NACA Lewis Flight Propulsion Laboratory

Costs of 1949 Inspection

Technical Labor (Engineers and Research Scientists, who designed setups, prepared and rehearsed talks, assisted as speakers, guides, attaches, etc.)	$	21,618.46
Service Labor (Design Illustrators, Photographers, Carpenters, Shop personnel, Buildings and grounds.)		46,493.30
Obligations, Materials, Supplies, etc. (Rental of buses and television, material from stores.)		11,611.72
Total direct charges(against PJO 706 -)		79,723.48
Administrative overhead (estimated about 65%) (Planning inspection, rehearsals, groupleaders, general administrative work on inspection, approvals, brochure, press releases, registrations, special correspondence.)		52,000.00
Total direct cost (estimated)(Cost of painting permanent facilities are not included)	$	131,723.48

1949 Inspection

Direct Charges on PJO 706

Tech. Labor	$ 21,618.46	)Design, talk preparation, Engineers, Speakers)
Service Labor	46,493.30	)Photo, Illustration, Carpenters, Building and Grounds)
Obligations, Materials, etc.	11,611.72	)Busses, Television rental)
Direct Costs Total	$ 79,723.48	

70% overhead (say $56,000)

Doesn't include costs on such items as administration and all overhead group.

Future costs of this nature will be more completely accounted for (per B. Clauser)

None of the painting of permanent facilities is charged.
Western Union teletype operator for press not included.
Electrical power due to diversion of personnel and interferenc
Intangible costs including loss of research output (estimated at two Laboratory weeks) cannot be computed.
2/52 or roughly 4% of were handled by the NACA Exchange
Guest Luncheon ticket sales entirely supported the cost of the luncheons for three days, the refreshments served the press, the refreshments for guests at the picnic grounds as well as those served employees at the end of their inspection tour, September 23, and special entertainment at Hotel Cleveland.

Data on Peak Loads Experienced during Annual Inspection - 9/20 - 22

FOR RECORD PURPOSES

Morrow - Wandersleben - 11/3) Peak loads were reduced by straddling 30 minute metering periods with 8 x 6 Ft. Tunnel operation.

Precedent was established for operating 8 x 6 Ft. Tunnel during daytime at less than maximum speed.

	8:30 - 5:00	Normal Day (peak)	30,000 KW
9/20	3:30 - 4:00	Peak	21,000 KW
	1:00 - 1:30	Peak - lunch	23,000
9/21	11:30 - 12:00	Peak	24,500
	1:00 - 1:30	Peak - lunch	22,000 KW
	3:30 - 4:00	Peak	24,500 KW
9/22	10:00 - 10:30	Before tour started	28,200 KW Peak
	1:00 - 1:30	Lunch for guests	22,000 KW For Show
	3:30 - 4:00		23,000
9/23	10:30 - 11:00		6,000
	9:30 - 10:00		6,000

NOTES ON THE COSTS AND VALUE OF THE INSPECTION

1. The intangible costs of the inspection in reduction of research output due to the diversion of personnel from their regular tasks and necessary interference with research operations is not known but is demonstrably less than the two Laboratory weeks estimated by some ($604,681).

2. There are good reasons for assigning a lower cost. An inspection provides our own organization an opportunity to take stock of our research progress and to present important results in a refreshing way to important people who haven't the time or the technical ability to digest our reports.

3. An inspection enables our research staff to meet and become acquainted with important men in aviation. Some of these contacts facilitate future contacts or result in on-the-spot exchange of information that either would not be learned or would otherwise cost our staff many days of travel - travel that costs NACA an average of between $20 and $80 per day exclusive of salaries.

4. By bringing in large groups of interested guests under conditions of our own choosing, we are able to avoid many hours of accompanied individual tours throughout the year with the attendant problem of securing individual clearances from Headquarters.

5. An inspection provides an opportunity for key personnel in NACA Headquarters, at the Langley and Ames Laboratories, and our West Coast Coordinator, as well as the main committee to get brought up to date on research progress made by the Laboratory and the availability of new equipment.

6. An inspection provides good training for a large group of research men in describing their work in straight forward English, in learning the value of good preparation and in developing good speaking habits and poise that will facilitate their presentation of more technical discussions at other times.

7. One of the most important by products of the inspection is the unusual opportunity it affords for every employee of the Laboratory to hear an understandable presentation of representative work in each division during employee's day after the official inspection. For the

three fourths of our employees who are not research scientists and for many scientists who do very specialized research, this opportunity to see and hear presentations of research results in all fields is not equalled by any other NACA activity; this gives morale a good boost because the employee sees accomplishments in a new perspective.

8. Many employees whose work is hindered by the inspection, but who have no duties in that connection, take annual leave during the inspection thus avoiding loss of research effort since the annual leave might otherwise be taken when research would be possible.

9. Many activities in the Laboratory, including most of the theoretical investigations are in no way affected by the inspection. In fact, theoretical research may benefit from the increased availability of computers whenever experimental research data is not taken during the inspection.

10. The need to maintain order and good working conditions is emphasized by the inspection which provides priority and a deadline for completion of construction and maintenance work that might otherwise suffer delays. The resulting improvement in Laboratory appearance is beneficial to the employees and in the long run saves maintenance funds.

11. The inspection provides a wealth of material for publicity about NACA - an activity that does much to insure continued financial support by the public. The nature of the talks and demonstrations prepared for an inspection are more suitable for such publicity than others prepared by the Laboratory and much effort is saved in getting our story to the public. The inspection took 3-1/2 days of all-out effort plus 1/2 day for all rehearsals, a total say of four laboratory days or 1.54 percent of a laboratory year which, at the normal rate of Laboratory expenditures, would cost about $241, 872.

12. The actual direct costs to which all time and material were charged on PJO 706 total only $79,723.48 and it is estimated that the cost of administrative overhead incurred by the show would add about 65% or $52,000. The actual cost of the inspection is, therefore, roughly $131,724 which corresponds to normal expenses for only 2.2 Laboratory days based on our 1950 budget of $15,706,000. Therefore, only about 55% of the Laboratory can be assumed to be engaged in the inspection for a four day period.

13. A total expenditure of $131,723 for 1275 guests amounts to about $103 per guest. This emphasizes the need for making a careful selection of guests. It further suggests that any increase in the cost of brochures or other effective souvenirs, which will help to insure that our guests remember what they saw and heard, may be well worth while.

NACA - Lewis

Cleveland, Ohio,
September 28, 1949.

MEMORANDUM For Record.

Subject: Conference held on September 28, 1949 to discuss Lewis Annual Inspection, September 20, 21 and 22, 1949.

Those Present: Representatives of each group assigned duties during Inspection.

1. A summary of the suggestions and criticisms is given below:

(a) Demonstration Setups

It was stated that there wasn't enough advance notice of what was needed to be done by the carpenter and mechanical crews. It was suggested that in the future it should be decided as far in advance as possible just what displays are going to be used and notify the proper individuals so that there will be as little last minute rush as possible. It was also suggested that a coordinator be chosen from each Division and conferences be held to coordinate the work for the various shops in preparation of the material for the inspection.

In connection with the charts, etc., the Illustration Department stated that their only objection was that they had too short a time in which to do a good job. The date on which we delivered our material to the Washington Headquarters for approval was later than originally scheduled. The preparation of material for the brochure was consequently delayed and therefore a great deal of overtime was worked in order to finish it on time.

Mr. Calmer stated that it was his belief that the setups could be used again next year and therefore a suitable storage place should be located. It was decided that Mr. Calmer and Dan White will try to find a suitable place on the reservation to store them until the next inspection or for some other conferences during the year.

(b) Speakers and Talks

It was suggested that, in the future, approval be obtained for the outline of each of the talks before they are written and then have the talks prepared according to the approved outline. Many of the talks were written completely and then changed; as a result, a good deal of time was wasted.

Dr. Sharp stated that by removing the technical jargon from the talks the visitors were able to understand and enjoy the talks to a fuller extent. Many favorable comments were made by the visitors in this connection.

Mr. Victory had commented that a few of the speakers voices were monotonous and that should be kept in mind in choosing speakers for the next inspection.

A visitor commented that each of the topics discussed seemed to have been solved or nearly solved. It was suggested that during the next inspection we indicate on the charts those results which have been obtained, those we are working on at present, and those results we hope to obtain.

It was pointed out that we could tell the visitors that from time to time technical conferences are held on various subjects at which time more detailed information and data is presented. It was also suggested that we print in the brochure a statement to the effect that such technical conferences will be held.

It was suggested that next year all the speakers get together and go over their proposed talks so that each speaker knows what the other is going to talk about. Each of the speakers could give some idea of what is coming next and show how the talks are related.

The question was discussed as to whether the speakers should be chosen for their speaking ability, regardless of whether they are working on the specific subject, or because they know the subject well and can also talk well. Mr. Sessions suggested that the individuals involved get together at some later date and discuss the matter because it is an important subject and should be decided. Dr. Sharp stated that new people should have a chance and that they can be trained in speaking during the year at various research meetings and division seminars.

(c) Physical Comfort of Guests

Every visitor must be able to see and hear during the talks and demonstrations. The demonstrations and speakers will have to be put on higher platforms in order that the visitors in the back rows will be able to see. We should know in advance the maximum size of each group so that proper seating is available and we should also allow for extras.

Not more than seating capacity should be allowed on each bus. It was difficult for the group leaders to talk to the people in their groups on the buses because they were so crowded. It is important that each of the group leaders be able to talk to his group on the bus and in that way he can tell them what is coming next and how it ties in with what they had just seen.

For the next inspection we should not allow more than 325 people on any one day and, if necessary, we should have an extra day to take care of the crowd.

DDT should be sprayed at all demonstrations to get rid of the flys.

It was agreed that the number of stops (eight) made during the inspection was a satisfactory number. The fewer stops were a great improvement and less tiring to the guests.

It is up to the group leaders to explain that there is a schedule tokeep and it should be done in such a way as to make the visitor feel that we are keeping things moving in his interest and that he will have an opportunity to see more. We should always have group leaders with good judgement who can handle such situations.

It was decided that we should definitely have the refreshments at the recreation area after the inspection each day, as we did this year, because most of the visitors were favorably impressed by it and it gave them an opportunity to meet other guests they had not had a chance to see during the day, and for the Laboratory staff to meet more of the visitors.

