Glider Airbrake Operating Force

Dr. Antony M. Segal

Report to OSTIV Sailplane Development Panel, February 1996

Prof. P. Morelli, Chairman, OSTIV Sailplane Development Panel.
Dear Piero,

A meeting of the Sailplane Development Panel was held in Zlin, Czech Republic, on 14th-16th September, 1995. In agenda item 9.4 (see below) I was asked to obtain information on the strength of a 5th percentile female.

I contacted Mr. Graham Turner, Head of Anthropometry at the Defence Research Agency Centre for Human Sciences, Farnborough, England. He kindly supplied the information that follows. The conclusions are, of course, my responsibility. I am most grateful to Mr. Graham Turner for his help.

The item from the minutes is as follows:

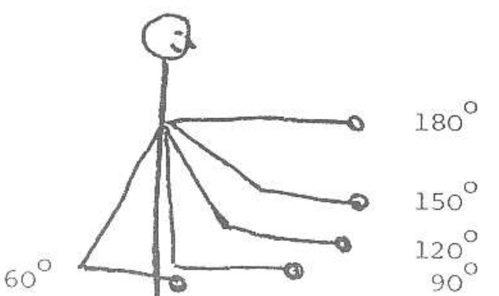
9.4 Airbrake Operating Forces

Mr. Waibel reported that difficulty was being experienced in meeting the control force standard for closing airbrakes, which is 200 N at 0.75 V_T. He understood that PZL also found this. He could see no operational need for the brakes to be closed at any speed higher than V_T, and thought that more than 200 N should be allowed - the lever is designed to withstand 350 N. There was general agreement for amending the speed to V_T (maximun aerotow speed), but opinions on increasing the force varied. It was decided that the matter should be referred to the Training and Safety Panel. Also, Dr. Segal would see if appropriate information was available on the strength of a 5th percentile female.

The relevant section from OSTIV Airworthiness Standards is as follows:

OSTIVAS Para. 2.82 Operation of Drag-increasing Device
It must be possible to extend the drag-increasing device at any speed through the speed range up to V_{NE} without causing any structural damage, and to retract the device at any speed up to 75% of V_{NE}, applying a force not greater than 200 N. It is recommended that the time for extension or retraction should not exceed two seconds.

The diagram illustrates the *deqree of elbow flexion* used in the experimental studies that follow.



Details of two studies follow, one from the US Army, the other from the Massachusetts Institute of Technology. I assume the army population would be physically stronger than the civilian population studied in the MIT report. This would explain the differing results, and also the differing values given for the relative strength of men and women.

Study 1 - Human Factors Engineering Design For Army Material (Mil-HDBK-759B) (Note - US Army)

General. The maximum amount of force or resistance designed into a control should be determined by the weakest person likely to operate the control. The quoted forces are those that can be exerted by 95% of the male population, in other words the 5th percentile of the male population.

Comparative strength. For the arm, a women's strength is 56.5% that of men. This figure comes from a study by the US Army Research Institute of Environmental Medicine.

Introduction. The manual push and pull forces quoted are those needed to be applied initially to an object to set it in motion, or to be sustained over a period of time. The arm strength is expressed in Newtons for a sitting man. It is not stated whether a backrest was used. L and R refer to the left and and the right arm. It is assumed the right arm is the dominant arm. The left arm operates the airbrake lever, so this will be the weaker arm in a right-handed population.
For reference, 1 lb.f. = 4.5 N.

Results.

Arm Strength For Sitting Man (Newtons) - 5th Percentile Male.

ELBOW	PULL		PUSH	
FLEXION	L	R	L	R
180°	222	231	187	222
150°	187	249	133	187
120°	151	187	116	160
90°	142	165	98	160
60°	116	107	98	151

Discussion. The force required to operate the airbrake locking mechanism is greater than that needed to open and close the airbrakes themselves, in my experience. Also, the lock is operated with the arm straight, when it can exert the maximum force. Opening and closing the airbrakes themselves is carried out with the elbow bent, when the arm can exert less force. I suggest these two conditions be considered seperately.

Airbrake lock. For a 5th percentile man, referring to the above table, I consider *187 N* should be the limiting force. (180° elbow flexion, left hand push.)

For a 5th percentile female, this should be *106 N*. (56.5% of the male value.)

Opening and closing the airbrakes. For a 5th percentile man, referring to the above table, I consider *98 N* should be the limiting force. (90° or 60° elbow flexion, left hand push.)

For a 5th percentile female, this should be *55 N*. (56.5% of the male value.) It should be noted that a female with short arms will be sitting further forward in the cockpit than a male, so her elbow will flex to a greater degree than the elbow of a male operating the airbrake. Hence, referring to the above table, the female will be able to exert less force than the male.

Study 2 - Humanscale 7/8/9 Manual (*Massachusetts Institute of Technology Press*), Authors: Diffrient, Tilley, Harman.

Comparative strength. Over 60 years of age - reduce figures by 50%.

For women - reduce figure by 25% (i.e. women are 75% as strong as men). The civilian men in this study would not be as strong as the Army personnel used in the previous study.

Introduction. The figures are for a sitting male with the back supported. The 100% value is the maximum arm force pulling or pushing the lever.

Results.

Strong Male	1000 N
Average Strength Male	600 N
Weak Male	150 N (I assume this is equivalent to a 5th percentile male.)

Arm Strength For Sitting Male (Newtons) - Back Supported.

ELBOW FLEXION	PULL	PUSH
180°	81%	100%
150°	88%	89%
120°	75%	75%
90°	64%	70%
60°	46%	67%

(The left and right arms are not considered separately in this study.)

Airbrake lock. For a 5th percentile male, referring to the above table, I consider *121 N* should be the limiting force. (180° elbow flexion, pull - 81% of 150 N.)

For a 5th percentile female, this should be *91 N.* (75% of the male figure.)

Opening and closing the airbrakes. For a 5th percentile male, referring to the above table, I consider *69 N* should be the limiting force. (60° elbow flexion, pull - 46% of 150 N.)

For a 5th percentile female, this should be *52 N.* (75% of 69 N.) I trust this information will be of assistance.

With best wishes,
Yours sincerely,

Tony Segal (s)

DR A.M.SEGAL MB BS Dip.Av.Med.

Copy to:
Mr. Bill Scull, Chairman, OSTIV Training and Safety Panel

Medical Standards For Instructors Aged 65-69 Years, and 70 Years and Over

Following a change in the British Gliding Association medical standards for instructors, I prepared the following notes for the CFI of the Lasham Gliding Society. These notes consider the relationship between age and the risk of sudden incapacity in the air due to coronary artery disease.

The new medical standards are presented in the BGA publication *Laws and Rules for Glider Pilots*, twelfth edition, May 1996.

Note 1 - Epidemiology of Coronary Heart Disease - Effect of Age

Note 2 - Social Inequalities in Health

Note 3 - Ageing.and Human Performance

Note 4 - Incidence of Coronary Deaths in UK Civilian Gliding

Note 5 - Fatal Gliding Accidents in the UK - 1960-1980

Note 6 - Fatal Gliding Accidents in Austria

Note 7 - Cockpit Deaths in USA Civil Aviation and Age

Note 8 - Cardiovascular Risk Assessment in Commercial Aircrew - "The One Percent Rule".

Note 9 - Cardiovascular Risk Assessment in Private Pilots

Note 10 - Cardiovascular Risk in Glider Pilots

Note 11 - Classification of Pupils

Note 12 - Class Three (PPL) Medical Certificate Requiremnents

Note 13 - Probability Theory and Electrocardiography Baye's Theorem

Note 14 - Analysis of Gliding Instructor Flying Statistics; Lasham Gliding Society, October 1994 - September 1995

Dr. A. M. Segal
May 1996

Note 1 - Epidemiology of Coronary Heart Disease

Effect of Age

The risk of coronary heart disease rises exponentially with age. The pattern of increase is seen to differ between men and women, as does the absolute risk.

Further information is given in the following publications: Coronary Heart Disease, an Epidemiological Overview, *Central Health Monitoring Unit Epidemiological Overview Series.*

Coronary Heart Disease Statistics 1992, *The Coronary Prevention Group/British Heart Foundation Statistics Database.*

These publications are available from the library of the British Medical Association, London.

It will be noted that, for males, the risk of fatal coronary heart disease between 65 and 75 years of age is 1.28% per year.

The Framingham Study carried out over a period of 24 years in the USA confirmed that in men the incidence of coronary heart disease rose steadily with age by five-year brackets. Sex differences in incidence were marked, the rate being higher in men. Also, the average age at which the disease developed was earlier in men.

Source: *The Framingham Study - The Epidemiology of Atherosclerotic Disease,* T.R. Dawber. Harvard University Press. 1980. Available from the B.M.A. library, London.

Table: DEATH RATES PER MILLION POPULATION FROM CORONARY ARTERY DISEASE IN ENGLAND AND WALES 1991

Age Group (years)	25-	35-	45-	55-	65-	75-	85+
Males	31	335	1,468	4,987	12,806	27,301	44,544
Females	8	55	274	1,577	5,734	15,914	35,153

Source: *Faculty of Public Health Medicine*, Royal College of Physicians, UK. "Guidelines for Health Promotion Number 38".

Note 2 - Social Inequalities in Health

This information is derived from the textbook "Sociology, New Directions", edited by Michael Haralambos, Causeway Books. This book is available from the Brunel University library, Uxbridge, Middlesex.

