Institute of Technology to include annuities in the supplementary sum to be raised to meet the conditions of the GEB pledge.

I replied that it had been the custom of the GEB to allow annuities to be counted at their actuarial value as gifts in reasonable amounts.

Dr. Millikan then said that there was a prospect of the Institute obtaining a gift on an annuity basis under which the Institute would pay whatever income the gift produced to the donor, and inquired if such an annuity could be considered.

I said that it could. (Of course in this case the rate of interest would need to be assumed* by the Board in evaluating the gift).

T.A.

T.a

(= postulated)

JUN 3 1936

MM – MW 1103.1
DEB files amj

GEORGE ELLERY HALE
PASADENA, CALIFORNIA

Mount Wilson Observatory
November 13, 1935

Dr. Max Mason
49 West 49th Street
New York.

Dear Mason:

As one's years increase in number disappointments and regrets multiply. But while I had heard from Millikan that you have been thinking of retiring, I was not prepared for your letter received yesterday.

To say that I regret your decision is to put it far too mildly. The fact is that with you absent Rockefeller Center will never seem the same. I have greatly missed Wickliffe Rose and others I used to meet at the Rockefeller offices, but in your case something in addition to friendly regard is involved. This includes not only your cheerful optimism and enthusiasm, but also your full scientific understanding of the many problems we have discussed in recent years. Nothing can replace this, though we are fortunate indeed to have such a good friend and supporter as Arnett still available. I can only wish you and interesting and satisfactory future, and trust sincerely that you will come to Pasadena in January, especially as two more (less severe) attacks of vertigo since I wrote last will prevent me from going east this year.

Adams, Anderson and I had a full discussion with McCauley, and from all the evidence, including the work done on the 120-inch and other mirrors here, we fully believe that the new 200-inch will serve our needs. In fact, if further defects do not appear below the 3 5/8 inch surface, and if no magic mirror defects develop in the figuring (they ought not to) we believe the thinner solid portion of the mirror will prove an advantage. McCauley is returning by way of the University of Michigan, in order to consult Timoshenko, and we hope to receive a favorable report before long. Perhaps McDowell may also bring some further information with him.

I think I wrote you that the English f/0.36 lens has turned out to be a remarkable success, setting a record for all such optical combinations. It is about four times as fast as even the Rayton lens, which itself set a record.

Looking forward to seeing you in January, and with a thousand thanks for all your unfailing interest and help,

Yours ever,

George E. Hale

GEH:G

FORM 198

1103.1

DEC 23 1935

MM	NOV 25 '35	1717
WW IBH	DEC 17 '35	WW IBH
IBH WWB	DEC 20 '35	
AMJ	DEC 23 '35	amj

INTERVIEWS:

Capt. C. S. McDowell

with Mr. Trevor Arnett

November 14, 1935

Capt. McDowell, who is Consultant on the 200-inch telescope project at the California Institute of Technology, brought with him preliminary estimates for the budget of 1936 and explained in detail the work which was being carried on and the progress which is being made. He thinks the conditions are right now for additional work on the building and the mounting, and he promised to have Dr. Hale send the detailed budget estimates before the end of this month.

T.A.

T.a.

DEC 20 1935

1103.1

CALIFORNIA INSTITUTE OF TECHNOLOGY
PASADENA

ASTROPHYSICAL OBSERVATORY

AIR MAIL
Duplicate by regular mail

November 22, 1935

Mr. Trevor Arnett
President, General Education Board
49 West 49th Street
New York.

Dear Mr. Arnett:

The Observatory Council met yesterday and decided to propose the enclosed budget for the year beginning January 1, 1936.

The considerable increase in the total new appropriation requested is the result of Captain McDowell's trip. He found that costs are increasing, and that it is therefore advisable to enter into agreements for construction as soon as possible. By securing certain guaranteed maximum figures in these agreements we hope to save money. Some of these agreements, covering large items such as the tube and major portions of the telescope mounting, may not be completed during 1936.

