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DEFENCE RESEARCH BOARD, (CANADA)

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04 THE EMPLOYMENT AND PROGRESSION OF
TECHNICAL OFFICERS AND TECHNICIANS
IN THE DEFENCE RESEARCH BOARD

by

11 N.W. Morton



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CP NO. 2

46 JUNE 1967
OTTAWA

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DEFENCE RESEARCH BOARD

DEPARTMENT OF NATIONAL DEFENCE
CANADA

CHIEF OF PERSONNEL BRANCH

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CP REPORT NO. 2

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THE EMPLOYMENT AND PROGRESSION OF TECHNICAL OFFICERS AND TECHNICIANS IN THE DEFENCE RESEARCH BOARD

1. Purpose The data of this report were among those collected as of 1 October 1966 to assist in deciding on the form of classification system to be used for employees of the Defence Research Board currently described as *technical officers* and *technicians*: these data were issued as Annexure "A" to Headquarters circular letter to Chief Superintendents DRBC 505-7 (C of P) of 24 February 1967. The purpose of this report is to record portions of the material that may have continuing value in indicating trends in levels of educational qualification of individuals entering DRB employment and rates of salary increase with experience.

2. Types of Duties Information was available for 198 technical officers and 608 technicians and assistant technicians on 1 October 1966. Examination of their duties indicated that these were not limited, to direct engagement in work of experiment or field trials, but included activities more peripheral in character, though none the less important, such as machinist, photographer or computer programmer. Accordingly, individuals were sorted into three groups: (Group A) those who participated directly in the general conduct of experimental or field projects, or whose training was intended to fit them to do so; (Group B) those who were essentially specialists or tradesmen (photographer, machinist, instrument maker, draftsman, etc.); and (Group C) those engaged in computer programming or data handling. Assistant technicians, technicians and technical officers were not treated separately, since although the grades of these classes overlap, the career progress of an individual typically takes him from one class to the next, over a period of years. The overall distribution among the research stations according to this threefold division (excluding 12 persons employed in DRB Headquarters and in the Operational Research Establishment) was as follows:

Group	Technicians	Technical Officers	Total
A	480	164	644
B	91	16	107
C	34	9	43

3. Education Levels A distinction was made also among four levels of education: less than high school completion, high school graduation, graduation from an institute of technology following completion of secondary school, and university graduation. Those with less than high school graduation included a number who had not proceeded beyond elementary school. On the other hand, many who had not attended a university or an institute of technology had completed correspondence courses in technical fields or had taken courses at private vocational schools. The majority of the university graduates were pass, not honors, graduates.

GROUP A

4. Statistical Data by Stations Medians for age, rank, salary, and length of service for Group A personnel at the above four education levels for seven research stations of the Defence Research Board are as follows:

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		TECHNICAL OFFICERS			
		University Graduates	Technological Institute Graduates	High School Graduates	Less Than High School Graduation
NRE	N	8	14	33	15
	Age	35.5	23.0	28.7	44.7
	Rank	TO 3	AT 3	T1-T2	T1
	Salary	7500	5071	5542	5719
	Service, years	10.5	1.0	9.8	12.5
PNL	N	3	9	19	6
	Age	36.3	22.0	39.7	42.1
	Rank	TO 3	T1	T3	T2
	Salary	6750	5280	6450	6125
	Service, years	9.5	0.4	9.3	8.0
DRML	N	9	10	10	5
	Age	26.3	29.3	45.5	43.0
	Rank	T1	T2-T3	T2-T3	T1
	Salary	5875	5750	6500	5375
	Service, years	2.5	4.5	13.5	6.5
DCBRL	N	19	22	30	11
	Age	34.5	25.5	35.5	44.7
	Rank	TO 2	T1	T2-T3	AT 2
	Salary	7083	5800	6188	4125
	Service, years	8.2	2.7	6.5	5.5
SES	N	5	26	33	41
	Age	38.0	24.6	41.8	45.8
	Rank	T3	T1	T3	T1-T2
	Salary	6250	5406	6375	5614
	Service, years	3.8	1.0	15.7	16.8
DRTE	N	9	46	51	12
	Age	36.8	28.0	40.3	44.3
	Rank	TO 4	T3	TO 2	TO 2
	Salary	7875	6208	7125	7500
	Service, years	9.0	6.7	12.4	16.0
CARDE	N	3	40	87	68
	Age	41.8	24.6	38.5	47.7
	Rank	TO 5	T1	T3	AT 3
	Salary	9125	5290	6382	5323
	Service, years	14.0	1.6	11.9	17.5

More detailed distributions of statistics are attached as Appendix "A".

5. Salary and Age Distributions of salaries by five-year age groups are shown in terms of the 75th, 50th, and 25th percentiles for each of the four education levels for Group A personnel over all stations in Figs. 1 to 4. In Fig. 5 the medians only are shown, together with the lower portion of the corresponding lines for doctorate and non-doctorate DSSOs for comparison.

6. Recent Recruitment Considering only technicians and technical officers recruited since 1 October 1964 and still on strength in Group A as of 1 October 1966, the distribution for stations by educational levels is as follows:

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	University Graduates	Technological Institute Graduates	High School Graduates	Less Than High School Graduation
NRE	2	10	4	—
PNL	—	8	3	2
DRML	4	4	1	1
DCBRL	3	9	8	4
SES	1	17	3	—
DRTE	2	17	6	—
CARDE	—	19	8	—
Total	12	84	33	7

It will be noted that of the 136, about 9 per cent were university graduates, 62 per cent graduates of institutes of technology, 24 per cent high school graduates, and only 5 per cent had less than matriculation standing. The corresponding percentages of all employees on 1 October 1966 were: graduates of university — about 9 per cent, of institutes — 26 per cent, of high schools — 41 per cent, and non-matriculants — about 24 per cent.

7. Salary Development The Salary records of Group A personnel employed before 1 October 1964, numbering 499, were examined to determine the typical rate of salary increase over the period of employment of 2 to 20 years. For purposes of comparison, each starting salary was expressed in terms of the salary paid on 1 October 1966 for the same grade and level in it. The mean annual rate of change was then determined on both an arithmetic and on a geometric basis. The distributions of rates and the median rate for all stations, subdivided by education levels, are as follows:

Mean Annual Increase in Salary (Arithmetic) 1966 Dollars

	University Graduates	Technological Institute Graduates	High School Graduates	Less Than High School Graduation
\$301 plus	8	16	17	2
251-300	11	15	28	7
201-250	12	18	65	16
151-200	9	29	59	34
101-150	3	4	43	44
51-100	0	1	14	31
1-50	1	0	0	12
Total	44	83	226	146
Median	\$238	\$221	\$197	\$134

Mean Annual Increase in Salary (Geometric) 1966 Dollars

	University Graduates	Technological Institute Graduates	High School Graduates	Less Than High School Graduation
7.0 or more	3	8	7	3
6.0-6.9	2	10	20	2
5.0-5.9	4	9	37	12
4.0-4.9	12	21	45	20
3.0-3.9	12	31	47	43
2.0-2.9	9	3	53	33
1.0-1.9	1	1	16	24
Below 1.0	1	0	1	9
Total	44	83	226	146
Median	3.9	4.3	3.9	3.2

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The medians for the seven research stations separately are given below, except when there were too few cases at a station to justify computing a median.

