FINANCIAL ANALYSIS OF CAPITAL BUDGETING
IN A MATURE AIRLINE INDUSTRY

by

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SUBMITTED IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR THE DEGREE
OF MASTER OF SCIENCE

at the
MASSACHUSETTS INSTITUTE OF TECHNOLOGY

June, 1975

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May 9, 1975

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Submitted to the Alfred P. Sloan School of Management on May 9, 1975 in partial fulfillment of the requirements for the degree of Masters of Science.

ABSTRACT

During the rapid growth of the U.S. Airline industry in the 1960's, capital budgeting for new equipment was primarily influenced by rapidly rising demand and the desire to replace obsolete propeller aircraft. In a mature airline with lower growth rates, replacement becomes a significant factor in capital budgeting. When combined with the distorted age distribution imposed by historic actions and inflation, low growth provides a setting in which capital budgeting patterns can have significant impact on earnings and cash flow.

Through the use of an analytical computer model, the impact of various capital budgeting strategies were examined. This analysis led to four primary conclusions. First, with historical cost accounting and inflation, cyclic investment leads to cyclic earnings. Earnings would be substantially smoothed by adopting a smooth investment policy. Second, a cyclic investment pattern produces large fluctuations in cash flow. This produces financial problems in investing cash during inflows and producing cash during outflows. Third, discounted cash flow (DCF) must be examined as a function of time to be meaningful when evaluating investment patterns. Fourth, use of an indicator such as real investment per unit traffic is useful in smoothing investment and therefore earnings and cash flow.

Thesis Supervisor: E. Eugene Carter
Title: Visiting Associate Professor
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CHAPTER I

INTRODUCTION

The U.S. Airline industry over the last twenty years has experienced growth and technological change at rates and at a scale duplicated in few, if any, other industries. In the period from 1963 to 1969, the industry grew at a compound rate of 19.9% (as measured by revenue ton miles).\(^1\) The domestic trunk airlines went from virtually all piston powered airplanes to jets, in the decade from 1959 to 1969, achieving dramatic increases in productivity. In the three year period from 1966 through 1968, the U.S. trunks ordered 7.3 billion dollars\(^2\) of new flight equipment or, in other terms, an amount equal to their combined 1968 net worth of 2.4 billion dollars each year!

However, the U.S. Airline industry faces a different situation today. The four years from 1969 to 1973 showed a compound growth rate of only 4.2%. Technological innovation, while still significant, does not promise any radical change in productivity for the near future. The SST, once heralded as the next major step, seems to have fallen as a result of economic and political considerations.

\(^1\)Air Transport 1974 Facts And Figures, Air Transport Association of America, Washington D.C.
\(^2\)Ibid.
Whether the U.S. Airline industry has reached that magical point at which it can be called mature is debatable. However, at some point in time, growth rates must drop from the super-normal levels to ones more in line with the growth in GNP and/or population. Whether maturity was reached in 1970, or the current drop in growth is only temporary, maturity will come to the U.S. airlines, and probably sooner rather than later. If the current situation is assumed to reflect maturity, then strategies for the future can be examined in this setting. If growth resumes, the study should still be valuable as an aid in examining that inevitable future maturity.

This study is intended to examine one aspect of the situation in a maturing airline industry: capital budgeting patterns for future expenditures. It is not intended to examine cost trends, fleet planning, competitive strategies, regulatory actions or any of the other problems which form the total environment in which the airlines must make decisions. By focusing on the single issue of capital budgeting as influenced by financial considerations, it is hoped that some light will be shed on this critical segment. When combined with all of the other factors, careful capital budgeting should help considerably in the difficult transition from a growth-dominated industry to a mature one.

In order to examine the financial aspects of capital
budgeting, I have developed a model of a hypothetical airline rather than attempting to exactly duplicate all aspects of any one airline. I have relied extensively on data from three U.S. trunk airlines to develop the underlying base from which to start. Data from these airlines have also been used to illustrate certain concepts or situations.

**Hypothesis**

It is my hypothesis that the pattern of capital spending in a low growth airline can adversely affect its financial performance. In particular, if a cyclic pattern is imposed on capital spending, it will be reflected in a cyclic variation in reported earnings. Thus, it is possible for an airline, while attempting to minimize the impact of the economic cycle, to generate cyclic performance simply through uneven capital budgeting. There are several factors which make the current airline situation critical.

First, if the low growth rates continue, replacement decisions become much more important. At zero growth rate, the airlines face the replacement of better than two thirds of their asset base in the next decade. By contrast, if the growth rate were 20%, the investment for replacement would be an insignificant 10% of total investment by an airline 13 times larger than today. Thus, replacement of the 1966-1968 investment will be much more significant in a low growth air-
line than in one experiencing rapid growth.

Second, the large capital expenditures of 1966-1968 and low current expenditures have imposed a significant distortion on the fleet structure. In some cases, better than half the fleet dates from that three year period. As the 1966-1968 investment ages, the depreciation tax shield will be lost (1975 or 1976) requiring increased cash outflows. Then in the early 1980's the 1966-1968 investment must be replaced. Unless special steps are taken, a new investment peak will be generated and a cyclic investment pattern established.

The final factor is inflation. Normally, the impact of a cyclic investment pattern on earnings is smoothed by the relatively long depreciation period. However, since inflation changes the value of money with time and depreciation (under current accounting practice) reflects only historical costs, uneven investment and inflation result in an uneven depreciation charge. Thus, a cyclic investment during an inflationary period is reflected through depreciation to produce cyclic earnings.

Conclusions

The analysis presented here leads to some general conclusions regarding the pattern of capital budgeting in a low growth airline.

1. With historic cost accounting and inflation,
cyclic investment will produce cyclic reported earnings. The greater the inflation rate, the greater the amplitude of the fluctuations.

2. Cyclic investment produces cyclic cash flows which place a significant strain on the financial capability of an airline. In periods of high cash inflow, investments must be made which are both hedged against inflation and liquid enough to provide the cash source for the next capital equipment cycle.

3. Discounted cash flow (DCF) must be examined as a function of time when evaluating competing capital budgeting patterns. This is particularly important when evaluating cyclic investment patterns since the DCF is high just after a major investment and low just before.

4. One indicator of investment performance is the constant dollar book value per revenue ton mile. If this measure of real investment per unit traffic is relatively smooth then the distortion of reported earnings as a result of the investment pattern should be minimized.
CHAPTER II

CRITICAL FACTORS

It is the purpose of this study to concentrate on the impact which capital investment patterns have on the financial performance of an airline. This is intentionally a narrow view and is aimed at understanding a critical segment of the total airline performance. I have not included cost trends, competitive strategies, or regulatory actions, all of which can have dramatic financial impact on an airline. Issues more closely related to capital budgeting such as fleet mix and standardization have not been included primarily because the added complexity would not add to the understanding of the basic issue. The analysis has been structured so that if profits or cash flows vary, the variation can be attributed to the investment policy rather than to some assumption in the relationship between operating costs and revenues.

In analyzing the current airline situation, I have chosen to concentrate on three U.S. trunk airlines as opposed to the industry in an aggregated form. This was done to allow the examination of different situations which otherwise would

---

3 All of the above items and many additional factors clearly must be included in any comprehensive airline capital budgeting decision.
be lost in the aggregation process. The three airlines considered were; United Airlines, American Airlines and Delta Airlines.

United was chosen as being most typical of the industry generally. It is the largest domestic airline and has a route structure which covers essentially the entire country. American provides an intermediate base point in the airline industry. It has typically pursued an aggressive policy toward the acquisition of new flight equipment. Delta provides an industry contrast to United and American. Delta has consistently been more profitable than the industry average and, although only 58% the size of United, (based on total revenue) earned an airline industry record profit in calendar 1974.

In examining these three airlines, I have intentionally used published data. While this may result in slightly less accuracy (particularly in the tax area), I feel that it allows a free discussion of the results without concern about the use of proprietary data.

Three factors appear to be critical in determining the impact of capital budgeting patterns on financial performance:

4All data shown for the individual airlines was derived from annual reports from 1958 to 1974.
This chapter discusses each of these three factors in some detail in order to provide the basis and starting point for the analysis of future capital budgeting patterns.