(d) Press

It was agreed that we had better press coverage, both by the radio and the newspapers, than ever before.

(e) Inspection for Laboratory personnel

Many of the Laboratory personnel could not get to see the demonstrations on Friday after the inspection. It was suggested that the whole day be allowed for inspection by Laboratory personnel after the annual inspection next time. Dr. Sharp agreed to devote a whole day next time for attendance by the members of the staff.

(f) Luncheon

Some visitors stated that they had not been served what was on the menu. It was requested that, in the future, we should make sure that there is no doubt that the visitors are getting what is on the menu.

Each day an announcement should be made stating that the girls serving are secretaries and computers from the Laboratory staff who offered their help for the Inspection.

By having an extra day for the Inspection, and thereby cutting down the size of the groups, the preparation of the meals would be much easier. It was again stated that for the next Inspection we will try to keep the groups down to 325 and serve all the guests in the auditorium.

It was agreed that the same luncheon menu should be used for all days of the Inspection, as was done this year.

(g) Transportation, Message Center, Registration

It was stated that the group leaders wasted time by going down to the Hotel to meet the guests.

Next time, we should request that all the buses have a side door exit as well as the front door. It keeps the groups moving faster.

The question was raised as to whether so many drivers were needed. It was decided that it was better to have too many than not enough and there were times during the day when they were all busy. It was agreed, however, to assign another office to them to wait in where they would be out of view of the visitors.

It was requested that during the next inspection an additional phone be provided for the message center. One was not enough.

During the next inspection there should be no overlapping of duties. Some of the girls that worked in the message center also served and this caused complications.

It was decided not to collect the badges from the visitors before they went to the picnic grounds because the badges helped the visitors mix together. In fact it was decided that badges need not be collected at all.

During the next inspection, dark colors will not be used for badges. The same colors can be obtained in lighter shades. It was difficult to read the name on the badge under the dark color.

imk

NACA - Lewis

Cleveland, Ohio,
September 28, 1949.

MEMORANDUM For Record.

Subject: Report of conference called by Mr. John F. Victory on September 22, 1949, to discuss the Annual Inspection of the Lewis Laboratory.

Those present: Messrs. J.F. Victory, W. Bonney, R.C. Sessions, W.E. Emley, Jr., E.G. Sharp, S. Calmer, A. Silverstein, E.J. Manganiello, W. Hunter, M. Hood (Ames) and D. Wiley (Ames).

1. A summary of the suggestions and criticisms is given below:

(a) General arrangements, schedules, handling of guests, etc.

(1) We should give as close as possible attention to the timing of the inspection so it does not conflict with other events in the community or events that the people we invite are interested in.

(2) Introduce the group leaders at the morning meeting. The group leader should in turn introduce his assistants on the first bus ride. It would be well also for the group leader to tell the guests to feel free to ask questions.

(3) The leaders should be distributed through the bus.

(4) Cleveland employees should have a distinctive badge, perhaps a different shape.

(5) Mr. Victory stated that he was immensely pleased and knew the Committee would be at the excellent teamwork between the laboratories.

(6) The continuity theme that was used this year was excellent but more clockwise attention will have to be given to the tour in order to preserve the continuity of the theme.

(b) Invitations and attendance

(1) The attendance of the military is so unpredictable that we might consider breaking the military day into two days with a quota for each day for the number of people to

come from Wright Field. If two days is unsatisfactory, we could limit Wright Field attendance to 100. In any case, a quota seems advisable - it commands attention. If we are to start a new relationship with Wright Field, Mr. Victory stated that now would be the time to start inasmuch as the new Commanding General, General Chidlaw, is very friendly.

(c) Demonstrations, subject matter of talks and clearances

(1) Have fewer NACA Headquarters people necessary to approve the text of the lectures and the brochure. Have them all review the material at the same time and recommendations be submitted to the Laboratory at one time.

(2) Summarize at the end of each talk and do it very simply. Tell what you are going to tell them - say it - and then tell them what you told them.

(3) Mr. Bonney reported that Adm. Richardson had stated to him that the level of presentation was just about right this year. It was high enough so people would not think they were wasting their time coming but was stated so most of them could understand it.

(d) Details of exhibits, properties and presentation

(1) Raise the speakers at the morning meeting about a foot by using a stand. Avoid use of the stage, however, because of its formality.

(2) Raise the exhibits and demonstration speakers high enough to be seen by all.

(3) Remember that persons sitting in the seats in front block the view of those in the rear and take this into consideration when checking to see if the exhibits, demonstrations and speakers are high enough.

(4) Provide more comfortable chairs and sufficient chairs to accommodate any possible overflow.

(5) All visitors must be able to see and hear, and in providing for this take into consideration the maximum possible attendance.

(6) At the 8' x 6' Supersonic Tunnel, some of the audience had to stand or sit in positions from which they could not see or hear.

(7) The level of color was correct.

(8) The austerity was just about right.

(9) The backdrop material did not give the effect of expensive. It was something obviously put together quickly with little expense but was in good taste.

(10) Mr. Victory did not like the use of charts with portions blocked off as was done at the 8' x 6' Supersonic Tunnel demonstration. Rather than this, he suggested the use of an arrow or a box around the words which are being emphasized so as to leave the whole chart readable.

(11) Mr. Victory commended the Laboratory on the 8' x 6' small tunnel stunt. However, it was so tricky and clever it appeared to be faked.

(12) At the Altitude Wind Tunnel, the first of the younger speakers was monotonous and his voice did not hold the interest of the audience.

(13) The 8' x 6' tunnel and the compressor demonstrations were too long.

(e) Press

(1) It is very desirable to have a press conference at the end of the day in the press room with a man fully qualified to answer spot questions and not get fouled up and whose reactions are fast.

(2) The press arrangements this year were handled far better than they ever were and radio coverage was excellent.

(3) The brochure is to be suggestive to the reader of what he saw and heard. It might be well, as a reminder, to show a picture of the setups. However, a picture reproduced in booklet size might be too small to show enough.

(4) We might consider having separate illustrations for the brochure, possibly only 4 or 5 charts especially made for the brochure.

(5) Everything possible should be done to permit earlier publication of the brochure but at the same time it must serve its purpose of reminding the visitors of what they have seen and heard.

(f) Basic policies

(1) Visitors should not be required to sit at one spot more than 25 minutes at the absolute maximum and 20 minutes is preferable.

(2) The laboratory personnel must know and realize the importance of the inspections and realize that they must do

the job with enthusiasm. This requires an educational program.

(3) When speaking of our work we might emphasize to a greater extent the teamwork between the military services, industry and the NACA, using the word "we" as referring to such a team. The use of the expression "Air Forces" is vague and misleading. Preferably, we should speak of the military services or to be more specific of the Air Force, the Navy, the Bureau of Aeronautics, etc.

at

→ Mr. Hunter

Cleveland, Ohio,
September 30, 1949.

MEMORANDUM For Chief of Research.

Subject: Annual Inspection of 1949.

Reference: "Preparation of Effective Lantern Slides" by L. S. Bonnell appearing in Chemical and Engineering News for September 12, 1949, pages 2600-2606.

1. Our recent annual inspection was well presented and well received. As such it reflected the excellent work of the research and service divisions, including the illustrations group.

2. There were, however, some minor imperfections which reduced the effectiveness of one or more isolated demonstrations. In several instances the difficulty was due, in part, to the fact that a prepared slide or chart had lettering or graphs too small to be legible to the audience in the rear of the room. Such a difficulty is generally easily corrected by methods indicated in the reference quoted, a copy of which is attached. This reference offers other suggestions which may be of value to future research project engineers in the preparation of talks and demonstrations. The article might also be of interest to the illustrations group and other service groups that participate in the preparation of material for NACA talks and activities. It is, therefore, suggested that this reference be called to the attention of these interested parties.

B. E. Gammon

B. E. Gammon,
Aeronautical Research Scientist.

BEG:mlh
HCB
LCG
BP

1 copy Chief of Re. mlh

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Aeronautical Research Scientist.

BEG:mlh
HCB
LCG
BP

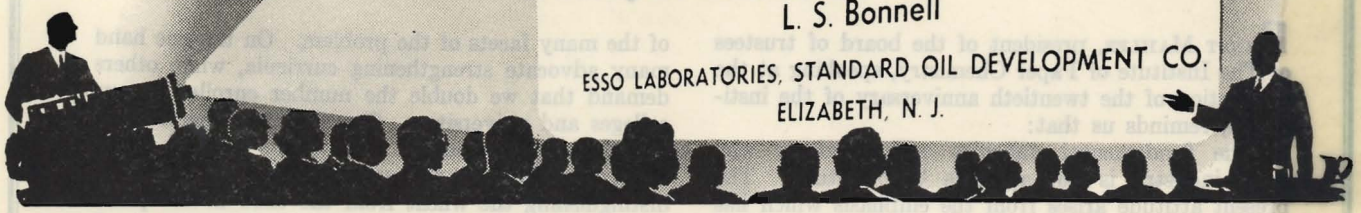
Please return to B.E. Gammon after use.

PREPARATION OF EFFECTIVE LANTERN SLIDES

L. S. Bonnell

ESSO LABORATORIES, STANDARD OIL DEVELOPMENT CO.

ELIZABETH, N. J.



A working guide for those who have occasion to use lantern slides for illustrating an oral presentation of a technical paper . . . It points out certain rudiments of choosing subject matter which are often overlooked and presents simple methods of preparing effective slides

It is generally conceded that poor lantern slides detract from an oral presentation. Many slides are criticized simply because they are illegible to a large number of the audience; oftentimes, because their subject matter is confusing. The literature dealing with the basic problem, that is, the preparation of lantern slide copy, is rather meager and is not always easy to apply to specific situations (*1, 2, 3*). In view of these facts, simple comprehensive methods for preparing effective slide copy were devised and put into use some time ago by various groups of the Standard Oil Co. (N. J.). These methods have been found helpful to the professional personnel charged with the responsibility of presenting technical reports before large groups and are described herein. Preparation of the slide itself has been touched upon only briefly since, with good copy, a competent photographer can produce acceptable slides by well-known methods (*4, 5*).