There are other items in the enclosed budget which should be adequate for the purposes named, while allowing some changes of procedure if further consideration should make them necessary. Thus, while a careful comparative study of sources of power has already been made, we have not yet decided whether it will be best to enter into an agreement with an electrical company to run a power line up Palomar Mountain from the nearest line available in the valley, or to establish a complete self-contained Diesel power plant of our own. On Mount Wilson we obtain power from a line installed by the Edison Company, but we also have a plant of our own, which serves for power, water and light when the power line from the San Gabriel Valley is (rarely) put out of commission for a time by the heaviest winter storms. In any case, a power plant of some kind will be needed on Palomar Mountain, but its exact capacity has yet to be determined in the light of further study.

In general, this budget is intended to cover expenditures necessary during 1936 and to provide for certain commitments which should be arranged soon.

I hope that you and Dr. Mason can visit us this winter, especially as the nature of some of our problems can be most clearly seen here and at Palomar Mountain.

I am sending a copy of this letter to Dr. Mason.

Very sincerely yours,

GEH:G

George E. Hale

1103.1

DEC 30 1935

CORNING GLASS WORKS
CORNING, N. Y.

NOV 25 '35 M.T
WW
DEC 17 '35 FBH
DEC 19 '35
DEC 19 '35
DEC 26 '35
DEC 27 '35

In reply refer to:
Dr. G.V. McCauley.

Nov. 22, 1935

Dr. J. A. Anderson,
Observatory Council,
Calif. Institute of Technology,
Pasadena, Calif.

Dear Dr. Anderson:-

Carrying out our agreement Dr. Timoshenko was consulted at Ann Arbor on Nov. 12. He pointed out that a correction was necessary for relatively thick discs in order to make the computed deflection agree with the measured value. This correction is necessary in the case of thick discs to account for the additional deflection due to shear. It was Dr. Timoshenko's opinion that this correction might amount to something like 30% but he stated that this estimate was merely a guess and referred to other sources for further information.

At Corning the problem was pursued further and from Dr. Timoshenko's own book on "Strength of Materials" part 2, page 496, a reference was found to actual experimental work by G.M. Russell, Engineering, Vol. 123, 1927, page 343. Also in Dr. Timoshenko's book on page 497 a formula is given for the deflection of thick plates clamped at the edges. This formula contains the correction factor due to shear and is as follows:

$$d = \frac{qa^4}{64D}\left(1 + \frac{4}{1-u}\,\frac{h^2}{a^2}\right)$$

where q is the uniform load
a is the radius of the plate
h is its thickness
D is the flexual rigidity and is given by the expression

$$D = \frac{Eh^3}{12(1-u^2)}$$

wherein E denotes Young's modulus for the material in the plate.

From the article by Russell it was found that experimental results had been compared with computed values from a formula by C. A. Clemmow. This formula is, in the nomemclature used above,

$$d = \frac{qa^4}{64D}\left(1 + \frac{8\,(3 - u)}{3\,(2 - u)(1 - u)}\,\frac{h^2}{a^2}\right)$$

Values of the deflection of a 3" steel plate of various thicknesses when clamped at the edge and loaded with 1,000 lbs. per sq. in. uniform pressure are given in the table below.

Thickness of plate (in.) (1)	Ratio of Radius to Thickness (2)	Deflection at Center: Measured (in.) by Russell (3)	Computed (in.): Timoshenko (4)	Computed (in.): Clemmow (5)
.1	15.0	.03100	.03318	.03320
.2	7.5	.00443	.00444	.00446
.3	5.0	.001575	.001462	.001474
.4	3.75	.00074	.000703	.000713
.5	3.0	.000427	.000416	.000428
.6	2.5	.000287	.0002807	.0002874
.7	2.143	.000203	.0002066	.0002124
.8	1.875	.000150	.0001614	.0001665

$E = 29.55$ lbs./in^2

$u = .266$

as given by Russell

The values in column 3 are as measured and reported by Russell. Those in column 4 are computed from the formula by Timoshenko and those in column 5 are computed by the formula of Clemmow. It is to be observed that the computed values by both formulae agree quite well with the measured values. The greatest discrepancy is for the thickness of .3" or for a ratio of radius to thickness of 5. In all probability there may be a misprint of the measured value as given by Russell. It is to be observed also that the agreement between measured and computed values is somewhat better when the computations for the deflection are made with the

formula by Timoshenko for discs whose ratio of radius to thickness is less than 2.5.