**Mean Annual Increase in Salary
(Arithmetic)
1966 Dollars**

	University Graduates	Technological Institute Graduates	High School Graduates	Less Than High School Graduation
NRE	—	—	219	145
PNL	—	—	200	—
DRML	—	—	175	—
DCBRL	263	231	181	—
SES	—	250	191	145
DRTE	—	200	200	180
CARDE	—	283	196	110

**Mean Annual Increase in Salary
(Geometric)
1966 Dollars**

	University Graduates	Technological Institute Graduates	High School Graduates	Less Than High School Graduation
NRE	—	—	5.0	3.6
PNL	—	—	3.6	—
DRML	—	—	3.5	—
DCBRL	4.5	3.8	3.6	—
SES	—	4.2	3.9	3.4
DRTE	—	3.8	3.8	3.8
CARDE	—	5.0	4.0	2.7

8. Salary Trends By a similar process, involving the conversion of initial salary into current dollar values and notation of the time at which the employee was promoted to each higher grade, lines were graphed showing individual salary development for the 499 personnel of Group A who had been employed on 1 October 1966 for two years or longer. Divided by the four educational qualification groups, these lines are shown in Figs. 6 to 10. The trends that they appear on inspection to indicate are shown in Fig. 11. In certain of these figures, there is shown also the maximum permissible progression rate authorized for comparable personnel in another government scientific agency (see para. 9 below). It will be noted that university graduates and technological institute graduates appear to follow much the same track, but few of the latter exceed 35 years of age. It will be observed also that no great difference emerges between the total group of technological institute graduates and those who graduated in fields other than electronics (and who make up about one-third of the total).

9. Note on Procedure The foregoing procedures are open to the criticism that a given point in a 1966 scale, e.g. the bottom step of the Technician 1 grade, may not have the same significance today that it had in 1956 or 1950. If "inflationary creep" in the relative value of grade levels has occurred, an apparent rate

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of progression will be too high when the current dollar equivalent of an earlier salary is set too low. In the illustration used above, if the significance of Technician 1 ten years ago is now best represented by Technician 2, the current values of the latter should be used for the former at the earlier date, and this would reduce the slope of the line describing the salary progress of the individual. However, one available datum, the *maximum* permissible salary progression in another government scientific agency for laboratory technicians and technical officers, expressed in 1966 dollars relative to years from graduation from the last educational institution attended full-time, for (a) technological institute or university graduates, and (b) high school graduates, involves rates that appear to correspond reasonably closely to the limiting cases for DRB staff. For example, the arithmetic rate for post-secondary school graduates in this other agency is \$382 per annum, and the geometric rate about 5½ per cent. For high school graduates the corresponding maximum values are \$340 and 6½ per cent. These would suggest that little or no inflation may have taken place in DRB grade values over the years.

GROUP B

10. Occupational Fields The occupational fields represented by technicians and technical officers assessed for the purpose of this report as falling in Group B are as follows:

Field	Number of Personnel
Machinist (fitter, instrument maker)	64
Photographer	15
Draftsman	4
Technical Stores	3
Animal Husbandry	3
Metal Plater	2
Inspector	2
Electrician	2
Sheet Metal Worker	2
Carpenter, Cabinet Maker	2
Welder	1
Ship Handler	1
Maintenance Supervisor	1
Glass Blower	1
Plastics Moulder	1
Printer	1
Reproduction Equipment Operator	1
Technical Illustrator	1
Total	107

It is notable that personnel in the most frequently occurring field, machinists and closely allied trades, are not found, or are rarely found, classified as technicians at CARDE and SES, which maintain an extensive maintenance and operating staff. They are almost all together in the other five stations.

11. Statistical Information Statistical data for this group are shown in Appendix "B". It may be observed that it includes few university or technological institute graduates. It tends toward lower middle age (median 45 years), the Technician 1 to 3 level, and salaries in the \$6000 - \$7000 range. Length of service varies widely over the whole range, averaging about 12 years.

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GROUP C

12. Statistical Information Statistical data for this group are shown in Appendix "C". Of the 43 persons included, 25, or nearly sixty per cent, are women. Nearly a quarter of the group are college or technological institute graduates, and only six persons did not complete high school. Average age is low, 32 years, and so is length of service. The average grade and pay level are Technician 1 and \$5400.

13. Salary Trends Fig. 12 shows salary trends determined on the same basis as in Figs. 6 to 10. The upward movement appears to be sharper than for the personnel of Group "A". While the trend for university and technological institute graduates in Group "A" may be represented (in the graphical illustration used) by a 45° line, that for the corresponding personnel in Group "C" is closer to 60°, while the trend line for high school graduates in Group "C" approaches 45°.

CONCLUSIONS

14. Several main features concerning the total population of 806 technicians and technical officers examined are evident:

- (a) The population is rather heterogeneous with respect to duties. While over three-quarters of it may be described in terms of direct and general participation in a scientific program, the contributions of the remainder appear to be less immediate or more specialized. These distinguishable elements of the population exhibit differences in age, education, salary progression, and other characteristics;
- (b) Group "A", which more nearly corresponds to the classic sense of the term "technician", is itself heterogeneous in respect of levels and types of formal training. Moreover, the composition of this group is changing in this regard. While at present about one-third are either university or technological institute graduates, and one-quarter have less than high school education, those recruited in the past two years who have remained with DRB are 70 per cent university or technological institute graduates, and only five per cent did not complete high school;
- (c) There is a positive relation between education level and grade or salary. Relatively few of those with less than high school education enter the technical officer ranks, but a large proportion of those with university education may expect to do so.

DISCUSSION

15. The relatively recent availability of large numbers of young people, trained at the rapidly expanding institutes of technology to be scientific technicians, suggests that they may set the standard for this class of work in the future. They make up over 60 per cent of the technicians hired in the past two years in what has been termed Group A in this report. While now composing only about one-quarter of this group (along with an additional five or ten per cent of university graduates), they would, if this rate of recruitment were to continue, compose a majority before many years. The lines of salary progression for these employees (Figs. 7 and 8) indicate that a substantial proportion of them will progress to a salary of \$10,000 or more (in 1966 terms) by the end of their working life, and that they will undertake a commensurate responsibility in the scientific program, corresponding to that of a present DRTO 8 or 9. If this is correct, it may become necessary to consider a pattern of organization of work that will permit them to carry out an increased proportion of the duties that have hitherto been performed by scientific officers. This would perhaps imply that the scientific officer would assume chiefly the responsibility for ultimate initiative and for general direction and planning. Such a policy would heighten the standard of excellence required in the scientific officer, while reducing the number needed for a given program. On the other hand, it may have to be borne in mind that many duties to be performed by individuals whom it is convenient or desirable to classify as technicians may not require the qualifications nor permit the expectations of university or technological institute graduates, and that for such purposes a lower standard may be necessary.