General Slide Copy Requirements

The use of a specialized procedure in preparing copy for a lantern slide is most essential if the slide is to be effective, first because of the limitations of human vision when dealing with slide projections; and second, because the audience usually has little time to study what appears on the screen. Therefore, one should make certain that his slide copy has been prepared in accord with a procedure, such as recommended herein, which will result in a slide that has the required legibility characteristics, and can be quickly understood. It is never safe to use any conveniently available copy without first ascertaining whether it meets the necessary slide copy specifications.

There are other general requirements for slide copy which should also be understood. For the standard $3^1/_4 \times 4$ inch slide which is preferred for use in auditoriums, the height/width ratio of the full slide field in reading position is 0.8. This is fixed by the maximum size commercial slide mask commonly used which is equivalent in proportions to the conventional projection screen. The corresponding ratio a 2×2 inch slide is 0.7 with the field in the preferred horizontal position. Whenever it can be done without distortion, therefore, the slide copy should have these proportions in order that maximum advantage can be taken of the full slide field. The copy specifications given later take this into account.

In addition, the size of the slide copy and of the printing thereon must bear a definite relationship to the auditorium projection conditions in order to ensure a legible projection. These conditions may vary widely, hence the copy specifications include a convenient means for taking them into account, based on the two factors normally involved. These are the maximum distance of the audience from the projection and the projection width.

Choice of Subject Matter

The first step in preparing slide copy is to select the subject matter. Since this important step appears to be one which often is not given adequate attention, it is worth considering in some detail.

The most effective slide is one which incorporates brevity, clarity, and simplicity. Its reception depends upon the care and judgment exercised in selecting its subject matter. If it cannot be grasped quickly and easily, it usually fails to "sell" what might otherwise be an interesting and convincing presentation. Observance of certain principles which are stated below is therefore of real importance in choosing and arranging the subject matter of a slide, regardless of what kind it is.

1. A slide should present one and only one central idea.

2. A slide should be as brief as possible. It is better to make two slides, each of which will convey its message forcibly and clearly, than to make a single crowded slide that may confuse the audience.

3. A slide need not be entirely complete and self-explanatory, because it is supplemented by the speaker's explanation of the point it is intended to illustrate.

4. Only the specific items to be mentioned in the presentation should be included. All nonessential captions, figures, equations, and the like should be omitted; otherwise, audience attention may wander to unimportant details.

5. The subject matter should be arranged, so far as possible, in the order the items will be mentioned in the presentation.

Dimension and Lettering Specifications

The second step in preparing slide copy is to select the copy and printing size specifications which will ensure obtaining a projection having satisfactory legibility. Fig. 1 is provided for this purpose.

Copy Size. The upper portion of Fig. 1 shows the maximum allowable slide copy dimensions which should be used with different sizes of printing when the projection conditions will be those specified (A/P = 6). These conditions may

CHEMICAL AND ENGINEERING NEWS

WALTER J. MURPHY, Editor

The Perennial Question

ERNST MAHLER, president of the board of trustees of The Institute of Paper Chemistry, speaking at the celebration of the twentieth anniversary of the institution, reminds us that:

"The fundamental difficulty with students who enter industry is not aptitude but attitude. The present attitude arises from the emphasis which has been put in times past upon vocational training rather than upon educational attitude toward learning. Thus, the graduate has tended to think of himself as someone who is prepared *to do* something rather than as someone who is equipped *to learn* something."

In Mr. Mahler's opinion the cause can be traced to the strong trend toward vocationalism in many colleges and universities during the 1920's.

"By substituting 'commercial' or vocational courses for fundamental instruction," he continues, "educators lost sight of the fact that true education is a study of values and not an imitative process. It is folly to try to equip students with memorized answers for every problem they will encounter in later life. An advancing world will not wait while one runs through the file of his memory in order to see whether there is a ready-made answer. Proper education, whether it be scientific or otherwise, should provide an adequate background of values, thereby equipping a student with the ability to think for himself and to meet new situations on terms of broad concepts rather than in terms of dated recipes."

No one will disagree with the goal of education as described by Mr. Mahler. Few will contend that many of our graduates of institutions of higher learning fail, for one or more reasons, to meet the requirements set forth by the speaker.

Certainly it is not true, however, that *all* our graduates lack the major desirable qualifications of being able to think and act independently, to initiate, to lead, and to inspire others. Many do possess these attributes; otherwise, how do we explain the phenomenal advances, scientific and other, achieved in this country over the past two decades?

Our educational system is one with many facets. The results achieved depend upon a variety of factors. The institutions of higher learning are but one of these factors. In the same institution one will find outstanding, mediocre, and poor instruction, inspiring teachers and plain hacks, misfits in the teaching profession as we find misfits in every walk of life. Institutions do not deliberately seek the latter; rather they strive to obtain the best available teachers within a pattern of limitations that is obvious to all.

Revamping and enlarging curricula are not the panaceas some believe them to be—they are merely two of the many facets of the problem. On the one hand many advocate strengthening curricula, while others demand that we double the number enrolled in our colleges and universities. Can the two objectives be achieved simultaneously?

Have we found any really satisfactory means of distinguishing the wheat from the chaff at the point of entrance into our institutions of higher learning? A considerable portion of grade and secondary school education is based on memory ability instead of initiative and perhaps rightfully so. We are making progress in our test methods, but progress necessarily is slow.

Can we say with all honesty that we have as yet reached a point in this country where all of the most promising, regardless of race, creed, or financial status are given the opportunity of obtaining the benefits of higher education? We have progressed farther in this direction than any other country, but much remains to be done before we reach our ultimate goal.

And what about vocational guidance at various levels in our system of education? Again progress is being made, but much yet remains to be done.

In the final analysis the burden rests primarily with the student himself. Those endowed by nature will rise above and conquer adverse conditions. In all honesty this is what we seek to find in men and women after they have left academic halls. When we find it, we recognize, applaud, and reward it. The traits leading to success are many and varied; not all of them can be found in textbooks, nor can the most inspiring teachers in the world plant them, nurture them, and cause them to grow in barren soil. When we can not agree entirely on what constitutes success, the problem is shown in its true light of extreme complexity.

We are optimistic, rather than pessimistic, about the products of our institutions of higher learning. We should remember that our graduates are products not alone of our colleges and universities, but of our grade and secondary schools, our homes, and, indeed, a wide variety of environments. If there is criticism to be made, let us not direct it exclusively at the teachers in our colleges and universities, but distribute it where it rightfully belongs.

Edmund Burke reminded us more than 200 years ago that "The march of the human mind is slow." That the subject of higher education is a perennial question is in itself a healthy omen. Thomas B. Reed, commenting on the slowness of progress, pointed out that the reason why the race of man moves slowly is because it must move all together.

be considered as fairly typical. For other projection conditions, copy dimensions should be based on Equation 1, especially if A/P will be much greater than 6. It follows from this equation that the most efficient use of the available slide field will be secured by first selecting the minimum lettering size, and then sizing the copy accordingly. If 2 × 2 inch slides are to be used, the copy height should be taken as 0.7 of the maximum width.

In the case of copy having fixed dimensions to which printed labels are to be affixed, e.g., a photograph, the minimum lettering size can be found either from Fig. 1 or by computing (H) from a rearrangement of Equation 1. It is recommended, however, that the size of printing for this sort of copy should generally be determined by using the procedure described in a later section on legibility tests.

It is suggested that the speaker should determine, if possible, what will be the values of A and P and be guided accordingly in making the slide copy.

Lettering. It is recommended that slide copy be lettered using either a LeRoy or a Wrico mechanical lettering set, or that it be typed with a special typewriter having boldface Pica Gothic type as described in the next section. Hand lettering, especially of graphs and illustrations, sometimes offers advantages over typing from the standpoints of flexibility and of variable letter sizes. Following are precautions that should be observed in lettering slide copy of all kinds in order to ensure satisfactory legibility:

1. Capital letters of any convenient size can be used; however, the smallest letters must correspond to the maximum allowable width (or height) of the copy selected from Fig. 1, or computed using Equation 1. Vertical lettering is preferred for legibility. Lettering for titles should be two sizes larger than the smallest size lettering.

2. If lower-case letters or symbols having lower-case size are used, the copy dimensions should be about half of those specified in Fig. 1 or computed based on Equation 1.

3. Only the combinations of templates and pen sizes specified in Fig. 1 should be employed. (These give a line thickness to letter height ratio of roughly 0.15 which results in obtaining maximum legibility. Lettering of any kind formed with lines that are either too thin or too thick is not satisfactory.)

4. Spacing between lines should be at least equal to the letter height, to facilitate rapid reading. Spacing between characters should preferably be about one third of the character width, or not less than twice the letter line thickness.

5. The paper used should be a smooth-surface, high-grade material. Tracing cloth is not recommended.

Lettering of tables is usually expedited by first preparing a typed copy, guided by the procedure given in the next section.

Typewritten Copy for Tabular Slides

In presenting technical papers, tabular slides are used quite extensively. Since typing is especially adapted to making copy for tables, it is convenient to describe its applications in connection with such slides although it has other uses. It is emphasized that typewritten copy is acceptable only if a suitable kind of typewriter is used, and if rigid specifications and procedures are followed in preparing the copy.

Equipment. To ensure obtaining clear, legible slides, a machine having the following features should be used:

1. Standard Pica Gothic type with upper case characters and numerals 0.10 inch high specially ground to a line thickness of 0.012 inch. (Only the upper case is used for slide copy.)
2. Electrically controlled action to ensure uniform density.
3. Carbon paper ribbon and a special ribbon feed, to obtain a dense black, clearly defined impression.
4. Roller ratchet for one-half line spacing.
5. Roller of medium hardness.

Typewriters having most or all of these features are manufactured by leading business machine companies. Improved equipment being developed by such concerns, especially machines having a justifying type of carriage, should merit investigation (*6*).

FIG. 1. Recommended Dimension and Lettering Specifications for Slide Copy for 3¼ x 4-Inch Slides

Basis: Dimensions and corresponding lettering sizes tabulated below will be satisfactory when A/P = 6, where

A = Maximum distance of audience from projection (feet)

P = Width in feet of projection with full size standard slide mask (3 inches wide, 2⅜ inches high)

When the value of A/P is much different from the above, copy dimensions should be computed from Equation 1 as described below.*

Maximum allowable copy dimensions excluding margins, inches (1)		Minimum size lettering-template number (2)	Recommended pen number (4)		Letter height	
Width	Height		LeRoy	Wrico	Inches	Mm.
6.7(3)	5.3(3)	100	00		0.100	2.5
8.0	6.4	120	0	7	0.120	3.0
9.3	7.5	140	1	7	0.140	3.6
11.7	9.3	175	2	6	0.175	4.4
13.3	10.7	200	2	5	0.200	5.1
16.0	12.8	240	3	4	0.240	6.1
19.3	15.5	290	4	3	0.290	7.4
23.4	18.7	350	5	3	0.350	8.9

(1) These dimensions refer to copy in reading position and only to subject matter which will appear on the screen when using a full size standard slide mask (3 inches wide, 2⅜ inches high).

