

Memorandum 6L-198

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Lincoln Laboratory
MASSACHUSETTS INSTITUTE OF TECHNOLOGY
Lexington, Massachusetts

SUBJECT: LINCOLN LABORATORY SALARY STRUCTURE

To: Lincoln Steering Committee

From: Jay W. Forrester

Date: 29 April 1955

A. INTRODUCTION

At the April 25 Steering Committee meeting, I was asked to study and to prepare a memorandum on the following aspects of the Lincoln salary structure:

1. The starting scale for graduates without experience with particular reference to the correctness of the scale selected by Lincoln April 21 for study purposes, which was

B. Sc.	\$370 to \$410, exceptional \$430
M. Sc.	\$430 to \$480
Ph. D.	\$600 to \$650, " \$700
2. Whether a starting scale adjustment should be tapered off over a ten-year period after graduation or should apply to the entire salary structure.
3. How the present salary levels compare with available data on other organizations.
4. How the 12 to 13 per cent total salary adjustment which the Laboratory divisions feel necessary compares with outside information.

As a brief summary of the results of the study in which many persons have participated, I believe the following:

1. Although the above starting scales are substantially above those we are now using, these changes are necessary to stand a competitive chance with this year's June graduating classes. The recommended B. Sc. rates may still be low by \$20 per month. The recommended M. Sc. and Ph. D. scales appear sufficient.

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A. INTRODUCTION (Cont.)

2. All available evidence shows that the country's entire engineering salary structure is rising. There is no tapering off of the rise at higher salary levels. The rise for more experienced men is somewhat higher in dollars but a lower percentage of present salary than at the low end of the scale.
3. The present salary levels of the Laboratory are difficult to measure and to compare in fair and reasonable way with information from outside. A rather detailed comparison of B. Sc. salaries was made because our sample of men at this level is larger (50 per cent of the Laboratory) and because more data from outside is available. The results indicate that the Laboratory may be as much as \$100 per month low at all age levels, depending on what outside information is used and how we rate the calibre of our staff compared with the national average engineer.
4. The 12 to 13 per cent total adjustment seems a modest recommendation considering that:
 - a. The average engineer in electronic industries has experienced a salary increase of about 10 per cent per year for the last four years.
 - b. The remaining 3 per cent, or \$20 per month, will be a minimum compromise with the amount that the present salary structure seems to lie below national data for 1954.

B. STARTING SALARIES

1. Bachelor's Degree

Figure 1 shows data on engineering Bachelor's Degree starting salaries. The Los Alamos and Engineer's Joint Council data have been plotted to show starting salaries actually paid as well as the reported hiring rates, since the latter are appreciably less and point up a possible fallacy in using published planned hiring rates as a guide. There seems to be a strong tendency to pay higher than the publicized starting scale. The "Proposed MIT 1955 Rates" are those agreed to by the Lincoln Steering Committee as a basis for making a recommendation on general salary structure.

B. STARTING SALARIES (Cont.)

The following conclusions seem justified by the data:

- a. The MIT starting scale for B. Sc. degree has been falling progressively behind the rest of the country.
- b. The "present MIT" range is lagging the national trend in starting salaries by about two years.
- c. The salary range recommended by the Lincoln Steering Committee for study purposes may be as much as \$20 per month low for 1955.

2. Doctor's Degree

Figure 2 shows the data on D. Sc. and Ph. D. starting salaries. The Los Alamos Survey uses four years from B. S. to Ph. D. Again the salaries shown are those reported as actually paid.

The following conclusions seem justified by the data:

- a. The present MIT Ph. D. scale is lagging about three years behind the national trend.
- b. The salary range recommended by the Lincoln Steering Committee appears correct.

3. Master's Degree

Figure 3 shows data on M. Sc. degrees. Less information is available than for the B. S. and Ph. D. degrees. From the available data, and if the M. Sc. scale is to fit properly between the B. Sc. and Ph. D., it seems clear that the "recommended" range is about correct and that the "present" rates are about \$50 per month low.

4. General

The information on the graphs seems in agreement with the other miscellaneous information we have regarding offers actually being made this year and last by other organizations who are seeking the same type men as we.

The inferior starting rates are of extreme seriousness. The Lincoln Laboratory will not be able to maintain a top level staff against the dual handicap of a low salary scale and a competitively unfavorable opportunity for graduate study.

When the Laboratory was in Cambridge and most of the best young staff entered via the Graduate School, we were in a better position to overcome the influence of low starting salaries because:

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B. STARTING SALARIES (Cont.)