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APPENDIX "A"

Age	University Graduates	Technological Institute Graduates	High School Graduates	Less Than High School Graduation	All
61-65			5	6	11
56-60			5	12	17
51-55	1		21	25	47
46-50	4		44	42	90
41-45	13	3	33	39	88
36-40	11	10	44	15	80
31-35	8	31	42	12	93
26-30	10	33	34	5	82
21-25	9	77	30	2	118
16-20		13	5		18
Total	56	167	263	158	644
Median (years)	36.0	25.1	37.8	46.2	36.2

Class and Grade	University Graduates	Technological Institute Graduates	High School Graduates	Less Than High School Graduation	All
DRTO 9			2		2
8	1		1	1	3
7	3		3	1	7
6	4	2	7	1	14
5	4	5	15	6	30
4	10	7	30	4	51
3	12	14	25		51
2	3	2		1	6
1					
Tech 4		4	14	5	23
3	5	20	47	13	85
2	4	16	51	27	98
1	8	86	33	32	158
AT 3	2	12	25	48	87
2			9	16	25
1			1	3	4
Total	56	167	263	158	644
Median	DRTO 3	Tech 1	Tech 2	Tech 1	Tech 2

Salary	University Graduates	Technological Institute Graduates	High School Graduates	Less Than High School Graduation	All
\$12001-12500			1		1
11501-12000					
11001-11500	1		1		2
10501-11000			1		1
10001-10500	1		2		3
9501-10000	2		1	1	4
9001- 9500	3	1	4	1	9
8501- 9000	4	1	8	3	16
8001- 8500	1	6	7	4	18
7501- 8000	9	5	25	4	43
7001- 7500	6	9	35	6	56
6501- 7000	8	17	34	3	62
6001- 6500	8	19	55	28	110
5501- 6000	5	19	30	28	82
5001- 5500	6	72	28	45	151
4501- 5000		18	14	11	43
4001- 4500	2		9	16	27
3501- 4000			7	5	12
3001- 3500			1	1	2
2501- 3000				2	2
Total	56	167	263	158	644
Median	\$6938	\$5455	\$6386	\$5489	\$6014

Years of Service	University Graduates	Technological Institute Graduates	High School Graduates	Less Than High School Graduation	All
19	1		29	43	73
18	1		6	14	21
17	2		11	10	23
16	1		13	9	23
15	2	2	19	17	40
14	4	1	17	10	32
13	5	2	21	5	33
12	2	6	17	8	33
11		5	14	7	26
10	2	10	10	4	26
9	6	4	20	5	35
8	4	6	5	4	19
7	2	10	10	5	27
6	4	3	8	1	16
5		5	9	4	18
4		7	8	2	17
3	5	5	4	1	15
2	3	17	9	2	31
1	5	33	14	2	54
0	7	51	19	5	82
Total	56	167	263	158	644
Median (years)	8.0	1.5	11.6	15.3	9.8

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APPENDIX "B"

Age	University Graduates	Technological Institute Graduates	High School Graduates	Less Than High School Graduation	All
61-65			3	6	9
56-60	1		2	6	9
51-55			6	12	18
46-50			5	10	15
41-45	1		6	13	20
36-40			6	7	13
31-35			5	4	9
26-30			3	3	6
21-25		2	5		7
16-20			1		1
Total	2	2	42	61	107
Median (years)			40.7	47.3	44.9

Class and Grade	University Graduates	Technological Institute Graduates	High School Graduates	Less Than High School Graduation	All
DRTO 10			1		1
9					
8					
7				1	1
6			1	1	2
5	1		1	1	3
4			2	2	4
3	1		3	1	5
2					
1					
Tech. 4			4	5	9
3			8	12	20
2			9	15	24
1		2	5	16	23
AT 3			4	6	10
2			3	1	4
1			1		1
Total	2	2	42	61	107
Median	T04	T1	T2-T3	T2	T2

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Salary	University Graduates	Technological Institute Graduates	High School Graduates	Less Than High School Graduation	All 1 st
\$13001-13500			1		1
12501-13000					
12001-12500					
11501-12000					
11001-11500					
10501-11000					
10001-10500					
9501-10000				1	1
9001- 9500				1	1
8501- 9000	1		2		3
8001- 8500				1	1
7501- 8000			2	2	4
7001- 7500	1		5	4	10
6501- 7000			4	8	11
6001- 6500			13	16	29
5501- 6000			3	18	21
5001- 5500		2	6	7	15
4501- 5000			2	2	4
4001- 4500			2	1	3
3501- 4000			1		1
3001- 3500			1		1
Total	2	2	42	61	107
Median			\$6231	\$6078	\$6146

Years of Service	University Graduates	Technological Institute Graduates	High School Graduates	Less Than High School Graduation	All
19			1	5	6
18				1	1
17			1	2	3
16				2	2
15			3	6	9
14			6	7	13
13			3	6	9
12			5	8	13
11	1			4	5
10			1	3	4
9			3	5	8
8			2		2
7			3	1	4
6			1	2	3
5			2	4	6
4			2	1	3
3			1		1
2	1		1		2
1			2	3	5
0		2	5	1	8
Total	2	2	42	61	107
Median (years)	-	-	9.2	12.3	11.8

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APPENDIX "C"

Age	University Graduates	Technological Institute Graduates	High School Graduates	Less Than High School Graduation	All
61-65	1		1		2
56-60			1	1	2
51-55					
46-50	1		1	1	3
41-45			2	1	3
36-40	1		4		5
31-35	2	1	5	2	10
26-30	1		2	1	4
21-25	2	1	3		6
16-20			8		8
Total	8	2	27	6	43
Median (years)	33.0		31.0	38.0	32.3

Class and Grade	University Graduates	Technological Institute Graduates	High School Graduates	Less Than High School Graduation	All
DRT0 6	1		1		2
5	1	1	1		3
4			2		2
3			1		1
2			1		1
1					
Tech 4					
3	1		7		8
2				1	1
1	4	1	1		6
Asst. Tech 3	1		2	4	7
2			3	1	4
1			8		8
Total	8	2	27	6	43
Median	Tech 1		Tech 1	AT 3	Tech 1

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Salary	University Graduates	Technological Institute Graduates	High School Graduates	Less Than High School Graduation	All
\$9001-9500			1		1
8501-9000	1				1
8001-8500		1			1
7501-8000	1		2		3
7001-7500			1		1
6501-7000			2		2
6001-6500	1		6	1	8
5501-6000	2		1		3
5001-5500	3	1	1	2	7
4501-5000				3	6
4001-4500			3		2
3501-4000			2		5
3001-3500			5		3
2501-3000			3		
Total	8	2	27	6	43
Median	\$5750		\$5250	\$4750	\$5392

Years of Service	University Graduates	Technological Institute Graduates	High School Graduates	Less Than High School Graduation	All
19			3		3
18					
17					
16					
15			1		1
14					
13	1				1
12			2		2
11				2	2
10	2	1	2		5
9			1	1	2
8				1	1
7	1		1		2
6			2		2
5	1		1		2
4					
3					
2	1	1	1	1	4
1	2		4		6
0			9	1	10
Total	8	2	27	6	43
Median (years)	6.0		2.0	8.5	5.3

