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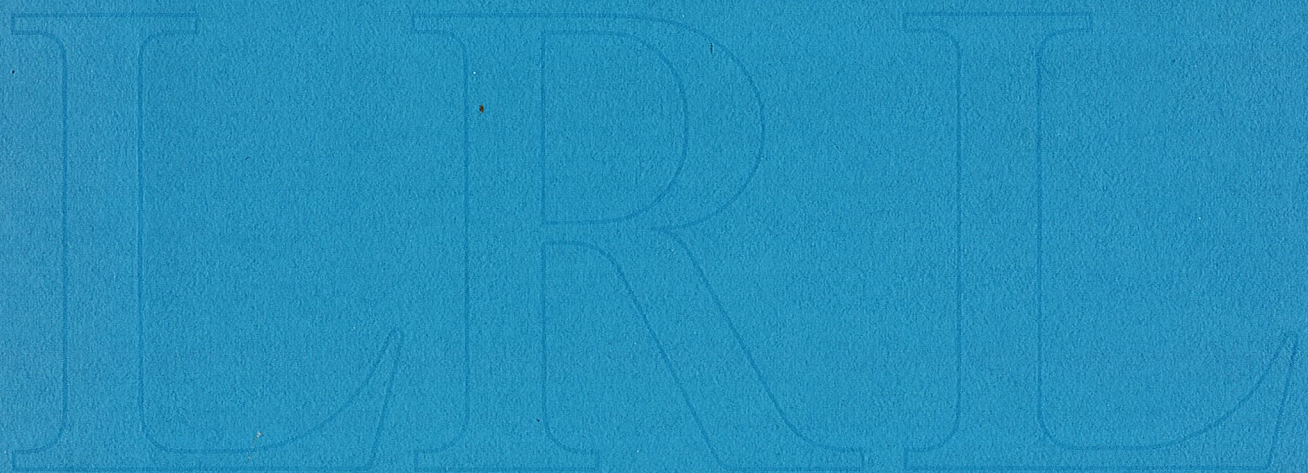
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HELP FOR REPORT WRITERS

Charlotte E. Mauk

September 1964

AEC Contract No. W-7405-eng-48



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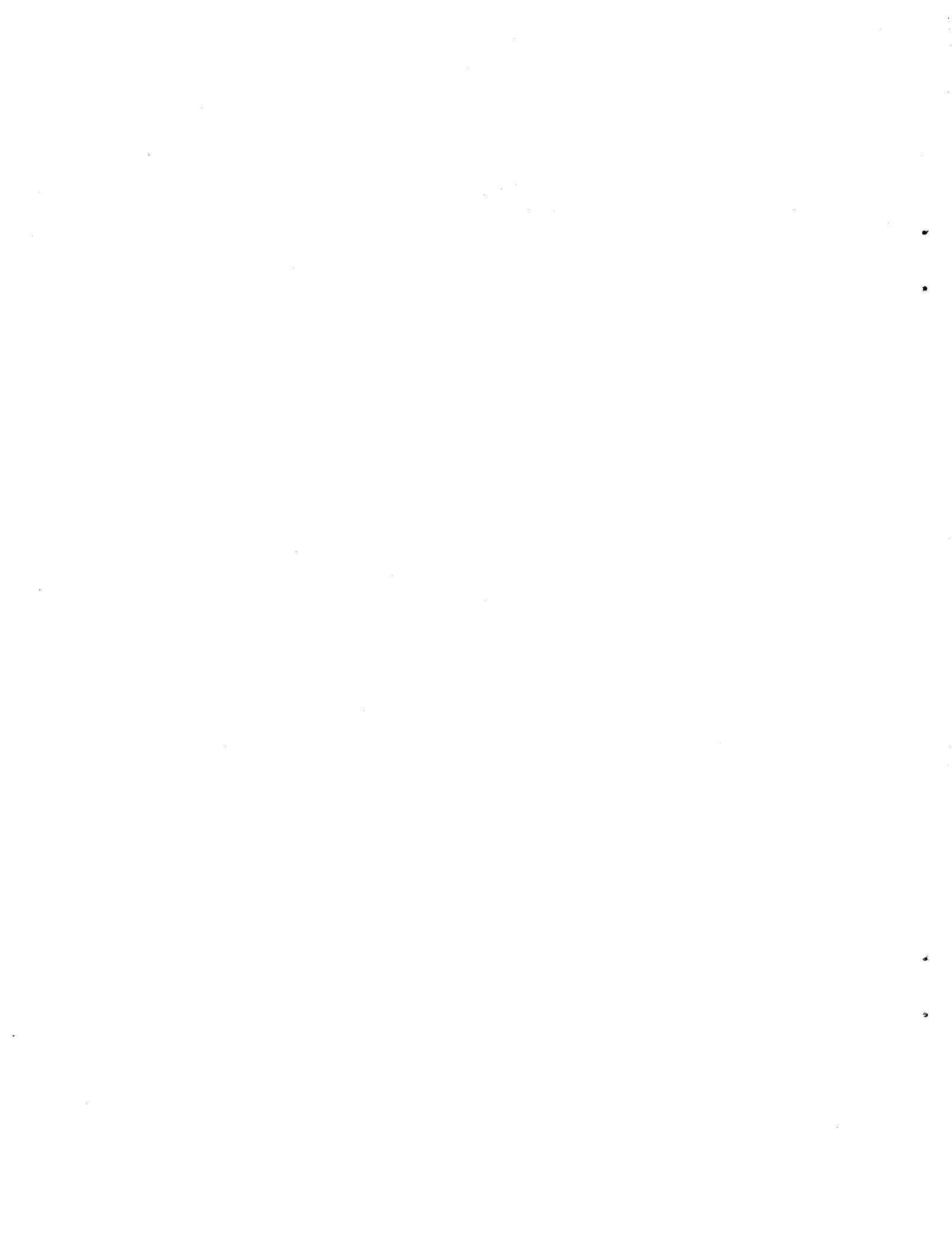
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## HELP FOR REPORT WRITERS

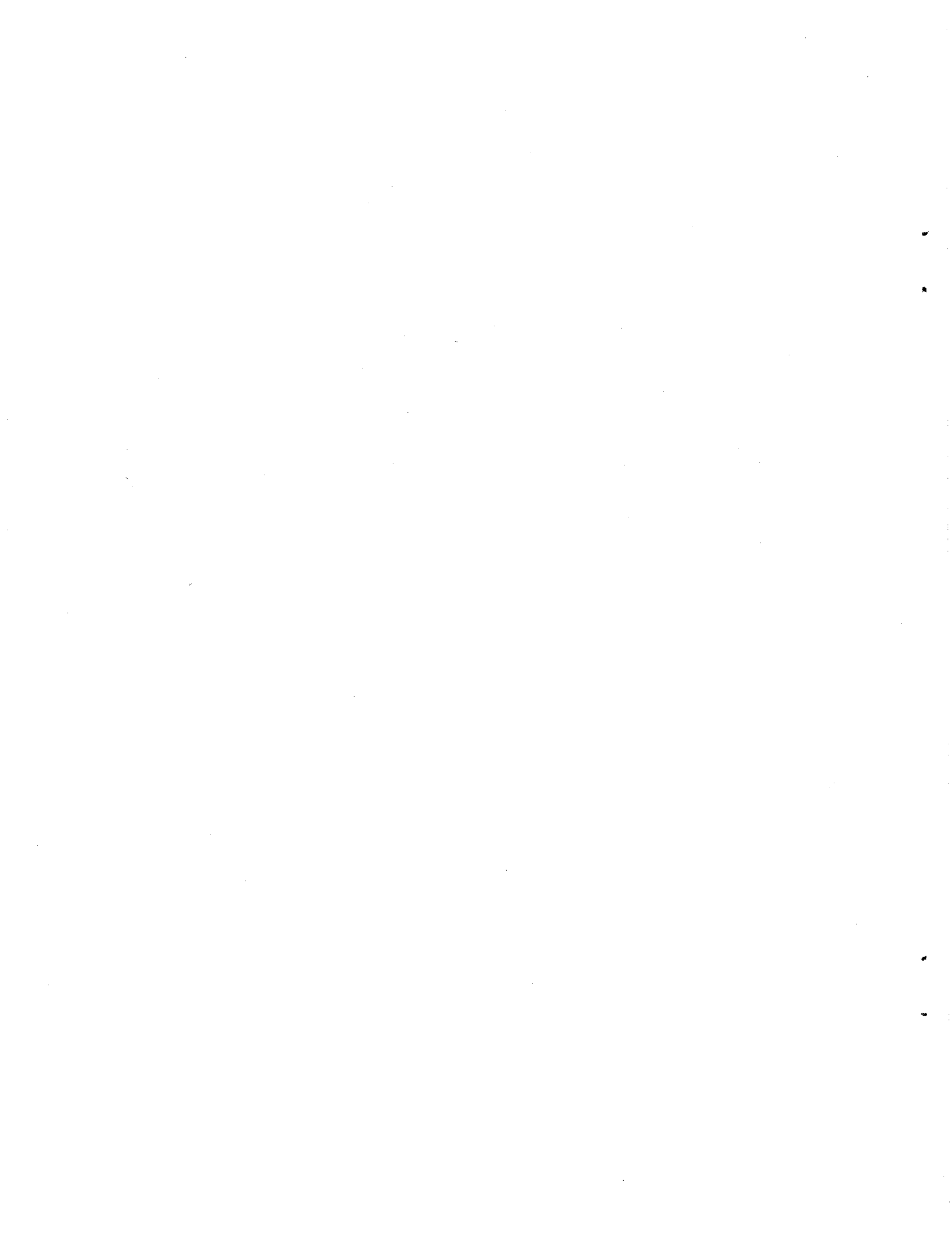
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Berkeley, California

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### ABSTRACT

Suggestions to writers of UCRL reports are accompanied by illustrations and examples. The experimenter is encouraged to approach the task of writing with confidence and to leave it with satisfaction for himself and for the reader. This paper presents material on usage, style, and form, and suggests how to avoid some of the most common errors. Specific LRL usages are given. The course of a paper through editing and reproduction is briefly described.





