1966

THE PARLIAMENT OF THE COMMONWEALTH OF AUSTRALIA

JOINT COMMITTEE OF PUBLIC ACCOUNTS

EIGHTY-FIFTH REPORT

AUTOMATIC DATA PROCESSING

F.13071/66

JOINT COMMITTEE OF PUBLIC ACCOUNTS

SIXTH COMMITTEE

R. CLEAVER, ESQUIRE, M.P. (Chairman)
. J. F. COPE, ESQUIRE, M.P. (Vice-Chairman)

SENATOR T. C. DRAKE- BROCKMAN (1)   J.S. COCKLE, ESQUIRE, M.P. (3)
SENATOR J. F. FITZGERALD   D.E. COSTA, ESQUIRE, M.P. (4)
SENATOR J. J. WEBSTER (2)   W. T. GIBBS, ESQUIRE, M.P. (5)
SENATOR I. E. WEDGWOOD   P. J. NIXON, ESQUIRE, M.P.
                                           L. J. REYNOLDS, ESQUIRE, M.P. (6)
                                           J. O. L. SEXTON, ESQUIRE, M.P.
                                           R. H. WHITTORN, ESQUIRE, M.P.

The Senate appointed its Members of the Committee
on 4th March, 1964, and the House of Representatives its
Members on 5th March, 1964.

.(1) Resigned 29th April, 1965   (4) Resigned 23rd March, 1966
 (2) Appointed 29th April, 1965   (5) Appointed 24th August, 1966
 (3) Deceased 3rd August, 1966·   (6) Appointed 23rd March, 1966

DUTIES OF THE COMMITTEE

Section 8 of the Public Accounts Committee Act 1951-1965 reads as follows :-

8.   The duties of the Committee are -

  (a) to examine the accounts of the receipts
       and expenditure of the Commonwealth and
       each statement and report transmitted
       to the Houses of Parliament by the
       Auditor-General in pursuance of sub-
       section (1.) of section fifty-three of
       the Audit Act 1901-1950;

  (b) to report to both Houses of the Parliament,
       with such comment as it thinks fit, any
       items or matters in those accounts,
       statements and reports, or any circum-
       stances connected with them, to which the
       Committee is of the opinion that the
       attention of the Parliament should be
       directed;

  (c) to report to both Houses of the Parliament
       any alteration which the Committee thinks
       desirable in the form of the public
       accounts or in the method of keeping them,
       or in the mode of receipt, control, issue
       or payment of public moneys;   and

  (d) to inquire into any question in connexion
       with the public accounts which is referred
       to it by either House of the Parliament,
       and to report to that House upon that
       question,

and include such other duties as are assigned to the Committee
by Joint Standing Orders approved by both Houses of the
Parliament.

TABLE OF CONTENTS

5.

JOINT COMMITTEE OF PUBLIC ACCOUNTS

EIGHTY-FIFTH REPORT

AUTOMATIC DATA PROCESSING

CHAPTER 1 - INTRODUCTION

On 28th April, 1966, Your Committee resolved to conduct
an inquiry into Automatic Data Processing (A.D.P.) comprising
digital computers and ancillary equipment including data
preparation and transmission equipment for use in Commonwealth
Departments.

2.   Your Committee's experience in the field of A.D.P.
began in 1962 when expenditure from the Advance to the Treasurer
for the financial year 1961-62 was under examination. In that
inquiry information was submitted regarding expenditure associated
with A.D.P. by the Department of Defence. The evidence showed
that in 1958 a Cabinet Committee on public service functions
had decided that the possibility of introducing A.D.P. into
the Australian Services should be examined, and that during the
early years, considerable difficulties were experienced in
attracting suitably trained A.D.P. programming staff from
overseas countries. In Your Committee's examination of the
Auditor-General's Report for 1963-64, evidence was taken from   P.P. No.160
the Superannuation Board and the Defence Forces Retirement   of 1964-65
BenefitsBoard on proposals, then current, to make use of
A.D.P. facilities whilst more recently, in its inquiry into   ,
the Department of Social Services Your Committee was able to   P.P. No.221
examine the proposals which had been made by that Department   of 1964-65
to install an A.D.P. system and to take evidence, at first
hand, on the problems involved.

3.   Apart from its own experience in the A.D.P. field,
Your Committee was also attracted by statements made by the
Auditor-General in his Reports for the financial years 1963-64
and 1964-65. In paragraph 239 of his Report for 1963-64 the
Auditor-General stated that the use of A.D.P. processing was

becoming progressively more extensive and that although automation
in the form of punched card processing systems had been used
for many years in various departments and instrumentalities,
the introduction of the electronic computer was of comparatively
recent origin. He stated that since 1958 the Department of
the Treasury had used electronic equipment in the Bureau of
Census and Statistics for operations such as expenditure and
revenue recording and payroll compilation whilst productive
operation by commercial-type applications in some departments
were scheduled to commence late in 1964. The Auditor-General
indicated that according to departmental records, Commonwealth
investment in A.D.P. (capital costs of equipment and buildings
excluding costs of alterations) approximated $7.8 million as at
30th June, 1964 whilst equipment delivered or on order, but not
paid for, amounted to approximately $9.3 million.

4.   In regard to A.D.P. generally the Auditor-General
made the following comments:-

"The high cost of installing electronic systems,
including the costs of system design, programming and
operation, requires the utmost care in planning for the
acquisition of these systems. The optimum use of equipment
capacity is a pre-requisite of operational efficiency.
Overseas reports indicate that the degree of success in
working with electronic systems is directly related to the
amount of pre-planning and study that have been undertaken
before the equipment has been acquired.

Many overseas systems are reported to have been
constantly changed at high cost because of poor initial planning
or failure to plan for opportunities to integrate closely related
procedures. In other cases overseas, frequent changes were
made in the types of equipment used with a result that
additional expenditure was incurred in re-programming and
conversion costs as each new type of equipment was installed.
Not only must departmental installations have capacity to perform
designed tasks but systems must be compatible with relevant
legislation, as for example, the Audit Act and Treasury
Regulations. From Audit examination generally, it would
appear that planning in the Commonwealth sphere up to the
present has taken cognizance of overseas experience.
Nevertheless, in some installations it has been observed that

unforeseen difficulties have been encountered or
circumstances have arisen which have delayed productive
output. Difficulties are usually encountered in the
change from manual to automated systems."

5.   In paragraph 257 of his Report for 1964-65 the
Auditor-General indicated that according to various departmental
records, Commonwealth investment in A.D.P. equipment and new
buildings (excluding building alterations) amounted to
approximately $15.1 million as at 30th June, 1965, whilst
departmental commitments for equipment delivered, or on order,
but not paid for at the same date amounted to approximately
$4.9 million.

6.   In the twelve months ended 30th June, 1965, therefore,
the combined level of expenditure and commitments on A.D.P.
facilities had risen from approximately $17.1 million to £20
million.

7.   In addition to the foregoing matters Your Committee
was also influenced by the fact that in countries such as
Britain and the United States of America, A.D.P. had attracted
the attention of Parliamentary Committees. In Britain, the
Estimates Committee of the House of Commons had inquired during
1965 into electrical and electronic equipment for the armed
services whilst in the same year in the United States of America,
a sub-committee of the House of Representatives Committee on
Government Operations had conducted a comprehensive inquiry into
A.D.P. equipment following the submission by the Audit Office
and its agencies of no less than ninety-six Reports to the
Congress. These Reports reflected the problems inherent in the
introduction of A.D.P. equipment and emphasised the need for
installations to be made on a well-planned and properly
co-ordinated basis.

8.   In determining the scope if its inquiry Your Committee
felt that a useful purpose would be served if, in addition to
examining the installations of A.D.P. equipment in the Commonwealth.
Service, it were to widen its terms of reference to examine the
technological changes that have already occurred in the
Australian community following the introduction of that
equipment and the technological changes which might be
expected to occur as the number of installations and
range of applications of that equipment increases. Accordingly,
Your Committee decided to take evidence not only from
Commonwealth departments concerned with A.D.P. installations

but also from the suppliers of computer and ancilliary equipment to the
Australian market and acknowledged experts in the field. At the same
time it was considered that specific attention should be given
to the co-ordination and general management processes for
A.D.P. within the Commonwealth Service and that detailed
examinations should be made of each installation in
Commonwealth Departments. In reaching this decision Your
Committee recognised that it would not be possible for this
task to be completed during 1966 but felt that the inquiry
should be commenced and taken to the stage where a detailed
examination had been made of one large departmental network
As the information available to Your Committee showed that the
network installed by the Bureau of Census and Statistics
is the most significant in terms of capital cost, that
network was selected for examination.

9.   Written statements submitted by witnesses were made
the subject of a public inquiry held at Parliament House, Canberra
on:—

Wednesday 22nd June, 1966	Thursday 28th July, 1966
Thursday 23rd June, 1966	Tuesday 9th August, 1966
Tuesday 26th July, 1966	Wednesday 10th August, 1966
Wednesday 27th July, 1966	

10.   The following witnesses, in order of appearance, were
sworn at the Public Inquiry and examined by Your Committee:—

Mr. F. L. Hall	– Manager of the Government Systems Group, IBM Australia Pty. Ltd.
Mr. J. P. O'Neil	– Australian Sales Manager, Control Data Australia Pty. Ltd.
Mr. F. M. Dobbs	– Director, Honeywell Pty. Ltd.
Professor J.A. Ovenstone	– Professor of Computing Science, University of Adelaide
Dr. G. N. Lance	– Computer Expert
Mr. P.W.E. Gyngell	– Managing Director, Australian Computers Pty. Ltd.
Mr. G. W. C. Veel	– Government Applications Manager, International Computers and Tabulators Pty. Ltd.
Mr. A. Harris	– First Assistant Secretary, Budget and Accounting, Department of the Treasury
Mr. D. J. Hill	– Assistant Secretary, Mechanical Accounting Division, Budget and Accounting Branch, Department of the Treasury

Mr. W. T. Gleeson	—	First Assistant Commissioner, Management Services Division, Commonwealth Public Service Board
Mr. J. Shaw	—	Assistant Commissioner, Management Services Division, Commonwealth Public Service Board
Mr. W. Grant	—	First Assistant Commissioner, Management Service Division, Taxation Branch, Department of the Treasury
Mr. K. F. A. Myers	—	Assistant Commissioner, Management Services Division, Taxation Branch, Department of the Treasury
Mr. R. H. Searle	—	Director, A.D.P. Section, Establishment and Finance Branch, Department of Health
Mr. L. B. Holgate	—	Director, Finance Section, Establishment and Finance Branch, Department of Health
Mr. L. D. Read	—	Chief Finance Officer, Budget and Accounting Branch, Department of the Treasury
Mr. L. K. Burgess	—	President of the Commonwealth Superannuation Board and Chairman of the Defence Forces Retirement Benefits Board
Mr. H. D. Pridmore	—	Assistant Statistician, Commonwealth Bureau of Census and Statistics
Mr. S. Burton	—	Director, Applications Division, Commonwealth Bureau of Census and Statistics
Mr. K. McR. Archer	—	Commonwealth Statistician, Commonwealth Bureau of Census and Statistics

11.   During its inquiry Your Committee was assisted by the following Observers:-

Audit Office	—	Mr. J. K. Lawrence
		Mr. A. K. Ragless
Public Service Board	—	Mr. F. C. Nordeck O.B.E.
		Mr. G. N. Vanthoff
Department of the Treasury	—	Mr. M. G. Cowie

12.   On Monday, 26th September, 1966, Your Committee
carried out inspections of A.D.P. equipment installed at:-

> The Commonwealth Bureau of Census and Statistics
> The Commonwealth Scientific and Industrial
> Research Organisation; and
> The Australian National University

13.   In considering the form that its Report on this
Inquiry should take, Your Committee reached the conclusion
that considerable advantage would accrue from the submission
of two distinct reports, the first to be of a general nature
covering such areas as technology, the economic and social
aspects of A.D.P. and the co-ordination and general
management of A.D.P. in the Commonwealth Service. The Second
Report will relate specifically to the A.D.P. installation
of the Commonwealth Bureau of Census and Statistics
and will incorporate evidence taken from the
Department of the Treasury, the Taxation Branch, the
Department of Health, the Superannuation Board and the Defence
Forces Retirement Benefits Board which are currently
using   the Bureau's A.D.P. facilities.

14.   Automatic Data Processing has evolved its own technical
language and in preparing this Report Your Committee has found
it necessary to employ extensively many of the technical terms
used by the industry and other witnesses who gave evidence during
our inquiry. To assist readers, therefore, Your Committee has set
out in Appendix No. 1 to the Report, a glossary of technical
terms used.

CHAPTER 2 - COMPUTER TECHNOLOGY IN AUSTRALIA

15.   Professor Ovenstone, Professor of Computing Science at   Exhibit
the University of Adelaide, informed us that Automatic Data   85/4
Processing systems are formed by combining computers, other
devices for acquiring basic data, communications, special
procedures and techniques, and appropriately trained staff
into a complex man-machine system that can -

- perform most of the routine clerical and
  administrative activities, and many of the
  planning and management processes, at present
  performed manually, and/or
- carry out and control experiments and calculations
  in all forms of scientific research, and/or
- provide to wide groups of users, 'utility'
  data processing services that would otherwise
  be impractical or uneconomic, and/or
- monitor and control production processing of a
  diverse range of manufactured and assembled, items.

16.   We were informed that the computer itself represents   Q.289
about one tenth of the total design effort and work that goes
into a system.

17.   Dr. Lance, a computing expert, advised us that the   Exhibit
term "hardware" in a computer context relates to the memory,   85/5
the arithmetic units, line-printers, card-readers, remote
consoles etc., and also that hardware is tangible, and needs an
air-conditioned environment for successful operation. He added
that "software" relates to the general purpose programmes and
monitor systems needed to perform calculations with the
computer hardware.

(i)   Australia's Position in the World Computer Industry

18.   Mr. O'Neil stated that the world computer industry   Exhibit
is estimated to be operating at a turnover of approximately   85/2
$44,500 million per annum and that it is expected to have an
average annual growth rate of about 20 per cent for at least
the next five years.   He claimed that in these circumstances
the computer industry will be the next great international
industry ranking with motor vehicle production and the oil
industry.   Mr. O'Neil also indicated that computers are

chiefly the tools of the sophisticated industrial nations, most
of the market outside the United States lying in Europe, Japan
and the industrialised British Commonwealth countries. Estimates
were said to show that there are now 386 computers in the United
States for every one million non-agricultural workers; in
Switzerland 123 computers per million workers; in Sweden
95 per million and in France about 60 per million.   Spain is
estimated to have about 7 computers per million of population
while the estimated figure for Australia is 76 per million,
placing it among the more industrialised countries of Western
Europe but well behind the United States of America.

19.   Details of the estimated Australian growth of
computer installations relative to other countries, published in the
American Magazine "Business Week" of 19th April, 1966 and submitted by
Mr. O'Neil, is given in Table No. 1 below.

Table No.1

Estimated Growth Rates of Computer Installations:
Selected Countries

Country	Computers ('000)	Value ($A m.)	Growth Rate (% per annum)
United States	27.0	6,700	10 - 13
Western Europe	6.0	1,960	20 - 22
Japan	1.9	270	20
Canada	.9	134	23 - 25
Australia	.3	36(i)	35
Latin America	.2	200	7

Exhibit
85/2

(i) This figure is believed to be underestimated by at
least $A14m., but has been retained for purposes
of comparison.

20.   It is significant to note, on the basis of these
figures, that Australia evidently has the highest estimated
growth rate of those countries selected.

(ii) The Automatic Data Processing Industry in Australia

21.   Although the Commonwealth Scientific and Industrial   Q.276
Research Organisation constructed in 1951, as a research project,
a computer which was the first logical design of this type in
the world, the industry in Australia today was said to be
virtually a supplying industry.

Exhibit
85/1

22.   It was claimed that no manufacturing capability for
computers exists in Australia today and also that substantial growth,not
only in demand but in the local electronic industry to provide the
advanced componentry would be a necessary prerequisite to a local industry.
Mr. Hall stated that the manufacture of computers in Australia
by IBM is under consideration, but that it is not expected that   Q.455
this would eventuate in the immediate future. The industry in   Q.366
Australia is highly competitive, and while there are more than
twenty companies supplying A.D.P. equipment, we were informed
that fifteen of these are not operating at a profit.

23.   Mr. Hall stated that the traditional office equipment   Exhibit
suppliers and the original punch card equipment manufacturers   85/1
already established in Australia before the introduction of the
first commercial computers in 1958 have entered the computer
market.   Also most of the U.S.A. and British computer
manufacturers have commenced operations in Australia, the initial
attraction generally being to bid for the large-scale Government
networks.   Success in that sphere has provided a base for
entering the commercial market.

24.   Professor Ovenstone supplied the following table
relating to A.D.P. systems installed or on order in Australia
for the period 1958 to 1966.

Table No. 2
A.D.P. Systems Installed or on Order: Australia
1958-1966

Supplier	Systems	Capital Value
	%	%
I.B.M.	45.0	40.0
I.C.T.	25.0	15.0
C.D.C.	5.0	10.0
Honeywell	5.0	13.0
Other	20.0	22.0
Total	100.0	100.0

Exhibit 85/4

25.   He pointed out that this table illustrates an   Exhibit
interesting situation which is peculiar to Australia and is   85/4
responsible for the extremely good support and competitive
position within the local industry.   He said that in most
other countries IBM has a virtual monopoly of A.D.P. equipment
and support facilities because of the quality of its marketing,
service, and support.   However, he indicated that in
terms of cost, IBM has often been more than 25 per cent higher
than its competitors in the local market for comparable
equipment and support because its prices throughout the world
are fixed in terms of development, staff and overhead costs in
the U.S.A.   Since these do not necessarily apply in Australia
it has frequently been practicable and effective to employ
other suppliers with at least equal support and productive
capability to provide the necessary equipment and support
facilities for many projects.   However, he said that this had
resulted in a very healthy competitive situation in Australia,
especially as regards the Commonwealth Government, universities,
research institutions and large scale equipment users.

26.   In regard to the pricing of equipment, Mr. O'Neil   Q.156
stated that as the supplying companies do not produce identical
equipment, there is a range of prices for equipment with
apparently similar purposes.   Other factors affecting comparative
prices are differences between suppliers in determining prices,
the cost structure of companies, and services supplied.

27.   With regard to service provided, he stated   Q.157-158
that no service is provided 'free' and that at present the
more competent user tends to subsidise the less competent,
since companies give the service that they feel their customers   Q.165-167
require.   He said that it is important that the user
should know what he is paying for and that he should be able
to analyse   into the correct categories.   He felt that
manufacturers perhaps suggest that these services are more
expensive than they actually are.

28.   Mr. Hall stated that systems engineering support   Q.119
from most manufacturers is included in the original purchase
price and that, on the acquisition of a computer, whether
by purchase or rental, a certain amount of support is expected
by the user from the manufacturer.   He also suggested that
this should be in proportion to the size of the installation,

and that it is a considerable part, on a continuing basis, of
the purchase price. It was indicated by Professor Ovenstone and
also by Mr. Gleeson, that the cost of programming support can be
up to two or three times the cost of hardware. Mr. Gleeson said,
however, that it would vary from one application to another, and
also with the designing of a system of programming and its becoming
operational.

9.383 and
9.1064-
1065

29.   With regard to profitability in the industry,
Mr. O'Neil indicated that companies would have different methods
of expressing the breakdown of costs of production of their
equipment. In the case of Control Data, however, the expression
'manufacturing costs' means the actual cost of producing hardware
and does not include the overhead costs of marketing development,
or systems programming development. He said that given this definition,
manufacturing cost of hardware would probably range between 25 and 60
per cent of the selling price and would vary with the items of equipment.

9.155

30.   Dr. Lance informed us that production costs of
software are very high; a monitor system of reasonable size
taking many man-years of effort to write, test and maintain.
The price of software, however, is not given separately, but
is included in the price quoted for hardware. We were also
told that some manufacturers place more importance on good
software than others and this means that the price of their
equipment is higher and that they appear to be at a competitive
disadvantage. He said that manufacturers may eventually place
a separate price on software and expressed the opinion that
this will result in an improvement on the present method of
pricing equipment.

Exhibit
85/5

31.   He indicated that software is an intangible
factor which is acquired when hardware is purchased. It is
not priced separately from the hardware and in this sense
is 'free'. He emphasised, however, that as the production of
software involves the incurring of costs by the manufacturer of
hardware, the manufacturer may increase the price of
the hardware supplied.   He also said that software was often
ill-defined. For example, one manufacturer may produce a
more efficient compiler   which will produce a programme in
half the time of one produced by another manufacturer.

9.469

He expressed the opinion that a purchaser buying his first   Q.470
computer needs considerable assistance from the manufacturer
while a purchaser with an experienced staff does not require
this to the same extent.

32.   Mr. O'Neil stated that there are essentially three   Q.162-
major services that accompany a computer system. First, there   165
is the software systems which are currently "manufactured" and
supplied as a manufactured item.   Software systems require
maintenance to the same extent as that required for hardware.
He claimed that this type of service should always be included
in the basic price of equipment.   Secondly, there is the
service provided in assisting computer users to embark on
certain applications.   He felt that this service should be   Q.162-
removed from the present price structure and assessed on the   165
basis of user needs.   The third service provided is that of
maintenance which is charged for separately.   Mr. O'Neil
expressed the view that charging separately for the second
service referred to above would tend to reduce the price of
the original equipment and at the same time enable users to
identify their costs of particular services.

33.   Professor Ovenstone expressed the opinion that the   Exhibit
competitive position should be retained if possible by con-   85/4
tinuing with the normal "tender-on-specification" procedure
even if only to a small group of selected suppliers.

34.   Mr. Hall claimed that it was highly questionable   Exhibit
whether the local industry potential will be great enough in   85/1
the next decade to provide a profitable operation for the
number of suppliers at present in the industry.   However, he   Q.92
also expressed the opinion that Australian industry is, in
many cases, willing to use computer technology and that the
outlook for the computer industry in Australia is good.
He expressed the opinion that it was reasonable to look to   Exhibit
the Government, as potentially the largest single user, to   85/1
provide the initiative and base for an established and
progressive local industry, and suggested that a logical
approach to manufacturing would be to concentrate on
specific types of computers where local demand was high,
but given the highly competitive position of the Australian
market this may not be possible in the immediate future.

(iii) Potential Computer Installations

        We were informed that Australia has so far made little impact on the potential computer market and in regard to Table No.1 referred to above, Mr. O'Neil stated that even if a more conservative growth rate of 30 per cent is considered, there would be more than 1,000 computers valued at some $140 million in Australia within five years whilst in ten years the number of installed computers would be nearly 4,000 valued at about $500 million.   He stated that there are two major factors leading to this type of development.   They are the gradual movement of more user firms into the field of A.D.P., and the divergence of user firms with more experience into the areas of new application.   He also informed us that in making such projections it must be borne in mind that exponential growth rates persist until the level of application has become comparable to the most advanced countries and that then the rate of growth declines because the demand for computers is dependent on the normal growth rates of the country concerned, and on technological advances which encourage the introduction of computers to new applications.   He believed that with computers, this second factor will probably be dominant for many years.   Mr. O'Neil suggested, therefore, that it seemed safe to assume an exponential growth rate in Australia for the next five years, but that there could possibly be some levelling out in the rate in the following five years.   He said that attempts made in the past to project computer growth rates have been almost invariably wrong and emphasised that the figures quoted earlier in Table No.1 were submitted with great caution and with very little faith in their ultimate accuracy. He claimed that, even as order-of-magnitude estimates, they indicate the growing importance of the computer industry in all countries of the world and particularly in those countries which are technologically advanced.

Exhibit
85/2

Q.207

Exhibit
85/2

Exhibit
85/2

36.   We were informed by Mr. O'Neil that the high capital cost of computer equipment, the serious lack of appreciation on the part of senior management of the advantages offered by A.D.P., and the difficulty experienced by many companies in obtaining an experienced programming and operating staff appeared to be factors limiting the use of computers in Australia.   Each of these factors are discussed in later sections of this Report.

Exhibit
85/2

37.   Mr. Dobbs suggested that Australia would have 1,000   Exhibit
computers installed by 1970 representing a value of approximately   85/3
$25 million and that by 1975 there will be at least 1,500 computers
installed.

38.   Professor Ovenstone stated that, in regard to   Exhibit
previous estimates made by so-called experts on the rate of computer 85/4
and system growth since 1953, there has been consistent under-
estimation of growth and needs in terms of equipment, investment
and staff. He predicted that the use of computers in Australia   Q.334 and
would almost double every year for the next two or three years,   Exhibit
                                                                   85/4
he said that the number of computers and systems that might be
economically and effectively utilised in Australia in the foreseeable
future can be estimated in many ways depending on the basic
assumptions made. To provide an assessment of reasonable upper
limits he quoted the experience of the United States of America
which has similar, or higher, standards to those obtaining in
Australia. He said that in the United States of America there are
approximately 30,000 computers, excluding special-purpose and
defence machines, used for over 700 different kinds of applications
by a population of some 180 million, that is, a ratio one computer
for 6,000 people, and the rate of computer usage is such that the
total number of computers is doubling every three years. He
therefore suggested that, given the current rate of growth,
it would seem reasonable to predict that there could be some
3,000 computers and systems effectively employed in Australia
within the next eight years. He added, however, that the   Exhibit
distribution and size of industrial and commercial organisations, 85/4
the range of financial expenditure by industrial and Government
groups and the shortage of trained and experienced staff would
be inhibiting factors to future A.D.P. development in Australia.
39.   Mr. Gyngell informed us that estimates of the   Exhibit
number of computers which will be installed in Australia vary   85/8
between 1,000 and 1,400 by 1970, but that since 400 have been
installed so far there are indications of a growth rate of
between 150 and 250 per cent over the next four years. He
stated that no attempt had been made to assess the real   Q.550
potential for computers in Australia and added that this
statement was applicable to all other countries as no
country had really examined fully the possibility of
centralising computing facilities on very large machines.

40.   Mr. Gyngell indicated that forecasting the number of   Exhibit
machines to be installed in Australia is probably more hazardous   85/6
than in other countries because, in general, industry here has
not yet decided on whether to centralise its data processing
activities.   However, he gave us details of estimated net
increases in computers in Australia from 1966 to 1970, prepared
by four manufacturers - IBM, G.E., I.C.T. and Australian
Computers which are given in Table No. 3 below.

Table No. 3

Estimated Net Increases in Computers: Australia

1966-1970

Value ($'000)	1966	1967	1968	1969	1970
Up to 100	67	86	103	122	146
100-200	29	34	43	49	57
200-400	22	27	30	36	40
400-600	7	8	9	10	11
600 upwards	5	6	7	8	9
Totals	130	161	192	225	263

41.   We were reminded by Mr. Gyngell of the survey   Exhibit
conducted by the Department of Labour and National Service which   85/6
estimated that 431 computers were planned to be installed by the
end of 1965; given this estimate and the accuracy of the above
figures a total of 1,402 computers will have been installed
by the end of 1970.

42.   Mr. Veel informed us that there would not be   Q.617
sufficient trained staff in Australia to enable computer usage
to double yearly for the next two or three years.   However,   Exhibit
he suggested that, given a growth rate of 35 per cent per   85/7
annum from 1959 to 1964 and a slightly lower rate from 1964
to 1966, there should be 1,200 computers installed in
Australia by 1970.   He added that it is highly
probable that the shortage of trained staff would be an
inhibiting factor to this rate of growth.