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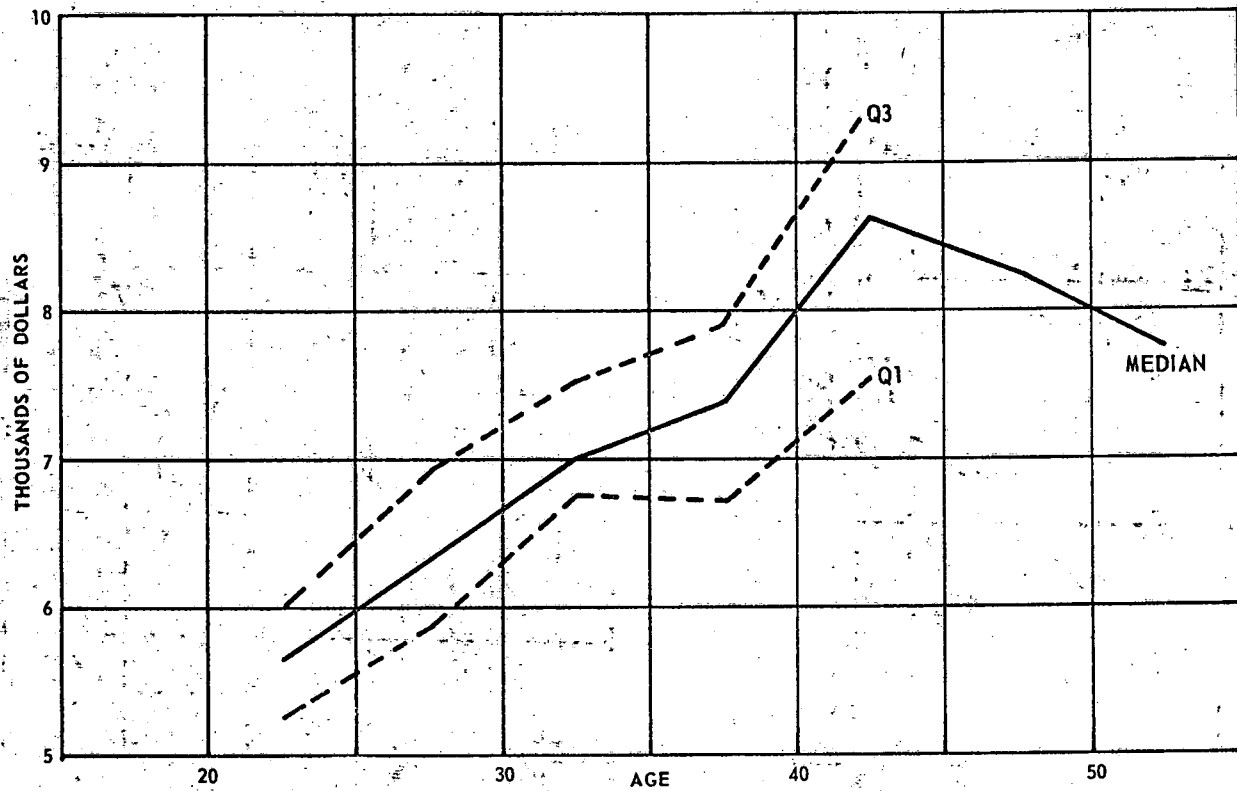


Fig. 1. Technicians and Technical Officers - University Graduates.

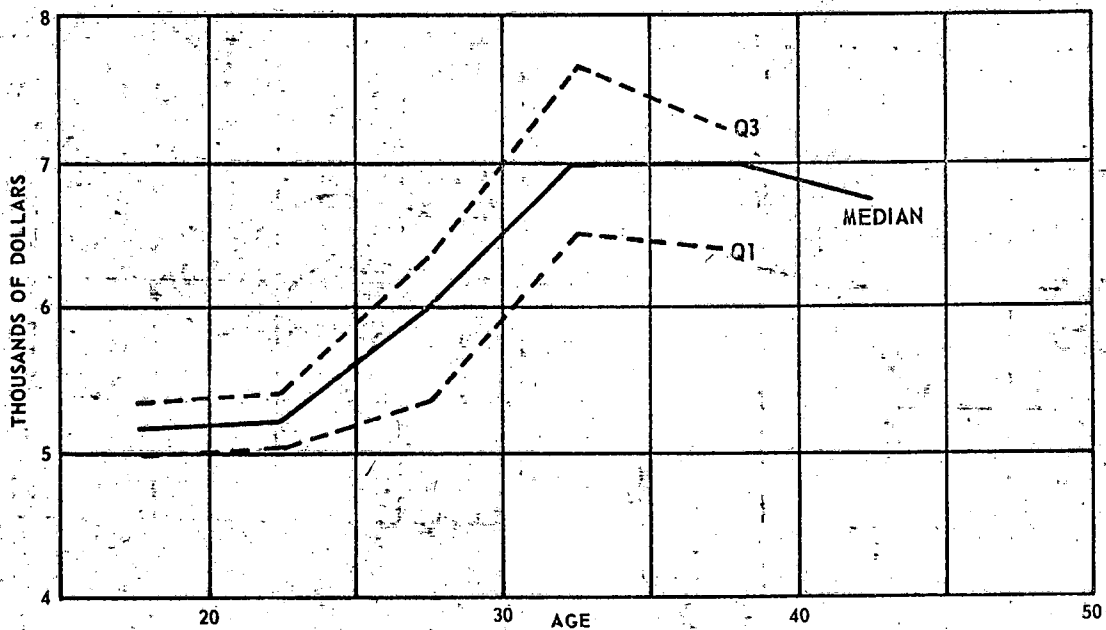


Fig. 2. Technicians and Technical Officers - Technological Institute Graduates.

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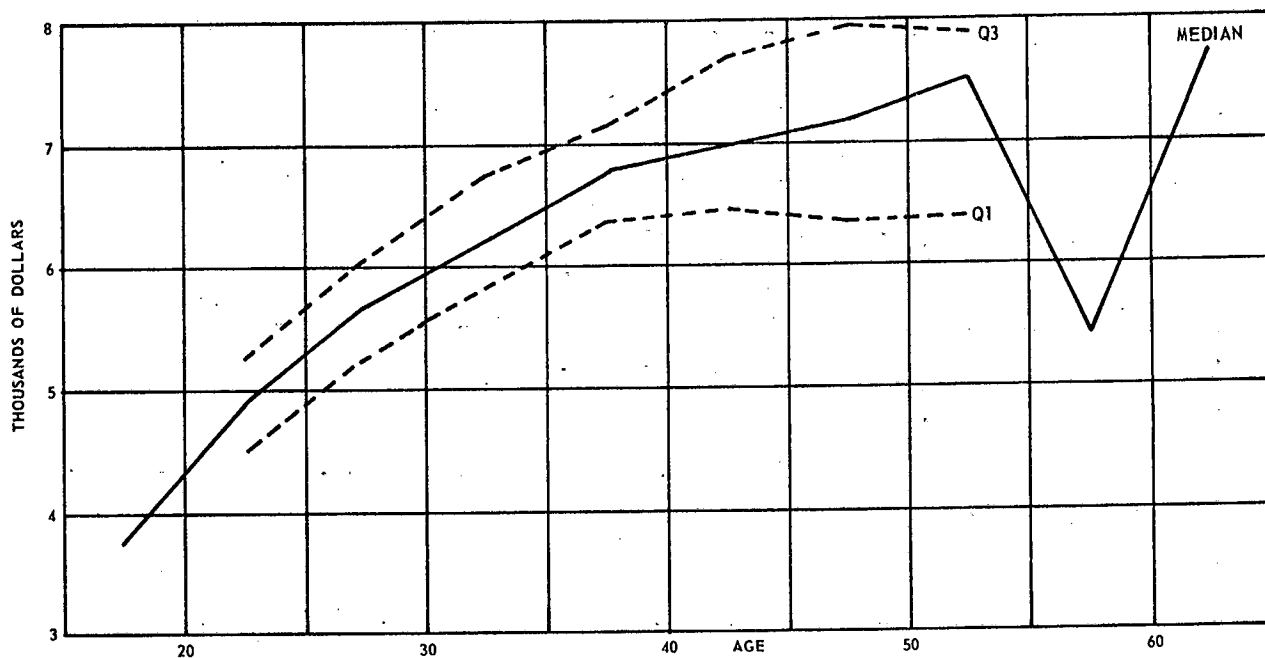


Fig. 3. Technicians and Technical Officers - High School Graduates.