(2) These numbers refer to templates furnished in LeRoy or Wrico lettering sets. The LeRoy instrument is supplied by Keuffel and Esser Co., New York, N. Y. The Wrico set is supplied by the Wood-Regan Instrument Co., Nutley, N. J., through Eugene Dietzgen & Co., New York, N. Y.

(3) This size is satisfactory for boldface Pica Gothic typewriter capital letters.

(4) These pen sizes are required in order to obtain maximum legibility.

* FORMULA FOR COMPUTING SLIDE COPY DIMENSIONS

The following equation can be used for computing the maximum slide copy width:

$$C = \frac{400\ P \cdot H}{A} \qquad (1)$$

where C = Maximum allowable width of copy in inches, excluding margins, when in reading position

H = Height in inches of minimum size lettering (capital characters) selected from the above table

A and P are defined as above.

Maximum copy height = 0.8C

Note: When the copy height/width ratio exceeds 0.8, the copy height controls the reduction involved in making the slide; hence this must not exceed 0.8 of the maximum width.

FIG. 2. Specimens of Typing

SPECIMEN OF PICA GOTHIC TYPE WITH CARBON PAPER RIBBON, UPPER CASE CHARACTERS AND NUMERALS GROUND TO 0.012 INCHES WIDTH. LINES ARE 1-1/2 SPACING, 4/IN.

SPECIMEN OF LOWER CASE, THIN-LINE GOTHIC TYPE WITH SINGLE LINE SPACING.

SPECIMEN OF ORDINARY PICA THIN-LINE TYPE, CLOTH RIBBON

FIG. 3. Tabular Slide Copy Design, Example 1

The vertical arrangement of the column headings combined with suitable ruling made it possible to meet copy size and proportion specifications

PROCESSES FOR IMPROVING 200-350° FRACTION					
YIELD AND QUALITY	FEED STOCK	PROCESS			
		RECYCLING		ONCE-THRU PLUS CHEM. TRTG.	RETREATING WITH CATALYST
		MILD COND.	SEVERE COND.		
YIELD, VOL.%	100	93.7	78.5	68.3	80.3
BLENDING OCTANE NO. A	88	96	(106-(112	104	93
BLENDING OCTANE NO. B	89	92	100	96	92
OLEFIN CONTENT, %	18	2	1	1	7(EST.)

Actual-size specimens typed with a machine having the above features are shown in Fig. 2 and, for comparison, a conventional thin-line Pica type is included. Ordinary typewriters having the latter kind of type and equipped with cloth ribbon are generally unsatisfactory from the standpoint of slide legibility, but will produce fair results if the keys are well aligned and if the ribbon used gives a dense black impression.

General Procedure. Ordinarily there are four steps involved in typing copy for tabular slides as stated below. Figs. 3 and 4 will serve to illustrate effective methods of designing and ruling tables in order to meet size specifications and to use space economically.

1. According to the principles outlined previously, the subject matter in the rough draft should be edited and arranged to place the various items in the order to be used in the presentation.

2. The first typed copy is redesigned if necessary to fit within the allowable copy dimensions indicated in Fig. 1 (6.7 × 5.3 inches) or computed from Equation 1. This copy should serve to indicate wherein modifications or rearrangement of the subject matter will be required in order to meet size specifications and to obtain the clearest arrangement of the material. Spacing between lines should not be less than $1^1/_2$ roller spaces. Double or triple spacing is even better; single spacing is unsatisfactory.

3. The final copy is ruled in ink when this is deemed necessary for ease in reading and for purposes of clarity, using light and medium weight lines which clear the characters by not less than about a half character height.

4. The main title, in order that it will be prominent, is printed in a larger and bolder print style than used for the body of the table.

If for some reason the copy for a table has to be hand lettered, reference should first be made to the preceding section on preparing such copy.

Typing Precautions.

1. Smooth, hard surface, high quality paper should be used, free of ripple and grain, and of tracing paper weight (about 11 lb.). THIS IS IMPORTANT.

2. The paper should be backed up with carbon paper (medium hardness); no other backing sheet should be used.

3. The carbon paper ribbon should be of medium hardness.

FIG. 4. Tabular Slide Copy Design, Example 2

ORIGINAL DRAFT: The various sections of the table below at the left are not arranged well for maximum clarity and space economy. Therefore, they were rearranged as illustrated at the right.
REDESIGNED COPY: In the redesigned copy, reduction in over-all dimensions and proper proportioning was accomplished by placing the "CONDITIONS" headings in a column and by reducing spaces between both the columns and the different sections of the table. Ruling aids in distinguishing among the three horizontal sections of the table.

COMPARISON OF VARIOUS CATALYSTS

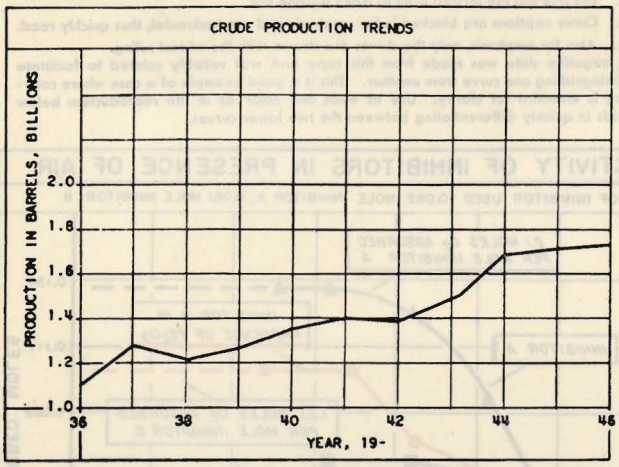
Catalyst	A	B	C	D
Feed Stock Range	--------- 200-270°F. ---------			
Conditions	----- 200#/sq.in., T_1 °F. ----			
Aromatics Yld - vol.%	39	38	42	40
Carbon - wt.%	0.1	0.1	0.2	0.1
Liquid Yld - vol.%	91	89	89	93
Conditions	----- 200#/sq.in., T_2 °F. ----			
Aromatics Yld - vol.%	53	-	52	-
Carbon - wt.%	0.9	-	3.5	-
Liquid Yld - vol.%	81	-	66	-
Conditions	----- 50#/sq.in., T_2 °F. -----			
Aromatics Yld - vol.%	70	62	60	-
Carbon - wt.%	2.8	1.8	4.4	-
Liquid Yld - vol.%	79	81	70	-

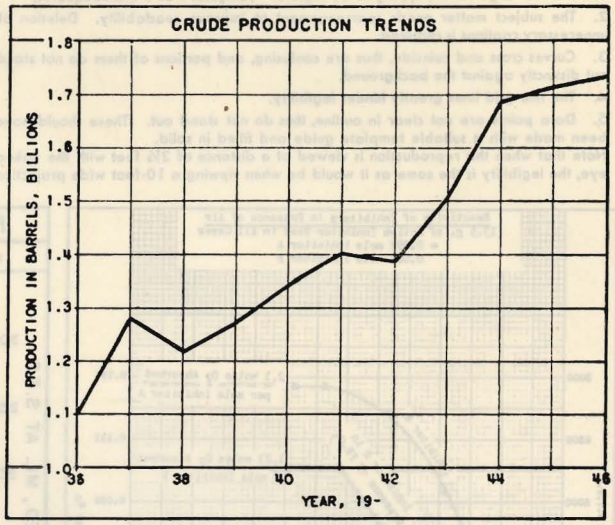
COMPARISON OF REFORMING CATALYSTS

FEED STOCK RANGE, 200-270°F.		CATALYST			
CONDITIONS	YIELDS	A	B	C	D
200#/SQ.IN. T_1, °F.	AROMATICS - VOL. %	39	38	42	40
	CARBON - WT. %	0.1	0.1	0.2	0.1
	LIQUID - VOL. %	91	89	89	93
200#/SQ.IN. T_2, °F.	AROMATICS - VOL. %	53	-	52	-
	CARBON - WT. %	0.9	-	3.5	-
	LIQUID - VOL. %	81	-	66	-
50#/SQ.IN. T_2, °F.	AROMATICS - VOL. %	70	62	60	-
	CARBON - WT. %	2.8	1.8	4.4	-
	LIQUID - VOL. %	79	81	70	-

FIG. 5. Selection of Graph Axis Divisions

The intent of the slides illustrated below was to show trends in U. S. petroleum crude oil production. The one on the left would not be apt to impress an audience with the sharp increase during certain years. The one to the right is more effective in this respect.





4. Erasures should never be made on the final copy.

5. Correction strips should be cemented on the copy, not attached with a water adhesive.

Choice of Type of Slide

The kind of subject matter in a slide or a series of slides may occasionally influence the choice of the type of slide, that is, whether it should be a positive, a negative, or a Kodachrome. Positive slides are more conventional. Negative slides made from ordinary black and white copy have the distinct advantage that they can be readily hand colored thereby greatly enhancing clarity and appearance. Kodachrome slides (*4*) are effective, but the slide copy must, of course, be made up in suitable colors and this may be unduly expensive. The latter two kinds of slides have the disadvantage that they require a well darkened auditorium in order to be fully effective. Use of negative slides will result, however, in obtaining maximum legibility and in minimizing eye fatigue. According to Hecht (*7*), the eye is tremendously more sensitive once it is adapted to darkness, compared to its sensitivity with ordinary illumination.

A colored, $3^1/_4 \times 4$ inch, negative slide can be easily prepared by applying aniline dyes (obtainable from artist's supply concerns) in water solution to the emulsion side of the glass negative plate, using a fine sable-hair spotting brush. Ordinary transparent water colors can also be used (*4*). Light shades of green, yellow, red, or blue are the most effective for line work. Positive colored slides require considerable experience and care, both in preparing the copy and in coloring. The cost of colored slides when done by professionals may be roughly twice that of ordinary slides.