**Growth Rate**

Airline traffic has grown rapidly since the mid 1920's almost without a pause. (Growth did stop during the post World War II years but then resumed its rapid rise.) Figure II-1 shows the classic growth cycle of several industries including the U.S. airlines.\(^5\) The semi-log format points up the typical turn from a growth industry to a mature industry. It is almost impossible today to tell whether that turn has been reached for the airline industry.

Figure II-2 shows the more recent traffic data and growth rates.\(^6\) While the sharp decline in growth rate may only be a temporary event, there are indications of maturity. Figure II-3 shows the yield (effective price) for the U.S.

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\(^6\) Air Transport 1974 Facts and Figures, Air Transport Association of America, Washington D.C.
GROWTH AND MATURITY

Figure II-1
U.S. DOMESTIC TRUNK TRAFFIC
REVENUE TON MILES

RTM
\approx 10^9 \text{ ton-miles}

YEAR


RTM GROWTH RATE
\sim \% 

YEAR


Figure II-2
Airline Yield

Figure II-3
trunk airlines in real terms. The shift from decreasing unit price to a more stable situation is also typical of the matur- ing process. However, while there are a number of signs which indicate that the U.S. airline industry is reaching a mature state, the answer is not critical to this analysis. It may safely be assumed that the industry will mature at some point and that the assumption of maturity used here will be valid at that time.

Growth, by its very nature, tends to focus investment decisions on meeting the needs of tomorrow. Figure II-4 indicates the proportion of total investment which is required to replace old equipment. If growth rates near 20% are main- tained and airplanes last between 14 and 21 years, only 3% to 7% of the investment goes to replacing used airplanes. It is clear that numbers of this order can be rather easily absorbed into the more serious decision as to whether it is possible to finance the growth requirement.

If, on the other hand, growth rates fall to the 4% growth rate typical of GNP, nearly 60% of the total investment is for replacement (assuming a 14 year life). As an obvious end point, if population growth falls from the historical 2% toward 0%, airline growth rates could easily fall to where better than 90% of the investment is for replacement.

Ibid.
Replacement as a Fraction of Total Investment

Figure II - 4
It is worth noting that historically, technical innovation has been a major factor in investment strategy. For example, there was a very significant increase in unit productivity with the introduction of the jet powered airplane. The direct operating costs dropped sharply and so the financial decision to invest was not too difficult. This was aided by a supporting marketing decision which made the replacement of old propeller airplanes almost mandatory.

The future of technical innovation is far less clear. To say that all the inventions have been made would be folly. However, it would be equally absurd to assume that past operating cost improvements may be extrapolated into the future. While jet engines appeared in the mid 1940's, they were not incorporated on commercial aircraft for nearly 15 years. There are no similar breakthroughs evident today and it may be a reasonable and conservative assumption to examine the airline industry without the benefit of further major technical innovation.

**Historical Actions**

The makeup of an airline fleet reflects past investment patterns and also has considerable impact on what future investment patterns will be. Figure II-5 presents the theoretical fleet age distribution for an airline where investment was governed solely by growth. As would be expected, the more
rapid the growth rate, the more the age distribution is skewed to the low end. The same data can be shown (Figure II-6) in terms of average age of the fleet. Again, as the growth rate increases, the average age declines and, as the life is increased, for a given growth rate, the average age increases.

The above distributions assume a steady state growth rate and constant airplane life. The next step is to assume that the actual fleet will be the result of variable growth rates and specific fleet replacement decisions. An examination of the United Airlines fleet and the significant factors which produced it, helps to illustrate this concept. The fleet age distribution for United Airlines is shown in Figure II-7 (a) and the average age in Figure II-7 (b). At first examination the United distribution is somewhat surprising with respect to the tremendous concentration from 4.5 through 7.5 years old. Almost 2/3 of the total fleet is contained in that 4 year span. There are several factors which produce this distribution. The most significant factor in producing the fleet structure is the period of rapid growth followed by low growth. Figure II-8 (a) compares the age distribution with one derived by assuming that investment exactly matched actual experienced growth. While the fit is reasonable, there are still areas which need to be explained.

A second factor is found in the types of airplanes
Fleet Average Age

![Graph showing fleet average age over time with lines indicating different airplane lives in years.](image-url)
UNITED AIRLINES FLEET

AGE DISTRIBUTION 1973

% of total fleet

AGE ~ YEARS

AVERAGE AGE

YEAR

FIGURE II-7
UNITED AIRLINES FLEET
AGE DISTRIBUTION

Figure II-8(a)
--- Actual Airplane Age
--- Predicted from Growth Rates

Figure II-8(b)
--- Actual Seat Age
--- Predicted from Growth

Figure II-8(c)
--- Actual Seat Age
--- Predicted from:
- Growth Rate
- Replacement Decisions
purchased. The last few years have seen the introduction of the "wide body" airplanes with their great capacity. Purchasing was not evenly spread through all sizes of airplanes and thus a fleet age distribution would tend to emphasize the earlier purchases of smaller airplanes. Figure II-8 (b) compares the age distribution of seats to that predicted by growth. As expected, recent years are increased in significance, but the four year period (4.5 through 7.5 years old) still contains more than half the total seats available.

Finally, United made two decisions which impact this distribution; to become "all-jet" in 1968 and, to retain the older DC-8-20/30 while retiring the 720 in 1973. When these two items are included, the match becomes quite good (Figure II-8(c)). In summary, it appears that the United fleet age distribution is primarily the result of meeting growth requirements. Modifications to that basic distribution are the result of specialized replacement decisions, the most significant of which was the decision to go "all jet".

Inflation

The impact of inflation on financial performance is related to the mechanics of accounting rather than to a more formal causal relationship. Inflation has its most dramatic impact on earnings through depreciation.

With no inflation, depreciation will mask the effect
of a cyclic investment pattern as long as the period of the investment cycle is less than the depreciation period. In other words, depreciation reflects the mean investment over the depreciation period. However, the situation changes with the addition of inflation. As illustrated in Figure II-9, inflation not only contributes to a rising current dollar investment and depreciation, but also causes the cyclic investment to be reflected in cyclic depreciation.

The impact of inflation on depreciation is very important when the effect on earnings is considered. Depreciation is typically a very large fraction of gross earnings from operations (before depreciation, interest, and taxes). Thus, fluctuations of 20% as shown in the example can easily mean the difference between a significant profit and a loss.

The factors of growth, historical action and inflation are important individually, but when taken together are critical to airline financial performance. At high growth rates, the investment pattern is not really an option since new equipment decisions are dominated by meeting new demand. At low growth, the pattern of capital budgeting comes under the control of management.

If the age distribution of an airline fleet were marked by uniformity, the impetus towards a cyclic investment pattern would be minimal. However, the varied growth rates and major technological innovations of the last two decades
INFLATION EFFECT ON DEPRECIATION

**REAL INVESTMENT**

![Graph showing real investment over time with inflation effects.]

**Nominal Investment**

![Graph showing nominal investment with inflation at 5% over time.]

**Depreciation**

- Straight line with 14 years life
- No inflation (nominal investment = real investment)

*Figure II-9*
have produced airline fleets with significant distortions. Combined with a low growth environment, there is a strong tendency to repeat past investment patterns when replacing aging equipment. This can easily result in a cyclic capital budgeting pattern.

Finally, without inflation, depreciation does much to smooth the variations in investment. With historic cost accounting and inflation, fluctuations in investment are reflected in depreciation charges. Thus, the combination of low growth, historically based fleets with uneven age distributions and inflation set the stage for a discussion of the impact of capital budgeting patterns.
CHAPTER III

ANALYSIS METHODS

The evaluation of various investment strategies presents a difficult problem. It would be desirable to have a single measure by which to judge the merit of any given strategy. However, as might be expected, a single measure inevitably results in a narrow view and overlooks other key factors. This chapter presents the various evaluation measures used.

The other key element of the analysis is a representation of the financial characteristics of airline capital budgeting. A computer model was developed to allow many investment patterns and parameter sensitivities to be explored. This model is not and cannot be a crystal ball for predicting the future. It does provide a valuable analytical tool and, as such, is presented and validated in this chapter. The computer program is presented in Appendix A.