- a. Demonstrated ability on our work could be used to go above formula level.
- b. The man was already living here, interested in the Laboratory, and often involved in a partly completed task, all of which influenced him to continue at MIT in spite of more favorable outside offers.

These factors no longer apply.

C. YEARLY SALARY INCREASES

Just as our starting scale has fallen behind, so has our yearly rate of salary increase and therefore, the entire salary structure. We are using a \$20 to \$30 per month yearly increase figure for B.S. men. The national average as given in the Los Alamos study has ranged from \$50 in 1951-52 to \$40 in 1953-54. The increases have been greater for our types of organizations. We are, therefore, faced with a recurring necessity for "scale adjustments" because of the sub-average yearly increment.

The reason for the high increment can be seen from Figure 4 which shows 1950, 1952 and 1954 B.S. salaries in the electronics industries as taken from the Los Alamos study. A man's yearly change is made up of two increments, 1) the slope of the salary versus age curve in any particular year, plus 2) the rise in the salary versus age curve from year to year. The yearly increments consist of a nearly constant \$24 per month per year slope on the curves for any one year plus a rise in the salary structure of \$20 to \$35 per month per year. The total rate of increase for an individual in the electronics industry has been over 10 per cent. The slope of the curves corresponds to the \$20 to \$30 merit increases we have been giving. The rise in structure, however, can only partially be compensated for by extra merit increases and has necessitated constant "adjustment".

It is clear from examination of the Los Alamos data that the rise in salary structure from year to year is no freak occurrence, but has been remarkably steady for the last four or five years. Some of it may be attributable to the increasing scarcity of engineers; some of it may simply be evidence of the steady increase in personal incomes that the country has experienced in the last few years. It represents the engineer's share in our increased standard of living due to technological improvements. The slope of the curves, however, represent the increasing value of a particular engineer from year to year as his experience and judgement improve. These two components are clearly evident in the figure.

C. YEARLY SALARY INCREASES (Cont.)

Figure 4 shows the fact, which is clearly supported by other data, that the changes in engineering starting salaries are reflected in the entire salary structure. These curves show an increase in B.S. starting rate of \$110 in four years while, for the same period, the salary ten years beyond the B.S. rose \$120. In the past, there has been a tendency to assume that a change in starting salary had no effect on salaries of men ten years and more beyond the B.S. degree. The evidence is the reverse. Although increases are not at the same percentage rate at the higher salary levels, they are actually larger in dollar value. It appears, in fact, that the increase in starting rates do not affect the salary structure as such but are merely one result of the steady yearly lifting of that structure.

Another interesting fact, apparent from Los Alamos and other data, is that there is no apparent flattening or saturating of an average individual's increase curve with age, at least through twenty years beyond the B.S. degree. He continues to receive annual "merit" increases of about the same size as a new graduate as well as participating in the general rise in salary structure as described above.

D. RELATIONSHIP OF PRESENT LINCOLN SALARIES TO 1954 INDUSTRIAL SALARIES

A comparison of present Lincoln salaries with those of outside organizations in 1954 shows that Lincoln's scale was low as of last year and that an additional adjustment is necessary beyond that required to meet the general increase in engineering salary levels during the last year. Lincoln's average B.S. salary is somewhat below electronics industry average despite the high quality of our staff.

In Figure 5 are plotted a number of curves showing industrial salaries in 1954 versus Lincoln salaries for B.S. only. Industrial data was obtained from the Engineer's Joint Council study of 1953 and the Los Alamos study of 1954. Since none of the data in these studies matched the conditions of Lincoln Laboratory, certain corrections and reservations must be applied to the curves. Fifty per cent of Lincoln staff hold advanced degrees. This is greatly in excess of the national average, and we have accordingly chosen the Lincoln B.S. curve as most closely corresponding to the national survey data.

1. Comparison with Engineer's Joint Council

The miscellaneous category (defined as consulting organizations, research and development laboratories and similar organizations) seemed to fit Lincoln best. The data for the study was taken in early 1953; therefore a conversion factor of one and one-half years times \$25 to \$30 per year or \$40 was added to correct the rise in salary levels to the fall of 1954. A further discrepancy occurs in that the EJC data includes all degree holders and therefore, presumably, Ph. D.'s and supervisory personnel. Since the curves shown may be \$10 to \$20 per month high when referred to B.S.'s only.