Social Class is defined as follows:

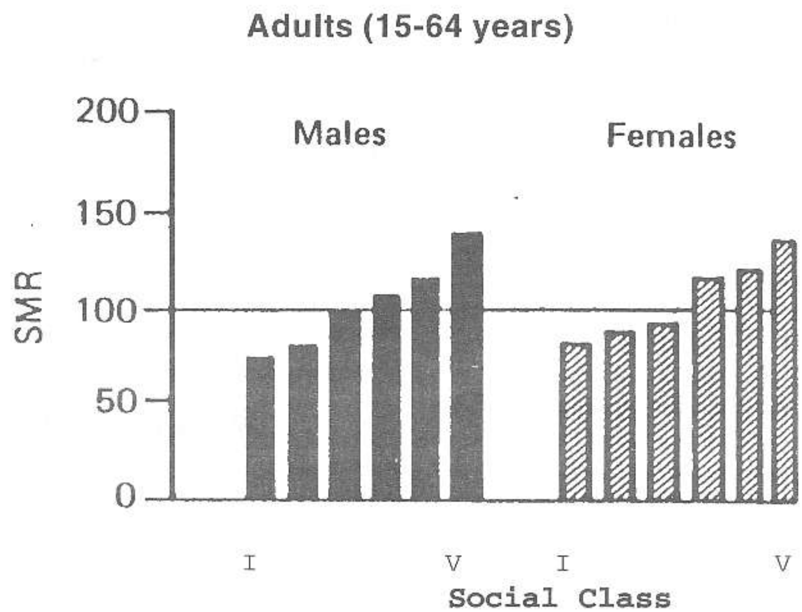
I Professional e.g. Doctors, Lawyers.
11 Managerial and Lower Professional e.g. Teachers, Sales Managers.
111N Non-Manual Skilled e.g. Clerks, Cashiers.
111M Skilled Manual e.g. Bricklayers, Underground Coal Miners.
IV Semi-Skilled e.g. Bus Conductors, Postmen.
V Unskilled e.g. Porters, Ticket Collectors, General Labourers.

Official statistics for England and Wales clearly indicate that the risk of premature death is systematically related to social class, as shown in the following diagram.

Source: Occupational Mortality: 1970 - 1972, *HMSO*, London, 1978

Note: The SMR is the standardised mortality rate which is a measure of the extent to which the mortality rate of each social class deviates from the average (100) of the age group as a whole.

Mr John D'Arcy, a member of the Lasham Gliding Society, has analysed the work of 50% of the flying members of the Society. All are in social classes 1, 11, or 111N.



Note 3 - Ageing and Human Performance

Source: "Air Travel, How Safe Is It?", Laurie Taylor, *BSP Professional Books*, 1988.

The following figures are from studies made in the USA by the FAA and National Transportation Safety Board. They refer to the observed accident rates for general aviation pilots (holding airline transport or commercial pilot certificates) for the year 1982. The observed accident rate begins to rapidly decrease in the 30s cohort age group, with the trend continuing to decrease past sixty.

Statistics relating to airline pilots in the USA show a similar correlation between increasing safety and the age of the crew.

These figures are especially significant because in the USA in 1982 there were more than 35,000 pilots over the age of sixty. A reason for this result may be that the older pilot's performance reflects the effect of increasing experience and judgement.

USA - General Aviation - Age of Pilot in Command and Accident Rate

AGE	ACTIVE PILOTS	ACCIDENTS PER 1,000 PILOTS
16-19	330	24
20-24	12,565	13
25-29	25,735	10
30-34	36,770	10
35-39	41,735	7
40-44	34,532	6
45-49	29,556	6
50-54	20,295	6
55-59	18,609	6
60+	18,764	5

Note: These figures do not show exposure to risk in terms of hours flown.

Query: This report states that the general aviation pilots studied held airline transport or commercial pilot certificates. This would appear to be unusual. However, it does not alter the significance of the figures.

Note 4 - Incidence of Coronary Deaths in UK Civilian Gliding

Mr. Bill Scull, Co-Chairman BGA Safety Committee, has informed me that there were between eight and ten deaths in flight, or shortly after flight, in UK civilian gliders in the past thirty years. It has not been possible to find out the ages of the pilots concerned at the time of their fatal accident. I have analysed the BGA flying statistics for UK civilian gliding clubs, published in *Sailplane & Gliding*, for the thirty years from 1965 to 1995.

The relevant figures are as follows:

Summation of Flying Members for each year of the 30 year period:	236,407
Total launches:	9,224,501
Total flying hours:	3,068,846

Assuming a figure of ten coronary deaths, the risk over the past thirty years is as follows:

Risk per "Flying Member Year":	One per 23,640
Risk per launch	One per 922,450
Risk per flying hour:	One per 306,885

It is clear that the risk of a sudden coronary death in flight, or shortly after flight, is very low.

Note 5 - Fatal Gliding Accidents in the UK - 1960-1980

Source:

Journal of Aviation, Space, and Environmental Medicine, November, 1983.

Paper by J. Cooke, A. Balfour, K. Underwood-Ground. *RAF Institute of Pathology and Tropical Medicine (IPTM).*

There were *33 accidents resulting in 39 deaths.* It was estimated that this represented 50% of the fatalities, as not all were reported to the IPTM. In one accident, the glider got high on aerotow, the rope was released by the tug pilot, the rope then seriously damaging the wing. This happened at a height of 600 metres, but the pilot made no attempt to escape by parachute. Autopsy showed *advanced coronary artery disease* - this was known and had been followed up beforehand.

During 1981 and 1982, there were *four further fatal accidents* in which six pilots were killed.. One involved an elderly pilot with gross cardiovascular disease, including an *old myocardial infarct* (note: the result of an old heart attack), and an abdominal aortic aneurysm. These had not been declared despite recent hospital attendance. He was found dead in the cockpit after a heavy landing.

Note 6 - Fatal Gliding Accidents in Austria

Source: *Fatal Sailplane Accidents*, R.H.E. Henn, Innsbruck University.

Technical Soaring, Volume X111, Number 3. Presented in 1987.

The following fatal accidents involving a cardiac cause are reported. There is no indication of the number of years over which these accidents occurred. There is also no statement of the number of glider pilots at risk.

Pilot aged 39 years became unconscious at altitude probably due to hypoxia. The glider broke up in flight, but the pilot did not use his parachute. Examination of the heart showed widespread old and recent areas of necrosis. Medication for heart disease was found in the cockpit.

A *female pilot* dived vertically into the ground after a winch launch. Her age was not given, but she was stated to be "young". The heart muscle showed a very fresh inflammation, like a florid myocarditis. This may have occurred with no previous symptoms.

An older *very senior pilot* crashed during a flight in the mountains. Some damage to the heart muscle was found, which may have occurred in flight. The coronary arteries showed some narrowing, and some calcarious deposits in the walls.
A *61 year old pilot* crashed in the mountains in difficult flying conditions. Fresh changes in the heart muscle were observed.

(Both the last two cases also showed some changes in the tissue of the brain.)

Note 7 - Cockpit Deaths in USA Civil Aviation and Age
Studies made by the USA pilot association ALPA identified 15 cockpit deaths in civil aviation between 1956 and 1966. All died from coronary heart disease. The ages and number of deaths were as follows:

28 years - one death.
30-39 years - four deaths.
40-49 years - six deaths.
Four deaths at *50, 52, 52, and 55* years of age. (Total: 15 deaths).

Source: Air Travel, How safe Is It?, Laurie Taylor, *BSP Professional Books*, 1988

Note 8 - Cardiovascular Risk Assessment in Commercial Aircrew "The One Percent Rule".
In the First and Second United Kingdom Workshops in Aviation Cardiology, Dr H. Tunstall-Pedoe converted human and aircraft failure rates into the same units. A suggested target for human medical incapacitation in flight causing catastrophic aircraft failure is one event in 10^{-9} hours. (*Note*: The target all-cause accident rate is $1/10^{-7}$ hrs). At 65 years of age, cardiovascular mortality rate is 1,000 per 100,000 per year.

This gives a cardiovascular mortality of 1% per year, or approximately one death in one million hours, or 10^{-6}. (One event in 100 years is one in 876,000 hours - approximately one in one million hours.)

It is assumed that the second pilot takes over from the incapacitated pilot 99 times out of a hundred.

It is also assumed that only 10% of the total flight time is critical in this connection - namely the take-off and the approach and landing. The target of one event in 10^{-9} years is then achieved.

Source:
European Heart Journal 1984: 5 (Suppl. A). "Risk of a coronary heart attack in the normal population and how it might be modified in flyers." Tunstall-Pedoe H.

European Heart Journal 1988: 9 (Suppl. G). "Acceptable cardiovascular risk in aircrew". Tunstall-Pedoe H.

European Heart Journal 1992: 13 (Suppl. H). "Cardiovascular risk and risk factors in the context of aircrew certification". Tunstall-Pedoe H.
(*Note*: Report on First European Workshop in Aviation Cardiology.)

Note 9 - Cardiovascular Risk Assessment in Private Pilots
North American and European statistics indicate a fatal accident rate one hundred times greater than that of large jet passenger aircraft. A target all-cause accident rate for private flying a hundred times greater than that for public transport flight is therefore set. This is 1 per 10^{-7} multiplied by 100, which equals 1 per 10^{-5} flying hours.