(iv) Taxation Rates in Relation to Computers

43.   Mr. O'Neil informed us that, in general, equipment   Exhibit
is sold in Australia at the same basic price as in the country   85/2
of origin, and that while equipment of U.S. manufacture is
subject to a $7\frac{1}{2}$ per cent Preferential Tariff rate, all equipment
is subject to sales tax at the rate of $12\frac{1}{2}$ per cent. He added
that when these additional costs are coupled with the lower
relative incomes of Australian organisations and the costs of
accommodation, air conditioning and operating personnel, the
total figure is considered by many companies to be prohibitive.
Mr. O'Neil also said that it is often extremely difficult in
feasibility studies for prospective users to satisfy themselves
that the introduction of A.D.P. is an economic proposition in
the short term.   Because of the contribution that computers
can make to productivity and development in this country and   Q.160
because they are an essential management tool, he said that the
wisdom of imposing a sales tax on computers seemed to be open
to question.

44.   Mr. O'Neil suggested to us that the depreciation   Exhibit
rate for taxation purposes on computers does not appear to be   85 /2
realistic for equipment subject to the rapid technological
advance displayed by computer equipment and that a rate of about
20 per cent per annum would better reflect the present situation.

45.   Mr. Dobbs indicated that his company   Q.229-
has been endeavouring for about two years to have the sales tax   230
removed from computers and that, in his opinion, this tax is
inequitable because it is immediately passed on to the
purchaser or renter of equipment.   He expressed the view that
computers should not be classified as a piece of office equip-
ment in the same way as an adding machine or typewriter.   We
were told that IBM, I.C.T. and Honeywell had recently approached
the Australian Chamber of Manufacturers, which has requested
the Government to consider the removal of sales tax from
computers.

46.   The Department of the Treasury informed us that,   Committee
under the income tax law, a company which purchases a computer   File 1965/3
and uses it for business purposes would not be entitled to an
outright income tax deduction for the cost of the computer.
However, the company would be able to claim a depreciation
allowance which would enable the cost of the unit to be written
off by instalments over the period estimated by the Commissioner
to be the effective life of the computer assuming that it is
maintained in reasonably good order and condition.

47.   With regard to depreciation allowances on rented   Q.227
equipment, Mr. Dobbs told the Committee that the life of a computer
is not really known, and that while maintenance would be the
limiting factor, a breakeven point would be reached between the
45th and 47th month of rental in the case of most equipment.

48.   The Department of the Treasury informed us that the   Committee
depreciation allowance in each year would normally be 22½ per   File 1965/.
cent of the written down value of the unit (written down value
being the original cost to the taxpayer, less depreciation allowed
in prior years). Alternatively, if the taxpayer has elected to
claim depreciation under the prime cost method, the annual
allowance would be 15 per cent of the original cost of the
unit. These are the standard rates based on an estimated
effective life of 6 to 7 years. Higher rates may be approved
if the taxpayer can show that, in the particular circumstances
of his case, the effective life of the equipment would be
shorter. However, no allowance may be made for premature
obsolescence resulting from the development of improved machines.
Adjustments would be made if the company should sell its computer.
If the sale is for less than the depreciated value, the
difference will be an allowable deduction. If the sale is
for more than the depreciated value, the excess depreciation
will be written back as assessable income. We were informed,
therefore, that the company would be allowed to write off the
whole of its outlay by means of income tax deductions, over the
period during which the computer is owned and used. Should the
company choose to lease a computer, the rental payments made
during each year of income will be deductible in full. Here
again, the company is able to deduct the whole of its outlay
over the period during which it uses the computer. Rental payments
which the lessee is entitled to deduct will be assessable income
in the hands of the lessor, but the lessor, if he is the owner
of the computer, will be entitled to claim depreciation allowances
in the manner described above.

49.   Mr. Cyngell suggested that the Government should give   Exhibit
urgent consideration to the introduction of Investment Grants,   85/8
to include computers. These grants are currently under consideration
in Britain. He informed us that while investment allowances   Committee
granted by the British Government are in the form of taxation   File 1965/3
                                                                     and
rebates, a Bill, not yet approved by the Parliament, provides   Qs. 584-587
for investment grants to be paid in cash. He said that the grant
which is normally 20 per cent of the value of equipment would be
increased to 40 per cent, if equipment, including computers, is
installed in a "development area", or if it is integrated with
machinery to be used in certain industrial processes.

(v) Technological Change in the Computer Industry

50.   The significance of Table No 4 as indicated by
Professor Ovenstone, and referred to below, is that the number
of systems has more than doubled every two years since 1960, as
has capital investment in this equipment. Professor Ovenstone
observed that previous underestimates of the growth rate in
terms of equipment, investment, and staff was undoubtedly due
to the fact that, whereas research and development about a
decade ago had preceded commercial production by from five to
ten years, this 'lead time' has been consistently reduced until
it is now approaching three to four years and is continuing to
decrease.. In respect of technological change he informed us
that the central processor portions of computers which, in 1956,
cost over $500,000, weighed 4 tons and occupied some 1,000
square feet of space, can currently be purchased for less than
$200,000, weighs less than 1,000 lbs. and occupies the space
of an average sized office desk.   He claimed that these measure-
ments will be at least halved within the next five years.
Professor Ovenstone stated that, at the present time, the central
processor may be purchased at the same price as that applying
ten years ago, but that it now occupies only two to three cubic
feet of space and weighs less than 100 lbs.   The witness added
that, while the central processor portion of the computer will
become smaller in the next five years or so, the peripheral
units are unlikely to change very significantly.

Exhibit
85/4

Q.350

51.   Mr. Gyngell submitted the following definition of
the three generations of computers which have so far been
produced:

Committee
File 1965/3

First Generation - Computers whose circuitry was composed
                     primarily of thermionic valves.

Second Generation - Computers in which valves were largely,
                     if not wholly, replaced by transistors.

Third Generation - Computers in which transistors are largely,
                     if not wholly, replaced by micro-integrated
                     circuits.

52.   He stated that the particular feature of each
generation is the increased degree of computing speed and of
electronic reliability it is capable of achieving compared to
those of the previous generation.   With regard to computers
designed primarily for 'commercial' usage, and generalising to
a considerable degree, Mr. Gyngell said that second generation
computers had achieved an increase in computing speed four

times greater and increased reliability five times greater than
those of the first generation. Third generation equipment,
however, has achieved an increase in computing speed ten times
greater, and an increase in reliability of fifteen times greater
than that of the second generation.

53.   Mr. Hall also stated that the three distinct technological   Exhibit
generations of computers had been developed within the last   85 /1
                                                                        and
decade and that the majority of installed computers fall into   Q.33
the the second or transistor generation, but that the cost
reductions associated with later models suggest that it would   Q.104
be desirable to acquire third generation equipment as soon as
the economics of the user organisation permit this.   He said
that technological change is associated with a reduction in
total cost, that is, in the cost of the equipment, its
installation, the ease with which it can be programmed, the
environmental costs associated with installation and also that
the physical requirements such as space, electrical require-
ments, false floors and air conditioning equipment are less. For
example, some of the smaller machines now being made simply
plug into a 240 volt power outlet.

54.   Mr. Hall indicated that technological   Exhibit
change can best be illustrated by improvements in the electronic   85 /1
internal speed measurement which can be classified in orders of
magnitude.   In the early or valve machines speed of operation
was measured in milli or thousandths of a second, in the
transistor era, micro or millionths of a second, and in the
latest solid logic series nano or billionths of a second.
He said that these rapid advances in technology have brought   Exhibit
with them substantial cost reductions, not only in the cost of   85/1
physical components, but also in the associated environmental
costs.   Succeeding generations are smaller, occupy less space, and
require less air-conditioning, whilst improved reliability,
together with inbuilt diagnostics, have reduced the maintenance
problem.   We were informed that these factors, and an
increase in the range of machines available, has broadened
the market considerably, enabling a potential commercial
user to rent a small system for $1,000 a month.

55.   Some witnesses felt that the generations of computers cannot be readily defined. For example, Mr. O'Neil considered that such a concept could be confusing particularly in regard to the clear emergence of a third generation. Professor Ovenstone agreed with Mr. O'Neil in this regard while Mr. Gleeson felt unsure of the meaning of the term "third generation equipment". He stated that the basic distinction between generations of computers is that between valve machines and modern transistorised equipment.

Qs. 218, 350 and 1001

56.   Mr. Gyngell expressed the view that real technological developments in computers themselves cannot be expected within approximately the next five years. Mr. Gleeson agreed with Mr. Gyngell and added that the sophistication of hardware has reached the stage where its use is lagging, but that future development is likely to continue in perhipheral equipment and software. Mr. Gleeson indicated that the cost of programming support can amount to two or three times the cost of hardware because a total project can be time consuming and complex, requiring considerable effort and a wide variety and high degree of skills.

Q.551

Q.876

Q.1064-1065

57.   Dr. Lance informed the Committee that the emphasis placed on software by both manufacturers and customers has changed markedly over the years; for example, in 1956 one rudimentary input programme was usually all that was supplied by the manufacturer with the hardware and it satisfied most customers. This, however, is no longer true. Customers now expect comprehensive libraries of standard programmes, a sophisticated monitor system to control the processing of problems automatically, and in addition the manufacturer is expected to provide software support so that the programmes, originally supplied, can be kept up to date.

Exhibit 85/5

58.   Mr. Hall stated that progress has not been as rapid   Exhibit
with software as with hardware and that increasingly large   85/1
research and development funds are being directed towards
achieving full utilisation of hardware advances already
implemented. He informed us that IBM is devoting approx-
imately $U.S. 60 million to software support in a recently
introduced range of systems. He added that the development   9.109
of programming systems is now taking a larger proportion of the
IBM budget than the development of hardware and that the
effective usage of hardware is dependent to a large extent on
the development of the appropriate software support. He said
that some of the methods developed by IBM will be adopted by
other manufacturers.

59.   He   also indicated that the internal speed of   Exhibit
the systems and their complexity has led to perhaps the most   85/1
significant development in recent years, that of Monitor or
Control Programmes, Executive or Operating Systems which
control, allocate and manage the available resources of the
computer to maximise utilisation, removing to a very large
extent the necessity for operator intervention and maintaining
the job flow through the system. He said that the control   Exhibit
programmes and associated language and other utility program nes,   85/1
whilst extremely complex, are sufficiently generalised and
flexible to meet the typical needs of users and also that they
will contribute more to improved computer usage in the
immediate future than hardware development. He added that   Exhibit
because of the increasing use of management science by   85/1
commercial users, and indeed many of the information require-
ments of commerce used by science, attempts are being made to
develop a universal language acceptable by all systems and
readily usable by both laymen and skilled scientists.

60.   Mr. O'Neil explained to the Committee that early   Exhibit
programming systems were tailored to each computer, with the   85/2
result that the conversion of programmes from one machine to
another was time consuming and frequently uneconomic. In the
last few years, however, languages have been developed which
permit applications to be transferred fairly rapidly from one
machine to another. In the industry these languages are
referred to as being "problem-oriented" as distinct from the
earlier "machine-oriented" languages. Mr. O'Neil expected
that eventually communication between man and the machine
will become simplified to the point where it no longer
represents a significant obstruction to computer usage.

61.   Mr. Pridmore informed us that there have been about   Q.1545
1,700 different computer languages constructed for different
kinds of computers, and that since these languages cannot
be used in a variety of applications, they are not all
general purpose languages. The two major languages are
COBOL and FORTRAN.   COBOL was constructed by a committee
set up by the U.S. Government and FORTRAN was originally
developed by IBM. FORTRAN has been improved to meet the
requirements of users. He explained that, in his opinion,
COBOL, or "Common Business Oriented Language", is neither
common nor particularly business oriented. He said that it
was not common because the specification produced by the
committee suffered from a number of technical difficulties.
However, it has one major advantage in that it enables the
programmer to describe in a very useful way the structure of
the data to be used. He said that parts of COBOL are   Q.1544
broadly analagous to facilities available in FORTRAN.
However, he expressed the opinion that FORTRAN is an easier
language to use. He also told us that a number of dialects
have evolved for both languages. Those belonging to FORTRAN
have been collated, and this language has now been standardised
by the American Standards Association and the International
Standards Organisation.

62.   Mr. Shaw stated that while FORTRAN was developed
largely as a language for scientific and technical data processing,
the version available with one supplier's equipment permits
it to be used for commercial type applications and that
COBOL has been developed mainly for commercial type applications.
In the case of COBOL, the language comprises a segment which all   Committee
suppliers offering the language must implement, and an optional   File 1965/3
segment of which suppliers may include any part of the whole.
He added that a further complicating factor is that the
efficiency of translation from the common language to the
language of the particular machine has varied widely. This
applies particularly to COBOL for which, in the past,
translations have generally been slow and programmes derived
from the translations have been comparatively inefficient.

63.   The U.S. Department of Defence sponsored and
supported COBOL primarily on the grounds that a programme
written in this language could be used on any machine. In
practice this facility has been found to be severely limited.
Apart from variations in dialect as between different types of
machines, attempting to run a sizeable COBOL programme written
for a larger machine on a smaller machine of the same type is
generally not possible.   However, Mr. Shaw indicated that the
language framework has provided a useful common basis for
programmers employed in areas of commercial application. After
13 years of development and research, a specific version of
FORTRAN was adopted on 2nd June, 1966, as an American Standard.
COBOL has been under development for the last 6 years and the
first versions of COBOL translation programmes (compilers) did
not become available until 1962/63.

64.   Mr. Shaw observed that, since FORTRAN has just
become, and COBOL is likely to become, an American Standard in
1966, the prospect is that these will remain the most common
languages over the next 3 to 5 years.   More recent languages,
such as PL 1, which tend to combine the features of COBOL and
FORTRAN, are still in a developmental state. The ALGOL language,
commonly used for scientific and technical data processing in
Europe, is gradually gaining favour elsewhere and is being
developed to permit its wider application to commercial type
processing.   He   observed that it is not possible to
predict, at this stage, which of these more comprehensive
languages will emerge as the universal language of the future.

(vi) Computer Applications

65.   Professor Ovenstone supplied Table No. 4 below which gives
details of computer systems installed in Australia up to 1966. The
estimates given were said to be conservative and to exclude other
data processing equipment such as punched card calculators, electronic
accounting machines and special purpose electronic computers.

Table No. 4.
Computer Systems Installed: Australia
1958-1966

Year	Installed Computer Systems[1]	Capital Value [1]
		$Am.
1960	10	3
1962	40	13
1964	170	43
1966(ii)	460	115

(i)   Estimated cumulative total

(ii) Includes outstanding orders

66.   Mr. O'Neil stated that, while the breakdown between   Exhibit
large, medium or small systems must always be arbitrary, he   85/2
believed that the distribution of Australian computer installa-
tions should be classified as follows:

large, 7: medium, 30: small, 320. He said that the large
systems are owned by the Commonwealth Government, and that the
operators of these systems are as sophisticated as any of their
counterparts in the United States of America and other advanced
computing countries. He added that, in a general sense, the   Q.143
installation of these systems had been successful and their
utilisation productive. He added that many of the medium scale   Exhibit
installations are in universities and Commonwealth and State   85/2
Government Departments, and that these also are operated at a
level of confidence and sophistication comparable with the best
installations in other countries. It is to be noted,however,that
the large and medium installations represent a very small pro-
portion of the total computer population.

67.   Mr. Hall stated that, by the end of 1965, there were   Exhibit
approximately 240 computers of all makes installed in Australia   85/1
and that the numerical analysis of these systems was about 85   Q.31
per cent commercial, 10 per cent university and research, and
5 per cent governmental, of which some $3\frac{1}{2}$ to 4 per cent would
be Commonwealth Government installations. He indicated that
installed systems cover a wide range from small scientific
machines valued at between $50,000-$60,000 to large scale systems
valued at some $2 million with about 80 per cent in the medium
size which are valued at approximately $400,000.

68.   At the request of the Committee, Mr. Hall provided   Q.38
details of computer installations by number and value.   These
are shown in Table No.5 below.

Table No.5
Computer Installations (i) : Australia
1966

Usage	Installations		Value		
Government				($1,000)	
Commonwealth	26		18,880		
State	14	40	5,250	24,130	Committee File 1965/.
Education		21		9,750	
Other		164		52,620	
Total		225		86,500	

(i) Estimates made by IBM

(ii) An installation is a location; there may be
one or more computers within an installation.

69.   On the basis of the data provided in Table No. 5   above,
it is noted that, while Commonwealth Government computer installa-
tions account for 11.6 per cent of total installations by number
in Australia, they represent some 21.8 per cent of installations
by value.   Mr. Gleeson advised us that, at the present time,   Q.928
the Commonwealth Service is highly mechanised.   An example of
the degree of computing power available within the Service is
the network installed by the Commonwealth Bureau of Census and
Statistics, considered to be one of the largest of its kind in
the world.   Mr. Pridmore suggested that about 90 per cent of   Q.1449
the computers installed or on order in the United States of
America are less powerful than one range of the Bureau's
installed equipment, while some 96-97 per cent of the same
equipment is less powerful than another range of the Bureau's
installed equipment.   Mr. Gleeson indicated that the   Q.987-
purchase of computers by the Commonwealth Government has   988
already made Australia one of the more advanced countries
in the field of A.D.P. within Government administration
among the industrialised nations.

70.   Mr. Hall advised the Committee that a pattern of   Exhibit
development for the industry in Australia has emerged. In the   85 /1
private business sector there has been a rapid utilisation of
small to medium size computers, almost exclusively on a rental
basis.   In the government sector there has been a slower
growth with a different emphasis in the following areas:

   . Education – with small computers, oriented
     towards the solving of scientific problems,
     installed in universities, and mainly rented
     in the earlier stages of introduction; and

   . Government – with an early bias towards scientific
     problem solving, but with an emphasis on
     large purchased systems.

71.   Mr. O'Neil stated that, in general, the bulk of   Exhibit
the work being done on computers in Australia may be divided   85/2
into three general areas as follows:

   . The production of analysis from a large volume
     of data, for example –

        . Trade and census statistics
        . Financial information
        . Critical path analyses for project control

- Labour saving in routine "paper shuffling"
  activities, for example -
    - Record keeping in insurance offices,
      banks, etc.
    - Payroll preparation
    - Processing of routine payments, such as
      pharmaceutical benefits, and pension cheques.
- Scientific computation where it is not possible to
  carry out the work by hand methods, for example -
    - Nuclear and crystallographic studies
    - Real time   applications as at the
      Woomera Rocket Range
    - Reduction and analysis of scientific
      data.

72.   Mr. O'Neil added that these advances are not limited
to the techniques developed and mastered for these applications.
Concurrent developments include:

- Availability of skilled personnel in the fields of:
    - Programming
    - The design of "software" systems
    - Digital and analogue circuit techniques
    - Numerical analysis
    - Data transmission
    - Data preparation
    - Installation and maintenance of computer systems
- Facilities for teaching and research in universities
  and some technical colleges
- A greater appreciation by management of the
  facilities offered by A.D.P.

73.   He quoted from the November/December 1965
issue of an Australian periodical, "Data Trend" to the
effect that the typical Australian computer installation
emerges as a small or medium sized machine, its major uses being:

" . Invoicing and elementary stock control
  - Payroll
  - Sales analysis

Such an installation usually employs a manager who is
also a part-time programmer, one or two programmers
and two to three trainee programmers who double as
operators. In other words, the typical Australian
installation is being used as a mechanised book-
keeping department".

74.   Mr. O'Neil informed us that in spite of a general impression which had been created, Australia is not relatively advanced in the computer arts.   He indicated that about 80 per cent of computers installed in Australia are employed as electronic versions of punched card accounting systems, their introduction and installation being decided by economic advantages in limited applications, or even by considerations of prestige, and for the most part their use is not indicative of any great advance in management techniques.   He added, however, that this statement did not include the majority of large government installations.

75.   He also stated that, for the most part, commercial enterprises in Australia have been extremely conservative, at least by U.S.standards, and that very few have exploited fully the apparent advantages of electronic data processing.   It was suggested by Mr. Hall that the proportion, by value, of Government acquisitions should be increasing relative to other organisations. He also suggested that the Government should be a pioneer in the field of administrative applications for which it has a tremendous potential. Mr. O'Neil informed us that the Commonwealth Government had been in the forefront in establishing A.D.P. in Australia while Mr. Hall told us that the initial impetus in scientific computing in Australia was provided by the Government.

76.   Dr. Lance indicated that the effects of computers on the sciences in Australia are widespread. It is possible to analyse the data from X-ray diffraction patterns in a matter of minutes; the data from radio-telescopes are recorded automatically on paper tape, which is then read into a computer, so that quite complicated calculations can be performed. He added that the effects of computers on the missile programme are obvious; some calculations have the effect of reducing the number of costly tests which must be performed, and moreover, by simulating the behaviour of missiles in flight, correction procedures can be worked out in advance and thus losses of expensive equipment are minimized.   Other areas which have benefited from the application of computers include the design of aircraft, made under licence, and the construction of highways. The Committee was informed that the distribution of industrial products can be optimised and the control of production itself is improved when computers are utilised for this purpose.

77. Dr. Lance informed us that the biological and
agricultural sciences in Australia have not benefited as
greatly as the physical sciences. One reason for this is
that applications to the former had not been developed
so fully as in other countries and therefore require much
greater local effort. Another reason is that the advantages to
be had from the application of computers to agriculture are not quite
so obvious. However, routine statistical analyses are being
carried out by computers which previously took weeks of hand
calculator work. They have enabled plant trials to be
expanded in size so that extra tests can be included, thereby
improving the accuracy of results. He informed us that plant
breeding can be simulated on computers, and in this way only
the approaches which appear to be profitable need be followed up
in the green house or in field trials. This also applies to animal
production. The problem of the classification of areas of
land, plants, animals, soils, sealife etc., can be approached on
computers and this type of work will eventually be used to
improve land and plant utilization.

78. Dr. Lance expressed the opinion that the C.S.I.R.O.
was probably doing as much as any other group in the world,
including the United States, in the agricultural sciences, and
that this is because Australia appreciates its dependence on
this branch of the sciences.   Q.534

79. Professor Ovenstone informed us that the Commonwealth   Exhibit
Government has sponsored several leading developments in the   85/4
application of A.D.P. within its own area of responsibility,
while Mr. Gleeson stated that the application of computer   Exhibit
methods to the processing of data by Commonwealth Departments,   85/9
and by those Statutory Authorities more closely associated
with the Commonwealth Public Service in the A.D.P. field is
widespread and additional Departments are considering its
application. Some $20 million has already been invested in
digital computer equipment in the Commonwealth Service and
approximately 1,000 staff are currently engaged in the
various facets of A.D.P. implementation and operation.
The role of the Commonwealth Service in the field of
A.D.P. will be discussed in greater detail in a later
section of this report.

(vii) Future Computer Applications

80. Mr. O'Neil advised us that in Australia we may
look forward to the use of computers, within the next five
years, in the following applications which are new to this
country –

- Airline reservation, i.e. seats available on
  particular flights would be available
  simultaneously throughout the world.
- Credit control
- Banking
- Management Information
- Stock quotation
- Diagnosis of electrocardiographs and X-ray photographs
- Message switching in public and private
  telecommunication networks
- Totalisator Agency Board operations
- Data collection (e.g. in factories for stock
  control and costing purposes)
- The operation of electricity generating
  stations, electricity distribution networks,
  gas and oil pipeline networks.
- Monitoring of hospital patients under surgery
  and during convalescence
- Closed loop control of continuous manufacturing
  processes in, for example, the chemical, oil,
  steel and paper industries.

81. Mr. O'Neil also suggested that before 1970 we may
see the emergence of true time sharing systems. Their integra-
tion with high speed data transmission networks may result in
the so called "computer utility", which is to be compared with
a telephone system in which subscribers use the facility
simultaneously from remote locations. We were told that
the use of a large computer in this way would result in cost
reductions and would permit the economic provision of a
wider range of special peripheral equipment. He stated
that it would effectively allow the small user access, from
his own premises, to the most powerful computing facilities.

82.   Mr. Gyngell stated, for example, that the cost of   Q.572
this form of utility between Sydney and Melbourne would be
approximately $3 million but that the cost of data transmission
for individual customers would, at present, be uneconomic.

83.   Mr. O'Neil indicated that recent technological   Exhibit
advances point the way to computing systems with increased   85/2
data storage capacity and much higher internal speeds. He
said that beyond 1970, therefore, there can be no doubt that
computers will be applied to all activities involving the
routine processing of data and the control of many manufacturing
processes. He added that, while computers will be larger
and the cost of data processing lower, tho advent of time
sharing from remote locations will permit lowered costs to be
passed on to the whole data processing community. In addition,
new techniques such as microcircuitry will reduce hardware costs
to the point where smaller computers and computer-like devices
could well become household equipment. He informed us that
techniques of communications and computing have much in common
and that there aro already signs that the two will merge. The
computer utility referred to above was said to be a good example
of the inter-marriage of these disciplines. He said that as
facilities for data processing at a distance grow, the ability
to process all of the community's data by machine will be
approached. Without judging the significance of new applications,
he provided the Committee with the following list of applications
and observations as being typical of some areas in which computers
are likely to be used in the 1970's.

Medicine

Whilst the human aspect will always be paramount,
information storage and retrieval systems should become a
valuable aid to medical diagnosis.

Law

Tho interpretation of the law and the administering of
justice obviously involves wisdom and fine human feelings and there
will no doubt be a very proper opposition to the use of computers
in searching for legal precedents and the provision of data
except insofar as they make available information which is
now extracted laboriously by hand methods.

Law Enforcement

The maintenance of comprehensive criminal records
with instant access to them will permit more rapid apprehension
of law-breakers.

Education

A good deal of work has already been done on the
problems of teaching and grading by machines. The success of
these methods has been established and there is little doubt
that the use of computers in education will increase rapidly
in the near future because these methods permit students to
proceed at a pace determined largely by their own ability and
also because each teacher can supervise many more students.

Engineering Design

The use of computers has already removed much of
the drudgery of routine computation. The use of displays
equipped with "light pen" and similar aids to design will
permit greater output from the creative designer.

Resource Control

Computers will enable optimum use to be made of
natural resources such as oil, water and perhaps minerals.
They will also be used to determine the best remedial measures
in cases of drought and other natural or man-made disasters.

Exhibit
85/2

Personal Finance

New systems of assessing personal credit ratings,
and the ability to process financial transactions immediately,
through data transmission networks connecting credit rating
bureaux, the banks and the retailers, may change the whole
character of present day monetary practice as it affects the
individual.

Social Controls

In the foreseeable future, it will be possible to
maintain a file on each individual to ensure that he meets his
statutory obligations to society. His taxation history, driving
record, credit rating etc. will be instantly accessible to
the proper authorities. Mr. O'Neil stated that the effects
of exploiting this form of control in an undemocratic society
is easy to envisage and he expressed the opinion that we
shall no doubt witness interesting developments as the
individual resists the trend to a totally controlled society.

84.   Mr. O'Neil informed us that new and perhaps
revolutionary technological advances will be made in both
computer hardware and in programming systems.   These,
together with similar developments in communication, in
higher standards of education and changes in the pattern
of living make it impossible to even guess at development
20 years ahead.

Exhibit
85/2

85.   Professor Ovenstone indicated that there is
virtually no profession, activity or skill that has not, or
could not soon be, considerably affected or influenced by
A.D.F. and its allied forms of automatic systems. Examples
given to us include economic planning at various levels, all
forms of transportation, communications of all types,
industrial and machine control, public utilities of many
kinds, library operations, document reading and abstraction,
accoustical "hearing", language translation, sociology and
the arts.