D. RELATIONSHIP OF PRESENT LINCOLN SALARIES WITH 1954 INDUSTRIAL SALARIES
Cont.

If one assumed that Lincoln staff are merely average, then the EJC data shows Lincoln to be \$25 to \$30 per month low on the average. It seems reasonable to contend that Lincoln staff average well above the median, including B.S. men as well as those with advanced degrees. Certainly, Lincoln's initial legacy from the campus laboratories was far above the average engineer. Much care has gone into the selection of new staff since that time. For new graduates we try for the top 10 per cent and are unlikely to have any interest at all in graduates below the middle of the class. Equivalent standards are applied to experienced candidates. Unfortunately, we are likely to judge our junior staff by comparing them to our best people rather than to the outside world. In industry there are many engineers doing routine design at drafting boards or routine maintenance and testing, tasks for which we customarily use non-staff, subcontract, or, in emergencies, rotation of regular staff. We feel that the median of our B.S. staff may conservatively be placed along the upper quartile line for the class of engineers as a whole. Compared to the EJC upper quartile, Lincoln salaries appear to be \$100 to \$125 per month low.

2. Comparison with Los Alamos Study

Plotted in Figure 5 is also the Los Alamos curve for B.S. and M. Sc. in the electronics industry for 1954. This is the category that seems to fit Lincoln best. This curve lies slightly above the Lincoln curve: a major discrepancy does not appear until the quality of Lincoln staff is considered. It is clear that our staff is receiving average pay for above average work and ability. The Los Alamos study unfortunately contains no data on distribution. However, if a distribution similar to that for the EJC study is assumed, then the upper quartile for the electronics industry should run nearly \$100 per month over the average for the industry.

Comparison between the data for Lincoln Ph. D.'s and the data for all electronics industry Ph. D.'s from the Los Alamos study show much the same relationship as that for B.S.'s. The Lincoln curve is close but below the industrial average for 1954. No data are available for a comparison of M.S. salaries. Lincoln salaries for these people are also low by an amount varying up to \$100 per month depending on the assumed quality of Lincoln staff.

E. AGE VERSUS YEAR FROM DEGREE AS BASIS FOR SALARY COMPARISON

Lincoln salaries in the preceding curves have been plotted against actual years from the B.S. degree to be in literal agreement with the Los Alamos and Engineers Joint Council studies. The Lincoln data includes Divisions 2, 3, 4, 5, 6 and 7, not Division 1, the Director's Office, or the Steering Committee. We believe there is a bias in the national data which, if removed, would widen the gap between

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E. AGE VERSUS YEAR FROM DEGREE AS BASIS FOR SALARY COMPARISON (Cont.)

Lincoln and the other curves.

Figure 6 shows Lincoln salary curves when plotted:

1. against actual year from B.S. degree,
2. against age with 22 years aligned with zero years after the B.S.

It will be seen that the salary versus age is lower than salary versus year from degree.

The instructions in the EJC study contain for the March 1953 survey, "If your records do not show year of Bachelor's Degree, substitute for 1952, men now 22 years old; for 1951, men 23, etc." One should expect age data to be more readily available and therefore to be prevalent in the sample. The comparable Lincoln curve would lie between those in Figure 6.

F. DATA USED IN THIS STUDY

The most helpful sources of information were the yearly "National Survey of Professional Scientific Salaries" by Los Alamos Scientific Laboratory. The reports for 1950, 1952, 1953, and 1954 were used.

Valuable information is available in the survey of companies in the "1953 Professional Income of Engineers" by the Engineers Joint Council representing the major engineering societies. Their study was made two years ago in the spring of 1953.

We also used the following:

1. "Case Alumnus" August 1954, giving 1954 starting salaries for Case Institute of Technology Alumni.
2. December 1952 survey of its membership by the American Institute of Chemical Engineers as reported in "Chemical Engineering Progress", July 1953.
3. Summer 1954 survey of its membership by the American Society of Mechanical Engineers as reported in "Mechanical Engineering" for April 1955.