Indicators

The evaluation of financial performance makes use of a number of indicators and financial measures. As presented earlier, the age and age distribution of an airline fleet indicate a great deal about past growth and investment strategy. However, even using an age distribution of available seats lacks considerably in relating to financial per-
formance. A more meaningful measure would be the real investment relative to some indicator of traffic. After trying several combinations, the most useful appears to be the real (constant dollar) book value per revenue ton mile (RTM). Using RTM as a normalizing factor allows comparisons between airlines of different sizes and passenger/cargo mix. It is difficult to get a good constant dollar book value, but a reasonable approximation may be obtained by adjusting the current book value by the consumer price index (CPI). 8

As shown in Figure III-1, the constant dollar net book value per RTM (CNBV/RTM) for United and American has an investment peak in the late sixties when the tremendous purchases referred to earlier occurred. However, a more important feature of the data is the current trend. Both United and American show a rapidly falling CNBV/RTM. This implies a depletion of the asset base with the further implication of future investment if the asset base is to be restored. Delta, on the other hand, has exhibited a much smoother (and lower) CNBV/RTM and particularly, has avoided a rapidly falling value as the low growth period began in 1969.

Another indicator of the airline financial

---

8 In addition to the net book value for flight equipment shown in annual report data, the estimated book value of leased aircraft was added so that the entire fleet was represented.
INVESTMENT PER UNIT TRAFFIC

CONSTANT $ NET BOOK VALUE

UNITED
AMERICAN
DELTA

YEAR


19.9% 4.4%

ESTIMATED

Figure III - 1
performance is the financial structure itself. The capital structure of the airlines is made up of three significant parts; interest-bearing long-term debt, deferred taxes, and equity.

Within the interest-bearing long-term debt are major subdivisions; long-term debt and lease debt. As the airlines debt escalated in the mid-sixties, they were unable to take full advantage of the investment tax credit (ITC) and so a number of financial leases were made with banks and insurance companies who had the profits to use the ITC.

The deferred taxes are a very important segment of debt since they represent a zero interest loan from the U.S. government. The airlines tend to write off new equipment using accelerated depreciation and short time periods (usually 7-8 years) for tax purposes but using straight line depreciation and long periods (usually 14-16 years) for financial accounting. This dramatically reduces actual taxes and results in a deferred tax in the financial books.9

Finally, in the equity area, I have included common

---

9It should be noted that the airline must be profitable in the tax books in order to achieve the full amount of deferred tax. This is true since there cannot be negative real taxes while there can be negative taxes in financial accounting. The use of tax loss carryforward (backward) does allow the depreciation to be spread over a longer period but doesn't allow the generation of as much deferred tax "debt".
stock, retained earnings and preferred stock. Figure III-2 compares the capital structure of the three airlines and Table III-1 gives more of the detailed information. The capital structure of United and American are very similar while Delta's shows some marked differences:

- United and American have about one quarter of invested capital from equity with Delta 10% higher.
- Approximately two thirds of the United/American capital comes from debt with Delta 20% lower.
- Delta has 20% of its capital from deferred credits while United and American have about 10% from this source.

The differences would be even more significant if market values were used for stock issues. Neither United nor American would change much (less than 3%), but Delta would move to 61% equity, 28% debt and 11% deferred credit.

The analysis presented here uses three financial measurements; earnings, cash flow, and discounted cash flow. Each of these measures is important to the total evaluation. Reported earnings have been the standard measure in industry and thus represent an important criteria. Management is usually judged and compensated based on short term earnings.

Cash flow is used as a measurement tool since it reflects the most basic consideration in continued operation
Capital Structure

![Diagram showing capital structure for United, American, and Delta airlines](image)

**Figure III-2**
### CAPITAL STRUCTURE

**Table III-1**

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<th>AMERICAN*</th>
<th>DELTA*</th>
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<td></td>
<td>$M</td>
<td>%</td>
<td>$M</td>
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<td>Common Stock</td>
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<td>15.9</td>
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<td>Retained Earnings</td>
<td>242.3</td>
<td>8.7</td>
<td>196.2</td>
</tr>
<tr>
<td>Preferred Stock</td>
<td>27.0</td>
<td>1.0</td>
<td>-</td>
</tr>
<tr>
<td>Total Equity</td>
<td>713.9</td>
<td>25.6</td>
<td>541.3</td>
</tr>
<tr>
<td>Long Term Debt</td>
<td>969.0</td>
<td>34.7</td>
<td>587.4</td>
</tr>
<tr>
<td>Leases (aircraft)</td>
<td>481.7</td>
<td>17.2</td>
<td>503.0</td>
</tr>
<tr>
<td>Leases (other)</td>
<td>333.5</td>
<td>11.9</td>
<td>316.7</td>
</tr>
<tr>
<td>Total Debt</td>
<td>1784.2</td>
<td>63.8</td>
<td>1407.1</td>
</tr>
<tr>
<td>Deferred Credit</td>
<td>297.7</td>
<td>10.6</td>
<td>181.5</td>
</tr>
<tr>
<td>Total</td>
<td>2795.8</td>
<td>100</td>
<td>2129.9</td>
</tr>
</tbody>
</table>

* Data as of December 1973 except Delta as of June 1974
of the airline. In this case, net cash flow is used and includes all cash transactions with the exception of dividend payments.

Finally, discounted cash flow (DCF) is used as an evaluation of various strategies consistent with the concept of the time value of money. With other things equal, it is better to have the cash now rather than later. The DCF data is presented as the net present value (NPV) of future cash flows and will be shown as a function of the discount rate rather than depending upon a single measure such as internal rate of return or NPV at a fixed discount rate.

The Evaluation Model

As with any model which is used to represent the structural situation of an economy, industry or corporation, trades must be made between complexity and accuracy. The more complex the model, the better (should be) the fidelity of representation. However, against the fidelity must be placed the ability to interpret the results and the time required for implementation. A highly complex, multi-loop model with a large number of variables may well serve to confuse where it was intended to enlightened. I have chosen to make a number of assumptions which allow an examination of the financial variables in some detail but essentially eliminate operating and marketing variables.
The model starts by projecting future revenues ton miles (RTM) based on an input growth rate. Growth rate may be varied on a yearly basis if desired. A basic assumption is made that a real investment of $1 will produce one RTM. This assumes that all airplanes are equally productive per dollar invested in real terms. While this assumption does not allow a type-by-type analysis, it does serve the purpose of examining capital budgeting patterns. Figure III-3 indicates the real investment per RTM for United Air Lines estimated in 1973 dollars.

The model then compares input annual investment with gross real investment required to meet the growth demand. Any excess investment is eliminated by selling off the oldest airplanes (for economic value). From the real investment, actual investment is determined based on the input inflation rate. From the array of actual investments, two depreciation values are calculated. For tax purposes, flight equipment is depreciated using double declining balance (DDB) and a seven year life. Straight line depreciation is used for the last three years to bring the residual value to zero. For financial accounting, flight equipment is depreciated using

\[\text{10} \text{The model assumes an initial investment which is distributed over time so as to satisfy the conditions that no airplane is over 14 years old and that investments were made in relation to input historical growth rate.}\]
TOTAL REAL INVESTMENT PER UNIT TRAFFIC

- 1973 DOLLARS
- UNITED AIRLINES

Figure III-3
straight line (SL) to zero and a fourteen year life. For simplicity, it is assumed that all equipment is acquired at mid year so that half of the calculated depreciation is taken in the initial and final years. Figure III-4 compares the two depreciation schedules for a $1 investment.

The taxes are computed both for tax purposes and for financial reporting. An investment tax credit (ITC) of 7% is assumed and is distributed over a seven year period in proportion to the DDB depreciation. It is assumed that ITC is used up to a limit of one half the tax and no expiration is assumed. For tax purposes, a negative tax is not allowed, giving rise to a tax loss carryforward for years in which losses are computed. No expiration is assumed and no readjustment of previous years is attempted. While this treatment of taxes is not exact, it represents the basic elements and the additional complexity required to represent further detail was not felt to be worth-while.