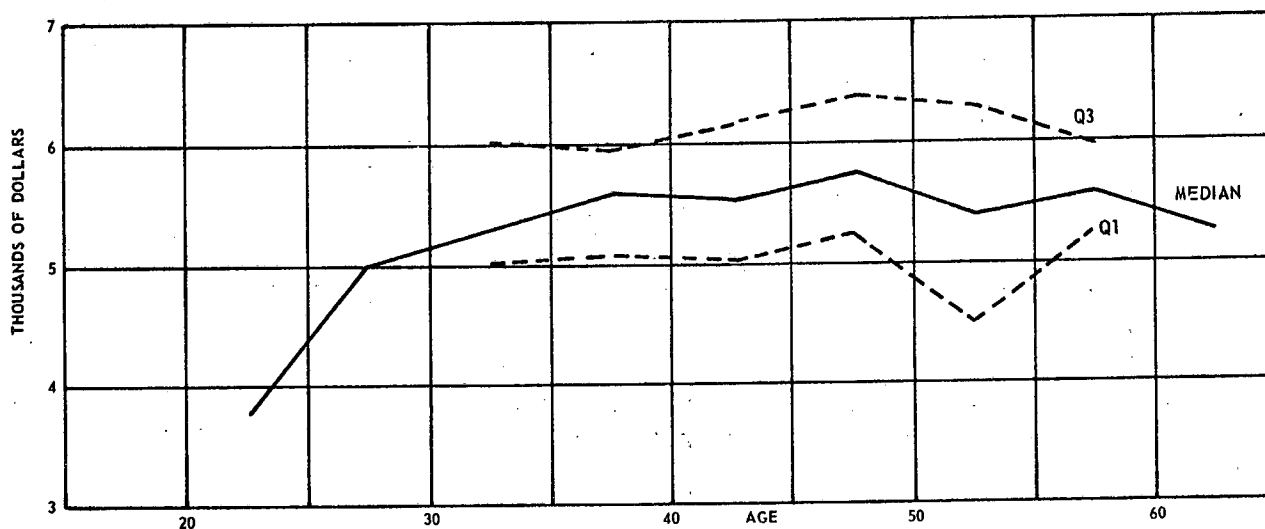


Fig. 4. Technicians and Technical Officers - Less than High School Graduation.

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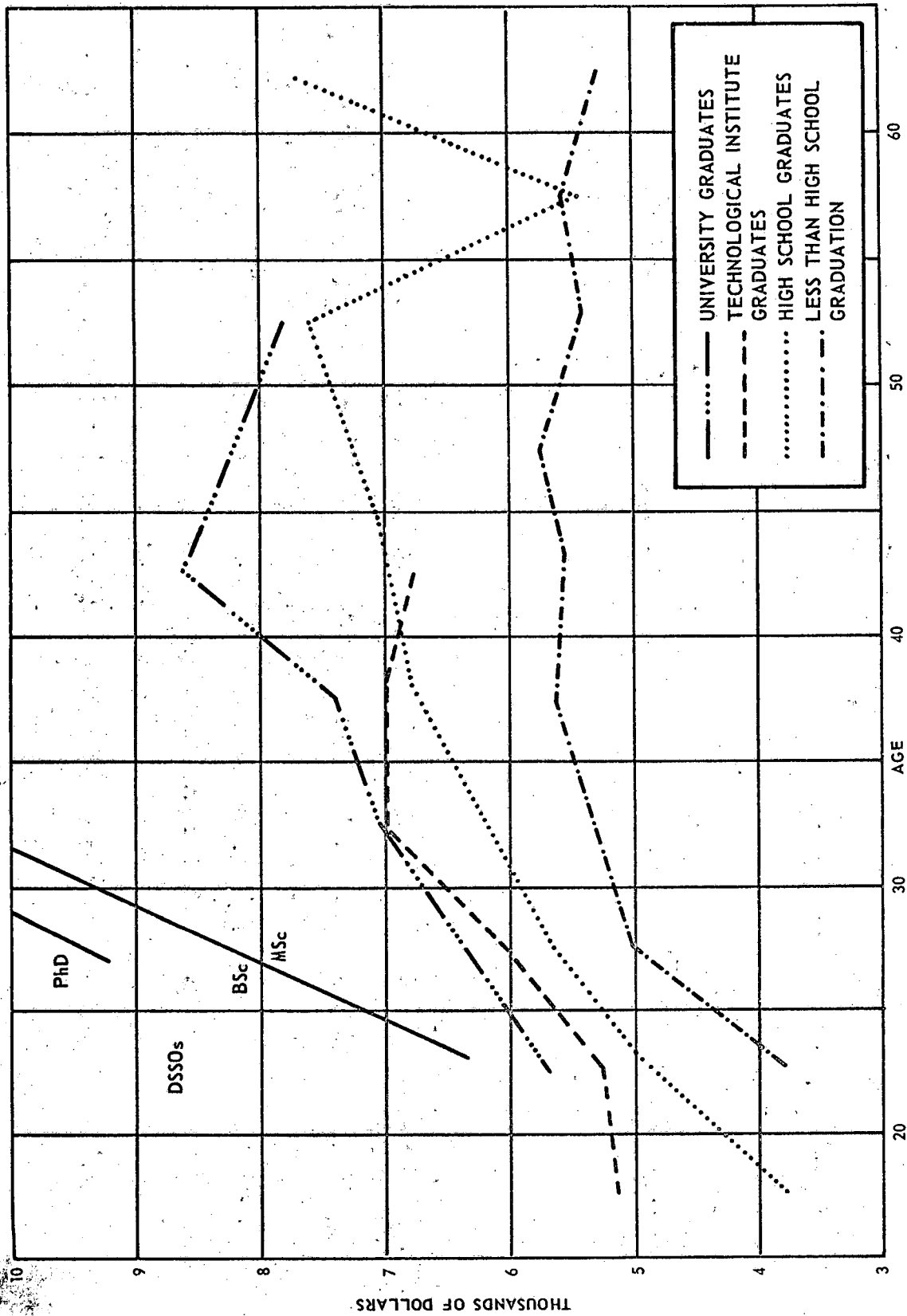


Fig. 5. Technicians and Technical Officers.

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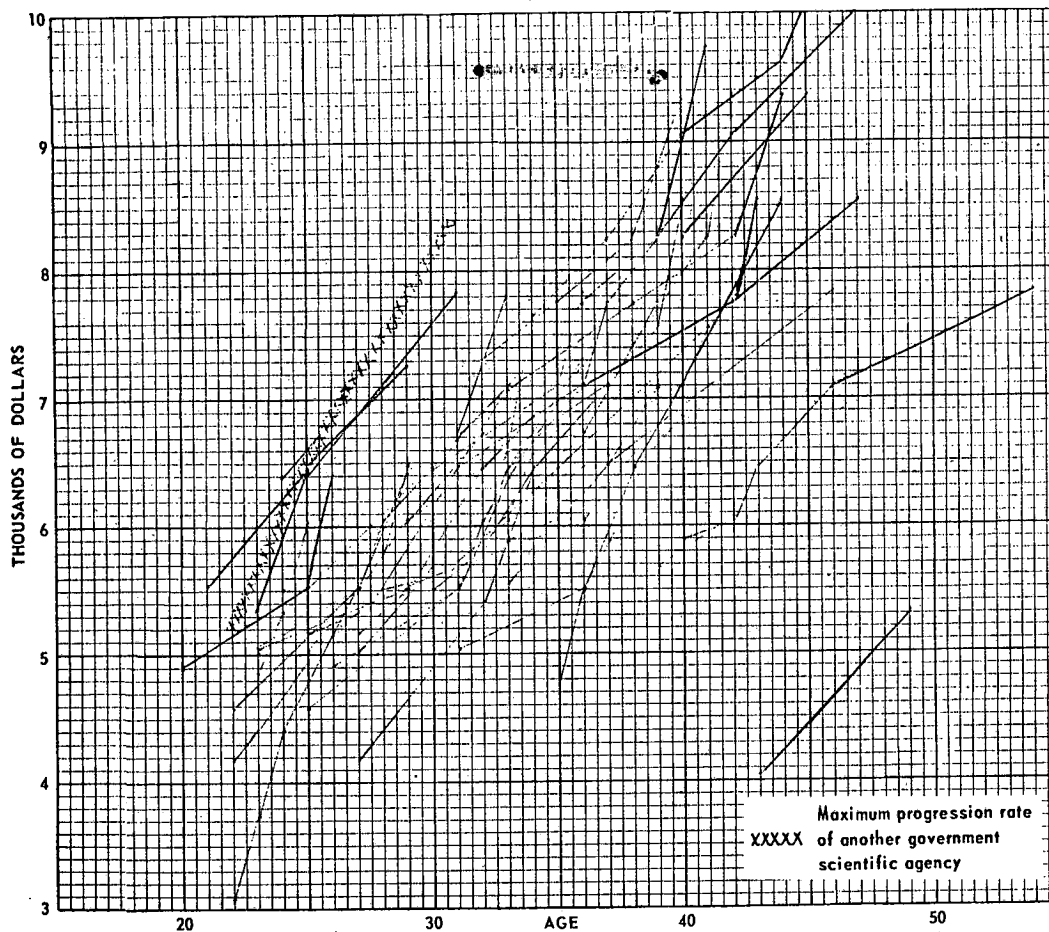