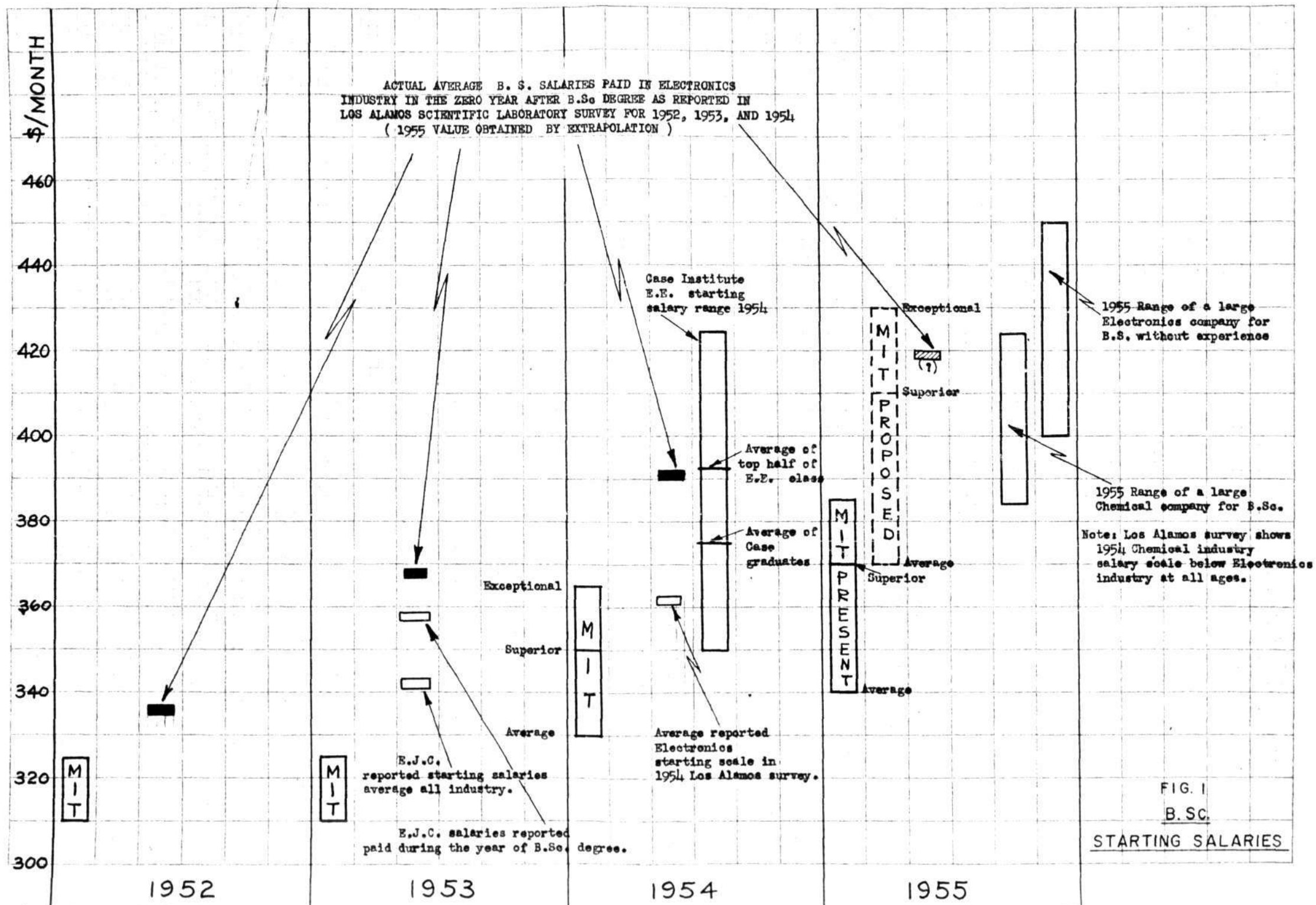
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Attached:
Figures 1 through 6