Long term debt is computed based on the cash needed for net purchases which are not covered by cash generated by operations after payment of taxes, interest, and dividends. Dividends are assumed to be half of earnings when profitable and zero in loss years. Interest is charged at 9% on debt and earned at 7% on negative debt (outside investments of excess cash.)

Cash from operations is basically determined as an
Depreciation Schedules

\[ \text{DEPRECIATION SCHEDULES} \]

\[ \text{INVESTMENT} \]

\[ \text{DEPRECIATION} \]

\[ \text{\$} \]

\[ \text{TAX ACCOUNTING} \]

\[ \text{FINANCIAL ACCOUNTING} \]

\[ \text{YEAR} \]

\[ \text{Figure III-4} \]
operating margin on revenue ton miles. Figure III-5 compares the operating margin used with that of the industry and American Airlines. Because of lease commitments which are reported as operating expenses but have implicit interest charges, it is estimated that about l¢/RTM should be added to the data shown. A graduated penalty is assessed for all airplanes over 14 years old in the fleet. This results in a cash margin which declines linearly to zero at 22 years. The reduction in cash flow is only an estimate of higher maintenance and modernization costs for older airplanes. The model output does not appear to be particularly sensitive to this assumption but it was felt to add some realism.

Any model should pass two basic tests; rationality and predictive capability. The relatively simple model used in this study is predicated on the assumptions laid out in the initial part of this section. Whether they meet a test of rationality may be judged by the reader.

The predictive quality of any model is always subject to debate. Almost by definition, it will only predict what has been anticipated and thus included in the model. For example, this model may predict cash flows in a stable economy with reasonable accuracy but will not predict profitability in the event of fuel cost increases. The model used here is intended to examine only the financial performance of an airline with differing investment strategies.
OPERATING MARGIN

MARKIN/RTM
~ $/TON-MILE

MODEL ASSUMPTION
AMERICAN
U.S. TRUNKS

YEAR

FIGURE III-5
With the above caveat, it is worthwhile to validate the results produced by examining the first 8 years run on the model. This period is intended to generally duplicate the investment strategy of United and American Airlines through the period of 1966 to 1974. It is typified by a period of sustained 15% growth with excess investment in model years 2 and 3, (model year 0 corresponds roughly to 1966). Growth rate and investment fall to zero in year 5.

Figure III-6 compares the constant dollar net book value (CNBV) per RTM of United and American with that of the model. The correlation indicates that the investment/growth relationships are similar. Figure III-7(a) and 7(b) compare the age distributions and average age and again the correlation is reasonable. Figure III-8 shows the capital structure of the model. While full data (present value of lease commitments) are not readily available over the full period, the capital structure data shown in Figure III-9 indicates the same structure and trends. Up to this point, the correlation is essentially "mechanical", i.e. by adjusting the inputs it should be possible to exactly reproduce the airline situation. It is important because it sets a realistic stage for the evaluation of future strategies.

It is also valuable to examine return on net worth and ROI. Since many of the operating factors which affect return are not considered, a satisfactory comparison of trends
INVESTMENT PER RTM

MODEL vs. AIRLINES

MODEL

AMERICAN

UNITED

*ESTIMATED

FIGURE III-6
FLEET AGE
MODEL vs. AIRLINES

AGE DISTRIBUTION

% of
TOTAL FLEET

AGE ~ YEARS

FIGURE III - 7
CAPITAL STRUCTURE
MODEL

FIGURE III-8
CAPITAL STRUCTURE

AIRCRAFTS

UNITED

75
50
25
0

% OF TOTAL CAPITAL

1972
1974

DEFERRED TAX

EQUITY

100

100

AMERICAN

% OF TOTAL CAPITAL

1972
1974

DEFERRED TAX

EQUITY

100

100

Figure III- 9
should be sufficient to proceed. Figure III-10(a) and (b) indicate a definite correlation with the declining return, losses and then initial recovery experienced by United and American. It should be noted that earnings data (including the model) were smoothed by application of a 3 year moving average to surpress some of the short term operating effects.

At the end of year eight, the model presents a simplified representation of the airlines financial situation and fleet structure at the end of 1974. Run forward, it should produce pro-forma financial data by which various investment strategies can be evaluated.
RETURN ON NET WORTH

RETURN ON INVESTMENT

FIGURE III-10
CHAPTER IV

STRATEGY ANALYSIS

In considering alternative strategies, it is most helpful to start with the apparent options, examine the general implications of those options and then build to other variants. There are an infinite number of possible combinations of growth rate, historical fleet structure, and inflation rate which can be analyzed. For clarity, I have chosen to look at the impact of capital budgeting patterns for an initial growth rate of 15% which drops to zero. The historical fleet structure used will be comparable to the current United and American Airlines fleets. Inflation will be initially at 5% with runs to check the sensitivity over the range of 0% to 10%.

Three possible strategy options for the no-growth case are as follows:

1. Do-nothing - This strategy is possible since new airplanes are not required to satisfy a growth requirement.

2. Replace airplanes at a fixed age - This strategy is the natural outgrowth of the assumption that capital equipment has some reasonable well defined life. The financial book life of 14 years is used for replacement, but the results
are similar for any fixed age.

3. Replace airplanes so that investment is at a constant rate - This strategy implies that replacement investment is made such that a steady turnover is achieved in a fixed time period. Again, 14 years is used but is not critical to the results.

The first step will be to look at the effect that these three options have on a simplified fleet structure. This should indicate the general characteristics of the options. The analytical model will then be used to examine the financial implications of the options with the more typical fleet structure and inflation.

Figure IV-1 illustrates the three potential fleet age distributions which result from the different investment patterns. The age distributions are shown five years after a transition from a growth rate of 15% to one of 0%. Figure IV-1(a) shows the "do-nothing" case where the net result is that the age distribution achieved during the period of growth ages uniformly and moves steadily to the right. The fixed age replacement case (Figure IV-1(b)) produces an age distribution which repeats itself as the 14 year old airplanes are replaced one for one by new ones. Finally, Figure IV-1(c) indicates a replacement at a steady rate compatible with the zero growth rate. After 14 years, the age distribution will
POSSIBLE STRATEGY OPTIONS

FLEET AGE DISTRIBUTION
FIVE YEARS INTO STRATEGY

Do-Nothing
(a)

% of TOTAL FLEET

0 5 10 15 20
AGE ~ YEARS

Fixed Age Replacement
(b)

% of TOTAL FLEET

0 5 10 15 20
AGE ~ YEARS

Steady Investment
(c)

% of TOTAL FLEET

0 5 10 15 20
AGE ~ YEARS

FIGURE IV-1
be flat with 7% of the fleet in each age group.

Using average age as an indicator of the investment policy reveals additional information. Figure IV-2 shows the same three cases. Option (a) forms an upper bound with the average age increasing at one year per year. This is clearly not an acceptable long term solution as will be examined later. Option (b) results in a continuing cyclic investment and average age. Finally, option (c) represents at least one transitional mode which results in a stable average age and a smooth investment.

With these three cases as a base, the model can be used to examine the financial performance for these same strategies. It is worth quickly reviewing the situation of the model airline as presented in Chapter III. Figure IV-3 shows the after tax earnings and cash flow for years zero to eight to the same scale which will be used throughout the rest of this analysis. As shown, the earnings drop sharply and then recover. The high negative cash flows associated with the large investment (corresponding to the 1966-1968 airline investment) cease and cash flow becomes positive as investment ceases. Finally, as shown in Figure IV-4, the constant dollar net book value per RTM (CNBV/RTM) peaks and then starts to decline rapidly.

Let us first examine the option of doing nothing at all. This option assumes that the airline would, over
POSSIBLE STRATEGY OPTIONS

AVERAGE AGE

FIGURE IV-2
EARNINGS AND CASH FLOW
MODEL
INITIAL YEARS

EARNINGS
(a)

CASH FLOW
(b)

FIGURE IV-3
CONSTANT DOLLAR NET BOOK VALUE PER RTM

MODEL

INITIAL YEARS

Figure IV-4
time, convert its asset base to cash. As noted earlier, this cash earns interest at a rate typical of "risk free" government securities and is not invested in other projects. As shown in Figure IV-5, earnings continue their rapid rise as debt is lowered and interest charges are decreased. In year 13 there is a drop as accumulated ITC runs out and the effective tax rate rises from 24% to 48%. The next rise in earnings is fueled by the declining depreciation charge which goes to zero in year 18. From here on, earnings decline to the fully taxed return from cash assets. Cash flow is very strong at first but shows a significant drop as ITC and loss carryforward from the rapid write off of flight equipment expire. From year 12 on, actual tax paid markedly exceeds the book tax as previously accumulated deferred tax must be paid. The net result is a positive but declining cash flow.