Exhibit
85/4

(viii) Need to Accelerate Computer Applications

86.   With regard to co-operation between Government,
Commerce and Industry in the introduction of A.D.P.,
Mr. Gleeson informed us that a users' association is being
established which will provide a forum for discussion by
interested parties, including equipment suppliers and users.

Q.896-
897

87.   Dr. Lance agreed that optimisation of the use of
resources by the productive use of computer technology would
lead to increased industrial production, and this, together
with more efficient channels of distribution, should lead to
a higher standard of living as well as increasing Australia's
competitive position in the export of certain manufactured
goods.   He added that this is basically true because prices
would be kept to a minimum if computer technology was applied
efficiently to industrial production.   He also stated that
Australia can be proud of its achievements in the field of
computer utilization, but that its place in the world will be
largely dependent on the extent to which the Government and
private enterprise continue to finance the purchase of the
most modern computers.

Q.532

Exhibit
85/5

88.   Professor Ovenstone expressed the view that
Australia, given its political, geographical and economic
position, must enter into an automated form of production to
produce its share of the material abundance required by other
countries.

Q.398

He also stated that the formulation of a suitable strategy
for the development of A.D.P. and allied automated systems
in Australia is a matter of some moment and urgency,
since, for the reasons given above and also because
Australia is a country of small population and high living
standards, it requires more productive capacity per man-hour
than most other countries if it is to retain its present
standards.

Exhibit
85/4

89.   Mr. Dobbs drew the attention of the Committee to
the fact that computers and the knowledge of their effective
use have become critical factors in measuring a nation's
strength. An example of this statement is the complexity
of social life today with its military, satellite and space
programmes. He indicated that without the computer these
programmes would not be possible.

Exhibit
85/3

Q.247

CHAPTER 3 - STAFFING AND EDUCATION

90.   It has been said that automation and education are
two sides of the same coin.   Professor Ovenstone expressed the
opinion that, to introduce A.D.P. and its allied forms of
systems, which really constitute automation, it is essential
to have adequately trained people to ensure that the systems
are effectively developed, installed and operated.   However,
we were informed that there is a world wide shortage of skilled
personnel in the computer industry.

91.   Mr. O'Neil expressed the opinion that A.D.P.
reflects somewhat in advance, the direction in which industry
as a whole is progressing.   He said that there is a tendency
to require a higher proportion of better trained people in the
formal sense in business and industry and this is seen more in
A.D.P. than in other fields.

Q.375

Q.376

Q.180

(i) The Magnitude of the Problem

92.   Mr. Dobbs stated that the digital computer raises
only one really important current problem and that is to learn
how to use the computer properly.   He quoted from a United
States Government publication[1] as follows:

Exhibit
85/3

> "Machine technology is growing beyond the
> ability of people to use it.   The technological
> gap should be closed by giving increased recog-
> nition to the people in the E.D.P. system by
> increased attention of top management to E.D.P.
> matters and by acceleration of automatic
> programming development.   A strong tendency has
> existed throughout the growth of E.D.P. to
> concentrate on the development of the equipment
> to a far greater extent than on the development
> of the man in the system".

Mr. Dobbs also quoted Dr. M.G. Kendall, Managing Director of
CEIR   Limited of Britain, who said, in a paper presented at
the recent Australian Computer Conference, that except perhaps
in the United States, the greater part of industry and
government has not yet learned to make proper use of even
the simple machines.

(i) Use of Electronic Data Processing Equipment in the Federal
   Government.   United States Government Printing Office,
   June 1964.

93.   We were informed by Mr. Dobbs that there is a need
for a substantial amount of education and re-education at all
levels in organisations using or contemplating using computer
systems and the training required for industry to implement the
computers already developed has become a considerable problem
in every country.   He said that universities in Australia have
been providing computer training but this has been almost
exclusively for the technical and scientific use of computers
and it has meant that industry itself and computer manufacturers
have supplied the major part of education and training for
commercial applications.   He said that this has produced an
upward salary spiral as organisations find themselves with
expensive equipment but insufficient trained people to
effectively utilise the potential of their equipment.

94.   Mr. Dobbs said that average position tenures have been
shortened since on many occasions, when a man completes his
training and begins to be useful he moves on to another position at
a higher salary.   He claimed that, until about 1964, many
promotions had been accelerated and individuals had been called
upon to make major decisions before they had acquired the back-
ground on which to base their judgment.

95.   In his submission, Professor Ovenstone stated that
the shortage of trained and experienced staff for analysis,
design, implementation, operation and research into computing
science had adversely influenced past A.D.P. development in
Australia and was an inhibiting factor to its future growth.
Mr. Dobbs said that shortage of trained staff is a large part
of the problem associated with implementation of A.D.P., and
Mr. O'Neil stated that the difficulty experienced by many
companies in obtaining an experienced programming and operating
staff was an inhibiting factor to computer usage in Australia.
He also expressed the opinion that, while this is a much
publicised problem, there is very little evidence to show
that any prospective user has failed to acquire a system on
this account.   Mr. O'Neil also said that the level of
training of many of the people associated with A.D.P. applica-
tions often leaves much to be desired and inhibits the timely
introduction of new applications.

96.   Mr. Hall noted that the growth rate of commercial
computer usage in Australia has been high by any standards and
he suggested that the ability to attract and train staff would
not appear to have inhibited this growth rate materially.   He
also said that, for the majority of commercial installations,
staff requirements can and have been met from within their own
resources, with the possible exception of the Data Processing
Manager.

Exhibit
85 /3

Q.220

Exhibit
85 /4

Q.225

Exhibit
85 /2

Exhibit
85 /1

97.   With regard to training courses in A.D.P., Mr. O'Neil   Q.173
agreed with Mr. Hall that there are two distinct training
requirements in the industry.   One is for the graduate, who
will become a part of senior management, and the other is for
the programmer, that is, the bulk of those who serve in the
installation.   Mr. O'Neil stated that, while the first
category is currently being reasonably well catered for by
the universities, and also that steps are being taken to
improve the position, there was still scope for improvement.
With regard to the second category, he said that, while
technical colleges and institutes were providing courses,
and were also endeavouring to improve the current position,
their efforts were not always effective.   He claimed that the
provision of finance and staff presented problems in the field
of training courses in A.D.P.

98.   Professor Ovenstone expressed the view that the   Exhibit
magnitude of the training problem cannot be overemphasised.   85/4
He suggested that in common with many other disciplines and
professions there are two main classes of people involved.
One of these, the incidental users, consists of people who
are interested in the use and application of computers.   This
class, which is numerically large, mainly needs orientation to
the concepts of A.D.P. so that the application and implications
of computing science for its own requirements can be understood
and used effectively in practice.

99.   The second class consists of "professional" staff
of five kinds:-

  . Computing Scientists who are engaged in research in
    their disciplines and in inter-disciplinary projects;
  . Programmers who are trained and experienced in system
    analysis, design, implementation and operation, with
    computer programming a part of their technical armament.
  . A.D.P. Engineers who design and develop special system
    instrumentation and devices.
  . Maintenance Technicians who repair and maintain
    particular ranges of system equipment.
  . Computer and Data Preparation Operators who operate
    their particular equipments according to prescribed
    procedures.

The first four of these require special training which must be
provided at the tertiary level.   Further, because of the scope
of A.D.P. programming and engineering, practitioners in these
fields will inevitably tend to specialize in some of the many
areas of Computing Science and A.D.P.

(ii) Efforts Made to Overcome Staff Shortages

100.   We were informed by Professor Ovenstone that, in an
endeavour to satisfy staff requirements, a few major users have
established their own training schemes; degree and diploma
courses have latterly been established in universities and
technical colleges; computer suppliers have always offered
specialised teaching, and other institutions have introduced
training programmes.   The quality of training and instruction
offered varies widely and, with the exception of some of the
courses offered in the universities, technical colleges and
some of the major users, is often extremely narrow and
specialised.   The universities tend to train highly skilled
professional staff and computing science research workers,
while the technical colleges and major users attempt to provide
analysis and programming staff for more conventional commercial
applications and frequently ignore new developments available
for these applications.

101.   We were informed that the Public Service Board has
provided assistance to certain Technical Colleges in the
development of A.D.P. training courses, and that the Service
has achieved marked success in A.D.P. training, apart from
training in equipment maintenance.   Indeed, it was stated
that the Commonwealth Service had led the world in this regard.
We were also informed that the Public Service Board had
endeavoured, through informal discussions in the early stages,
and more recently by participation in the University of Sydney
Appointments Board E.D.P. Careers Committee, to encourage the
wider development of tertiary education in this field.

102.   Mr. Hall indicated that there are very few courses
offered by Australian universities which provide practical
training in the operation of computers.   He said that most
university training currently available will produce specialist
computer technologists of the future, and that the courses
provided by the University of Adelaide are constructed to
produce highly skilled Masters or Bachelors of Computer Science.
He also said that courses are offered by the Caulfield and
Royal Melbourne Institute of Technology and the Caulfield Technical
College and that a number of practical courses are to be introduced
at the Sydney Technical College. Mr. Hall expressed the opinion
that a great deal of training can be done at the programmer and
user level if young people are trained in the use of equipment.

Exhibit
85/4

Exhibit
85/9

Q.886

Exhibit
85/9

Q.89

103.   Mr. Pridmore indicated that, while publicity is being given to career opportunities and national requirements in A.D.P. at the university level through Appointments Boards, little is being done in this respect at the secondary school level.   Mr. Dobbs indicated that education in computer usage should begin at the secondary school level, and Mr. Pridmore suggested that publicity should be given to career opportunities in A.D.P. at the secondary school level.

Q.1408
and
Q.222-
223

(iii)Estimated Staff Needs

104.   We were informed by Professor Ovenstone that the University of Sydney's E.D.P. Careers Committee had estimated that some 3,000 people are directly concerned with research, development, implementation, operation, support and marketing of systems in Australia at present. This figure includes about 2,000 people with some programming training, and 1,000 more or less trained operators.   He expressed the opinion, however, that the majority of these people should only be classed as partially experienced in the duties which they would be expected to perform as professional or semi-professional people either in Australia or overseas.   He claimed that many of these relatively inexperienced people would be almost completely ineffective as A.D.P. staff outside   their own special environment without further extensive training in appropriate areas of A.D.P.   He added that, without the active support and participation of the equipment suppliers, many of the systems installed in Australia would be even less effective than they are at present.   He said that the staffing situation is therefore much worse than it may seem from the figure quoted, and that urgent measures are required through bodies such as the Public Service Board and the Australian Computer Society to define professional standards and a code of ethics so that balanced and uniformly accepted training programmes can be developed in Australia.

Exhibit
85/4

105.   To furnish us with an assessment of the numbers and type of staff required, Professor Ovenstone quoted the following serious underestimates of projected requirements made since 1958.

Exhibit
85/4

- Professor Ovenstone, in 1958, estimated the following requirements by 1965: Graduates 150, Diplomats 400, Maintenance Technicians 200, and Computer and Data Preparation Operators 1,000.
- Professor Bennett, in 1961, estimated that at least 240 graduates would be needed by 1966.

- Professor Ovenstone, and Mr. Pearcy, a member of the staff of the C.S.I.R.O., in 1962 estimated that the following would be required by 1967/68: Graduates 800, Diplomats 1,000, Maintenance Engineers 600, Computer and Data Preparation Operators 3,000.

- The E.D.P. Careers Committee, set up by the University of Sydney, estimated in 1960 the following requirements by 1970: Trained Operators 1,000, and Trained and Skilled Staff 9,000-11,000.

- A Department of Labour and National Service survey recently estimated that each computer in Australia requires an average of six senior personnel.

106.   Professor Ovenstone noted that, given the last estimate referred to above and the number of trained people estimated by the Sydney University E.D.P. Careers Committee to be at present available, about 4,000 additional senior staff would be required by 1969/70.

107.   Mr. Dobbs indicated that estimates made by Professor Bennett in 1961 seemed to be reasonable when evaluated in 1964. However, he expressed the view that these estimates could treble every five years, for some time to come, and that in his opinion trained staff are not available in these numbers. He also expressed the opinion that too great an emphasis may have been placed on the technical graduate who comes to A.D.P. applications unprepared for commercial systems work and sometimes becomes dissatisfied with it because of the difference in the nature of its activities compared with his technical university work. He elaborated on this by saying that education in the field of A.D.P. is at almost a purely scientific and mathematical level and that when graduates are confronted with the mundane task of running commercial installations they become bored.

Exhibit 85/3

108.   With regard to the future role of Universities and Technical Colleges in the practical training of A.D.P. personnel, Mr. Gleeson indicated that the Public Service Board would like to see the development of courses which would provide suitable training in analysis, design and implementation of commercial applications. He said that the Public Service Board would welcome an increase in the number of courses offered by Technical Colleges. If this were done, some of the Board's resources now employed in

Q.909

training could then be used for other purposes, and also more
skilled people would be made available for private industry.
He added that an increased supply of skilled personnel would have
the additional advantage of eliminating possible skilled staff
losses from the Commonwealth Service.

109.   Mr. Gyngell expressed the view that the computer   Q.551
industry itself has a very real responsibility in terms of
education to educate users in conjunction with the Government
as to potential computer applications.

(iv) Desirable Attributes for Recruits

110.   Mr. Hall told us that because the computer industry   Q.16
was young, it was the policy of his company to recruit people of
30 or under with very flexible minds. He said that this does not
mean that people over the age of 35 are not competent in the
A.D.P. field but that people in this age group could do extremely
well with customer installations, marketing and systems organisa-
tions, and that they may bring a depth of maturity needed in
some installations.   He stated that IBM generally seeks people   Q.11
who are graduates and who have had some exposure to industry,   Q.496
but not necessarily previous experience in computing.   Graduates
are preferred because, in general, they are better able to cope
with the vigorous eighteen month training programme given by
IBM.   Both Mr. Hall and Dr. Lance agreed that it is desirable
for graduates, whether for marketing or for work in the
scientific field to come from a wide range of disciplines.
111.   Mr. Hall expressed the opinion that while IBM   Q.20
preferred graduates in the fields of marketing and systems
analysis he believed that people with lesser educational
qualifications, given training, experience, and exposure can
become successful programmers or systems analysts.   He informed
us that graduates are not required by commercial companies,
and that most of the people trained for customer installations
by IBM are of Leaving Certificate standard, although some have
accounting qualifications.   He expressed the view that, in
general, this level of education is adequate.   He also said   Q.21
that commercial companies endeavour to meet their A.D.P. staff
requirements from within their own organisations and that this
has the advantage that they understand the task they are
required to perform.   We were informed that people recruited
from outside an organisation become productive much later than
those from within it.   Dr. Lance agreed that, while education   Q.502
to matriculation standard was adequate for training in the
programme-systems analyst fields for commercial applications,
it was not adequate for scientific applications, where
graduates are needed.

112.   Mr. Hall indicated that there was scope for the   Q.22-
employment of more women in the computer industry and that his   23
experience in the United States suggested that women were very
competent in the fields of education and systems analysis.   Q.501
Dr. Lance expressed the opinion that the right type of female
in programming and systems work is   equal to, and sometimes
superior to, the male.   Mr. O'Neil agreed that women made
exceptionally good programmers and Mr. Gleeson informed us
that there was no distinction made between men and women in
the field of A.D.P. in the Commonwealth Service.

113.   Mr. Hall stated that aptitude is considered to be   Q.11
important by IBM because of its relationship to personal satisfaction
and success in the organisation.   Dr. Lance expressed the   Q.502
opinion that desirable attributes for programmers were
patience, accuracy and capacity for work.   A sense of
responsibility is also considered to be necessary.

         Mr. Pridmore advised the Committee that an alert,   Q.1407
fairly well trained mind is a desirable attribute for A.D.P.
recruits.   He indicated that school leavers would be
considered in a recruitment drive conducted by the Bureau of
Census and Statistics, but that evidence of intellectual
curiosity as reflected by undertaking   tertiary studies,
was desirable.

115.   With regard to aptitude tests for selection   Committee
purposes, we were informed by Professor Ovenstone that a group   File 1965/?
of psychologists from Commonwealth authorities have been
carrying out investigations of these tests with a view to
refining them for grading purposes but, even at this stage of
development, the results of the current tests are highly
significant in detecting 'non-programmers'.   He emphasised
that all staff should undertake these tests, since academic
qualifications do not seem to be the only factor determining
programmer aptitude.   We were told, however, that failure to
reach the 'threshold' of tests does not mean that the person
is unintelligent or not suitable for other forms of research.
It was claimed that the tests indicate whether or not a
person is suitable for programming; they do not suggest
other characteristics and personal interviews must still
be undertaken for those who qualify in the tests.

47.

(v) The Education of Management

116.   Mr. Dobbs supplied copies of a summary of findings
of a survey of computer installations by leading American   Committee
companies undertaken by McKinsey and Company, a firm of   File 1965/3
Management consultants.[1] The survey isolated factors
determining efficient usage of computer systems. It was
found that the main determinant of productive usage of
computer installations is not technical, but managerial.

117.   It is stated by Mr. Dobbs that, since it was not   Exhibit
until 1962 that any reasonable number of computers existed in   85/3
Australia, the bulk of A.D.P. experience in this country has
been gained only in the past four years. This means that
most men in managerial positions whose age is over 40 received
their basic education at a time when the concept of the computer
was not included in current thinking. Mr. Dobbs indicated
that in the United States of America emphasis is being placed   Q.251
on the education of management in A.D.P. systems, and that his
company advises that there be a direct line from the man-in-
charge of the system to some top official.

118.   Mr. O'Neil informed the Committee that there is not   Q.343
yet in Australia, to the extent that there is in the United
States, an appreciation of the fact that management must attend,
on an average, three or four weeks each year on some course of
management training. He suggested that, until this is
appreciated, a management problem will persist in Australia
with A.D.P. He said that there are several managements in   Q.170-
Australia who appreciate the advantages offered by A.D.P., but   171
generally it is not fully appreciated. He added, however,
that this problem is not unique to Australia and in his
opinion management organisations are trying seriously to
educate management in data processing techniques.

119.   He said that Managers should have a wider knowledge of the appl-

ication of computers. He suggested that such knowledge of
A.D.P. will be obtained eventually by the same means as a
more scientific knowledge of management is being obtained,
i.e. through schools and courses run by management consultants
and through the activities of management associations. He
added that younger people moving into the ranks of management
will have a knowledge of A.D.P. However, while there is very
little formal training available in A.D.P. in Australia there
is virtually none at the management level. He also said that   Q.137

(1) Getting the Most Out of Your Computer ; McKinsey and
Company Incorporated, Melbourne.

while the supplier of A.D.P. equipment recognises the need for
education of management, he should not be responsible for
training management because both his recognition of this need
and his approach are based on a desire to sell equipment.

120.   Mr. O'Neil informed us that management is currently   Q.178
becoming a science, but that it requires a great deal more
development in order to reach that status.   The implication
of this, he said, is that managers will undergo greater formal
training than in the past.   He expressed the view that, in a
commercial A.D.P. installation, the senior personnel should
have a standard of training equivalent to that of a graduate.
He expressed the opinion that their training must be thorough
in the sense that they have been taught and have worked out in
their minds the basic principles upon which A.D.P. operates.
He said that this is being undertaken in the universities,   Q.178
although most of the courses offered are designed to train
the type of graduate that the industry itself supplies and
which the computer supply industry requires. He also stated
that the training of accountants in future must include
training in A.D.P., but that it has not yet been commenced.
He added that a difficulty in this field is a shortage of
people to actually perform the training.

121.   With regard to the development of management   Q.1035
science Mr. Gleeson expressed the opinion that the advent of
new techniques and equipment provided a powerful tool for
management planning and control to be improved.   He added
that the improvement which management will be able to devise
in its use of improved techniques of planning and control will
be an evolutionary process.

122.   Mr. Dobbs expressed the opinion that, as an   Q.258
executive officer should never be expected to write a computer
programme or to design a system, a top level executive
orientation A.D.P. appreciation course of three weeks
duration could acquaint him with the basic facts which
could then be supplemented by reading.   In his experience,   Q.255
Australia is facing up to the problem of training its
executives.

123.   We were informed by Mr. Hall that it is difficult   Q.342
to induce management to attend A.D.P. courses. While Mr. Dobbs
agreed with this, he added that manufacturers would prefer not
to conduct management courses, and that generally they do so
only because they are not being provided for elsewhere.

124.   Professor Ovenstone said that, although manufacturers   Q.342
and the Commonwealth Service make extreme efforts to contact and
educate management, it is very difficult to induce people to
attend the courses; either because the courses are of too long a
duration or are too difficult.

125.   Management courses have been conducted by the   Exhibit
Commonwealth Public Service Board since 1960, and we were   /7
informed by Mr. Gleeson that a large number of very senior
officers, including permanent heads of departments, have
attended them.   He also said that the opinion expressed by   Q.1036
Mr. Hall, to the effect that IBM had experienced difficulty
some years ago in arranging for senior men to attend a three
day orientation course was still substantially true. Mr. Gleeson   Q.1055
also expressed the opinion that, while the application of A.D.P.
requires co-operation between management and the equipment
suppliers, and since basically management is responsible for
the control of its organisation, it is responsible for the
determination of its needs from the A.D.P. system. Mr. Pridmore   Q.1515
expressed the view that it is incumbent on anyone who is
associated with management to know as much as possible about
A.D.P.

(vi) Suggested Method of Resolving the Staff Problem Through Education

126.   During the inquiry we asked Professor Ovenstone to suggest
methods through education, for resolving the staff problem in the   Q.397
A.D.P. field. Subsequent to the Inquiry, he submitted a relevant   and
document the substance of which is set out in the remainder of   Committee
this Chapter.   File 1965/3
127.   The problem, as seen by Professor Ovenstone, is how
to train and educate the large number of people likely to be
either associated or intimately concerned with A.D.P. in one
way or another over the next decade.   Apart from the 'incidental
user', whose numbers are very large, but who also need
principally, education and orientation, rather than detailed
training and instruction, Professor Ovenstone estimated that
the classification and numbers of staff as shown in Table No. 6
may be required in Australia between 1969 and 1976.

TABLE No. 6
Estimated A.D.P. Staff Requirements in Australia:
1969-1976

Classification	Available (1966)	Required (1969)	Demand per Annum (from 1969)
Computing Scientists	30	200	20
Programmers, etc.	300	2,500	300
Engineers	20	200	30
Maintenance Technicians	100	1,500	200
Computer and Data Preparation Operators	500	6,000	1,000
Total	950	10,400.	1,550

128.   Professor Ovenstone indicated that those estimates
may be conservative.   He said that, in general, the incidenta...
user in A.D.P.,referred to above,does not seem to pose major
educational problems.   He said, in regard to this class, that
the onus still remains with the user to indicate deficiencies
in courses offered, and also to devote sufficient time and study
to his chosen course.   Given the attendance rate of senior   Q.342
administrative staff at evening courses conducted by the
University of Adelaide, and management courses available,
Professor Ovenstone considers that the main areas requiring
consideration are those concerned with the professional class
of personnel.

(a) Training of Professional Staff

129.   With regard to the five classifications within the
'professional' category, Professor Ovenstone said that there
may be wide variations within each as regards effectiveness in
a particular environment, in speciality and skills and in basic
educational requirements.

130.   We were informed that the relatively few experienced
and qualified staff in Australia have gained their experience
overseas, or have acquired their training as systems have been
introduced in their organisations; and also that equipment   Committee
suppliers are assisting in training staff, but that they cannot   File 1965/3
cope with anticipated demands in either quality or quantity of
staff requirements and, further, that these methods are most
unsatisfactory for large organisations such as Government
Agencies since they do not -

   . Ensure that the most effective or appropriate
      systems are developed and applied within the
      agency for its purposes;
   . Provide suitable professional standards and
      qualifications for general use throughout
      the Commonwealth, and
   . Produce high-calibre staff in sufficient numbers
      for system analysis, design and development in
      Australia.

131.   On the basis of these considerations, Professor
Ovenstone estimated that not more than 30 per cent of the
total demand for A.D.P. staff can be obtained from people
currently working in this field and in the present
circumstances, even if all Universities and technical
colleges were to commence special training of appropriate

standing in 1966, sufficient numbers of adequately trained staff
could not be expected to be available before 1968/69. Therefore,
in addition to provision of long term needs as estimated in Table
No.   above, special efforts would need to be made over at least   Q.378
the next three years to train to an appropriate tertiary level
partially-qualified staff at present engaged, or about to be
engaged, in A.D.P. and computing science, and provide sufficient
staff with an acceptable minimum of tertiary A.D.P. education and
experience until long term proposals for extensive formal
training becomes effective in output.

(b) Maintenance Technicians, Computer and Data Preparation Operators

132.   Professor Ovenstone stated that, while special
tertiary education is needed for computing scientists,
programmers and engineers, it is evident that existing courses
supplemented by suitable equipment could provide adequate
training for both maintenance technicians and data preparation
operators.   In the case of maintenance technicians, up to two
years of technical college training in electrical and electronic
engineering with a computer bias should be adequate as initial
training.   He stated that final training for particular equip-   Committee
ment would always be provided, in any case, by the manufacturer   File 1965/3
and that data preparation operators would normally be trained
by the equipment manufacturer or employer, although appropriate
part-time technical college training would be a most valuable
means whereby re-training and/or basic operator training could
be provided outside normal working hours.   Most of the
content of these courses would be concerned with extension to
basic typing courses and would not raise major problems except
that of finance for provision of data preparation equipment
and of adequate supervision and accommodation.

133.   Professor Ovenstone claimed that computer operators,
senior computer operators and shift supervisors for computer and
A.D.P. system operations are in quite a different situation as
regards training.   He said that it is not generally appreciated
how important skilled computer operators and supervisors are to
the efficient and effective operation of an A.D.P. system.
These operators can frequently ensure that the time required to
process a given amount of data is held to a reasonable level in
spite of errors, faults and adverse circumstances occurring in
the working day.   By appropriate re-batching or re-scheduling

of data and computer operations each day, a good operator can save many hours of system operating time which, under normal procedures, would otherwise be required. He said that, since a computer can cost over ̤500 an hour to operate, it is apparent that skilled operators can have marked effects on the running costs of A.D.P. systems. The training of these operators was said to be an area that has been generally neglected and is one in which the technical colleges can play a vital part in the immediate future with rapid returns in terms of time and costs. He expressed the opinion that the main problem is that of providing colleges with adequate equipment, peripheral devices and instructors, for training purposes, both on a full time and a part time basis.

134. Professor Ovenstone stated that the following levels of computer operator training can be readily distinguished:

- Peripheral equipment - Provision of skill and competence on operating equipment such as card readers, card punchers, paper tape readers and punchers, high-speed printers, magnetic tape units etc.

- Consoles of small to medium systems - Training in the efficient operation of these installations with several peripheral devices.

- Large time-sharing computers - Training in the efficient console operation of these installations with many peripheral and remote devices.

- Complete medium to large installations with several peripheral units and multi-shift operation - Training in the supervision, and operation of this type of installation.

Committee File 1965/3

135. Of the levels of training listed above we were informed that the first requires mainly manual skills with practical experience and comparatively little formal training. We were also informed that, given a range of peripheral devices and adequate initial qualifications and aptitudes, part-time training of about 4 hours a week over a period of three months should produce a skilled and proficient base-grade computer operator. The other three levels of computer operations, however, were said to require both suitable equipment and additional intensive training in machine-

language programming, monitor programme systems, the logic of
computer systems and in the various aspects of programme
development.   Professor Ovenstone said that part-time courses
requiring about 5 to 6 hours of study and practical work per
week for at least a year would be needed to train these people
adequately and that in the process they would require access to
reasonably sophisticated computers and programme systems.