The target for medical cause incapacitation in flight should be a tenth or less of this, namely 1 per 10^{-6} flying hours.

1% per year risk of incapacitation equates to 1 per 10^{-6} flying hours.

Private pilots usually do not fly with another qualified pilot, so incapacitation poses an absolute threat to the safety of the flight. The risk of fatality arising from incapacitation in flight is therefore that of the incapacitation.

"The 1% Rule" may therefore be applied to private flying.

Source: Draft document, *Joint Aviation Requirements*.
"The Concept of Aeromedical Risk Assessment". April 1994.

Note 10 - Cardiovascular Risk in Glider Pilots

The following points may be considered. Some increase and some decrease the risk and severity of an accident as compared with commercial and private power flying.

a) A training flight is usually at or below 2,000 ft., so the entire flight's time must be considered at risk.

b) A four or five point harness is worn by both instructor and pupil, so an incapacitated pilot will not obstruct free movement of the control column. The rudder pedals may have some restriction of movement.

c) Injury and the risk of a fatality are probably less in a glider than in a powered aircraft accident. This is especially so with the new crash worthy glider cockpits that are coming into use.

d) Owing to the club structure of gliding, members are closely observed when they are around the airfield. Physical or behavioural abnormalities are likely to be seen at an early stage.

e) The more senior experienced instructors are generally older and do more instructional hours than junior instructors.

Note 11 - Classification of Pupils

Air experience pupils will usually be experiencing their first glider flight, and will have no previous experience of flying in sporting machines. They will also have no appreciation of the risks of gliding as a sport. Club members, both pre-solo and post-solo, have made a conscious decision to take part in the sport of gliding, and so accept there is a degree of risk. This holds for other sporting activities, such as sailing, canoeing, sub-aqua, and mountaineering and skiing. Post-solo pilots may be expected to land the glider safely in the majority of cases of instructor incapacitation.

Pre-solo pilots present a more complex situation. There can be no set number of launches after which the pupil may be considered competent to land the glider safely. A young person will learn at a more rapid rate than an older person.

A person learning continuously over a summer period will learn faster than a pupil having scattered lessons over the bad weather of winter. An incident occurring on the final approach will possibly be easier to handle safely, than an incident occurring on the launch or in the circuit with more complex problems to handle.

Note 12 - Class Three (PPL) Medical Certificate Requiremnents

Source: *Guidance Notes for Authorised Medical Examiners*, Civil Aviation Authority, March 1994.

Period of Validity.	
50-69 years at time of examination	12 months
70 years and over at time of examination	6 months

Electrocardiogram (ECG)	*Periodicity.*
50 - 59	every 2 years
60 - 69	annually
70 and over	every 6 months

Note 13 - Probabilty Theory and Electrocardiography Baye's Theorem

Source: "Probability Theory and Medical Tests", Air Cdre. C A Hull, 1991. Notes for the Diploma in Aviation Medicine study course.

The following are direct extracts from the text:

1) " For medical purposes, Baye's theorem essentially means that the likelihood of a certain disease or disorder being present is directly (though not linearly) related to the prevalence of the disease in the population being studied. This is important in clinical aviation medicine, because:

a) Most aircrew in whom a serious medical disorder is suspected are asymptomatic.

b) The prevalence of disease is often low.

c) Few, if any, tests are "diagnostic" in the sense of being always correct. In other words, false positives and false negatives occur."

2) "The practical implication is that, unless one has some idea of the prevalence of the sought-for disease in the population being studied (which will give the prior probability of disease in the individual being examined), the significance of any result is almost impossible to decide. Where prevalence is high, a positive result is highly credible; where low, a positive result is probably untrue."

3) "This fact is of great importance in aviation medicine, when tests which are regarded as reliable in a hospital patient population are applied to healthy aircrew. Exercise ECG testing is a case in point. On one occasion, all aircrew in a major USAF command were required to undergo a test. If the exercise ECG was abnormal, they underwent a maximal treadmill test. When this was also abnormal, they underwent cardiac catheterisation and coronary angiography. Only about a quarter showed any coronary disease, and in most of these it was slight. In other words, more than three quarters of all positives were false positives. The practice of routine exercise electrocardiography was abandoned! This is not to belittle the value of exercise testing. For the reasons given, a positive result in a symptomatic patient is almost always correct. In clinical aviation medical practice, however, such tests must be used selectively and with awareness of potentially fallacious results."

Note 14 - Analysis of Gliding Instructor Flying Statistics; Lasham Gliding Society, October 1994 - September 1995

I am grateful to Mr. Graham McAndrew, CFI Lasham Gliding Society, for giving me access to these figures, pages 30-41.

The 'bar charts' were kindly prepared by Mr. Steven Dutton.

Each section of the study is divided into Full Category ('Cat') instructors, Assistant Cat instructors, and Air Experience instructors

The Age of Instructors
Full Cat instructors are generally of an older age group than Assistant Cat instructors. There are no Assistant instructors over 69 years of age.

Air Experience instructors show a broad spread of ages, from youth to the older age groups.

Average Flying Time Spent Instructing
The instructional flying hours increase with the experience of the instructor.

Full Cat instructors have the maximum number of hours.

Assistant Cat instructors are intermediate in hours.

Air Experience instructors have the minimum number of instructional flying hours.

Total Instructional Flying Time, by Age Groups
Full Cat instructors in the older age groups show high instructional flying time.

Assistant Cat instructors in the older age groups show lower instructional flying time.

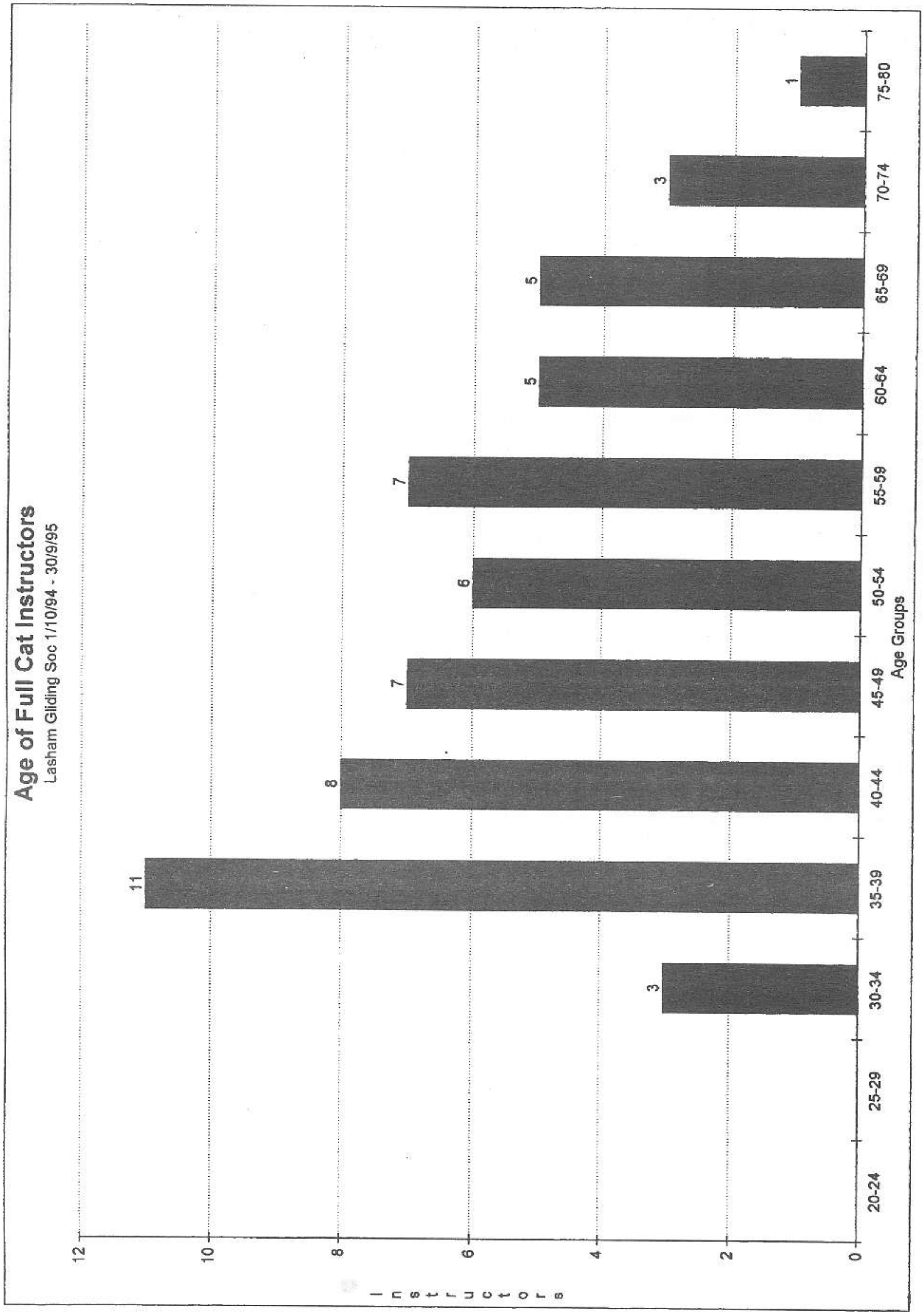
Air Experience instructors fly few instructional hours in all age groups.

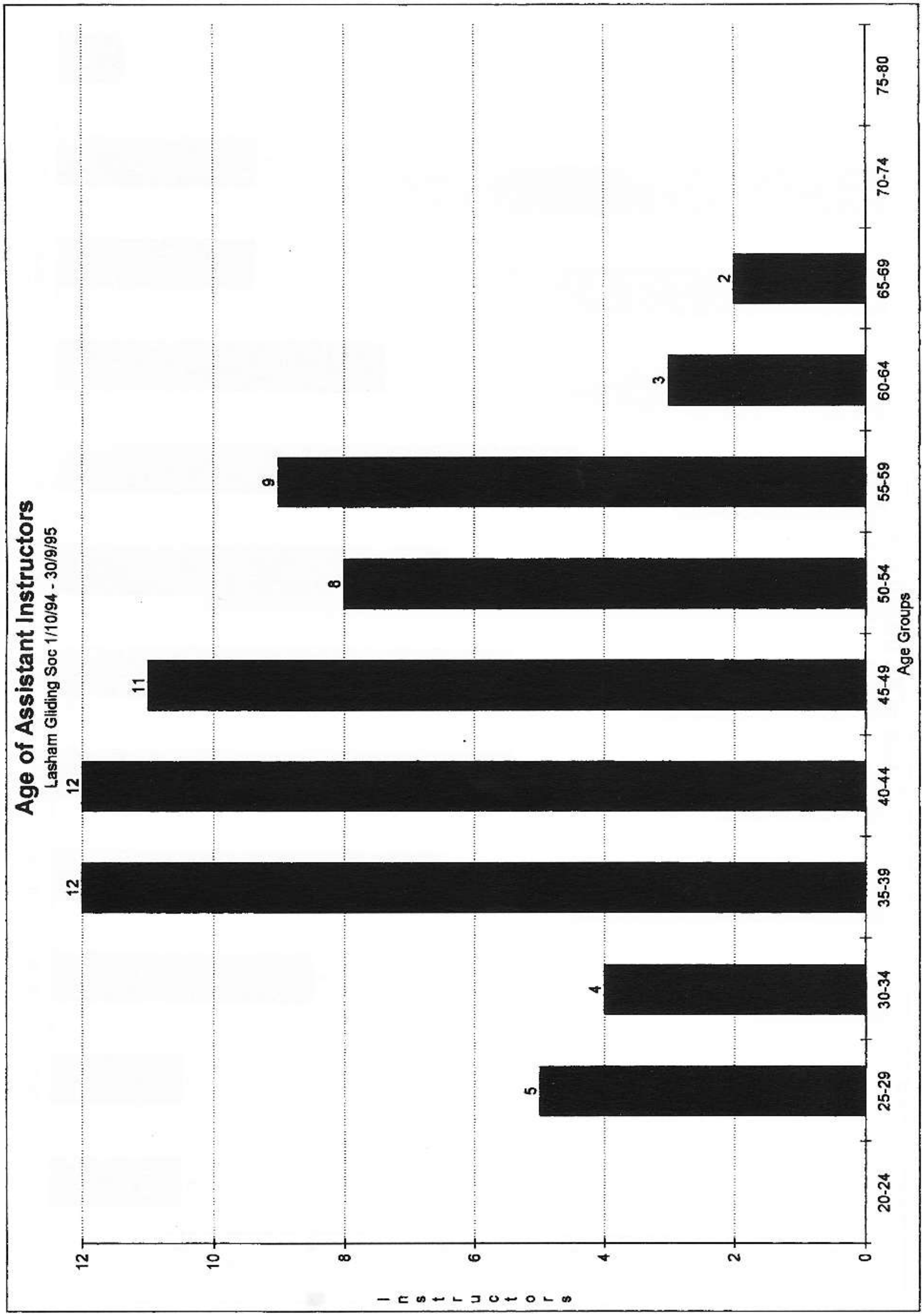
Conclusion

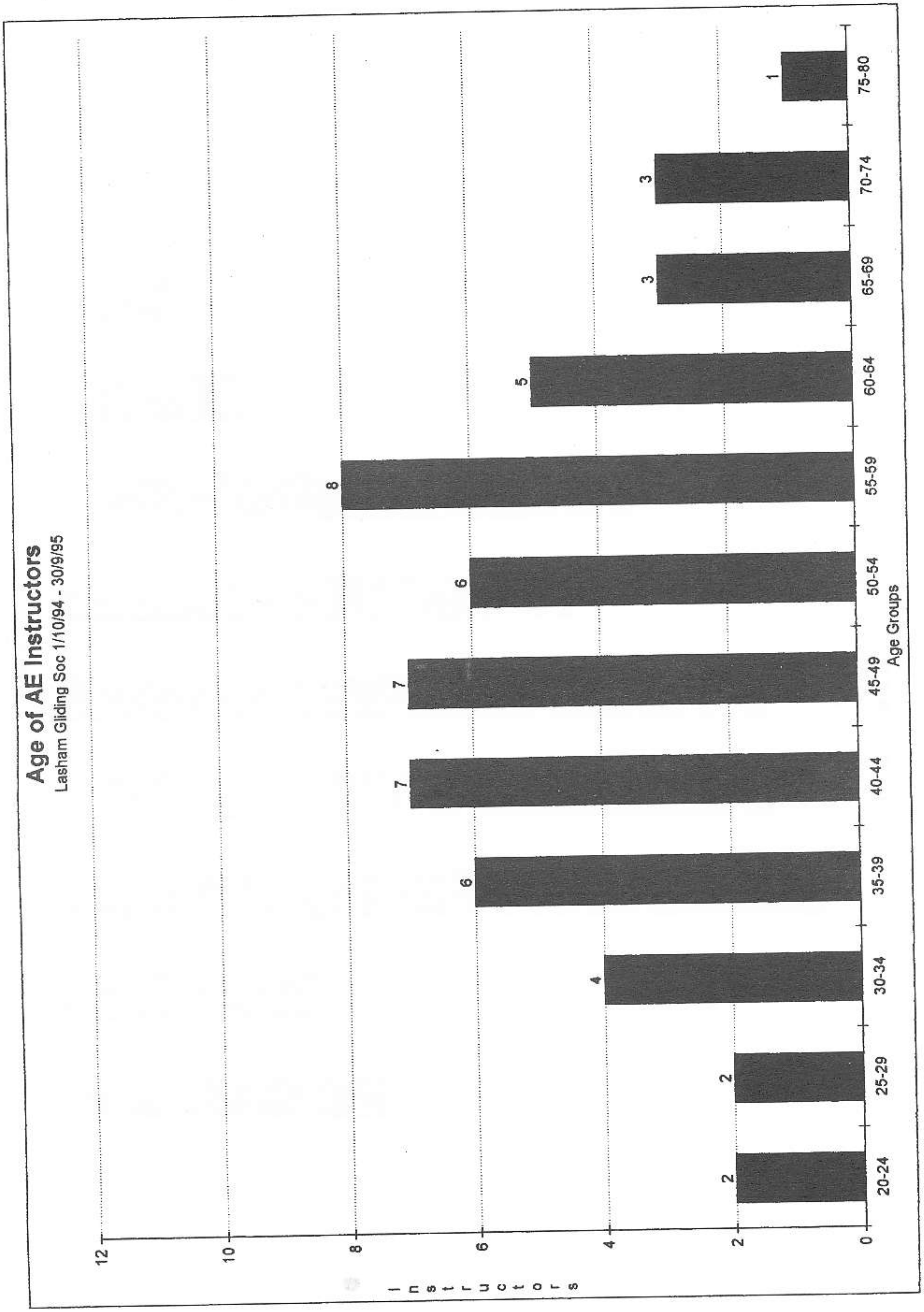
Full Cat instructors are generally of an older age group and fly more instructional hours than other classes of instructor.

There are no Assistant Cat instructors over the 65-69 age group.

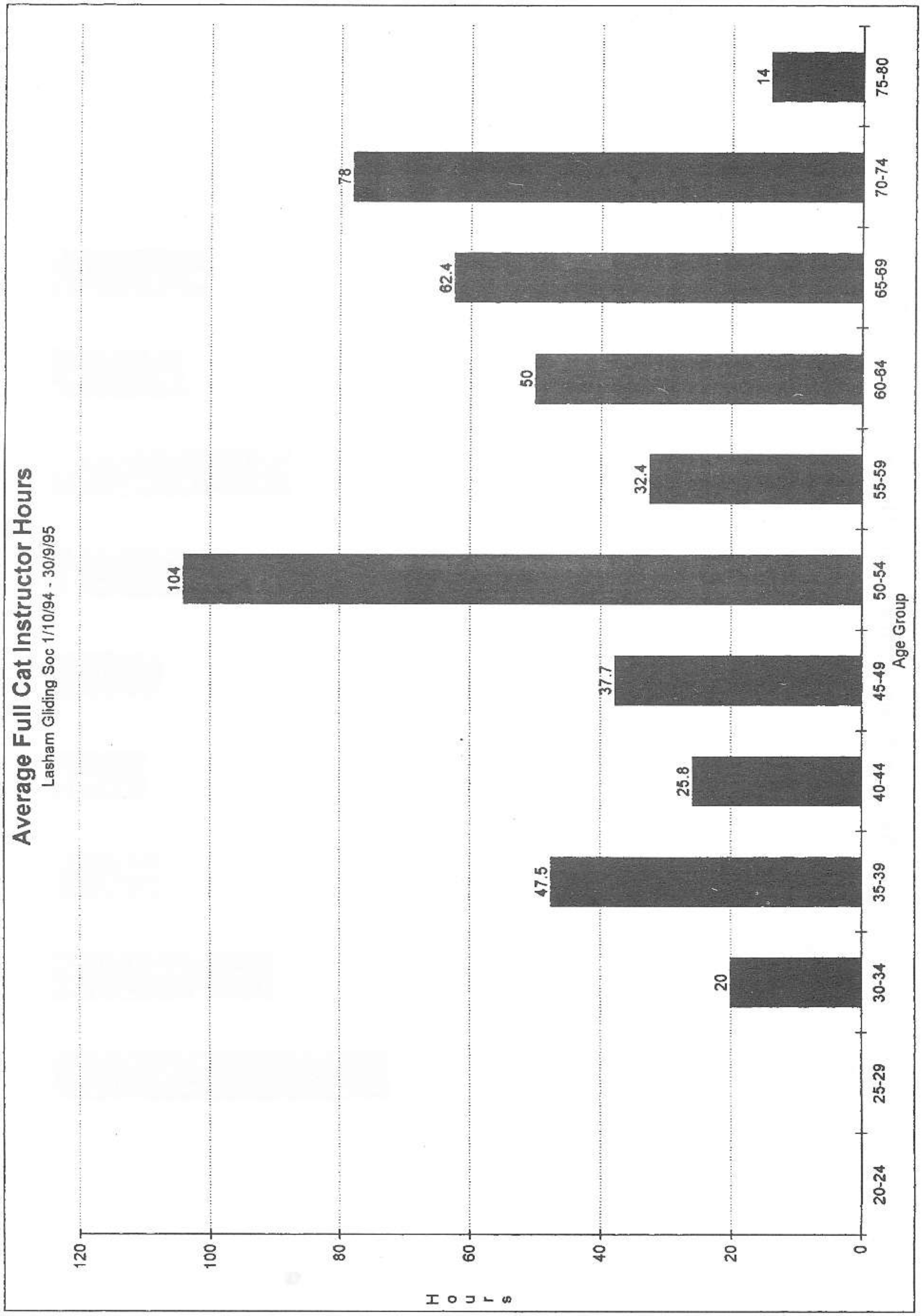
Note:
Lasham Gliding Society instructors fly approximately 10% of the total UK civilian gliding instructional flying hours. The above figures represent a reasonable sample of the situation in the UK. However, they may not be representative of the smaller gliding clubs.

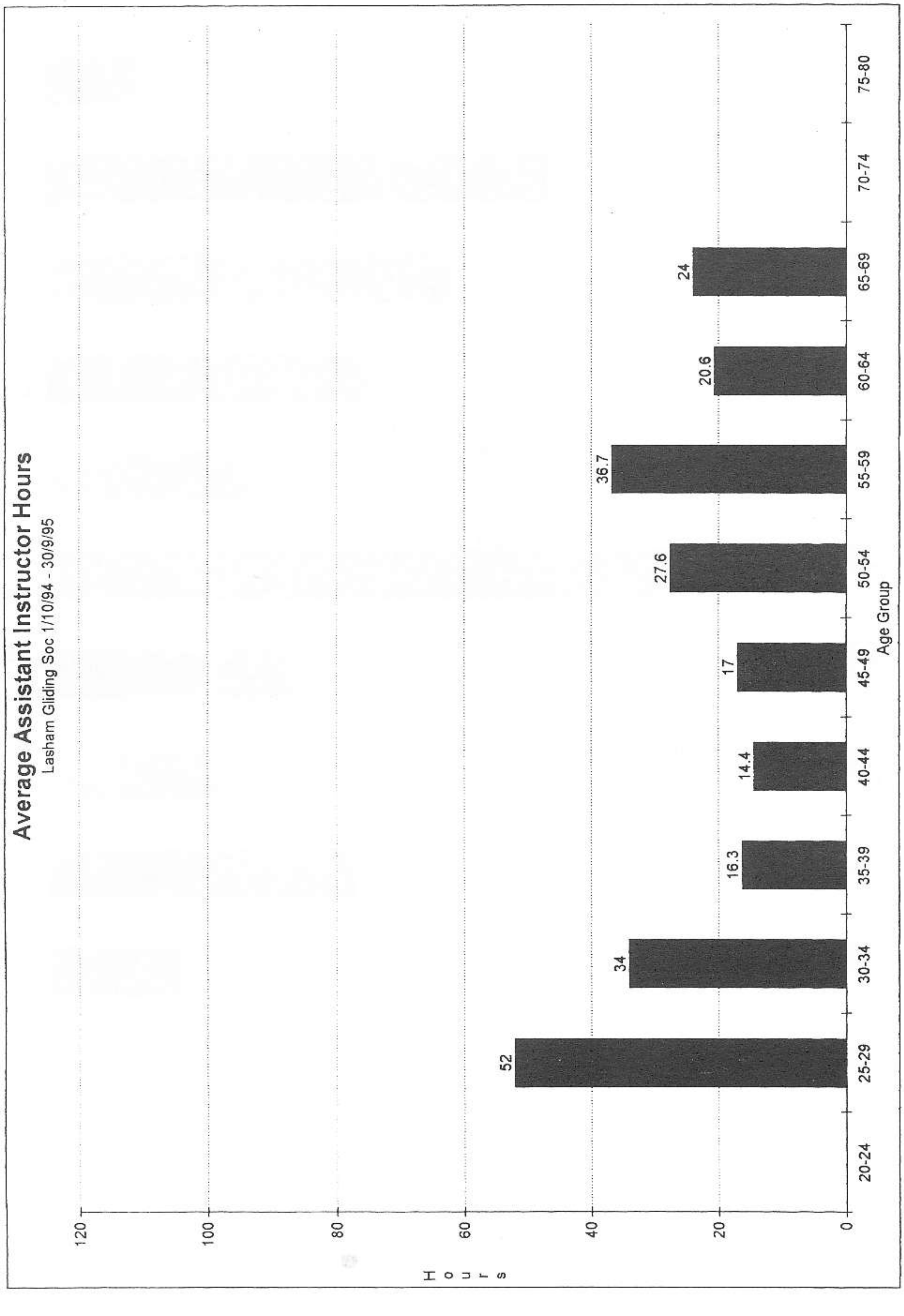

Age of Full Cat Instructors
Lasham Gliding Soc 1/10/94 - 30/9/95
Instructors
Age Groups
0
2
4
6
8
10
12
20-24
25-29
30-34
35-39
40-44
45-49
50-54
55-59
60-64
65-69
70-74
75-80
3
11
8
7
6
7
5
5
3
1


Age of Assistant Instructors
Lasham Gliding Soc 1/10/94 - 30/9/95
Instructors
Age Groups
20-24
25-29
30-34
35-39
40-44
45-49
50-54
55-59
60-64
65-69
70-74
75-80
0
2
4
6
8
10
12
5
4
12
12
11
8
9
3
2