The "do-nothing" alternative is really a benchmark from which to judge other options. It is a viable option only in the last resort when no other solution exist. It should also be noted that while earnings are still rising (mostly from declining depreciation charges) the investment base is rapidly decreasing. This results in a rate of return well in excess of CAB standards thus presenting the illusion of high return and possible adverse fare action when in fact margins are falling.
CASE I - Do Nothing

EARNINGS

MODEL YEAR

AFTER TAX EARNINGS

- $M

CASH FLOW

MODEL YEAR

- $M

FIGURE IV-5
Viewed from today's perspective (approximately year 9), the first few years of this option are very attractive. Rising earnings and cash flow can not help but be exciting to an industry which has suffered from low earnings and/or losses in recent years. It is the long term implication of going out of business which make the option of doing nothing unattractive! It is tempting to delay purchases during the initial years with the intention of doing something later. This leads to the concept of delay until replacement is required.

The second option is to begin replacement of old equipment as it reaches a given age. One convenient age would be 14 years when book depreciation is complete. (The results are essentially the same if longer periods are chosen.) Figure IV-6 presents the earning and cash flow projection for this option. The impact of previous investment patterns is very clear. The earnings closely parallel the "do-nothing" case until the combination of higher depreciation and interest charges from the new investment peak (year 17) dominate and earnings crash.

The other part of the story, cash flow, shows the same substantial impact (Figure IV-6(b)). Net cash flow (cash from operations plus proceeds on sold aircraft and less tax payments, interest and new investment) is highly cyclical. Heavy cash drains are followed by high cash inflows. Whether
CASE II - FIXED AGE REPLACEMENT

EARNINGS

CASE II
FIXED AGE REPLACEMENT

CASE I
DO NOTHING

CASH FLOW

CASH FLOW

FIGURE IV-6
an airline can finance such demands and effectively use the substantial excesses is an important consideration. To assume that the high cash inflows in years 19-25 can be safely invested in assets liquid enough to supply the next round of purchases is questionable.

The impact on earnings is very significant in terms of investment strategies and thus deserves careful analysis. Figure IV-7 shows the build up of charges against income from operations. As can be seen, the cyclic character of the depreciation charges builds the cyclic investment pattern directly into reported earnings. As shown in Chapter II, inflation is the primary factor in the fluctuations in depreciation.

The impact of the inflation rate on earnings is significant. Figure IV-8(a) shows the earnings before interest and taxes (EBIT) for a fourteen year replacement cycle as a function of the inflation rate (5% inflation is the base case). Since earnings from operations are assumed to be steadily increasing at the inflation rate, the cyclic nature of EBIT is the result of the variations in depreciation. Reflected into after tax earnings, (Figure IV-8(b)) the effect of cyclic investment and high inflation is dramatic. It should be noted that without inflation, earnings are relatively stable and acceptable considering that growth rate is zero.

The fluctuations in cash flow are also reflected in
EFFECT OF DEPRECIATION AND INTEREST

CASE II

FIXED AGE REPLACEMENT

Figure IV-7
IMPACT OF INFLATION

CASE II
FIXED AGE REPLACEMENT

EBIT
(a)

INFLATION RATE
10%
5%
0%

MODEL YEAR

EBIT

MODEL YEAR

EARNINGS
(b)

INFLATION RATE
10%
5%
0%

MODEL YEAR

FIGURE III - 8

AFTER TAX EARNINGS
~ $M
the capital structure of the airline. Figure IV-9 shows the highly cyclic nature imposed by the assumption of cash needs being met from debt financing. One possible alternative is to stabilize the capital structure at 50% equity by the sale and repurchase of stock as required. Figure IV-10 shows the stock variation required and the resulting capital structure. While this may appear to be more sound, the impact on earnings is only minor (Figure IV-11) and the impact on earnings per share is tremendous. It is clear that changing the source of required funds does not relieve the more basic cyclic behavior imposed by the investment strategy.

In summary, the second option of replacing old flight equipment as it reaches a given age, has several problems. The fleet age structure imposed by historical actions is repeated in new equipment purchases. In the presence of inflation, this leads to cyclic variation in depreciation and thus in EBIT. These fluctuations are in turn amplified by the debt service which peaks at the same time. Together, interest and depreciation exert a heavy pressure on earnings so that cyclic investment patterns impose a cyclic character on earnings.

The third option is to invest at a rate consistent with the growth rate. In this case, assuming a fourteen year life, just over 7% (1/14) of the fleet would be replaced every year. This approach to investment strategy results in
CAPITAL STRUCTURE

CASE II

FIXED AGE REPLACEMENT
Effect of Equity Policy

**Total Stock Outstanding**

Model Year

**Equity Policy**

- Constant Equity
- Constant Capital Structure

**Capital Structure**

Model Year

**Debt**

Debt + Equity

- %

DEBT includes deferred tax

Figure III-10
EFFECT OF EQUITY POLICY

EARNINGS

AFTER TAX EARNINGS ~ $M

-100

0

100

200

10 15 25

MODEL YEAR

CONSTANT EQUITY

CONSTANT CAPITAL STRUCTURE

EARNINGS PER SHARE

EPS ~ $/SHARE

1.5

1.0

0.5

0

10 15 25

MODEL YEAR

FIGURE IV - 11
a much smoother earnings and cash flow projection (Figure IV-12) than the Case II strategy of replacement at a fixed life since it surpresses the historical pattern. However, there is still more variation than desired during the transition phase. (After year 26, the fleet is completely uniform.)

A fourth strategy is to invest to smooth average age or constant dollar net book value per RTM. As shown in Figure IV-13 a further smoothing of earnings and more particularly cash flow is achieved. Looking at the build up of charges against earnings from operations (Figure IV-14) highlights the much smoother depreciation charge and the almost constant interest payment. The capital structure also reflects the more stable pattern with the equity share growing slowly as shown in Figure IV-15. It is also important to note that, unlike the cyclic case where deferred tax remained an almost constant 10%, here this "interest free" debt grows from 15% to 26%. Another comparison between the cyclic investment (Case II) and the stabilized investment (Case IV) is shown in Figure IV-16. In the cyclic case, the asset base is depleted and then massively built up to be depleted again while the smoothed investment case results in little variation in CNBV/RTM.

Both the capital structure and the CBNV/RTM call to mind the differences noted earlier between United/American and Delta. Delta has a much higher proportion of capital from
CASE III - STEADY INVESTMENT

EARNINGS
(a)

CASE III
STEADY INVEST.

CASE II
FIXED AGE REPLACEMENT

MODEL YEAR

CASH FLOW
(b)

CASE II
FIXED AGE

CASE III
STEADY

MODEL YEAR

FIGURE III-12
CASE IV - SMOOTHING POLICY

EARNINGS

(A)

CASH FLOW

(B)

FIGURE IV-13
EFFECT OF DEPRECIATION AND INTEREST

CASE IV
SMOOTHING POLICY

Figure IV-14
CAPITAL STRUCTURE

CASE IV
SMOOTH INVESTMENT

% of TOTAL CAPITAL

DEBT

DEFERRED TAX

EQUITY

MODEL YEAR

0  25  50  75  100

10  15  20  25

Figure IV-15
CONSTANT DOLLAR NET BOOK VALUE PER RTM

CASE II - CYCLIC INVESTMENT

CASE III - SMOOTH INVESTMENT

MODEL YEAR

FIGURE IV-16
equity and deferred tax. In addition, the CNBV/RTM for Delta has been relatively more stable.