Slides of Graphs

Because graphs are so frequently used in presenting technical papers, a discussion of designing such copy should be of interest. The procedures outlined should also serve as a guide, with respect to weight of ruling and general arrangement of subject matter, for preparing other kinds of illustrations such as equipment drawings and maps.

Hand Lettered Graphs. The general principles previously discussed are used in preparing graphs; the following additional points should be noted:

1. In planning the copy, the different sections of the graph—spaces for captions on axes, main title, and grid section—should be laid out so that the finished copy will have the proper proportions.

2. Axes of the graph should be so graduated that the relationship graphed portrays clearly what is intended and can be grasped quickly. (See Fig. 5.)

3. Extreme accuracy in graphing is normally unnecessary because the objective is illustration and not reading accuracy; hence, only sufficient grid lines to enable rough readings should be shown.

It is frequently necessary and often expedient to construct the grid section of a graph on plain paper and scale it so that the completed copy has the proper proportions; e.g., see Fig. 7. Occasionally, commercial graph paper ruled only in light sky blue will be found convenient since this ruling disappears when photographed with orthochromatic film. Conventional fine-grid graph paper ruled in other colors should not be used unless the colored grid is eliminated by photographing through a suitable color filter.

4. Generally the fewer curves shown in a graph the more readily it will be understood; hence, the minimum number should be shown which will illustrate the relationship in question. When curves cross and/or partially coincide, they should be shown in different colors. Clearances between curves composing a family should not be less than the height of the smallest lettering used.

5. Curves should be identified when possible by word labels rather than by

FIG. 6. Recommended Width of Ruling for Slide Copy of Graphs and Illustrations

MINIMUM PRINTING SIZE LEROY SCALE NO.	WIDTH OF RULING, INCHES®		
	CURVE OR MAIN OUTLINES	BORDER LINES AND AXES	GRID LINES
100x	0.025	0.015	0.010
120	0.035	0.021	0.010
140	0.045	0.027	0.013
240	0.065	0.039	0.018
350	0.090	0.054	0.026

® Regardless of copy dimensions, the width of ruling for a given printing size should be that specified here.

x Corresponds to Pica Gothic type previously specified.

FIG. 7. Redrafting of Slide Copy, Example 1

ORIGINAL DRAFT: The fine-grid graph shown at left (⅓ of actual size) would be hopelessly unsuitable for slide copy because:

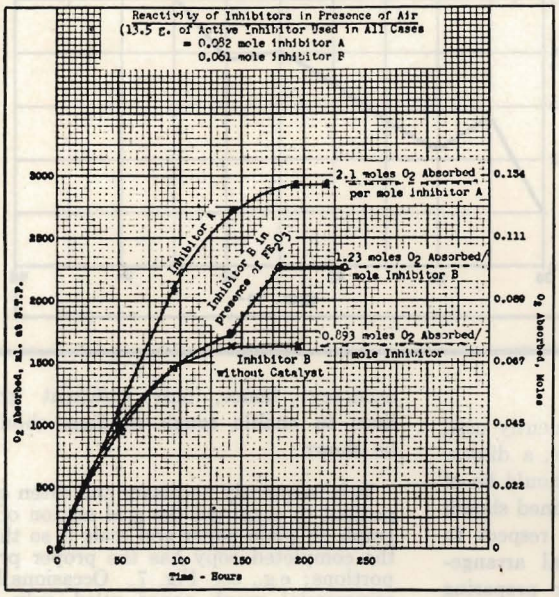
1. It is too large for the typing to be legible. (Original was 9 inches square.)
2. The subject matter needs rearrangement to improve readability. Deletion of unnecessary captions is required.
3. Curves cross and coincide, thus are confusing, and portions of them do not stand out distinctly against the background.
4. The fine grid lines greatly hinder legibility.
5. Data points are not clear in outline, thus do not stand out. These should have been made with a suitable template guide and filled in solid.

Note that when this reproduction is viewed at a distance of 2½ feet with the naked eye, the legibility is the same as it would be when viewing a 10-foot wide projection of a 3¼ by 4-inch slide of this graph from a distance of 75 feet. The reader can thus demonstrate for himself how illegible a slide of this sort would be.

REDRAFTED COPY: Compared with the original draft, the redrafted copy at right is far more legible. Note should be taken that in this copy:

1. The ordinate has a smaller scale which allowed height to be reduced.
2. The title has the largest print to make it stand out.
3. Curve captions are blocked in for emphasis and are horizontal, thus quickly read.
4. Also for emphasis, only the curves are drawn with the widest ruling.

A negative slide was made from this copy and was suitably colored to facilitate distinguishing one curve from another. This is a good example of a case where coloring is essential for clarity. Use of even one color as in the reproduction below aids in quickly differentiating between the two lower curves.



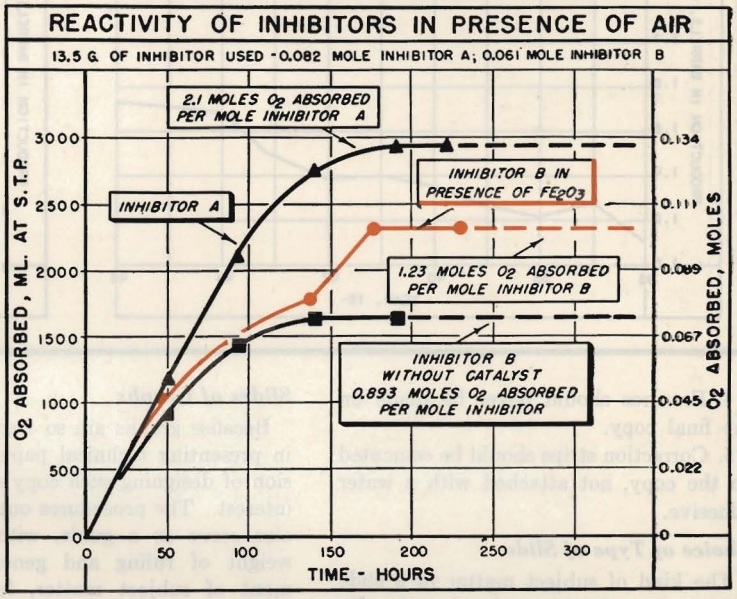
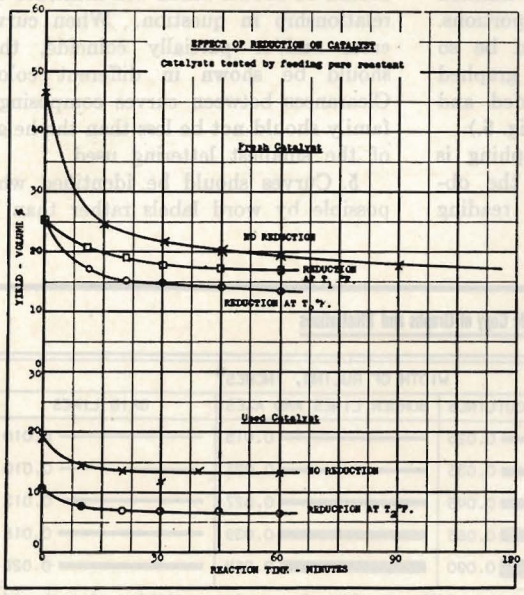


FIG. 8. Redrafting of Slide Copy, Example 2

ORIGINAL DRAFT: Illustrated below at the left is another example of copy which would be entirely unsuitable for a slide for many of the same reasons as in the example shown in Fig. 7. Note that the captions are partially covered by the grid lines and are therefore not entirely legible.

REDRAFTED COPY: Since the data points were not necessary for understanding this graph, they were omitted from the redrafted copy shown at the right. A colored negative slide was made of this copy with the curves labeled "T_2" in one color and those labeled "NO REDUCTION" in another color. Rapid comparison of the corresponding curves in each of the two sections of the graph was thus facilitated, and possible confusion of the audience was avoided.



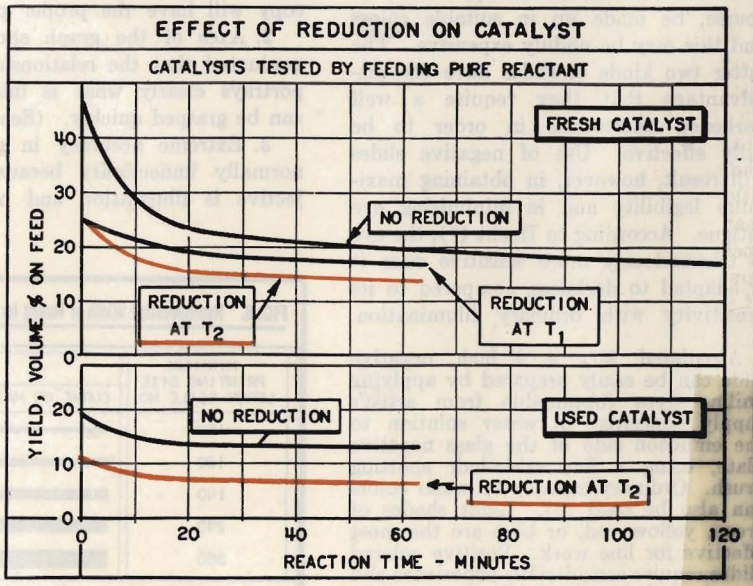
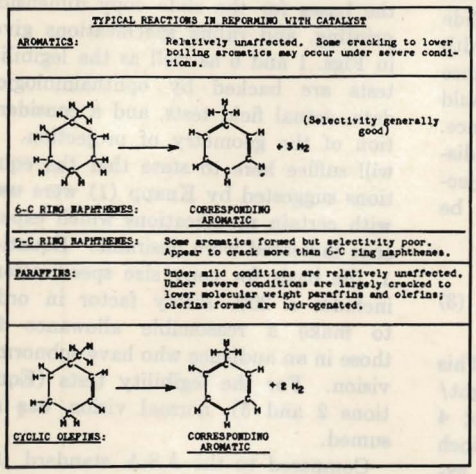
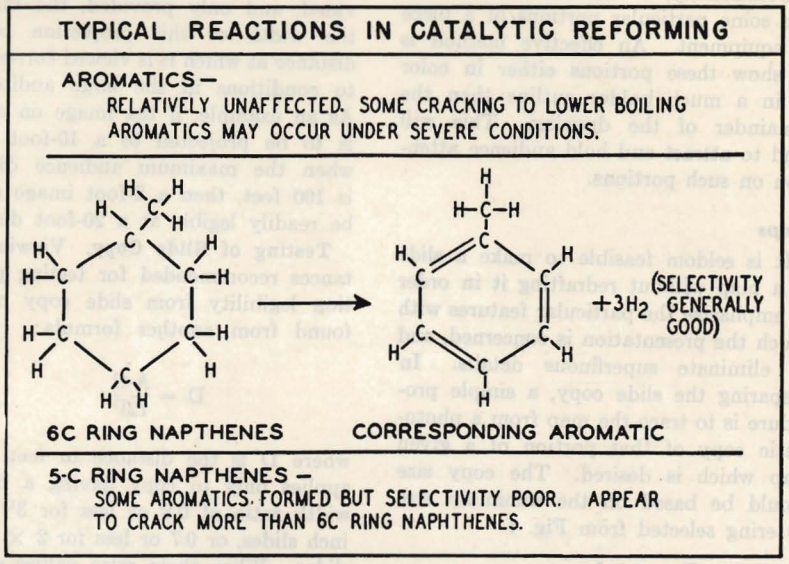