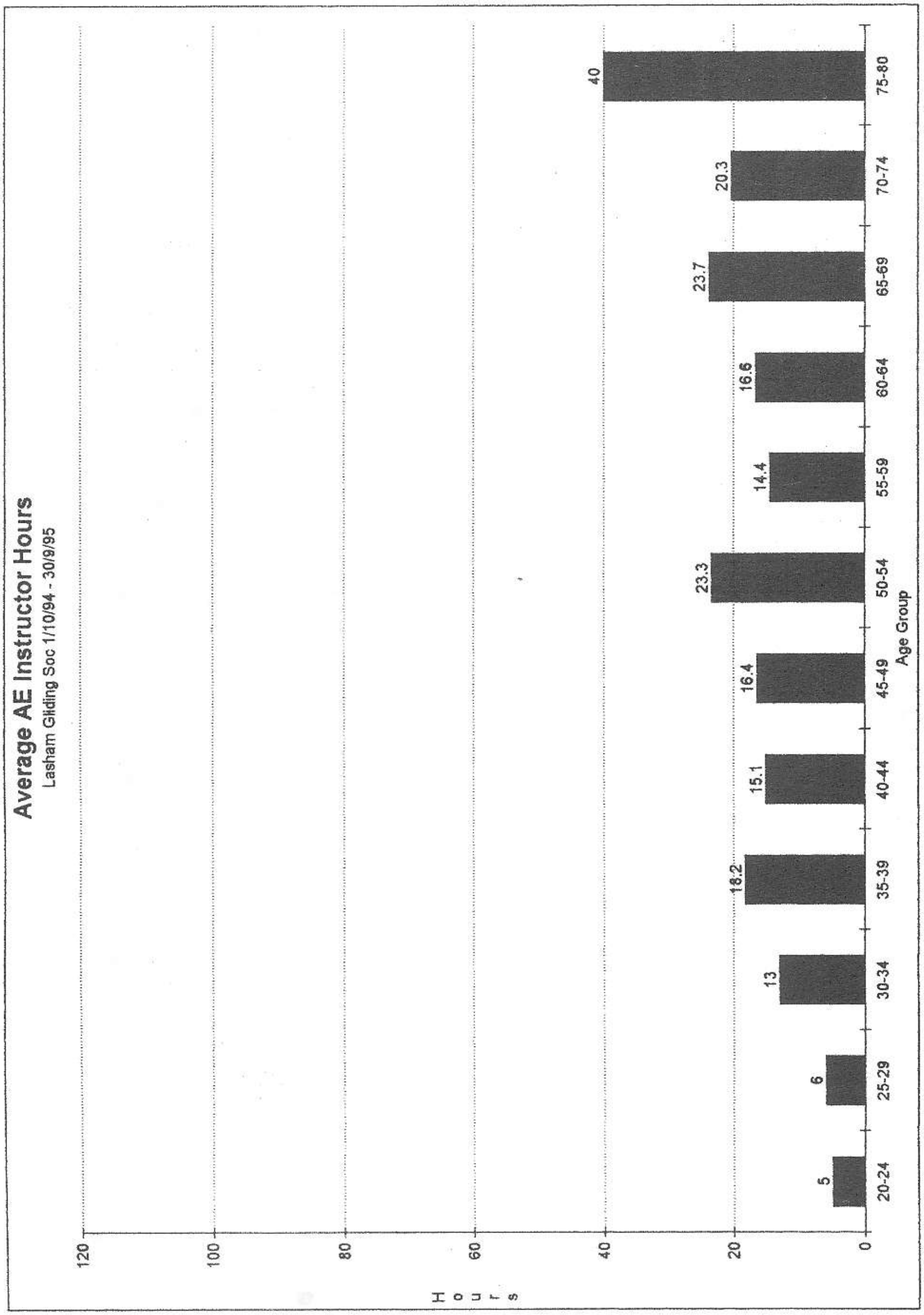


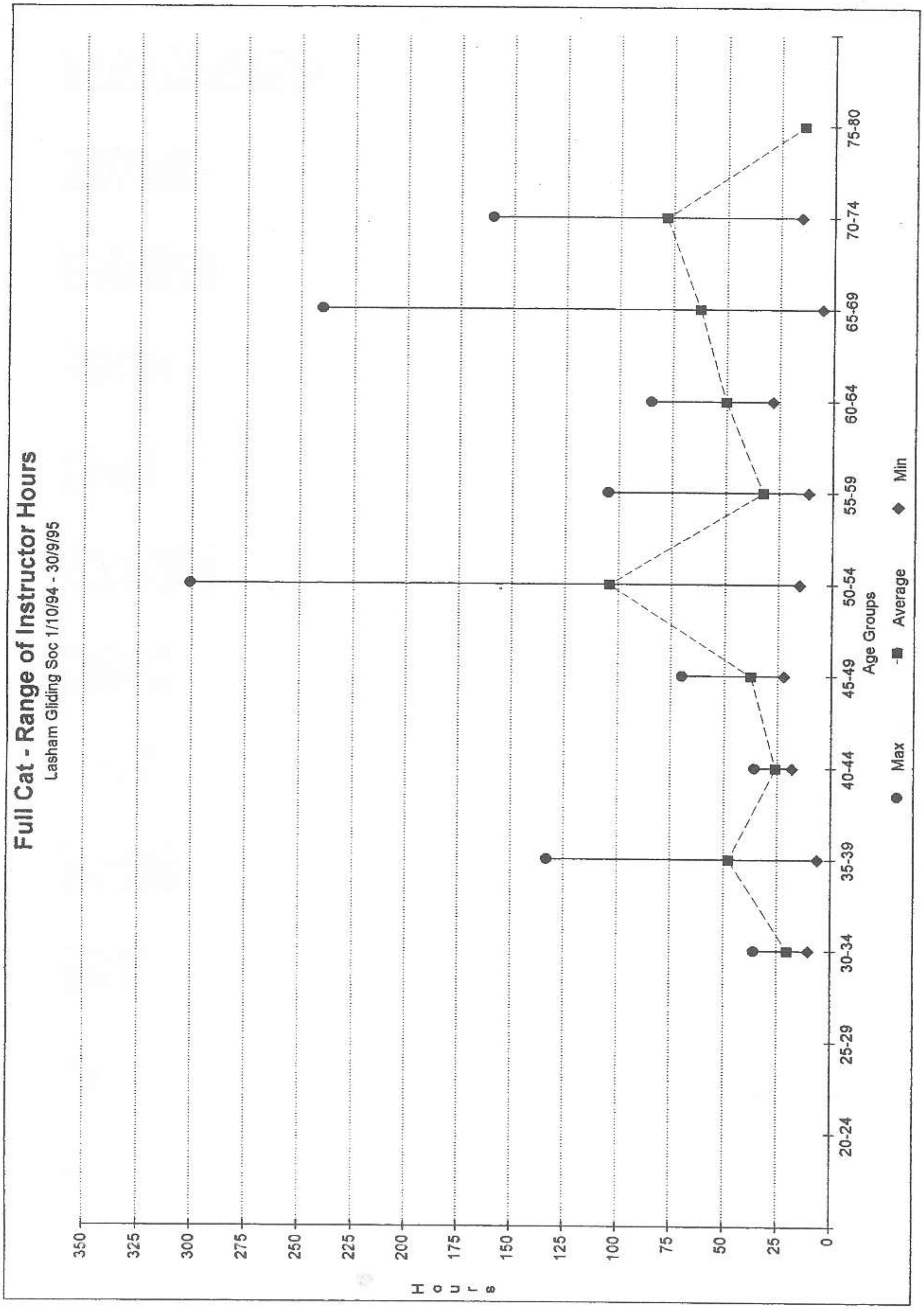
Age of AE Instructors
Lasham Gliding Soc 1/10/94 - 30/9/95
Instructors
0
2
4
6
8
10
12
Age Groups
20-24
25-29
30-34
35-39
40-44
45-49
50-54
55-59
60-64
65-69
70-74
75-80
2
2
4
6
7
7
6
8
5
3
3
1

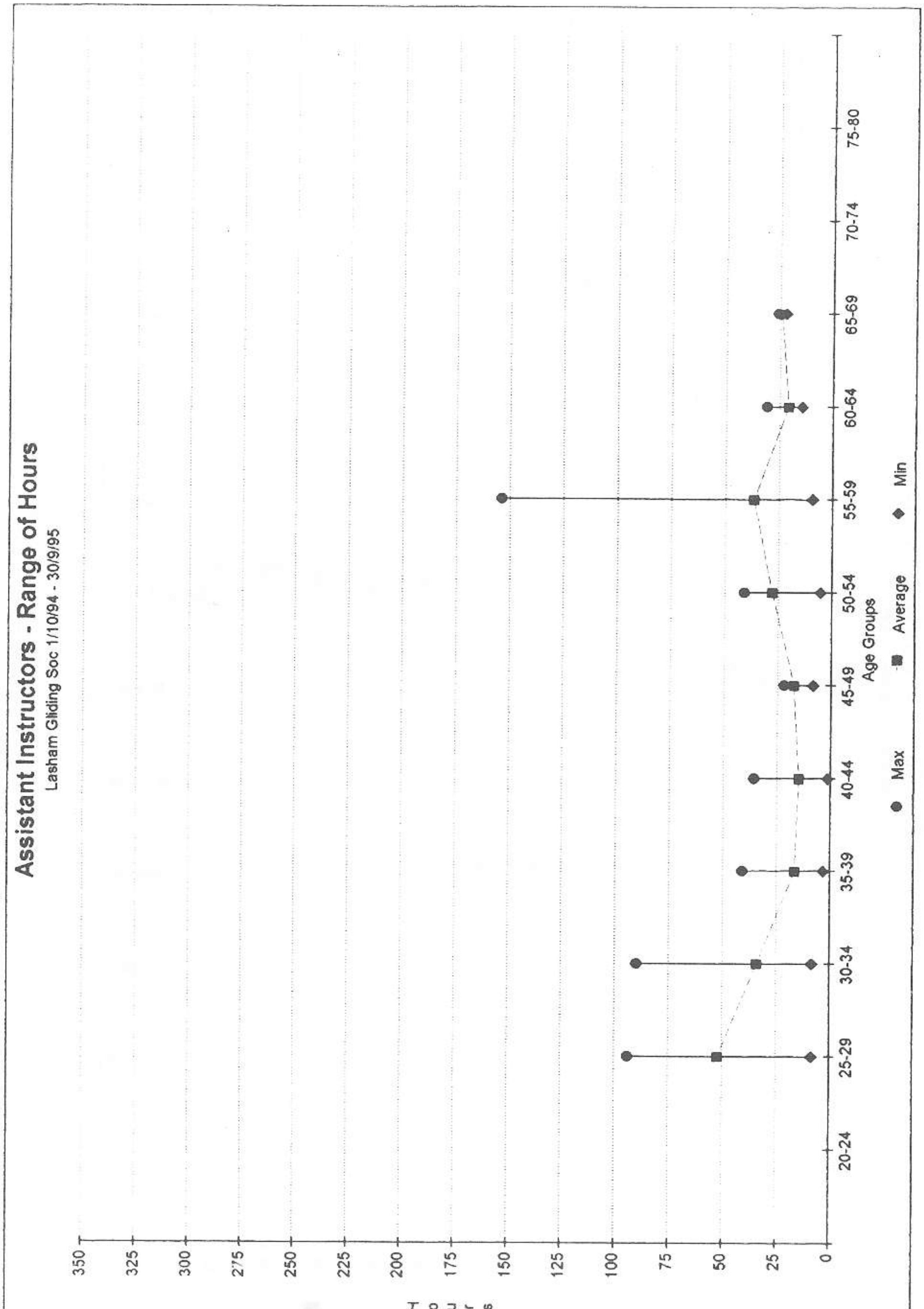

Average Full Cat Instructor Hours
Lasham Gliding Soc 1/10/94 - 30/9/95
Hours
0
20
40
60
80
100
120
Age Group
20-24
25-29
30-34
35-39
40-44
45-49
50-54
55-59
60-64
65-69
70-74
75-80
20
47.5
25.8
37.7
104
32.4
50
62.4
78
14