The other main analysis tool is discounted cash flow. Figure IV-17(a) shows the DCF net present value (NPV) as a function of discount rate. This data is from the perspective of year 9. As shown, Case I (do-nothing) has the highest NPV at discount rates above 8% and Case IV (smoothed investment) is higher than Case II (cyclic investment) up to 21%. However, if future cash flows are viewed from year 18, an entirely different picture is presented (Figure IV-17(b)). Now, Case II has the highest NPV and Case I the lowest. Since the goal of the analysis is an optimum investment pattern, rather than a single investment, the decision should be valid at any point in time.

In order to examine an investment strategy properly, it is advantageous to see how the NPV varies with time. Figure IV-18 presents the same three cases at two discount rates. This presentation helps considerably in the analysis of the various options. Case I (do-nothing) shows the highest initial NPV but steadily declines as the asset base is depleted. The decline is at a compounded rate of better than 8% which, coupled with a 5% inflation represents a significant drop in real terms. The cyclic nature of the Case II cash flows becomes evident when plotted as a function of time. Finally, the steady rise of the Case IV (smooth investment)
DISCOUNTED CASH FLOW

BASE YEAR - 9

(a)

NPV

~M

CASE I - Do Nothing
CASE II - Cyclic Investment
CASE III - Smooth Investment

DISCOUNT RATE

0 5 10 15 20 25

BASE YEAR - 18

(b)

NPV

~M

CASE I - Do Nothing
CASE II - Cyclic Investment
CASE III - Smooth Investment

DISCOUNT RATE

0 5 10 15 20 25

Figure IV - 17
Discounted Cash Flow vs. Time

10% Discount Rate

CASE I - Do Nothing
CASE II - Cyclic Invest.
CASE III - Smooth Invest.

15% Discount Rate

CASE I
CASE II
CASE III

Figure III-18
NPV (8% compounded rate) is apparent. If it were possible to jump from one strategy to another, the best of all worlds might be obtained. However, investments are required in some specific pattern over time. Thus, it is impossible to move from a zero investment strategy (Case I) to the smoothed investment of Case IV in year 12 without having made the investments in years 9, 10, and 11.

Based on the earnings data, cash flows and DCF, there appear to be strong financial advantages to a smooth investment policy. As is typical in any endeavor, trades must be made to achieve the best overall performance. The high profits and cash flows in the near term make the "do-nothing" case attractive but the penalty in later years is too severe. A smoothed earnings and cash flow picture comes at the expense of some peak profits but avoids the pressure on earnings after heavy investment.
CHAPTER V

CONCLUSIONS

While it is always dangerous to generalize from specific cases and examples, there appear to be certain conclusions which can be drawn from the analysis presented here for the low growth airline.

1. In periods of inflation and with current historic cost accounting, a cyclic investment pattern will produce cyclic reported earnings. The amplitude of the fluctuations in earnings will be the result of the amplitude of the investment cycle and the rate of inflation. For double-digit inflation rates which have been experienced recently, the amplitude can easily be from substantial loss to "excessive" profit. Some form of replacement cost accounting would eliminate this "structural" problem which results in cyclic earning. Baring a change in accounting conventions, there is strong motivation to smooth earnings through a smooth investment pattern.

2. A second major problem with a cyclic investment
pattern is that it produces cyclic cash flows. Thus, there are periods of high positive cash flow during times of low investment and high negative cash flows during peak investment periods. While the accumulated cash flow may be positive (even on a discounted basis) there are significant problems presented. During periods of cash inflow, investments must be made which both hedge against inflation and which are liquid enough to provide a cash source for the next peak capital investment. This process makes an optimum capital structure almost impossible to maintain.

3. Discounted cash flow (DCF) while giving a proper answer for a single point investment, must be examined as a function of time when evaluating competing investment strategies. A cyclic investment pattern will produce a cyclic DCF as a function of time. The net present value will be high just after a major investment has been made and low just before the next major investment.

4. Several indicators of investment performance are available. The simplest relate to fleet
age and age distribution. A more valid measure appears to be the constant dollar net book value per revenue ton mile. This measure of real investment per unit traffic should remain relatively stable if investment is being made in line with traffic growth and a stable replacement policy is being maintained.

When the airline industry reaches maturity the key financial factors shift from the source of funds for expansion to optimizing financial performance. With inflation as a "fact of life" there is a strong motivation to establish an orderly turnover of capital assets. The optimum investment turnover rate will depend on the tax structure, growth rate, and general profitability of the airline. However, the airlines need to achieve the steady turnover of investment and still maintain the capability to adjust to demand. This may well result in orders placed at a steady rate with adjustments in sales of used equipment to balance demand.

The future presents the airlines with many opportunities and many problems. While much of the "silk scarf" glamour is gone, the real business of dealing with operating costs, market share, regulatory activity, financial control, etc. remain. The proper investment strategy can contribute substantially to overall financial performance of the airline.


The airline model is described in Chapter III. This appendix presents the documentation of the program and its major features.

The program, named "Airline Pro Forma" is written in BASIC and was executed on the Sloan School PRIME computer. "Airline Pro Forma" is an interactive program with the operator making the following decisions:

1. Starting RTM
2. Starting long term debt
3. Starting equity
4. Number of years to run
5. Real investment for each year
6. Stock sold in each year
7. Future inflation rate
8. Future growth rate
9. Historic inflation rate
10. Historic growth rate

Additional years can be run by specifying the following:

1. Number of additional years
2. Inflation rate
3. Growth rate

The following pages contain a list of variables and a program listing.
List of Variables

\[ z \quad \text{year} \]
\[ A(z+2) \quad \text{average age} \]
\[ A(z+28) \quad \text{record of actual investment} \]
\[ B(z+2) \quad \text{double declining balance depreciation} \]
\[ C(z+2) \quad \text{total equity} \]
\[ D(z+2) \quad \text{debt} \]
\[ E(z+2) \quad \text{capital stock sold} \]
\[ F(z+2) \quad \text{accumulated straight line depreciation} \]
\[ H(z+2) \quad \text{accumulated ITC (tax books)} \]
\[ I(z+23) \quad \text{real investment} \]
\[ J(z+2) \quad \text{accumulated ITC (financial books)} \]
\[ K(z+2) \quad \text{tax paid (tax books)} \]
\[ L(z+23) \quad \text{actual investment} \]
\[ M(z+2) \quad \text{total actual investment} \]
\[ O(z+2) \quad \text{cash from operations} \]
\[ P(z+2) \quad \text{earnings} \]
\[ Q(z+2) \quad \text{oldest airplane in fleet} \]
\[ R(z+2) \quad \text{revenue ton miles, total real investment} \]
\[ S(z+2) \quad \text{straight line depreciation} \]
\[ T(z+2) \quad \text{tax paid (financial books)} \]
\[ U(z+2) \quad \text{accumulated deferred tax} \]
\[ V(z+2) \quad \text{accumulated tax loss carryforward} \]
\[ W(z+2) \quad \text{cash flow} \]
$X(z+2)$ inflation deflator