Signed

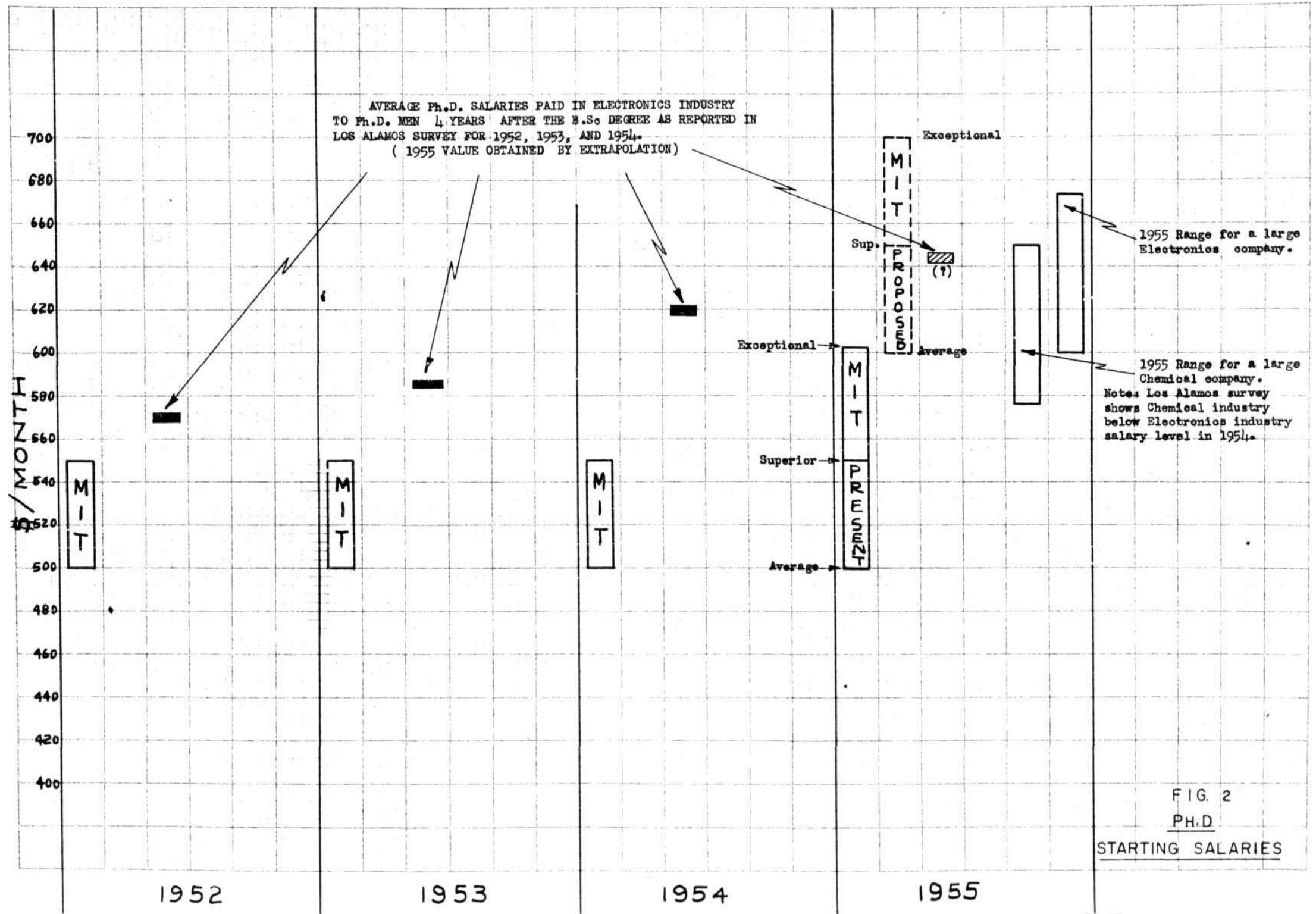
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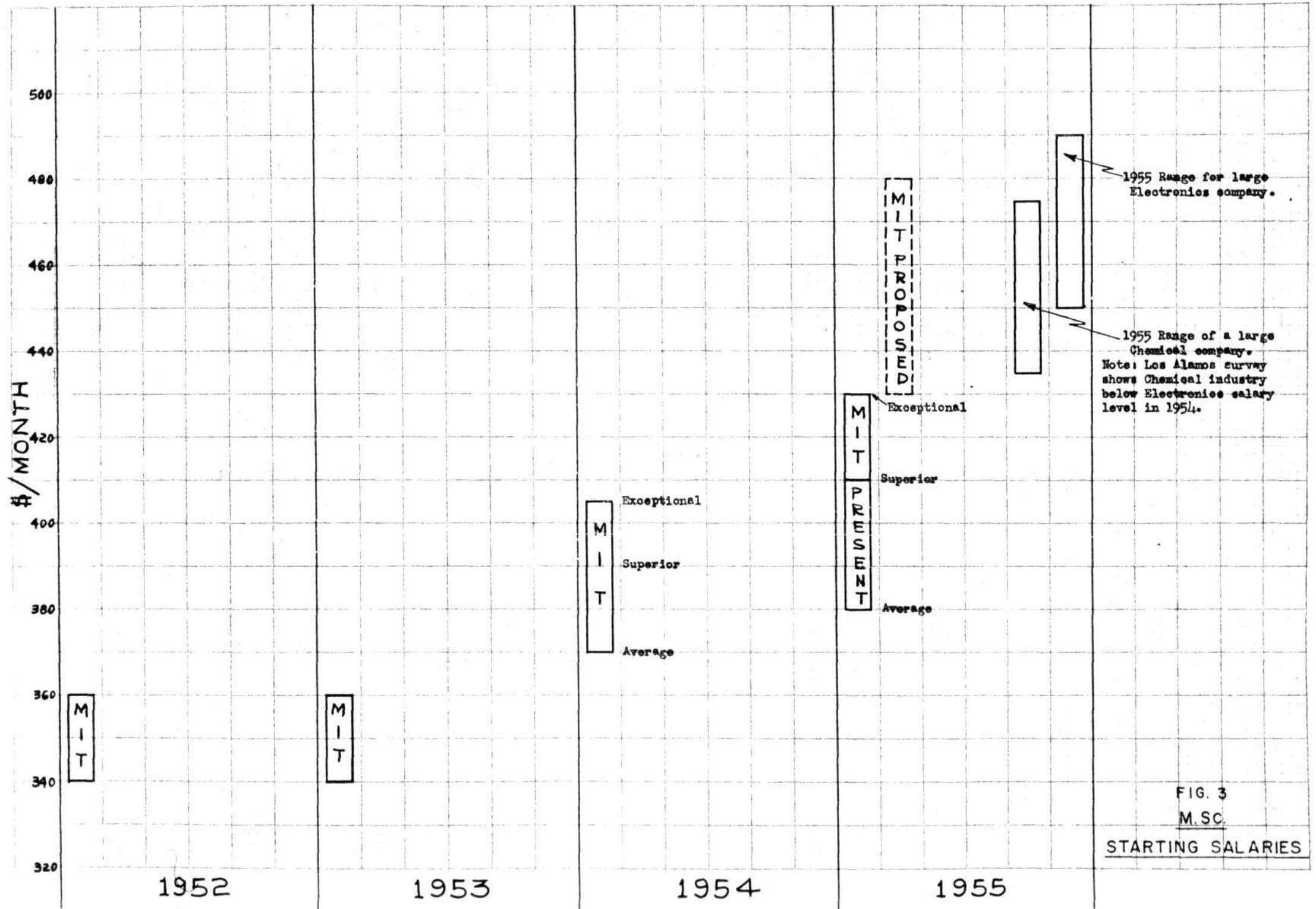