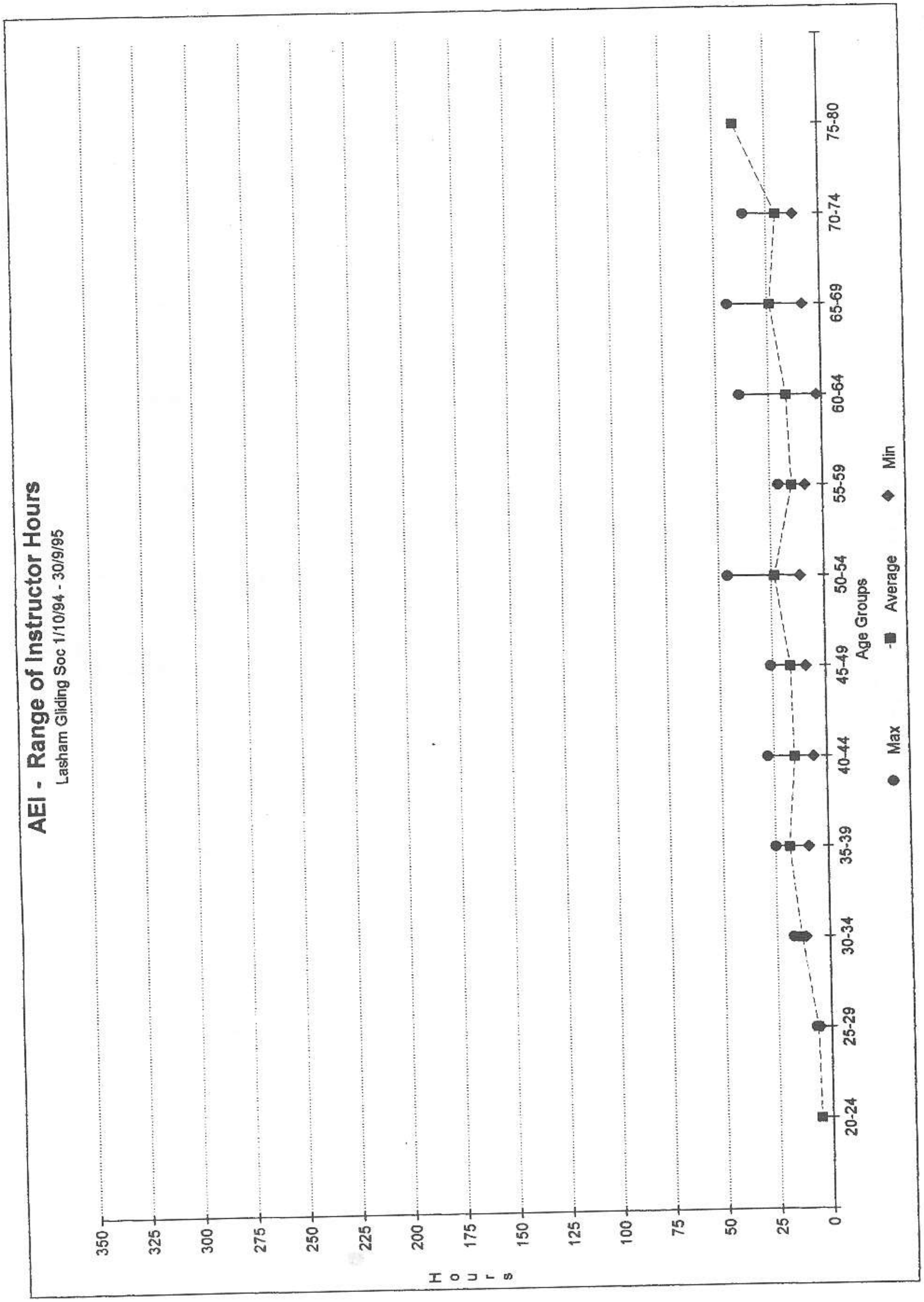


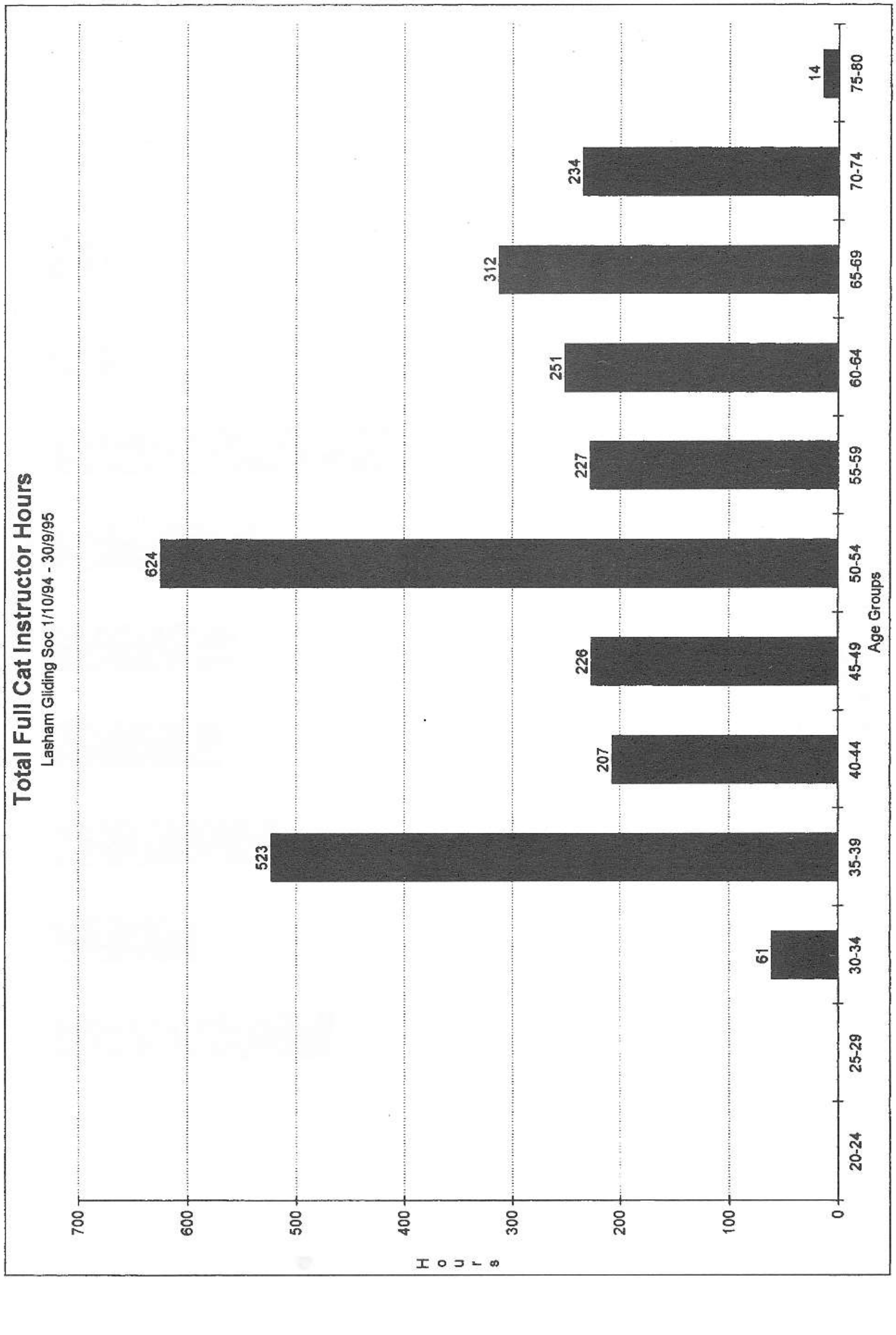
Average Assistant Instructor Hours
Lasham Gliding Soc 1/10/94 - 30/9/95
Hours
Age Group
0
20
40
60
80
100
120
20-24
25-29
30-34
35-39
40-44
45-49
50-54
55-59
60-64
65-69
70-74
75-80
52
34
16.3
14.4
17
27.6
36.7
20.6
24


Average AE Instructor Hours
Lasham Gliding Soc 1/10/94 - 30/9/95
Hours
Age Group
20-24
25-29
30-34
35-39
40-44
45-49
50-54
55-59
60-64
65-69
70-74
75-80
5
6
13
18.2
15.1
16.4
23.3
14.4
16.6
23.7
20.3
40
0
20
40
60
80
100
120

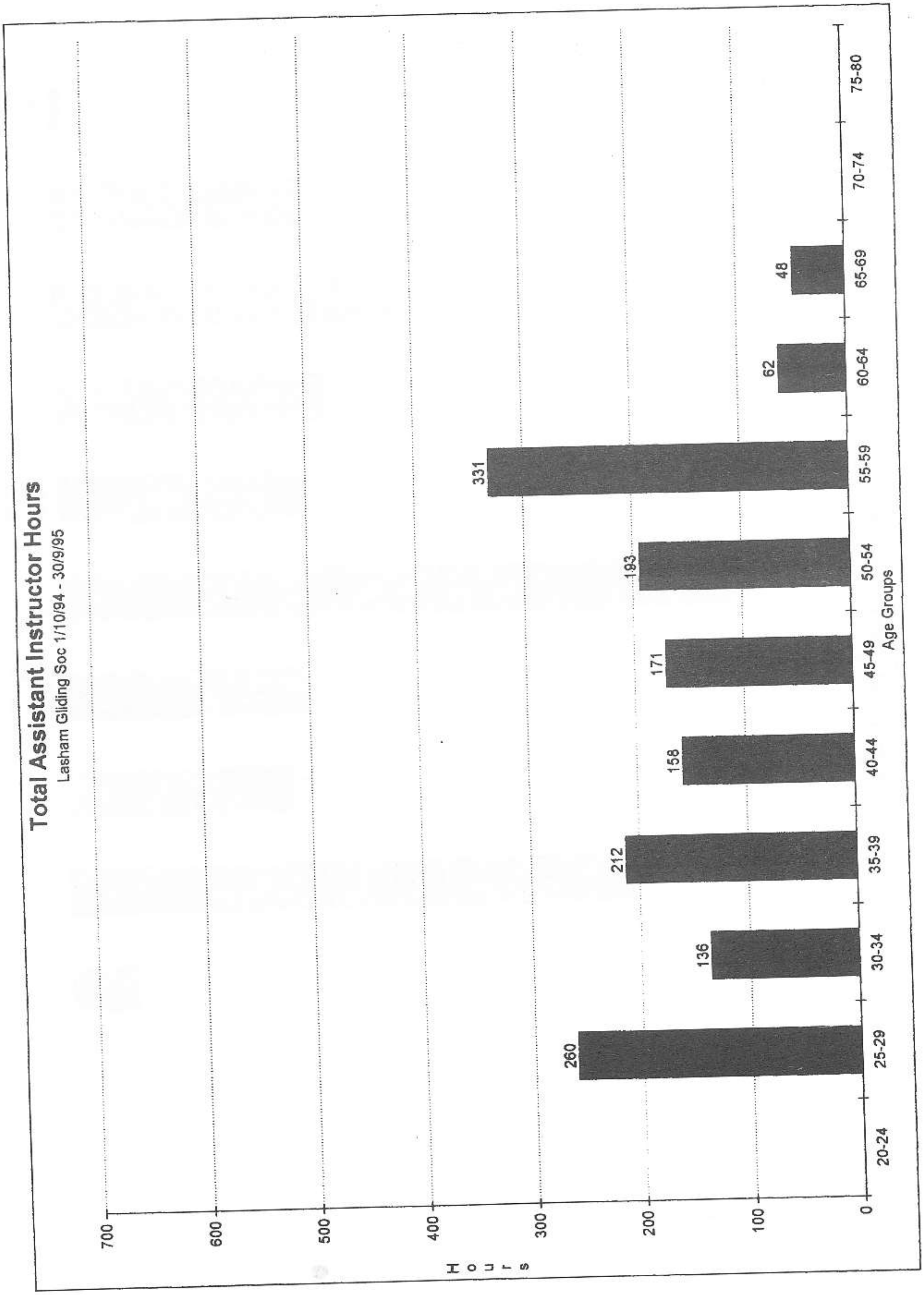

Full Cat - Range of Instructor Hours
Lasham Gliding Soc 1/10/94 - 30/9/95
Hours
350
325
300
275
250
225
200
175
150
125
100
75
50
25
0
20-24
25-29
30-34
35-39
40-44
45-49
50-54
55-59
60-64
65-69
70-74
75-80
Age Groups
Max
Average
Min


Assistant Instructors - Range of Hours
Lasham Gliding Soc 1/10/94 - 30/9/95
Hours
350
325
300
275
250
225
200
175
150
125
100
75
50
25
0
20-24
25-29
30-34
35-39
40-44
45-49
50-54
55-59
60-64
65-69
70-74
75-80
Age Groups
Max
Average
Min

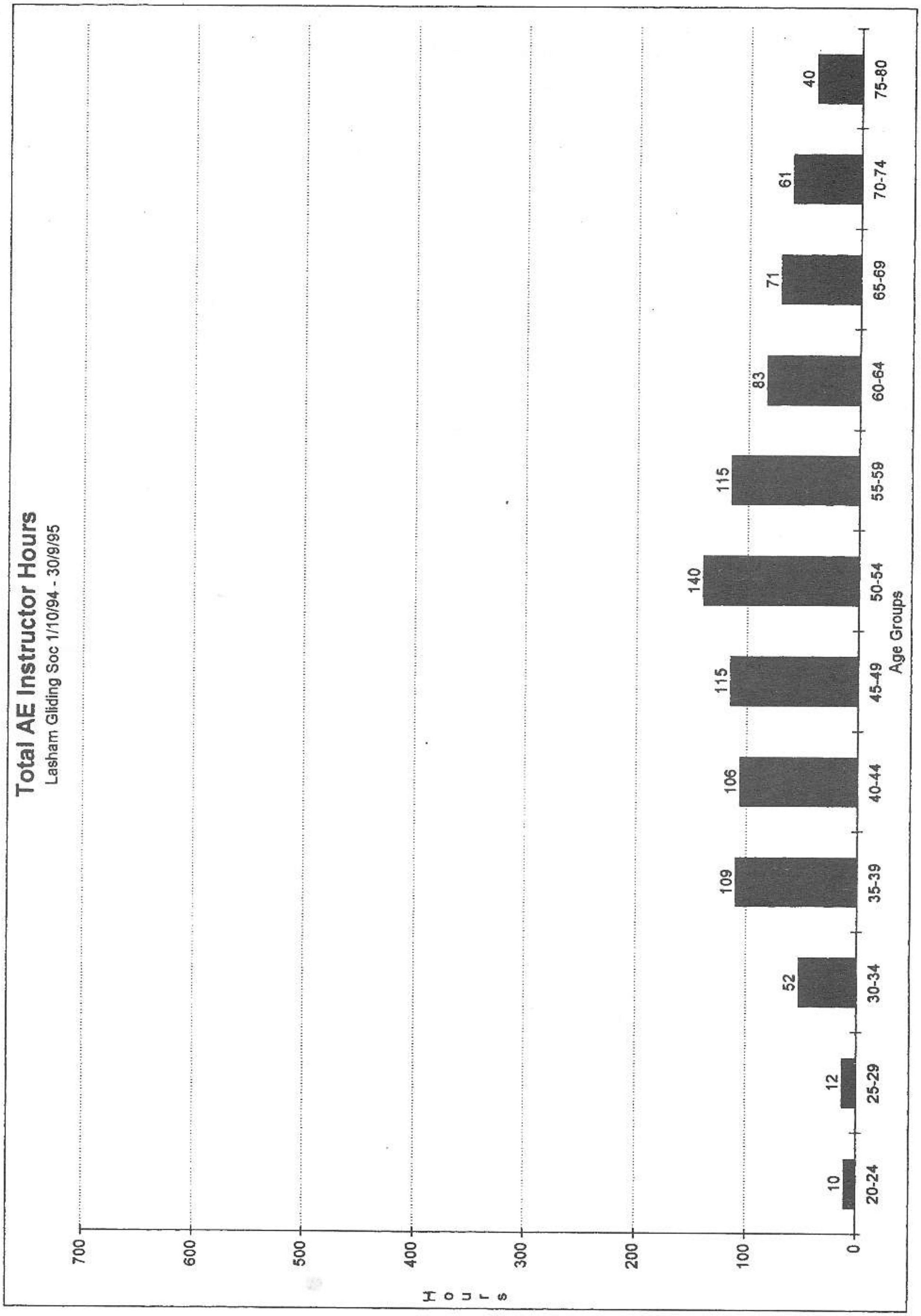

AEI - Range of Instructor Hours
Lasham Gliding Soc 1/10/94 - 30/9/95
Hours
350
325
300
275
250
225
200
175
150
125
100
75
50
25
0
20-24
25-29
30-34
35-39
40-44
45-49
50-54
55-59
60-64
65-69
70-74
75-80
Age Groups
Max
Average
Min



Total Full Cat Instructor Hours
Lasham Gliding Soc 1/10/94 - 30/9/95
Hours
Age Groups
0
100
200
300
400
500
600
700
20-24
25-29
30-34
35-39
40-44
45-49
50-54
55-59
60-64
65-69
70-74
75-80
61
523
207
226
624
227
251
312
234
14



Total Assistant Instructor Hours
Lasham Gliding Soc 1/10/94 - 30/9/95
Hours
Age Groups
0
100
200
300
400
500
600
700
20-24
25-29
30-34
35-39
40-44
45-49
50-54
55-59
60-64
65-69
70-74
75-80
260
136
212
158
171
193
331
62
48



Total AE Instructor Hours
Lasham Gliding Soc 1/10/94 - 30/9/95
Hours
700
600
500
400
300
200
100
0
10
12
52
109
106
115
140
115
83
71
61
40
20-24
25-29
30-34
35-39
40-44
45-49
50-54
55-59
60-64
65-69
70-74
75-80
Age Groups