136.   Professor Ovenstone advocated that the following
certificate courses should be offered in technical colleges to
teach the basic skills required of data processing and
computer operators.

  . Data Processing operator: Skill and accuracy in
    transcribing accounting machines and punched paper
    tape equipment, instruction in elementary care and
    maintenance of this equipment, and use of basic   Committee
    data preparation equipment and stationery handling   File 1965/3
    equipment.

  . Computer Peripheral Equipment operator: Skill and
    accuracy in operating computer peripheral equipment
    such as high-speed printers, magnetic tape units,
    plotting units, card punchers etc., small computer
    console operation; wiring and operation of major
    punched card equipment such as collators, reproducers
    and accounting machines.

  . Computer operators: Training and skill in console
    operation of large computers, knowledge of machine
    language programming and compiler basis; operating
    knowledge of monitor systems, and theory and
    practice of computer system operation.

137.   The first of these certificates would be concerned
mainly with improving typing skills and accuracy and with
extending the knowledge of the operator.   For a trained
touch-typist, the course could probably be completed in about
3 months assuming ten hours a week of theory and practice.
The second course would probably require about 3 months'
full-time training while the third would involve about one
year of study and practical work.

138.   Professor Ovenstone suggested that the computer
operator courses should be a series of certificate courses to
be given by Technical Colleges leading to a Higher Certificate
or Diploma for Senior Computer Operators and Supervisors.   The
basic qualification for these courses would be the equivalent
of Intermediate, but preferably matriculation standard, with
appropriate experience and aptitude.

(c) Programmers

139.   The Committee was informed by Professor Ovenstone
that of all the professional staff concerned with A.D.P., the
programmer presents the greatest problem because, depending on
the system and its applications within the environment, his
responsibilities can range from merely transcribing some well-
defined specification of an A.D.P. procedure into an appropriate
programming language to the analysis, research, design,
development and introduction of a complete system of the most
complex kind.   He informed us that the Commonwealth Service
in its non-scientific areas makes no distinction between the
basic programmer and the system analyst who analyses designs
and develops the system.   The view of the service, with
which Professor Ovenstone concurs, is that, at the base level,
a programmer spends at least 90 per cent of his time coding
for a computer and 10 per cent of his time doing system
analysis work, and that, at the higher levels of programmer
grades, the proportions become reversed and are changed until,
in the more senior grades, virtually no programming is done,
although the officer concerned should be well experienced in
the programming languages and programmes used in the system.

Committee
File 1965/3

140.   Professor Ovenstone informed us that the Common-
wealth Service definition is not shared by many equipment
suppliers and commercial firms who, in an endeavour to overcome
shortages of staff with appropriate qualifications and
experience, have restricted the term "programmer" to the
preparation and proving of computer programmes from flow
diagrams and specifications prepared by others designated
'systems analysts', 'scientific representatives', 'data
processing representatives' etc.   He expressed the opinion
that this segregation is often artificial and only a matter
of degree, and is further confused by the need for so-called
'systems programmers' who are required to design, develop,
maintain and improve the many compilers, programme systems,
programming languages and similar software used in A.D.P.
systems.   He also said that this somewhat artificial
difference exists in practice and that any educational
system proposed must attempt to take account of both views.

141.   A University degree, or its equivalent, with
specialised mathematical or other relevant experience was
said to be an essential qualification for programmer positions
in 'scientific' applications and in many other medium to large
systems.   However, Professor Ovenstone stated that for the

majority of commercial applications, qualifications of this
level are not necessary, although certainly some extended form
of tertiary education is. He again emphasised the fact that
there are many partially trained programmers currently employed
in Australian A.D.P. systems and that their needs must also be
taken into account when an A.D.P. educational system is being
established. He added that, during the next five to ten years,
when major expansions in A.D.P. applications are likely to
occur in Australia, people who have the following educational
training are likely to become available for training in this
field:

- A University degree with a mathematics major and
  perhaps some computer experience;
- A University degree, or its equivalent, with no
  computer experience;
- Little or no tertiary education and some relevant
  experience and/or qualifications; and
- Little or no relevant tertiary education but
  special experience and background essential to
  the development of a particular system.   Committee File
                                             1965/3

142.   Professor Ovenstone said that this variation in
experience creates problems in the provision of staff with an
acceptable minimum of training and experience, especially since
the largest numbers of people available will be those without
tertiary qualifications.

(d) Outline of Proposed Solutions for Provision of Estimated Programmer Requirements

143.   Professor Ovenstone suggested that courses for
programmers may be summarised as those providing for either,

- Pass degree University graduates undertaking
  post-graduate diploma courses for one-year
  full-time or two years part-time at a University
  or other recognised place of research; or
- Technical College students undertaking one of
  four Higher Certificate Courses, any three of
  which can lead to a Diploma or Technological
  Degree, over a period of three years study
  full-time, but any one of which could be taken
  subject to appropriate pre-requisites for the
  various courses.

144.   He expressed the opinion that in the critical
period ahead when both training facilities and lecturers
will be in extremely short supply, it is undesirable to
begin training people who have neither the aptitude nor
capabilities for programming. He suggested, therefore, that
all potential programmer trainees be tested for aptitude
prior to being accepted for programming courses for at
least the next five years.

(e) Training for University Graduates

145.   We were informed by Professor Ovenstone that,
of the categories of people available for programmer
training in the immediate future, that of graduates
provides the least problem.

146.   Professor Ovenstone said that post-graduate
courses derived from a general course can be readily
instituted at the main universities equipped with computing
facilities. He said that adequate experienced lecturing for   Committee
such courses is already available, or can be obtained in   File 1965/3
about the next twelve months, to meet the expected training
requirements for the next two or three years, and that
some of the graduates of these courses would be available to
build up the numbers of lecturing staff needed for future
training. He felt that, depending on the background experience
of the graduates, these post-graduate courses would last from
one to two years, and should be completed by a written
examination and thesis, and that a Diploma of Computing Science
should be awarded on the successful completion of such a course.

(f) Training for Computing Scientists and Engineers

147.   Professor Ovenstone considered that, for
computing scientists, the basic level of training required
is a University degree, usually a higher degree or appropriate
research experience with a good foundation in mathematics,
statistics, numerical analysis, computer programming,
programming theory, theory of systems, operations
analysis, automatic control, theory of automata, information
theory and similar topics. He indicated that the
disciplines covered in this work encompass a
wide range not dealt with adequately by other

disciplines and had led to the establishment of special academic departments in computing science in at least three Australian Universities with suitable A.D.P. and computing facilities. He also stated that post-graduate education to cover the research needed for the increasingly complex automatic system planned for introduction over the next few years has commenced at the main Universities equipped with computing facilities.

148. Professor Ovenstone informed us that suitably trained engineering staff are also required to design and develop instruments, data processing equipment, new components, and new complexes of instrumentation for the advanced systems being planned for industrial scientific and Government applications. We were informed that these involve training engineers to degree standard with relatively minor modifications to existing curricula in final years, and that this is already being undertaken in most Universities. He expressed the opinion that the type of training needed for computing scientists and engineers can be clearly specified, and that, while there is still a seriou. shortage of such people, the provision of adequate finance and computing facilities to Universities could ensure that this educational problem would be solved by suitable post-graduate courses to attempt to meet short-term needs, and by appropriate undergraduate courses to meet most of the long-term needs. He suggested that, subject to suitable pre-requisites, courses designed for A.D.P. engineers and for the degree in Computing Science, might be attended by advanced undergraduates and graduates in other Departments who wish to specialise in aspects of A.D.P. and Computing Science.

<div style="text-align: right">Committee
File 1965/3</div>

(g) Proposals for an Institute of Computing Science

149. Professor Ovenstone expressed the opinion that, as a natural consequence of a large number of people being engaged in A.D.P. and Computing Science, an independent professional society, similar to that of the Institute of Engineers, would eventually be set up to disseminate technical information between members, define and maintain professional standards, prescribe a code of ethics, and inform the community of the potential and applications of A.D.P. and Computing Science. He indicated that with problems arising in the provision of adequate training standards and in the resolution of possible conflicts between different training schemes, the need for such an institute is urgent and that, because of its

essentially independent character, the institute should
comprise representatives from the main organisations involved
in A.D.P., including Universities, technical colleges,
Commonwealth and State Governments, branches of commerce and
industry, computer manufacturers and suppliers, and
consultants.

150.   He suggested that such an institute should
prescribe grades of membership determined by qualifications
to maintain its professional standards and that an important
feature of these qualifications and grades would be that
they could also form a set of professional standards that
could be used by employers of A.D.P. staff. He said that
this procedure would overcome many current classification
problems and ensure recognition of the institute.

151.   Professor Ovenstone expressed the opinion that,
as a result of the establishment of professional standards,
many of the problems met in providing effective and experienced
staff could be quickly overcome and that, as a consequence,
the formation of such an Institute or Society of Computing
Sciences should be sponsored both by individuals experienced
in the computing sciences and by organisations involved in
A.D.P. He expressed the opinion that, given suitable
support and sponsorship, the newly formed Australian Computing
Society could effectively perform the functions of this
proposed Institute.

Committee
File 1965/3

(b) The Role of Universities, Technical Colleges and Technological
Institutes

152.   As a background to this attempt at assessing the
role of the various tertiary educational institutions in
solving the training problems associated with A.D.P. in
Australia and without commenting on the forms of education
involved, Professor Ovenstone submitted the following
relevant statistics for 1963/64. In that year, teaching
and research staff numbered some 1,500, students about
70,000, and graduates, with a minimum entrance qualification
of matriculation, about 6,000. In the same period, it has
been estimated that there were over 15,000 teaching staff
in technical colleges and technological institutes and some
270,000 students, whose minimal entrance qualifications were
intentionally, and rightly, in the opinion of Professor
Ovenstone, directed at providing opportunities for tertiary
and adult education to a much wider range of people.

153.   In terms of the subject matter involved, it has already been stated that A.D.P. operators, computer operators, and maintenance technicians are basically skilled trades and sub-professional occupations while those of computing scientists and A.D.P. Engineers are, as their designations imply, research and professional occupations.   Professor Ovenstone stated that because of this, these two groups naturally prescribe the roles that the various tertiary educational institutions should undertake (viz.) the technical colleges and technological institutions should have the responsibility for A.D.P. and computer operations and for maintenance technicians, while the Universities should have the responsibility for the computing Scientists and the A.D.P. Engineers.

154.   He indicated, however, that the many and various types and grades of programmers do not permit this simple classification to be made, the main reasons for this being the differing requirements of industry, computer suppliers, and research in computing science.   For these reasons, Professor Ovenstone suggested his proposed methods for training programmers.   He stated that, for the large majority of routine applications, an intensive course in programming at a technical college or technological institute, with similar courses in system analyses and design, would be sufficient and adequate, while suitable post-graduate courses at Universities could provide a short-term solution to the more scientific needs pending degree courses producing sufficient numbers of professional people.

155.   Professor Ovenstone summarised the three functions at the Universities in both the short term and the long-term as follows:

   (i) Tertiary education for all forms of computing science, and A.D.P. system research, design and development;

   (ii) Computing and A.D.P. facilities for University teaching and research generally; and

   (iii) Informative training and orientation for students of other disciplines that may be affected by A.D.P. so that the places of these techniques may be later understood and used effectively.

156.   Professor Ovenstone stated that, in the long term, the special needs of the first group referred to above demand a particular course of study, particularly in its later phases, and should lead to at least a Bachelor's degree in Computing Science over a period of three years. He informed us that a shorter period would not provide sufficient time to cover the necessary fields and would not give the required experience to either computing scientists or engineers. He advocated that honours and other higher degrees should also be provided as outlined above. For the short term he suggested that post-graduate courses in Computing Science are an immediate need.

157.   With regard to the provision and the mode of operation of A.D.P. equipment and facilities within a university Department, Professor Ovenstone said that the quality of teaching and the standard of graduates to be produced must be the first concern when acquiring and using equipment.   He said that so far there has been an unfortunate desire to make University Computer Laboratories pay their own way, and that this has forced them to undertake extraneous tasks and frequently provide 'closed shop' programming services to gain adequate revenue. He added that the need to earn revenue has been a major factor tending to inhibit the breadth of teaching and has placed undue emphasis upon the highest attainable efficiency in the use of equipment. He expressed the view that, to obtain the best result from teaching, equipment used by a Department of Computing Science should be operated principally on an 'open shop'   basis and should not be required to gather revenue as a primary objective. He said that this would allow adequate machine time for teaching practical computing and data processing.

Committee
File 1965/3

158.   We were informed by Professor Ovenstone that Technical Colleges should be required to provide training for people who do not have suitable academic qualifications for University training, but whose training and experience should tend towards that provided by the Universities. He informed us that some Technical Colleges have already appreciated the need for provision of courses in A.D.P. and associated subjects, and are giving courses in system analyses, commercial data processing, numerical analyses, analogue and digital computer logic and circuitry, often without

Q.378

direct access to computing equipment, using demonstrations on equipments owned by consultants and service bureaux. He stated that by introducing new courses and expanding current courses, and by providing the main technical colleges with A.D.P. equipment and adequately trained staff in Departments similar to those proposed for the Universities, Technical Colleges would be able to train programmers, maintenance technicians and operator staff ab initio, and to complete the A.D.P. training of the partially-trained programmers currently available.

(i) The Role of Secondary Teachers' Colleges

159. Professor Ovenstone indicated that the effects of A.D.P. throughout society must eventually affect some aspects of teaching at secondary levels. He said that, at least in the later secondary years, some orientation toward the uses of A.D.P. must be provided. This, he claimed, must necessarily involve teachers and therefore the activities of Teachers' Colleges. He emphasised the need in the near future for the provision of suitable courses for secondary teacher students, as well as for practising secondary Teachers and suggested that courses for the student Teacher could be provided through the University Computing Science Departments while those for practising secondary Teachers could be coped with by means of summer schools arranged in the Universities.

*Committee
File 1965/3*

(j) The Role of Recognised A.D.P. Research Centres

160. We were informed by Professor Ovenstone that, as it is extremely unlikely that adequate teaching facilities can be set up in either universities or technical colleges in the immediate future without affecting current A.D.P. development, special action will be needed to provide some training facilities of adequate standard in the areas where major applications are already planned. In this regard he said that some establishments in organisations such as the Commonwealth Service have already commenced training and research in A.D.P. and that, of these, those of adequate standard should be affiliated with an appropriate technical college as a 'recognised place' of A.D.P. training and research until suitable teaching facilities can be provided.

161. He also said that, even after the proposed Departments of computing science have been set up in universities and technical colleges, it would be extremely desirable to retain such an affiliation, particularly at the post-graduate level, as this could ensure access to A.D.P. facilities other than those which may be available at the tertiary educational establishment and would provide an admixture of pure and applied research and development desirable in any discipline.

(k) The Role of the Proposed Institute of Computing Science

162.   Professor Ovenstone informed us that the proposed institute of Computing Science would be most important in assisting all places of A.D.P. tertiary education to meet demands for trained staff and that once such an institute was recognised it could provide advice on and standards for all A.D.P. and computing science matters. He said that, in particular, it could determine professional standards for organisations and levels of effective training, co-ordinate training courses, specify acceptable curricula for courses and disseminate information relating to advances made in research techniques and development. He added that the formation of an independent institute was of major importance and that, in view of the urgency of providing effective A.D.P. training, it should be sponsored by all practical means.

(1) Estimated Expenditure Required for A.D.P. Facilities for Use in Education

163.   Professor Ovenstone said that estimates made for expenditure required to provide the facilities for the proposals mentioned above are complicated by many factors, some of which are:-

Committee
File 1965/3

- Whether equipment is to be purchases or hired;
- The variation in 'educational' discounts and restrictions placed on the user by the manufacturer;
- The variation in facilities already available or on order;
- The need to provide complete sets of peripheral equipment;
- The availability of suitable accommodation for equipment and the degree of modification and air conditioning equipment required; and
- The need to provide permanent staff.

164.   On the basis of existing equipment, and the assumption that new equipment will be purchased rather than hired, Professor Ovenstone estimated that some $8 million would be needed for A.D.P. equipment for use in education over the next five years. He estimated that, over the same period, the capital cost of constructing or modifying buildings for proposed computing science Departments including special power units would be within the range

$1 million to $2 million whilst running costs, including
salaries for existing and proposed facilities would amount to
about $3 million. Over a five year period, therefore, the   Q.379
estimated total costs would be some $10 to $12 million, of which
about $6 million would be required within the next three years.

165.   Professor Ovenstone said that the magnitude of the
demand for trained A.D.P. staff over the next few years is the
most significant factor in the problem of providing adequate
tertiary education and it may appear that the estimates made
are somewhat inflated.   In this regard, however, he said that
the requirements had been assessed conservatively from the best
available information and also that they may prove to have
been underestimated and emphasised that A.D.P. development
and application have been constantly underestimated in all   Committee
countries.   File 1965/3

166.   He claimed that the provision of adequate numbers
of trained staff for A.D.P. system developments in the next few
years demands urgent action by all schools of tertiary
education and that, in particular, a training scheme to meet
the needs of the near future is required immediately.   He
also expressed the view that this type of training should
supplement a more formal training scheme at universities and
technical colleges which cannot produce sufficient numbers of
trained A.D.P. staff before 1968/69.   He said that this
short-term scheme would also ensure that the necessary numbers
of experienced lecturers could be provided for the more formal
tertiary education involved in the long-term training schemes. He stated
that the courses which he had outlined as a means of solving this urgent
problem are both practical and necessary and that they should be
implemented as soon as possible.

CHAPTER 4 – CRITERIA BY WHICH COMPUTER INSTALLATIONS MAY BE JUSTIFIED AND THEIR EFFICIENT USAGE MEASURED

167.   It has been claimed[i] that Automatic Data
Processing may be used in any situation where information is
collected and processed for further use or for decisions to be
made to implement actions. The characteristics of A.D.P. in
commercial use are speed, precision, accuracy, information
storage capacity, ability to make decisions when data is
programmed, and almost unlimited ability to perform routine
administrative and clerical tasks.[ii]

168.   It has also been claimed[iii] that installation
of a computer is justified where there is a direct economic
advantage, or more precisely, when the investment in both
investigation and equipment is more than offset by the monetary
or qualitative values that management places on the beneficial
results of the new system. The capital and operating costs of
an A.D.P. system and its impact on personnel are such that a
substantial outlay is said to be justified on preliminary studies,[iii]
generally referred to as exploratory and feasibility studies.

169.   An exploratory study is undertaken to ascertain,
at relatively little cost, whether the benefits likely to be
derived from the introduction of A.D.P. are sufficiently
evident to warrant the launching of a costly feasibility
study, and whether the cost and inconvenience of introducing
an A.D.P. system is justified. It should also be used to
define the areas within which the system is to be applied.[iv]

170.   A feasibility study is undertaken, among other
things, to investigate the existing systems, procedures and
reports, to determine records and information required for
efficient operation, and to design A.D.P. procedures for the
maintenance of records and for the production of information
required.[iv] The selection of competent personnel to undertake
a feasibility study is believed to be vital to its success.

(i) Pilz, W.K. Automatic Data Processing in General Administration:
    The Lessons of Overseas Experience in *Public Administration*
    March, 1963. P.60.
(ii) Jacobs S.B.; Allen P. and Thatcher M. : E.D.P. in Government
    Departments and Instrumentalities – *The Task of the Auditor*
    in *The A.S.A. Bulletin*, December, 1964, P.8.
(iii) Pilz W.K. op.cit. P.56
(iv) *The A.S.A. Bulletin*, op.cit. P.9

The feasibility study should be undertaken by a small group
of people who possess knowledge of the management needs
of the organisation concerned, an understanding of the
capabilities and limitations of computers and other equipment,
and with experience in management system analysis and
design.[i]   An auditor should be associated with the
feasibility study and should commence this association not
later than the stage at which the design of A.D.P. procedures
is being considered. The role of the auditor normally is
to advise on audit procedures and controls, for example,
statutory requirements. The auditor, becoming familiar with
the proposed procedures, should then be able to undertake
his responsibilities in the audit of records processed
by A.D.P.[ii]

171.   With regard to the importance of feasibility
studies, it has been stated that the first and most
important step in the introduction of A.D.P. is the
feasibility study, and that the capital investment and
operating expenses, together with its impact on personnel,
are so great that the cost of the study is justified. It
has also been suggested that the best potential uses for a
computer are not likely to be programmes already highly
mechanised. For example, it would be very difficult to
recover the cost of a computer installation and pay for its
maintenance from the marginal savings, if any, that could be
made from efficiently established mechanical processing methods.
The economic justification of A.D.P. is more likely to be found
through new and broader approaches to data processing involving
more highly integrated operations and the more efficient
production of more accurate information for decision making.[iii]

172.   The McKinsey Survey[iv] supplied by Mr. Dobbs,   Q.1047, 1048
and supported by Mr. Gleeson, indicates that this is the   and Committee
most searching examination of computer usage which has yet   File 1965/3
been undertaken and that the conclusions based

(i)   Pilz, W.K., op. cit. P.57
(ii) A.S.A. Bulletin, op. cit., P.10
(iii) U.S. - Congress - House of Representatives - Committee on
      Post Office and Civil Service - Subcommittee on Census
      and Government Statistics. Report on the use of electronic
      data processing equipment in the Federal Government.
      Washington, Govt. Print. Office, 1960. P.5-6
(iv) Getting the Most Out of Your Computer. op cit.

on the survey are of particular significance since the companies
included therein had all had extensive experience in computer
usage. It was claimed that the conclusions of the survey
provide a measure of the wide range of benefits, including
tangible returns that have been achieved by computer usage,
and also that factors determining results of installations have
been isolated.

173. The survey, conclusions of which were published recently,
examined twenty-seven companies, nine of which emerged as being of
"above average" efficiency and eighteen of "average" efficiency.

174. Regarding the breadth of application of A.D.P.
it was found, almost without exception, that the above-average
companies had made extensive use of computer installations.
Applications undertaken by these companies included their
major functions and not only in the field of accounting and
routine processes. The systems of the "average" companies
were found to be confined mainly to routine record keeping
activities. While the application to A.D.P.
processes of routine office functions had reduced company
costs significantly; the full potential of the computer is
affected only when its applications cover major and key problems
of the organisation concerned.

Committee
File 1965/3

175. As a measure of tangible results following
computer installations, the survey found that of current
expenditure on A.D.P., 35 per cent was for systems support
and programming, and 65 per cent for equipment and salaries
of computer personnel, while for each $US 1 of current
expenditure the above average companies annual return
is $US 1.30, of which some 69.2 per cent was attributable to
reduced administrative costs and about 30.8 per cent to more
recent gains in operating efficiency. The
above average companies had already recovered installation
costs and were contributing to profits an amount in excess
of the cost of developing new applications. The determination
of expenditure and returns from "average" companies was found
to be difficult as few independent analyses of the
costs of computer-systems and resultant savings had
been undertaken. Some of the companies in this group

were unaware of the value of their current expenditure on
A.D.P. and none had recovered installation costs or were
operating their computers at a profit. Moreover, most of
them did not know at what stage installation costs would
be recouped.

176.   The intangible benefits arising from computer
installations had not been realised to a significant degree
by "average" companies. However, such benefits had been
achieved by the "above aberage" companies in that by
taking advantage of the low incremental cost of additional
processing of data already being processed by the computer,
information which had previously not been economic to
obtain was now available. Intangible benefits, therefore,
had generally accompanied reduced administrative and
operating costs of installations in "above average" companies.

177.   The survey isolated criteria or "bench marks"
by which an appraisal of A.D.P. results could be made. The
first of these is the cost of A.D.P. in relation to cost of
installation and operation. It was found that installations
which had not recovered their installation costs within
four years were not operating economically. It was
estimated that companies with less than four years A.D.P.
experience should be able to determine the stage at which
their installation and operational costs would be recovered.

Committee
File 1965/

178.   It was suggested that where it is no longer
possible to determine savings made by A.D.P. installations,
the amount being spent on them should be calculated.
It was suggested that if expenditure is found to be at
a low level, the applications may not have been broad
enough while an increase in expenditure, where costs are
not being recovered, should be based, as in the "above
average" companies, on significant accomplishments in
applications and efficiency.

179.   The presence of intangible benefits was
also considered to be a criteria for evaluating results.
While these benefits may be difficult to measure it
was considered that their existence can be determined.

It was pointed out,however, that a careful assessment should
be made to determine whether an increase in information obtained
as a result of the use of an A.D.P. system was not being
mistaken for better quality information.

180.   The third criteria ' suggested was the size
of the area to which A.D.P. is being applied. It was found that
major gains were not being made if applications were
restricted to one or two functions of organisations,
or if they were confined to   routine record keeping functions.

181.   In addition to isolating differences in
results, the survey sought to identify the underlying causes
for average or above average results from comput-r installations.
As noted in Chapter 3 above of this Report, it was found that
the major determinant of effective utilization of computer
installations is not technical, but managerial and organisational.
Less than satisfactory results in the companies surveyed
could not, in any instance, be traced to equipment failure.
It was found that all companies had mastered most of the   Committee
technical demands of their computer systems and, analyses   File 1965/3
of other factors such as size of company and type of industry
indicated that these factors may influence but were not
determinants of the level of accomplishment. A comparison
of the patterns of management and organisation as between
the "above average" and "average" companies revealed significant
differences between the two groups of companies. Because these
differences were so pervasive, and because of their obvious
relation to the results obtained by companies, it was concluded
from the survey that patterns of management and organisation
were the main determinants of A.D.P. success in the group of
companies studied.

182.   Differences in management and organisation of
the A.D.P. installations as between the two groups of companies
appeared to originate from the concept of the computer held
by management.   In the "average" companies
managements viewed their installations either as technologically
advanced accounting machines to be used for the speedy
performance of traditional functions,(and hopefully, at
lower cost), or as mysterious devices to be mastered by
technicians and technically trained subordinates to whom

all responsibility for their successful operation had been delegated. Management in the "above average" companies viewed their installations in a different manner. The computer was regarded as being a major economic resource within organisations and was subject to the same management processes as other resources.

183.　　　　The conceptual difference of A.D.P. usage as between the two groups of companies was evident in all important aspects of the installation and organisation of an installation. It was demonstrated in the quality of leadership provided by managements, it was reflected in their planning and control of A.D.P. operations, it was demonstrated in the role played by managements in their installations and was also reflected in the quality of the staff of installations.

184.　　　　From the data provided by the survey, it was concluded that the success of an A.D.P. installation is more heavily dependent on executive leadership than on any other factor.　　　No company achieved above-average results without the active participation of top management and that there executive management had effectively abdicated its responsibilities, the results were seldom outstanding.

185.　　　　The difference in executive leadership in relation to A.D.P. was found to be manifest in many ways. In the "above average" companies it was found that the most senior computer executives, that is, executives whose functions include responsibilities other than for the A.D.P. systems, are likely to be one level below their chief executive officers, while in the "average" senior computer executives were more likely to be two, three or even more levels below their Chief Executives, and also that senior executives devote far less time to the management of their A.D.P. systems than do their counterparts in the "above average" group of companies. The survey conclusions noted the difference in the 'atmosphere' surrounding A.D.P. management as between the two groups.　　　In the "average" companies the interest of management in their A.D.P. systems was likely to be superficial and sporadic with the result that some A.D.P. managers felt that

their efforts had been hindered rather than assisted by the
interest shown by their executives management. In the
"above average" companies, by contrast, executive management
had clearly defined objectives for their installations, centred
on the major problems of their organisations. It was also
found in the "above average" group of companies that executive
management had ensured the availability of adequate resources
to complete the A.D.P. project and that human and organisational
obstacles to efficient A.D.P. operation had been overcome. As
well, within the latter group,   the executive
management had challenged the plans of their A.D.P. groups,
and had insisted on significant tangible benefits from its
investment in A.D.P. equipment.