## INTRODUCTION

The scientific report is the final step in a unit of research. Whether it takes the form of a thesis, a paper for a meeting, a contribution to a periodical, or an internal project publication, it presents the researcher's findings to an interested and sympathetic audience. Its preparation should not be regarded as either terrifying or burdensome—but neither should it be approached too lightly. Good experimental results deserve good packaging.

A good report is one that is logically arranged and clearly stated, and expressed as simply as the subject matter permits. Unfortunately, it seems that logic, clarity, and simplicity are hard to come by, and not all reports do justice to the material they present.

The purpose of this guide is to encourage writers of reports and to help them in making their reports as readable and useful as possible. Suggestions are offered for correct writing and easy reading, and some of the principal pitfalls in report preparation are pointed out.

## ORGANIZATION

The writer of a report usually wants to tell what he was trying to do (Introduction), how he went about it (Method and Apparatus), what he found out (Experimental Results), and how he interpreted the findings (Conclusions). The Introduction and the Conclusions, taken together, should give the essence of what was done; the rest of the report should tell how and provide the detail. An informative abstract, telling a browser what the report covers and helping an indexer to document it, should provide the reader with the substance of the paper at a quick glance.

Especially in a paper for a journal it is desirable to have a brief section on Results and Conclusions follow the Introduction directly, then to go into the necessary detail on methods, apparatus, and findings. Or it may be well to include a very brief outline of method in the body of the paper and to present details in an appendix.

The recommended procedure is for the writer to prepare a comprehensive outline at the beginning and then fill it in step by step. If he doesn't easily work that way—and it should be recognized that there are some who don't—he should start by getting down on paper the things that are in his head just bursting to be said, then take stock of what he has and what is needed (here comes that Outline), and finally round out the work into a complete and orderly presentation. This latter method may not be the most efficient, for it usually calls for considerable rearranging and rewriting as well as filling in, but because it permits the unaccustomed writer to make a start more easily and warm up gradually, it may result in an easier, more readable style. It may also relieve some of the anguish with which a researcher contemplates report writing.

In either case, the writer should go back over the completed draft and make sure that he has described results, for example, under that heading and not under "Apparatus" or "Method," and that the progression from one point to another is logical and has not been made so rapidly that it leaves unanswered questions. It is neglect of this step that makes so many papers read like a collection of afterthoughts.

Because he is entirely familiar with the subject, the average researcher has to make an effort to see where the reader may have difficulty in following him from point to point. He should reread his draft, section by section and sentence by sentence, asking himself: Does the reader have to jump too big a gap from there to here? Does this statement really fit here better than anywhere else? Does it really convey what it is meant to say?

If he has time to make a complete draft and then set it aside long enough to partly forget it, the writer, on rereading the manuscript, will find any number of things that the reader (or editor) shouldn't.

## GUIDANCE FOR THE WRITER

Many a scientist who can present his ideas with fluency and simplicity in oral discussion becomes tongue-tied (finger-tied?) when he has to put them in writing. If he could approach the task with a relaxed and matter-of-fact attitude, both he and his reader would have an easier time. Why can't he make his report more nearly conversational in style? Maybe he confuses stiffness and circumlocution with the formality and dignity he hopes to achieve. He should heed Ulman,\* who says, "Don't try to impress your reader; try to tell him something."

Naturalness and directness are not incompatible with dignity; simplicity is an ingredient of true elegance. Reports will be better when those who write them come to appreciate the beauty of straightforward English.

Many of us tend to make written sentences too much longer than spoken ones. It is natural—and correct—to tie several ideas together into one unit when we are composing formal statements. We pause more frequently than to think ahead than we do in conversation; we work out a certain fusion of related ideas. The danger is that the fusion may grow into confusion. We would do well to stop occasionally to look at the results from the viewpoint of the reader, and make sure we don't overwhelm him.

A fault in many papers is ambiguity. Not the words that are used, but the way they are placed, may keep the reader from understanding their meaning. What is perfectly clear to the writer (who knows what he is talking about) may not be so to the reader (who is trying to find out). A criterion of clarity that is easy for an editor to apply is whether he has to go back and read a passage over again to find out what the writer intended. The writer seldom develops sufficient detachment to appraise his own sentences, but perhaps he can try them out on somebody less familiar with the field—a patient wife, for example—to see if an uninitiated reader can tell what the sentence is saying even without knowing what it is talking about.

Fashions change—in writing as in anything else. The flowery ornamentation that once passed for elegance is as obsolete as gingerbread architecture. Simplicity is valuable. Further, what some of us were taught to avoid may be perfectly good English. It is no sin to occasionally split an infinitive or to use a preposition to end a sentence with. We often gain both clarity and ease by doing so.

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\* Joseph M. Ulman, Jr., and Jay R. Gould, Technical Reporting (Holt, Rinehart and Winston, New York, 1959).

Worst of all the old taboos that make for awkwardness, ambiguity, and downright ridiculousness is the effort to avoid use of first-person pronouns. Many of us handicap ourselves unnecessarily by not saying "I," "we," or "our" when the context calls for it. First-person expressions, judiciously used, would improve most scientific reports. The editor of Physical Review favors the natural use of first person. ASTM instructs authors to use it. We can be just as objective in writing "We made four different tests" or "I believe that . . ." as in self-consciously twisting our sentences into the passive construction. (See Ulman, Section 13.13)

In general, what sounds natural and unstilted is the best writing.

#### Help When Needed

This report is not intended to make up for what a scientist did not get around to learning in Freshman English (or may have forgotten since then), but it can suggest some valuable reference books. All are in the LRL library; each is particularly helpful in a different way.

Perhaps most generally useful is Ulman and Gould's highly readable "Technical Reporting." Ulman combines a matter-of-fact approach with good exposition. There is a lot of common sense in his presentation of a few rules of punctuation, for instance. See especially Sections 15.2 and 15.7. His clear explanations why and his examples of how not to are worth a few minutes of anyone's time. See also his sensible and enlightening treatment of hyphens and compound modifiers, the section on dangling modifiers (14.4), and the chapter on style (Chapter 13).

For authentic reference on usage—and for generally delightful browsing—there is nothing like Fowler's "Modern English Usage."<sup>\*</sup> (The only trouble is that the browsing in this book is too delightful. Rarely can one go directly to a single item, read it, and resolutely shut the book; he is much more likely to find himself in the middle of a chuckle and wonder, "Now, what was it I started to look up?") Fowler's concern is for correctness without pedantry, and it is fun to watch him prick the pompous. He not only presents what is correct and tells why what's wrong is wrong; he also gives enough illustrations that the reader can develop a feeling for the usage. Among the best expositions are those on how to use hyphens (p. 243) and Fowler's definitive treatment of "that" and "which" (p. 634).

Evidence in UCRL manuscripts suggests that many report writers could profitably look up such articles as "Superstitions" (p. 586), "Preposition at end" (p. 457), "Unattached participles" (p. 674), "Enumeration forms" (p. 142), "Walled-up object" (p. 699), and "Double passives" (p. 121). The reader will have fun while learning.

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\* H. W. Fowler, A Dictionary of Modern English Usage (Oxford University Press, 1944).

More? Try "Elegant variation," "Gerund 4," "Such," "Out of the frying pan," "That, conj., 4," "Overzeal," "Due" and "Owing to," and "Formal words."

Other helpful references are:

The McGraw-Hill Author's Book (McGraw-Hill Book Company, Inc., New York, 1955).

Author's Guide for Preparing Manuscript and Handling Proof (John Wiley & Sons, Inc., New York, 1950).

A Manual of Style (University of Chicago Press, Chicago, 1949).

Kate L. Turabian, Manual for Writers of Term Papers, Theses, and Dissertations (University of Chicago Press, Chicago, 1955).

In all questions of meaning, spelling, and hyphenation or combination of words, Webster's Unabridged Dictionary is the generally accepted authority. For technical usage the AIP Manual\* gives preferred forms.

Style for UCRL reports (i. e., capitalization, references, forms for equations, etc.) coincides in most respects with that followed in AIP publications.

#### Some Common Pitfalls

Emphasis here on a few persistent errors may help writers to avoid them. This is no attempt to make a complete list, but merely a spotlight to illuminate some of the places at which poor writing is easily cured. Some of the errors are so common that even good writers may find themselves represented.

#### Dangling expressions

The unattached participle is probably the commonest fault. It leaves the reader dangling and the writer looking foolish. Often it is the result of the writer's shrinking from use of a personal pronoun. To avoid saying "I" or "we" he may put down some such nonsense as "Boiling the mixture with sodium chloride, a white solid was obtained." The reader is left with the unsatisfied feeling of having started to read one sentence and finished another. Who boiled the mixture? (He won't believe the white solid did it!) If the reader's senses have been assailed often enough by this illogicality he may be able to pass over it with scarcely a shudder. But how much easier for the writer to have said, simply, "...we obtained a white solid." Or, if he is not bold enough to own up to having done the work, the experimenter may

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\*Style Manual for Guidance in the Preparation of Papers for Journals Published by the American Institute of Physics, New York, revised Second Edition, 1963 (PUB. R-128).

record, "When the mixture was boiled with sodium chloride, a white solid was obtained."

The writer whose eyes are open may enjoy recasting some of these: "When cutting from the solid the chips stick to the cutter and clog the teeth." (The chips do the cutting?) "By recycling the heavy fraction, the recovery of light molecules is increased." (The recovery recycles the fraction?) "Upon radiographing the welded joints, the security of the system is assured." (Security does the radiographing?) "On mixing, additional assumptions would, however, be necessary in the choice of such a mean potential energy, and this does not seem to be warranted in the present asymptotic theory."

### "Data"--a plural

"Data," being a plural noun (singular: datum), requires the plural form of a verb: "The data are all here," not "the data is all here." Although Ulman makes a case for occasionally treating "data"--in the sense of "a body of information"--as singular, such expressions as "this data" and "data is" grate harshly on the knowing ear. Let not LRL be among the first to depart from what still is (and may long be) the correct form.

### "Such that"

An inexplicable misuse seems to be creeping through the laboratories. It is not a part of the justifiable jargon, but a downright misapplication: the use of "such" where "so" is called for in an adverbial expression. Thus we find the strange and senseless statement, "This is a circuit arranged such that..." What is called for is either "...is arranged so that..." or (more wordily but no more clearly) "...is arranged in such a manner that..." The word "such" is an adjective, indicating kind, character, degree, or extent; "so" is an adverb with the sense of "in the way or manner indicated." (Fowler deals interestingly with some other misuses of "such.")