Considering the deflections of the unsupported areas of the 200" disc as being the mean of the deflections for a circumscribed and an inscribed circle respectively, we find the circles involved to be of radii 8.85" and 6.41". The ratio of radius to thickness for thicknesses ranging from 3-5/8 to 5" will lie between limits of 2.44 and 1.38. Consequently computed values of the deflection should be expected to agree fairly closely with actual values in the case of the 3-5/8" thickness and will be somewhat too high for the 5" thickness in the case of the inscribed circles. The discrepancy between computed and actual values for these ratios of radius to thickness should, however, be less if computed by the Timoshenko formula. This computation is shown in the table below.

Deflection of 200" disc during grinding as function of thickness.

Thickness of slab (1)	Deflection of Circumscribed Circle 10^{-6} (in.) (2)	Deflection of Inscribed Circle 10^{-6} (in.) (3)	Mean Deflection 10^{-6} (in.) (4)	q(lbs/in^2) (5)
3.625	2.485	.955	1.72	.32 + .290
4.0	2.13	.95	1.54	.32 + .324
4.5	1.795	.747	1.27	.32 + .364
5.0	1.570	.657	1.11	.32 + .405

above assumes $E = 9.28 \times 10^6$ lbs./in^2

$u = .18$

as best available values for Pyrex disc glass.

Column 2 gives the deflection for the circular plate circumscribing the unsupported area. Column 3 contains the deflections for the circular plate of the inscribed area. The figures in column 4 are the means of the deflections in columns 2 and 3. The uniform load shown in column 5 is made up of the weight of the grinding tool which is computed to be .32 lbs./sq. in. and the weight of the glass for the various thicknesses. It is to be observed from these figures

that the mean deflection is of the order of 1/12th of a wavelength for the 3-5/8" thickness and of the order of 1/20th of a wavelength for the 5" thickness. Comparing these figures with the computed deflection of the 30" ribbed disc given in the table below we see that the deflection of the 200" disc with a slab thickness of 3-5/8" would be approximately the same as that of the 50" disc whose slab thickness was slightly more than 3/4".

Deflection of 30" disc during grinding as function of thickness.

Thickness (in.)	Deflection of Circumscribed Circle 10^{-6} in.	Deflection of Inscribed Circle 10^{-6} in.	Mean Deflection 10^{-6} in.	q (lbs/in^2)
0.5	7.54	1.568	4.55	.18 + .04
.75	2.676	.632	1.65	.18 + .06
1.0	1.358	.340	.849	.18 + .08
1.5	.608	.178	.393	.18 + .12

above assumes $E = 9.28 \times 10^6$ lbs./in^2

$u = .18$

as in previous table.

We have been informed that the slab thickness of the 30" disc was thinner at some places than at others. My recollection is that the thinnest sections were said to be less than 3/4". Actual experience with the 30" has indicated no trace of the Japanese effect in figuring. Accordingly it would seem that there could be no possibility of danger from this source with the 200" even if a thickness of 3-5/8" were selected for the finished slab.

As a further comparison a computation was made of the deflection of a 60" mirror supported at the edge. A thickness of 10" was assumed for this disc. For a plate supported at the edge instead of being clamped the deflection at the center is approximately twice that for the clamped edge plate. Accordingly the computed deflection was found to be 8.74×10^{-6} inches or nearly a half wavelength. This would represent the distortion of the 60" mirror unless some form of support were provided at its back.

These figures are presented for your further consideration regarding your decision to proceed with work yet to be done on the disc. We have proceeded with the further inspection of the disc in its mold, with the removal of all minor abrasions from the surface and with a single measurement of strain at the extreme rim of the disc. Our inspection shows no defects in the body of the disc, the removal of further abrasions does not alter the available thickness of the finished slab which was determined by the two major abrasions previously reported, and the measurement of strain gave a birefringence of only 25 mμ per cm. at the extreme rim which is of the same order as the discs previously made and shipped.