186.   With regard to management controls,
executive management in the "above average" group of
companies had ensured that each A.D.P. application had been
approved only after a careful feasibility study had been
undertaken, which had realistically measured estimated financial
costs and risks of the proposals against expected expenditure
on the proposed installation. It was also found that, in the
most successful installations, prior to the A.D.P. installation,
detailed plans of the project had been drawn up including
estimated staff requirements and the formation of interim goals
over the period of the project. During the course of the
project, progress reports were made which compared interim
costs and achievements against those planned. Managers of
successful installations also requested and reviewed economic
analyses of completed projects to ensure the achievement of
anticipated results.

Committee
File 1965/3

187.   In the most successful of the companies
examined   executive management   had accepted   a   large
share of responsibility for the efficient utilisation of its
A.D.P. installation in contrast to the position in the less
successful installations where   important
decisions relating to computer systems decisions were taken
by the technical staff.

188.   The attitude of executive management was found
to be reflected in the calibre of the computer systems
management and staff. It was stated that, in the most
successful companies, systems managers' backgrounds included
extensive systems experience supplemented in some cases by
operating experience. Systems personnel in the typical
"above average" companies were more experienced and trained
than their counterparts in the "average" companies since the
background experience of those managing the computer systems
on the latter group of companies had been confined almost
entirely to accounting procedures.

189.   It was also revealed that technical staff had
been allowed to influence decision making in the choice of
A.D.P. equipment in the most successful companies, but this
was not true of the less successful users. This, together with
less effective leadership from management, was said to suggest
that the "average" group of companies had less overall control   Committee
of the A.D.P. installation and its operation than was   File 1965/3
the case in the "above average" companies.

190.   The survey concluded that, unless management
was willing to provide the necessary leadership, in the
organisation, management and staffing of its installation
the A.D.P. systems would continue to operate at a loss and
prove to be frustrating to personnel. However, where
management is effective, A.D.P. applications should cover
broad scale aspects of an organisation's activities as well
as providing significant intangible benefits and a substantial
reduction in operating costs.

191.   As indicated Mr. Gleeson also provided the Committee   Q.1047-
with a summary of the findings of the McKinsey report and, in   1048
particular, referred to the background experience of the
computer systems manager. He indicated that extensive systems
experience has been a determining factor in the success
achieved by Commonwealth installations.

192.   With regard to evaluation of the financial cost   Q.1051-
of operating an individual computer installation, Mr. Gleeson   1052
indicated that criteria are available and suggested the following:
Hardware efficiency, time involved in unscheduled stoppages of
equipment, objectives and time schedules of an application as compared with

actual achievement, and necessity of corrective procedures to
a planned application.

193.   Mr. Veel indicated that it is extremely difficult to   Q.653
measure the profitability of a computer installation and that
normally a great financial saving would not be expected.
He said that in a vourable situation, a break even' point
with existing costs may be achieved in about eighteen
months from the date of installation assuming that the
costs of .. .P. methods do not exceed those of the previous
manual methods.   He said that after a 'break even' point
has been reached, costs of computation should decline if the
volume of processing increases.   He suggested that an estimate
of A.D.P. costs may be made, for example, some four years
after a computer has been installed, by comparing current
costs with the cost of previous manual methods of data
processing.

194.   During the inquiry we sought from witnesses, clarification
of the operative capacity of equipment and endeavoured to
obtain a standard of normal usage against which the used
capacity of departmental installations could be assessed.

195.   In this regard, Professor Ovenstone informed us that   Qs. 297
capacity could depend on the nature and extent of the   303 & 301
peripheral equipment involved.   He said that a computer has
a wide range of capabilities in any one direction including
printing capacity, tape capacity, and calculating capacity
and these need not be used simultaneously.   He added that
installed capacity would be determined by requirements, as
assessed during the feasibility study which is conducted prior
to its installation.   He expressed the view, however, that
unless a completely detailed investigation of the
requirements of an organisation has been done prior to
installation equipment should not be used in excess of 30 to
40 per cent of installed capacity.

196.   Mr. Lance informed us that a machine is being operated   Q.425
at capacity if it is in use for 22 hours per day, since two
hours per day are required for unavoidable routine maintenance
procedures.   He claimed, however, that if saturation of
equipment is to be avoided, it should not be used in excess
of 12 hours per day as this allows a desired degree of
flexibility to accomodate additional work on the computer.   Q.436
He indicated that saturation is a it the   Q.437
                                                                   Q.441
factor in the introduction of new equipment and that while

additional equipment may be added to the original computer
to enable it to process more complex problems and additional
work, the value of this procedure would be limited by the
capacity of the central processor portion of the computer.

197. Mr. Gleeson indicated that the two extremes of
usage of A.D.P. equipment would occur immediately after   Q.996
installation, and again when saturation point has been reached.
He said that usage of the equipment will increase while
applications are being implemented and with the development of
new applications until saturation point is approached.
He indicated that at the stage of saturation, equipment would
be in use for three shifts daily, seven days a week, allowing
no flexibility to accomodate peak loads of work or
additional applications.   With regard to capacity being   Q.1088
used in Commonwealth installations, he stated that the
Bureau of Census and Statistics installations are in some   Q.996
instances being used on a three shift basis while those
installed by C.S.I.R.O. are being used on a two shift
basis.   He expressed the view that two shift operations   Q.1013
on the basis of a five day week would be normal usage for   Q.1014
A.D.P. equipment.   Q.1088

CHAPTER 5 - A.D.P. IN THE COMMONWEALTH SERVICE

(i) Applications in General

198   Professor 'Queonstone informed us that while general
purpose digital computers were first developed in Australia   Exhibit no.
about 1951, at the C.S.I.R.O., for scientific applications,   85/4
one of the most ambitious and successful A.D.F. systems
first developed in this country was at the Weapons Research
Establishment, Salisbury, during the period 1953-1956 for
scientific and technical purposes.   He expressed the opinion   Q 287
that at one stage this system was superior to anything in the
Western world and that it provided much of the expertise and
basic data necessary for large A.D.P. development by
Australians.   Apart from these installations we were informed Exhibit no.
by Mr. Gleeson that positive action for A.D.P. development   85/9
on a broad front in the Commonwealth Service commenced in
mid 1958.   He said that following consultations between the
Public Service Board and the Department of Defence,
arrangements were made in 1958 to study the field of use
for A.D.P. within the Defence group of Departments and also
that, at that time, certain other organisations such as the
Postmaster-General's Department, the Treasury and the Bureau
of Census and Statistics were watching developments overseas
and giving consideration to the installation of computers.

199.   It was stated in the Report of the Auditor-General
for the financial year 1963-1964 that planning for
commercial operation of A.D.P. in Commonwealth departments
is the responsibility of the individual departments concerned,
but overall co-ordination is achieved through an Inter-departmental
Committee on Automatic Data Processing, approval for the
establishment of which was given by the Prime Minister in
1960.   The Committee, which comprises representatives of the
Public Service Board (Chairman), Departments of the Treasury,
Defence and Postmaster-General, with representatives of other
departments to be co-opted as required, was established in
1960 and in the same year a Policy Committee comprising
representatives of the Prime Minister's Department (Chairman),
Treasury, Public Service Board and the Universities
Commission was established to co-ordinate plans for the
development of electronic computing facilities for scientific
and technical purposes as between Australian Universities and
Commonwealth Departments, Authorities and Instrumentalities.

200. We were told that arrangements were made for all
Departments to submit to the Public Service Board, for
consideration by the Interdepartmental Committee on A.D.P.,
their proposals for acquisition of A.D.P. equipment, except
for proposals concerned with the processing of secret
information within the Defence Group of departments.

Exhibit no.
85/9

201. Mr. Gleeson stated that because of the significance
of C.S.I.R.O.'s computer installations for use as Service
Bureaux by departments outside the Defence group for
computation work of a scientific and technical nature,
arrangements were also made for proposals for the establishment
of computing facilities by C.S.I.R.O. to be submitted to the
Public Service Board, for consideration by the Interdepart-
mental Committee on A.D.P.   He also said that the Atomic
Energy Commission has been brought into consultation
regarding the relationship between its research computing
facilities and those of the C.S.I.R.C.   He added that since
the establishment of th Interdepartmental Committee,
comprehensive A.D.P. studies have been undertaken by certain
departments and by the two authorities mentioned above.
At the time of our inquiry, proposals for the acquisition of
A.D.P. equipment have been submitted to the Board by the
following organisations:

Exhibit no.
85/9

> Army *
> Atomic Energy Commission *
> Civil Aviation
> C.S.I. .O. *
> Housing - .ar Service Homes Division
> Interior - Survey Branch *
>   Bureau of Meteorology
> Postmaster-General's *
> Repatriation
> Social Services
> Supply *
> Treasury - Bureau of Census and Statistics *
>   Commonwealth Actuary *

* Computing equipment installed.

.202.   Professor Ovenstone stated that the most significant
systems installed in the Commonwealth Service since 1958
were made by the Department of Defence, which is linked by
data lines to various defence establishments in Australia
and overseas; The Postmaster-General's Department, the
Bureau of Census and Statistics, C.S.I.R.O. and recently,
QANTAS.   We were told that the first three of these
organisations have sought to develop 'integrated' systems
which, by using centralised communications and data 'files'
or magnetic tape and large central computers, would deal with
most of their routine activities and also cope with 'ad hoc'
applications and other special data processing problems.
Subsidiary computers, or satellites, are being used in some of
these systems to perform preliminary editing and conversion of
data prior to its despatch to the central computer.   The
C.S.I.R.O. installation is providing a network of compatible
computing facilities for scientific work throughout the
Commonwealth, again using satellite computers in the main
capital cities for preliminary work and a large computer in
Canberra for major computing.

Exhibit
85/4
Committee
File
1965/3

203.   The Postmaster-General's Department has made extensive
use of computers since they first became available in Australia,
and has recently acquired its own computers for departmental use,
which includes analyses of reports of plant faults and maintenance
work, analyses of traffic to facilitate planning, account
processing, network simulations, allocation of orders and
facilities, analysis of contracts and computations associated
with research development and design.   Developments in the
Postmaster-General's Department are being directed towards a
nation-wide management information system based on an integral
network of computers and telecommunications links, dealing
with the processing problems of the Department on a total
basis.   The Department has a monopoly of data transmission
lines within the Commonwealth.

Committee
File
1965/3

204.   In his report to the Parliament for the financial
year 1965-66 the Minister for Civil Aviation, The. Hon. R.W.C.
Swartz, stated that a specification has been prepared for
an integrated data processing system within the Department
of Civil Aviation and also for an automatic message switching

system. He said that an approach will be made shortly to the Interdepartmental Committee on A.D.P. for approval to call tenders for suitable equipment.

205.   Examples of A.D.P. installations in Commonwealth authorities and instrumentalities are QANTAS (commercial), Snowy Mountains Hydro-electric Authority (technical and commercial), Australian Atomic Energy Commission (scientific), Commonwealth Banking Corporation and Reserve Bank of Australia (commercial).

Committee File 1965/3

206.   An installation is being planned for QANTAS to cope with 'on-line' airline reservations, initially in Australia but later throughout the world, using centralised communications networks and special remote terminals which will permit direct 'conversation' between the booking agent and the records held by the computer.

Exhibit No. 85/4

207.   Mr. Gleeson stated that the majority of Commonwealth departments either make use of computers to a greater or lesser degree, or have staff engaged in establishing plans for the implementation of A.D.P. systems or in conducting studies for the purpose of determining the potential application of computers. He told us that some departments which have not approached the Interdepartmental Committee for the installation of equipment are using the A.D.P. facilities of other Commonwealth organisations, particularly those of the Bureau of Census and Statistics and C.S.I.R.O. He said that the use made of these installations comprises work which ranges from administrative type processing to technical and scientific computing.

Exhibit 85/9

208.   Of the nine Commonwealth departments and nine statutory authorities which use computers, the majority employ them, at least partially, on applications which are subject to Audit attention. As at 30th June, 1966 more than thirty such applications were operational while others were at various stages of development.

Report of the Auditor-General 1965-66, P.211

209.   Mr. Gleeson informed us that approximately $20 million has been invested on computer equipment in the Commonwealth Service and approximately 1,000 staff are currently engaged in the various facets of A.D.P. study, implementation and

Exhibit no. 85/9

operation. He said that the application of computer methods
to the processing of data by Commonwealth departments, and by
those statutory authorities more closely associated with the
Commonwealth Public Service in the A.D.P. field, has been
widespread and additional departments are considering its
application. He stated that the introduction of A.D.P. is a
long-term project. He said that the development of a large
scale A.D.P. system is a complex task which requires many
man-years of effort and that the devising of new systems,
procedures, and rules of operation, the planning for,
installation and programming of the computer, and the planning
for and installation of associated equipment are all complex
operations entailing work of a high order by skilled staff.
In addition, he said that, because of the wide impact on the
organisation concerned, it is necessary to proceed cautiously
with the introduction of A.D.P. Before the new systems can be
introduced operationally they must be carefully tested and it
is essential to ensure that they will in fact work effectively.
He also said that in most cases this involves parallel running
of both the old and new systems. 'Parallel running' means that
the conventional system is retained in use while the A.D.P.
process is brought into operation.

210.   Mr. Gleeson indicated that the reason for Commonwealth   Q.1047
computer installations generally being satisfactory in operation,
is that the approach following on the implementation of
installations is the "total systems" (or integrated) approach.
He said that this method originated in the Public Service Board,
where it was decided that, before entering the complex field
of A.D.P. it was necessary to have a firm plan and programme
for the introduction of this expensive equipment. He also said
that the wisdom of this approach, applied since 1958 in the
Commonwealth Service, has been confirmed by observations made
overseas by the Board's officers of less than successful
installations in organisations which had not followed this
approach. He added that the total systems approach has been   Q.1047
encouraged for some years by many overseas governments and
other non-governmental organisations and that it is still
the subject of discussion. He quoted the following extract
from the McClellan Committee Report, published in the United
States of America in March, 1965:-

"The development of computer based systems can often
be facilitated if there is an adequate frame of reference/
so that any given system or sub-system can bo viowed in
terms of its relationship to the total structure of systems
in an agency. This is particularly true in the business
type or programme type of functional areas; it may be
less feasible if novel, experimental, scientific research,
or pionoering applications are involved. Therefore, a
master systems plan for an agency, at the highest
feasible level, is desirable. All efforts to dovolop
a system can then bo undertaken in relation to the plan,
in order to achieve an orderly and co-ordinated programme."

211.   Mr. Gleeson said that an alternative to the total
systems approach is 'hardware hypnosis', that is, the purchase
of hardware before deciding on applications for which it
will be used.

Q.1047

212.   Mr. Pridmore expressed the view that integrated
systems can bo implemented progressively and that in his
experience this approach is preferable to the introduction of
a whole manual system simultaneously. With regard to the
Department of Health, Mr. Searle indicated that the nature
of its applications procludod any approach other than a gradual
implementation of its applications due for example, to the need to maintain
continuity without disruption of the existing pharmaceutical
benofits payments system.

Q.1510-
Q.1511

Q.1207

213.   Mr. Gleeson claimed that because of the existing
co-ordineting machinery, and the co-oporation of departments,
the installations of the Commonwealth Service compare
favourably with those in overseas countries including the
United States of America. He also claimed that all
Commonwealth Service installations have been introduced
and are operating on a sound basis.

Q.894
Q.1024

(ii) The Co-ordination of A.D.P.
(a) The Role of the Interdepartmental Committee

214.   As already indicated, an Interdepartmental Committee on
A.D.P. was established in 1960 to co-ordinate automatic data
processing activities of the Commonwealth Government
Administration. Mr. Harris informed us that the Inter-   Exhibit
departmental Committee is an advisory body without power to   85/8
enforce its recommendations. He claimed, however, that it has   Q.724
had a decided influence on the procurement of equipment and
on the overall course of development of A.D.P. within
Commonwealth Departments. He also claimed that the Committee
has some influence on the acquisition of A.D.P. equipment for
the Service Departments.

215. Mr. Harris informed us that the method of determination   Q.706-710
of membership of the Interdepartmental Committee has not been
changed since its inception in 1960, while Mr. Gleeson indicated Q.846-847
that the co-option of a department to the Interdepartmental
Committee was determined by the business to be transacted at
a particular meeting of the Committee. He said that the
C.S.I.R.O. and the Department of Supply are named within the
Committee's terms of reference as Departments to be co-opted.
The C.S.I.R.O. was mentioned because of its planned installations,
and the implications of this for other departments. It
had been co-opted for the majority of meetings held by the
Committee. He informed us that the Department of Supply had
been co-opted because of the nature of its A.D.P. applications
and their relevance to proposed installations within the
Commonwealth Administration but he did not know of other
departments which had been co-opted to the Committee. He
said, however, that there was a distinction between co-option
and consultation, and that departments had been brought into
consultation for particular items of business of the Committee.
He stated that he did not know of any occasion when a
department with a proposal before the Committee had not
been brought into consultation while its proposals were
under consideration but he added that a department may
not be present for the full deliberations of the Committee.
Mr. Harris and Mr. Archer both agreed that departments would   Q.711 - Q.712
be represented at Committee meetings while their proposals

were being discussed and Mr. Archer added that a Department
would be given an opportunity to present its case to the
Committee should the Treasury view not be favourable to
the proposed installation. Mr. Harris indicated that whilst
disagreement had occurred between the Committee and departments
submitting proposals, he was unaware of any occasion where
open conflict had occurred between the Committee and a.
department.

7.1606

7.754 to
7.758

216. Mr. Harris claimed that all departments recognise the
position and function of the Interdepartmental Committee and
that even though the Committee has no statutory authority,
there is no doubt about its authority in fact. He said that
the Commonwealth Stores Supply and Tender Board would not wish
to receive a proposal from a department to purchase a computer,
unless it had the endorsement of the Committee, or to invite
tenders to a department's specification unless the Committee
had examined the specification and, in general, endorsed it.

7.711-
712

217. He expressed the view that the Interdepartmental Committee
would be a suitable body to undertake res_ponsibility for the
official usage of equipment and for its disposal or transfer
between departments. He was not aware of the extent to which
the Committee has already done this, but would support the
extension of the Committee's terms of reference if this
was found to be necessary to cover its responsibility in this
field. He also indicated that examinations of departmental
specifications by the Interdepartmental Committee affords
an assurance to the Commonwealth that no significant
technological development is overlooked before tenders
are called.

7.815

Q.804

218 It was suggested in previous evidence to the Committee
that the establishment of centralised A.D.P. facilities would
curb the ambitions of individual departments which may
otherwise attempt to acquire equipment in excess of their
reasonably estimated requirements. In this regard,
Mr. Archer informed us that this is one of the functions
of the Interdepartmental Committee which could safely be
left within its jurisdiction.

7.624
7.1636

(b) The Role of the Public Service Board

219.   Mr. Gleeson informed us that the role of the Public
Service Board in the development of A.D.P. facilities and
systems in the Commonwealth Service has centred around the
Board's responsibilities in the provision of related new
organisation structures, establishments, pay scales,   Exhibit
recruitment and training of staff and overall co-ordination   85/9
of the introduction of A.D.P.   He said that the Board has
kept in continual contact with, and taken appropriate action
in regard to, the development of A.D.P. activities within the
departments and has co-operated with those Statutory
Authorities whose requirements are financed directly through
the Commonwealth budget, as well as with other organisations
whose A.D.P. activities are relevant to A.D.P. matters within
the Commonwealth Service.

220.   He stated that, under the working arrangements developed   Exhibit
in association with the Interdepartmental Committee on A.D.P.,   85/9
the Public Service Board's Management Services Division has
acted as the servicing arm of the Committee on a wide variety
of matters such as the detailed examination of and recommendations
on departmental proposals for the implementation of A.D.P.
and for the acquisition of equipment.

221.   Reference has been made in Chapter 2 of this Report to
the role of management generally in introducing A.D.P.   With
regard to the responsibility of management in the Commonwealth
Service,in particular, Mr. Gleeson informed us that, under the   1.979
Public Service Act, the Permanent Head of each department is
responsible for the whole of the administration of his
department, including the acquisition of A.D.P. equipment,
its installation and its usage. However, Section 17 of the   1.980-
Public Service Act places a responsibility on the Public   981
Service Board in the oversight of the usage of A.D.P.
equipment within the Commonwealth Service.

222.   He stated that, since the early days of A.D.P.   Exhibit
development and application in Australia, the Public Service   85/9
Board has been keenly aware of the need for a co-ordinated
and balanced development of A.D.P. within the Commonwealth

Service. He indicated that, in 1959, a number of problems were foreseen, such as the possibility of idle capacity developing and the lack of co-ordinated development and therefore during that year a written submission was made to the appropriate authorities for the establishment of suitable co-ordinating machinery. Simultaneously, an officer of the Board's staff inspected overseas A.D.P. developments and confirmed the wisdom of the Board's proposals for the co-ordination of A.D.P. within the Commonwealth Service.

Q.830–
Q. 832

223. He said that, in collaboration with the relevant departments and statutory authorities, the joint use of facilities by Commonwealth organisations and joint developments in other areas of common interest has been actively encouraged and achieved. Examples of this activity were the use of the facilities installed by the Bureau of Census and Statistics and C.S.I.R.O. by other Commonwealth organisations.

Exhibit
85/9

224. With regard to servicing of the Interdepartmental Committee by the staff of the Public Service Board, Mr. Gleeson informed us that there is an A.D.P. group comprising ten officers within the Board's Management Services Division. Since 1962, approximately half of this group has been engaged in the conduct of training courses in A.D.P. and that, of the remaining five, probably from two to three are continually engaged in servicing the Interdepartmental Committee. He said that the assistance available to the Committee is not limited to that provided by the Public Service Board as from time to time assistance on committee projects is provided by officers of other departments.

Q.877–
880

225. We were informed that officers of the Public Service Board have, for a number of years, provided practical assistance to departments in investigating the application of computer methods ranging from participation with departmental officers into joint investigations of possible A.D.P. applications to the arrangement of particular tasks for certain authorities. He indicated that this type of activity had extended beyond the confines of the Service to the provision of advice and assistance to State Government administrations and to certain overseas countries under the Colombo Plan.

Exhibit
85/9 and
Q.889

226.   He said that in order to maintain current information   Exhibit
on A.D.P. for the purpose of assisting departments and to   85/9 and
                                                                    Qs.843 and
enable the Board to discharge its A.D.P. role generally, the   845
Board's office maintains contact with developments in A.D.P.
through publications obtained from overseas countries. He
added that the Public Service Board is also in close association   Q.843
with organisations outside the Commonwealth Service, including
equipment suppliers and manufacturers. Commonwealth officers   Q.845
in London and New York supply information on progress in the
field of A.D.P. in Britain and the United States of America
whilst visits are made by Commonwealth officers to other
countries.

227.   Mr. Gleeson claimed that within the Commonwealth Service   Q. 840
and authorities, and in the universities, there is sufficient   Q 841
information on A.D.P. available to the Commonwealth to meet its
needs. He said that the range and depth of technical
information on A.D.P. available within the Service is of a very
high order and compares very favourably with the general level
of technical knowledge of computers possessed by the industry.

228   He informed us that the Public Service Board's Management   Q.922-
Services Division has been approached by each State Government   924
for advice on A.D.P. The New South Wales Government was the
first State authority to introduce A.D.P. on a broad scale.
Prior to this, A.D.P. had been used in that State for
scientific and engineering computations only. Mr. Pilz, the
officer in charge of the first New South Wales State Government
A.D.P. Centre obtained advice from the Commonwealth Public
Service Board prior to the establishment of that centre in
1960, and collaboration between the New South Wales and
Commonwealth Public Service Boards has been close since that
time. Mr. Gleeson said that an officer of the Western
Australian Government had sought advice from the Commonwealth
Public Service Board on the introduction of A.D.P. in
Western Australia and also in the recruitment of an
officer to lead the Western Australian Government's A.D.P.
study group. He added that the Commonwealth Public Service
Board had assisted State Governments by providing them with
places in its training courses, so that the officers so
trained could initiate and conduct similar courses within
State Services.

229.   With regard to a Government wide information exchange,   Q.920-
Mr. Gleeson stated that there is no formal organisation to   921
facilitate the dissemination of A.D.P. information through the
Service.although there is a Government-wide A.D.P. information
exchange in operation. He said that there was a good deal of
information exchanged between Departments and between individuals
within Departments. It was stated that the Board's A.D.P.
group serves as a source of reference for inquiries from any
department regarding matters associated with A.D.P., and for
this reason, it would be said that the Board's A.D.P. study
group offers a form of information exchange by rendering A.D.P.
services to departments generally. He said that, in a circular
issued by the Board to departments in 1960, it was made clear
that the Board's A.D.P. group within the Management Services
Division would operate as a source of information.   He
indicated that the lines of communication within the service
were operating to a very significant extent.

230.   We were informed by Mr. Gleeson that, as with other   Exhibit
areas of work in the Service, the Public Service Board is   85/9
responsible for the examination of and determination on
departmental proposals for A.D.P. establishments and patterns
of organisation for A.D.P.   He indicated that continuing
attention is given to pay scales for personnel employed in
A.D.P. and that, currently, and in conjunction with the major
A.D.P. users within the Service, a review is being conducted
of the duties, responsibilities, qualifications and salary
scales for staff engaged in programming for A.D.P.   He said   Q.932
that salary ranges for A.D.P. staff as between the Commonwealth
and State Services were not uniform, but that the divergence
is not great. He added that, during the review of A.D.P.
staff matters being undertaken at the time of our inquiry ,
an officer of the Commonwealth Public Service Board had
had discussions on this matter with officers of the State
Services.

231.   Mr. Gleeson indicated that the Public Service Board   Q.969
is responsible for the organisation of a computer section within
a Commonwealth department in the case in which the installation
is not used exclusively by the department in which it is
housed. He added that when the need arises the Board also   Q.974

examines the management of service sections in relation to the
obligations of the parent department to other departments
using the computer.

232. With regard to the co-rdination and the transfer of   Q.976
A.D.P. equipment between departments and authorities, Mr.
Gleeson said that the powers of the Public Service Board in
this field are adequate, but that the need for such transfers
has not yet arisen because of the Board's co-ordinating approach
to the establishment of A.D.P. installations.   In relation to   Q. 1080
future possible transfers of A.D.P. equipment between departments
and/or statutory authorities, he indicated that such transfers
would be considered towards the end of 1966 when planning for
the development of what might be regarded as phase two of A.D.P.
development within the Commonwealth Service will be reviewed.

233. He stated that while it could not be claimed that there   Q.919
had been any widespread increase in efficiency in the
Commonwealth Service since the introduction of A.D.P.
significant improvements in efficiency have been achieved
since its introduction particularly in specific areas of
application such as the planning and construction of buildings
and the refitting of ships.   He said, however, that the
groundwork is being laid to maintain and increase the efficiency
of the Service in the future.