### "That," "which"

An unfortunate misconception is that "which" is a more elegant form of the relative "that," and that its use makes speech or writing more formal. The truth is that each has its own use, both in speech and in writing. We say, "The book that is on the mantel is new" when we want to make it clear that we are talking about one particular book as distinguished from all others in the room. "That," in such an expression, is serving a defining use. On the other hand, "which" is called for in a nondefining clause. "The new book, which is on the mantel, came today." The fact that the book is on the mantel has nothing to do with the principal statement, but is merely an added bit of information. A test that the writer can run through quickly in his mind is to see what he can leave out without changing the principal statement. If, as in the first example, the "that" can be left out without changing what the sentence says ("The book on the mantel is new"), then "that" is the correct word. If the "which" clause can be lifted out entirely and made into a separate statement ("The new book came today. It is on the mantel"), then "which" is the correct choice. The "which" is a convenient means of combining two essentially independent statements into one sentence.

In such a simple sentence as the first example above, substitution of "which" for "that" would not seriously confuse the reader. In the long and complex sentences frequently found in reports, however, misuse of "which" may force the reader to go back over the same sentence several times to find out which "which" refers to what. This necessity for rereading is exasperating as well as time-consuming (and means that the report is not so effective as it ought to be).

"Due to" and "owing to"

Use of "due to" where "owing to" is called for is probably a harmless illiteracy—but why not either learn the difference or else avoid the term altogether? "Due to" is used to relate noun to noun: "The delay was due to breakdown." "Owing to" is used to relate a verb expression to a noun or an expression serving as a noun: "They were delayed, owing to breakdown." (See Fowler, p. 123, 417.) The writer who is unsure of this expression ordinarily will not go wrong with "owing to," but can usually avoid any difficulty by using "because of."

"Might" and "may"; "could" and "can"; "would" and "will"

The first word of each of these pairs is properly used only when a condition about which there is considerable doubt or improbability is stated or implied. Unwary writers may surround their own work with uncertainty by using the wrong form.

Compare "We might be able to measure the effect if the instruments were more sensitive" with "We may be able to measure it with more sensitive instruments" or "... if the instruments are made more sensitive." The first form does not sound very hopeful.

See the difference between "The counting circuit could be modified if new tubes were available" and "The counting circuit can be modified if new tubes are used" or "can be modified with new tubes." The first has a shoulder-shrugging implication.

"We would do so if we could" expresses greater doubt than "We will if we can," which implies a probability or an expectation of being able to.

"Factor of"

There are certain terms that must impress researchers as sounding particularly scientific; they get dragged into all sorts of inappropriate uses, even if sentences must be distorted and simplicity must be sacrificed in order to display them. Thus we may find some such illogicality as "the yield from A was greater by a factor of two than from B." This is not only awkward; it is also ambiguous. "Greater than" implies addition; "a factor of" implies multiplication. Was the writer merely (but not simply) trying to say, "The yield from A is twice that from B"? Then why didn't he? Good scientific writing finds the simplest way of saying things, not the most complex.

"Times larger than"

This incredibly nonsensical expression appears with increasing frequency in otherwise good writing—but what does it mean? How is a reader to interpret "X is three times larger than Y"? Again "times" implies multiplication; "larger than" implies addition (or the subtraction that finds a difference).  $X = 3Y$ ?  $X = 4Y$ ? If the author writes "X is three times as large as Y" there is no illogicality nor ambiguity.

"Since" and "as"; "while" and "although"

"Since" and "while" have connotations of time, and are most properly used to express "in the period following the time when" and "during or throughout the time that." Too often "since" is used in a cause-and-effect statement, and "while" is used to indicate a seemingly contrary or incompatible condition. These uses, though legitimate, are ambiguous—and therefore inadvisable. If you have a sentence in which "as" or "because" can be substituted for "since," it ought to be. If "although" serves as well as "while," let it.

Unstrung beads

One who has read enough scientific reports can find considerable virtue in the system prevailing in Romance languages, in which a noun is usually introduced first and most of the modifiers are strung out after it. That way, at least, a reader knows what is being talked about, even if he has to wait a while to learn what its attributes are. Maybe because they have spent too much time reading German, our scientists get into the habit of piling such a tremendous burden of adjectives and adjectivally used nouns in front of the thing they are describing that the subject itself becomes obscured and the relations of the modifiers become uncertain.

Suppose a reader comes across such a formidable blob of words as "improved neutral decay branching ratio determination of the  $K_1^0$  meson." At first glance one wonders what it is that's "improved." "Improved decay?" Hardly. "Improved branching?" No. "Improved ratio?" Improbable. "Improved determination!" Yes, it must be. Hm-m-m-m! "Determination of the  $K_1^0$  meson?" No. Oh! "Improved determination of the branching ratio for neutral decay of the  $K_1^0$  meson." Well, why not say so in the first place? The whole mental process has not really taken very long, but this passage was a confusing deterrent to smooth, rapid reading. It has left a faint residue of undefined resentment. Maybe the writer was trying to achieve brevity — but it wasn't worth it. He forgot that the flat printed page cannot convey the rising and falling voice tones of speech.

Sometimes there are perfectly good reasons for not rearranging the words as above. We can still offer helpful guidance with hyphens: "improved neutral-decay branching-ratio determination of the  $K_1^0$  meson" is much easier to grasp at first sight.

Hyphens, then, are used to show the temporary combination of two or more words into a single modifying expression. Thus we correctly indicate with a hyphen or two that we are talking about "a



high-pressure pump" (not a pressure pump up on a shelf), "the two-pound hammers" (hammers weighing two pounds, not simply two hammers to pound with or two one-pound hammers), "signal-to-noise ratio" (ratio between signal and noise, not the message to the noise ratio), "long-time observations" (not prolonged scrutiny of the clock). It is worth while to quote Ulman here:

A compound adjective that comes before the noun it modifies should be hyphenated. Although this rule is commonly relaxed, it should be followed quite rigorously in technical writing. Technical subjects seem to call for a lot of compound adjectives, some of them quite complex; and technical writing must be precise. If you do not hyphenate compound adjectives, your reader will often be momentarily delayed, sometimes actually confused.

What would you do with these? "High energy proton bombardment spallation product analysis," "standard current monitor electrometer," "beam pulse monitoring signal," "decay in flight analysis," "electron pair energy splitting," "Gaussian momentum density distribution," "silicon surface barrier type solid state detector." (Also see Fowler, p. 243; Ulman, Section 15.7.)

Prefixes and suffixes

It may be helpful to consider that, in general, a hyphen is used to indicate a temporary union of two words to serve a special purpose. Thus we have the hyphenated combinations quoted in the preceding paragraphs. Such prefixes and suffixes as are listed in the box, however, are united more firmly and form permanent words. Thus we write solid such terms as infrared, ultraviolet, radiocarbon, radiofrequency, subcommittee, predetermine, preamplifier, nonnegative, threefold, clockwise, waterproof, lighttight, superheated, semiautomatic, backscattering, semiplastic, and so on. The hyphen is used, however, if a prefix is joined to a proper noun (non-Euclidean), if writing the combination solid would be ambiguous (un-ionized), or if the prefix is combined with a word beginning with its terminal vowel (semi-invalid). Note, however, that the prefix "self-" always retains the hyphen.

<u>Reminder</u>	
These are some of the prefixes and suffixes that form solid (unhyphenated) combinations:	
anti...	...fold
extra...	...tight
infra...	...wise
multi...	...less
non...	
photo...	
radio...	
semi...	
sub...	
super...	and, usually,
ultra...	...proof
un...	
	and, usually,
back...	
pre...	

### Important Little Marks

It is quite possible to combine all the rhetorical elements of a correct sentence and yet come out with a dead-level, characterless statement that leaves the reader unsatisfied and not very sure of what is being presented to him. The missing ingredient is punctuation. Oh, yes---the writer may have thrown in a comma or two, and ended up with the customary period. But if he did not place the commas correctly, or did not recognize that something more was needed, his statement turned out drab---if not hazy or downright confusing.

There are writers who maintain that they do not want to slow the reader down with punctuation. (They apparently don't care if the reader is slowed down because he gets lost and has to go back and re-read the sentence.) There are other writers who are dimly aware that some sort of punctuation is called for, and therefore sprinkle it haphazardly through a sentence. There are---fortunately---still other writers who care enough about clarity and smoothness that they have learned how to punctuate, and are not too apathetic to make effective use of that knowledge.

Rules for punctuation are not so rigid as to preclude individual style. Within rather wide limits the author may include or omit certain points, may choose between commas and semicolons, between commas and dashes and parentheses, or between dashes and colons. Each can have its own subtle effect on the flavor of the whole statement. The writer who has "discovered" punctuation is like the cook who has learned about spices and herbs: he has new zest at his command. (This metaphor can also be extended to the dangers of overuse.)

There are certain usages in punctuation that are strongly recommended for LRL papers. Writers should note that these usages need not interfere with flexibility or with personal predilection, and that adopting them should increase clarity and understandability.

#### Commas

One would expect every writer to know how to use commas, but an editor has evidence that many do not. Two common misunderstandings may be clarified here.

In Series. Commas should be used to separate the items of a series of three or more words (or phrases or numbers or letters or symbols). Many schools teach that the comma is not necessary before the final member of such a series, and in literary work it may not be. In scientific writing, however, dropping this comma may introduce ambiguity, and report writers are strongly urged to always use this comma. (Ulman gives some excellent demonstrations of the importance of this seemingly insignificant little point, and makes a convincing plea for consistent use of it.)

In Compound Sentences. In a compound sentence—that is, one that could be two separate sentences but is joined into one by a conjunction such as "and," "but," "or," or "for"—a comma should precede the conjunction. Leaving the comma out confuses the reader, who has to read on for some distance beyond the conjunction before he recognizes that what it joins are the two almost separate statements, not merely two single terms that happen to be next to the conjunction. For example, see what a difference the comma could have made in these confusing sentences:

The technicians modified several oscillators and condensers were installed to improve performance.