FIG. 9. Redrafting of Slide Copy, Example 3

The typed copy to the left was wholly unsuitable for a slide. It contained so much material that it could not be arranged and printed to make a legible slide. Therefore, it was redrafted to make two slides, one of which is shown to the right. This appears much less crowded, legibility is far superior to that of the original draft, and the double bonds are easily seen because of proper spacing of the ruling.





numerals combined with a legend. The latter scheme is apt to be too confusing to the audience.

6. Data points should be omitted unless they contribute information essential to an understanding of the relationship plotted. If they are included, they should be large enough to stand out beyond the curve (maximum dimension equal to minimum letter height), and should be inked in solid. (See Fig. 7.)

7. All lettering, captions, scale titles, and numerals should be placed in a horizontal position when practical.

8. Titles on the axes should indicate both the nature of the variables and their units of measurement. The same applies to parameter values shown on a family of curves.

9. Lettering sizes should be those indicated in Fig. 1, using the minimum size lettering for numerals on axes and for lettering explanatory captions, the next larger size for axis captions, and the next larger size than this for the main title. Lettering should be located so that when the copy is ruled the clearances between the ruling and the characters will be slightly less than the height of the minimum size lettering.

10. Ruling of the copy should follow the guide given in Fig. 6. This provides emphasis for the most important element of a graph, viz. the curve.

The purpose of most of these statements will be clear from the accompanying Figs. 5, 7, 8, and 9.

Typewritten Graphs. Hand lettering is normally superior to typing in the preparation of graphical slide copy. Satisfactory typed copy can be made, however, if the precautions previously discussed for typing tabular copy and lettering graphical copy are observed. See Figs. 5, 8, and 10. It has been found helpful in laying out a typewritten graph to type axis titles, curve titles, explanatory notes, etc., on a piece of onionskin paper, and place this over a pencil draft of the master slide copy prior to typing it in order to check the spacing and general appearance. Lettering of the main title (LeRoy No. 140 Scale, No. 1 pen) improves the appearance of the slide.

Bar Graphs. Slides of bar graphs are often used for qualitative comparisons. They are sometimes more effective than are tabular comparisons for impressing upon an audience some particularly important fact or group of facts. As an example, the information in Fig. 10 will, to many people, appear more striking in bar graph form than it does in tabular form.

Slides of Process Flowplans

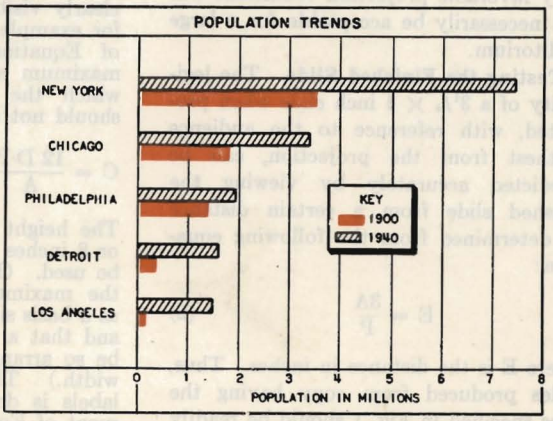
The most important thing to keep in mind in making slides of drawings of any kind is to keep them simple. Drawings should be drafted with the object of emphasizing those portions which are the principal subject of the presentation.

To take a concrete example, a drawing which is intended to illustrate the flow of materials in equipment required for carrying out a given process should be executed with the heaviest ruling tracing the flow of materials, and with a much lighter-weight ruling outlining the vessels. This will enable the audience to concentrate on following the material flow without confusing the flow lines with the vessel outlines. A colored negative slide is most effective when several materials or a complicated flow is considered. If the drawing is to illustrate the shape or disposition of vessels and

FIG. 10. Tabular Versus Bar Graph Slides

The impressive thing about the population trends shown below is that some cities jumped in population more than others. It is immediately apparent from the bar graph, whereas one has to pause momentarily to discern this from the tabular comparison. Coloring of the graph enhances its attractiveness.

POPULATION TRENDS		
YEAR	1900	1940
CITY	POPULATION IN THOUSANDS	
NEW YORK	3437	7455
CHICAGO	1699	3397
PHILADELPHIA	1294	1931
DETROIT	286	1623
LOS ANGELES	102	1504



the flow is of secondary importance, then the vessel outlines should be in the heaviest ruling.

Occasionally, it is desired to emphasize some particular portions of a piece of equipment. An effective method is to show these portions either in color or in a much bolder outline than the remainder of the drawing. This will tend to attract and hold audience attention on such portions.

Maps

It is seldom feasible to make a slide of a map without redrafting it in order to emphasize the particular features with which the presentation is concerned, and to eliminate superfluous details. In preparing the slide copy, a simple procedure is to trace the map from a photostatic copy of that portion of a given map which is desired. The copy size should be based on the minimum size lettering selected from Fig. 1.

Legibility Tests and Their Application

Visual examination at a prescribed distance of either a slide or the slide copy provides a convenient and rapid means of predicting in advance whether or not the slide will be clearly legible to the entire audience in an auditorium. This method, developed from the geometry of projection (*1*), is also useful as a basis for judging whether or not an acceptable slide can be made by photographing a subject such as a printed illustration, a photograph or photomicrograph, or objects having fixed dimensions, e.g., chemical apparatus and small machine parts. In addition, the proper size of lettering for explanatory labels to be shown on such apparatus, for example, can be readily determined.

In applying such legibility tests, it should be remembered that since the audience usually has no opportunity to study details closely, the printed matter and other essential details of the subject tested must be instantly legible to the observer without the necessity of squinting. It is emphasized that slides which appear satisfactory when viewed under very favorable projection conditions will not necessarily be acceptable for a large auditorium.

Testing the Finished Slide. The legibility of a $3^1/_4 \times 4$ inch slide when projected, with reference to the audience farthest from the projection, can be predicted accurately by viewing the finished slide from a certain distance as determined from the following equation:

$$E = \frac{3A}{P} \qquad (2)$$

where E is the distance in inches. Thus, slides produced from copy having the sizes specified in Fig. 1 should be readily legible at a distance of 18 inches. Slides should be viewed against a well illuminated plain white background. A small projection which is recommended in testing 2×2 inch slides, will also serve provided, and only provided, the ratio of the width of this projection to the distance at which it is viewed corresponds to conditions in the large auditorium. As an example, if the image on a slide is to be projected to a 10-foot width when the maximum audience distance is 100 feet, then a 2-foot image should be readily legible at a 20-foot distance.

Testing of Slide Copy. Viewing distances recommended for testing projection legibility from slide copy can be found from another formula:

$$D = \frac{A \cdot C}{12P} \qquad (3)$$

where D is the distance in feet. This applies only to copy having a height/width ratio of 0.8 or less for $3^1/_4 \times 4$ inch slides, or 0.7 or less for 2×2 inch slides. When these ratio values are exceeded, the viewing distance should be computed by substituting 1.25 times copy height for C in Equation 3 if the larger size slide is to be used, or 1.4 times copy height if a 2×2 inch slide is to be used.

Legibility Test for Photographs and Objects. Equation 3 can also be used as a basis for judging legibility when a slide is to be made by direct photography of a subject of the kind suggested above which has fixed dimensions. A photographic or printed reproduction is acceptable copy provided that the portion to appear in the slide is clear in detail and can be photographed to obtain the desired result. The same is true of an object. An example will assist in clarifying this application of Equation 3, and the method of finding the proper size of printing for explanatory labels.

Example. Assume that a slide is needed to illustrate the course of a chemical reaction by means of a number of test tubes with appropriate printed labels under each and that the anticipated maximum audience distance and the projection width are 100 and 14 feet, respectively. If the essential details of this subject are found to be clearly visible at a distance of 6.0 feet, for example, then from a rearrangement of Equation 3, it is found that the maximum allowable copy width within which the tubes should be arranged should not exceed 10 inches. Thus,

$$C = \frac{12\,D \cdot P}{A} = \frac{12 \times 6 \times 14}{100} = 10 \text{ inches}$$

The height should not exceed 0.8×10 or 8 inches if a $3^1/_4 \times 4$ inch slide is to be used. (It should be understood that the maximum allowable width is used as a basis simply for sake of convenience and that a subject need not necessarily be so arranged as to occupy this entire width.) The size of printing for the labels is determined from a rearrangement of Equation 1 as follows using the value of C determined as above:

$$H = \frac{C \cdot A}{400P} = \frac{10 \times 100}{400 \times 14} = 0.179 \text{ inches}$$

A No. 175 template (H = 0.175) would be satisfactory in this case using the pen size specified in Fig. 1.

Derivation of Copy Specifications

For the information of those interested, the bases for the slide copy dimension, printing, and ruling specifications given in Figs. 1 and 6 as well as the legibility tests are backed by ophthalmological data, actual field tests, and a consideration of the geometry of projection. It will suffice here to state that the equations suggested by Knapp (*1*) were used with certain modifications which experience indicated were desirable. Equation 1, the basis for copy size specifications, includes a 20% safety factor in order to make a reasonable allowance for those in an audience who have subnormal vision. For the legibility tests (Equations 2 and 3), normal vision was assumed.

Compared to the A.S.A. standard (*3*), the specifications given here are essentially the same with regard to ruled lines, and to the accommodation of projection variables. Experience has confirmed that the methods recommended will give satisfactory results.

Acknowledgment

The author is indebted to various individuals in the Standard Oil Co. (N. J.), affiliated and subsidiary companies who have contributed to different portions of this paper. Special thanks is due H. G. M. Fischer and A. C Patterson of the Standard Oil Development Co. for their constructive criticism of the manuscript and their continued interest in the educational motive behind this work. The contributions made by Carl A. Moore and others of the Standard Oil Development Co., which provided the foundation of the present paper, are gratefully acknowledged. Also of assistance were numerous valuable suggestions made by C. W. Haemer of the Comptroller's Printing Standards and Charting Division of the Standard Oil Co. (N. J.).

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Files

NACA - Lewis

100.64

Cleveland, Ohio,
September 16, 1949.

MEMORANDUM For Those Concerned.

Subject: Telephone conversation between Mr. James Kelly of the Washington office and R. C. Sessions, September 16, 1949.

1. Mr. James Kelly of the NACA Washington Headquarters office, advised me by telephone today that a NACA plane will come to Cleveland for the inspection on September 21. It will bring only very few Congressional guests - possibly four or five staff members, one Congressman and one Senator. Mr. Sweeney on the Staff of the Senate Interstate and Foreign Commerce Committee will be one of the guests.

2. A total of 15 or 20 persons, including Washington Office personnel will probably come on the plane.

3. The plane will return on the evening of September 21. Arrangements should be made for some sort of a dinner in Cleveland for the visitors before they take off for their return trip to Washington.

Robert C. Sessions,
Executive Officer.

RCS:kmb
cc: Dr. Sharp
Messrs. Baxter
" Emley
" Hunter
" Tousignant
Mrs. Gosney

NACA - Lewis

100.64

Cleveland, Ohio,
September 28, 1949.

MEMORANDUM For Record.

Subject: Conference held on September 28, 1949 to discuss Lewis Annual Inspection, September 20, 21 and 22, 1949.

Those Present: Representatives of each group assigned duties during Inspection.

1. A summary of the suggestions and criticisms is given below:

(a) Demonstration Setups

It was stated that there wasn't enough advance notice of what was needed to be done by the carpenter and mechanical crews. It was suggested that in the future it should be decided as far in advance as possible just what displays are going to be used and notify the proper individuals so that there will be as little last minute rush as possible. It was also suggested that a coordinator be chosen from each Division and conferences be held to coordinate the work for the various shops in preparation of the material for the inspection.

In connection with the charts, etc., the Illustration Department stated that their only objection was that they had too short a time in which to do a good job. The date on which we delivered our material to the Washington Headquarters for approval was later than originally scheduled. The preparation of material for the brochure was consequently delayed and therefore a great deal of overtime was worked in order to finish it on time.

Mr. Calmer stated that it was his belief that the setups could be used again next year and therefore a suitable storage place should be located. It was decided that Mr. Calmer and Dan White will try to find a suitable place on the reservation to store them until the next inspection or for some other conferences during the year.

(b) Speakers and Talks

It was suggested that, in the future, approval be obtained for the outline of each of the talks before they are written and then have the talks prepared according to the approved outline. Many of the talks were written completely and then changed; as a result, a good deal of time was wasted.

Dr. Sharp stated that by removing the technical jargon from the talks the visitors were able to understand and enjoy the talks to a fuller extent. Many favorable comments were made by the visitors in this connection.

Mr. Victory had commented that a few of the speakers voices were monotonous and that should be kept in mind in choosing speakers for the next inspection.

A visitor commented that each of the topics discussed seemed to have been solved or nearly solved. It was suggested that during the next inspection we indicate on the charts those results which have been obtained, those we are working on at present, and those results we hope to obtain.

It was pointed out that we could tell the visitors that from time to time technical conferences are held on various subjects at which time more detailed information and data is presented. It was also suggested that we print in the brochure a statement to the effect that such technical conferences will be held.

It was suggested that next year all the speakers get together and go over their proposed talks so that each speaker knows what the other is going to talk about. Each of the speakers could give some idea of what is coming next and show how the talks are related.

The question was discussed as to whether the speakers should be chosen for their speaking ability, regardless of whether they are working on the specific subject, or because they know the subject well and can also talk well. Mr. Sessions suggested that the individuals involved get together at some later date and discuss the matter because it is an important subject and should be decided. Dr. Sharp stated that new people should have a chance and that they can be trained in speaking during the year at various research meetings and division seminars.

(c) Physical Comfort of Guests

Every visitor must be able to see and hear during the talks and demonstrations. The demonstrations and speakers will have to be put on higher platforms in order that the visitors in the back rows will be able to see. We should know in advance the maximum size of each group so that proper seating is available and we should also allow for extras.

Not more than seating capacity should be allowed on each bus. It was difficult for the group leaders to talk to the people in their groups on the buses because they were so crowded. It is important that each of the group leaders be able to talk to his group on the bus and in that way he can tell them what is coming next and how it ties in with what they had just seen.

For the next inspection we should not allow more than 325 people on any one day and, if necessary, we should have an extra day to take care of the crowd.

DDT should be sprayed at all demonstrations to get rid of the flys.

It was agreed that the number of stops (eight) made during the inspection was a satisfactory number. The fewer stops were a great improvement and less tiring to the guests.

It is up to the group leaders to explain that there is a schedule tokeep and it should be done in such a way as to make the visitor feel that we are keeping things moving in his interest and that he will have an opportunity to see more. We should always have group leaders with good judgement who can handle such situations.

It was decided that we should definitely have the refreshments at the recreation area after the inspection each day, as we did this year, because most of the visitors were favorably impressed by it and it gave them an opportunity to meet other guests they had not had a chance to see during the day, and for the Laboratory staff to meet more of the visitors.

(d) Press

It was agreed that we had better press coverage, both by the radio and the newspapers, than ever before.

(e) Inspection for Laboratory personnel

Many of the Laboratory personnel could not get to see the demonstrations on Friday after the inspection. It was suggested that the whole day be allowed for inspection by Laboratory personnel after the annual inspection next time. Dr. Sharp agreed to devote a whole day next time for attendance by the members of the staff.

(f) Luncheon

Some visitors stated that they had not been served what was on the menu. It was requested that, in the future, we should make sure that there is no doubt that the visitors are getting what is on the menu.

Each day an announcement should be made stating that the girls serving are secretaries and computers from the Laboratory staff who offered their help for the Inspection.

By having an extra day for the Inspection, and thereby cutting down the size of the groups, the preparation of the meals would be much easier. It was again stated that for the next Inspection we will try to keep the groups down to 325 and serve all the guests in the auditorium.

It was agreed that the same luncheon menu should be used for all days of the Inspection, as was done this year.

(g) Transportation, Message Center, Registration

It was stated that the group leaders wasted time by going down to the Hotel to meet the guests.

Next time, we should request that all the buses have a side door exit as well as the front door. It keeps the groups moving faster.

The question was raised as to whether so many drivers were needed. It was decided that it was better to have too many than not enough and there were times during the day when they were all busy. It was agreed, however, to assign another office to them to wait in where they would be out of view of the visitors.

It was requested that during the next inspection an additional phone be provided for the message center. One was not enough.

During the next inspection there should be no overlapping of duties. Some of the girls that worked in the message center also served and this caused complications.

It was decided not to collect the badges from the visitors before they went to the picnic grounds because the badges helped the visitors mix together. In fact it was decided that badges need not be collected at all.

During the next inspection, dark colors will not be used for badges. The same colors can be obtained in lighter shades. It was difficult to read the name on the badge under the dark color.

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NACA - Lewis

100.64

Cleveland, Ohio,
September 28, 1949.

MEMORANDUM For Record.

Subject: Report of conference called by Mr. John F. Victory on September 22, 1949, to discuss the Annual Inspection of the Lewis Laboratory.

Those present: Messrs. J.F. Victory, W. Bonney, R.C. Sessions, W.E. Emley, Jr., E.G. Sharp, S. Calmer, A. Silverstein, E.J. Manganiello, W. Hunter, M. Hood (Ames) and D. Wiley (Ames).

1. A summary of the suggestions and criticisms is given below:

(a) General arrangements, schedules, handling of guests, etc.

(1) We should give as close as possible attention to the timing of the inspection so it does not conflict with other events in the community or events that the people we invite are interested in.

(2) Introduce the group leaders at the morning meeting. The group leader should in turn introduce his assistants on the first bus ride. It would be well also for the group leader to tell the guests to feel free to ask questions.

(3) The leaders should be distributed through the bus.

(4) Cleveland employees should have a distinctive badge, perhaps a different shape.

(5) Mr. Victory stated that he was immensely pleased and knew the Committee would be at the excellent teamwork between the laboratories.

(6) The continuity theme that was used this year was excellent but more clockwise attention will have to be given to the tour in order to preserve the continuity of the theme.

(b) Invitations and attendance

(1) The attendance of the military is so unpredictable that we might consider breaking the military day into two days with a quota for each day for the number of people to

come from Wright Field. If two days is unsatisfactory, we could limit Wright Field attendance to 100. In any case, a quota seems advisable - it commands attention. If we are to start a new relationship with Wright Field, Mr. Victory stated that now would be the time to start inasmuch as the new Commanding General, General Chidlaw, is very friendly.

(c) Demonstrations, subject matter of talks and clearances

(1) Have fewer NACA Headquarters people necessary to approve the text of the lectures and the brochure. Have them all review the material at the same time and recommendations be submitted to the Laboratory at one time.

(2) Summarize at the end of each talk and do it very simply. Tell what you are going to tell them - say it - and then tell them what you told them.

(3) Mr. Bonney reported that Adm. Richardson had stated to him that the level of presentation was just about right this year. It was high enough so people would not think they were wasting their time coming but was stated so most of them could understand it.

(d) Details of exhibits, properties and presentation

(1) Raise the speakers at the morning meeting about a foot by using a stand. Avoid use of the stage, however, because of its formality.

(2) Raise the exhibits and demonstration speakers high enough to be seen by all.

(3) Remember that persons sitting in the seats in front block the view of those in the rear and take this into consideration when checking to see if the exhibits, demonstrations and speakers are high enough.