$Y(z+2)$ dividend

$G_1$ historical growth rate

$G_2$ future growth rate

$G_3$ historical inflation rate

$Z_1$ future inflation rate
REM -86- AIRLINE PRO FORMA

REM AIRLINE PRO FORMA
10 PRINT "AIRLINE PRO FORMA"
20 PRINT
30 PRINT "HOW MANY YEARS":
31 INPUT Z2
32 IF Z2<32 THEN 40
33 Z2=32
40 LET G5=1
41 LET Z3=0
50 DIM A(75)
51 DIM B(75)
52 DIM C(75)
53 DIM D(75)
54 DIM E(75)
55 DIM F(65)
56 DIM H(40)
57 DIM I(60)
58 DIM J(35)
59 DIM K(35)
60 DIM L(60)
61 DIM M(35)
62 DIM O(35)
63 DIM P(35)
64 DIM Q(35)
65 DIM R(35)
66 DIM S(35)
67 DIM T(35)
68 DIM U(35)
69 DIM V(35)
70 DIM W(75)
71 DIM X(60)
72 DIM Y(35)
80 PRINT
85 PRINT "INPUT INITIAL YEAR CONDITIONS"
86 PRINT
87 PRINT "REVENUE TON MILES":
88 INPUT R(2)
94 PRINT
95 PRINT "LONG TERM DEBT":
96 INPUT D(2)
97 PRINT
98 PRINT "TOTAL EQUITY":
99 INPUT C(2)
100 IF G5>6 THEN 110
101 LET Z3=Z2
102 PRINT
103 PRINT "HOW MANY MORE YEARS":
104 INPUT Z4
105 IF (Z4+Z3)<=32 THEN 109
106 Z4=32-Z3
107 Z2=Z4+Z3
110 PRINT
111 PRINT "REAL INVESTMENT FOR NEXT":(Z2-Z3):"YEARS"
PRINT
FOR G9=Z3+1 TO Z2
PRINT G9:
INPUT I(G9+23)
NEXT G9
PRINT
PRINT 'CAPITAL STOCK SOLD':
PRINT
FOR G4=Z3+1 TO Z2
PRINT G4:
INPUT E(G4+2)
NEXT G4
PRINT
PRINT 'FUTURE INFLATION RATE':
INPUT Z1
PRINT
PRINT 'FUTURE GROWTH RATE':
INPUT G2
IF G5>0 THEN 150
LET Z3=Z3+1
GOTO 185
PRINT
PRINT 'HISTORICAL INFLATION RATE':
INPUT G3
LET X(23)=1
FOR N7=1 TO 21
LET X(23-N7)=X(24-N7)*1+G3
NEXT N7
PRINT
PRINT 'HISTORICAL GROWTH RATE':
INPUT G1
LET F(1)=0
LET J(1)=0
LET H(1)=0
LET V(1)=0
LET X(1)=200
FOR G=0 TO 13
LET G0=G0+1/(1+G1)^G
NEXT G
I(23)=R(2)/G8
LET R(1)=R(2)/(1+G2)
FOR G8=6 TO 13
LET G7=(G8+.5)/(1+G3)*(1+G1)^G8
LET F(2)=F(2)+G7*I(23)/14
NEXT G8
F(40)=1
FOR N7=1 TO 20
F(N7+40)=F(N7+39)-F(40)/18
IF F(N7+40)<=0 THEN 180
NEXT N7
FOR G=0 TO 14
LET I(23-G)=I(23)/(1+G1)^G
LET L(23-G)=L(23-G)/(1+G3)^G
1 REM -38- AIRLINE PRO FORMA

184 NEXT G
185 FOR Z=Z3 TO Z2
186 M(Z+2)=0
187 Z9=0
188 Z7=0
189 C(Z+40)=0
190 A(Z+2)=0
191 R(Z+2)=R(Z+1)*(1+G2)
192 L(Z+23)=I(Z+23)*((1+Z1)^Z)
193 A(Z+40)=L(Z+23)
194 Z9=0
195 LET Z5=R(Z+2)
196 FOR Z6=0 TO 22
197 LET Z8=I(Z+23-Z6)
198 IF Z=0 THEN 200
199 X(Z+21)=X(Z+22)/(1+Z1)
200 Z5=R(Z+2)
201 FOR Z6=0 TO 22
202 Z8=I(Z+23-Z6)
203 IF Z7>0 THEN 212
204 Z5=Z5-Z8
205 IF Z5<0 THEN 206
206 IF Z6>26 THEN 1625
207 NEXT Z6
208 LET N5=L(Z+23-Z6)
209 LET I(Z+23-Z6)=Z8+Z5
210 LET L(Z+23-Z6)=N5*I(Z+23-Z6)/Z8
211 GOTO 215
212 LET N5=L(Z+23-Z6)
213 LET I(Z+23-Z6)=0
214 LET L(Z+23-Z6)=0
215 IF Z6>14 THEN 222
216 Z9=Z9+N5-L(Z+23-Z6)*Z6/14
217 C(Z+40)=C(Z+40)+(N5-L(Z+23-Z6)*(14-Z6)/14
218 E(Z+40)=E(Z+40)+(N5-L(Z+23-Z6)*F(40+Z6)*X(Z+23-Z6)/X(Z+23)
219 Z7=Z7+1
220 NEXT Z6
221 NEXT Z6
222 Z9=Z9+N5-L(Z+23-Z6)
223 E(Z+40)=E(Z+40)+(N5-L(Z+23-Z6)*F(40+Z6)*X(Z+23-Z6)/X(Z+23)
224 Z7=1
225 NEXT Z6
240 FOR N9=3 TO 23
242 LET H(Z+2)=A(Z+2)+(I(Z+N9)*(Z3.5-N9))
243 LET M(Z+2)=M(Z+2)+L(Z+N9)
244 NEXT N9
245 LET A(Z+2)=A(Z+2)/R(Z+2)
250 IF Z>0 THEN 260
251 S(Z)=M(Z)/14-L(Z23)/28+I(Z23)/(((1+G1)*(1+G3)^14)*28)
252 GOTO 270
260 S(Z+2)=L(Z+23)/28+L(Z+9)/28+Z0/28
261 FOR Z6=0 TO 12
262 S(Z+2)=S(Z+2)+L(Z+22-G6)/14
REM -AIRLINE PRO FORMA-

263 NEXT G6
270 LET R(Z+2)=.143*L(Z+23)+.245*L(Z+22)+.175*L(Z+21)
271 LET B(Z+2)=B(Z+2)+.125*L(Z+20)+.6E-02*L(Z+19)+8.7E-02*L(Z+18)
272 LET R(Z+2)=R(Z+2)+.6E-02*L(Z+17)+4.3E-02*L(Z+16)
275 IF Z=0 THEN 300
280 LET F(Z+2)=F(Z+1)+5*(Z+2)-Z9
281 LET C(Z+2)=C(Z+2)+.125*L(Z+20)+.9E-02*(R(Z+2)-N9/7)/X(Z+22)
290 IF Z>0 THEN 315
312 LET D(Z+2)=D(Z+1)+D(Z+39)\(Z+1)+K(Z+1)+B(Z+39)
316 LET D(Z+2)=D(Z+2)+L(Z+23)+L(Z+22)+E(Z+40)-E(Z+39)/2-E(Z+2)
317 IF D(Z+2)>0 THEN 320
318 D(Z+40)=0-D(Z+2)
319 D(Z+2)=0
320 IF Z>0 THEN 324
321 B(40)=9E-02*D(Z+2)-7E-02*D(40)
323 GOTO 325
324 B(Z+40)=9E-02*D(Z+2)-7E-02*D(Z+40)
325 N=(O(Z+2)-S(Z+2)-B(Z+40)+E(Z+40)-C(Z+40))/2-E(Z+2)
326 IF N>0 THEN 340
327 T(Z+2)=N
328 J(Z+2)=J(Z+1)+(B(Z+2)*7E-02)
329 GOTO 369
340 LET N1=(B(Z+2)*7E-02)*J(Z+1)-N*5
350 IF N1>0 THEN 360
351 LET T(Z+2)=N-(B(Z+2)*7E-02+J(Z+1))
352 LET J(Z+2)=0
353 GOTO 369
360 LET T(Z+2)=N*5
361 LET J(Z+2)=J(Z+1)+(B(Z+2)*7E-02)-N*5
369 N3=(O(Z+2)-B(Z+2)-B(Z+40)+E(Z+40))/2-E(Z+2)
370 IF N3>0 THEN 390
371 LET N2=B(Z+2)*7E-02+H(Z+1)-N3*5
372 IF N2>0 THEN 380
373 LET K(Z+2)=N3-B(Z+2)*7E-02-H(Z+1)
374 LET K(Z+2)=K(Z+2)-V(Z+1)
375 IF K(Z+2)>0 THEN 397
376 LET K(Z+2)=0
377 LET V(Z+2)=V(Z+1)-N3-B(Z+2)*7E-02-H(Z+1)
378 LET H(Z+2)=0
379 GOTO 400
380 LET K(Z+2)=N3*5
381 LET K(Z+2)=K(Z+2)-V(Z+1)
382 IF K(Z+2)>0 THEN 394
383 LET K(Z+2)=0
384 LET V(Z+2)=V(Z+1)-N3*5
385 LET H(Z+2)=H(Z+1)+B(Z+2)*7E-02-N3*5
386 GOTO 400
390 LET K(Z+2)=0
391 LET V(Z+2)=V(Z+1)-N3
392 LET H(Z+2)=H(Z+1)+7E-02*B(Z+2)
393 GOTO 400
394 LET H(Z+2)=H(Z+1)+7E-02*B(Z+2)-5*N3
395 LET Y(Z+2)=0
396 GOTO 400
397 LET Y(Z+2)=0
398 LET H(Z+2)=0
400 FOR N4=0 TO 21
401 IF I(Z+2+N4)>0 THEN 403
402 NEXT N4
403 LET Q(Z+2)=21.5-N4
410 P(Z+2)=P(Z+2)+S(Z+2)-B(Z+40)-T(Z+2)+E(Z+40)-C(Z+40)
420 LET W(Z+2)=P(Z+2)+T(Z+2)-K(Z+2)+S(Z+2)
430 LET U(Z+2)=U(Z+1)+T(Z+2)-K(Z+2)
440 LET V(Z+2)=V(Z+2)+5*P(Z+2)
441 IF Y(Z+2)>0 THEN 443
442 LET Y(Z+2)=0
443 IF Z=0 THEN 445
444 LET C(Z+2)=C(Z+1)+E(Z+2)+P(Z+2)-Y(Z+2)
445 W(Z+40)=O(Z+2)+E(Z+40)-K(Z+2)+B(Z+40)-L(Z+23)
450 NEXT Z
451 IF G5>0 THEN 460
452 LET Z3=Z3+1
460 PRINT
470 PRINT 'BASIC DATA-1; TAX DATA-2; TAX RATE-3; CASH FLOW-4;'
471 PRINT 'FLEET DATA-5; DEPRECIATION-6; DEBT STRUCTURE-7;'
472 PRINT 'ALL OF THE ABOVE-8; ENOUGH ALREADY-9;'
474 PRINT 'WHAT DATA':
475 INPUT N8
476 IF N8=2 THEN 600
477 IF N8=3 THEN 650
478 IF N8=4 THEN 700
479 IF N8=5 THEN 800
480 IF N8=6 THEN 900
481 IF N8=7 THEN 1000
482 IF N8=9 THEN 1600
483 PRINT
484 PRINT
485 PRINT 'BASIC DATA'
486 PRINT
487 PRINT 'YEAR', 'EARNINGS', 'ROI', 'CASH FLOW', 'INVESTMENT'
488 PRINT
489 IF G5=0 THEN 494
490 PRINT Z3, P(2), P(2)/(.15*R(2)+M(2)-F(2)+D(40)), W(2), A(40)
491 PRINT
492 FOR N7=Z3+1 TO Z2
493 N0=1.15*R(N7+2)+M(N7+2)-F(N7+2)+D(N7+40)
494 PRINT N7, P(N7+2), P(N7+2)/N0, W(N7+2), A(N7+40)
495 PRINT
496 NEXT N7
497 IF N8=8 THEN 600
500 GOTO 474
600 PRINT
601 PRINT
602 PRINT 'TAX DATA'
1. REM -91- AIRLINE PRO FORMA