If in the light of the figures presented here there is no reason in the minds of the members of the Observatory Council to depart from the course agreed upon, we will proceed with that program. We are in readiness now to remove the mold and proceed with the cleaning and final inspection of the disc; but will await your confirmation after a study of the report here made.

Yours very truly,

Geo. V. McCauley

Physical Laboratory.

cc: Dr. G.E. Hale
Dr. Max Mason
Dr. Adams
Capt. C.S. McDowell
Dr. A. L. Day

md.

CALIFORNIA INSTITUTE OF TECHNOLOGY
PASADENA

ASTROPHYSICAL OBSERVATORY

November 23, 1935

Mr. Trevor Arnett
President, General Education Board
49 West 49th Street
New York.

Dear Mr. Arnett:

In the haste to get the budget figures in proper statement form to reach you November 25, a discrepancy crept in, due to an error in transcription. I am therefore enclosing corrected sheet, to replace the first sheet of the budget mailed you last evening.

I am also sending a copy to Dr. Mason.

Very sincerely yours,

George E. Hale

GEH:G

1103.1

CALIFORNIA INSTITUTE OF TECHNOLOGY
PASADENA

November 25, 1935

Mr. Trevor Arnett
President, General Education Board
49 West 49th Street
New York.

My dear Mr. Arnett:

I owe you a word of explanation regarding the proposed budget, of which I sent a corrected first sheet Saturday.

On Friday, while checking the figures, I had a slight attack of vertigo, the curious trouble which has pursued me since last spring. By waiting quietly I recovered in time to sign my letter, but I was unable to compare and check all the figures with our notes and records. The revised sheet sent you Saturday was gone over carefully by Dr. Anderson and my Secretary, and I think it was correct in all respects.

By that time we had received a telegram from Corning, saying that after another critical examination of the 200-inch disk and a recalculation by Dr. McCauley, they were convinced that this disk will prove satisfactory. Dr. McCauley's full report came today, and we are all confident that unless unexpected defects appear after complete removal of the mould, the disk will reach our highest expectations. The budget sent you assumes this will be the case, and the amount inserted for Corning should therefore clean up our indebtedness to them, including their 10 p/c profit, together with shipping expenses and insurance.

I understand that a copy of Dr. McCauley's technical report was sent to Dr. Mason, who has perhaps had an opportunity to examine it by this time.

Very sincerely yours,

GEH:G

Geo. E. Hale

JAN 17 1936

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CALIFORNIA INSTITUTE OF TECHNOLOGY
PASADENA

ASTROPHYSICAL OBSERVATORY

25 November 1935

MM	NOV 29 '35	m m	a.h. 12/23	in Journal Letter
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TA	JAN 16 '36	T. A.		
FBK	JAN 16 '36	JBH		
FSB AMJ		FB	amj	

Dr. Max Mason, President
Rockefeller Foundation
49 West 49th Street
New York City, N. Y.

Dear Max:

I am enclosing a sort of historical report of the steps we have gone through in the development of the design of the telescope tube and mounting, and certain related matters. I hope that this gives you the picture you want to present to the Directors. If not, I will go into it in more detail. Dr. Hale has seen this and approved it.

I had a nice trip out and have been quite busy since my arrival. Spent the weekend on Palomar Mt. and enjoyed it immensely.

Hope you can send me your brother's address, so that I may look him up.

With best regards.

Very sincerely,

Sandy

CSMcD:hb

DEVELOPMENT OF TELESCOPE DESIGN

At the end of 1934, there were available at the California Institute of Technology, studies and tentative designs on two types of mountings for the 200-inch telescope. For purposes of identification, these may be designated as the Fork type and the Yoke type, the fork type consisting of a cone supported so as to rotate on bearings and with two projecting arms which carried the trunnions for the telescope tube: the yoke type consisting of a mounting with bearings at both ends, the north being a horseshoe type so that the tube could be lowered down into the horseshoe when pointing north; the south end being solid, and the two ends connected together by a structure and carrying trunnions for the telescope tube approximately midway between the two ends of the mounting.