Under the circumstances we should be grateful for the damage could have been much more extensive.

### Semicolons

A semicolon is used to join statements that could stand as separate sentences but are more effective if they are joined into one. In the examples just above, semicolons could have been used instead of commas and conjunctions:

Under the circumstances we should be grateful; the damage could have been much more extensive.

In listing within a sentence complex items in which there already are commas, semicolons may be used between the items:

Inquiries were sent to Paris, Texas; London, Ontario; Berlin, New Hampshire; Rome, New York; Moscow, Idaho; and Dublin, Georgia.

The function of semicolons must not be confused with that of colons or that of dashes. Here is a rule of thumb for the writer who is unsure: Except in a listing, a semicolon should not be used where it would not be possible to use a period instead.

### Parentheses and Other Separators

Unless one writes in the most staccato style, using excessively brief, almost disjointed sentences, he often finds it useful to insert in a sentence some explanatory material that may not be strictly essential to the direct course of the statement but goes better there than in a separate passage. He must find ways of indicating to the reader which parts of a statement are subsidiary or parenthetical. This may be done—according to the degree of separation called for—by pairs of commas, of dashes, or of parentheses.

A pair of parentheses serves to tell the reader, "Now, here some explanatory material is inserted. Hold on to the thread of what you have read thus far, and go on from this point after you have read through the insertion."

If the supplementary material does not have to be so definitely set apart, a dash before the explanatory passage and another one after it serve nicely. (Caution: Don't forget to put in the second dash, or your reader will go on and on, still waiting for the signal that the side excursion is over and that he has got back to the main sentence.)

When the explanatory material calls for but little separation, or when the sentence is fairly simple, a pair of commas suffices. Be careful, however, to avoid the common error of letting too many commas creep into the sentence; if the structure already calls for a good many of them, then it is better to use something other than commas to set apart the inserted passage. For example, in the last sentence of the first paragraph of this section, the expression "according to the degree of separation called for" could have been set off by a pair of commas, but the dashes make clearer the relation of this passage to the rest of the sentence, and the reader doesn't have to wonder which of a whole series of commas is the one he is looking for to complete the pair. Parentheses would not have been desirable here; they imply too great a separation.

#### How Is Your Bridgework?

The experimenter who has lived with a piece of research for months or years knows it too well to explain it easily to somebody else. When he tries to write about it he is apt to forget that the reader doesn't know as much as he does; he leaps rapidly from one high point to another and leaves the reader floundering somewhere between two inadequately connected thoughts. It is the writer's responsibility to build bridges across the gaps. If he expects anybody outside his own working circle to be interested in his report, he must write it so that it can be understood outside that circle.

Haste is the enemy of continuity. If it is at all possible to do so, the writer should make up the first draft of the entire report and then put it away. If he then goes off and thinks about something else for a while—a day or two helps, a week or more is better—he finds, on returning to the report, that he has achieved a measure of detachment and can better evaluate his own writing. Now is the time to go through the manuscript searchingly, seeing that it leads the reader logically from one point to the next, making sure that like items are grouped together and presented in orderly manner, and looking for places where the text can be rearranged or simplified or shortened, or where explanatory material must be inserted. Perhaps the writer can try out his draft on somebody who is not too familiar with the field and who, having a more detached viewpoint, can offer valuable criticism on sequence and intelligibility.

Clarity is worth working for.

## GUIDEPOSTS FOR THE READER

A well-organized report is easy to read through the first time, and easy to refer to a second time. Ease of first reading depends on orderly sequence; ease of referral depends on logical grouping and titling of the various units. Arrangement of the subdivisions of a report is closely allied to the preparation of an outline (whether before or after the fact). Once the parts are arranged, they are made easily identifiable by titles, subheads, and so on.

For a very short paper—not more than two or three pages—it may not be necessary to subdivide the text into separately labeled parts. In reports of any appreciable length, however, the Abstract, Introduction, Conclusions, Method, and Results should be treated as though they were separate chapters, and some of these should be broken down further and headed appropriately.

The usual subdivisions are titled as shown on the following page. Note the form.

### Title

A title should be as brief as is consistent with specific designation. Not only for the sake of the reader, but also for efficiency in library listing and bibliographic reference, a concise (but complete) title is superior. A three-line title overwhelms and repels the prospective reader. Let the title indicate what a report is about; let the abstract summarize the contents.

### Contents

In any paper of moderate length, the Contents is usually counted on to perform the functions of an index. It should therefore be specific enough to be of help to the person who wants to find again some particular point, yet not so detailed that it becomes cumbersome and defeats its own purpose.

The arrangement of the Contents used at the beginning of this guide is the form that is standard for UCRL reports. Each of several main divisions of the paper is handled as a separate chapter. Some of the chapters are in turn broken down into subdivisions. Although, in the body of the paper, some of these are divided into still smaller sections, it is not usually desirable to list the smallest subdivisions in the Contents; there is a reasonable balance between too much and too little detail.

It is not necessary or desirable to number and letter the chapters and their subdivisions, unless these designations are to be used for internal reference (e. g.: "See IV.C.2"). If such indications are used, the Contents is set up as in Example II.

TITLE

Subtitle

The title (or chapter heading) is in capitals, centered. The subtitle is centered, is in lower-case letters with the initial letters of principal words capitalized, and is underlined. A short unit does not need further subdivision. A longer one may be broken down by use of subtitles into smaller parts, thus:

Sidehead

The sideheads are set up, as are the subtitles, in "caps and lower case" and underlined, but are placed at the left margin. More space is left above the sidehead than below, and the first line of text is given paragraph indentation. If further subdivision is needed, the next step may be the

Paragraph head. This also is underlined and set flush left, but only the first word is capitalized; a period follows; the text starts on the same line. It is properly used, however, only for a single paragraph.

If further divisions are required, as in series of related items, the following scheme of designation and indentation can be used:

1. Another subdivision. The text starts on the same line; succeeding lines of the subdivision are not indented.

a. Yet another subdivision. Text starts on the same line, and continues flush left on succeeding lines.

(i) Still another subdivision is designated thus; here, too, the continuing text runs from the left margin. (If, in a long paper, the margins for successive subdivisions were set farther and farther to the right, there would be too much blank space left.)

(a) If further breakdown is needed, it may be marked and indented thus.

(b) A unit corresponding to (a) would be equally indented, then continue flush left.

(ii) A unit corresponding to (i) would be . . .

b. A unit corresponding to a. would . . .

2. A unit corresponding to 1 . . .

Example I. Recommended forms for headings and subheadings.

THE DETERMINATION OF DOODLER CONSTANTS

Contents

Abstract . . . . .	3
I. Introduction . . . . .	5
II. Conclusions . . . . .	8
III. The Experimental Problem . . . . .	10
IV. Apparatus . . . . .	13
V. Procedure	
A. Testing and Calibration . . . . .	16
B. Experimental Runs . . . . .	23
1. With baffles in place . . . . .	25
2. Without baffles . . . . .	26
VI. Recording of Results . . . . .	29
VII. Analysis of Data . . . . .	30
Acknowledgments . . . . .	33
Appendixes	
A. Fritter's Law . . . . .	34
B. Derivation of Equations . . . . .	37
References . . . . .	41

Example II. Recommended form for Table of Contents.

### Abstract

Each LRL report should include an informative abstract—a single paragraph, preferably not more than 200 words, summarizing (not merely describing) what was done and what the results were. An informative abstract permits one to learn the substance of the report quickly, without having to read through the entire paper. The abstract is particularly important for preparation of TIS library-catalog cards and for use in journals of abstracts. It should be as brief as is consistent with completeness and easy understanding, and deserves careful writing. In papers that are written specifically to be submitted to journals, the abstract—and indeed the whole paper—should be written with the requirements of that journal in mind.

### Placement of Figures and Tables

Ideally, an illustration is most useful if it is found facing the page on which reference to it is made. Practically, this is almost never achieved. As a general rule, however, figures and tables are placed as near as possible to the point at which they are first mentioned. The writer should therefore make sure that the illustrations are numbered in the order in which they are introduced; this requires that the progression be logical, both in the text and in the arrangement of figures.

Figures should be accompanied by legends or titles that are complete enough to explain the illustrations but not so long that they look like pieces of misplaced text.

Examples of the proper form are:

- Fig. 7. Typical comparison of direct and delayed coincidence rates to find factor relating delayed and accidental coincidences.
- Fig. 5. Histogram of the distribution of 244 successive counts of one tritiated fatty acid sample. Smooth curve is the normal curve obtained from the data.

The second example is just about as long as a legend should ordinarily be (except for explanation of symbols, sometimes necessary).



## CONVENTIONS, QUIRKS, USAGE

The correct LRL forms for Title Page, Contents, Abstract, and Introduction Page, for chapter and section headings, for tables, and for footnotes are demonstrated in this report. Typists are urged to note spacing, capitalization, and form, and to follow the same style in manuscripts submitted to the Information Division. The time required to bring a carelessly prepared paper into agreement with UCRL style could be more profitably used in other ways.

### Accepted Standards

For accepted general usage in spelling, hyphenation, capitalization, and abbreviations, Webster's New International Dictionary, Third Edition (unabridged) is the standard authority. For specialized UCRL usage, see the Appendix (pages 33-36, this report); here are given the correct spelling and compounding of words often troublesome to writers. Abbreviations are given in UCRL-8543 Rev 2.

### Miscellaneous Admonitions

Authors' names. The complexities of indexing, filing, and identification are sufficiently severe even under the most favorable conditions. When an author is listed only by his surname and an initial or two, the complexity is multiplied.

Example: if one looks in a library index for John A. Miller, who may also be listed as J. Miller and J. A. Miller, then he may have to search three different parts of the catalog; entries for Jackson, Jacob, James, Jefferson, Jerome, Joachim, and Johannes Miller could all appear between J. A. Miller and John A. Miller. Moreover, how could other J. Millers or J. A. Millers be distinguished from our John? All LRL reports should carry authors' full names, or at least include one given name and initial. If John Allen Miller prefers to be known as J. Allen Miller, he should so write it consistently; "J. A." gives no clue to his preference.