Fig. 6. Technicians and Technical Officers - University Graduates.

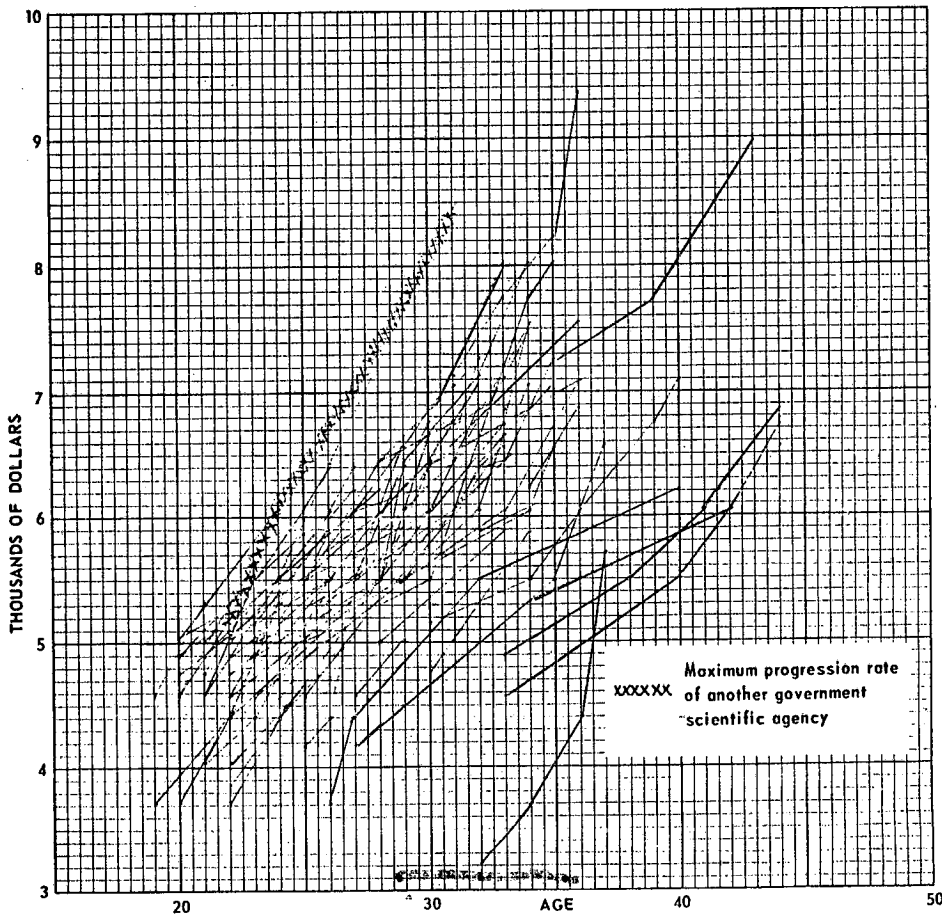


Fig. 7. Technicians and Technical Officers - Technological Institute Graduates.

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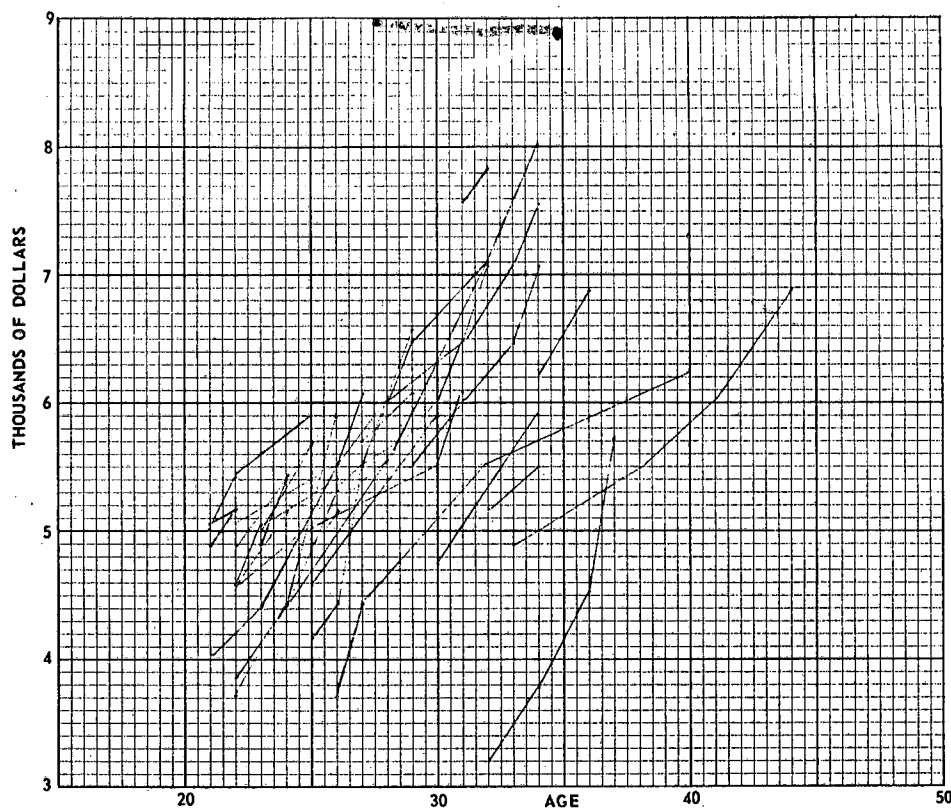


Fig. 8. Technicians and Technical Officers -
Technological Institute Graduates in fields other than Electronics.