603 PRINT
610 PRINT 'YEAR', 'TAX PAID', 'DEF. TAX', 'ACC. ITC', 'LOSS CF'
611 PRINT
615 IF G5=0 THEN 620
616 PRINT Z3, K(2), T(2)-K(2), H(2), V(2)
617 PRINT
620 FOR N7=Z3+1 TO Z2
625 PRINT N7, K(N7+2), T(N7+2)-K(N7+2), H(N7+2), V(N7+2)
626 PRINT
630 NEXT N7
640 IF N8=8 THEN 650
645 GOTO 474
650 PRINT
651 PRINT
652 PRINT 'TAX RATES'
653 PRINT
660 PRINT 'YEAR', 'BOOK RATE', 'ACTUAL RATE'
661 PRINT
665 IF G5=0 THEN 670
666 N9=T(2)/O(2)-S(2)-B(40)+E(40)-C(40)
667 PRINT Z3, N9, K(2)/O(2)-B(2)-B(40)+E(40)
668 PRINT
670 FOR N7=Z3+1 TO Z2
672 N9=T(N7+2)/O(N7+2)-S(N7+2)-B(N7+40)+E(N7+40)-C(N7+40)
673 N9=K(N7+2)/O(N7+2)-B(N7+2)-B(N7+40)+E(N7+40)
675 PRINT N7, N5, N9
676 PRINT
680 NEXT N7
690 IF N8=8 THEN 700
695 GOTO 474
700 PRINT
701 PRINT 'CASH FLOW'
702 PRINT
710 PRINT 'YEAR', 'CASH OPS', 'A/P SALES', 'DIVIDEND', 'NET C.F.'
711 PRINT
715 IF G5=0 THEN 720
717 PRINT Z3, O(2), E(40), Y(2), W(40)
718 PRINT
720 FOR N7=Z3+1 TO Z2
725 PRINT N7, O(N7+2), E(N7+40), Y(N7+2), W(N7+40)
726 PRINT
730 NEXT N7
734 PRINT
735 PRINT 'DISCOUNT CASH FLOW TO WHAT BASE YEAR':
736 INPUT N7
743 PRINT
745 PRINT 'DISCOUNT RATE', ' NPV'
746 PRINT
747 FOR N6=0 TO .5 STEP 5E-02
748 LET N9=9
749 FOR N5=N7 TO Z2
750 N9=N9+W(N5+40)/((1+N6)^(N5-N7))
1 REM -92- AIRLINE PRO FORMA

751 NEXT N5
752 FOR N5=1 TO 21
753 N9=N9+(N(N7+2)+F(N7+2)+X(N7+2))/R(N7+2)
760 NEXT N5
770 PRINT
780 PRINT N6,N9
790 NEXT N6
800 PRINT
810 PRINT 'DISCOUNTED CASH FLOW AGAIN-1; CONTINUE-0':
820 INPUT N7
830 IF N7=1 THEN 734
840 IF N7=8 THEN 800
850 GOTO 474
860 PRINT
870 PRINT 'FLEET DATA'
880 PRINT 'YEAR', 'AVERAGE AGE', 'OLDEST A/P', 'RTM', 'CBV/RTM'
890 PRINT
900 PRINT 'YEAR', 'S.L. DEP', 'ACC. DEP', 'BOOK VALUE', 'DDB DEP'
910 PRINT
920 IF G5=0 THEN 920
930 PRINT 'YEAR', 'DEBT', 'SECURITIES', 'ACC. DEF. TAX', 'DEBT-EQUITY'
940 PRINT
950 FOR N7=Z3+1 TO Z2
960 PRINT N7,SC(N7+2),FC(N7+2),MC(N7+2)-FC(N7+2)*X(N7+2)/R(N7+2)
970 NEXT N7
980 IF N7=8 THEN 1000
990 GOTO 474
1000 PRINT
1010 PRINT 'DEBT STRUCTURE'
1020 FOR N7=Z3+1 TO Z2


```
1021 N5=(D(N7+2)+U(N7+2))/(D(N7+2)+U(N7+2)+C(N7+2))
1025 PRINT N7, D(N7+2), D(N7+40), U(N7+2), N5
1026 PRINT
1030 NEXT N7
1040 IF N8=8 THEN 1606
1050 GOTO 474
1600 PRINT
1601 PRINT
1602 PRINT 'ENOUGH ALREADY!'
1603 PRINT
1604 PRINT 'MORE YEARS-1; STOP-0':
1605 INPUT N6
1606 IF N6=0 THEN 1999
1620 LET G5=0
1621 GOTO 101
1625 I(Z+23)=I(Z+23)+Z5
1630 PRINT
1631 PRINT 'YEAR':Z: 'INVESTMENT REVISED TO': I(Z+23)
1640 GOTO 186
1999 PRINT 'THANK GOD!'
2000 END
```
Referring to the program listing, the following major sections can be identified:

- **lines 10 - 159**: variable scaling and input
- **lines 160 - 184**: establish initial conditions
- **lines 185 - 319**: calculation of depreciation
- **lines 320 - 398**: calculation of taxes
- **lines 400 - 450**: earning and cash flow
- **lines 451 - 1050**: print options
- **lines 1600 - 2000**: exit and corrections

All calculations in the program are done in a step by step fashion, completing one year and then incrementing to the next year.