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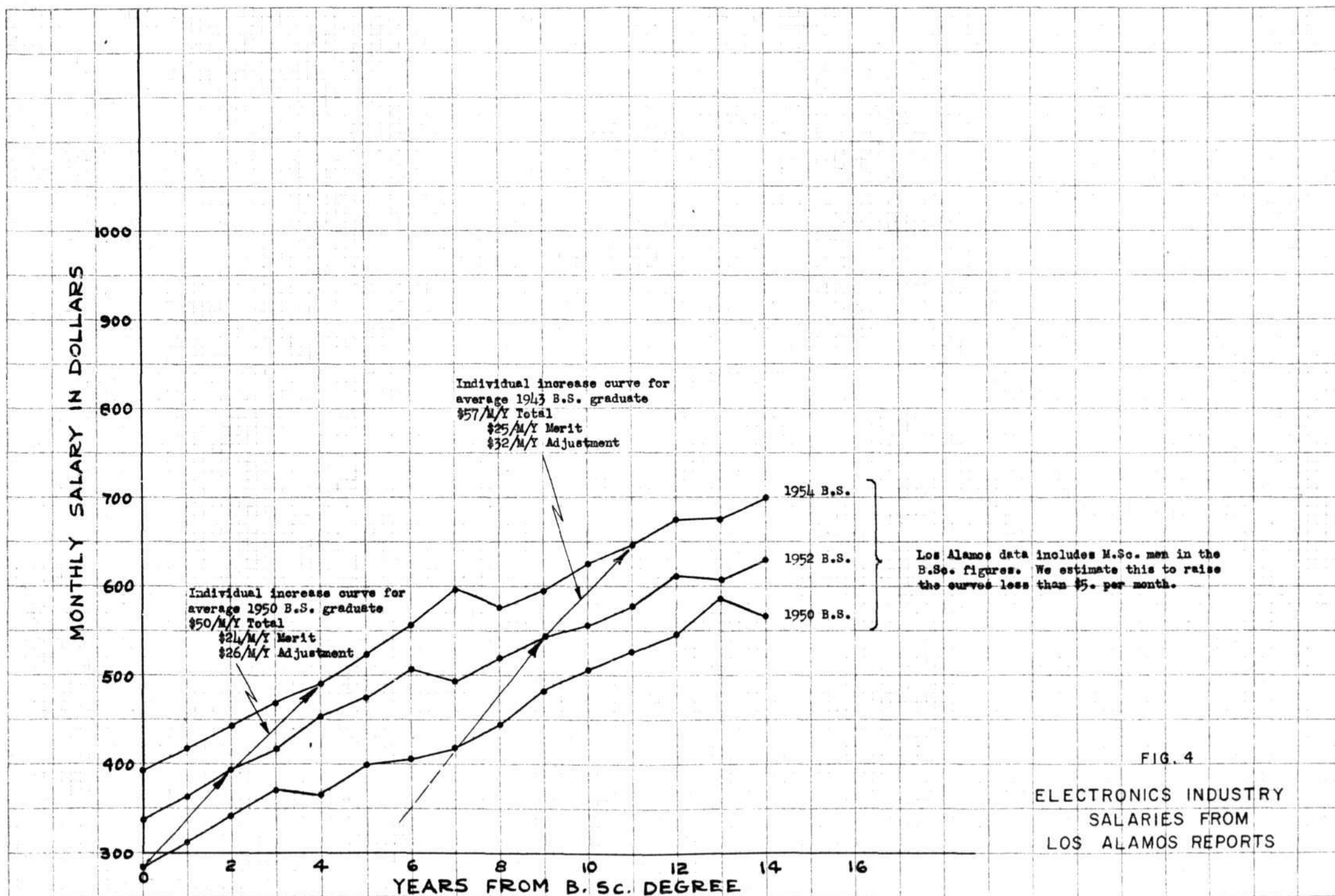