To obtain the greatest possible assistance in selecting the type of mounting, and to get information and data from which to develop the mounting into a design stage suitable for manufacturing purposes, a large number of engineers and manufacturing firms were consulted. The problem naturally was a combined structural and mechanical one, and the probabilities were that welding would be greatly involved. In the past, the Union Iron Works in San Francisco, a shipbuilding plant, now a subsidiary of the Bethlehem Shipbuilding Company, had built the mounting and the tube for the 60-inch, and the Bethlehem Shipbuilding Company at Quincy, Mass., had done similar work in connection with the 100-inch at Mount Wilson. The class of work required is, in general, along the lines used in large shipbuilding, except that greater precision and accuracy is necessary, and the equipment available at the large shipyards makes them somewhat a natural source of manufacture of such structures. Their engineers and consultants should have information and data that would be of considerable interest in the particular problem. Therefore, plans of the two types of mounting were sent to Mr. Wylie Wakeman, Vice-Pres. and General Manager of the Bethlehem Shipbuilding Company, and Mr. Burkhardt, Chief Engr. of that Company; also, to Mr. Homer Ferguson, President of the Newport News Shipbuilding and Dry Dock Company; Mr. J. F. Metten, President of the New York Shipbuilding Company. All of the above named men were personally contacted and the problems gone over with them in detail, as well as with Mr. W. W. Smith of the Federal Shipbuilding Company, a subsidiary of the U. S. Steel Company. All of the above companies made exhaustive studies of our plans and submitted detailed reports, giving their comments.

Plans of the different types of mountings were also shown to and discussed with Messrs. Pawley, Beekman and Stevens of the General Electric Company, and their comments and recommendations were gladly given, based on their experience in welding and machining heavy structures for the electrical development work in Russia; with Mr. Mildon, Vice-President and General Manager of the Westinghouse Plant in Philadelphia, Mr. Hodgkinson, Chief Consulting Mechanical Engineer of Westinghouse, with Mr. H. F. Schmidt, Consulting Engineer, and Mr. J. Ormondroyd, of the Mechanical Research Dept. of Westinghouse. Later, with Mr. Merrick, President of the Westinghouse Electric & Mfg. Company, and with Mr. W. H. Harmon,

Vice-President of the Baldwin-Southwark Corp. at Eddystone, Pennsylvania, also with Mr. Kruse of that company: with Mr. M. B. Butler, Jr., Vice-President of the Budd Mfg. Company of Philadelphia in connection with the possible use of stainless steel or other alloyed steels in this construction, also with Mr. Llewellyn, consulting engineer of the U.S. Steel Company, particularly in connection with alloyed steels. With Dr. John Johnston, Director of Research of the U. S. Steel Company, and Dr. Bain, Chief Metallurgist of that Company. With Isaac Harter, Vice-President of Babcock & Wilcox Company, Mr. Trainer, General Manager of Special Production, of that Company who had charge of their work on Boulder Dam. Also, with Mr. Bliss and Mr. Burrell of Warner-Swasey Company. With Mr. Otis Hovey of the American Bridge Company. With Mr. Wilfred Sykes, Ass't to the President and General Manager of the Inland Steel Company, and with quite a number of representative, unattached engineers, the following of whom gave particular study and comment on our proposed designs.

Dr. W. F. Durand, Prof. Emeritus of Stanford University
Prof. S. F. Timoshenko, of the University of Michigan

Also, Mr. John Bessells and Prof. Geo. B. Karelitz of Lessells & Karelitz, in their special study and report made under authorization of the Observatory Council, in collaboration with Prof. Timoshenko.

Besides the studies and reports obtained from outside sources, the types of design were carefully studied by the immediate engineering staff on this project, assisted materially by the regular staff of the California Institute of Technology, especially by the studies made by Prof. R. R. Martel, W. H. Klapp, Dr. Th. vonKarmon, and the other members of the technical advisory committee of the Observatory Council.