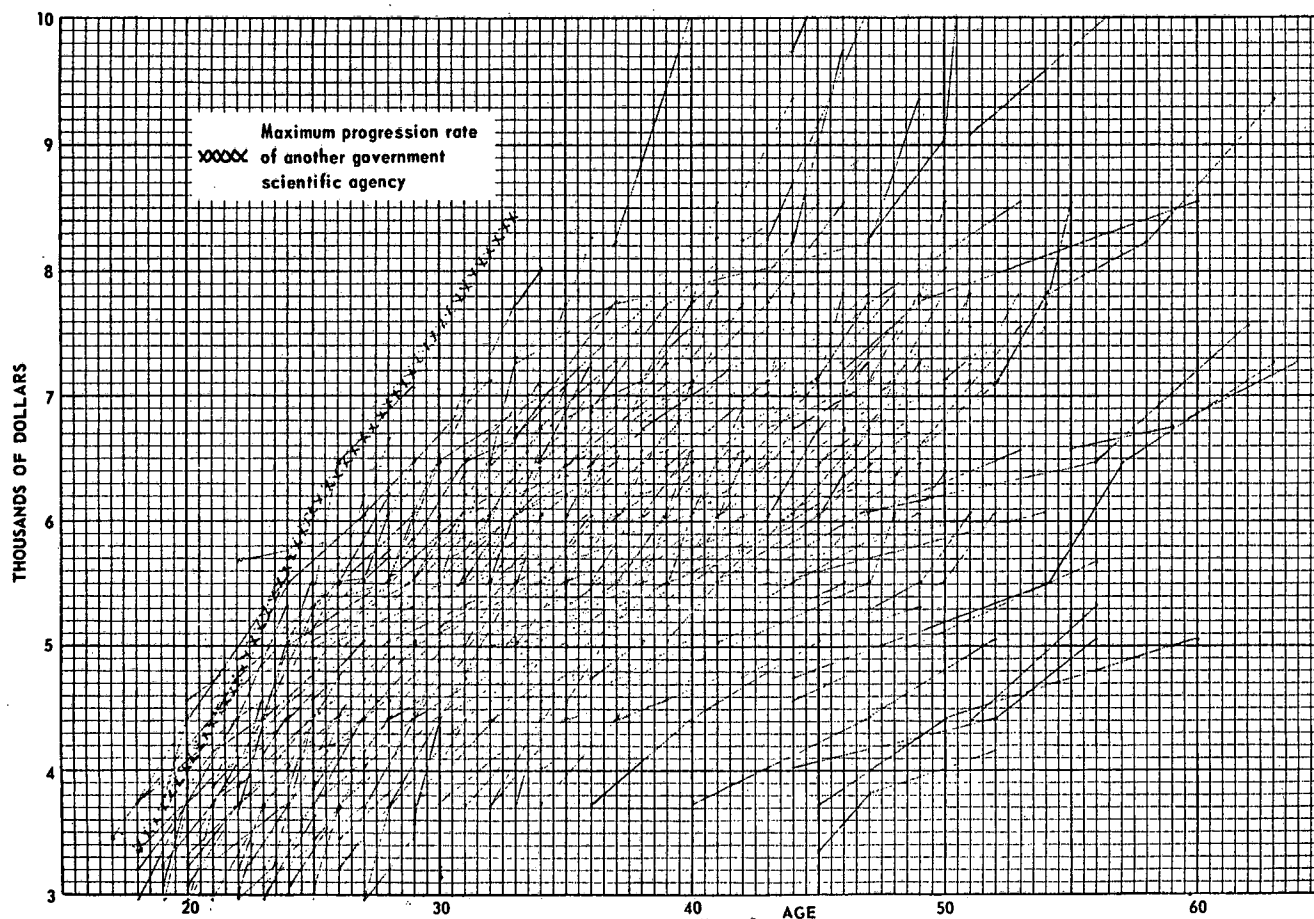


Fig. 9. Technicians and Technical Officers - High School Graduates.

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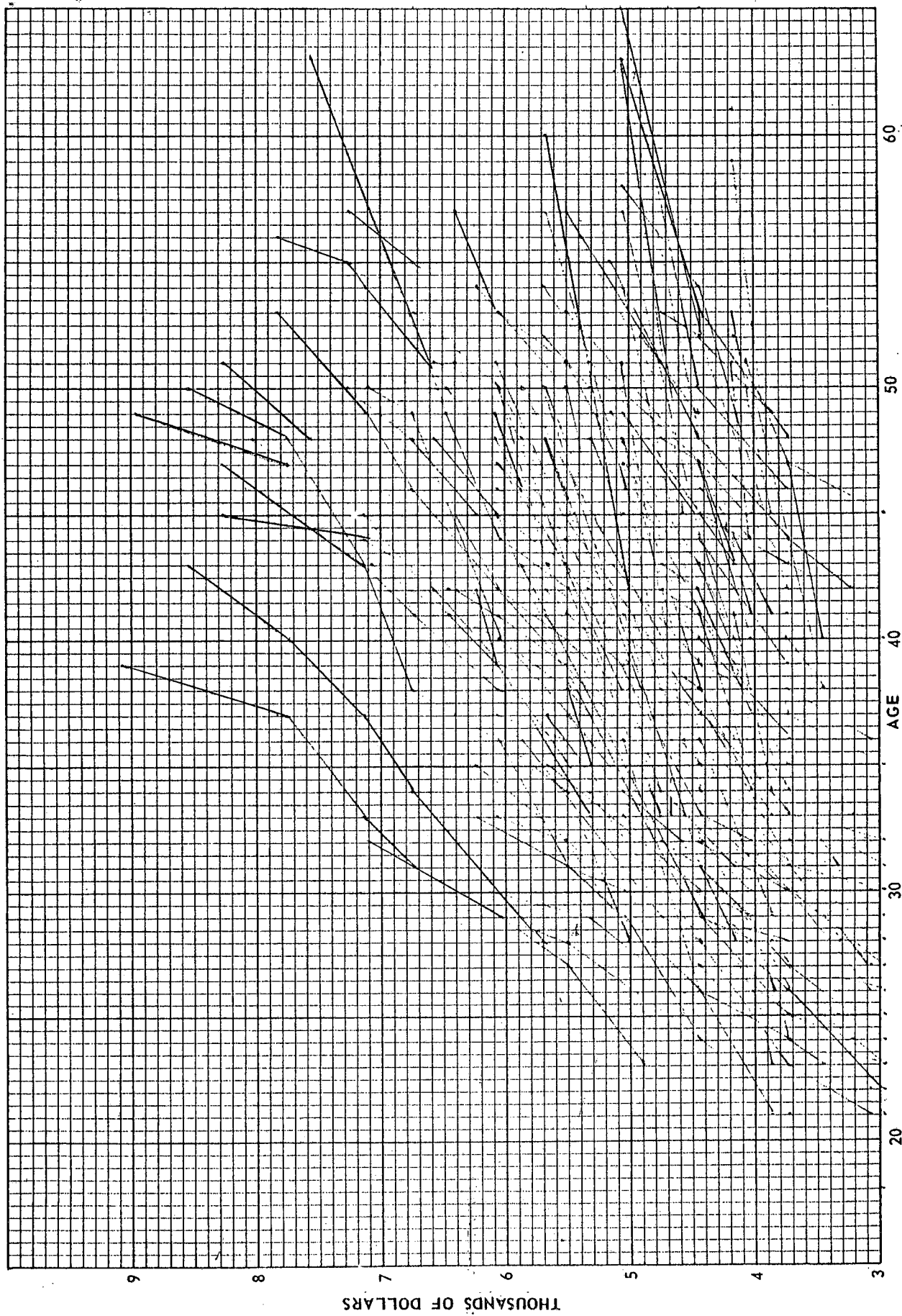


Fig. 10. Technicians and Technical Officers — Less than High School Graduation.

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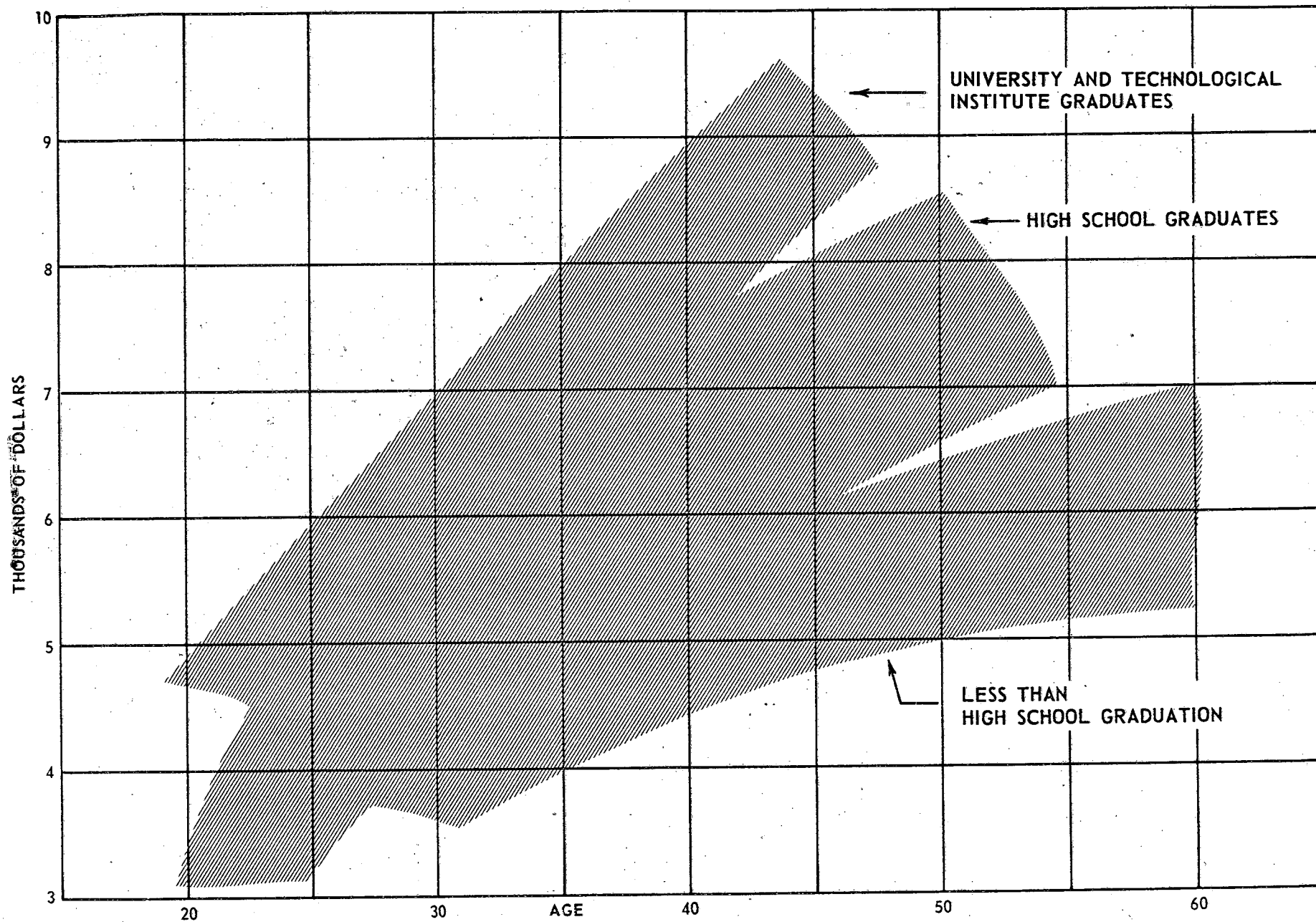


Fig. 11. Technicians and Technical Officers - Indicated Salary Trends.

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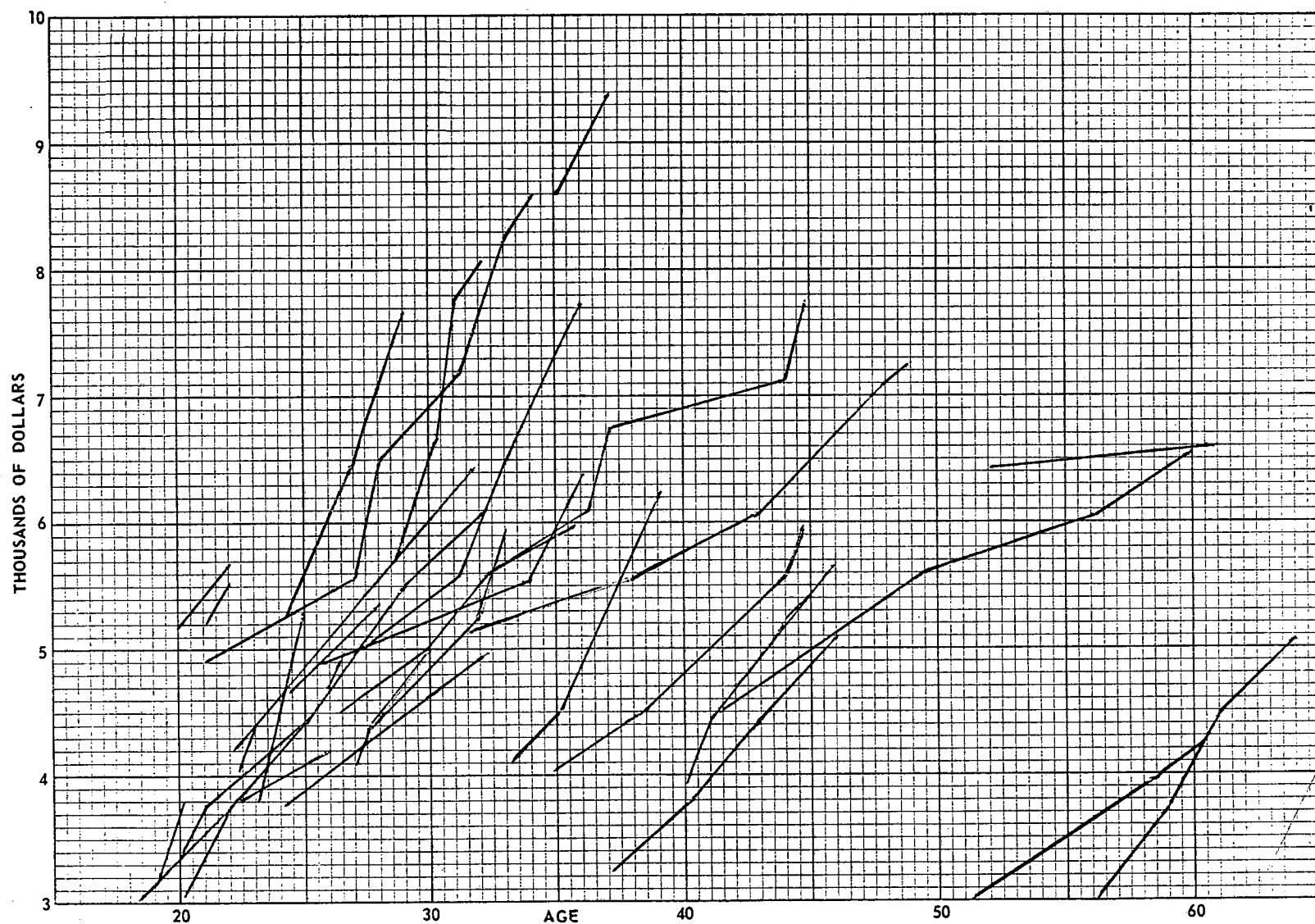


Fig. 12. Technicians and Technical Officers - Data-Handlers and Programmers.

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