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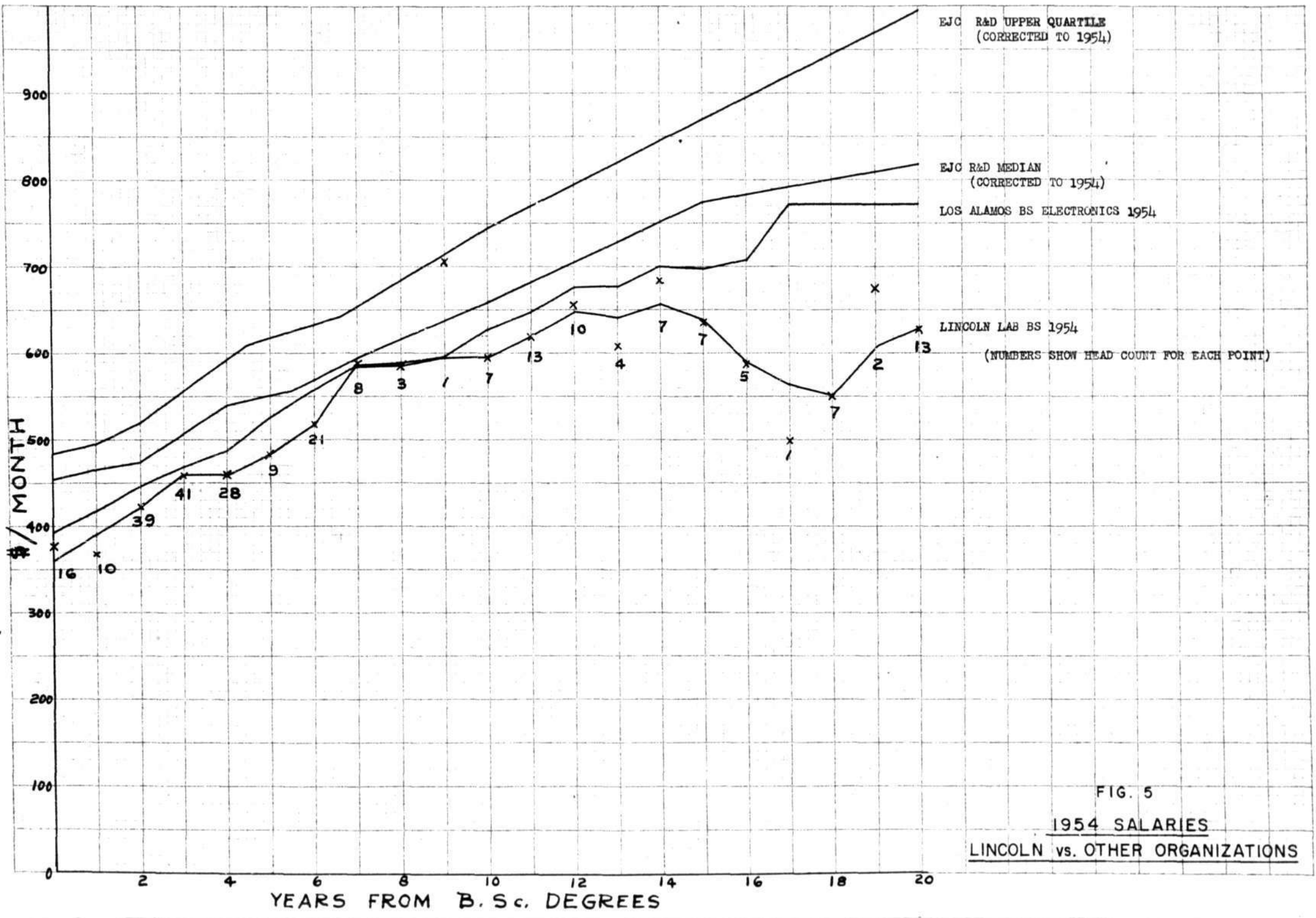
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FIG. 4
 ELECTRONICS INDUSTRY
 SALARIES FROM
 LOS ALAMOS REPORTS