The result of all these contacts and studies was the practically unanimous opinion that the yoke type of mounting was the one preferred, and the development and refinement of design has proceeded with this type of mounting.

Since determining the general type of mounting, continued discussion and study has been made by a number of those mentioned above, on the preferred details of construction. This has crystallized the interest of manufacturing of the tube and mounting between two companies, or groups, namely the Westinghouse Electric & Mfg. Company and a combination of the Babcock & Wilcox Company and the Baldwin-Southwark Corporation. Mr. Isaac Harter, Vice-President of B&W and Mr. W. H. Harmon Vice-President of Baldwin-Southwark, with Prof. Hollister of Cornell who is consultant for Babcock & Wilcox, and Prof. Beggs, consultant of the Baldwin-Southwark, who have spent some time here in Pasadena going over details and giving suggestions and comments. Similarly Mr. Merrick, President of the Westinghouse Electric & Mfg. Company, Mr. Hodgkinson, Chief Consulting Engineer, and Mr. Ormondroyd, of their company, have spent quite some time here with our staff, in the development of details.

Dr. W. F. Durand has spent some time going over our plans here in Pasadena, and, similarly Dr. S. F. Timoshenko and Prof. Geo. B. Karelitz.

In addition to the above, our plans have been studied and comments given on them, by design divisions of the Bureau of Construction and Repair and Bureau of Engineering of the Navy Department, and by the Design Department of the Mare Island Navy Yard.

The present status of the tube and mounting is: a one-tenth scale model of the tube has been completed and tested for deflections and found satisfactory. The details of the rest of the mounting are completed to the extent of manufacturing a one-tenth scale model, which manufacture is under way, and this model will be tested for determination of final design.

In addition to the tube and mounting, considerable study has been made on the method of control and precise drive. In addition to those individuals mentioned heretofore, there have been others who have been consulted on this part of the problem principally. These include Mr. H. C. Ford, President of the Ford Instrument Company, who has spent some time here going over studies in detail and who is at the present time, preparing his recommendations. Mr. Robert McMath, who developed the control and drive for the McMath Telescope and whose design has been used to a great extent on the McDonald Telescope. Dr. V. Busch, Vice-President of the Massachusetts Institute of Technology, with Prof. Buckingham of that institute. Also, Dr. V. K. Zworykin of the RCA Research Laboratory.

The foregoing gives a general picture of the procedure in developing the main features of the design. We have had the finest type of cooperation from all parties and assistance from many on special parts of this problem who have not been mentioned, for instance, Dr. F. B. Jewett has given his comments and recommendations onvarious things, particularly in connection with communication. Dr. Coolidge of the General Electric Company has given his assistance on certain details. Dr. Styri and his associates, of the SKF Industries, have made extensive studies of our bearing problems. Also, the Timken Bearing Company and the Messinger Bearing Company, have made similar studies.

Pounedourek

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CORNING GLASS WORKS
CORNING, NEW YORK

DEVELOPMENT AND RESEARCH DEPARTMENT

December 4, 1935

EXECUTIVE COMMITTEE
ALANSON B. HOUGHTON
ALEXANDER D. FALCK
GEORGE B HOLLISTER

mm mm 12/23

Dr. Max Mason
President, The Rockefeller Foundation
49 West 49th Street
New York City

Dear Dr. Mason,

Sunday, December 8, has been designated as the date on which the 200-inch disk will be officially shown for the first time. I communicated with Dr. Hale suggesting that he or some of his group might wish to be present, and I am now writing you asking whether we may have the pleasure of having you with us at that time. Invitations have been extended to representatives of various press services, and no doubt some of these will be present. There is nothing spectacular at all in what will be shown but since you were unable to attend any of the casting operations, we hope that you can make arrangements to join uson this occasion.

Sincerely yours,

J.C. Hostetter

J.C. Hostetter
Director, Development & Research

JCH:FRF

FORM 87

DEC 30 1935 TBa

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December 23, 1935.