Numbers in text. The trend is toward an increasing use of numerals instead of spelled-out numbers in scientific text. Numerals may be used except

- (a) when the initial word of a sentence is a number ("Thirty tests agreed well within 1%, but "We ran 30 tests");
- (b) when the number is less than 10, is not a ratio or a factor, is isolated, and without dimensions ("We tried the same test four different times, " but "The wall is 12 feet high and 3 feet thick"); or
- (c) when confusion would result from juxtaposition ("We lined up twenty 3-inch blocks").

Symbols in text. In general it makes for easier reading (quicker comprehension) if well-known symbols and widely understood abbreviations are used rather than spelled-out words for such terms as are illustrated below. Note how much more readily the eye takes in the left-hand member of each of these examples:

20°C	20 degrees centigrade
14%	14 percent or fourteen percent
35 mm	35 millimeters
340 MeV	340 million electron volts

It is hard to imagine that any UCRL writing would require the formality represented on the right.

Hyphen for "to." Such an expression as "3 to 4%" or "19 to 21 in." should be so written, because of the ambiguity of "3-4%" (three-quarters of a percent?) and the momentary confusion (is that a hyphen or a minus?) in "19-21 in." In set type an "en dash," intermediate in length between hyphen and em dash, is available, but on a typewriter it is easier and clearer to write "to." An exception may be desirable in stating melting points (for which an en dash can be contrived, so that the temperature range is given as "178° - 180°"), or in superscript numbers (as in "... reported by others<sup>4-9</sup>").

Mathematical equations. The person who writes down a mathematical equation is familiar with the terms, the symbols, the forms, and the conventions. Typists are not—and ought not be expected to be. It is the author's responsibility to see that all equations in the manuscript given to the Information Division are exactly as he wants them; he should check up on spacing, centering, correct placement of symbols, proper levels of subscripts and superscripts, and readability of hand-written characters. Though the author may mean eta (η), if it looks like the English "n" the typist naturally writes n. If characters have been inserted by hand, it is advisable to pencil a note in the left margin, "This is nu," "gamma," "eta," "omega," or whatever is intended, whenever a new symbol is introduced. Often there is opportunity for confusion between hand-written 0 (zero), O (cap.), and o (l. c.); between V and v, W and w, "one" and "prime" or "one" and "ell," and so on. Each should be clearly labeled the first time it occurs, and subsequently whenever there is chance of confusion.

Illustrations

The illustrations for a paper should be planned at the time the outline is developed, and made up when the draft is far enough along that needs are definitely known. Proper planning can assure the best presentation, and avoid the common errors of too many drawings or too much information in one frame. An illustrator or an editor will gladly help a writer to design special illustrative material and to relate it to the text.

If existing drawings are to be used together with new ones, both should be carefully checked to make sure that they agree in symbols,

designation of quantities, and style of lettering. (It is often possible to make some changes in old drawings--an editor can be consulted for suggestions.)

Labeling on diagrams or graphs is preferably in lower-case letters, with capitals only for the first word of an expression, or for a proper noun. Lower-case lettering is not only more easily read; it also permits more information in a given space (or conversely, allows use of larger letters).

Lettering on a diagram should be kept to a minimum. Get everything possible off the drawing and into the title. For labeling parts it is often desirable to use lettered or numbered callouts, explained in the legend below the figure. (Not only is it a lot faster and easier to type the information than to letter the diagram; also the typed legend remains the same size no matter how much a drawing is reduced.) Journals definitely prefer drawings with a minimum of lettering.

The points that photograph best (i. e., retain their individuality) are O, ●, △, ▲, □, ■, ▽, ▼, ◇, ◆. In a series of related drawings the same quantity should be represented by the same shape in each drawing.

Photographs that are to be used in a report should include only as much as necessary to present the desired information. There is no sense in showing an entire machine to illustrate the function of a very small part of it. If a new photograph cannot be made, it may be possible to enlarge a small portion from an existing negative to show the part in question.

If photographic prints are to be labeled with callouts (or to have any lettering or marking put on them) and be rephotographed, such marking should be shown not on the print itself but on an overlay (fastened with tape to the back of the print and folded over the front). Use a soft pencil or pen, and do not press down, or the print will be damaged.

A photomicrograph should have on it a scale (such as 1μ) that becomes a part of the negative and is magnified or reduced with the print, of whatever size. A draftsman can easily put a scale on a print or a negative according to indications on an overlay or on an attached sheet.

Drawings may be made up on sheets approximately 8.5×11 in. (size 1), 11×17 in. (size 2), or 18×22 in. (size 3). Negatives made from them are limited in size, however, and the prints reproduced in reports are usually 5×7 in. Keep in mind, also, that in a thesis an illustration together with its legend cannot be larger than 6×9 in. This reduction should be kept in mind in planning a drawing, so that important information will not be lost. It may be well for an author who is laying out a size 3 sketch to back off occasionally and see how it looks from a distance of, say, 12 to 15 feet. If he can't see fine detail or read the lettering it behooves him to make them larger.

Possibly the drawing could be split into two or more parts, each of which would then be less reduced in printing.

If a paper is intended for publication in a journal the figure is reduced still further--probably to no more than 3 inches wide.

The style followed by the particular journal for illustrations should be carefully observed--and called to the attention of the editor and the illustrator. (The AIP Manual gives comprehensive instructions on preparation of illustrations.)

Sketches to be made into slides should be severely simple, with good strong lines, few (and large) numbers on the coordinate scales, and a minimum of lettering--made as large as practical. Some people seem to have the idea that a slide should carry the conditions of the experiment and all the supplemental data. It is much better to leave the identification off the slide and tell the audience what it is. (It is a rare lecturer who stops talking long enough for the viewers to give their attention to much information on the screen.) If lecturers had to stand at the back of an auditorium and try to see on the screen what the audience is subjected to, slides would be simpler and better.

Remember, also, that a slide is wider than it is high, and plan your drawing accordingly.

### Tables

A table should be presented as simply as its content will allow. There should be no vertical rulings, and as few horizontal rulings as possible. The example shows UCRL style.

Table I. Mean size and distance judgments for horizon and zenith positions.

Condition		Judgment			
		Size (in.)		Distance (ft)	
<u>Horizon</u>	<u>Zenith</u>	<u>Horizon</u>	<u>Zenith</u>	<u>Horizon</u>	<u>Zenith</u>
Dark	Cues	9.58	8.89	6.94	8.86
Cues	Dark	8.69	8.39	9.48	11.79

### References and Citations

There are almost as many styles for bibliographic citations as there are publications, and we have had to choose arbitrarily that one form which is best suited to LRL reports. For the sake of uniformity and the avoidance of confusion, that style should be followed for all LRL papers. (An exception may be made for an article prepared specifically for a journal and not to be issued as a general LRL

report; it is then desirable to follow the style used by that particular journal.)

A bibliographic citation is referred to in the text by a superscript number placed at the end of the statement in which the reference appears (if possible, at the end of the complete sentence), thus:

Studies\* of this threshold\* by Germain and French\* indicate that the correct value\* is very close to 0.0326 z.<sup>1</sup>

The asterisks in this example indicate the various positions at which some authors seem to think the reference number should be placed; note, however, that every one of them interferes to some extent with the reading of the sentence as a whole and gives the reader a feeling that he is being interrupted. Let him get all the way through before introducing a distraction. If the sentence requires a different treatment, place the reference number so that the reader is permitted to complete as much of a thought as possible before the interruption occurs:

Studies of this threshold by Germain and French<sup>1</sup> indicate that the value of 0.0311 quoted by Englander<sup>2</sup> is too low; the true value must be closer to 0.0326.

Sometimes it is worth while to rearrange a sentence to avoid awkwardness in the placing of the reference number.

The citation may be placed as a footnote at the bottom of the page on which it is first referred to, or may be placed in a list at the end of the report. If there are not too many citations or too many references to them, it usually is better to place them as footnotes; if the list is long or if certain citations are referred to again and again, the bibliography at the end is probably more convenient.

Footnotes and explanatory notes may be referred to by such symbols as \*, †, ‡, §, \*\*, ††, ‡‡, §§, in that order, and placed at the bottom of the page. It is easier and better, though, to number the footnotes and citations in the order in which they occur, and handle them all alike (most journals require this).

Footnotes and citations, if placed at the foot of the page, are treated as shown in the example: a short line starting at the left margin separates this part of the page from the text, and the symbol followed by a space) or number (followed by a period and double space) precedes the note or citation.

---

\* Not here.

1. Franz Germain and Alleman French, Minimum Effective z Factors in Cyclodynes, Rev. Math. Nonsense 7, 36 (1974).
2. Finn Englander, The z Factor in Interstitial Phenomena, J. Phys. Previews 6, 14 (1975).

The information that should appear in the citations in a bibliography is as shown below, in the order given.

Journal article

author(s), as given in journal,  
title (if desired--more often omitted than included),  
name of periodical (and series, if necessary),  
volume number, in Arabic numerals, underlined (and issue, if  
necessary, in square brackets),  
page number,  
year of publication, in parentheses.

Example: Roger F. Dashen and David H. Sharp, Experimental Consequences of  $\phi$ - $\omega$  Mixing, Phys. Rev. 133, B1585 (1964).

(Note that the authors' names are not shortened to R. F. Dashen and D. H. Sharp, but are shown as they are printed in the journal.)

Book

author(s), as given in book,  
title, underlined,  
(editor or translator, if necessary),  
(edition number or series number, if necessary),  
{ publisher's name,  
place of publication, } all within parentheses,  
year of publication, }  
chapter or page number, if necessary.

Example: Bernard G. Harvey, Introduction to Nuclear Physics and Chemistry (Prentice-Hall, Inc., Englewood Cliffs, N. J., 1962), Ch. 10.

Example: The International Dictionary of Applied Mathematics, W. F. Freiberger, Editor-in-Chief (D. Van Nostrand Company, Inc., Princeton, N. J., 1960), p. 346.

Article in book

author(s), as given in book,  
title of article, followed by word "in,"  
title of book, underlined,  
(editor or agency compiling the book, if necessary)  
(edition number, or series number, if necessary)  
{ publisher's name,  
place of publication, } all within parentheses,  
year of publication, }  
page number.

Example: James Bonner, Plant Hormones, in Frontiers in Science, Edward Hutchings, Jr., Ed. (Basic Books, New York, 1961), p. 88.

Report

author(s), as given in report,  
title,  
originating } agency, if not clear from  
issuing }  
document number,  
month--abbreviated--and year of publication,  
page number, if necessary

Example: K. Das Gupta, A New Process of x-Ray Scattering from Single Crystals, California Institute of Technology Report TID-20364, Feb. 1964.

(In a paper to be submitted to a journal, the originating agency must be included, also the indication that the report has not been published.)

Example (in a paper for a journal): Norma O. Davis, E. T. Arakawa, L. C. Emerson, and R. D. Birkhoff, The Angular and Spectral Distributions of Light Emitted from Electron-Bombarded Silver Foils, Oak Ridge National Laboratory Report ORNL-3485, March 1964 (unpublished).

Article in Report

author(s), as given in report,  
title of article, followed by word "in,"  
title of report  
originating } agency, if not clear from  
issuing }  
document number,  
month and year of publication,  
page number.

(For submission to a journal, include originating agency and "unpublished.")

Example: Arthur J. Pape and Samuel S. Markowitz, Production of  $Be^7$  in  $He^3$ - and  $He^4$ -Induced Nuclear Reactions, in Chemistry Division Annual Report, UCRL-11213, Feb. 1964, p. 84.

Thesis

author, as given in report,  
title (followed by designation in parentheses, "Ph. D. Thesis" or "M. S. Thesis"),  
originating agency, if not clear from  
document number,  
month--abbreviated--and year of issue,  
page number, if necessary.

(For submission to a journal, the originating agency must be included, also the indication that a paper has not been published.)

Example: Don Leslie Lind, Differential Distribution of Charge-Exchange and Inelastic Neutrons in  $\pi^-$ -p Interactions at 313 and 371 MeV (Ph. D. thesis), UCRL-11435, June 1964.

Example (for journal): Joseph Schwartz, Associated Production from 1.5 to 2.4 BeV/c (Ph. D. thesis), Lawrence Radiation Laboratory Report UCRL-11360, June 1964 (unpublished).

Private communication

full name(s),  
installation (in parentheses),  
words "personal communication,"  
year.

Example: John O. Rasmussen (Lawrence Radiation Laboratory),  
personal communication, 1964.

Patent

name(s) of inventor(s),  
title of patent,  
number of patent,  
issuance date.

[Note that for an item not yet patented it is correct to give the name(s) of the inventor(s) and "Patent pending" if the application for patent has been sent to the U. S. Patent Office--but a criminal offense if it has not.]

Whether or not the title of an article or report should be a part of the bibliographic citation depends on how likely it is that a reader can easily consult the publication referred to. Whereas it can be assumed that practically all readers have access to the Journal of the American Chemical Society, the Physical Review, Proceedings of the Society of Experimental Biology and Medicine, and so on, it is improbable that project reports are as readily available. Stating the titles of such reports therefore gives the reader some idea whether or not a particular paper contains information useful to him, and may either encourage him to obtain a copy or spare him the needless effort of tracking down a report that turns out not to be relevant. (Note, however, that most journals do not use the title in a reference.)



## HOW REPORTS ARE REPRODUCED AND DISTRIBUTED

A manuscript received by the Information Division is gone over by an editor who checks for consistency and clarity, for correct usage, and for agreement with the LRL report style. If the report has been made up according to that style in the first place, subsequent work is lightened significantly; not only is there less time lost in getting the report ready for printing, but there is also a better likelihood of finding and correcting all the possible inconsistencies, errors, ambiguities, and non sequiturs that the author was too close to and could not see.

The report is then typed in final form on the sheets from which it will be reproduced, and illustrations are prepared for printing. (If it is a thesis, the author is expected to proofread it.)

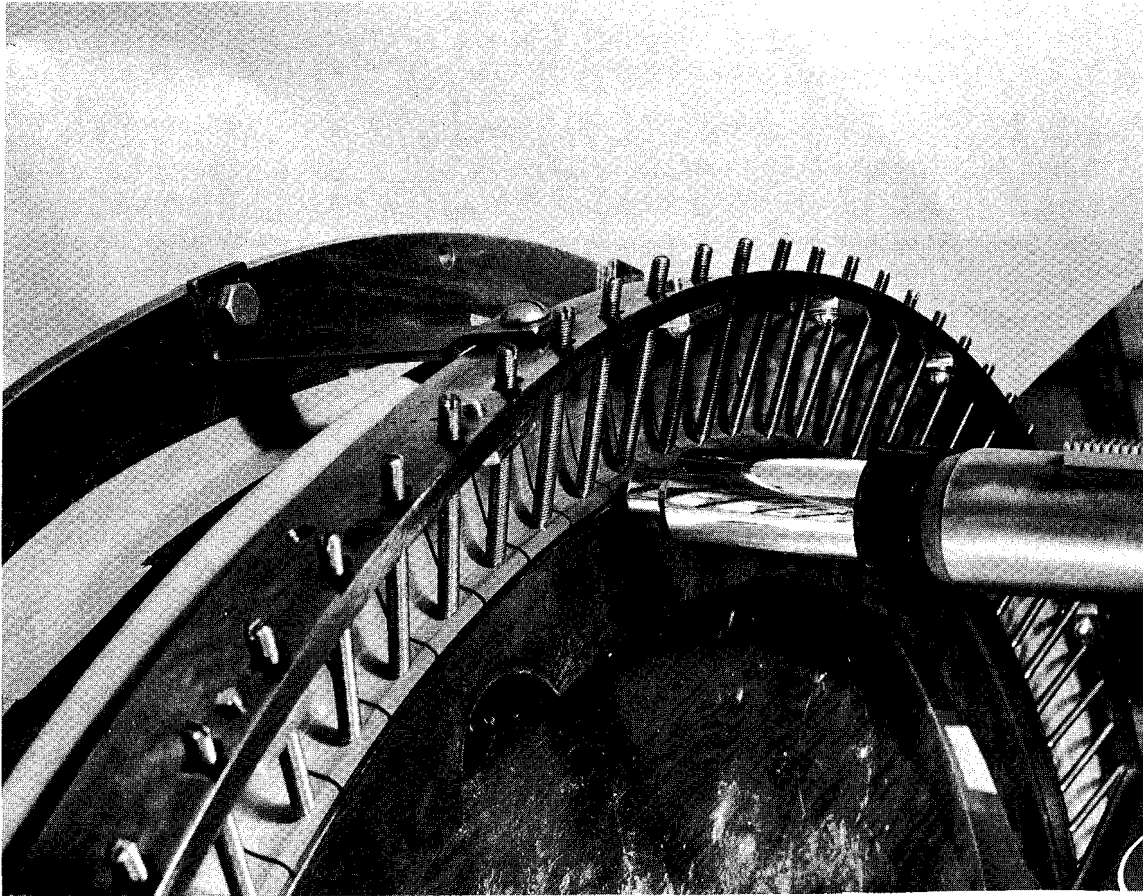
### Mechanics of Printing Text

LRL reports are usually reproduced by Multilith. In this process the text is typed with special ribbon on a specially prepared master sheet, which may also be drawn on with a special pencil. The typed master sheet is mounted on a rotating drum, which passes it first over inked rollers. Wherever the master sheet has been typed or drawn on, the ink adheres to it, but the unaltered surface does not pick up ink. As the drum turns, the ink on typing or drawing is next transferred to an intermediate rubber-faced cylinder which in turn transfers it to the impression paper; the cycle is repeated for each sheet to be printed.

Unfortunately, fingerprints on the master sheets have the same effect as typed or penciled marks: ink adheres to them. It is therefore important for the author to remember, when he is proofreading the prepared master sheets, that the surface should not be touched anywhere inside the borders. Smears caused by fingerprints can be removed, but not easily—and the clarity of the typed text may suffer.