(c) The Role of the Department of the Treasury

234. Mr. Harris informed us that the Treasury, as the   Exhibit
department controlling the accounting practices and procedures   85/8
of all departments of the Commonwealth, has a vital interest
in the development of the best possible accounting systems in
this area.   Consistent with the policy of progressively
modernising accounting systems, the Treasury has been actively
engaged, over the past two years, in developing systems to
enable the payroll and ledgerkeeping functions of the Sub-
Treasuries to be processed by the computers installed in each
mainland State and Canberra by the Bureau of Census and Statistics.
He said that some of this work is already on an operational basis
and that the computer systems will be extended as quickly

as resources will permit.   He stated that,

except insofar as specific responsibilities rest
with the Department of the Treasury under the Audit Act and
Treasury Regulations, the Treasury has no direct control over
the other Departments of State, since this is a power which,
under Section 25(2) of the Public Service Act is exercised by
the Permanent Head of each department.

235.   He stated that the Department of the Treasury nevertheless
exercises an influence over accounting procedures and systems
of departments indirectly through membership of the Inter-
departmental Committee on A.D.P.; through the Treasury's role
in financial management of the Commonwealth's affairs; through
the Treasury's administration of the Audit Act; and through the
operations of the Commonwealth Stores Supply and Tender Board.
Each of these influences is discussed below.

. Membership of the Interdepartmental Committee

236.   Mr. Harris stated that the Department of the Treasury
has a real influence on the administration of other departments
arising from its representation on the Interdepartmental
Committee on A.D.P. as the Treasury representative is able to
put forward Treasury views on any proposal which may be
submitted for the use of A.D.P. equipment. He said that
aspects of proposals for the installation of A.D.P. equipment
on which the Treasury views must be taken into account, include
the work to be carried out by the proposed system, conformity
of the proposed A.D.P. processes with the Audit Act and
Treasury Regulations, compatibility of proposed systems
with existing and proposed Treasury systems, the availability
of unused machine capacity in other installations already
operating, and the costs of operating comparable units.

237.   As noted previously in this Report the Prime Minister's
approval for the establishment of the Interdepartmental
Committee provided for a representative of the Treasury to
be included in its membership. The Commonwealth Statistician
was appointed by the Secretary of the Treasury to the
Interdepartmental Committee at its inception in 1960 and he
has represented the Treasury continuously since that time.

We were informed that the Commonwealth Statistician is regarded
as being a Treasury officer. Mr. Archer indicated that Treasury   Q.1637
interests, in the context of the Interdepartmental Committee,
concern all financial aspects of any proposed acquisition of
A.D.P. equipment. He added that he had been appointed   Q.1590-
Commonwealth Statistician under Section 4 of the Census and   1594
Statistics Act 1904-49 and as such is directly responsible to
the Treasurer. He said that as Commonwealth Statistician he is
not limited in any way other than by the terms of that Act.
For administrative purposes, however, the Commonwealth Bureau
of Census and Statistics is referred to as the Statistician's
Branch of the Treasury. He expressed the opinion that
there was nothing unusual about his representing the Department
of the Treasury on the Interdepartmental Committee on A.D.P.

238.   In regard to the Treasury's attitude to the appointment
of Mr. Archer as its representative on the Interdepartmental
Committee, Mr. Harris indicated that generally the expert   Q.749
knowledge of the Commonwealth Statistician and his officers in
the field of A.D.P. meant that he could serve the Committee
better than an officer whose interests were more concerned
with financial matters. He informed us that the Treasury
has its other sources of information and control either through
its funding operations or through the Commonwealth Stores
Supply and Tender Board. The Treasury was therefore in a
position to examine the conclusions reached by the Interdepartmental
Committee if this was considered to be necessary. He indicated   Q. 751.
that it would have been possible to co-opt the Commonwealth
Statistician to the Committee as required, and to have
appointed instead a representative who would have been able to
deal with departmental queries of a nature which would
normally be answered by the Department of the Treasury.

. Financial Management of the Commonwealth's Affairs

239. Mr. Harris stated that it is the responsibility of the Department of the Treasury in its role in financial management of the Commonwealth's affairs to analyse financial proposals, or to determine the level of proposed expenditure, or to arbitrate between competing claims before recommending the appropriation of funds. He did not know of a case in which funds had been withheld from a department after it had been subjected to the procedures for the acquisition of equipment as determined by the Interdepartmental Committee. He expressed the opinion, however, that should the Interdepartmental Committee be satisfied as to the desirability of a particular development within a department but was concerned about the rate at which the department wished to implement its plans, then, rather than reject the departmental proposal, it may agree to it in principle but it may query the rate at which it should be introduced. He indicated that the Treasury may infer from such a query that the availability of funds for the scheme proposed be given careful consideration. However, as departments have, in general, kept development plans to a practical level, the Treasury has not found the need to exercise this fund's control procedure as a means of controlling the rate of development within a department.

Exhibit 85/8

Q.753-756

Q. 753-756

. Administration of the Audit Act

240. Mr. Harris informed us that the Audit Act and the related Treasury Regulations set out the legal framework upon which the Commonwealth's accounting system is built. Although departments are not required by law to submit A.D.P. accounting systems to the Treasury for examination, it is necessary for departments to seek Treasury approval when the department desires to seek an exemption from or variation to standard accounting controls and procedures. He said that, in such circumstances, the Treasury would examine the system from the general aspect of accounting acceptability and compliance with the principles expressed in the Audit Act and the Treasury Regulations before issuing an approval to the implementation of the system. He indicated that, in practice, A.D.P. installations in the Commonwealth Service have been modelled in accordance with existing legislation but that a more efficient

Exhibit 85/8

Q. 731

A.D.P. system could possibly be devised in respect of some
procedures if the Audit Act or Treasury Regulations were
amended.

241.   He informed us that the Audit Act is framed in general   Exhibit
terms, and that detailed accounting procedures are provided for   85/8
by the Treasury Regulations and Treasury Directions. He said
that the Treasury Regulations include a provision to the
effect that departmental chief officers may issue accounting
instructions for their departments provided that these
instructions are not inconsistent with the requirements of the
Audit Act and the Treasury Regulations. He added that
with the opening up of this new and dynamic field, it is
most important that departments keep within these rules,
or if they find they cannot, to approach the Treasury with a
view to changing the law. He indicated that the Treasury has   Q.735
not received requests from departments for the amendment of
existing legislation following the examination of statutory
requirements during the period of a feasibility study and
expressed the opinion that it would probably be too early
at that stage, in the framing of a system, to determine
whether amendment of a Treasury Regulation was desirable or not.
He said that a request for amendment to a Regulation would
be more likely to be made after the feasibility study had been
completed, while detailed systems analysis was being undertaken,
and prior to actual programming. He stated that Treasury
has commenced an examination of the legislation to ensure that
amendments are recommended where this course becomes necessary
to meet changing situations and that proposals for the amendment
of Treasury Regulations 84 and 109 were being considered.

242.   Mr. Harris said that there are various provisions in the   Q.758
Treasury Regulations which say "unless the Treasurer otherwise
approves (or directs)" and that this type of provision has
been used over many years to approve an accounting procedure
which in substance meets the requirement of the regulations,
but does so in a manner that is slightly different from that
which is provided in the regulation concerned. He said that
this could occur under ordinary machine procedures where, for
instance, a department wishes to prepare simultaneously a

requisition and order, both of which are provided for in two
separate sections of the Treasury Regulations. He indicated
that the Treasury would agree to a department preparing these
two forms simultaneously provided that in so doing, they did
not detract from the overall efficiency of the system. He
said that this type of provision had been used in relation to
A.D.P. procedures to ensure that the spirit of the Audit Act
and Treasury Regulations is maintained even though a particular
regulation has to be covered by the use of the words "unless
the Treasurer otherwise approves."

243. He said that a Treasury Direction would oblige a   Q.759
department to refer to the Treasury a matter involving a
departure from the Audit Act or Treasury Regulations in terms
of the specific words used. However, this discretionary authority
does not extend to all accounting procedures, and it is only
in certain areas that any discretion is given to the Treasury
to modify accounting procedures in this way.

244. Mr. Harris indicated that Treasury Regulation No. 132   Q.760-
provides that every Chief Officer shall ensure that the   761
provisions of the Audit Act and Treasury Regulations are
complied with so far as they concern officers under his control.
He added that in many cases the initiation of amendments by
the Treasury may not meet the situation concerned and that it
is the exercise of a discretion provided for by Treasury
Regulations to vary a specific procedure laid down. The Audit   Q.762
Observer, Mr. Ragless, indicated that, if departmental heads
feel that any of their proposed applications infringe existing
legislation, they should approach the Treasury to have the
necessary amendments made. He added that officers of the   Q.763
Auditor-General's Department are conscious of their
responsibilities in this regard and that he knew of no
instance where existing legislation has been breached. The
Auditor-General has investigated the variation of forms
provided for in Treasury Regulations, and is now satisfied
that the Treasurer or his delegate has approved the variation
of forms used in computer processes.

245. The Auditor-General, in his Report for 1965-66, stated
that assistance continued to be given to departments and
authorities, where requested, in participating in exploratory

studies and in the consideration of procedures related
to automatic data processing.

246. Mr. Harris said that he know of only two instances in
which departmental approval had been sought for a variation
of standard accounting procedures to comply with automatic
accounting procedures and they had both been referred to the
Treasury after the installation of computers. He said that
currently there are no outstanding problems in relation to the
amendment of existing legislation to comply with automatic
accounting procedures apart from Treasury Regulations 84
and 109, amendments to which are being considered. He indicated
that an examination was required of Section 34 of the Audit
Act, as this section in its present form may place some
limitations on the efficiency of future A.D.P. installations.
He said that this amendment was an accounting problem rather
than an A.D.P. problem and that agreement had been reached
with the Auditor-General to pursue the matter urgently.

Q.766-
773

Q.774
775

. Operations of the Stores, Supply and Tender Board.

247. Mr. Harris informed us that the Commonwealth Stores
Supply and Tender Board is responsible to the Treasurer for the
purchase of all stores, including office machines in general
use throughout Departments. He said that although departments
have not been required under the Treasury Directions to seek
the Board's approval for the purchase of A.D.P. equipment,
the Board has, over a long period of years, had this
responsibility in relation to all classes of office machines,
including punched card equipment and that departments have,
in fact, frequently utilised the services of the Board in
arranging contracts for such purchases. He said that the
Department of Supply has, however, arranged for the computer
requirements of the Service Departments in accordance with
its responsibilities in this area. He said that the
responsibility of the Department of Supply in relation to
the Service Departments is parallel in function to the
Commonwealth Stores Supply and Tender Board in that it has
a contract Division which offers a similar facility to the
Service Departments as the Commonwealth Stores Supply and

Exhibit
85/8

Q.723

Tender Board offers to civil departments. Mr. Harris indicated that only one department, the Postmaster-General's Department has a complete and very competent contracting organisation of its own for the purchase of technical equipment. Q.747-748

248. He indicated that, in general, departments have been satisfied to use the Stores Supply and Tender Board although there is no real requirement for them to do so. He said that the Department of the Treasury had received unsolicited compliments regarding the documentation of Commonwealth Government specifications and procedures for the purchase of A.D.P. equipment from unsuccessful tenderers. Q.713

249. Mr. Harris informed us that when the Stores Supply and Tender Board receives tenders it seeks a recommendation from the purchasing department, and hence enables a thorough evaluation of the tenders to be made by the department concerned. After evaluation by the Interdepartmental Committee the Stores Supply and Tender Board makes its decision in the light of the views expressed by the department concerned and the Committee. He claimed that the decisions taken by the Stores Supply and Tender Board are not a mere formality and that, in his experience of the Board, including three major A.D.P. proposals, the logic of the proposals made has been very carefully examined in lengthy sessions in which the various points in the arguments put forward have been noted and discussed with those concerned. He informed us that once a decision has been reached, the Stores Supply and Tender Board has the further responsibility for negotiating the actual terms of the contract. He claimed that the experience of the officers of the Board has been of considerable value to the Commonwealth in the acquisition of A.D.P. equipment. Q.805-807

250. Mr. Harris informed us that members of the Commonwealth Stores Supply and Tender Board had no expertise in A.D.P. technology as such but they assist departments in the framing of specifications to ensure that a good contract will result from the invitations to tender. Expect advice on A.D.P. technology is obtained, however, from the department concerned, and from the Interdepartmental Committee. Q.705

251.   With regard to the fact that Treasury Directions do   Q.716
not provide for approval by the Commonwealth Stores Supply
and Tender Board for departmental purchase of computers,
Mr. Harris informed us that because of the establishment of the
Interdepartmental Committee approval of the Board was not
considered to be necessary. He indicated, however, that it
has been convenient for departments to utilise the services
of the Board in processing tenders received and in arranging
contracts.

(iii)Recruitment and Training of A.D.P. Staff

(a) Recruitment

252.   Mr. Gleeson stated that, because of the shortage of
qualified and experienced A.D.P. staff both within and outside
the Commonwealth Service, and to ensure that uniform standards
apply in the recruitment of A.D.P. staff, the Public Service
Board has been associated, both in detailed and co-ordinating
ways, in staff recruitment programmes. He stated that the   Exhibit
recruitment of Programmers-in-Training is controlled by the   85/9
Board, with departmental participation in the selection and
allocation of recruits, and that overseas recruitment,
particularly from Britain, has been a source of qualified staff
for several years although it is likely that this source will
yield few recruits in the future. He claimed that the Board
and departments have combined their resources and collaborated
closely in the recruitment of staff from this source.

253.   He advised us that the Board, in association with   Exhibit
departments and other relevant authorities, has been active   85/9
in the development, testing and validation, and application
of psychological tests for the selection of A.D.P. staff.
He said that, in conjunction with major departmental A.D.P.
users, qualifying examinations have been devised for Programmers-
in-Training and qualifying and proficiency tests for operators.

254.   Mr. Gleeson indicated that, with increased staff, the   Q.886
Public Service Board could increase the rate of implementation
of A.D.P. applications and that it was endeavouring to increase
its staffing resources through recruitment programmes. He said
that, in general, the Board's efforts in recruitment had been
successful and that the recruitment of 88 Programmers-in-
Training for 1966 had been carried out satisfactorily and
harmoniously by the Public Service Board and departments.

255.   He informed us that estimates had been made of   Q.833
A.D.P. staff requirements, within the Commonwealth Service,   Q.837
up to 1970. He said that as there should not be problems
in the recruitment of data preparation staff or computer
operators, an estimate had not been made of requirements
in these categories. With regard to programmers, however,
it was estimated that the following numbers will be required
in the period to 1970.

Table No. 7

Commonwealth Service

Programmer Requirements:

Estimated Annual Increase 1966-1970

Year	Number
1966	267
1967	248
1968	263
1969	283
1970	302

Mr. Gleeson stated that at present there are some 450 Programmers
employed in the Commonwealth Service, so that allowing for about
20 per cent wastage, about 1500 Programmers will be needed
during the period 1966-1970. He added that over the past few
years the wastage rate had been about 10 per cent. He indicated   Q.836
that the Board had experienced difficulty in recruiting
Programmers in the past, and that it was not expected that
these problems would be resolved in the near future. With
regard to the mechanics of obtaining A.D.P. staff, he stated   Q.983-984
that the creation of positions and the provision of funds to
enable them to be filled is not a problem generally. He
said that the real problem was the availability of trained
staff to fill vacant positions. In an endeavour to overcome
this problem, the Public Service Board had initiated its own
training programmes. About 50 per cent of the A.D.P. staff   Q.898
in the Service have been recruited from within the Service
and those recruited from outside the Service would be mainly
Programmers-in-Training. He said that staff is recruited on   Q.930
the basis of suitability for A.D.P. work and is then allocated
to departments according to departmental needs. He informed
us that the recruit would be given basic training in systems
analysis and design and would then be instructed in the
functions of the Department to which he had been allocated.

256.   Mr. Pridmore informed us that whilst no doubt exists   Q.1405
as to the shortage of skilled A.D.P. personnel, the
estimated requirements may have been exaggerated in some
instances. He said that the policy of the Bureau in its

recruitment programme had been to obtain quality rather than
quantity. He expressed the opinion that the optimum qualification   Q.1406
for a Programmer should be a university degree, but that this
did not mean that a person without a degree could not perform
the duties of a Programmer. For example, some of the better
Programmers on the staff of the Bureau of Census and Statistics
do not have tertiary qualifications but they have up to ten
years experience in A.D.P. work and proven ability in the field.

257.   With regard to recruitment overseas Mr. Pridmore   Q.1423
expressed the view that the expenditure involved was justified
and that in the case of the Bureau of Census and Statistics,
and in relation to some members of its staff, achievements
in the field of A.D.P. would not have been as great as they
have been without staff recruited from Britain. He added,
however, that with the growth of knowledge, and experience in
Australia, the need for recruitment from Britain should diminish.
He stated that the Bureau of Census and Statistics had not   Q.1434
recruited staff in any country other than Britain. Whilst the
United States of America is the most advanced country in
A.D.P., its citizens present some difficulties in relation to
their appointment to the Commonwealth Service.

258.   The Public Service Board Observer, Mr. Vanthoff,   Committee
informed the Committee that the Public Service Act provides   File
that permanent appointment to the Commonwealth Service be   1965/3
limited to British subjects. Non-British subjects may be
employed as temporary employees, but they are required to
make an oath or affirmation declaring allegiance to the Queen
and to the upholding of the Australian Constitution. To
conform to this provision, nationals of the United States of
America are required by United States law to renounce their
American citizenship. These statutory limitations restrict   Committee
opportunities for attracting recruits from the United States   File
of America to work in the Commonwealth Service. He stated,   1965/3
however, that the Public Service Board has considered the
possibility of offering term contracts to United States
citizens who may be willing to work in the Commonwealth
Service for a period of time. He added, however, that
the high total cost of travel, other transfer expenses,

and the level of remuneration which must be offered to
attract United States citizens to work in Australia, makes
impracticable a formal continuing scheme designed to gain the
employment of a significant number of citizens from that
country in this manner.

259. Mr. Gleeson claimed that the Public Service Board is   Q.929
making progress in overcoming the A.D.P. staff shortage within
the Commonwealth Service. He said that the Programmer-in-
Training scheme, commenced in 1964, has significantly improved
the staffing position and it is anticipated that developments
in the universities and technical colleges will result in
further improvements.

(b) Training

260. Mr. Gleeson stated that training is associated with   Exhibit
the problems of recruiting suitable staff for A.D.P. in the   85/9
Commonwealth Service and that the Public Service Board and   Q.886
departments have placed heavy emphasis on in-service training.
He claimed that success achieved in this field in the
Commonwealth Service is of a very high order and expressed the
view that the Commonwealth Public Service had led the world
in some aspects of A.D.P. training. He said that, since 1960,
the Board has been conducting management orientation training
and more detailed courses, including a three months' full-time
course in systems analysis and design for potential A.D.P.
staff within the Commonwealth Service. Other courses conducted
by the Board include specialised programming courses for A.D.P.
personnel and professional personnel. He indicated that the
Public Service Board, in association with the Department of
Defence, the Bureau of Census and Statistics and the Postmaster-
General's Department, has co-ordinated the development of and
participated in the conduct of training courses which form
part of a twelve months Programmer-in-Training scheme.
He said that this scheme has become the major source of
trained third division recruits for duties in the analysis,
design and implementation of A.D.P. systems in the
Commonwealth Service.

261.   We were informed by Mr. Pridmore that a comprehensive   Exhibit
staff training programme is provided by the Bureau of Census   85/14
and Statistics for all users of its computer network and he
indicated that the Bureau training section was established
during the feasibility study stage of the proposed complex.

262.   Mr. Gleeson indicated that most of the A.D.P. tutors   Q.1061
on the staff of the Public Service Board were not professionally
trained teachers, but added that specialist advice on training
methods was available within the Training Section of the
Public Service Board.

263.   Mr. Pridmore informed us that most of the Bureau's
training officers had been trained as teachers or had had
experience as lecturers. He stated that the purpose of the   Exhibit
Bureau's Training Programme was to ensure a steady supply of   85/14
trained personnel in all categories of staff required to   Q.1441
programme, operate, and administer a large scale computer
installation. He said, however, that the A.D.P. work of the
Bureau was not unique in that the A.D.P. training provided by
the Bureau could have been undertaken by the Public Service
Board. He added that the Programmer-in-Training course conducted   Q.1440
by the Bureau and the systems analysis and design course   Q.1442
conducted by the Public Service Board are not to be compared
since each has a different purpose to serve. However, he
said that in some respects they are complementary.

264.   He informed us that the Public Service Board's course   Q.1442
was instituted in about 1960 when experience in A.D.P. in the
Commonwealth Service and throughout Australia, apart from
universities and scientific institutions, was virtually non-
existent. He indicated that the purpose of the course was to
acquaint staff with the fundamentals of A.D.P. equipment and
approaches to systems analysis and design so that they could
examine the work of the Service in a manner that would enable
it to be processed by a computer, while the Bureau's Programmer-
in-Training scheme, instituted late in 1963, is designed to
produce skilled programmers. He said that the Bureau's
course has been adopted in a slightly modified form by
other Commonwealth departments.

265.   We were informed that while the Public Service Board   Q.1409
conducts a course for systems analysts (or programmers) of three
months duration, and the Department of Defence also conducts a three
month course for Programmers, the Bureau's Programmer-in-
Training scheme is of twelve months duration. Mr. Pridmore   Q.1409
expressed the view that it was possible to impart the rudiments
of programming to a person in six months, but that it would not   Q.1411
be possible in this time to train him to the level of an
efficient programmer.

266.   Management courses conducted by the Public Service   Q.1036
Board for Permanent Heads of Departments are of one day's   Q.1039
duration. Mr. Gleeson indicated that in his experience and   Q.1096
assuming the A.D.P. support which exists within departments,
this course is sufficient. He said that little time is
required to convey to people of high intelligence and at high
levels of management, the principles of A.D.P. and that it is
this type of training which is required by Permanent Heads.
He also said that attendance at the Board's course would not
enable a Permanent Head to discuss an A.D.P. programme, but he
suggested that this would not be necessary since the officer-
in-charge of A.D.P. in the department concerned would be
responsible for A.D.P. programmes. He added that while a
Permanent Head could learn the principles of A.D.P. in one
day, this would not mean that his education in this field is
complete and that a longer course would be necessary for
personnel at relatively high and intermediate levels of
management.

267.   Mr. Pridmore informed us that extensive use had been   Q.1440
made of the three week management courses conducted by the   Q.1632
Bureau of Census and Statistics. He said that while the
Bureau course places emphasis on the use of official
statistics, it incorporates material which is common to
other courses of this type, including many of the ideas
presented in the Board's Management Course. Mr. Archer
indicated that if the resources were available to increase
the length of the Bureau's course, and if senior staff were
able to attend them, he would prefer that they be longer

than three weeks duration. He said that consideration is being
given to offering refresher courses to officers who had
attended the Bureau's earlier management courses.

268.   The Auditor-General in his Report for the year
ended 30th June, 1956 stated that Audit officers are made
available from Central Office and State Branches to lecture
on auditing procedures at departmental training courses for
systems analysts and Programmers'-in-Training.

269.   Mr. Gleeson claimed that the Commonwealth Service has   Exhibit
achieved marked success in A.D.P. training, excluding   85/9
training in equipment maintenance and that it had endeavoured,
through informal discussions in the early stages, and more
recently by participation in the University of Sydney
Appointments Board E.D.P. Careers Committee, to encourage
the wide development of tertiary education in this field.
He expressed the opinion that it is practicable to expect that   1.1058
in the foreseeable future a greater proportion of A.D.P. staff
for the Commonwealth Service be trained by technical colleges
and universities. He said that a problem to be overcome in
this regard is the difficulty of obtaining suitably qualified
people to teach the required subjects in tertiary institutions
and that if those could be obtained A.D.P. training in the
Service could be confined to specialised fields relevant
to departmental requirements.

(iv) Expenditure on A.D.P.

270. In each year since 1963-64, the Auditor-General
has included in his Reports to the Parliament, information
relating to expenditure and commitments by departments
and Authorities on A.D.P. According to departmental
records available to the Auditor-General, Commonwealth
investment in A.D.P. (capital costs of equipment and
buildings including commitments but excluding the costs
of alterations) amounted to ₩7,800,000 by 30th June, 1964.
Expenditure in the three years 1963-64 to 1965-66 is shown
below in Table No. 8 .

TABLE NO. 8
DEPARTMENTAL EXPENDITU.E ON A.D.P.
(INCLUDING C.S.I.R.O.)
1963-64 TO 1965-66

Item	1963-64 $	1964-65 $	1965-66 $	
Purchase of Equipment (i) Hire of Equipment (i) Expenditure on New Buildings.	1,554,294 174,386 284,694	6,680,400 610,600 599,400	6,774,200 1,150,900 1,527,700	Auditor- General's Reports 1963-64. to 1965-66
Total	2,013,374	7,890,400	9,452,800	

(i) Includes ancillary equipment.

271. Although information was not available relative to
expenditure on building alterations for years prior to
1965-66, such expenditure in that year amounted to
approximately $534,900.

272. In addition to expenditure actually met on equipment
and buildings (including alterations), the Report of the
Auditor-General for 1965-66 indicated that departmental
commitments in respect of A.D.P. equipment, buildings and

buildings alterations amounted to approximately a further
$3,528,300 as at 30th June, 1966.

273.   On the basis of information which it had obtained
from Departments, the Department of the Treasury informed us
that the estimated value of A.D.P. equipment purchased by   Exhibit
Commonwealth Departments and C.S.I.R.O. as at' 30th June,   85/8
1966 amounted to $21,889,789 while the estimated total
value of expenditure, including contracts let as at 31st
May, 1966 amounted to $24,778,516.   The distribution of
these figures between departments (including C.S.I.R.O.) is
shown in Table No. 9 below.

TABLE NO. 9

PURCHASE OF A.D.P. EQUIPMENT BY COMMONWEALTH DEPARTMENTS AND C.S.I.R.O.

Department or Authority	Estimated Total Expenditure to 30th June, 1966	Total Value of contracts let to 31st May, 1966
	$	$
DEFENCE	4,053,386	4,097,466
NAVY	613,756	1,074,632
ARMY	22,000	1,491,000
AIR	1,833,945	1,844,011
SUPPLY (i) (ii)	4,291,820	4,291,820
INTERIOR	12,448	12,448
HEALTH	33,400	33,400
C.S.I.R.O.	3,323,290	3,362,524
P.M.G.'s	1,886,211	2,290,068
TREASURY –		
STATISTICIAN'S BRANCH	5,713,077	6,059,113
COMMONWEALTH ACTUARY	Nil	102,818
TAXATION BRANCH	41,064	41,064
OTHER BRANCHES	65,392	78,152
Total	21,889,789	24,778,516

(i) Includes a contribution received from the British
    Government   towards the cost of equipment.

(ii) Includes Analogue equipment valued at
     $1,508,500.

(v) Costs of Installation and Operation

274.   In formulating questionnaires for use by
departments in this inquiry, we sought specific information
relating to capital costs involved in the installation of A.D.P.
oquipment and operating costs up to 30th June, 1966.