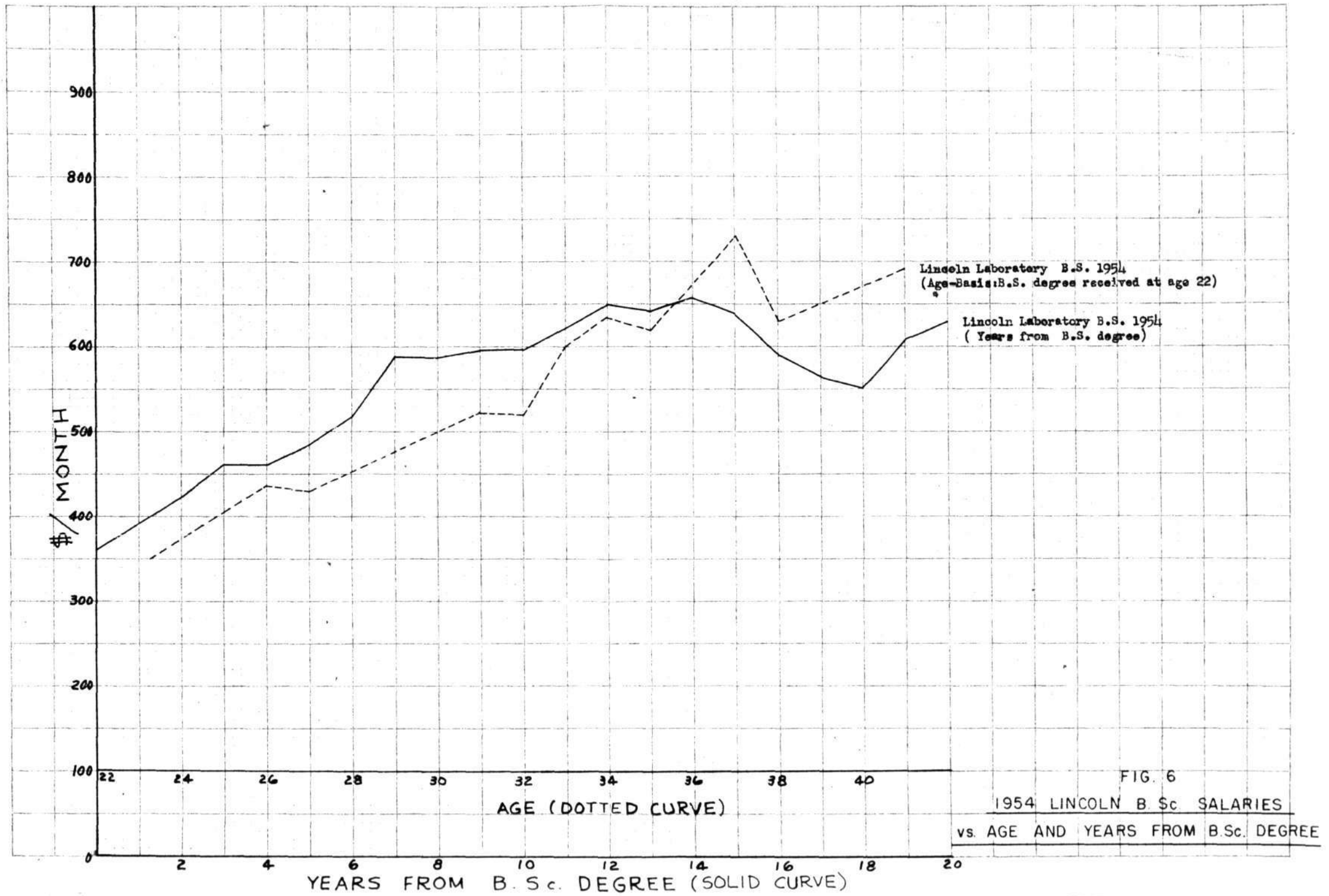
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FIG. 5
1954 SALARIES
LINCOLN vs. OTHER ORGANIZATIONS

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5 X 5 TO THE 1/2 INCH
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