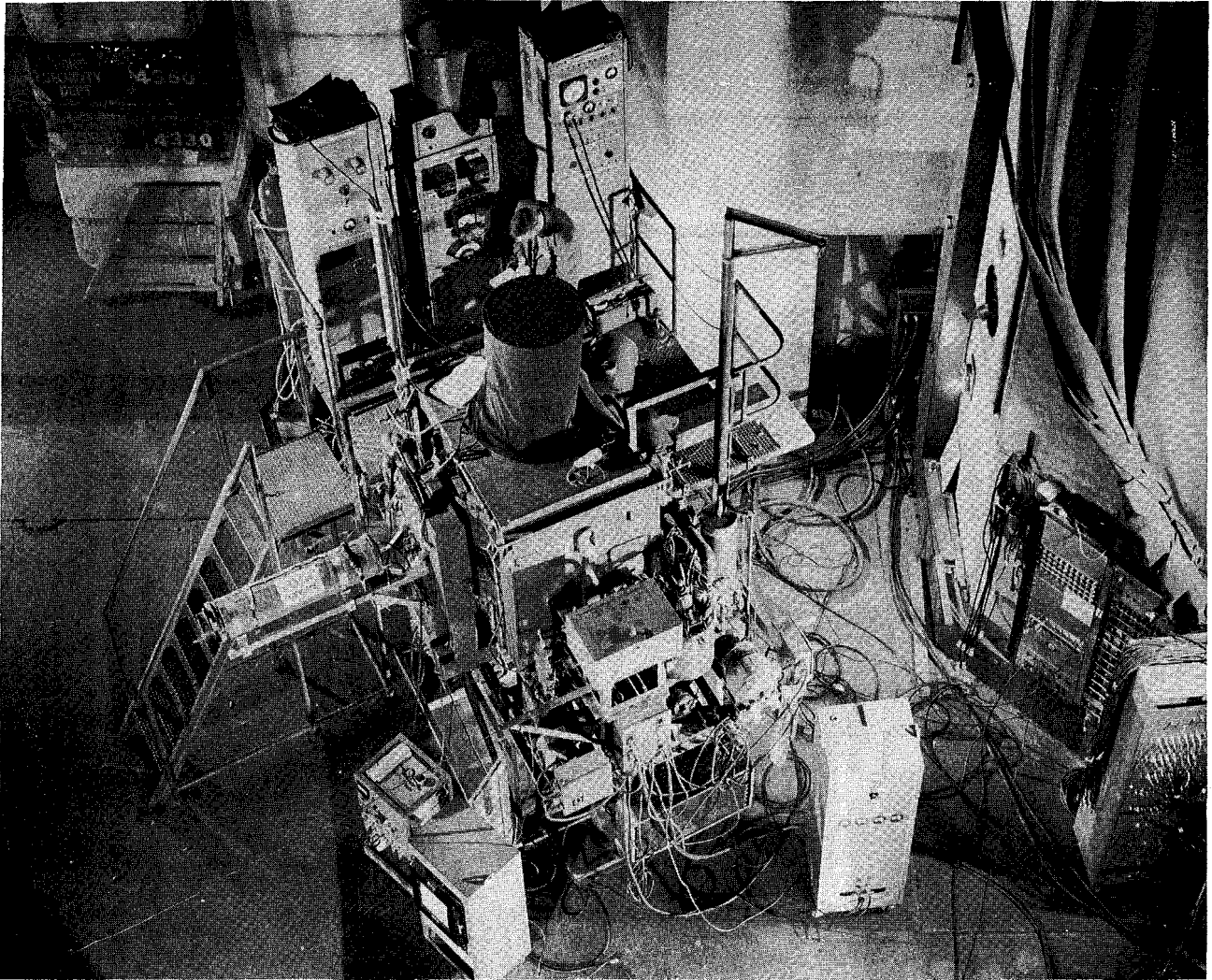
### Photographs and Drawings

If a photographic illustration is to be used in a report, a "screen negative" is prepared from it. This is a photographic negative made through a screen placed a short distance in front of the focal plane, so that the image consists of numerous uniformly spaced tiny-black dots, the size of which is a function of the density (blackness) of any particular part of the negative image. A print from such a negative is known as a half-tone illustration. This screen negative is used to prepare a positive image on a light-sensitive Multilith master sheet. In the positive image, light areas of the original subject are represented by very small dots, dark areas by larger ones. The dots on the master sheet receive and transfer the ink, and the print that results on the impression paper consists of corresponding dots. Figures 1, 2, and 3 are such prints; a hand lens reveals the dot structure.



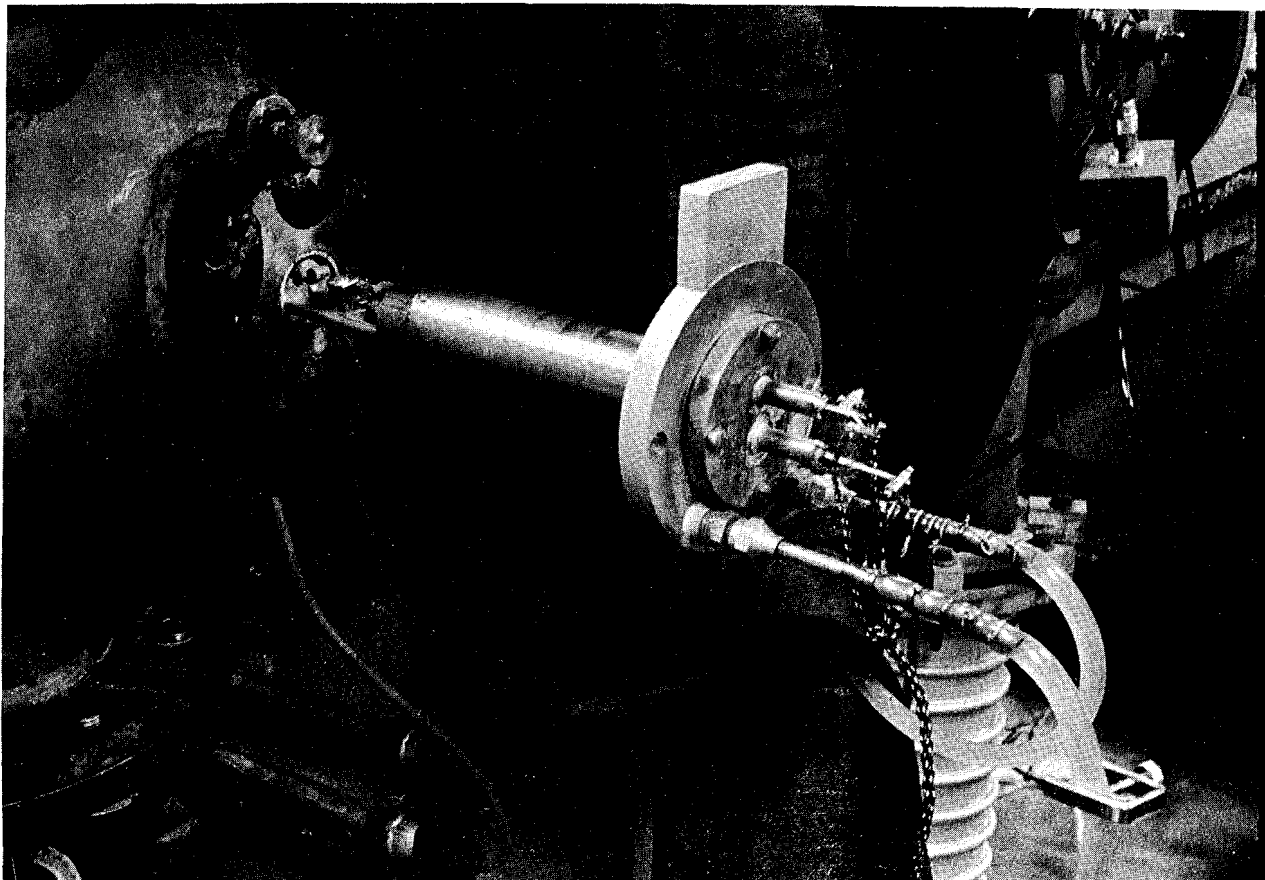
ZN-4340

Fig. 1. A satisfactory representation of a difficult subject. Contrast is good, but not too extreme for effective half-tone printing.



ZN 246

Fig. 2. A difficult subject, not well represented. The great amount of confusing detail and the unsuitable lighting make this type of illustration generally unsatisfactory.



ZN-1731

Fig. 3. When the range from bright to poorly illuminated areas is extreme, this printing method does not reproduce the picture faithfully; here the light areas are clearly enough represented, but practically all detail in the shadow is lost.

It is readily seen that a photographic illustration to be printed by this method should not depend on exceptionally fine detail, as detail cannot be faithfully reproduced. The print should have good contrast, but should not have excessively light or excessively dark areas. Areas that are too light tend to become characterless; areas that are too dark tend to fill in, owing to the spread of ink where dots are so large as to be almost continuous. Figure 1 is made from a photographic negative suitable for this type of reproduction. The limitations of the method are apparent in Fig. 2, which contains too much fine detail, and in Fig. 3, in which the contrast between light and dark is too extreme.

Diagrams, drawings, and graphs, and the typed legends for half-tone illustrations, are photographed directly (not through a screen), and prints are made from the negatives on sensitized Multilith masters. These figures are reproduced in solidly inked lines (not dots), as in Figs. 4 and 5.

#### Did You Double Check?

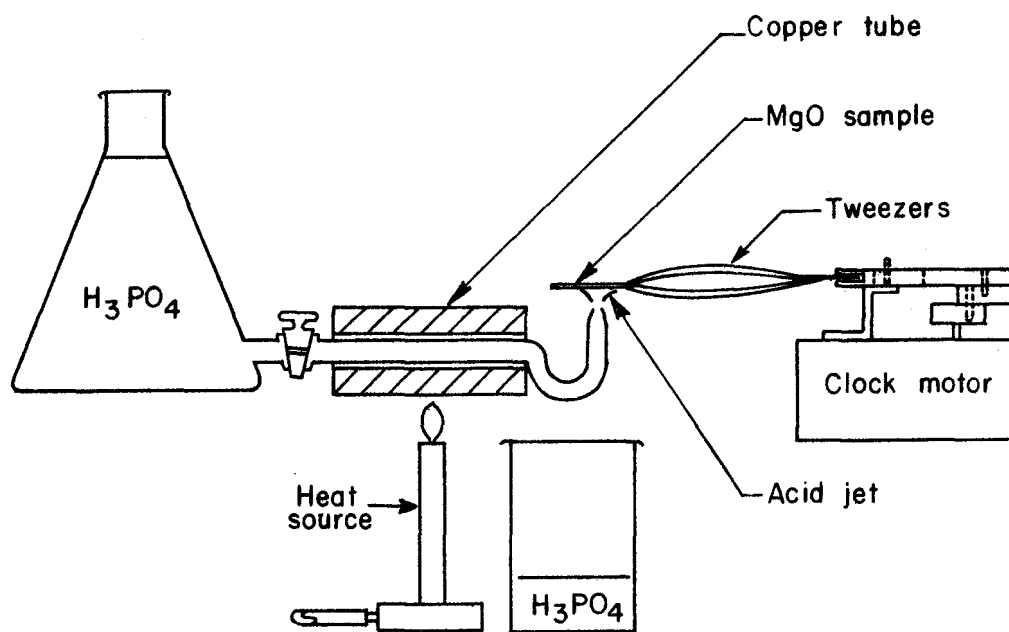
Any alteration in cuts or diagrams requires the making of a new negative. Authors are therefore urged to discover any errors in the illustrations (as well as in the text!) before the material is turned over to the Information Division for processing.

#### Distribution of Reports

Any paper originating in the Lawrence Radiation Laboratory must be processed by the Information Division. This applies to Research and Development reports, theses, or journal articles.