(4) Provide more comfortable chairs and sufficient chairs to accommodate any possible overflow.

(5) All visitors must be able to see and hear, and in providing for this take into consideration the maximum possible attendance.

(6) At the 8' x 6' Supersonic Tunnel, some of the audience had to stand or sit in positions from which they could not see or hear.

(7) The level of color was correct.

(8) The austerity was just about right.

(9) The backdrop material did not give the effect of expensive. It was something obviously put together quickly with little expense but was in good taste.

(10) Mr. Victory did not like the use of charts with portions blocked off as was done at the 8' x 6' Supersonic Tunnel demonstration. Rather than this, he suggested the use of an arrow or a box around the words which are being emphasized so as to leave the whole chart readable.

(11) Mr. Victory commended the Laboratory on the 8' x 6' small tunnel stunt. However, it was so tricky and clever it appeared to be faked.

(12) At the Altitude Wind Tunnel, the first of the younger speakers was monotonous and his voice did not hold the interest of the audience.

(13) The 8' x 6' tunnel and the compressor demonstrations were too long.

(e) Press

(1) It is very desirable to have a press conference at the end of the day in the press room with a man fully qualified to answer spot questions and not get fouled up and whose reactions are fast.

(2) The press arrangements this year were handled far better than they ever were and radio coverage was excellent.

(3) The brochure is to be suggestive to the reader of what he saw and heard. It might be well, as a reminder, to show a picture of the setups. However, a picture reproduced in booklet size might be too small to show enough.

(4) We might consider having separate illustrations for the brochure, possibly only 4 or 5 charts especially made for the brochure.

(5) Everything possible should be done to permit earlier publication of the brochure but at the same time it must serve its purpose of reminding the visitors of what they have seen and heard.

(f) Basic policies

(1) Visitors should not be required to sit at one spot more than 25 minutes at the absolute maximum and 20 minutes is preferable.

(2) The laboratory personnel must know and realize the importance of the inspections and realize that they must do

the job with enthusiasm. This requires an educational program.

(3) When speaking of our work we might emphasize to a greater extent the teamwork between the military services, industry and the NACA, using the word "we" as referring to such a team. The use of the expression "Air Forces" is vague and misleading. Preferably, we should speak of the military services or to be more specific of the Air Force, the Navy, the Bureau of Aeronautics, etc.

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COMMENTS ON 1949 LEWIS LABORATORY INSPECTION

18459

General:

The Lewis Laboratory is to be congratulated for an interesting and effective inspection. The large number of demonstrations were carefully prepared and resulted in a major improvement over previous inspections. The talks were well organized and composed so as to be readily understood, and were well delivered by all speakers.

Charts:

This year's charts were of ample size and material was presented in an excellent simplified form. The use of colors has been greatly reduced, and it is believed that this trend could be further extended in limiting their use to strictly functional purposes. It is believed that the main titles of the charts should be in black rather than the dark blue used, in order to give them greater weight.

Chart Stands:

It is believed that smaller and simpler chart stands are in order to aid in dispelling the idea on the part of the visitors that too great an effort goes into the preparations for the inspection. For example, one of the visitors remarked that it must take the Laboratory several months to prepare the inspection. It is recommended that simple chart stands just large enough to accommodate the charts be used, and that the charts be moved into view by the speakers.

Lunch Period Exhibit:

The omission of the usual on-the-stage instrument exhibit must have been apparent to all previous inspection visitors. It is believed that considerable interest in this type of exhibit has been shown by the visitors in the past, and that resumption of this type of exhibit should be considered for future inspections. It is the only opportunity the visitor has for asking questions and closely examining research equipment.

Demonstrations:

The Lewis Laboratory is to be commended upon their extensive use of attractive demonstrations throughout the tour. It is believed, however, that wherever possible a greater use of the actual research equipment in demonstration should be made in order to give the visitor a better concept of research equipment and how research is actually performed. This point is

illustrated by Langley inspection demonstrations in the Spin and Free-Flight Tunnels, Tank, Impact Basin, Gust Tunnel, etc.

9-22-49

NOTES ON THE COSTS AND VALUE OF THE INSPECTION

1. The intangible costs of the inspection in reduction of research output due to the diversion of personnel from their regular tasks and necessary interference with research operations is not known but is demonstrably less than the two Laboratory weeks estimated by some ($604,681).

2. There are good reasons for assigning a lower cost. An inspection provides our own organization an opportunity to take stock of our research progress and to present important results in a refreshing way to important people who haven't the time or the technical ability to digest our reports.

3. An inspection enables our research staff to meet and become acquainted with important men in aviation. Some of these contacts facilitate future contacts or result in on-the-spot exchange of information that either would not be learned or would otherwise cost our staff many days of travel - travel that costs NACA an average of between $20 and $80 per day exclusive of salaries.

4. By bringing in large groups of interested guests under conditions of our own choosing, we are able to avoid many hours of accompanied individual tours throughout the year with the attendant problem of securing individual clearances from Headquarters.

5. An inspection provides an opportunity for key personnel in NACA Headquarters, at the Langley and Ames Laboratories, and our West Coast Coordinator, as well as the main committee to get brought up to date on research progress made by the Laboratory and the availability of new equipment.

6. An inspection provides good training for a large group of research men in describing their work in straight forward English, in learning the value of good preparation and in developing good speaking habits and poise that will facilitate their presentation of more technical discussions at other times.

7. One of the most important by products of the inspection is the unusual opportunity it affords for every employee of the Laboratory to hear an understandable presentation of representative work in each division during employee's day after the official inspection. For the

three fourths of our employees who are not research scientists and for many scientists who do very specialized research, this opportunity to see and hear presentations of research results in all fields is not equalled by any other NACA activity; this gives morale a good boost because the employee sees accomplishments in a new perspective.

8. Many employees whose work is hindered by the inspection, but who have no duties in that connection, take annual leave during the inspection thus avoiding loss of research effort since the annual leave might otherwise be taken when research would be possible.

9. Many activities in the Laboratory, including most of the theoretical investigations are in no way affected by the inspection. In fact, theoretical research may benefit from the increased availability of computers whenever experimental research data is not taken during the inspection.

10. The need to maintain order and good working conditions is emphasized by the inspection which provides priority and a deadline for completion of construction and maintenance work that might otherwise suffer delays. The resulting improvement in Laboratory appearance is beneficial to the employees and in the long run saves maintenance funds.

11. The inspection provides a wealth of material for publicity about NACA - an activity that does much to insure continued financial support by the public. The nature of the talks and demonstrations prepared for an inspection are more suitable for such publicity than others prepared by the Laboratory and much effort is saved in getting our story to the public. The inspection took 3-1/2 days of all-out effort plus 1/2 day for all rehearsals, a total say of four laboratory days or 1.54 percent of a laboratory year which, at the normal rate of Laboratory expenditures, would cost about $241, 872.

12. The actual direct costs to which all time and material were charged on PJO 706 total only $79,723.48 and it is estimated that the cost of administrative overhead incurred by the show would add about 65% or $52,000. The actual cost of the inspection is, therefore, roughly $ 131,724 which corresponds to normal expenses for only 2.2 Laboratory days based on our 1950 budget of $15,706,000. Therefore, only about 55% of the Laboratory can be assumed to be engaged in the inspection for a four day period.

13. A total expenditure of $131,723 for 1275 guests amounts to about $103 per guest. This emphasizes the need for making a careful selection of guests. It further suggests that any increase in the cost of brochures or other effective souvenirs, which will help to insure that our guests remember what they saw and heard, may be well worth while.

NACA Lewis Flight Propulsion Laboratory

Costs of 1949 Inspection

Technical Labor (Engineers and Research Scientists, who designed setups, prepared and rehearsed talks, assisted as speakers, guides, attaches, etc.)	$	21,618.46
Service Labor (Design Illustrators, Photographers, Carpenters, Shop personnel, Buildings and grounds.)		46,493.30
Obligations, Materials, Supplies, etc. (Rental of buses and television, material from stores.)		11,611.72
Total direct charges(against PJO 706 -)		79,723.48
Administrative overhead (estimated about 65%) (Planning inspection, rehearsals, groupleaders, general administrative work on inspection, approvals, brochure, press releases, registrations, special correspondence.)		52,000.00
Total direct cost (estimated)(Cost of painting permanent facilities are not included)	$	131,723.48

1949 Inspection

Direct Charges on PJO 706

Tech. Labor	$ 21,618.46	)Design, talk preparation, Engineers, Speakers)
Service Labor	46,493.30	)Photo, Illustration, Carpenters, Building and Grounds)
Obligations, Materials, etc.	11,611.72	)Busses, Television rental)
Direct Costs Total	$ 79,723.48	

70% overhead (say $56,000)

Doesn't include costs on such items as administration and all overhead group.

Future costs of this nature will be more completely accounted for (per B. Clauser)

None of the painting of permanent facilities is charged.
Western Union teletype operator for press not included.
Electrical power due to diversion of personnel and interference
Intangible costs including loss of research output (estimated at two Laboratory weeks) cannot be computed.
2/52 or roughly 4% of were handled by the NACA Exchange
Guest Luncheon ticket sales entirely supported the cost of the luncheons for three days, the refreshments served the press, the refreshments for guests at the picnic grounds as well as those served employees at the end of their inspection tour, September 23, and special entertainment at Hotel Cleveland.

Data on Peak Loads Experienced during Annual Inspection - 9/20 - 22

FOR RECORD PURPOSES

Morrow - Wandersleben - 11/3) Peak loads were reduced by straddling 30 minute metering periods with 8 x 6 Ft. Tunnel operation.

Precedent was established for operating 8 x 6 Ft. Tunnel during daytime at less than maximum speed.

	8:30 - 5:00	Normal Day (peak)	30,000 KW
9/20	3:30 - 4:00	Peak	21,000 KW
	1:00 - 1:30	Peak - lunch	23,000
9/21	11:30 - 12:00	Peak	24,500
	1:00 - 1:30	Peak - lunch	22,000 KW
	3:30 - 4:00	Peak	24,500 KW
9/22	10:00 - 10:30	Before tour started	28,200 KW Peak
	1:00 - 1:30	Lunch for guests	22,000 KW For Show
	3:30 - 4:00		23,000
9/23	10:30 - 11:00		6,000
	9:30 - 10:00		6,000