275.   The importance of maintaining adequate cost
records was referred to in the Report on the McKinsey Survey
a summary of which has been included in chapter 4 of this Report.
In that survey, it was found that the "above average" companies
had already recovered installation costs and were contributing
to profits an amount in oxcess of the costs of developing new
applications. The determination of expenditure and returns by
"average" companies, however, was found to be difficult and
little independent analysis had been made of their costs of
computer systems and resultant savings. Some of the "average"
companies were unaware of the value of their current expenditure
on A.D.P. and almost all acknowledged that they had not recovered
installation costs or were operating their computers at a profit.
Moreover, most of them did not know at what stage installation costs
would be recouped.
276.   In approaching the question of costs and their
analysis we also had available to us the results of a study
which had been made into a computer installation in the Electricity
Trust of South Australia.[i] The survey covered the economics
of installation, areas in which savings were made, the approach
to conversion to A.D.P. and management information. The study
claimed that by June, 1966, four years after the A.D.P.
installation had been established and on the basis of savings
being made in 1965, all costs will have been recovered from
direct savings without any indirect or intangible benefits being
taken into account. It was also claimed that the equipment
then installed would operate satisfactorily for a further four
years and that during this period, at the rate of savings and
salary rates applying in 1965, there would be a net financial
gain equal to at least three times the purchase price of
the computer.

(i) M. M. Powell, A.A.S.A. "Practical Results of a Computer
    Installation in the Electricity Trust of South Australia"
    in The Australian Accountant, April, 1966.

277.   In view of the study undertaken by the Electricity
Trust of South Australia and the importance placed by the McKinsey
survey on the recording and analysis of A.D.P. costs we questioned
several departmental witnesses on this aspect.

278.   Mr. Harris informed us that the Department of the
Treasury has not undertaken an overall study of the economics of   Q.698 and
conversion of Treasury accounting procedures from manual methods   Q.699
to processing by computers and that he was unaware of any study
having been made in the Commonwealth sphere along the lines of
that undertaken by the South Australian Electricity Trust.
Although such a study would be a difficult task due to the
variety of uses to which computers had been put by the
Commonwealth Government, he considered that it would be useful   Q.741
if such a study were to be made. He added that a continuing
assessment should be made of the efficient usage of equipment
purchased by the Commonwealth. He indicated that the
Interdepartmental Committee would be a suitable body to undertake
such a task and that he would fully support any move that was to be made
to extend, if necessary, the terms of reference of that Committee
to enable the work to be undertaken.

279.   In regard to criteria that may be used for costing
following the installation of equipment, Mr. Gleeson stated that
so many factors are involved in costing that costs alone should
not be regarded as a criterion. No general review has been   Q.849
made and he considered that such a review would be premature   and Q.850
as many of the applications are currently in the process of
implementation. As at the 31st March each year, however, the
Public Service Board has obtained from departments a report of
activities in their management services fields covering organisation
and methods reviews, industrial engineering and A.D.P. He added
that a general progressive review of achievements in the A.D.P. Field
is made by the Public Service Board in association with the
departments.

280.   On the question of whether the Interdepartmental
Committee on A.D.P. acts as a continuing supervisor of the
whole operations of A.D.P., Mr. Gleeson informed us that the   Q.1049
Committee interests itself in a broad way in the progress
towards implementation of systems and concerns itself in detail
in particular cases. However, the Committee is not able to

provide surveillance of the continued operation of the system.

281.   In regard to the type of survey undertaken by the
Electricity Trust of South Australia Mr. Gleeson pointed out
that the nature of the system operating there prior to the   Qs. 1071 &
introduction of A.D.P. is not known and may not have been the   1073
most economical. In the case of the Commonwealth Service,
operations are already highly mechanised and hence the scope
for savings arising from the introduction of A.D.P. is not
great. He indicated that progressive reviews are made by
particular departments but that no written annual review has
so far been made.

282.   Mr. Pridmore agreed that there would be very   Q.1512
great merit in attempting to assess the value of achievements   Q.1513
made in data processing through the use of computers in the
Commonwealth Service. He emphasised, however, that in the case
of the Commonwealth Service there is a vast range of computer
usage and it is very difficult for many departments to cost
expenditure met on particular projects. In the case of A.D.P.   Qs. 1512
itself the project becomes fairly well defined and the costs   & 1513
associated with its implementation become more clearly
defined, arising from the analyses and investigations undertaken
in order to reach a stage where material can be placed on a
computer. However, at the interface between the manual system
and the computer system, the definition of effort and its
related cost becomes more difficult to measure. This is
particularly so in the case of the Commonwealth Service. In
the case of the Bureau of Census and Statistics, he informed us
that an arrangement had been established whereby every job put   Q.1561
on the computer is costed in terms of computer time used. The
costing of the total project, however, including the clerical
procedures involved, would require substantial alterations to
be made to the manner in which work is costed in the
Commonwealth Service.

283.   Mr. Gleeson expressed the view that inter-   Q.982
departmental charging is an effective way of ensuring that   Q.985
                                                                             Q.986
efficient and economic use is made of a computer particularly
in the scientific field.   With regard to commercial
applications, however, he indicated that as an installation
may have been designed to process more data than it will be

processing during the early stages of its usage (because in
commercial type data processing a team effort is usually
directed towards the development of a fully integrated data
processing system) he doubted the wisdom of inter-depart-
mental charging for time used on the computer.   He also
stated, however, that serious consideration will need
to be given to charging for commercial computing within
the Commonwealth Service in the future and that this will
be something for Treasury to pursue in due course.   Mr.
Pridmore expressed the view that while the Bureau of Census
and Statistics does not charge users for time used on the
Bureau's computer, it should do so.   He considered that
user departments should be aware of the cost of using
computers and this awareness is not achieved unless charges
are actually levied.   In addition, the levying of charges
would impress upon users the need to develop efficient
programmes for use on computers.   Referring to American
experience he indicated that the A.D.P. Division of the
Bureau of the Census in that country charges each Division
of the Bureau for its use of the Computer.

Qs. 1561,
1584 and
1585

284. Dr. Lance stressed the importance of computer users
appreciating the value of the service which they receive.
He pointed out that in general there are three types of
computer installation.   In the first case, the computer may
be owned and operated by a section of a Department for its
exclusive use.   In the second case, the Computer may be
owned and operated by a department with one of its sections
providing a service for other sections.   In the third case
the computer may be owned and operated by one department but
does not provide exclusive service for that department.
In the first case referred to, the operational costs of the
computer are usually absorbed by the department concerned.
In the second case referred to, the computer section may have
a budget to cover operational costs and in these circumstances,
computer time is provided without charge to other sections
of the department who might not always appreciate the value
of the service provided.   In these cases inefficient programmes
may be written and used repeatedly with the result that
management loses all sense of the true costs of the projects
involved and the capacity of the computer is taken up sooner
than would otherwise occur.   In the third case referred to,
he said that inter-departmental charges may be made to
avoid the subsidising of one department by another.

Exhibit
85/5

285. The Treasury Observer, Mr. Cowie, expressed the view that   Q.1237
for accounting applications of A.D.P., the system of making a
direct financial charge is probably the least satisfactory
method of control, since agreed time-sharing may be planned,
having regard to current operating needs and need not be
costed for the purposes of control. For scientific and
mathematical applications, however, he indicated that an
unexpected demand for computer time could necessitate the
purchase of time from outside installations.

286. In view of the nature of the evidence submitted relative
to interdepartmental charging for the use of computer time
we asked the Treasury Observer whether the Department of the
Treasury had considered preparing a notional cost analysis   Q.1290
for each Commonwealth Department.   In reply the Department
of the Treasury stated that it was broadly in agreement with
the views expressed in our Fifty-Fifth Report that, subject   Committee
to certain exceptions, Your Committee doubted the   File 1965/3
desirability or necessity for one department, as a general   P.P. No. 87
rule, to charge another for any service or function.   of 1961
Consistent with this view, the Department had examined closely
a number of interdepartmental payments and in several of these
the payments had been abandoned.

287. With regard to the question of whether or not the Bureau   Committee
of Census and Statistics should charge departments for time   File 1965/3
used on its computers, the Department of the Treasury
expressed the opinion that this would create unnecessary
administrative work.   It stated that all departments using
the computers would be required to estimate, more than twelve
months in advance, the cost involved for a financial year.
The Bureau would be required to calculate a unit rate for usage,
to time and cost each client's usage, to raise and issue accounts
(on which receiving departments would have to spend time on
examination and authorisation for payment) and to follow up
recovery of the amounts claimed.   It added that having done
this and having received the amounts claimed the Bureau would
merely repay them to the Consolidated Revenue Fund.   The net
effect of these actions would be the expenditure of a great
deal of administrative and clerical effort which would result
in no expenditure being made from the Commonwealth Public
Account and more importantly, would not have increased operating
efficiency.   The Department stated that the present administrative
controls exercised by the Bureau provide for current usage to be
determined on a mutually agreed time-sharing basis by all of the
parties involved and that this provides adequate safeguards
against excessive or inefficient usage.

(v) OBSERVATIONS AND SUGGESTIONS BY WITNESSES

288. During the course of our inquiry a number of
observations were made by witnesses in connection with the
planning,   and implementation of A.D.P. in the
Commonwealth Service including implementation of
administrative and commercial applications, the question
of hire or purchase of equipment, and tendering
procedures.   In addition specific suggestions
were made in support of the establishment of
a network of Service Bureaux for general purpose computing.
The main observations and suggestions made are set out below:-

(a) Implementation of A.D.P.

289. Mr. Hall claimed that the introduction of A.D.P. to   Exhibit
the many administrative and commercial applications within   85/1
the Public Service has not proceeded at the same rate as
scientific computing and that in their approach to the
purchase of computers, Government Departments have been   Q 63
ultra cautious, to the point where the purchase of a
computer has become a major operation for any department.
He added that even after specifications have been issued
and evaluated, and an order placed with a manufacturer, a
long period of time elapses before an installation is
actually made.   Hence the feasibility study reports and the
estimates on which the decision to instal a computer are
based, are invalidated.

290. In reply to a question requesting information on the
manner in which a Government Department would acquire a   Q.64
computer, Mr. Hall indicated that initially a Department
would commence an investigation, staff to undertake the
study would be selected from the Organisation and Methods
section of the department and their exposure to A.D.P. would
then be effected by attendance at a systems analysis course
conducted by the Public Service Board after which, an officer
may be sent to Britain or the United States of America for
experience in similar departments in those countries.

After returning to Australia the officer may then form an A.D.P. group
and commence a study for the Department. He expressed the view
that this experience, while useful, has been limited and that
during his early association with the Public Service Board's
training course he had observed on a number of occasions that
departmental officers were being exposed to a virtually outmoded
technology.

291. On this point, Mr. Gleeson stated that during the period
to which this criticism referred, the equipment on which
officers of the Commonwealth Service were being trained was
the best available in Australia and that he did not agree   ?.899
with the criticism.

292. Mr. Hall also claimed that lack of commercial application   Exhibit
knowledge at the operative level after installation has   85/1
inhibited implementation of A.D.P. within the Service and
that, so far, a large amount of experience has not yet been   Q.71 & 95.
gained in this area.   He suggested that the transfer of staff
from departments with two or three years of deep experience to
departments undertaking exploratory and feasibility studies,
or to those departments with recent access to equipment, may
enable the latter departments to determine sooner than
otherwise the manner in which they should proceed to acquire
and apply automation to their data processing functions.

293. While Mr. Hall claimed that the introduction of A.D.P.   Q.74 - 75
by the Government   had made a significant contribution to
the efficiency of the service and that while initial entry
by the Commonwealth Service was in scientific computing,
providing appropriate provision was made prior to
installation, there was no reason today why one type of computer
with the appropriate peripherals could not be used for both
scientific and commercial applications as the two forms of
usage may be complementary.

294. With regard to management involvement in the
introduction of A.D.P. in the Commonwealth Service, Mr. Hall   Q.76
expressed the opinion that in the early stages
top management was not sufficiently involved
in the procedures.   He claimed, however, that currently,
the most senior officers are extremely active in the field
and participate directly in A.D.P. projects.   Mr. Hall
told us that where this had occurred, the installations
have been very successful.

295. Mr. Hall expressed the view that the main reasons for
the level of administrative and commercial computing not being   Q.100
as advanced in the Commonwealth Service as in the scientific
computing field are that it was introduced later and on a
different scale to that of scientific and specialist computing.
He commented that an understanding of the total information
requirements of an organisation or department is desirable :   Q.103
to achieve the most effective use of a computer installation.
However, he claimed that this could be achieved at the same
time as smaller applications are being developed, so that
personnel are being trained and knowledge and experience are
being obtained simultaneously.   He said that if this method
is adopted, that when all applications are finally implemented,
immediate or relatively early efficient operation of the whole
system should be achieved.

296. Mr. Hall expressed the opinion that the Commonwealth
Service could have been further advanced in its A.D.P.
applications if it had, in the early stages of its   P.64
programme acquired smaller machines for departmental usage
since this would have had the advantage of personnel gaining
experience within their own departments.   He claimed that
this would not have been costly and that a small computer
installed in a department could have become effective within
a relatively short space of time with limited application.   He
said that from this point and assuming basic experience and
exposure to A.D.P., the decision to move, on a practical basis,
into a larger installation could perhaps have been effected
more smoothly.

He claimed that this would have helped the development of
commercial applications within the Commonwealth Service and   Q.64
again drew our attention to the fact that while the Service
is advanced in the field of scientific computing, it has
been very slow by comparison with private enterprise in
adopting commercial applications.

297.   Mr. Gleeson disagreed with the statement that a long   Q.949
period of time elapses between the commencement of an
exploratory study and the placement of an order for a
computer. With regard to the observation that administrative
and commercial A.D.P. applications within the Commonwealth
Service had not proceeded at the same rate as scientific
computing be contended that this differnce arises from the   Q. 977
different nature of scientific and technical computing on
the one hand and commercial type data processing on the
other.   He said that the development of commercial type
A.D.P. systems is much more complex than the development
of scientific type systems and that this is the basic reason
for the different period of time involved in the three
types of systems becoming effectively operational.

298.   Mr. Harris indicated that the present method by which   Q.802
Departments acquire equipment is highly satisfactory and
that it is a very involved and complicated procedure requiring
that care and attention be given to the purchase of equipment.
He also said that the systems operated by the Commonwealth Service are
complex and open to public criticism in every respect, and
that this requires a considerable amount of effort on the part
of Commonwealth officers to ensure that a change of this
kind is made after the most careful thought.   He expressed the
view that the Commonwealth Service had not been too cautious,
having regard to the problems, difficulties and magnitude
of the transactions involved, and also that the procedures are
not lax in any way.

299. Professor Ovenstone disagreed with the observation
that the Commonwealth Service had been slow in introducing
computers into the administrative areas of government.
He indicated that criticisms of this nature would be based
on the nature of administrative applications. He said that
the Government had sponsored very advanced developments
in this area and that in administrative and clerical work,
including invoicing, billing, stock control, and other
accounting functions, some of the systems in Government
installations are "well within the forefront" of overseas
developements.

Q.278
279

(b) Hire and Purchase of Equipment

300. With the exception of three small machines, computers
currently installed by Commonwealth Departments have been
purchased while approximately one half of those installed
by statutory Authorities have been purchased, the remainder
being on hire.

Report of
the
Auditor-General
1965-66

301. With regard to the Government's decision to purchase
rather than rent A.D.P. equipment, Mr. Hall indicated that
there are advantages to be gained from renting such
equipment. He said that a machine that is purchased may
be replaced within two or three years by another which is
twice as fast, and would allow for expansion and that the
cost of rental would be lower than the purchase price of the machine
initially installed.   He indicated that if improvements in
Technology continue at their current rate, rental must offer
advantages, but this would not be true in all circumstances.
He said that because the Government acquires A.D.P. equipment on
a large scale it has been able to purchase it on
better terms than has industry.

Q.44

Q.105

302. He expressed the opinion that had the Government
installed equipment on a rental basis three or four years ago
staff would have been available to implement A.D.P. applications
more rapidly.

Q.66
Q.67

303. Mr. O'Neil indicated that the Government is in a
unique position in that, providing its initial purchases
of equipment are correctly made, its requirements should be
met by that equipment or by an expansion of the basic system   Q.218
rather than by its replacement after a period of four or
five years.   If a department's requirements outgrow its
installed system there would almost certainly be another
department which could acquire that system when it is
replaced in the former department by a larger system.   He
expressed the view that in general the Government should
purchase rather than rent equipment.

304. Dr. Lance stated that, from a scientist's viewpoint,
purchasing rather than renting equipment is to be preferred.   Qs. 421 &
He added that a scientific organisation which is in a position   422
to re-orient its equipment as its knowledge, requirements
and expertise develop must find that purchase of equipment
is preferrable to rental.

305. Mr. Gleeson indicated that the question of purchase
or rental of A.D.P. equipment is basically a matter of   Q.1029
economics.   First, a break even point must be considered,
below which it would be cheaper to rent equipment and beyond
which it would be cheaper to purchase.   On the basis of
single shift operation, this break even point is estimated
to be four to five years and that this point will be
reduced if second and third shifts are introduced.   He said
that requirements would therefore determine which method
of acquisition is adopted and that the Commonwealth Service
has rented equipment where the need was of an interim nature,
pending future developments.   Equipment has been purchased when
the request was for equipment which would be used beyond the
break even point.   He added, however, that it cannot be
said that under all circumstances either rental or purchase
is the preferred proposition.   He said that the Public
Service Board has taken the opportunity to progressively
re-assess its approach to the question of rental or purchase
and it has not found any defect in its policy.

306.   With regard to a Treasury evaluation of the   Q.809
merits of hire as against purchase of A.D.P. equipment   Q.814
Mr. Harris indicated that a comparison of methods of
acquisition has been made on each occasion on which a
purchase proposal has been placed before the Commonwealth
Stores Supply and Tender Board. He added that, so far,
the conclusion has been reached that purchase is the
most economic proposition but that he was not aware of any
retrospective economic evaluation of the merits of purchase
or rental as a method of acquisition by the Commonwealth
Service having been made.

307.   Mr. Archer doubted that he was in a position   Q.1607
to comment on the merits of purchase versus hire of
A.D.P. equipment because until the advent of A.D.P.
all of the Bureau's equipment was hired. With regard
to the purchase of hardware as against data preparation
equipment, he indicated that even under a hiring
arrangement all the benefits of advanced techniques
may not necessarily accrue to the hirer since it may
not suit the supplier to make these benefits readily
available if he considers that the installed equipment
is performing satisfactorily.

308.   With regard specifically to data preparation   Q.1568
equipment, Mr. Pridmore informed us that in certain
respects changes in this equipment are fairly rapid
and that such equipment, being subject to heavy
usage by operators tends to deteriorate fairly
quickly in some of its component parts. He indicated
that for these reasons it is considered that data
preparation equipment should be hired. He claimed that
the cost of changing programmes for use on a new machine,
in learning to operate it, in training staff and like
matters is as great whether the machine concerned is
hired or purchased.

(o) Tendoring Procoduro

309. With regard to the methods of purchase and acceptance   Exhibit
of hardware and computer consumable items, Dr. Lance stated   85/5
that the Stores Supply and Tender Board should realise that
computers cannot bo purchased in the same manner as other items
of office equipment. He said that computers are often on long
term delivery, i.e. for more than twelve months, and also that
the successful manufacturer may modify equipment or introduce
a new model before delivery is completed. He suggested that
some floxibility within the financial limits to which a user   Q 471
had boon originally committed should be loft in contracts to   Q 479
enable departments to take advantage of such' improvements.
Ho informed the Committee that acceptance tests for A.D.P.   Exhibit
equipment are essential, and are to some extent of a very   85/5
specialised nature. Ho indicated that the method of acceptance
used by the British Government i.e. a support unit, avoids
the need for technical staff to certify acceptance certificates
so that payment may be made within a given financial year.
With regard to this suggestion Mr. Harris indicated that such a   Q.744
support unit oxists in the staff of the Public Service Board
and that its expert knowledge is available to the Intordepartmental
Committee and to all Commonwealth departments.

310. Dr. Lance said that in Australia thore are three
companies supplying punched card oquipment and about six
companies supplying lino printer stationery. He claimed to be
unaware of any tendency towards monopolisation or restrictive   Exhibit
trade practices on the part of the industry supplying computer   85/5 and
consumable supplies and advocated that contracts for these   Qs. 482 and
items should bo let in a manner which would encourage   489
competition. Mr. Hall indicated that there is intense
competition in the punched card market both in Australia
and in overseas countries.

Mr. Harris informed us that thore are bulk contracts   Q.772
for a number of items of computer consumable supplies,
but that some are let to more than one supplier because
in certain cases particular computers have special
requirements.

312. Mr. Shaw indicated that considerable effort is expended   Q.1539
in the evaluation of competing tenders on a uniform, fair and
unchallengeable basis. He said that bench mark problems and
performances of machines are set, scheduled and examined in
detail, and performances of machines in various circumstances
are also scheduled and examined in detail. He claimed that in
this way the performance, cost and capacity of each of the relevant
pieces of equipment are compared. He said that support that is
offered by way of software availability, capacity to expand,
delivery times and other factors are taken into account in
order to thoroughly evaluate each aspect of each of the machines
tendered. He informed us that in this way a decision is reached
and that in his experience there has not been any bias in any way
in favour of one supplier, nor a choice made where it had not been
deserved.

313. Mr. Harris, Chairman of the Commonwealth Stores Supply   Q.637
and Tender Board, indicated that attention has been given to the
statement of software and training requirements in specifications
in as accurate a manner as possible. He expressed the opinion
that there is difficulty in placing a monetary value on the
words used by companies in their tenders. He said that departments
endeavour with great care to assess this matter and also that the
Interdepartmental Committee attempts to do likewise and with as
much care as is given to its assessment of hardware tenders.
He added that the Stores Supply and Tender Board, as a non expert
body, must tend to rely on assessments made by the department
concerned and the Interdepartmental Committee but that software
is not overlooked by the Stores Supply and Tender Board.

314. With regard to the development of computer systems,   Q.677
Mr. Harris said that ideally a large amount of systems analysis
should be undertaken on major tasks designed for a particular
computer installation before the specification is written and
tenders are invited.

315. In relation to specifications for both hardware and   Q.1619
data preparation equipment, Mr. Archer informed us that the
Bureau specifications were framed in such a way that it was
possible for alternative equipment to be offered and that the
Bureau's tender document had provided that any tenderer may
offer equipment to meet whatever he regarded the specification
to require.

316. Mr. Veel indicated that the computer industry was aware
of claims that Commonwealth purchases had been made on the
basis of hardware considerations alone. In regard to such
claims, Mr. Glooson stated that price, characteristics of
hardware and software support offered by the company in
the way of programmer assistance and training and the power/cost
ratio of the equipment were all taken into account in the
evaluation of tenders. Other factors considered are the
production status of the equipment, delivery date, and the
expansibility of the equipment in the light of estimated
future requirements. He indicated that the Stores Supply and   7.1065
Tender Board would not pay undue regard to software included
in the purchase of a computer since it would assume that
such an assessment had been undertaken by the Public Service
Board, the Interdepartmental Committee and the department
concerned. He indicated that very close attention is given to
the software accompanying the computer being acquired.

317. Mr. Veel expressed the view that there is a need to reduce   7.664
the present wasted effort on the part of suppliers in tendering
for government A.D.P. contracts. He said, for example, that
seventeen companies may tender to meet a specification.of which
perhaps four or five may be considered. He suggested that a
form of bidders meeting could achieve improvements in this
method of tendering. He claimed that the cost of meeting a
tender could amount to $50,000 representing a considerable outlay
to the industry. He indicated that, generally, the industry   7.665
is not dissatisfied with the quality of departmental specifications.
He considered that Government departments make intelligent use
of advice available from companies in the selection and use
of computers. He said that the Government has a group of
extremely well qualified officers in this field, and that they
are perhaps better qualified than many people in the supplying
companies. He added that a great deal of expertise is required
in the assessment of software required for A.D.P. applications.

318. Mr. Hall indicated that as only one supplier would
receive a contract when let, the Department concerned could
convey the nature of the problem to a group of bidders at
a conference where it would be obvious to some suppliers
that they should not bid for the contract.   He indicated
that in some cases this could be an effective way of
purchasing equipment for a Government Department and that
it is used in a number of cases in the United States of
America.   In that country, however, a considerable amount
of knowledge has developed and there has been a move towards
seeking requests for price quotations.

Q 70
Q 73

319. Mr. Harris expressed the view that the aim of bidders'
conferences would be to enable a department to modify details
of a proposed specification.   He understood that departments
already have extensive discussions with computer companies
as to the current state of technology in the industry so
that all recent development would have been considered in
the preparation of specifications.   He said that such a
conference was not intended to be a substitute for the
formal tendering procedure and that he would not favour
any arrangement which led to termination of the public
tendering system.   He also expressed the view that
individual discussions by Departments with companies could
produce more intelligent results than a bidders conference
since the latter could be confusing to Departments.   He
indicated that expenditure incurred by computer suppliers in
seeking government business is not peculiar to the computer
Industry and that any company tendering for large contracts
is involved in considerable expense in submitting a tender.
He said that a great deal of care is taken in the preparation
by departments of specifications and in their approval by the
Interdepartmental Committee with the intention of avoiding
this problem of excessive expenditure by Companies.   He
indicated that if a Company incorrectly reaches the conclusion
that it is a strong contender for a particular contract the
responsibility for this view must be with the Company itself.

Q.803

Q.804

Q.683

320. Mr. Gyngell expressed the opinion that a bidders
conference would not differ in principle from the present
method of acquisition of computers by the Commonwealth government.   Q.597

321.   With regard to tendering procedure Mr. O'Neil   Q.208
indicated that one of the greatest problems in tendering
procedure is the system of calling for quotations on the
basis of written documents which is a fairly general practice
for large acquisitions in industry and for the Government.
He said that for its own sake an organisation must present
a document to ensure that it is assessing its problems clearly.
At the same time, from the point of view of both the supplier
and the purchasing organisations, discussions with the supplier
should develop over the period in which the application is
being considered. He said that in this way the supplier would
appreciate the problem of the user and the user would obtain
the benefit of the supplier's experience in similar circumstances.
He indicated that in purchasing computers the choice of
manufacturers should be narrowed over a period of time to a
short list of normal suppliers. He said that the Government
approach to purchasing is somewhat different from that of a
commercial user in that it is constrained to a tendering system
which virtually ensures that every possible supplier is   Q.215
examined in exhaustive detail. In these circumstances Government
departments are unable to reduce the number of suppliers or
range of equipment which they will consider.

322.   Mr. Gleeson informed us that it would be possible
for the supplier of original equipment for an installation
to lower his price when tendering for equipment and having   Qs. 1085 &
secured a contract to raise his price when offering additional   1086
equipment for the enlargement of the initial installation.
He stated, however, that this was not a valid reason for
changing the traditional system of tendering. He said that
in certain situations there need not be a "tie" to the original
supplier although generally, because of critical factors such
as programming of applications and possible reprogramming that
may be involved in transferring to equipment supplied by another
manufacturer it is likely that a second installation would be
supplied by the company which had supplied the original
equipment. He indicated, however, that this is not inevitable.

323.   Mr. Pridmore informed us that in relation to more   Q.1530
modern types of data preparation equipment, there may be good
reasons for this equipment being related to computing equipment.
He expressed the view that should expansion of an installation
be contemplated, there is no doubt that the original supplier's
equipment should be used, and that this would be general practice
throughout the world. An example of this being, that should an

additional printer be required, the electronic circuitry of
a printer from the original supplier would be designed to match
the remaining parts of the manufacturer's equipment.

324.   Mr. Archer indicated that a purchaser would not   Qs. 1621 &
be "tied" to an original specification and that if a second   1623
computer was required, new tenders would be called. Mr. Harris
informed us that should additional ancillary equipment be
required it would be included in the class of machines provided   Q.718
for by Treasury Directions and its acquisition would therefore
be processed by the Commonwealth Stores Supply and Tender Board.