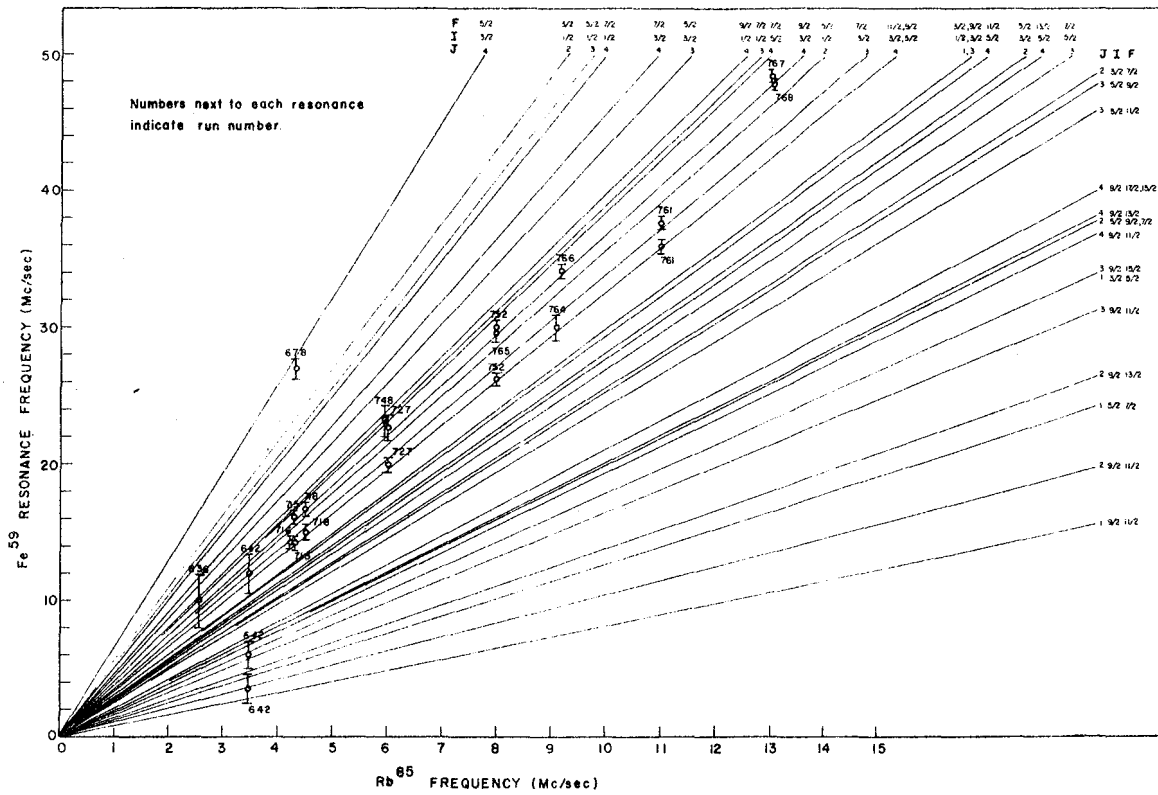
Research and development reports are distributed by the Information Division to other AEC laboratories and universities according to standard AEC distribution lists. The category to which a report is assigned depends on subject matter and classification, and the number of copies used in a standard distribution may run from a score or so to a good many hundred.

An author may request the Information Division to send copies of an unclassified report to specified individuals or laboratories not on the regular distribution list. The author should let the Information Division know how many copies will be needed for this purpose before the report is run off; although it is always possible to rerun a recent report, it saves time to print the required number of copies on the original run.



MU-27554

Fig. 4. A drawing well planned for effective reproduction. It is simple and uncluttered.



MUB-1780

Fig. 5. A good drawing turned bad. This size is just not suitable for such a small print, and details and lettering are lost.

HISTORY OF REPORT IN TECHNICAL INFORMATION DIVISION

Manuscript

assigning number  
 recording  
 editing  
 querying author  
 inserting corrections  
 checking by author  
 (incorporating last-minute changes)  
 processing illustrations  
 reviewing for unclassified release  
 typing Multilith masters  
 (or bond copies for journal articles)  
 (getting author's help in interpreting equations)

(retouching negatives)  
 numbering pages  
 mounting negatives of figures, of legends, of  
 page numbers, and of UCRL number on  
 masking sheets  
 proofreading by typists  
 (rechecking by editor)  
 proofreading by author

In Graphic Arts--Printing:  
 preparing Multilith masters for illustrations  
 running pages (text and illustrations):  
 one-side copies for Technical Information  
 (theses; additional one-side copy)  
 regular copies for distribution  
 collating and binding

local processing

In Patent Department:  
 obtaining patent release

In Mail Room:  
 packaging, wrapping, and addressing for  
 mailing to AEC standard distribution lists

sending copies to special distribution list  
 sending copies to Technical Library,  
 Washington, D. C.  
 sending copies and publication forms to Division  
 of Technical Information Extension, AEC  
 Oak Ridge  
 preparing file copies and loan copies  
 preparing file-card records  
 filing work folder ^

Line drawings

editing  
 (consulting with authors)  
 drafting  
 checking with author  
 assigning and recording drawing numbers  
 checking by editor  
 assigning and recording negative numbers

In Graphic Arts--Photography:  
 preparing line negatives  
 (retouching negatives)  
 (making prints for journal article)

Photographs

assigning and recording negative numbers  
 (marking special parts, adding scales, etc.)

In Graphic Arts--Photography:  
 preparing half-tone negatives  
 (retouching negatives)  
 (making prints for journal article)

Figure legends

editing  
 typing on composing paper

In Graphic Arts--Photography:  
 preparing negatives of legends  
 (retouching negatives)

(steps set in parentheses are not always included)



## APPENDIX

Spelling Guide

Words whose spelling, hyphenation, or capitalization has caused uncertainty are listed below:

a axis	cooperate
$\alpha$ -particle or alpha-particle (a)	coordinate
$\alpha$ particle or alpha particle (n)	cosmic-ray (a); cosmic ray (n)
asymmetry	Coulomb (a); coulomb (n)
audio frequency	co-worker
autoionization	cross-section (a);
backscattering	cross section (n)
back-titrate	cutoff (n); cut off (v)
bakable; bakeout	desiccator
band-pass (a)	dipole
band width	disk
Bevatron	dropoff (n)
boiloff (n); boil off (v)	dropout (n)
breakdown (n); break down (v)	d-p reaction
bremsstrahlung	eigenfunction; eigenvalue
build-up (n); build up (v)	electrooptical
bypass	eluant
cathode-ray (a); cathode ray (n)	end-point (a); end point (n)
center-of-mass (a);	erg gauss <sup>-1</sup>
center of mass (n)	extranuclear
Clebsch-Gordan	falloff (n); fall off (v)
close-up (a or n); close up (v)	fallout (n)
Compton effect	fine-structure (a)
cooldown (n)	fine structure (n)

flowmeter	microamperes
formulas or formulae	microphotometer
full-scale (a); full scale (n)	midpoint
full-width (a); full width (n)	mockup
$\gamma$ -ray (a); $\gamma$ ray (n)	n-n interaction or nn interaction
Geiger-Mueller	nonnegative
half-life (a); half life (n)	nonradioactive
half maximum (n)	<b>n-p</b> interaction or np interaction
half value (n)	<u>nth</u>
halfway	one-half
half width	one-tenth
Hermitian	O-ring (a); O ring (n)
inch or in. (never use " sign in body of paper)	outgas
184-inch; 88-inch	overall
infrared	percent
isoelectric	photoeffect
<u>ith</u>	photoelectric
K capture (n)	photomultiplier
K-electron capture	pickup (n); pick up (v)
knock-on event	pileup (n); pile up (v)
lifetime	preamplifier
line breadth	pre-exciter
lineup (n); line up (v)	preoperational
magneto-optical	printout (n); print out (v)
mean free path	pumpdown (n); pump down (v)
mean life	quantum-mechanical
metalloprotein	quasi-elastic (a)

quasi principle (n)	turn-on (n); turn on (v)
radioactive	turnoff (n); turn off (v)
radiocarbon	turnout (n); turn out (v)
radioelement	ultraviolet
radio-frequency (a); radio frequency (n)	underside
readout (n); read out (v)	underway (a); under way (adv)
reevaluate	Van de Graaff
RG-63/U	Variac
Schrödinger	wave form
Segrè ( <u>not</u> Segré)	wave front
semiempirical	wave function
setup (n); set up (v)	wavelength
short-lived	wave number
shutdown (n); shut down (v)	wide-band (a)
spillout (n); spill out (v)	x-ray (a); x ray (n)
start-up (a or n); start up (v)	y axis
Stefan-Boltzmann	
subcooled	
sulfur	
superheated	
symmetry	
Tektronix	
thermionic	
time-of-flight (a); time of flight (n)	
tuneup (n); tune up (v)	

Capitalization in Titles

In titles and subtitles (or in headlines) all principal words are capitalized (including the second element of a compound word).

The following words are not ordinarily capitalized except at the beginning of a statement:

articles

a  
an  
the

conjunctions

and    if  
as     or  
but    nor

prepositions

at    in    on  
by    of    up  
for   to

For consistency, however, some of these may be capitalized in titles or headlines:

**Addresses In and Near Chicago**

or if everything else is capitalized:

**Cyclotron Design Completed At Berkeley**

Note that verbs (such as be, is, are), pronouns (such as it, he, them), and adjectives (such as her, its) are not exempted from capitalization just because they are short.

Greek Alphabet

alpha	A	α
beta	B	β
gamma	Γ	γ
delta	Δ	δ
epsilon	E	ε
zeta	Z	ζ
eta	H	η
theta	Θ	θ
iota	I	ι
kappa	K	κ
lambda	Λ	λ
mu	M	μ
nu	N	ν
xi	Ξ	ξ
omicron	O	ο
pi	Π	π
rho	P	ρ
sigma	Σ	σ
tau	T	τ
upsilon	Υ	υ
phi	Φ	φ
chi	X	χ
psi	Ψ	ψ
omega	Ω	ω

Signs Used in Correcting Proof

- ∂ Delete; take out.
- Ⓝ Take out letter and close up.
- stet Let it remain: change made was wrong.
- ⌒, Ⓞ Join together or close up (no space).
- ∪ Bring closer together (usually means "leave single-unit space").
- center Put in middle of line
- ⊙ Insert a period.
- = A hyphen.
- ∇ Insert an apostrophe.
- ∧ Insert a comma.
- ⌞ Raise the word or letter.
- ⌋ Lower the word or letter.
- [ Bring matter to the left.
- ] Bring matter to the right.
- Use em quad space (on proportional-spacing typewriter, 5 units)
- # Make a space.
- # Make a single-unit space.
- ∩ Insert a superior letter or numeral.
- ∩̇ Insert an inferior letter or numeral.
- ¶ Make a paragraph.
- no ¶ Run on without a paragraph.