Dear Mr. Hostetter:

In the press of business incidental to our December meetings, I have neglected to answer previously your kind note of December 4th, telling me of the date at which the 200-inch disk would be officially shown. I am sorry that I was unable to come up. I would have been very much interested in seeing it.

We send to Dr. McCauley, yourself and all concerned our hearty congratulations at the successful completion of the work. This has been a scientific and technical problem of the first magnitude, and the remarkable way in which your group has proceeded in the scientific manner is a notable achievement.

With cordial greetings,

Sincerely yours,

MAX MASON

Mr. J. C. Hostetter,
Corning Glass Works,
Corning, New York.

MM:AEB

FORM G24

DEC 27 1935

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GJB WWB	Mail	
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December 20, 1935

My dear Doctor Hale:

I desire to notify you that at the meeting of the Executive Committee of the General Education Board held December 12, 1935, the Committee appropriated $1,229,673.67, or as much thereof as may be needed, to the California Institute of Technology to cover the itemized budget of the Astrophysical Observatory for the period from January 1 to December 31, 1936. It was noted that the budget for 1936 calls for a total sum of $1,252,950, which after deducting the balance on hand of $23,276.33 from a previous allocation leaves the net amount required of $1,229.67 3.67. The Committee's action was taken in accordance with the request contained in your letters of November 22nd and 23rd.

The Auditor will follow the present procedure in making remittances.

A copy of this letter is being forwarded to Doctor Millikan.

Sincerely yours,

W. W. BRIERLEY

Doctor George E. Hale
California Institute of Technology
Pasadena, California

WWB:KEO

~~HHH~~ WW WW FBH FBA FEC 1943

December 27, 1935

Dr. George E. Hale
Astrophysical Observatory
California Institute of Technology
Pasadena, Calif.

Dear Dr. Hale,

I believe that Dr. McCauley took care of the question regarding freight rates on the 200-inch disk raised in your letter of December 17 during my absence from the city. If there is anything further that we can do to expedite a final decision, please let us know. Incidentally, we are still awaiting word from you as to the final routing on the disk.

We sent forward to Sir Richard Gregory the photographs that you requested. We should like very much to have a small number of the reprints of your article which will soon appear in Nature.

Inasmuch as the 200-inch disk is approaching its final phases as far as Corning is concerned, we decided to safeguard your interests and our own in this disk by placing an all coverage insurance policy on it, insuring California Institute and Corning Glass Works against loss during the period of cleaning out the cores, inspecting, crating and loading on the car. The cost of this insurance was indeed nominal, costing but $500 for $100,000 coverage. I know that you will agree with the logic that led to this action. We assume, of course, that the insurance that you will place on the disk will take effect immediately when it is loaded on the car in Corning.

I wish to take this opportunity to wish you and your colleagues a very happy and prosperous New Year.

Sincerely yours,

J.C. Hostetter
Director, Development & Research

JCH:FRF
cc- GVMcCauley
JTLittleton
MaxMason✓
ALDay

JAN 17 1936

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CALIFORNIA INSTITUTE OF TECHNOLOGY
PASADENA

ASTROPHYSICAL OBSERVATORY

December 30, 1935

WWB	JAN -3 '36	
	JAN -3 '36	
IA	JAN -4 '36	I.a
MM	JAN -4 '36	MM
WW	JAN -7 '36	WW
AMJ		

Mr. W. W. Brierley
Secretary, General Education Board
49 West 49th Street
New York.

My dear Mr. Brierley:

Thank you for your letter of December 20, FBB FBM FB informing me that the Executive Committee of the General Education Board has appropriated $1,229,673.67, or as much thereof as may be needed, to cover the itemized budget of the Astrophysical Observatory for the period from January 1 to December 31, 1936, as requested in my letters of November 22 and 23. This will enable us to carry out a large amount of work and, we hope, to save money by taking advantage of present opportunities.

Believe me, with kind regards and best wishes for the New Year,

Yours very sincerely,

George E. Hale

GEH:G