325.   Mr. Shaw advised us that as data preparation equipment   Q.1186
is regarded as office equipment, a department contemplating its
hire would advise the Public Service Board and seek its comments
in addition to approaching the Stores Supply and Tender Board.
He added that the Interdepartmental Committee would expect to
be advised and its advice sought, should departments contemplate
either the hire of equipment or the use of a Service Bureau.

326.   Mr. Archer informed us that all decisions regarding   Q.1616 &
rental or purchase of A.D.P. equipment are made by the   1617
Public Service Board. He said that he was satisfied with
the present procedure of purchasing or hiring equipment
through the Commonwealth Stores Supply and Tender Board.
Mr. Gleeson indicated that consideration has been given to   Q.1618
alternative forms of purchasing, but he said that it had
not been possible to improve on the present method of   Q.873
tendering and purchasing. With regard to errors that may
have occurred in government purchase of A.D.P. equipment,
Mr. Veel expressed the view that it would be unlikely that   Q.670
a catastrophic decision would have been made. He indicated,
however, that there may be disappointment in the software
that is ultimately provided.

(d) SERVICE BUREAUX

327. Mr. Veel considered that it would be logical to have
a sensible sharing of equipment within a group of Government
organisations and that such an arrangement should be feasible
as the Government pays more attention to the acquisition of
equipment, including preparation of specifications than
would be expected from the average private purchaser.   He
also claimed that the establishment of a computer utility or
a form of centralised installation where one authority has a
degree of control over the work processed by the system
would afford a means of control for the Government over
ambitious departments seeking to install computers.

Qs. 621 to
624 and
658

328. Mr. Gleeson informed us that the fundamental point in
regard to the desirability of interdepartmental sharing of
equipment is whether the nature and scale of a Department's
Automatic data processing is such as to warrant the
establishment of that Department's own separate facilities or
to use facilities offered by an organisation operating in the
nature of a Commonwealth Service Bureau such as the Bureau
of Census and Statistics.   He also indicated that a
determining factor in relation to the timing of the introduction
of an installation of this nature would be the staff shortage
anticipated for some time to come.   He said that co-ordination
of A.D.P. has been achieved by the Commonwealth Government
in the form of Service Centres, in the case of scientific and
technical computing at the C.S.I.R.O., and for commercial computing
at the Bureau of Census and Statistics.

Q 925

Q.870

329. He indicated that, in the short term, organisations
currently using the C.S.I.R.O. and Bureau of Census and
Statistics Installations will almost certainly continue to
use them, but that the period for which they will continue to
do so will require determination in the future.   He added
however, that there was some concern at the developing
situation whereby the Bureau of Census and Statistics network
may not be able to cope with additional demands being made
upon it.   Future requirements of A.D.P. equipment are difficult
to assess since departmental needs change and there may be basic
developments in equipment affecting the approach to assessment.

Q 882

Q1050

He informed us that consideration had been given to the
desirability of either establishing additional installations
or to increasing the size of existing installations such as
that of the Bureau of Census and Statistics.   He said that
a survey of potential A.D.P. needs within the Commonwealth   Q883
Service had been undertaken by the Public Service Board
in 1961, and that the position is currently being reviewed _
to include possible future usage of the Bureau of Census and
Statistics network.

330.   With regard to future usage of the Bureau's network,   Q 1629
Mr. Archer informed us that it was originally intended that   Q1631
the basic equipment would be in use until about 1969 or
1970 and that this estimate was currently valid.

331.   Mr. Pridmore indicated that future development of the   Q 1535
facilities of the Bureau of Census and Statistics could take   Q1537
one of several possible forms, including the establishment
of large numbers of installations, or the introduction of
larger installations on a regional basis, or thirdly the
development of very large scale Service Bureaux.   Each of
these however, would present problems of implementation.

(e) LARGE-SCALE COMPUTING FACILITIES

332. Mr. Gyngell stated that time sharing techniques offer   Q.577
an opportunity to optimise the use of both computers' and
users' time, since it provides for the running of a
number of different programmes at the same time within a
computer. He informed us that while technically, computers
are now very rapid in operation, the methods of input to and
output from the computer are relatively slow. He informed
us that time sharing permits the computer to process more
than one programme simultaneously, so long as the input and
output equipment is not used for more than one programme
a t the same time.   On a time shared basis, computer time
is being used which would otherwise be wasted. He indicated
that up to 15 programmes may be processed simultaneously
providing sufficient peripheral equipment and storage capacity
exist within the installation to hold the programmes. He
added that this method of A.D.P. operation is becoming standard
procedure in the use of computers.

333.   He   suggested that the Commonwealth Government   Exhibit no.
should enter the field of Computer Service Bureaux in   85/6
competition with those Companies already offering bureau
facilities in Australia.   Applications processed by such
bureaux were said to include Commercial projects required at
regular but infrequent intervals such as share registrations
and monthly sales statistics; technical computations which
may require powerful equipment which would be uneconomic for
a single user; management science techniques such as resource
scheduling; programme testing for organisations gaining
experience in computer techniques and regular usage for
ordinary commercial applications such as invoicing and payrolls.
He claimed that commercial Bureaux provide valuable services
to many users.   He added, that there is a great number of
small businesses for which the use of a computer is uneconomic
in the present situation, either because the business is too
small or because the use of a large computer is cheaper than the
use of a small one.

For these reasons he suggested that for computers to be economic
for these potential users, a computer grid system in the
form of a public utility should be established and claimed
that this service could be provided almost immediately. He
suggested that a development of this type could yield
substantial benefits for Australia.

334. In developing his proposal Mr. Gyngell stated that
large computers could be established in regional centres,
each connected to a large number of users and to each other
over data transmission lines. He said that input - output
consoles could be hired by users who would be charged for the
use made of the computer.   Such a scheme   Exhibit no.
could be started in a small but useful manner and then   85/6
expanded as it met with widespread acceptance.

335. He stated that the Government should not content itself
with being a large, or very large computer user, encouraging
the use of computers merely by example. He indicated that
such an example tends to foster the belief that only very   Exhibit no.
large organisations could justify the use of a computer and   85/6
that this belief is becoming increasingly more illusory.
He stated that a computer grid system is the logical method
of providing low cost computer facilities and he suggested
that it be given urgent consideration.   Having
regard to the present development towards standardisation
of equipment between manufacturers, Mr. Gyngell said that the estab-
lishment of such a system should not unduly limit the choice of equipment
offering. He claimed that installation of a utility of this
nature is a necessary form of investment for this country and
that a similar complex is operating at the Massachusetts   Q.574
Institute of Technology in the United States of America.

336. Mr. Hall expressed the opinion that as time sharing is in
the initial stages of implementation, the experience of
manufacturers would be limited and that the benefits of time   Q.53
sharing have not yet been proven. He felt, however, that
due to the similarity existing between Government Departments,
time sharing might hold greater attractions for Government
operations than for those of private enterprise. He informed us
that the Canadian Government has embarked on a project which
incorporates time sharing machines which should prove to be
of great interest and he suggested that this project should be
studied by governments throughout the world to assess whether
or not it could be successfully adopted.

(vii) PROBABLE FUTURE IMPACT OF A.D.P. ON THE
ADMINISTRATION OF THE SERVICE.

337. Mr. Gleeson claimed that computer based systems will, Exhibit
particularly in the longer term, prove significantly more 85/9
economical and effective than would substantially expanded
manual or mechanical systems. He said that their use is,
and will be, a significant factor in the maintenance of a
modern and efficient public service. Although the cost of Q 919
implementation is high in terms of equipment and manpower,
the investment is primarily of a long term nature designed
overall to increase productivity in a general environment of
competing demands on available resources. He stated that
there is a limit to the extent to which predictions can be
made regarding the probable future effects of A.D.P. on the
administration of the Service, particularly those which
will arise through changes in technology. He noted that the
basic changes in hardware, such as the development of the
transistor and of chip circuitry have occurred over a
relatively short period and claimed that the authorities
concerned with the implementation of A.D.P. in the Commonwealth
Service have been able to ensure that development plans are as
flexible as is practicable and that systems are introduced
in such a way that foreseeable changes in technology can be
incorporated.

338. He also stated that the pace of extension of
A.D.P. applications will necessarily be determined to a large Exhibit
85/9
extent by the availability of suitable staff to implement new Q927
systems. He said that it has not been practicable, nor
would it be sensible, to attempt to develop all possible
applications simultaneously. Current applications, and
those under development have been judged to return the
greatest administrative, technical and scientific advantages.

He stated that the next major stage of A.D.P. development in the
Commonwealth Service will provide for the widening of the
scope of its application and for its extension to new areas of
application.   He added that the expansion of activities,
considered together with developing changes in technology and
associated equipment costs, will require careful examination
to determine whether it would be more practical and economic
to enlarge existing computer installations or to provide
additional installations.   He informed us that several
technological and allied developments can be expected to
affect the longer term usage of A.D.P. in the Commonwealth
Service including -

- the availability of more powerful and
  relatively cheaper computers, based on
  power-cost ratios;
- further development in peripheral equipment
  such as data transmission facilities,
  enabling a reduction in the total number
  of installations than would otherwise be
  necessary by permitting immediate access
  to computer capacity by remote users;
- technological change in data preparation
  equipment may allow the collection of data
  closer to its source, thus eliminating
  data transcription and reducing the cost
  of data processing;
- developments in computer operating systems
  and languages which should increase the
  productivity of programmes;
- development of sophisticated information
  systems which would facilitate research
  and reference work, thus avoiding
  duplication in research efforts; and
- an increased sophistication in planning and
  control systems enabling better overall
  control of government operations.

339.   Mr. Gleeson said that A.D.P. applications for scientific,
technical and administrative purposes are expected to become   Exhibit
more pervasive in the Commonwealth Service and by an evolutionary 85/9
process, to affect administration in a variety of ways.
He indicated that the introduction of Management science to   Q.1035.
the Commonwealth Service would be an evolutionary process,
as, under present conditions its broad application to large
organisations such as the Commonwealth Service would be a
lengthy procedure.   He added, however, that as computer
techniques become routine subjects within Universities, a
new type of manager will emerge.   In the short-term period,
however, the Public Service Board is endeavouring to impart
knowledge of A.D.P. methods to its senior officers.

CHAPTER 6 - CONCLUSIONS

339.   In deciding to initiate an inquiry into Automatic
Data Processing, Your Committee was mindful of the growing
awareness of Industry and Government alike in this field of
technology and of the rapid development of computer applications
both in Australia and overseas.   Your Committee itself had
encountered problems associated with A.D.F. in its various
inquiries into Departments and we had noted observations
made by the Auditor-General in his Reports to the Parliament
from 1963-64 onwards.   We were aware also of Reports on
other countries experience in this field.   Your Committee
felt that a useful purpose would be served if a general
inquiry were to be undertaken, in a context sufficiently
broad to embrace technological changes occurring
concurrently with the growth of computer usage
on the one hand and an examination of the co-ordination
processes involved in its introduction to the Commonwealth
Service on the other.   From this we sought to draw out
useful guidelines for management in this developing area,
with particular reference to the Commonwealth Service.

340.   Arising from the broad nature of the inquiry, Your
Committee extended its range of witnesses to include the
suppliers of computer and ancillary equipment to the
Australian market and acknowledged experts in the field of
computer usage.   This procedure enabled a variety of
evidence to be obtained and points of view expressed on
relevant areas of the Commonwealth Administration, as is
evidenced particularly by the observations and suggestions
made by witnesses for improving Commonwealth operations, and
enriched greatly an already stimulating and challenging field
of inquiry.

341.   As the evidence taken in the present inquiry does not,
by design, cover all of the computer applications within the
Commonwealth Service there are, of necessity, areas of
evidence recorded in this Report, on which Your Committee
would not, at this stage, feel competent to reach firm
conclusions.   At the same time, however, some of these areas
are of such importance and the evidence taken sufficiently

conclusive for us to offer tentative conclusions or observations which it is hoped might serve as guides to a successor Committee should it decide to conduct further inquiries into specific aspects of A.D.P. within the Commonwealth Government administration.

Computer Technology in Australia

342.   The evidence submitted suggests that while the number of computers installations in Australia has not been large compared with the number of installations in highly industrialised countries overseas, Australia's position would compare favourably with that of some of the more significant countries of Western Europe.   The evidence also suggests that Australia's growth rate for computer installations will be high compared with corresponding growth rates in overseas countries.

343. From the outset the Australian computer market has been supplied wholly by overseas-based companies, mainly of British or American origin.   It would appear from the evidence, that, by comparison with the position in some overseas countries, the supplying industry is in a competitive position, but at the present stage may not be highly profitable.   In these circumstances the evidence also suggested that a manufacturing industry might not be established in Australia within the next decade.

344. In regard to market growth for computers in Australia, estimates supplied by witnesses varied widely but suggested that by 1970 the number of computers installed might increase to a level in the vicinity of 1,200 to 1,400.

345. In regard to technological advances made within the computer industry the evidence shows that changes arising from research and development are now being implemented commercially at a more rapid rate than was the case a decade ago and this has resulted in declining costs of computation, based on power-cost ratios in industrial, scientific and commercial applications.

346. The evidence indicates that computers have already been applied to a significant range of scientific and commercial applications in Australia and that this range is expected to increase substantially in future years. The need to accelerate the rate and increase the range of applications, in response to the need for increased productivity was emphasised by witnesses.

Staffing and Education

347. It would appear from the evidence submitted that there is a world-wide shortage of skilled personnel in the computer industry. Conservative estimates relating to staffing in Australia suggest that whilst about 1,000 trained staff are available in 1966, about 12,000 would be required by 1970 and that the demand for trained staff would increase by about 1,500 per annum between 1969 and 1976. Witnesses emphasised the role which must be taken by educational institutions if the growth of computer usage in Australia is not to be impeded in the years ahead. Specific proposals for future education programmes were made by Professor Ovenstone. These and other related observations, which are set out in Chapter 3 of the Report are commended to the authorities concerned for examination.

Criteria by which Computer Installations may be justified and their efficient usage measured.

348. Chapter 4 of the Report contains criteria that may be adopted as guidelines to the installation and productive usage of computers. Some criteria referred to in that chapter were developed from a survey conducted into the results achieved in company installations in the United States of America. Whilst these criteria may be applicable to such installations, Your Committee recogn.ses that some of them, particularly those relating to profitability may not be applicable to Governmental installations where profitability in the commercial sense is not relevant and where the uses to which computers might be put could, in the public interest, be somewhat different from the

uses made of computers in commercial undertakings. Subject
to these qualifications, Your Committee believes, on the
evidence, that the following basic criteria are validly
applicable to computer installations and usage within the
Commonwealth Service:-

(i) Installation Criteria

. Exploratory Studies

349. In respect of each proposed A.D.P. system an
exploratory study should be undertaken to ascertain at
relatively little cost, whether the benefits likely to be
derived from the implementation of A.D.P. are sufficiently
evident to warrant the commencement of a feasibility study,
to define the areas within which such a system should be
applied and to determine whether the costs and inconvenience
of introducing an A.D.P. system are justified.

. Feasibility Studies

350. In cases where exploratory studies satisfy the
requirements mentioned, a feasibility study should be
undertaken to investigate, in particular, the department's
existing systems, procedures and reports, to determine records
and information required for efficient operation and to design
A.D.P. procedures for the maintenance of records and the
production of required information. Such a study should be
undertaken by a small group of officers with a knowledge of
the management needs of the department concerned and also an
understanding of the capabilities and limitations of computers
and other equipment and experience in management system
analysis and design.

(ii) Usage Criteria

. Scope of Applications

351. When computers have been installed, the applications
placed on them should cover the major functions of the
department concerned and should not be limited to accounting
and routine aspects of its work.

. Costs of Installation and Operation

352. Departments which have installed computers or
ancillary equipment to be used in conjunction with other
departmental installations should maintain accessible records
of their installation and operating costs from which
management appraisals of the use of A.D.P. equipment may be
made.

. Management Participation

353. It is clear that for departmental installations to
achieve maximum success in concept and implementation, the
Permanent Head of the department concerned should identify
himself with the project prior to the initiation of an
exploratory study and with all subsequent major phases of
acquisition, installation and operation. It is also
probable that the closer the level of the chief A.D.P. officer
in a department to the Permanent Head, the greater will
be the operative success of the installation.

. Normal usage of Installed Capacity

354 In regard to criteria relative to computer usage,
we were informed that capacity can depend on the nature and extent
of peripheral equipment in use and that a computer has a wide
range of capabilities. It was said that saturation point
is the determining factor in the introduction of new
equipment and that while additional equipment may be added
to the original computer to enable it to process more complex
problems and additional work, the value of this procedure
would be limited by the capacity of the original processor
portion of the computer. In the case of Commonwealth
installations, it was claimed that a two shift operation on
the basis of a five day working week would constitute normal
usage for A.D.P. equipment.

A.D.P. in the Commonwealth Service

355. Positive action for the development of A.D.P. in the
Commonwealth Service commenced in 1958. Whilst the planning
for commercial operation of A.D.P. in the Commonwealth Service
is the responsibility of the individual departments concerned,
overall co-ordination has been the responsibility since 1960
of an Inter-departmental Committee appointed by the Prime
Minister. This Committee comprises representatives of the
Public Service Board (Chairman) the Departments of the
Treasury, Defence and Postmaster-General

with representatives of other departments to be co-opted as required. The Secretariat for the Committee is supplied by the Public Service Board.

356. Your Committee supports the concept of an Inter-departmental Committee to undertake overall co-ordination between departments in the A.D.P. field. It feels however, that any observations which it might make as to the range of functions of that Committee, the composition of its membership or its success in the co-ordination role, would be premature at this early stage in a broad inquiry. In particular, for example, Your Committee has not had the opportunity to take evidence from Departments which have submitted A.D.P. proposals to the Public Service Board for consideration by the Committee, but which are not included in the membership of the Committee. Their experiences would require careful evaluation.

357. In its relation to the co-ordination of computer usage, the Public Service Board is vested with particular responsibilities under Section 17 of the Public Service Act. It also exercises certain responsibilities in regard to training which, as has been indicated, is a very vital area in A.D.P.; and it also provides direct practical assistance to departments in the investigation of computer methods and applications.

358. The role of the Department of the Treasury in A.D.P. includes the responsibility for the financial management of the Commonwealth's affairs, membership of the Inter-departmental Committee, administration of the Audit Act and the operations of the Stores, Supply and Tender Board.

359. The Treasury's function in the realm of financial management is traditionally more widespread than the field of A.D.P. and in general, constitutes the basis for Treasury participation in a wide variety of Commonwealth interests. In these circumstances, and having regard to the growth of Commonwealth expenditure on A.D.P. in recent years, our attention was drawn to the fact that the Commonwealth Statistician has represented the Department of the Treasury on the Inter-departmental Committee since its inception in 1960.

Your Committee is most anxious that its views on this
appointment should not be misunderstood. Having regard
to the nature of the Inter-departmental Committee's functions
and its power to co-opt members, Your Committee would express
some concern if it were to find that, with his wide
experience, the Commonwealth Statistician were not a member
of the Committee. At the same time, however, we must
question whether in the appointment of the Statistician as
its representative on the Committee, the Department of the
Treasury is able to exercise the same degree of direct
financial responsibility that it would feel bound to accord
to other interdepartmental committees and administrative
agencies on which it serves.

360. In regard to the administration of the Audit Act by the
Department of the Treasury, we note Mr. Harris' comment that
in practice, A.D.P. installations in the Commonwealth Service
had been modelled in accordance with existing legislation
but that a more efficient A.D.P. system could possibly
be devised in respect of some procedures if the Audit Act
or Treasury Regulations were to be amended. In particular,
he indicated that an examination is required of Section 34 of
the Audit Act, as that Section, in its present form, may place
some limitations on the efficiency of future A.D.P.
installations. We note with approval Mr. Harris' advice
that agreement has been reached with the Auditor-General
to seek urgent amendment to this Section and we trust that the
Department will give early consideration to the amendments of
other Sections of the Act and attendant Regulations and Directions
which in their present form, might impede the efficient
introduction and operation of A.D.P. in Commonwealth departments.

361. We note that estimates have been made of A.D.P. staff
requirements within the Commonwealth Service for the period up to
1970 and that whilst the Public Service Board does not expect
to experience problems rel tive to the recruitment of data
preparation staff or computer operators, difficulties have
been experienced in obtaining sufficient programmers in the
past and this difficulty is expected to persist in the future.

Compared with some 450 programmers available in 1966 in the
Commonwealth Service, about 1,500 are expected to be required by
1970 on the basis of a normally expected wastage rate of
approximately 10 per cent per annum. We note with approval the
assurance given by Mr. Gleeson that the Public Service Board is
making progress in overcoming the A.D.P. staff shortage within
the Commonwealth Service and that the Board's recruitment
for the Programmer-in-Training scheme, commenced in 1964,
has significantly improved the staffing position.

362.   The provision of training in the Commonwealth
Service is undertaken partly by the Public Service Board and
partly by departments within the Administration. In this regard
we note the views expressed by Mr. Pridmore that while the
Programmer-in-Training course conducted by the Bureau of
Census and Statistics and the Systems Analysis and Design
course (or Programmer Course) conducted by the Public Service
Board serve different purposes they are complementary in some
respects. This raises the question of whether or not the courses
concerned might be either repetitive or in conflict in respects
in which they are not complementary and we would expect the
Public Service Board to ensure that neither of these
possibilities should arise. We also note that whilst the
Public Service Board and the Department of Defence provide
training courses for systems analysts (or programmers) of three
months duration, Mr. Pridmore expressed the view that over a
period of six months it would only be possible to train
staff in the rudiments of programming. Your Committee
believes that due to the importance of Programmer training
and its close link with optimum usage of installations and
programmer staff requirements over the next few years, this
variety in duration of courses offered should be examined
by the Public Service Board and departments concerned without
delay.

363.   Management training courses of one-day's duration have been
provided by the Public Service Board for Permanent Heads of
departments, whilst management training courses of three weeks
duration have been provided by the Bureau of Census and Statistics
for senior staff of departments. We note with interest Mr.
Archer's remarks that if the resources were available to increase
the duration of the Bureau's course and if senior staff were able
to attend them, he would prefer the course to be extended and
that consideration had been given to offering refresher courses

to officers who had attended tho Bureau's oarlier courses.
Your Committoe would support the extension of tho Bureau's
present training course and would exhort departments to ensure that
suitable offioers aro made available to tako advantago of that
course and of such refroshor coursos as the Bureau finds it
is ablo to mako available.

364.   During our inquiry evidonoo was taken relative to
the question of conducting economic studies relating to the
costs of installing and oporating A.D.P. systems in the
Commonwealth Servioe. We note tho views oxpressed by Mr. Harris
that although suoh a task would provo difficult to accomplish
it would serve a useful purpose. Attontion is invited to
Mr. Harris' viow that the Interdepartmental Committeo would be
a suitablo body to undertako such a task and that he would fully
support any move that was mado to oxtend, if nocessary, the
torms of reference of that Committoo to enablo tho work to be
undertakon. We note also the viows expressed by Mr. Gleeson
that the Public Servioo Board obtains roports from departmonts
as at 31st March each yoar rolative to aotivitios in their
managemont servioes field including A.D.P. and that whilst
progressive reviews are made by partioular departments, no
written annual reviow has so far beon mado.

365.   Your Committee bolieves that the undertaking of
ecodomic studies of aohievements for eaoh Commonwoalth A.D.F.
installation, would prove to bo a valuable task and might well
elucidate whether or not optimum use is boing mado of equipment.
In this conneotion wo believe that the data relating to
installation and operating oosts of A.D.P. systems which we have
obtained readily from a wide rango of departments in connootion with
tho prosent inquiry may   prove usoful in suoh a study.

366.   , As an adjunot to the quostion of dovoloping economic
studies some witnosses suggested that inter-dopartmental oharges
should bo leviod on usor departmonts by dopartmonts supplying
computer servioes. In partioular it was suggostod that usor
departments should bo aware of the oosts of using computers
and that this awareness is not aohioved unless oharges are
aotually leviedi It was stated that the apparent provision

of free computer services can result in the preparation of
inefficient programmes and their repeated use with the result
that management loses all sense of the $true$ costs of projects
involved and the capacity of the computer is taken up sooner
than would otherwise occur. As indicated by the Department of
the Treasury, Your Committee examined the question of inter-
departmental payments in its Fifty-fifth Report, and, subject
to certain qualifications, doubted the desirability, or
necessity, for one department, as a general rule, to charge
another for any service or function. Whilst Your Committee
sees no reason to depart from the views expressed in the Fifty-
fifth Report, it believes that the arguments raised in support
of the levying of inter-departmental charges for computer
services are basically valid. In addition we believe that
Members of the Parliament should be able to make their own
assessment, in money terms, of the extent to which certain
departments are providing computer services for others.
In all the circumstances we believe that the objectives concerned
would be achieved if departments providing computer services
were to assess economic hourly charge rates for the use of their
computers and to apply these rates to the computer time used by
client departments. The annual figures resulting from these
calculations could, with advantage, be published for the
information of the Parliament either in the Report of the Auditor-
General or in the Report of the Public Service Board, both of
which already supply certain information relative to A.D.P.
operations in the Commonwealth Service.

367.   During the course of our inquiry a number of
observations were made by witnesses in connection with the
planning, implementation and use of A.D.P. in the Commonwealth
Service including administrative and commercial applications,
the question of hire or purchase of equipment
and tendering procedures.   In addition, specific
suggestions were made in support of the establishment
of a network of Service Bureaux for general purpose computing.

The main observations and suggestions made are set out in
part (vi) of Chapter 5 of the Report.   We would commend their
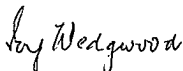consideration to the authorities concerned.

For and on behalf of the Committee:

Richard Cleaver
Chairman

David N. Reid,
Secretary,
Joint Committee of Public Accounts,
Parliament House,
CANBERRA,   A.C.T..

19th October, 1966.

GLOSSARY OF TERMS

A.D.P. Equipment   A machine or group of interconnected machines consisting of input, storage, computing, control, and output devices, which uses electronic circuitry in the main computing element to perform arithmetic or logical operations automatically by means of internally stored or externally controlled programmed instructions.

A.D.P. System   This term is descriptive of an interacting assembly of procedures, processors, methods, personnel and automatic data processing equipment which performs a complex series of data processing operations.

A.D.P. - E.D.P.   In general usage, these terms are synonymous.

Ancillary or Peripheral Equipment   Ancillary equipment comprises devices such as punched card machines, magnetic tape units and printers which are used to transmit instructions into the central processor portion of a computer and to receive information from it.

Central Processor   The portion of a computer which includes the circuits controlling the interpretation and execution of instructions.

Compiler   Part of the software which is developed to facilitate the writing of programmes.

Closed Shop Computing   The organisation of a computing group whereby all programmers using computer installation belong to the same computing group.

Hardware   The electronic equipment within a computer installation comprising ancillary equipment and the central processor.

Open shop Computing	A computer installation in which Programmers using the equipment may belong to any computing group.
Programme	The list of instructions which is fed into a computer, on punched or magnetic tape.
Programming Language	A computer language used by programmers to write computer routines or programmes.
Real time	The performance of computation at the same speed as the events being simulated, or at a speed which enables analysis or control of related and concurrent events.
Software	The programmes and monitor systems used to perform calculations with hardware i.e. languages and compilers.
Systems analysts	Before a programme can be written the application has to be analysed in great detail, and systematically re-arranged to exploit the capacity of the computer and to offset its limitations. This is the work of systems analysts.

INDEX TO EXHIBIT: