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Blended winglets

Recommendation report

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Summary

Airline Qjet operates in a competitive market. Within this market, Qjet wants to achieve the goals set regarding environment, innovation and cost reduction. Qjet has requested a project team to investigate if a winglet modification on all the aircraft will help Qjet reach these goals.

Research has concluded that the B737-300 will not be modified with Blended Winglets (BW). The value of the organisation, Net Present Value (NPV), is negative. Next to that, the break-even point of the winglet modification is reached after the phase out is completed. The B737-700 and the B737-800 will be modified with the Split Scimitar Singlets (SSW) rather to the BW. The NPV is positive for these modifications. On top of that, the break-even point is reached within the 10-year timeframe and before phase out.

The NPV is decisive in the conclusion of the modification. The NPV can be calculated with the values of the airlines financial balance and the calculations of the modifications; the Net Cash Flow (NCF), the Weight Average Capital Costs (WACC), the risk factor and the timeframe.
The NCF is the yearly income minus the yearly costs including the costs and incomes of the modification. The WACC is the cost an organisation has to pay for the total owned capital by the proportionally weight values of all costs, assets and tax rate. The value of the WACC is 7,8%. The risk factor is calculated by an identification of the risks and an assessment of expected probability and impact. The overall risk factor is 32%. The timeframe, as stated by Qjet, regards 10 years.

The NPV is calculated for all possible modifications of all aircraft in 3 possible cases; worst-, most likely and best-case. The modification can be recommended if the NPV has a higher positive outcome than the baseline. The baseline of the NPV is calculated without any modifications.
The NPV of the B737-300 is in all the cases negative. The NPV of the B737-700 is in all cases with positive. The NPV of the B737-800 is positive in all case with both modifications, except for the BW modification in the worst-case.

The NCF of the company is not constant. The income and costs of the airline are constantly changing. In 2015 the total airline costs are the costs for fuel, personnel, inflight service, fees, ground service, depreciations of aircraft and building and reservation for maintenance parts and tooling. These costs are € 1,18 billion. The incomes of the airline is the income of flight tickets and inflight service, this income is € 1,19 billion.
The costs of the modification are grouped in acquisition, transportation, insurance, modification personnel and reduced revenue. The total modification costs are € 8,6 million per year over 10 years. The benefits of the modification are fuel savings and the reduced maintenance costs, this results in a total financial benefit of € 11,8 million the first year.

The modifications of the B737-700 and B737-800 are recommended to be performed during the summer season of 2016. The winglets will be transported by airfreight to the maintenance hangar at Schiphol. The modification will be performed by hired mechanics, with winglets and tooling from Aviation Partners Boeing. Through the modification, Qjet will achieve the environmental goal by a reduced fuel flow of 3%, a reduction in noise of 6,5% and an emission reduction of 5%. Next to that, the goal of innovation is achieved, because the SSW are introduced in 2014. The technique is still new and the maintenance personnel need training for the maintenance of the winglets. Lastly, the goal of cost reduction is achieved since the engines use 3% less fuel. This leads to less power required which in turn results in less wear of the engines. This results in an engine maintenance reduction of 9%.

Introduction

Qjet wants to know of it will be feasible and desirable to add winglets to the current fleet of 3 B737-300, 7 B737-700 and 40 B737-800 aircraft. Qjet investigates the winglets will comply with the goals in terms of environment, innovation and cost reduction. Whether or not this decision is favourable will be investigated. Moreover, Qjet has set boundaries. The timeframe of the investigation is 10 years. If it is decided to modify the fleet, it shall be performed by the technical services department integrated in Qjet.

In order to conduct this investigation, Qjet has appointed a project team consisting of seven people. All seven have done previous projects, which makes them capable to investigate the possibility of winglets for the fleet.

After the conclusion (1) of the investigation of Qjet is described, the project group gives recommendations for the future (2). The project group has come to this conclusion based on the net present value (3). The result of the report viewed through different cases of the scenario (4). In order to get the full picture, the costs of every aspect of the winglets and other factors that affect the costs and benefits of the modification are investigated, namely the weight average capital cost (5). To perform a modification, the risks of the modification and the advantages and disadvantages of winglets will be taken in account. The modification risks are explained in modification risks (6). The status of Qjet has influence on the arguments for the conclusion. The airline will be fully described in the final chapter (7) of this report on how winglets will have an effect on the airline.

The various appendices support the chapters and give extra explanation where needed. Appendix XII calculates the savings achieved by the winglets. In order to get the information on the winglets, the website of Aviation Partners Boeing (APB) is used, APB is the manufacturer of winglets for Boeing aircraft. This rapport is based on guidelines from the aviation instances such as the European Aviation Safety Agency (EASA) and the International Air Transport Association (IATA).

1 Conclusion

To decide whether or not to modify will depend on the Net Present Value (NPV) calculations. The NPV has been calculated in different cases with several different variables. The modification needs to be profitable within the timeframe of 10 years or before phase out as requested by Qjet.
The NPV has to comply with two different statements. The first statement is that the NPV has to be positive, otherwise the value of the company will decrease and extra funds are needed. The second statement the NPV, when modified, needs to be higher than the baseline. The baseline is the NPV in the same timeframe calculated without modifying the aircraft.

By means of the NPV there can be concluded that the B737-300 will not be modified. This is concluded because the NPV is negative in all cases and below the baseline. The modification has to be profitable within 3 years, as the aircraft will be phased out by the end of 2017. This result is due to the savings being too low in order to reach a break-even point within the 3-year timeframe.

The NPV calculations for the B737-700 conclude that both the blended winglet (BW) and the split scimitar winglet (SSW) are viable options. The NPV is higher than the baseline and positive in all different cases. In all cases the NPV of the SSW is higher than the NPV of the BW. This results in the SSW being more profitable for Qjet. The break-even point is later for the SSW, compared to the BW, but the savings will pay back this difference by the end of the 10-year timeframe.

The SSW is the best option for the B737-800. In all cases the SSW has a positive NPV, while the BW has a negative NPV in the worst case. The break-even point for the B737-800 of all cases is reached within the set timeframe. The break-even point for the BW is reached faster except for the worst case. From this fact there can be concluded that the BW is no option for Qjet and that the SSW will be recommended on the B737-800 fleet.

2 Recommendation

This research does not include an opportunity cost since there was no alternative investment plan present. Therefore, further investigation of the opportunity costs is recommended. The most common alternative is to deposit the money in a bank account in order to receive interest. Nowadays the interest is negative[1], therefore it will cost money to deposit the money in a bank account. Further research on the possible alternatives will result in a better picture of the investment possibilities that Qjet has for the near future.

[1] European Central Bank (ECB) deposit rate: https://www.ecb.europa.eu/stats/monetary/rates/html/index.en.html

3 Net present value

The NPV is the value of the organization. The NPV is calculated to predict the future value of the organization. For Qjet the NPV has been calculated for each winglet modification on each aircraft for a timeframe of 10 years. The NPV can be calculated with the following equation (Equation 1: Net present value formula).

$$NPV = \frac{Net\ cash\ flow}{(1 + (i + r))^t}$$

Equation 1: Net present value formula

The net cash flow (NCF) has been calculated as the difference between the costs and income, plus the savings in fuel costs minus the costs that have to be paid for the modification per year (7). The ‘i’ is the costs of capital (5), or weight average capital costs (WACC). The ‘r’ in this equation is the risk factor. The risk factor can be concluded from the risk analysis made in (6). The ‘t’ is the amount of years the NPV has to be calculated for. In this case the ‘t’ will be 10 years for the B737-700 / -800 and 3 years for the B737-300 due to the phase-out policy.

In order to compare the NPV for different aircraft in the 3 cases, a baseline has to be set. The cases are concluded from the scenario analysis (4). This baseline is set by not modifying the aircraft and calculating the NPV in that case. The following table shows the NPV values for the 3 aircraft types without modification, the baseline (Table 1: Net present value calculations without modification).

Aircraft	Worst case	Most likely	Best case
B737-300	€ - 449 647	€ 4 122 009	€ 3 715 622
B737-700	€ - 1 186 296	€ 10 875 009	€ 9 802 845
B737-800	€ - 7 322 882	€ 67 130 285	€ 60 511 928

Table 1: Net present value calculations without modification

The next table shows the NPV for the aircraft with the modification installed in the 3 cases (Table 2: Net present values with modification).

Modification type	Worst case	Most likely	Best case
B737-300 BW	€ - 1 232 522	€ - 536 784	€ - 509 441
B737-700 BW	€ 6 677 242	€ 19 258 866	€ 19 197 535
B737-700 SSW	€ 11 298 492	€ 24 143 737	€ 24 594 551
B737-800 BW	€ - 1 426 860	€ 74 509 524	€ 70 772 646
B737-800 SSW	€ 2 563 013	€ 79 178 689	€ 76 761 485

Table 2: Net present values with modification

Concluding from the tables above, the B737-300 will not be modified as the NPV will not be positive within the timeframe set before the phase-out. The B737-700 / -800 can both be modified with the split scimitar as this modification has a positive NPV relative to the baseline after 10 years in all the cases. The NPV of the blended winglet is positive relative to the baseline for the B737-700 in all cases and can be considered as an option. However, the NPV of the B737-800 blended winglet modification is negative relative to the baseline in the worst case. Therefore, the blended will not be included as an option to consider for modifying for B737-800 fleet.

4 Scenario

In order to provide a recommendation for the winglets, 1 scenario with 3 cases has been developed. The 3 cases are:

- Best case
- Worst case
- Most likely case

For each of the cases, 6 different variables (Appendix III) have been set. These variables have been adjusted to the worst and best predictions resulting from the market analysis (Appendix IV). With all the variables together in a model, a sensitivity analysis can be made (Appendix V). The cases are made based on the predictions from the market analysis. The most likely case is intermediate to the best case and the worst case.

4.1 Worst case

The current world economy is recovering from the economic crisis that occurred in the year 2008. This recovery is still fragile and therefore there is a realistic chance that the world economy will collapse again. For this reason, the worst case is based on a new economic crisis. The table below (Table 3: Worst case variables) shows how the variables change. The explanation of the variables and dependencies can be found in Appendix V.

Worst case	Current	At year 10	Difference per year
Load factor	80%	58%	-0,30%
Use of IFS	60%	77%	-0,30%
IFS margin	250%	264%	0,50%
Ticket margin	5%	8%	4,50%
Kerosene price	$ 474,90	$ 474,90	0,00%
€ / $ Rate of exchange	$ 1,115	$ 1,026	-0,75%

Table 3: Worst case variables

As the table shows, almost all the variables have become negative in this case. The variables that have been raised are the ticket margin and the inflight services (IFS) margin. The revenue of Qjet will be under pressure and therefore the break-even point of the modification will move further into the future (Table 4: Break-even point worst case).

Modification	Years	Months
B737-300 BW	9	9
B737-700 BW	4	4
B737-700 SSW	4	3
B737-800 BW	7	7
B737-800 SSW	7	11

Table 4: Break-even point worst case

The table shows that for all possible modifications the investment is returned within 10 years. However, during this crisis, the costs of the airline will increase and the income will decrease. This result in a negative NPV for the B737-300 and the B737-800 Blended Winglet (BW) modification (Table 2: Net present values with modification). This means that if Qjet invests in the modification, the airline will not be profitable at the end of the 10-year timeframe (Appendix VI, Table 26: Revenue worst).
The modification B737-700 BW and B737-700 / -800 SSW do have a positive NPV, and can be recommended.

4.2 Best case

In the best case, the economy will recover faster than presumed. The world Gross Domestic Product (GDP) will increase and more people will use the sky for transport. The table below (Table 5: Best case variables) shows the percentages that are assumed with this case.

Best case	Current	At year 10	Difference per year
Load factor	80%	85%	0,55%
Use of IFS	60%	65%	0,70%
IFS margin	250%	250%	0,00%
Ticket margin	5%	5%	0,00%
Kerosene price	$ 474,90	$ 812,24	5,00%
€ / $ Rate of exchange	$ 1,115	$ 1,386	2,00%

Table 5: Best case variables

A very noticeable change is the increase of the price for kerosene by 5%. Normally the increase of kerosene price would be a bad thing, but in this case it makes the modification more profitable. More savings will be made against the same cost and therefore the investment is returned faster. In this case, the euro is growing stronger which will decrease cost for modification.

Modification	Years	Months
B737-300 BW	9	2
B737-700 BW	4	3
B737-700 SSW	4	1
B737-800 BW	7	2
B737-800 SSW	7	5

Table 6: Break-even point best case

The table above (Table 6: Break-even point best case) shows that all the investments will be returned within 10 years. With the increased fuel price will the savings increase rapidly. Together with an increase of the load factor, use of IFS services and positive NPV value (Table 2: Net present values with modification), the revenue of Qjet will be steady over the coming 10 years (Appendix VI, Table 27: Revenue best case). The drop in revenue after 2019 can be explained by the rising fuel cost, which can no longer be covered by the savings alone. Although the drop of revenue in 2019, it can be concluded that modification is profitable for all aircraft except for the B737-300. The B737-300 aircraft will be phased out in 2017 and the investment is not returned within two years.

4.3 Most likely case

Both of the above cases together create the most likely case. The economy is steadily recovering and the kerosene prices are slowly increasing as predicted. The representing numbers are found in the table below (Table 7: Most likely case variables).

Most likely case	Current	At year 10	Difference per year
Load factor	80%	83%	0,30%
Use of IFS	60%	62%	0,30%
IFS margin	250%	250%	0,00%
Ticket margin	5%	5%	0,00%
Kerosene price	$ 474,90	$ 640,03	2,75%
€ / $ Rate of exchange	$ 1,115	$ 1,271	1,20%

Table 7: Most likely case variables

The return on investment time of the most likely case will be a few months longer than in the best-case (Table 8: Break-even point most likely case). This means that the modifications will also be profitable within the stated 10 years, however, the B737-300 is not profitable within the 3-year spectrum.

Modification	Years	Months
B737-300 BW	9	6
B737-700 BW	4	4
B737-700 SSW	4	3
B737-800 BW	7	5
B737-800 SSW	7	9

Table 8: Break-even point most likely case

Beside the positive return time on the investment for the B737-700 and B737-800, the NPV is positive (Table 2: Net present values with modification) and thus allows a revenue growth until 2024 (Appendix VI, Table 28: Revenue most likely case). Therefore, it can be concluded that with the most likely case the modification on the B737-700 and B737-800 will be profitable within the 10-year timeframe.

4.4 Conclusion cases

The modification will be recommendable for the airline if the modification break-even point and the NPV is positive at the end of the 10-year timeframe. The possible recommendations are show in Table 9: Possible recommendations modifications.

Modification	Worst-case	Best case	Most likely case
B737-300 BW	Negative	Negative	Negative
B737-700 BW	Positive	Positive	Positive
B737-700 SSW	Positive	Positive	Positive
B737-800 BW	Negative	Positive	Positive
B737-800 SSW	Positive	Positive	Positive

Table 9: Possible recommendations modifications

5 WACC

WACC of a company is the cost that an organisation has to pay for the total capital owned. In order to calculate the WACC several components are needed for the formula (Appendix VII); the equity, the total debts, the cost of capital, the rate of interest and the tax rate. The total debts, the cost of capital and the rate of interest can be derived out of the balance sheet of Qjet. The WACC of Qjet is 7,79% of the total capital.

5.1 Assets

5.1.1 Debit

The debit side of a financial balance consist out of all the assets of a company, divided in 2 categories: fixed and current assets. Fixed assets are assets that are fixed for a year. For Qjet the fixed assets are:

- Property
- Aircraft
- Landing rights

The value of the fixed assets decreases every year; this is called depreciation. This depreciation is the reservation for wear and tear of the equipment. However, landing rights value does not decrease and remain the same over time. The landing rights are hard to acquire on the major airports Qjet flies on. This scarcity results in a steady value for the landing rights. The value of the landing rights a fixed value of € 49 858 per take-off and landing at Schiphol, resulting in a total value of € 3,6 billion. An overview of the value of property and aircraft is given in Appendix VIII.

The next part of the debit side is the current assets. These assets are a representation of the value of all assets expected to be converted to cash within 1 year. Qjet has 2 current assets on the balance:

- Stocks
- Cash

The parts in storage, stocks, are used for the routine maintenance. All the parts in storage have the value of 5% of the new price of the aircraft. Besides stocks, cash is needed to pay the suppliers, therefore the amount of cash is roughly 1/8 times the yearly costs.
An overview of the all the assets is given in Table 10: Debits Qjet, resulting in a total value of € 6,5 billion of all assets.

Debit	Value
Fixed assets	
Property	€ 22 800 000
Aircraft	€ 2 512 000 000
Landing rights	€ 3 600 000 000
Current assets	
Stocks	€ 174 500 000
Cash	€ 150 000 000
Total	€ 6 459 300 000

Table 10: Debits Qjet

5.1.2 Credit

The credit side of a balance sheet consist out of all the liabilities of the company. The liabilities with duration less than 1 year are the current liabilities, such as ground services and invoice of fuel. Liabilities with duration longer than 1 year are called fixed liabilities. The value of the current liabilities is presumed 40% of the monthly operating costs, resulting in € 30 million.
The fixed liabilities consist out of two balance posts:

- Equity
- Long term debts

The total fixed liabilities can be calculated, because both sides of a balance need to be even. So the total of the credit side needs to be € 6,5 billion. The current liabilities are removed from the total, resulting in the total fixed liabilities of € 6,5 billion. The rate of interest is 8% (Appendix II).
The long-term debts are 10% of the total liabilities representing a value of € 643 million. The second post for the fixed liability is the equity, consisting out of two parts, the shareholders and the private equity. The shareholders provide Qjet with 35% of the total fixed liabilities, resulting in a 55% private equity. The total equity has a value of € 5,8 billion.
An overview of the credit side of the balance is in Table 11: Credits Qjet.

Credit	Value
Fixed liabilities	
Equity	€ 5 786 370 000
long term debts	€ 642 930 000
Current liabilities	
Short term debts	€ 30 000 000
Total	€ 6 459 300 000

Table 11: Credits Qjet

There can be concluded that the equity represents a value of € 5,8 billion and the debt is € 673 million.

5.2 Stock exchange listed

Companies can choose to be stock exchange listed, which brings a number of advantages and disadvantages. The main reason for a company to list on the stock market is to attract additional capital. After the financial crisis in 2001, Qjet decided to react on the market and the new opportunities. In 2002, Qjet became listed on the stock exchange. The additional capital is used to partially finance the purchase of the B737-800 aircraft, with which Qjet can reach a wider market. Qjet listed with 35% of the owned funds. This means that Qjet can still make investments when needed by selling more shares. Qjet will bring a maximum of 49% of its shares to the stock market. After the listing on the stock market in 2002, the share price in 2014 is around € 42. The share has been dependent on the financial market and as shown in the graph (Table 12 Market share Qjet), after the crisis in 2008, the share significantly dropped. After the crisis, the share has had a constant growth.

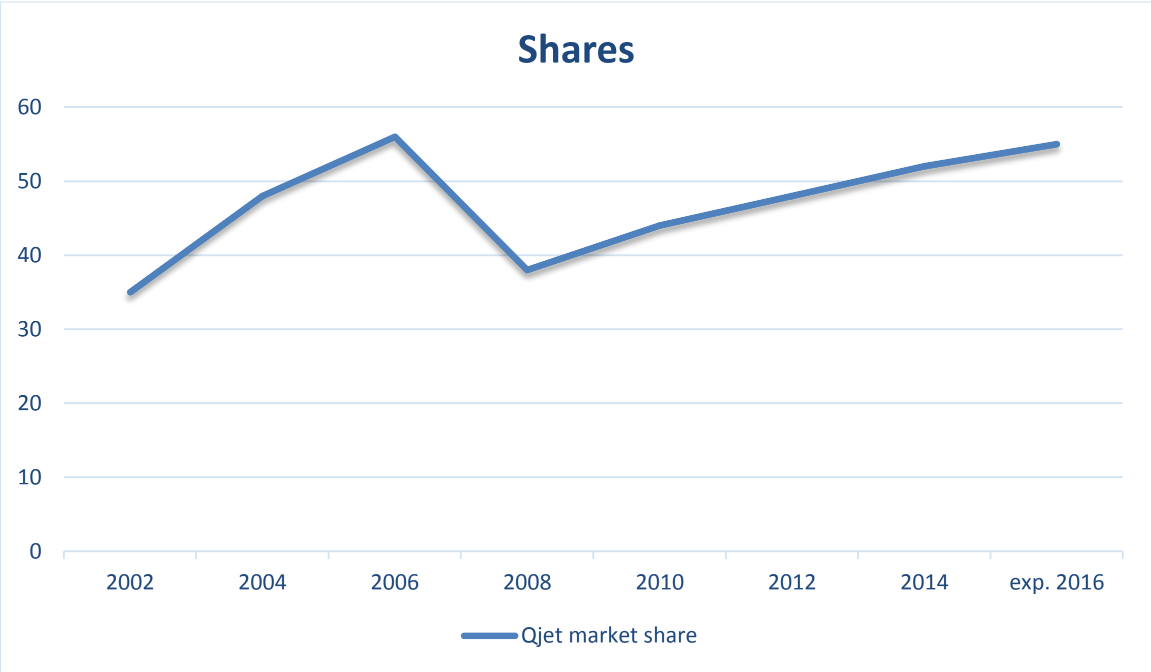

Table 12 Market share Qjet

When listed on the stock market the brand awareness of Qjet has grown, this gives the opportunity for the company to develop and grow. A company will receive a decent position within the financial world when listed, so there is a possibility to attract investors and get more capital.

5.2.1.a Requirements stock market:

There are a number of conditions and requirements if a company wants to list. Companies need to comply with a number of quality standards and the financial situation of the company must be transparent, this implies that Qjet needs to share financial information with the outside world. Including that, the company must meet a number of reporting requirements. At Qjet, there are 2 employees in the finance department, which are involved with the stock market listing. The following requirements are mandatory for a stock listing:

- Publishing quarterly financial reports
- Obliged meetings with Shareholders
- Transparency of the financial situation of the company

6 Modification risks

To support the conclusion via the NPV a risk factor has to be calculated according the risk analysis. This factor will be included as a percentage. Via the risk analysis costs have to be known and explained. These costs are related to the modification process. When calculating these costs there are no extra variables included as previously done in the scenario analysis.

6.1 Risk analysis

6.1.1 Defining risks and scores

The risk analysis will determinate which risks can occur during the modification. These risks will be classified by the impact and the expected occurrence of the risk. With the use of this method there can be evaluated how much risk is taken with the modification of Qjet its aircraft. The chances that errors occur and the impact that these errors will have, are set in 5 factors (Appendix IX). These factors will be multiplied with the probability of the error to show the total risk per combination (Appendix X).

6.1.2 Managing the risks

Risks connected to the modification process can be divided into multiple categories. The risks that are applicable to Qjet have been divided into the following categories:

- Organisation
- Modification
- Logistics
- Human factors
- Laws and regulations
- Finance
- External

For each risk, the possible error is given (Table 13: Risks and possible errors). For the risk factors that have been assigned can be referred to the table of Appendix X.

No.	Activity / Description	Risk factor	Possible errors
Organisation			
1	Lack of hangar space	Medium 3D (12)	Modifications will not be finished in time, which will cause a domino delay in the whole process.
Modification			
2	Error by mechanic / Unusable set of winglets	Low 1D (4)	Due to an error, a set of winglets proves to be unusable. Delays can occur due to reordering.
3	Incorrect Tooling	Low 2A (2)	Tooling for the modification is not present and / or wrong, slowing down modification.
Logistic			
4	Late delivery of parts	Medium 3D (12)	Late delivery can cause a domino effect throughout the whole process, causing a delay that can influence the airlines performance.
5	Shipping damage	Low 1D (4)	During shipping winglets can be damaged and declared unusable.
6	Hold on delivery by supplier	Medium 2D (8)	The supplier holds the deliveries and creates a direct delay in the process of modification.
Human factors			
7	Injurie during work	Low 2B (4)	By failing to comply with safety regulations, injuries can occur and staff can be unable to work for multiple weeks, as well as the modification itself due to investigation to the cause.
8	Illness of personnel	Low 3A (3)	Illness can lead to less available manpower on the floor.
9	Lack of personnel	Medium 2E (10)	Insufficient personnel to perform the modifications can lead to a longer lead-time and results in delay in the modification process.

10	Lack of knowledge	Medium 2E (10)	Insufficient knowledge will lead to errors in the process and slows the process down or causes dangerous situations.
Laws and regulations			
11	Regulation changes	Medium 1E (5)	Changes in regulations according to the winglet modifications can lead to a stop or delay of the project.
12	No release to service	Medium 2E (10)	Incorrect installation or production faults can lead to errors during test flights. This can lead to AOG.
Financial			
13	Insufficient equity	Medium 2E (10)	No money will be available to further start / proceed the modifications.
14	Incorrect values	Medium 3C (9)	The costs for the winglets can be higher than calculated due to wrong value use or supplier price raise. This will result in a budget exceedance.
15	Rising cost / Extra tooling	Major 5C (15)	Due to errors or wrong use of tooling, extra tooling or winglets might be needed which will raise the costs for the modification.
External			
16	Low fuel prices	Major 4D (16)	If the oil prices remain low, the fuel savings remain small. This results in less profit from the winglets.
17	Economic crisis	Major 4E (20)	Economic crisis strikes and the equity of Qjet drops.
18	Currency change	Medium 5B (10)	Raise of the dollar exchange rate can cause higher costs for tooling and winglets.

Table 13: Risks and possible errors

6.1.3 Minor / Medium risks

The risks rated between 4 and 8 have been rated minor and can generally be mitigated by taking control measures. The risks that have a factor rated less than 4 are too little of impact to have any influence on the feasibility of the project. Beside the minor risks, there are also medium risks. These risks are harder to mitigate and have a higher impact on the process of the modification. The risks rated from 4 until 12 are shown with the respective mitigations made by Qjet (Table 14: Minor and medium risks).

Activity / Description	Risk factor	Control measures
Minor		
Error by mechanic / Unusable set of winglets	4	The implementation of SOPs will decrease the impact of the error. The error can be found by looking at completed procedures.
Shipping damage	4	There is an insurance policy to cover the cost of the damage. A reserve winglet unit is also available for this risk.
Injuries during work	4	High safety standards and procedures. Aside SOPs are available for installing the winglets. There will be daily controls on safety.
Regulation changes	5	Out of Qjet its control
Hold on delivery by supplier	8	Out of Qjet its control
Medium		
Incorrect values	9	The cost model must be checked by multiple people to minimize the risk of incorrect values.
Lack of personnel	10	Hiring personnel to perform the modification.
Lack of knowledge	10	Hiring experienced mechanics.
No release to service	10	Monitoring the modification process and maintaining the high level of reliability set by Qjet.
Insufficient equity	10	Qjet will keep in contact with all the funders and the bank.
Currency changes	10	Out of Qjet its control.
Lack of hangar space	12	Flexible planning will make room to place AOG in the hanger.
Late delivery of parts	12	A reserve unit of winglets will be present in the warehouse. This will reduce the delays.

Table 14: Minor and medium risks

6.1.4 Major risks

Major risks are risks that have a risk factor rated between 15 and 25. These risks will have a high impact on the feasibility of the project, therefore it is important that these risks are known before a decision for the modification can be made. All the major risks are out of the direct control of Qjet, no direct measures can be taken (Table 15: Major risks).

Activity / Description	Risk factor	Control measures
Rising cost / Extra tooling	15	Out of Qjet its control
Low Fuel prices	16	Out of Qjet its control
Economic crisis	20	Out of Qjet its control

Table 15: Major risks

6.1.5 Conclusion

For the risks, Qjet is dependent on external sources to mitigate them. The controlled risks give a risk factor that is used for the calculation of the NPV. The maximum risk is achieved if each activity has the highest risk factor of 25. The risk factor for the modification of the aircraft of Qjet is 32% out of the total amount of possible risk.

6.2 Modification

As seen in the risk analysis, modification and the associated parts; equipment, logistic, staff and finances make up most of the risks.

6.2.1 Modification types

The B737 series have 2 different types of winglet modifications available based on the generation of the B737. Aviation Partners Boeing (APB) introduced in 2001 a modification for this type of aircraft, the BW for the B737-300 and B737-700 / -800. APB improved the BW in 2014 with a new type of winglets, the SSW for the B737-700 / -800.

6.2.1.a Blended Winglet

According the original equipment manufacturer (OEM), APB[2], the BW is a modification on the wingtips of the aircraft made of carbon fibre composite. This upward-swept wingtip modification reduces the wingtip vortex, which results in a significant reduction in induced drag. When the drag is reduced on the aircraft, less power from the engines is required to create movement of the aircraft. According the APB[3][4], this result in less fuel needed and reduction in noise and emission production (Appendix XI). For some aircraft, the noise reduction can result in lower airport fees, however the B737 series do not have this specific advantage (Appendix XII). Beside the noise reduction, the payload range capability of the aircraft increases resulting in more fuel savings during operation. The constraints on the winglet modification are that aircraft delivered before 2001 are not pre-fixed for winglets and the wingspan increases (Appendix XIII). Since the pre-fix is not present on these aircraft the structures will have to be changed, this modification will take longer and thus creates more costs. In the fleet of Qjet there currently are 3 not pre-fixed B737-300 that have been delivered before 2001.

[2] (Boeing A. p.)
[3] (Boeing A. p.)
[4] (Bradly, 2013)

6.2.1.b Split Scimitar Winglet

The SSW is the successor of the BW and was introduced in the year 2014[5]. The SSW is developed with the same intention as the BW: fuel flow, emission and noise reduction. The SSW is only available for the next generation aircraft, the B737-700 and B737-800. This design is based on the BW with an addition: downward-swept wing tips. The SSW gives an additional fuel reduction on the block fuel required during an operation compared to the BW. The presence of vortices has decreased with SSW compared to the BW thus further decreasing the induced drag of the aircraft. Aircraft installed with SSW will therefore gain an additional range of 65 nautical miles, approximately 120 kilometres (Figure 1: Additional range with SSW). A constraint is the increase of wingspan (Appendix XIII).

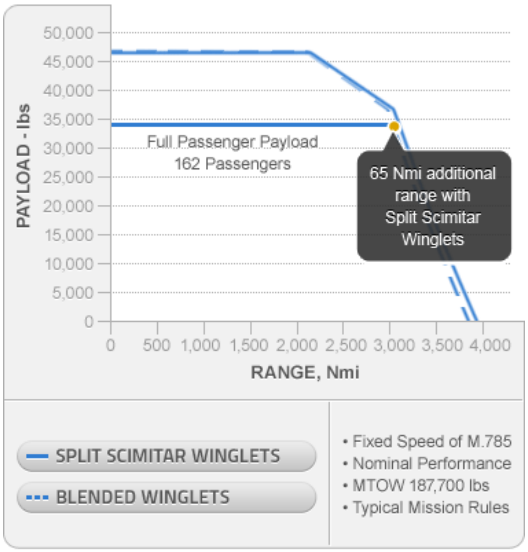

Figure 1: Additional range with SSW

6.2.2 Equipment

All equipment needed for the modification will be hired from APB. This will be done in order to make sure that everything needed will be in one package. The tooling and other necessities are send to Qjet with the first delivery of the winglets. This equipment will be send back after the modifications are completed.

6.2.3 Logistics

All the winglets are manufactured by APB, which is established in Seattle. The winglets must be transported from the supplier to the technical services department of Qjet, which is located at Schiphol. During the modification process, both left and right winglet are installed simultaneously, which means that 1 pair of winglets for each type of aircraft that will be modified must be in stock for the technical services department at all times. The winglets will be carried on a cargo carrier from Seattle to Schiphol. For the delivering process, the following terms are made in the contract with the insurance company and the cargo carrier:

- The first delivery will contain 2 sets of winglets, 1 for direct use and 1 reserve.
- During shipment, the cargo carrier is responsible for the winglets. When placed on the ground in specified area in the hanger of Qjet the ownership of the winglets shifts to Qjet.
- The insurance of the winglets is 8% of the value. The insurance ends when the winglets are installed on the aircraft.

More winglets in stock means more storage space needed, which gives more costs. Only 1 reserve pair per chosen type of winglets will be kept in store. The modification process is planned so Qjet knows exactly on which days a set of winglets is required for modification. Therefore, the cargo carrier shall deliver a set of winglets from Seattle 3 days in advance of the modification. This way Qjet keeps low storage costs and above all no extra storage is needed in the hangar

[5] (Boeing A. p.)

6.2.4 Extra employees

Looking at the modification process of the BW, the B737-300 will take up to 2200 hours. In an optimal situation, the modification process can be completed in 8 to 10 days. If the modification will be completed within 10 days, the work will be performed in 3 8-hour shifts consisting of 9 to 10 mechanics. The BW modification of the B737-700 / -800 will take up to 450 hours in 4,5 days. This means that the modification can be completed with 3 8-hour shifts consisting of 4 to 5 mechanics per shift. The time needed for the modification of the B737-700 / -800 with SSW is 520 hours. In an optimal situation, the modification can be completed within 3,5 - 4 days. Meaning that 3 8-hour shifts consisting of 5 to 6 mechanics per shift are needed.

6.2.5 Return on investment

The choice whether to modify the fleet is partially based on the return on investment point (ROI) of the modification. The ROI point is the number of years in which the modification is profitable. In order to get there, the costs and benefits are given (Table 16: Cost and benefits overview). The inputs for these totals are explained in (Appendix XIV).

Modification	Total costs	Benefits / year
B737-300 BW	€ 3 403 352	€ 337 226
B737-700 BW	€ 9 244 226	€ 2 042 811
B737-700 SSW	€ 12 971 739	€ 2 943 321
B737-800 BW	€ 51 141 890	€ 6 583 394
B737-800 SSW	€ 72 628 880	€ 8 903 794

Table 16: Cost and benefits overview

From the total costs and the benefits per year, the ROI for each winglet and aircraft combination can be derived (Table 17: ROI regarding the costs and benefits and (Appendix XV)

Modification	Years	Months
B737-300 BW	10	1
B737-700 BW	4	6
B737-700 SSW	4	4
B737-800 BW	7	10
B737-800 SSW	8	2

Table 17: ROI regarding the costs and benefits

6.3 Modification implementation

The SSW modification of the B737-700 and B737-800 is recommended to be performed by the accelerated schedule (Appendix XVI). This means that free space in the summer season maintenance schedule will be used for modification of the aircraft. This moment is chosen because this will make the modification time as short as possible.

All winglets will be purchased from ABP. Tooling and mechanics will hired from ABP. Transport of all the goods will take place by airfreight. By retrieving all needs for modification from one company, Qjet wants to make sure that the modification is performed according to the manuals.

7 Airline

In order to fill the final part of the NPV formula, the NCF has to be calculated. This is done by calculating the total costs of the airline and subtracting that from the total income of the airline. The costs are calculated by taking the sum of all costs: fuel costs, purchase of IFS, the decrease of value of aircraft and buildings, maintenance costs and personnel costs. The total income is the sum of the income of tickets and IFS.

7.1 Costs

The total costs for the airline are specified in certain categories (Table 18: Total costs airline).

Cost	Monthly	Yearly
Operational		
Fuel	€ 18 205 403	€ 218 464 831
Personnel	€ 8 942 275	€ 107 307 300
Inflight service	€ 3 833 333	€ 46 000 000
Fees	€ 26 346 189	€ 316 154 268
Ground services	€ 22 052 829	€ 264 633 943
Depreciation		
Aircraft	€ 14 541 667	€ 174 500 000
Buildings	€ 50 000	€ 600 000
Maintenance		
Parts	€ 3 333 333	€ 40 000 000
Tooling	€ 833 333	€ 10 000 000
Total cost	€ 98 138 362	€ 1 177 660 341

Table 18: Total costs airline

7.1.1 Operational

The operational costs consist of 5 parts.

1. Fuel
2. Personnel
3. Inflight service
4. Fees
5. Ground services

Ad 1. Fuel

As explained in fuel cost Appendix XVII, the cost for fuel are € 244 million per year.

Ad 2. Personnel

As explained in personnel cost Appendix XVIII, the cost for personnel are € 107 million per year.

Ad 3. Inflight service

To determine the cost for the IFS the cost per passenger are calculated. During a flight, 60% of all passengers will use IFS. With a load factor of 80%, the total costs of IFS is € 4 per passenger (Appendix II). With these percentages, the total costs for IFS are € 46 million.

Ad 4. Fees

In Table 19: Fees an overview is given of the fees. The method used to calculate the fees is given in Appendix XIX . The numbers are the cost per week, making the total cost € 316 million per year (Table 19: Fees).

Type of A / C	Landing fee	Legs	Total
B737-300	€ 3 383	87	€ 294 353
B737-700	€ 3 832	200	€ 766 456
B737-800	€ 4 293	1117	€ 4 794 968
Total landing fees			**€ 5 855 777**
Navigation fees			€ 291 666
Total Fees per week			€ 6 147 444
Total Fees per month			€ 26 346 189
Total Fees per year			€ 316 154 268

Table 19: Fees

Ad 5. Ground services

The cost for ground services are calculated for each leg. The cost can be divided in 2 categories, equipment cost and labour cost. The cost for equipment is presumed to be € 3 500 per turn around. To calculate the cost of the labour, the turnaround time (TAT) is used. The TAT for Qjet is 50 minutes. The second part that is the number of personnel; 9 employees are working during the turnaround. The labour cost is € 20 per hour per employee, resulting in a total cost of € 3 665 per turn around. Qjet is flying 72 206 legs per year resulting in a total cost of € 265 million per year. An overview of all the data is shown in Table 20: Ground services calculations.

Posts ground services	Value
TAT [Hours]	0,9167
Man power	9
Labour costs	20
Equipment costs	€ 3 500
Total costs per turn around	€ 3 665
Total costs per week	€ 5 145 660
Total costs per year	€ 264 633 943

Table 20: Ground services calculations

7.1.2 Cost of depreciation

Fixed assets have depreciation. The value of the depreciation is dependent on the expected period of utilization of the asset. For an aircraft, the expected utilization is 20 years, and for the buildings 50 years. The value of the depreciation is the value divided by the 20 or 50 years. The result is the depreciation per asset per year. An overview on the depreciation of property and aircraft is given in Appendix VIII.

7.1.3 Maintenance

The cost of maintenance is divided in 2 categories: parts and tooling. The cost of parts are € 40 million per year. In order to certify and replace the tooling, € 10 million per year is reserved.

7.2 Income

7.2.1 Tickets

The calculation for the ticket price can be dived in 2 categories, standard price and price per ASM. The price per ticket is calculated by the costs per ticket with a marge. The standard price is based on the standard cost. The standard cost includes all the cost with the exception of fuel. These standard cost for Qjet are calculated to be € 959 million per year. To determine the standard cost per aircraft the number is divided by the total amount of aircraft, resulting in € 19 million per aircraft per year. However, the aircraft are not always flying with a maximum load factor. The predicted load factor helps to split the costs over the expected passengers. Qjet has a load factor of 80%. To determine the ticket price, a single value is needed. This single value is the weighted average of the cost per passengers. These costs per expected passengers per type are multiplied with the total number of AC of that type. Resulting in a weighted average of € 80,46 per expected passenger Table 21: Flight costs per passenger.

Type	Cost per expected passenger	Number of A / C	Total
B737-300	€ 96	3	€ 288
B737-700	€ 85	7	€ 594
B737-800	€ 79	40	€ 3 141
Total		50	€ 4 023
Weighted average	€ 80		

Table 21: Flight costs per passenger

The second part is to determine the cost per ASM. The only influence of this number is the fuel costs. To minimize the effect of missed revenue to pay the cost, the expected revenue is used. The total fuel costs are divided trough the total amount of ASM multiplied with the expected load factor, resulting in € 0,02 of cost per ASM. The ticket price is calculated by the costs per ASM with a 5% margin. The total revenue of the tickets is € 1,1 billion, calculated through Appendix XX.

7.2.2 Inflight services

To determine the revenue of the inflight services, the cost per passenger needs to be determined (Appendix XXI). The profit margin set by Qjet is 250%. The percentage of passengers using inflight services is 60% of the passengers on board. Resulting in a revenue of € 86 million per year.
An overview of the total revenue is given in Table 22: Revenue Qjet.

Revenue	Monthly	Yearly
Tickets	€ 91 798 849	€ 1 101 586 192
In flight services	€ 7 155 556	€ 85 866 667
Total revenue	€ 98 954 405	€ 1 187 452 858

Table 22: Revenue Qjet

7.3 NCF

The NCF is calculated by subtracting the total income and the costs of the modification form the sum of the total costs of the airline and the savings of the modification (Table 23: NCF calculation).

Post	Value (baseline)
Income airline	€ 1 187 452 858
Cost airline	€ 1 177 660 341
Savings modification	€ 11 847 115
Costs modification	€ 8 560 061
Total NCF	€ 13 079 570

Table 23: NCF calculation

The total NCF used for the NPV calculation is € 13 million.

7.4 Qjet

7.4.1 Mission and vision

Both the mission and vision give an indication how Qjet wants to operate as an airline and present itself to the industry. The mission of Qjet is:

Mission

"Qjet operates in a saturated market, which is why Qjet needs to differentiate itself from its competitors. Low ticket fares for reasonable service is an important aspect to Qjet passengers. This is accomplished by low costs throughout the complete airline and maintenance department. High customer service shall be provided in- and outside the aircraft. Sustainability and innovation are the goals to make the airline profitable for many years to come."

The mission of Qjet leads to the following vision:

Vision

"Qjet aims to become the market leader in the competitive market for holiday and business travellers. This will be accomplished by an increase of efficiency within the airline and increasing the high services for the customers. Innovation and sustainability are key values within Qjet, these will reflect through a safety culture as well as an overall upkeep of education."

7.4.2 Strategy

In order to achieve the mission and vision, several goals have to be set and reached through a strategy. This strategy is based on the SWOT of Qjet (Appendix XXII). Qjet has set 3 goals as an organisation.

The first goal for Qjet is to increase the efficiency on fuel consumption. Qjet aims to reduce the pollution in the next ten years by 5%. Via this goal, Qjet hopes to attract more passengers due to being more environmental friendly.

The second goal for Qjet is to decrease the costs in maintenance. Aircraft have to have low maintenance cost so the cost-benefit scale will be in balance. Balancing the technical services department will bring reduction in maintenance costs and will have a big influence on the sustainability and profitability of the airline.

The last goal that has been set by Qjet is exploring new passenger markets. Qjet has to be looking at a wider range of passengers than just the holiday traveller. This will result in the airline not depending on just 1 part of the market, but also include other passenger types.

These goals are put into the strategy as follows:

"Fuel consumption reduction will be achieved by constantly monitoring new possibilities in fuel saving technologies. The new possibilities will directly be examined and implemented if possible. Qjet wants to be a leading airline in saving fuel and being environmentally orientated.
Beside the fuel savings, Qjet has set a goal to have a well-balanced technical services department. This will be achieved by running the technical service department effectively and according the Lean methodology.
The last goal is to switch the focus on the business passenger market, next to the holiday passengers. Qjet wants to exploit this market by implementing a frequent flyer program. Aside from the frequent flyer program, the frequency of operating on several destinations will change during the winter schedule.
The benefits and goals have to be achieved within the next 10 years."

7.4.3 Company structure

Qjet has adopted the Lean methodology. Everything and everyone in the Lean philosophy is focused on creating value in all processes and eliminating waste. This philosophy can be seen in the company structure of Qjet. The company structure can be seen in Appendix XXIII.
Six departments have been divided in Qjet its structure:

1. Human resource management
2. Technical services
3. Marketing
4. Quality
5. Operations
6. Engineering
7. Finance

Ad 1. Human resource management

Responsible for recruitment and maintaining the education of staff. Any further detail on the Human Resource Management (HRM) department and the employee expectations can be found in Appendix XXIV.

Ad 2. Technical services

In this department, three sub departments are present which are all under control of the technical services manager. There will be direct support by the engineering department.

Ad 3. Marketing

The marketing department is responsible for the service to the customer and the image of Qjet. All levels of marketing have been covered by the following 4 sub-departments: field marketing, digital marketing, product marketing and marketing communications.

Ad 4. Quality

Quality is responsible for the certification of the airline and its personnel. Quality will constantly monitor the law changes and the processes that are performed.

Ad 5. Operations

The operations department performs the daily operations. This department will make a crew and maintenance planning.

Ad 6. Engineering

Engineering is the direct support of the Technical Services (TS). Procedures and processes performed by TS will first be worked out and checked by engineering which will then provide the tooling and instructions needed.

Ad 7. Finance

The finance department is responsible for payment of wages, clients, suppliers and other parties.

7.4.4 Enlisting

7.4.4.a Stakeholders in the Aviation

The aviation industry has many stakeholders. These can be companies, governments and other people involved. The stakeholders in the aviation industry include suppliers of aircraft parts, but also the security of the airport. All the possible stakeholders in the aviation industry are named in Appendix XXV .

7.4.4.b Stakeholders of modification

The following stakeholders are important in regards to the modification of the fleet with BW or SSW:

1. Employees
1. Passengers
2. Aircraft financing (shareholders, investor groups)
3. Governments and regulators
4. Airline manufactures and suppliers

Ad 1. Employees

An expenses post is loan of Qjet personnel. These stakeholders will notice if a modification is to be applied. Maintenance personnel needs to be certified for winglet modification.

Ad 2. Passengers

Passengers prefer a lower ticket price and this could be a result of the modification. Even the look of an aircraft with winglet gives the passengers a premium view.

Ad 3. Aircraft financing (shareholders, investor groups)

Ever since the founding of Qjet, debts have been used to finance the aircraft. Since 2002, Qjet is listed (5.2) so shareholders are part of the financial situation. When chosen for the modification of the aircraft, more capital is needed. This can be requested by additional debts or to increase the amount of shares on the stock exchange.

Ad 4. Governments and regulators

After modification, an aircraft must be approved conform regulations by EASA.

Ad 5. Airline manufactures and suppliers

The OEM APB develops the winglets and needs to deliver the winglets at the right time when Qjet starts to modify the aircraft.

7.4.5 Marketing

A structured marketing method is needed to operate successfully in the market Qjet operates in. Marketing clarifies the principles and procedures of the company. The marketing mix of Qjet is based on the business model and includes:

1. Product
2. Place
3. Promotion
4. Price

Ad 1. Product

The service of Qjet consists of transporting passengers from a location to another, including:

- Transporting business travellers
- Transporting holiday Travelers
- Extra services as; foods, drinks and souvenirs

Ad 2. Place

Qjet transports passengers across Europe from the main airport Schiphol, where the TS is located. The parts for maintenance and the suppliers of winglets are mainly from the Boeing group located in Seattle, United States of America.

- Main airport and technical department Schiphol
- Operations throughout Europe
- Maintenance on outstations throughout Europe via Service Level Agreements (SLA)
- Boeing and winglet suppliers located in Seattle

Ad 3. Promotion

To keep the costs as low as possible, Qjet will not spend much capital on marketing:

- Qjet spend as little as possible on advertising
- No advertising agency, only a sales department
- The last years Qjet built its name with public relations

Ad 4. Price

Qjet implies to keep the ticket prices as low as possible. With a low promotion, Qjet can keep the costs low for a low ticket fare.

7.4.6 Phase-out policy

Qjet has a maximum set for the age of aircraft, which can be reached while in service. The maximum service duration is 25 years due to an increase of maintenance costs of aircraft above the age of 25. Aside of the increased maintenance costs, OEMs have already released the next generation aircraft before this time. These aircraft have better specifications and might reduce the operating costs.

7.4.7 Qjet versus Alliance

An alliance can offer many advantages as show in Appendix XXVI. However, the disadvantages are too great for Qjet. Qjet is not a member of an alliance.

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Blended winglets

Appendices

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Appendices

Appendix I List of abbreviations

Abbreviation	
A / C	Aircraft
A320	Airbus A320
A340	Airbus A340
A380	Airbus A380
ANSP	Air Navigation Service Provider
APB	Aviation Partners Boeing
ASK	Available Seat Kilometres
ATO	Aviation Training Organisation
ATPL	Air Transport Pilot License
B737	Boeing 737
B747	Boeing 747
B777	Boeing 777
BW	Blended Winglet
CA	Captain
Cat	Category
CEO	Chief Executive Officer
CLA	Collective Labour Agreement
EASA	European Aviation Safety Agency
ECB	European Central Bank
ED1	Engineering Department 1
EUR	Euro (€)
FA	Flight Attendants
FAQ	Frequently Asked Question
FO	First Officer
FPPM	Flight Planning and Performance Manual
FSNC	Full Service Network Carrier
G1	Ground 1
G2	Ground 2
G3	Ground 3
G4	Ground 4
GDP	Gross Domestic Product
HC	Hybrid Carrier
HRM	Human Resource Management
IATA	International Air Transport Association
IFS	Inflight Services
IL&T	Infrastructuur, Leefomgeving & Transport
IMF	International Monetary Fund
IOSA	IATA Operational Safety Audit
ISIS	Islamic State of Iraq and Syria
LCC	Low Cost Carrier
MTOW	Maximum Take-Off Weight
NCF	Net Cash Flow
Nm	Nautical mile

NPV	Net Present Value
O&D	Origins & Destination
O1	Office 1
O2	Office 2
O3	Office 3
O4	Office 4
OEM	Original Equipment Manufacturer
OPEC	Organization of Petroleum Exporting Countries
OPS	Operations
Pax	Passengers
ROI	Return On Investment
RPK	Revenue Passenger Kilometres
SLA	Service Level Agreement
SOP	Standard Operating Procedures
SSW	Split Scimitar Winglet
SWOT	Strengths Weaknesses Opportunities and Threats
TAT	Turnaround Time
TOGA	Take-Off Go Around
TS	Technical Services
USD	United States Dollar ($)
WACC	Weight Average Capital Costs

Appendix II List of assumptions

No.	Assumption
1	The exchange rate EUR / USD 1 / 1,115
	Exchange rate is from www.belastingdienst.nl of October 2015.
2	Load factor
	This factor is 80%
3	Financial overview
	For all the values calculated per year, 360 days per year are used
4	The hangar cost € 30 million
	This is based on the price of a hangar for a comparable airport in America
5	Qjet is since 2002 listed for 35% of the company shares for € 35 per share
	The funds gained by listing are used to partly finance the new B737-800 aircraft
6	Cost of equity
	The rate of interest on equity is considered to be 8% per year
7	Cost of debts
	The rate of interests on debts is considered to be 8% per year
8	All aircraft of B737-700 and B737-800 have pre-fixed wings for winglets
	All Boeing produced aircraft are pre-fixed for winglets since 2001
9	If a modification is performed during a C-check (light or heavy) or a D-check of a B737-700 and B737-800, the modification will only increase the maintenance by three days
	The duration of four days can be shortened by one day for the modification can be started during the light or heavy maintenance
10	The insurance payed for the delivery of the winglets is 8% of the value
	This percentage is estimated for the high value transportation through the air
11	The saving for the split scimitar winglets
	For the B737 -700 / -800 the saving percentages is equal
12	Maintenance engines
	The maintenance cost for engines are lowered with 9% when winglets are installed
13	Modification time split scimitar
	The modification takes four days
14	Qjet does not have ATO and part-147
	Both organisation types are found to be not profitable for Qjet.
15	All aircraft, B737-300, B737-700 and B737-800 are phased out after twenty to twenty-five years
	Average aircraft life is 23 years with these Boeing aircraft
16	The landing fees are calculated with using Schiphol as half of the landing airports
	Almost every aircraft is based on Schiphol, thus every two landings one is on Schiphol
17	Qjet has three layers of management
	This type of management structure is commonly used in a LCC / HC carrier
18	For every four Cat A employees, one Cat B employee is present. One Cat C per shift is planned.
	Cat B personnel can sign off tasks performed by Cat A, Cat C oversees the operation
19	Maintenance tooling has a budget of € 10 million per year
	This budget will be used for depreciations, gauges and renewing of tooling
20	Maintenance parts has a budget of € 40 million per year
	This budget is used for parts for the aircraft to maintain a stocked warehouse
21	Ground handling cost are € 132 million per year
	These costs are based on a turnaround of 55 min with 7 service handlers and an equipment usage of € 3500 per turnaround

22	Navigation fees are € 15 million per year
	This is an assumption as there is no direct information available
23	Aircraft age
	An educated guess is made for the year the aircraft came into service
24	The number of employees per department
	The maintenance department is determined by a source for http://web.mit.edu/airlinedata The office department is an educated guess.
25	Maintenance workweek
	The normal workweek for the maintenance department is seven days
26	Turnaround time
	The turnaround time is 55 minutes
27	Cost for inflight services
	The cost are € 4,33 per passenger
28	The number of passengers per airport is calculated by the number of (international) passengers divided by the number of (international) flights on the different destinations
	The number of passengers to and from Schiphol / Rotterdam-The Hague / Eindhoven airport are not available
29	Flight and maintenance planning
	The duration of the maintenance and the flights is based on information from existing airlines through google maps and personal experience

Appendix III Variables

The outcome of the scenario model is dependent on 6 variables. These variables are retrieved from the market analysis (Appendix IV).

- Load factor
- Use of IFS
- IFS margin
- Ticket margin
- Oil price
- € / $ Rate

Ad 1. Load factor

Aircraft are most of the time not fully utilized, therefore a factor has been introduced which describes the utilization of the aircraft. This is called the load factor. The load factor is the amount of seats utilized by passengers and is expressed as a percentage of the available seats.

Ad 2. Use of IFS

IFS is available on all flights of Qjet. This does not mean that all passengers are using IFS. This variable expresses the percentage of the total amount of passengers on a flight using IFS.

Ad 3. IFS margin

This variable is the margin that is made on the sales of IFS. The IFS margin is expressed as the amount of money that is added to the cost price of the products offered.

Ad 4. Ticket margin

Ticket margin is the margin that has been applied to the ticket price in order to make a profit on flights.

Ad 5. Oil price

The oil price is hard to predict as it is fluctuating. A fluctuating price will make a major difference in financial savings that are made over a year. In the model, this variable is built as a percentage added onto the current value of $ per barrel.

Ad 6. € / $ Rate of exchange

The rate of exchange between the euro and dollar is fluctuating continuously. When the dollar is growing stronger, differences can occur in the prices Qjet has to pay for importing products. This can result in products decreasing in value overtime. The changes of the rate of exchange have been expressed in the model as a percentage added onto the euro price for 1 dollar.

Appendix IV Market analysis

Airports

Airports play a major role in the planning and services of airlines. Airports do not only determine the network that airlines can fly, but also provide the ground services for the handling of luggage and technical service needed by the passenger. Beside the fact that the airports are vital to the existence of airlines, the airports have a big impact on the employment of the catchment area. Competition between airports is based on the capacity the airport has, the demand on the routes the airlines operate, but most of all the catchment area and surrounding airports. Smaller airports are increasing in size and are expanding their catchment areas. This results in more passengers and airlines at these smaller airports.

This leads to the fact that travellers tend to think that airlines switch to smaller airports and are leaving the bigger airports. This is not the case, the number of people whom can afford flying is still increasing on a yearly base and thus all airports will be fully used.

Major airports such as Schiphol have a strong position within the market. These airports can rely on this strong position most of the time, even in worse economic conditions.

Ownership and passengers

Out of an IATA research[6], which has been performed in 2010, it has been shown that only 9% of the airports is in full private ownership, 78% is under governmental rule and that 13% have a mixed private / governmental ownership. Governments still have interest in the major airports because these airports support more industries then only the aviation industry.

This (partial) governmental ownership automatically gives these airports a stronger position in the market. The evidence the IATA research gives for this strong position is the raise of airport charges in 2010. In total, a third of the airports raised their charges, including 21 of the 24 major airports in Europe. This was done due to the fact that passenger numbers declined because of the impact the economic crisis had. Despite the raise of these charges, none of the major airlines changed the routes to smaller airports. The fact that these airports still create higher demands of passengers than small airports is clearly a higher priority than the fact that small airports charge less. The switch of airlines between small and major airports can therefore be seen as evidence for normal network optimization rather than a real switch.

Therefore, Qjet must not focus on the cheapest airports but on what airports will deliver the best demand in the network. A strong passenger demand will deliver Qjet a strong position in the market between the Full Service Network Carriers (FSNC) and the Low Cost Carriers (LCC) (Appendix XXVII).

As previously mentioned, the demand of airports is highly influenced by the catchment area that Qjet is operating in. The demand that is created out of these catchment areas is depending by a wide range of factors, such as the types of passengers, short-, medium- or long-haul flights and airport services.

Although the airports try to influence all these factors, passengers have become an increasing influence over time. The passengers are better informed by the internet and are scavenging the best offers, time and location.

[6] Airport Competition / IATA ECONOMICS BRIEFING No 11

Difference in passengers

Time is an important factor in the passenger's choice of an airport. The economical Frontier Economics[7] performed a research on the likeliness of a passenger who has to choose between 2 airports based on time and price. This report shows that every 1% increase in distance the likelihood of the passenger to fly from that airport declines by 4%. In the figure below (Figure 2), the graph made by Frontier Economics for Stansted cooperated to Luton and Gatwick is shown.

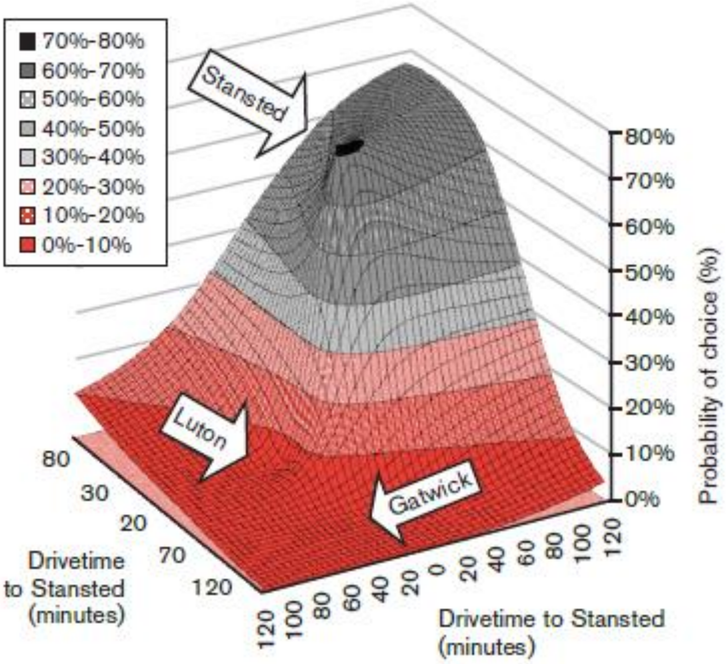


Figure 2 Probability of using alternative airports based on travel time ***Source: Frontier Economics***

The more time increases, the less likely it becomes for the passenger to travel from that airport. The report also shows that with every 1% of increase in distance the relative price should be changed by 1% to get travellers to use that airport.

IATA states that time is especially important for the holiday travellers. The passengers search for the best price and location and will then compare the time to fly. The first choice is the airport, then the airlines are researched that fly on the desired destination.

Business travellers and travellers that are visiting friends and family have a very different approach according to IATA. These travellers simply choose the airline that services the airport nearest to the family or the business meetings. These travellers are not strict about the departure airport but the shortest route is of greater importance.

For Qjet it is important to find a good mix between major and smaller airports in order to satisfy the holiday and business passengers.

Passenger demand

The demand of passengers that travel all around the world is rapidly increasing. With the worldwide economic crisis, passenger numbers were declining from 2008 until 2010. However, with the regain of confidence in the market, the passenger numbers have been increasing. The forecast made by aircraft manufactures and organisations such as IATA show great growth in passenger demand worldwide. This is due to the growing economies of the Asian, South American and African continents. On these continents, the GDP is growing which makes flying more affordable for the middle class.

[7] (economics, 2015)

IATA as well as the aircraft OEMs are expecting to profit from the growing passenger demand. In the Global Market Forecast 2015-2034[8], Airbus separates 2 markets (Appendix XXIX), the emerging economies and the advanced economies. The expectation of the growth of Revenue Passenger Kilometres (RPK) is directly dependent on the growth of GDP. This will increase most in the upcoming economies and therefore Airbus expects the emerging market to grow with 5,8% against a growth of 3,8% on the advanced economy market. Altogether, the total expected growth in RPK will rise with 5,8% worldwide in the coming twenty years.
The competitor manufacturer Boeing is expecting a growth in RPK as well. The number Boeing states in their Current Market Outlook 2015-2034[9] is lower (Appendix XXX). Boeing believes that the RPK will only raise 4,9% worldwide in the coming twenty year based on historical facts and future prospects.
In opposite, IATA[10] only gives short-term updates on the raise of RPK. The latest forecast shows that the RPK is growing with 6,7% over 2015 by a 1% raise in GDP (Figure 3).

Worldwide airline industry	2013	2014	2015
Spend on air transport*, $billion	752	769	763
% change over year	1.8%	2.2%	-0.7%
% global GDP	0.9%	0.9%	1.0%
Return fare, $/pax. (2015$)	493	473	429
Compared to 1994	-59%	-61%	-64%
Freight rate, $/kg (2015$)	2.33	2.22	2.02
Compared to 1994	-60%	-62%	-66%
Passenger departures, million	3,143	3,327	3,542
% change over year	5.1%	5.8%	6.5%
RPKs, billion	5839	6190	6603
% change over year	5.7%	6.0%	6.7%
Freight tonnes, million	49.3	51.5	54.2
% change over year	2.3%	4.5%	5.3%
World GDP growth, %	2.5%	2.6%	2.9%
World trade growth, %	2.7%	3.0%	3.7%

Note: RPK = Revenue Passenger Km, FTK = Freight Tonne Km, y-o-y = year on year change. GVA = Gross Valued Added (firm level GDP). * Airline revenue +indirect taxes. Sources: IATA, ICAO, EIU, Neth CPB, PaxIS, CargoIS.

Figure 3: Economic performance of the airline industry **Source: IATA**

Compared to 2013 and 2014 this is a major increase. The main reason for this growth is the upcoming economic cycle after the world crisis. The fact that there are big differences in predictions between the manufactures shows that passenger demand is hard to predict. Out of all numbers given above can be concluded that growth of RPK is certain in the future, because of a growing GDP worldwide. However, the exact numbers are not predictable.
Qjet operates in the more advanced economies where the growth prospects are lower. This means that Qjet will have to specialize in multiple kinds of travellers. When focusing on one kind of traveller, the revenue will not increase because only one market will not be profitable in the upcoming years. Therefore, the strategy of Qjet has started to focus on a combination of business travellers and holiday travellers instead of only holiday travellers.

Airlines

Airlines are the largest participants of the aviation industry. In these days the LCC are upcoming and FSNC are struggling. When the LCCs were introduced, the difference between the 2 types was large.

[8] Airbus Global Market Forecast 2015-2034
[9] Boeing Current Market Outlook 2015-2034
[10] IATA ECONOMIC PERFORMANCE OF THE AIRLINE INDUSTRY

The ticket prices of the LCC were significantly lower, which resulted in the passengers shifting away from the FSNC to the LCC. The FSNC therefore and reduced the inflight service for a lower price. In the past years, the difference between the types of airlines has narrowed. From research, performed by KPMG[11], it shows that the gap narrowed from 3,6% Available Seat Kilometres (ASK) to 2,5% ASK over 5 years (2006-2011). The FSNC have cut on personnel and reconstructed the fleet to operate fuel and cost efficiently.
Another development that narrows the difference is the upcoming of the hybrid carrier (HC). The HC airlines combine the business model of the LCC with the model of the FSNC. A good example is AirBerlin. HC airlines started as smaller carriers that only flew in Europe for relatively low prices. Today HC airlines have grown to a group that exists of multiple airlines and possess an own TS. The fleet of the HC carriers have expanded the network by offering long-haul flights but also kept the smaller routes in service for relatively low prices. This combination of model has made that HC are currently performing well compared to the FSNC.
Competition has not only narrowed because of these new airlines, but also because of merges between the FSNC. Via merging, the FSNC make the already strong positions on major airports even stronger. Merging means more connections and more slots blocked for the competition.
Another development in the aviation industry is the upcoming of the Chinese and Middle-Eastern carriers. As can be seen in Figure 4**,** the market share in RPK of these airlines has grown most compared to others over the years 2012 / 2013 (Figure 4).

Figure 4: Market share by traffic of top 15 airlines **Source: martketshare.com/ICAO**

The Chinese airlines are growing because of the constant growth in GDP, and therefore RPK, in the Asian-pacific regions. The Middle-Eastern carriers profit from reasonably low fuel prices since the country they are based are oil producing countries.
The largest growing airline in Europe is Ryanair. By flying routes that no other airline operates on, LCC create a monopoly position on these routes against lower fares. The extra distance the

[11] Economic impact of the travel and tourism industry/marketrealist.com

passengers will have to travel because of the use of smaller airport is compensated by the lower ticket fares.
Although the gap between the carrier types is narrowing, this gap will never be closed. Hybrid carriers are the best performing type in the current market. These airlines deliver reasonable service against a fair price and fly sufficient routes to keep the passengers happy. Qjet has to focus on getting the hybrid standard implemented throughout its business.

Oil industry

In past years, the oil industry has proven to be very unpredictable. Therefore, companies have started big projects to get oil out of the earth on more difficult locations. Most of these projects have stopped recently because the price drop of a barrel oil.
The main reason for this drop is the fact that the USA, which is the biggest user of fossil fuels, has started to exploit shale oil and shale gas. Investments in this have played out so well that the USA has become more self-sufficient than ever before. Because the USA buys less oil on the market, the prices have dropped drastically.
Another reason of a sudden overload of oil on the market is disagreement within organization of petroleum exporting countries (OPEC). OPEC was a cartel of 13 oil-producing countries that try to keep the prices on a level where all the members make enough money to fund the expensive oil production projects. Together the members used to stop producing oil to keep the prices on the same level. Since Indonesia dropped out last year, the trust has gone within the cartel and the countries do not reduce the production of oil any more. This resulted in the market being flooded.
In addition, the wars that are going on in the Middle East have an impact on the price. Most countries where ISIS is active have large oil reserves. ISIS sells the oil on the black market in order to finance the war.
The expectation for the future is that oil prices will stay low for a while but will eventually rise again (Figure 5).

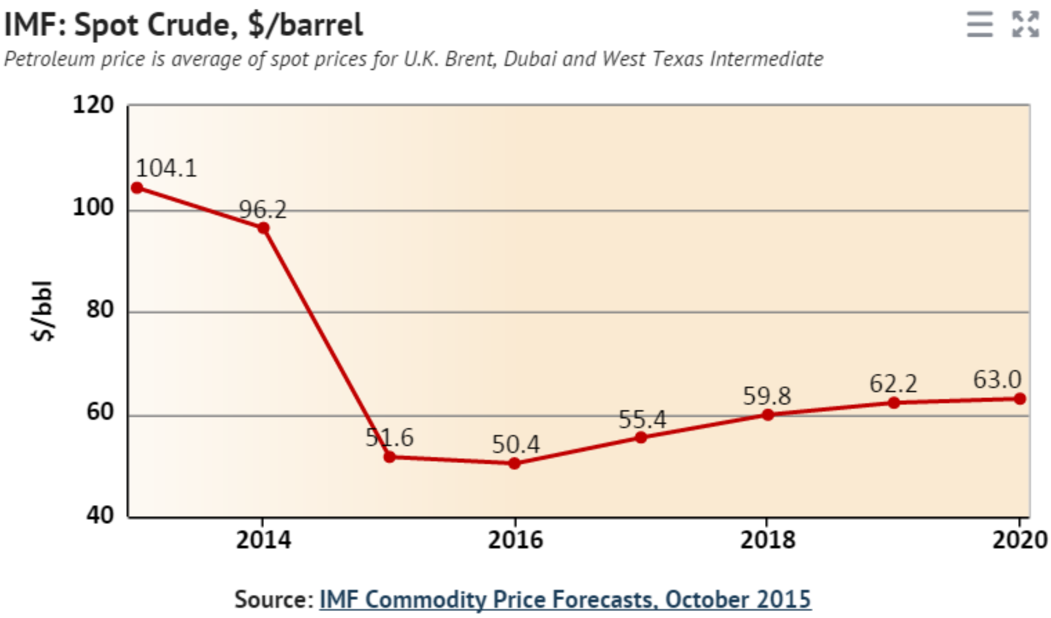


Figure 5: Oil price forecast 2015-2020 **source: knoema.com**

Since prices were high before the drop last year, airlines have focused their future on becoming environmental friendly and more efficient. Despite the drop, airlines have not stopped investing. The competition in low ticket fares between the different kinds of airlines is too high.
Another reason is that the passenger amounts are still expected to grow and therefore the use of fuel. This growth in fuel and the fact that oil will eventually run out, both still support an environmental friendly strategy for the future.

Appendix V Scenario variables and sensitivity

In the table below (Table 24: Variables and dependencies) the variables and the dependencies can be found.

Variables	Influencing variable
Load factor	Ticket prices, Use of IFS, IFS margin
Use of IFS	IFS margin
IFS margin	-
Ticket margin	-
Kerosene / Oil price	Ticket prices IFS margin Fuel cost
€ / $ Rate of exchange	Ticket prices IFS margin

Table 24: Variables and dependencies

All the variables have a sensitivity on the final result. The analysis of this sensitivity can be found in the table below (Table 25: Sensitivity table). The load factor has, beside a lot of influence on the other variables, also a high sensitivity rated of 65% out of the total of 100%. With these facts known, it is understandable that a small percentage change per year in load factor can result in a large difference in the profit of the IFS and the tickets. Beside the load factor, the kerosene price and the exchange rate also have a large influence in the determination of the ticket process with sensitivities of -12% and 11%.

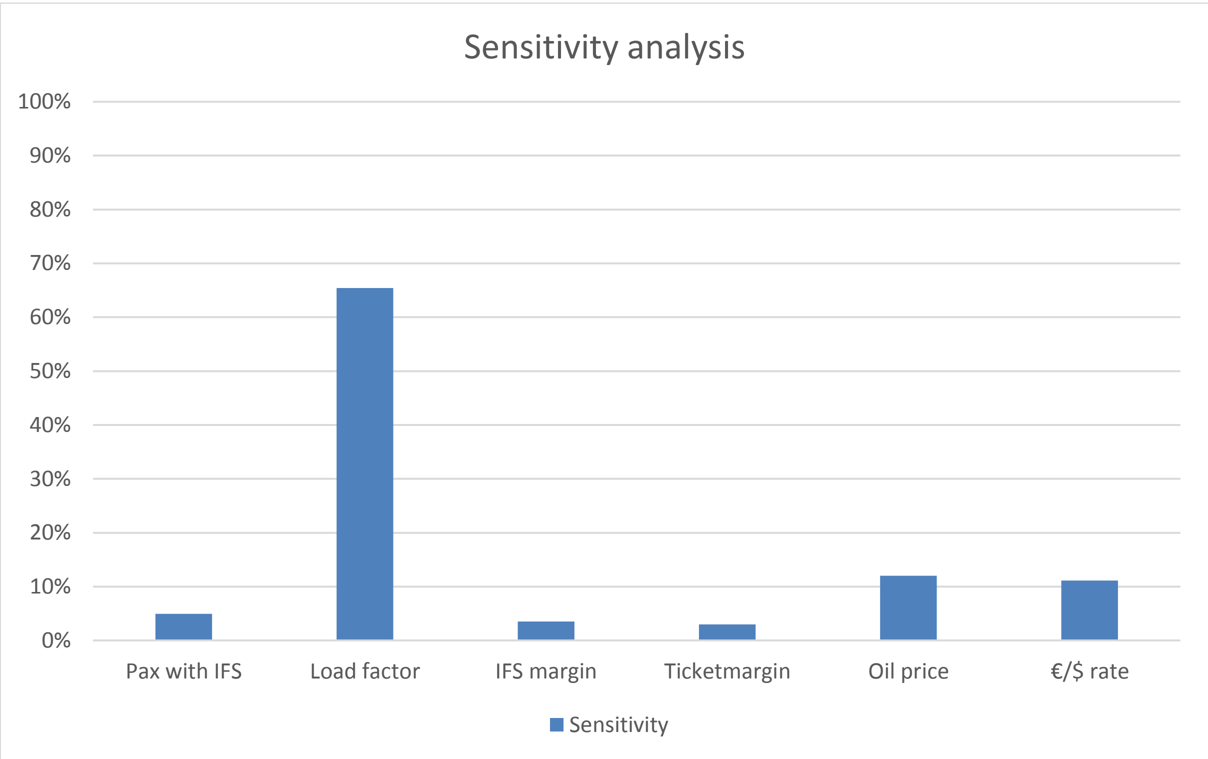


Table 25: Sensitivity table

Appendix VI Scenario analysis

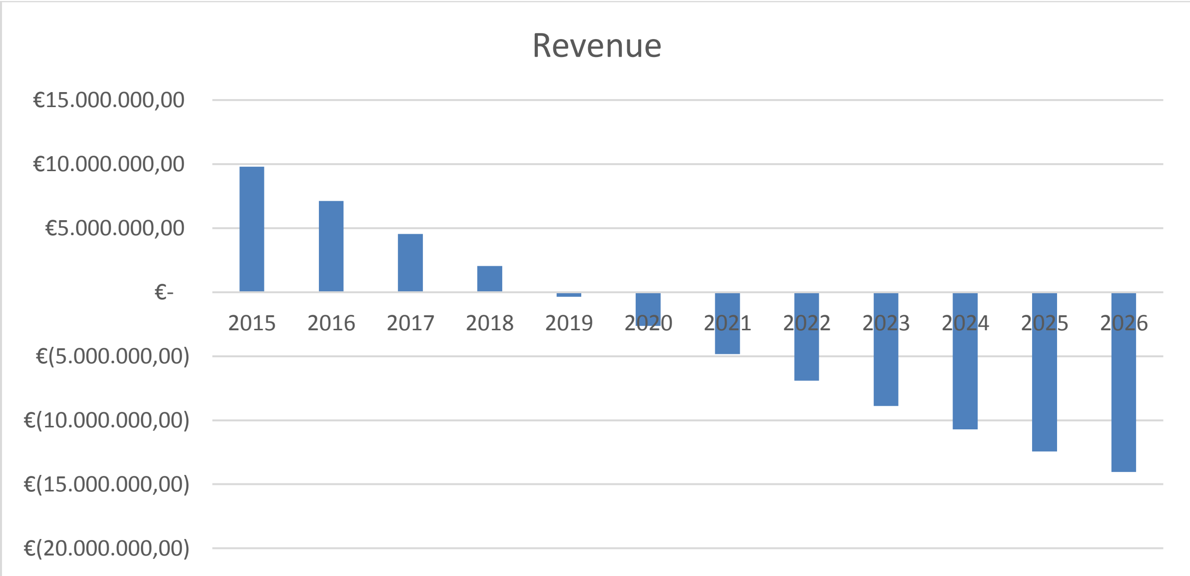


Table 26: Revenue worst case

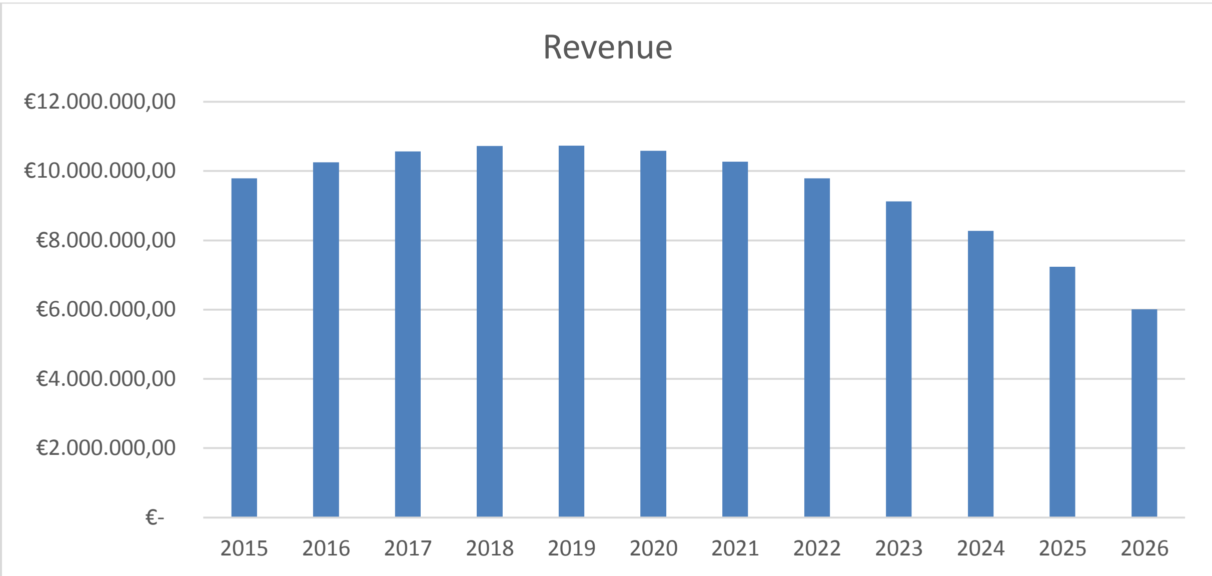


Table 27: Revenue best case

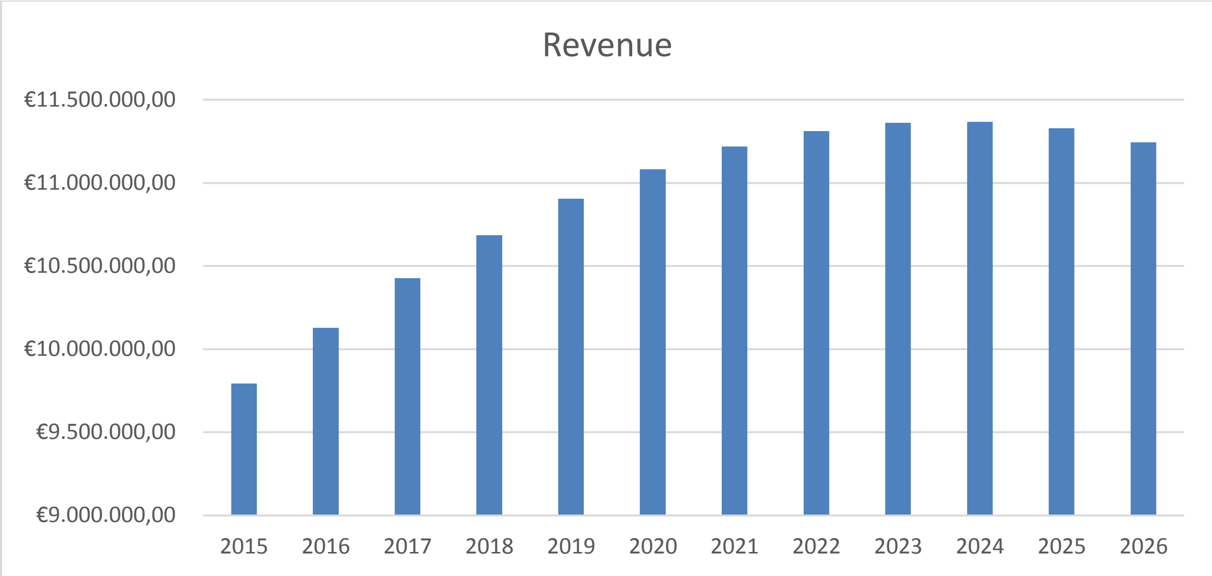


Table 28: Revenue most likely case

Appendix VII WACC calculation

To calculate the WACC, the equity (E), debts (D), cost of equity (R_e), cost of debt (R_d) and the corporate tax rate (t) need to be known. The equity and debts are known. The cost of the debt is the percentage of interest, while the cost of equity is the percentage a shareholder expects in return for his investment. To calculate the WACC the following formula (Equation 2) is used.

$$WACC = \frac{E}{D+E} \cdot R_e + \frac{D}{D+E} \cdot R_d \cdot (1-t)$$

Equation 2: WACC formula

A way to simplify this equation is to multiply the R_e with the percentage of private equity and the R_d versus the percentage of debts.

Qjet has a cost of equity and a cost of debt of 8%. Qjet is stationed in the Netherlands, which results in a corporate tax rate of 25%.

Appendix VIII Finances Qjet

B737-700		€ 70 000 000		
Year	In service	New	Value	Depreciation
2011	1	1	€ 66 500 000	€ 3 500 000
2012	2	1	€ 129 500 000	€ 7 000 000
2013	3	1	€ 189 000 000	€ 10 500 000
2014	5	2	€ 311 500 000	€ 17 500 000
2015	7	2	€ 427 000 000	€ 24 500 000

Table 29: B737-700 depreciation

B737-800		€ 75 000 000		
Year	In service	New	Value	Depreciation
2004	3	3	€ 213 750 000	€ 11 250 000
2005	6	3	€ 416 250 000	€ 22 500 000
2006	9	3	€ 607 500 000	€ 33 750 000
2007	12	3	€ 787 500 000	€ 45 000 000
2008	15	3	€ 956 250 000	€ 56 250 000
2009	18	3	€ 1 113 750 000	€ 67 500 000
2010	21	3	€ 1 260 000 000	€ 78 750 000
2011	24	3	€ 1 395 000 000	€ 90 000 000
2012	28	4	€ 1 590 000 000	€ 105 000 000
2013	32	4	€ 1 770 000 000	€ 120 000 000
2014	36	4	€ 1 935 000 000	€ 135 000 000
2015	40	4	€ 2 085 000 000	€ 150 000 000

Table 30: B737-800 depreciation

Building	€ 30 000 000		
Year		Value	depreciation
2004		€ 29 400 000	€ 600 000
2005		€ 28 800 000	€ 600 000
2006		€ 28 200 000	€ 600 000
2007		€ 27 600 000	€ 600 000
2008		€ 27 000 000	€ 600 000
2009		€ 26 400 000	€ 600 000
2010		€ 25 800 000	€ 600 000
2011		€ 25 200 000	€ 600 000
2012		€ 24 600 000	€ 600 000
2013		€ 24 000 000	€ 600 000
2014		€ 23 400 000	€ 600 000
2015		€ 22 800 000	€ 600 000

Table 31: Building depreciation

Appendix IX Risk factor / multiply table

Chances and impact are defined as described in the table below (Table 32).

Chance Error Scores	Frequency	Impact category	Consequences
1	Extremely improbable	A (1)	Minimal to no raise in cost / time
2	Improbable	B (2)	25% raise in cost / time
3	Remote	C (3)	50% raise in cost / time
4	Occasional	D (4)	75% raise in cost / time
5	Frequent	E (5)	Terminal for project to proceed

Table 32: Factors **Source: Hulpdocument risicoanalyse Nederlandse Emissie Autoriteit**

The different colours illustrate the total impact of the risk on the process. Green represents the non to little risks, orange represents the medium risks and finally red indicates a high risk (Table 33).

Chance Error	Impact				
	A Negligible	**B Minor**	**C Major**	**D Hazardous**	**E Catastrophic**
1 Extremely improbable	1A (1)	1B (2)	1C (3)	1D (4)	1E (5)
2 Improbable	2A (2)	2B (4)	2C (6)	2D (8)	2E (10)
3 Remote	3A (3)	3B (6)	3C (9)	3D (12)	3E (15)
4 Occasional	4A (4)	4B (8)	4C (12)	4D (16)	4E (20)
5 Frequent	5A (5)	5B (10)	5C (15)	5D (20)	5E (25)

Table 33: Multiply table **Source: Hulpdocument risicoanalyse Nederlandse Emissie Autoriteit**

Appendix X Total risk analysis

Table 34 shows the possible the risks and the possible errors. This table also shows the rating according to the multiplying table described in Appendix IX and the solutions implemented to reduce the possibility of the risks.

No.	Activity / Description	Possible errors	Risk	Control measures
Organisation				
1	Lack of hangar space	Modifications will not be finished in time, which will cause a domino delay in the whole process.	Medium 3D (12)	Flexible planning will make room to place AOG in the hanger.
Modification				
2	Error by mechanic / Unusable set of winglets	Due to and error the set of winglets proves to be unusable. Delays can occur during reordering.	Low 1D (4)	The implementation of SOPs will decrease the impact of the error. The error can always be found by looking at completed procedures.
3	Incorrect Tooling	Tooling for the modification is not present or wrong, slowing down modification.	Low 2A (2)	A reserve tooling kit will be present while modification is in progress.
Logistic				
4	Late delivery of parts	This can cause a domino effect throughout the whole process causing a delay that can influence the airlines performance.	Medium 3D (12)	Reserve unit of winglets will be present in warehouse. This will make the delay caused as little as possible.
5	Shipping damage	During shipping winglets can be damaged and declared unusable.	Low 1D (4)	There is an insurance policy to cover the cost of the damage. Beside this, the reserve winglet unit is also available for this risk.
6	Hold on delivery by supplier	The supplying holds his deliveries and creates a direct delay in the whole process of modification.	Medium 2D (8)	Out of Qjet its control.
Human factors				
7	Injuries during work	By failing to comply with safety regulations injuries can occur and staff can be out of order for multiple weeks. As well as the modification itself due to investigation of the cause.	Low 2B (4)	High safety standards and procedures. Aside SOPs are available for installing the winglets. Every week there will be controls on safety.
8	Illness of personnel	Can lead to less available man power on the floor.	Low 3A (3)	Personnel on standby.
9	Lack of personnel	Insufficient personnel to perform the modifications can lead to a slower lead-time.	Medium 2E (10)	Hiring personnel in advance of modification
10	Lack of knowledge	Insufficient knowledge will lead to errors in the processes and slows it down or cause dangerous situations.	Medium 2E (10)	Hiring experienced people that can train and support the less experienced mechanics.
Legal				
11	Regulation changes	Changes in regulations according to the winglet modifications can lead to a stop or delay of the project.	Medium 1E (5)	Out of Qjet its control.
12	No release to service	Incorrect installation or production faults can lead to errors during test flights. This will lead to AOG.	Medium 2E (10)	Monitoring the modification process, and maintaining the high level.
Financial				
13	Insufficient equity	No money will be available to further start / proceed the modifications.	Medium 2E (10)	Next to negotiating with funders and the bank, this risk must be accepted.
14	Incorrect values	The costs for the winglets can be higher than calculated due to wrong value use or supplier price raise. This will result in a budget exceedance.	Medium 3C (9)	The cost model must be check by multiple people to minimize the risk of incorrect values.
15	Rising cost / extra tooling	Due to faults or wrong use extra tooling or winglets might be needed which will raise the costs budgeted for modification.	Major 5C (15)	The SOP are made for limited use of materials. Beside this, most tooling is delivered with the winglet unit.
External				
16	Low fuel prices	If the oil prices stay low, the savings will be far lower and therefore make it unprofitable to modify.	Major 4D (16)	Out of Qjet its control.
17	Economic crisis (coming 10 years)	Economic crisis strikes and the equity of Qjet drops.	Major 4E (20)	Out of Qjet its control.
18	Currency changes	Raise of the dollar exchange rate against the euro can cause higher costs for tooling and winglets.	Medium 5B (10)	Out of Qjet its control.

Table 34: Total risk analysis

Appendix XI Noise

According to the excel sheet from EASA (Table 35: Winglets vs no winglets compared to noise chapter) the winglets do not alter the noise chapter qualification for the aircraft. The 300 has only the option for APB winglets. The B737-700 and B737-800 have the option for BW as well as SSW.

Type of A / C	Winglets modification	Noise Chapter
B737-300	None	3
B737-300	APB winglets	3
B737-700	None	3
B737-700	Winglets	3
B737-800	None	3
B737-800	Winglets	3

Table 35: Winglets vs no winglets compared to noise chapter

Noise abatement fees

Some airports have a noise abatement fee, which means that these airports charge extra for noise pollution while other airports do not. Amsterdam Schiphol Airport is one of the airports that has such an extra fee. This means that the costs are there, but it is impossible to get an accurate overview of the costs of the noise abatement fees since every airport has their own rules on how to deal with aircraft noise.

Appendix XII Benefits winglet modification

The benefits of the winglet modification are listed below:

1. Climb improvement
2. Emission reduction
3. Thrust reduction
4. Fuel flow reduction

Ad 1. Climb improvement

The winglets result in a 3% thrust reduction on the step climb. Next to that, the winglets give the aircraft the advantage to reach the cruise altitude faster. With the improved take-off performance, the B737 series are allowed to increase the maximum take-off weight. The improved climb performance allows lower thrust settings, which reduces the costs on maintenance.

Ad 2. Emission reduction

The total emission reduction through the winglets will be 5%. Moreover, the noise reduction of the aircraft will be around 6,5%. However, the airport fees do not change because of the noise reduction.

Ad 3. Noise reduction

Because of the winglet modification, the induced drag reduces, which results is less thrust needed. The thrust reduction is approximately 3% in total.

Ad 4. Fuel reduction

The fuel savings are shown in the following tables: Table 36: Block fuel reduction BW and Table 37: Block fuel reduction SSW. The data is differentiated on the different distances Qjet is operating. The savings are given in percentages on the block fuel. Both the BW and SSW are shown.

Distance (Nm)	0-250	250-500	500-750	750-1000	1000-1250	1250-1500	1500-1750	1750-2000	2000-2250
B737-300	1,00%	2,00%	2,88%	3,33%	3,77%	3,89%	4,00%	4,22%	4,39%
B737-700	0,00%	2,00%	2,77%	3,17%	3,39%	3,50%	3,66%	3,78%	3,89%
B737-800	0,00%	2,11%	2,83%	3,27%	3,50%	3,56%	3,67%	3,83%	3,94%

Table 36: Block fuel reduction BW

Distance (Nm)	0-250	250-500	500-750	750-1000	1000-1250	1250-1500	1500-1750	1750-2000	2000-2250
B737-700	0,00%	2,62%	4,02%	4,72%	5,01%	5,28%	5,49%	5,73%	5,89%
B737-800	0,00%	2,73%	4,08%	4,82%	5,12%	5,34%	5,50%	5,78%	5,94%

Table 37: Block fuel reduction SSW

Appendix XIII B737 dimensions

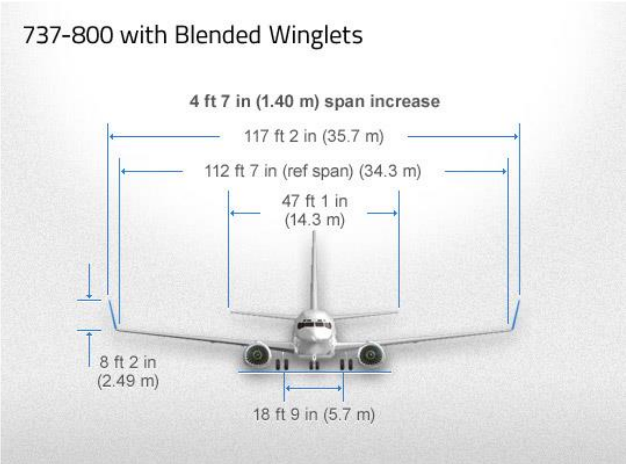


Figure 7: B737-800 BW

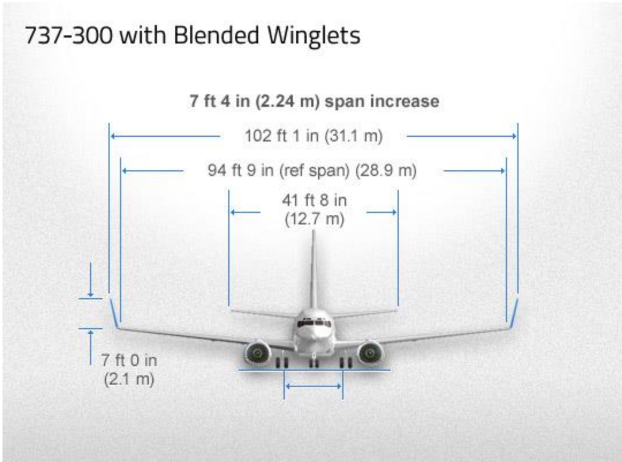


Figure 6: B737-300 BW

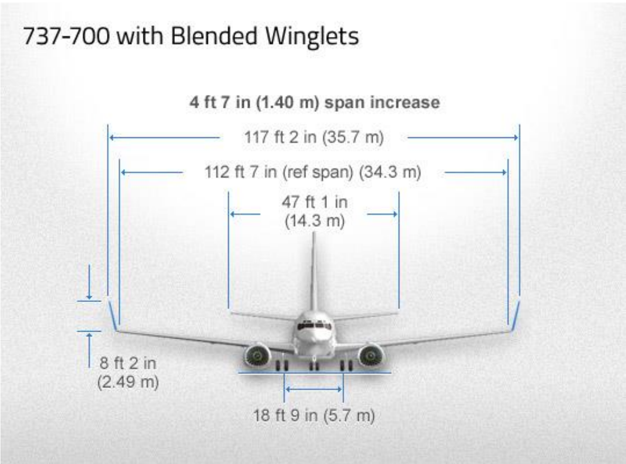


Figure 8: B737-700 BW

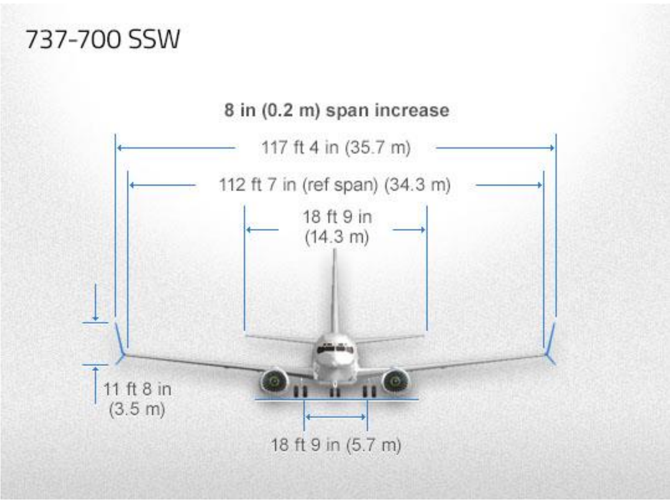


Figure 10: B737-700 SSW

Figure 9: B737-800 SSW

Appendix XIV Total costs and benefits modification

Costs

The costs are grouped in:

1. Acquisition cost
2. Transportation and insurance cost
3. Modification personnel cost
4. Reduced revenue

Ad 1. Acquisition cost

The costs for purchasing the winglets. This is the sum of the winglets for all aircraft, whichever is chosen. An important factor if the modification will be performed is the cost of a set of winglets. The costs of one single modification set, consisting of one winglet for each wing is shown in the table below (Table 38: Pricelist modification set).

Modification	Price	Total aircraft	Total price
B737-300 BW	€ 583 000	3	€ 1 749 000
B737-700 / -800 BW	€ 951 000	47	€ 44 697 000
B737-700 / -800 SSW	€ 1 467 000	47	€ 68 949 000

Table 38: Pricelist modification set

Ad 2. Transportation and insurance costs

The cargo space needed for 1 single modification set with safety packing, gives the total package dimensions and will be described in (Table 39: Dimensions winglets packages).

Winglet version	Height	Width	Depth	Weight
BW	4m	6m	4m	350kg
SSW	6m	8m	4m	550kg

Table 39: Dimensions winglets packages

This expense is the transportation and insurance costs combined. The transportation is the cost for the transport of the winglet for all aircraft through air-transport. The insurance for the winglets is applicable from the acquisition of the winglet, to the moment the winglets are installed on the aircraft. The transport and insurance costs are shown in the following table (Table 40: Transport and insurance costs). The shipments are the same as the number of aircraft. On the first shipment, there are two winglets and the last shipment will be returning the hired tooling. Total price is insurance costs plus shipment costs times shipments.

Costs	B737-300BW	B737-700 / -800 BW	B737-700 / -800 SSW
Insurance costs	€ 46 640	€ 76 080	€ 117 360
Shipment costs	€ 6 000	€ 6 200	€ 6 600
Shipments	3	47	47
Total price	**€ 157 920**	**€ 3 867 160**	**€ 5 826 120**

Table 40: Transport and insurance costs

Ad 3. Modification personnel costs

The staff hired for the modification, will only perform the modification. When the modifications are completed, the contract with these employees will end.
The labour costs are based on the modification time described and the costs of 1 set of winglets. The labour costs will be calculated as follows: for every 4 category A certified staff there will be 1 category B mechanic per shift. 1 Category C certified mechanic will be present per shift. This result in

the following table (Table 41: Labour costs for modification). The costs stated in the following table are based on the information given by the OEM of both type of winglets[12].

Costs	B737-300 BW	B737-700 / -800 BW	B737-700 / -800 SSW
Category A	€ 2 720	€ 1 020	€ 1 360
Category B	€ 880	€ 440	€ 440
Category C	€ 540	€ 540	€ 540
Total labour costs per shift	€ 4 140	€ 2 000	€ 2 340
Total labour costs per A / C	€ 124 200	€ 24 000	€ 28 080
Total labour costs for modification	**€ 372 600**	**€ 1 128 000**	**€ 1 319 760**

Table 41: Labour costs for modification

Ad 4. Reduced revenue

The time the aircraft is in the hangar for the modification, would have been the time the aircraft could have produced revenue in operation. The revenue missed because of the modification time, can be considered a cost for it is missed income.

Benefits

The benefits are grouped in:

1. Fuel savings
2. Reduced maintenance

Ad 1. Fuel savings

The fuel savings are based on the fuel savings percentage per stage length. These savings are different for every aircraft and every modification. The savings are the sum of the savings for all aircraft with the selected modification.

Ad 2. Reduced maintenance

By using winglets, the thrust that is needed to take off can be reduced. This means that the engine does not need to use the take-off go around (TOGA) setting, and thus does not operate at full power. For the B737 series, the reduced thrust settings result in 3% less thrust. The relation between the thrust settings and the engine maintenance is exponential, this means that the engine maintenance costs are reduced by 9%. Engine maintenance cost is 35% of the total maintenance cost on an aircraft. This means that the costs on maintenance can be reduced by 3,15%.

Costs and benefits per aircraft type

The aircraft types are:

1. B737-300
2. B737-700
3. B737-800

Ad 1. B737-300

The costs and benefits for the B737-300 with winglets are shown in (Table 42: Costs B737-300) and (Table 43: Benefits B737-300).

Costs B737-300	Blended Winglet	Split Scimitar Winglet
Winglet	€ 1 749 000	N / a
Transportation and insurance	€ 157 920	N / a
Staff	€ 372 600	N / a
Reduced revenue	€ 1 123 832	N / a

[12] (Boeing A. p.)

Total	**€ 3 403 352**	**N / a**

Table 42: Costs B737-300

Benefits per year B737-300	Blended Winglet	Split Scimitar Winglet
Fuel savings	€ 223 462	N / a
Reduced maintenance	€ 113 764	N / a
Total	**€ 337 226**	**N / a**

Table 43: Benefits B737-300

Ad 2. B737-700

The costs and benefits for the B737-700 with winglets are shown in (Table 44: Costs B737-700) and (Table 45: Benefits B737-700).

Costs B737-700	Blended Winglet	Split Scimitar Winglet
Winglet	€ 6 657 000	€ 10 269 000
Transportation and insurance	€ 575 960	€ 867 720
Staff	€ 168 000	€ 195 560
Reduced revenue	€ 1 843 266	€ 1 638 459
Total	**€ 9 244 266**	**€ 12 971 739**

Table 44: Costs B737-700

Benefits per year B737-700	Blended Winglet	Split Scimitar Winglet
Fuel savings	€ 1 777 362	€ 2 677 872
Reduced maintenance	€ 265 449	€ 265 449
Total	**€ 2 042 811**	**€ 2 943 321**

Table 45: Benefits B737-700

Ad 3. B737-800

The costs and benefits for the B737-700 with winglets are shown in (Table 46: Costs B737-800) and (Table 47: Benefits B737-800).

Costs B737-800	Blended Winglet	Split Scimitar Winglet
Winglet	€ 38 040 000	€ 58 680 000
Transportation and insurance	€ 3 291 200	€ 4 958 400
Staff	€ 960 000	€ 1 123 200
Reduced revenue	€ 8 850 690	€ 7 876 280
Total	**€ 51 141 890**	**€ 72 628 880**

Table 46: Costs B737-800

Benefits per year B737-800	Blended Winglet	Split Scimitar Winglet
Fuel savings	€ 5 066 543	€ 7 386 943
Reduced maintenance	€ 1 516 851	€ 1 516 851
Total	**€ 6 583 394**	**€ 8 903 794**

Table 47: Benefits B737-800

Appendix XV Break-even point modification

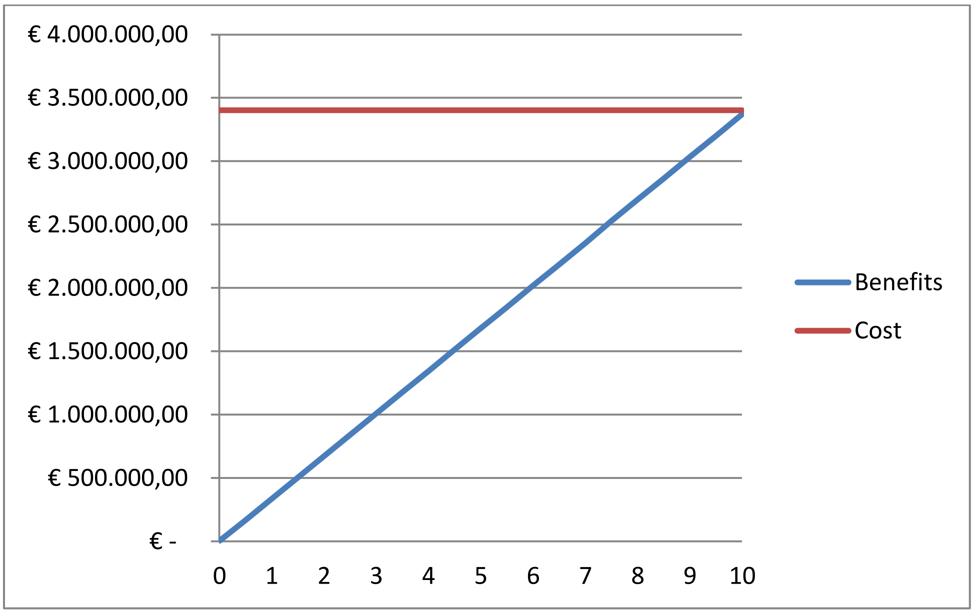


Table 48: B737-300 BW modification break-even point

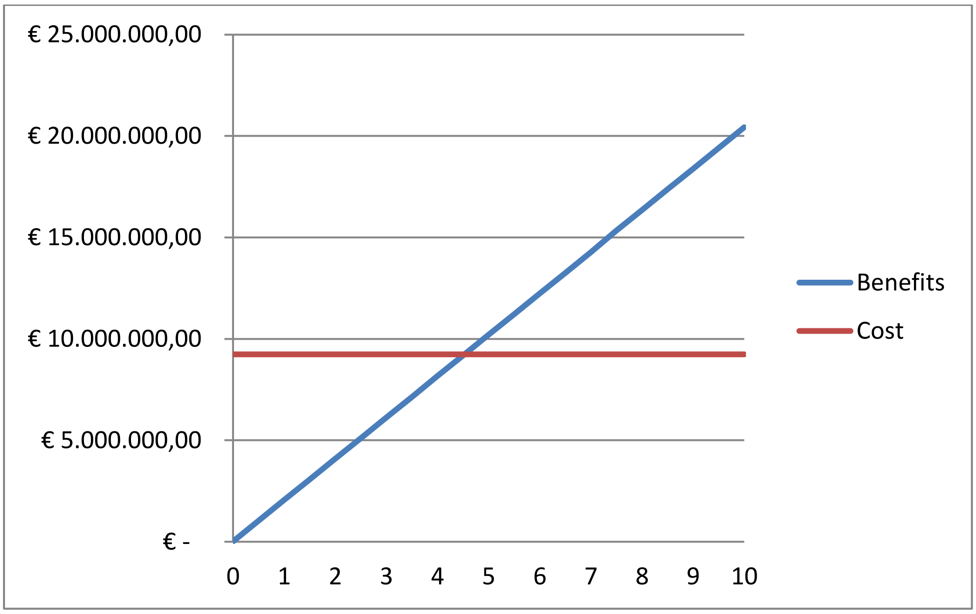


Table 49: B737-700 BW modification break-even point

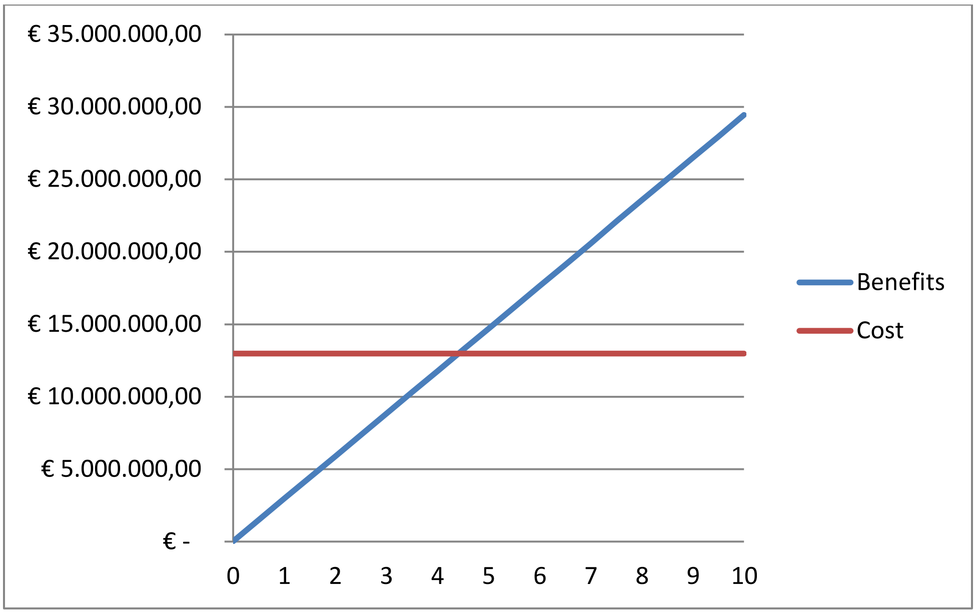


Table 50: B737-700 SSW modification break-even point

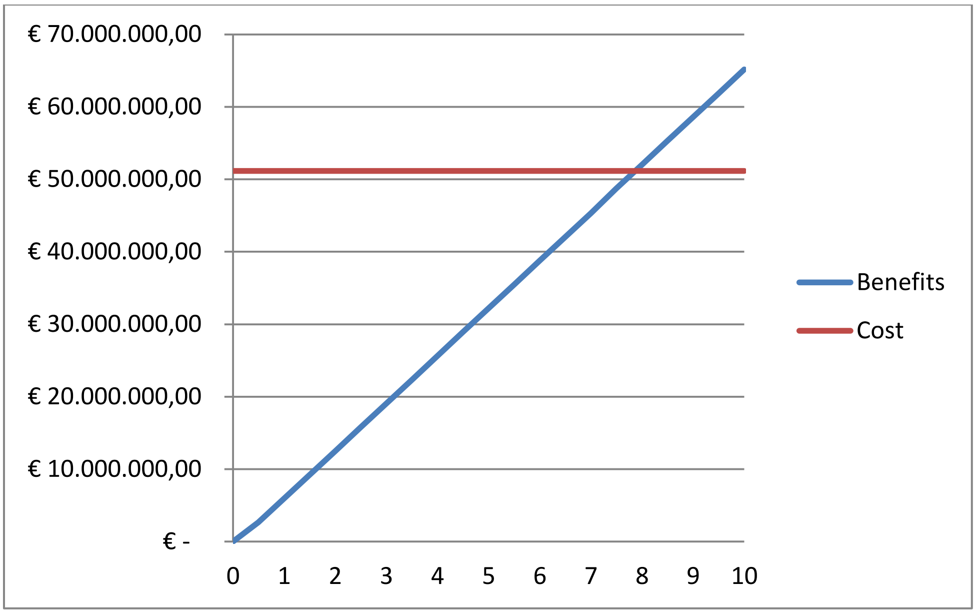


Table 51: B737-800 BW modification break-even point

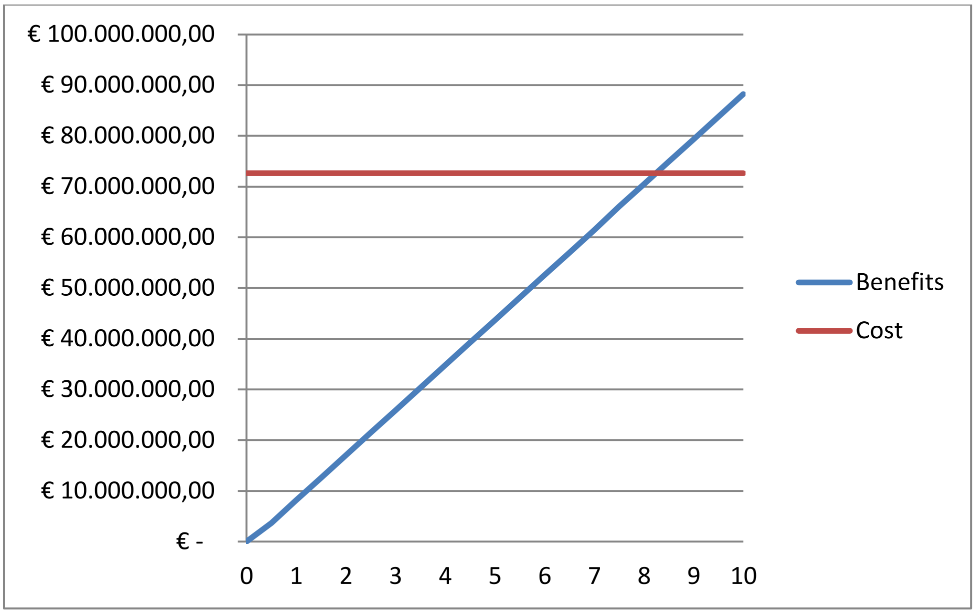


Table 52: B737-800 SSW modification break-even point

Appendix XVI Modification schedule

The modification schedule takes the time used for modification in account. The modification will take up to 4 days for the B737-700 and B737-800 and will be planned in the long-term schedule. There are 2 ways to implement the modification in the planning. It can be done by performing the modification during of the C-check or an accelerated way by using the summer season.

The heavy C-check is scheduled for 5 weeks. In the most favourable case, it will only take 3 weeks, while in the most unfavourable condition it takes up to 5 weeks. The planning will consider the most unfavourable condition. It is unlikely that all heavy C-checks will use the unfavourable condition, which means there will be some time left in the planning. The time that will be created in case of a favourable condition can be used to modify multiple aircraft. If the time is not available, the checks and modification can use the time needed in the summer season.

The accelerated way uses the free space during the summer season to modify the fleet. This will take a total of 250 days to modify the whole fleet. During the summer season, 2 bays will be free, which can be used to modify.

Appendix XVII Fuel costs

To determine the costs of fuel, all the destination have to be known. To simplify the calculations, the airports are divided in categories of 250 NM. Once all the airports are classified in increments of 250 nm, 9 categories will be left. All these categories have weight averages. With the help of the Flight Planning and Performance manual (FPPM) of all separate aircraft, the amount of fuel for 1 leg can be determined (Table 53: Fuel per leg).

Category (NM)	0-250	250-500	500-750	750-1000	1000-1250	1250-1500	1500-1750	1750-2000	2000-2250
Avg. distance (Nm)	200	368	592	873	1109	1334	1649	1906	2100
B737-300 (kg)	2250	3500	4750	6250	9000	11000	13000	14500	15000
B737-700 (kg)	1700	3300	4250	5750	8000	9500	10500	12500	14000
B737-800 (kg)	1800	3600	5200	7750	9250	10500	12750	13750	15000

Table 53: Fuel per leg

The routes and frequency of all the flight legs need to be allocated to the different types of aircraft. For some of the aircraft it is not possible to operate from specific airports, a reason can be insufficient range or runway length. Therefore, airports can be excluded for 1 of the types of aircraft. This will result in the following table, showing the flight legs per week (Table 54: Legs per week).

Category (Nm)	0-250	250-500	500-750	750-1000	1000-1250	1250-1500	1500-1750	1750-2000	2000-2250
B737-300	35	8	30	0	14	0	0	0	0
B737-700	0	0	4	0	0	28	104	48	16
B737-800	57	294	194	236	156	150	30	0	0

Table 54: Legs per week

The total amount of fuel can be determined by multiplying the number of flight legs per week with the amount of fuel needed for this leg. For example, the total amount of fuel needed for the category 0-250, will be: 2250 times 35 resulting in a total of 78750 kg per week. The following 2 tables are used to calculate the cost (Table 55: Costs per week, Table 56: Costs per year). The total amount is multiplied by the current price of jet fuel. The latest price for jet fuel in Europe on October 30th is $ 0,4259 per kg.

Aircraft	Total amount (kg)	Total price
B737-300	375 250	€ 159 826
B737-700	2 199 000	€ 936 596
B737-800	7 399 300	€ 3 151 505
Total	9 973 550	€ 4 247 927

Table 55: Costs per week

Aircraft	Total amount (kg)	Total price
B737-300	19 298 571	€ 8 219 634
B737-700	113 091 429	€ 48 167 820
B737-800	380 535 429	€ 162 077 377
Total	512 925 429	€ 218 464 831

Table 56: Costs per year

As a result, the costs for fuel will be € 4 247 927 per week. To calculate the price per year the total per week is divided by 7 days and multiplied with 360 days, which results in € 218 464 831 per year.

Appendix XVIII Labour costs airline

Flight crew planning

The crew planning is the planning for the captain (CA), the first officer (FO) and the flight attendants (FA). To be able to fly 1 aircraft for 18 hours per day for 7 days a week, 6 crews per aircraft are needed. One crew for the B737-300 has 1 CA, 1 FO and 3 FA. The crew for a B737-700 / -800 needs 1 CA, 1 FO and 4 FA. This is according law stating that 3 FA are needed when 100-149 passengers are aboard the aircraft, and 4 FA are required with 150-199 passengers aboard. For 50 aircraft, the total number of employees is given in (Table 57: Flight crew employees).

Function	Number per B737-300	Number per B737-700 / -800	Total employees	Costs
CA	18	282	300	€ 2 982 000
FO	18	282	300	€ 1 482 000
FA	54	1128	1182	€ 2 980 800

Table 57: Flight crew employees

Additional to the wages, costs for outstation stayover are based on the number of nights a month a crew will sleep in a hotel. When consulting the flight planning, the total aircraft on outstation during a night are given in Table 58: Outstation stayovers)

Aircraft type	Number of aircraft outstation	Total cost monthly per aircraft
B737-300	1	€ 12 000
B737-700	3	€ 14 400
B737-800	15	€ 14 400

Table 58: Outstation stayovers

The total costs for hotel stayover yearly is € 3 254 400.
The total costs for cabin crew including outstation stayover is € 92 592 000 per year.

Maintenance planning

The number of maintenance employees per aircraft is stated at 6. This means a total of 300 maintenance engineers work in 5 teams to cover a 24 / 7 maintenance availability at base and line maintenance. The engineers are certified in certain categories (Table 59: Maintenance employees).

Category	Percentage	Number
A	70%	210
B1	15%	45
B2	15%	45
Manager / C		15

Table 59: Maintenance employees

A maintenance manager is also a certified C engineer.
The shift plan for the five teams (team a through e) are given in Table 60: Shift plan maintenance employees)

	M	D	W	D	V	Z	Z	M	D	W	D	V	Z	Z	M	D	W	D	V	Z	Z	M	D	W	D	V	Z	Z	M	D	W	D	V	Z	Z
Da	e	a	a	a	b	b	b	b	c	c	c	d	d	d	d	e	e	e	a	a	a	a	b	b	b	c	c	c	c	d	d	d	e	e	e
Eve	d	e	e	e	a	a	a	a	b	b	b	c	c	c	c	d	d	d	e	e	e	e	a	a	a	b	b	b	b	c	c	c	d	d	d
Nig	b	c	c	c	d	d	d	d	e	e	e	a	a	a	a	b	b	b	c	c	c	c	d	d	d	e	e	e	e	a	a	a	b	b	b

Table 60: Shift plan maintenance employees

These teams have a shift allowance because of the evening and night shifts, this allowance is 25% of the salary and is according to the Collective Labour Agreement (CLA).

The total costs for the maintenance department of 315 engineers including shift allowance is € 10 192 500.

Office personnel

In the category of office personnel, many different departments are in place. Many employees fill these departments with various functions (Table 61: Office personnel).

Department	Number of employees	Functions
Finance	10	• 1 finance supervisor • 9 finance employees
Customer care	15	• 2 customer care supervisors • 10 customer care employees • 3 customer care trainees
Human resources	10	• 1 human resource supervisor • 9 human resource employees
Sales	5	• 1 sales supervisor • 4 sales employees
Planning	12	• 2 long term maintenance planners • 3 short term maintenance planners • 4 personnel planners • 3 flight planners
Engineering	15	• 15 technical engineers
Documentation	10	• 10 technical documentation employees
In-house stores	21	• 3 stores team leader • 18 stores employees
Flight preparation	21	• 3 flight preparation supervisor • 18 flight preparation employees
Quality and safety	6	• 3 operation managers • 2 type rating managers • 1 internal auditor • 1 company document monitor
Management	4	• 1 general manager • 1 maintenance manager • 1 flight manager • 1 engineering manager

Table 61: Office personnel

A total of 129 employees work at 11 departments. 6 of these departments have day and evening shifts, and thus a 20% shift allowance.

The total salary sum is € 4 522 800 per year.

Total employee salary

A total of 2226 employees make a total of € 107 307 300 per year within Qjet. These employees are categorised within 3 general departments (Table 62: Total employee salary).

Department	Number of employees	Costs of personnel	% of total salary
Flight crew	1782	€ 92 592 200	86%
Maintenance crew	315	€ 10 192 500	9%

Office personnel	129	€ 4 522 800	4%

Table 62: Total employee salary

Appendix XIX Landing fees at airports

In order to calculate the fees (Table 63: Fees on various airports) of the types of aircraft, the Maximum Take-Off Weight (MTOW) of each type is used as well as the maximum number of passengers. The second constraint is that the landing and take-off from five different airports will happen during the day in order to calculate the costs. The last constraint is the fact that the aircraft will get the connected handling and therefore the connected handling charges are included.

Airport	Type of A / C	Costs
Amsterdam Schiphol Airport	B737-300	€ 4 252
	B737-700	€ 4 815
	B737-800	€ 5 389
Munich Airport	B737-300	€ 3 543
	B737-700	€ 3 972
	B737-800	€ 4 431
Bucharest Henri Coandă Int. Airport	B737-300	€ 3 528
	B737-700	€ 4 018
	B737-800	€ 4 522
Malta International Airport	B737-300	€ 2 911
	B737-700	€ 3 325
	B737-800	€ 3 720
All Greek Airports	B737-300	€ 76
	B737-700	€ 82
	B737-800	€ 112

Table 63: Fees on various airports

Concluding from these five airports the average fees for each aircraft is calculated (Table 64: Calculated fees).

Type of A / C	Fees
B737-300	€ 2 862
B737-700	€ 3 243
B737-800	€ 3 635

Table 64: Calculated fees

The actual fees will be higher due to the fact that the HUB for Qjet, Schiphol, will have a bigger impact on the costs. If these five airports are taken as example, the routes need to be in consideration as well. The assumption is made that each flight will go from Amsterdam to one of the other four airports and back. The amount of landings on an airport will be multiplied by the costs shown in Table 63. This results in an 18% increase, but will give the numbers more accuracy (Table 65: Improved airport fees).

Type of A / C	Fee
B737-300	€ 3 383
B737-700	€ 3 832
B737-800	€ 4 293

Table 65: Improved airport fees

Appendix XX Ticket price calculation

The ticket price is the result of the following formula:

$$Ticket\ price = ((Cost\ per\ ASM\ *\ Distance\ (NM)) + standard\ costs) * (1 + profit\ margin)$$

With the ticket price known, the revenue of each airport can now be calculated, but not without the introduction of the load factor. The load factor is a percentage on how many of the total seats are filled whit passengers. The formula used to calculate the revenue is:

$$Revenue = ticket\ price * (total\ number\ of\ seats * load\ factor)$$

Appendix XXI Inflight service per passenger

The calculation to determine the cost per passenger is:

$$IFS\ income = total\ cost\ of\ inflight\ services / (total\ of\ expected\ passengers)$$

Resulting in € 4,33 per expected passenger.
With the cost known, the calculation of the revenue for the inflight services can be made. The following formula is used to calculate the total revenue:

$$Total\ revenue = cost\ per\ passenger * total\ number\ of\ seats * load\ factor * (1 + profit\ margin) * percentage\ using\ the\ inflight\ services$$

Appendix XXII SWOT analysis

For the SWOT analysis a confrontation matrix has been made for Qjet (Table 66: Confrontation matrix)

Internal analysis	External analysis
Strengths	**Opportunities**
• Lean organisational structure • Good market position between FSNC and LCC • Own TS brings less dependency on other parties	• Focussing on the growing market of business travellers • Being an alternative for FSNC with almost same service level / frequent flyer program • Creating an environmental friendly image for the future
Weaknesses	**Threats**
• Costs TS brings lower margin • Listing creates more external dependency • No direct intercontinental route connections	• Environmental challenges set by the government • FSNC and LCC shifting to Qjet its market position • Government investment in fast train routes throughout Europe

Table 66: Confrontation matrix

Strength

The strength of Qjet is mostly based on the Lean structure. Therefore, all cost inefficient processes are eliminated. From the start of the Lean methodology, this structure has been present in the Qjet organisation. The result is that the implementation of new processes is relatively easy and efficient. With the Lean structure, Qjet wants to keep the market position between the FSNC and LCC, in the HC. Qjet its market segment is the best performing segment at this moment. However, FSNC and LCC are moving operations towards the HC segment.

This HC form, in the Qjet model, brings its own TS. Having a TS means that there is no dependency on third parties for the scheduled maintenance of the fleet. Qjet always knows what happens to its aircraft and has full responsibility for the fleet. This means that the customer know that Qjet stands for high service and high quality maintenance.

Weaknesses

Beside the fact that having TS gives the airline a strength in servicing the aircraft, it also brings a weakness. This weakness is the maintenance personnel that is employed needed. A significant cost of an airline is the personnel costs. Having more personnel automatically means that the operating costs will be higher and the margins on the ticket prices will be lower.

Another weakness is Qjet being listed on the stock exchange. Although Qjet still has a majority of the stock, all decisions will have to be discussed with the shareholders. This means that the company is partially depended on shareholders for its decisions and equity.

The third weakness of Qjet is that there is no direct connection to intercontinental routes. HC such as AirBerlin have expanded the fleet in order to fly these routes. Qjet has chosen to stay within the European borders. The fact that other airlines do provide such cover, makes that Qjet has a weaker position in this part the market.

Opportunities

The market of air travel is growing and is expected to grow for a long time. This growth is generally seen in business travellers and people that travel for family visits. In accordance with the strategy that Qjet follows and a well serviced wide network within Europe, the growing market of business passengers is an opportunity which cannot be missed.

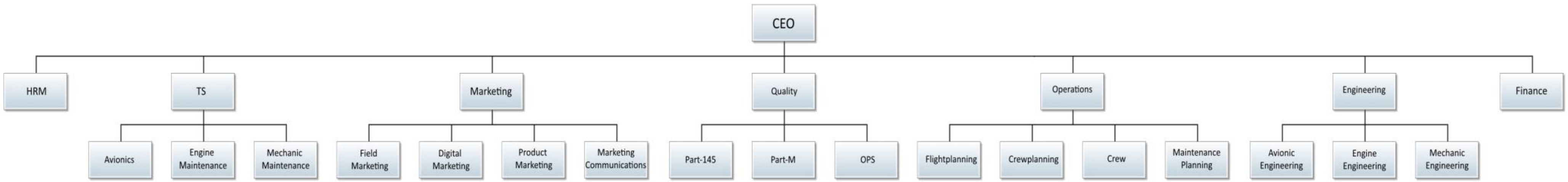
Together with this new market, there is the opportunity to strengthen the HC position of Qjet by introducing a frequent flyer program. This is an opportunity because the gap between the LCC and

FSNC airlines is closing. With a frequent flyer program, Qjet can persuade passengers to stay with the airline.
Finally, the world recently had to deal with environmental issues. Airlines are more aware of polluting than before. By adjusting the investment strategy and new processes to this awareness, Qjet can distinguish itself from others.

Threats

Environment is, besides an opportunity, also a threat for Qjet. Governments all over the world are making the laws for CO_2 reduction stricter. These laws are made so rapidly that airlines have a hard time keeping up. Therefore, the public image of airlines is harmed. If Qjet does not consider this, the image will be damaged and passengers choose another airline.
Beside the threat of image loss, there is also the constant threat of LCC and FSNC moving toward the market of Qjet. If the gap narrows even more, the market that Qjet operates will disappear. Qjet will therefore have to keep its values and image clear to the public because it is an alternative for both sides.
The last threat mentioned in the SWOT is the major threat of governments investing in high-speed train travel. This will take away passengers from the airlines since the train is cheaper and equally fast. For Qjet this is a threat because the high-speed trains are focused on the business travellers. Since Qjet wants to expand their services in this market, these trains are a big threat.

Appendix XXIII Company structure



Appendix XXIV HRM

Human resource management

For an organisation like an airline, wages are a significant part of the total cost. The different sectors in the airline have different wages. Within Qjet these sectors are:

- Pilots
- Cabin crew
- Maintenance staff
- Office personnel
- Engineering department

The gross wages for these sectors are dependent on age, experience, time in company, level of responsibility and other factors. For this reason, the wages are categorised in scales and steps. To advance a scale, a promotion must be made. To advance a step, several factors can be decisive;

- Aging (under the age of 23, minor wage can be paid.)
- Appreciation during an evaluation interview
- To gain a mandatory training certificate
- Gaining experience per year
- An increase of responsibility or workload in the function
- If a superior finds it deserved

Pilots

Several aspects from the CLA for pilots will be illustrated.

Wages

The wages a pilot receives is based on the experience and position of the pilot. These wages are payed monthly (Table 67: Wages pilots Qjet).

Step	FO-A	FO-B	CPT
1	€ 2500	€ 3000	€ 5000
2	€ 3000	€ 3500	€ 6000
3	€ 3500	€ 4000	€ 7000
4	€ 4000	€ 4500	€ 8000
5	€ 4500	€ 5500	€ 9000
6	€ 5500	€ 6000	€ 10000
7	€ 6000	€ 6500	€ 11000
8		€ 7000	€ 12000

Table 67: Wages pilots Qjet

These wages are based on a workweek of 5 days and thus 40 hours.

FO-A

A first officer class A has limited experience. A FO-A has at least 800 hrs total flight time, of which 400 hrs on an aircraft type owned by Qjet.

FO-B

A first officer class B has more experience. A FO-B has at least 1500 hrs total flight time, of which 800 hrs on an aircraft type with which Qjet flies.

Overtime compensation

Overtime is not permitted.

Off days

A pilot in Qjet has the right of several off days per year. The number of days is dependent on the number of years in service of Qjet and based on a fulltime workweek (Table 68: Off days per service year).

Years in service	Number of off days
0-2	20
2-5	21
5-10	22
10 or more	23

Table 68: Off days per service year

The second day of Easter, Ascension Day, Whit Monday, New Year´s Day, Kings Day, Christmas, Boxing Day and Liberation Day, if not on a Sunday, are additional off days.

Flight duty time

During normal operations, several laws have to be followed;

- A duty, including standby duty, must not exceed 12 hours if there is no possibility for effective rest.
- Between 2 duties at the home base, at least 8 hours of effective rest is provided. The minimum rest period at an outstation can be shortened (Appendix XXXI).
- A maximum of 60 hours of duty, standby or active, per 7 consecutive days is allowed.
- Per local day, 1 duty is allowed.
- The maximum duty time per reporting hour can be found in Appendix XXXII.

Reserve time

If a pilot is planned as reserve, the following regulations are applied;

- If a pilot is planned as reserve at Schiphol airport and the duty has gone by without effective duty, the complete duty will be considered working time.
- If a pilot is planned as reserve at Schiphol airport and the pilot is called for active duty, the hours prior to active duty will half be counted as active duty with a maximum of 3 full active hours.
- If a pilot is planned as reserve at Schiphol airport and the pilot is called for active duty after 6 standby duty hours, these hours will be counted as full active duty.
- If a pilot is planned as reserve from home and the duty has gone by without effective duty, these hours will not be counted as work.
- If a pilot is planned as reserve from home and in 6 hours from the start of the duty the pilot is called, the prior hours will half count as active duty.
- If a pilot is planned as reserve from home and after 6 hours from the start of the duty the pilot is called, the prior hours will count as 75% of active duty.
- A pilot can only be planned reserve at Schiphol airport or at home

Cabin crew

Regarding cabin crew, several aspects of the CLA are important for Qjet.

Wages

The wage a cabin crew earns is dependent on the function in the cabin (Table 69: Wages cabin crew).

Step	CA-minor	CA	Purser
1	€ 1500	€ 1700	€ 2000
2	€ 1600	€ 1800	€ 2100
3	€ 1700	€ 1900	€ 2200
4	€ 1800	€ 2000	€ 2300
5		€ 2100	€ 2400
6		€ 2200	€ 2500
7			€ 2600

Table 69: Wages cabin crew

CA-minor

A Cabin attendant, which is under the age of 23, will be considered a CA-minor.

Overtime compensation

Overtime is included in the wages.

Off day

Number of off days can be found in Table 68: Off days per service year.

The second day of Easter, Ascension Day, Whit Monday, New Year´s Day, Kings Day, Christmas, Boxing Day and Liberation Day, if not on a Sunday, are additional off days.

Flight duty time

Cabin crew must follow the same regulations as pilots considering flight duty time. These regulations can be found in Appendix XXXII.

Reserve time

Cabin crew must follow the same regulations as pilots considering reserve time. These regulations can be found in Appendix XXXII.

Maintenance staff

The regulations considering maintenance personnel are collected from the CLA for ground personnel. Maintenance staff works in shifts 24 / 7 a week.

Wages

These wages are dependent on the experience and number of service years within Qjet (Table 70: Wages maintenance staff).

Step	G1	G2	G3	G4
1	€ 1500	€ 1700	€ 2200	€ 2600
2	€ 1550	€ 1750	€ 2300	€ 2700
3	€ 1600	€ 1800	€ 2400	€ 2800
4	€ 1650	€ 1850	€ 2500	€ 2900
5	€ 1700	€ 1900	€ 2600	€ 3000
6	€ 1750	€ 1950	€ 2700	€ 3100
7		€ 2000	€ 2800	€ 3200

Table 70: Wages maintenance staff

In addition to the regular salary, a shift allowance is given when working certain shifts (Table 71: Shift allowance).

Shift	Allowance
Day, evening and nightshift	25% of month salary
Day and evening shift	20% of month salary
Day shift	No allowance

Table 71: Shift allowance

G1
G1 is the salary scale for;
- Aircraft technician in training.

G2
G2 is the salary scale for;
- Aircraft technician with licence Cat A

G3
G3 is the salary scale for;
- Aircraft technician with licence Cat B1
- Aircraft technician with licence Cat B2

G4
G4 is the salary scale for;
- Aircraft technician with licence Cat C
- Maintenance manager

The maintenance manager starts at step 4.

Overtime compensation
For maintenance personnel, certain laws and company procedures must be followed;
- The maximum labour at 1 local day is 12 hours. A nightshift at the most can be 10 hours. A nightshift contains at least 3 hours from 00.00 to 06.00 local time.
- The maximum hours in a consecutive week is 60, this is 624 hours per 13 weeks. When the schedule contains nightshifts, then a maximum of 520 hours per 13 weeks is allowed.
- Overtime compensation will mean gaining hours to adopt when this is possible (Table 72: Overtime compensation).

Local time	Local time	Compensation
Monday through Friday	00.00-05.59	175% of salary
Monday through Friday	06.00-23.59	150% of salary
Saturday or Sunday	00.00-05.59	200% of salary
Saturday or Sunday	06.00-23.59	175% of salary

Table 72: Overtime compensation

Off days

Number of off days can be found in Table 68: Off days per service year.

The second day of Easter, Ascension Day, Whit Monday, New Year´s Day, Kings Day, Christmas, Boxing Day and Liberation Day, if not on a Sunday, are additional off days.

Office personnel

The most important parts of the CLA will be highlighted for office personnel.

Wages

For office personnel, the scale which the employee will be in is dependent on the function within Qjet and thus on the level of responsibility.

Step	O1	O2	O3	O4
1	€ 1500	€ 1700	€ 2200	€ 2400
2	€ 1550	€ 1800	€ 2300	€ 2500
3	€ 1600	€ 1900	€ 2400	€ 2600
4	€ 1650	€ 2000	€ 2500	€ 2700
5	€ 1700	€ 2100	€ 2600	€ 2800
6	€ 1750	€ 2200	€ 2700	€ 2900
7		€ 2300	€ 2800	€ 3000

Table 73: Wages office personnel

O1

All office personnel performing these functions will be in scale Office 1 (O1);

- Junior finance administration
- Junior customer care
- Junior human resource assistant

O2

All office personnel performing these functions will be in scale Office 2 (O2);

- Finance administration
- Secretary
- Receptionist / telephonist
- Check-in servicer
- Service desk
- Customer care
- Store employee
- Sales employee
- Human resource assistant
- Freight assistant
- Secretary of the CEO
- Short term planner

- Long term planner
- Material planner
- Personnel planner

O3

All office personnel performing these functions will be in scale Office 3 (O3);

- Manager finance administration
- Freight coordinator
- Manager customer relationships
- Manager human resources
- Manager stores

O4

All office personnel performing these functions will be in scale Office 4 (O4);

- Accountable manager Part-145
- Accountable manager Part-M
- Accountable manager Operations

Overtime compensation

Overtime regulations can be found in overtime compensation of maintenance staff.

Off days

Number of off days can be found in Table 68: Off days per service year.

The second day of Easter, Ascension Day, Whit Monday, New Year´s Day, Kings Day, Christmas, Boxing Day and Liberation Day, if not on a Sunday, are additional off days.

Engineering department

The engineering department know to find all the required information for the maintenance of the aircraft.

Wages

The wages for the engineer department is found in Table 74: wages engineering department.

Step	ED1
1	€ 2400
2	€ 2500
3	€ 2600
4	€ 2700
5	€ 2800
6	€ 2900
7	€ 3000

Table 74: wages engineering department

Overtime compensation

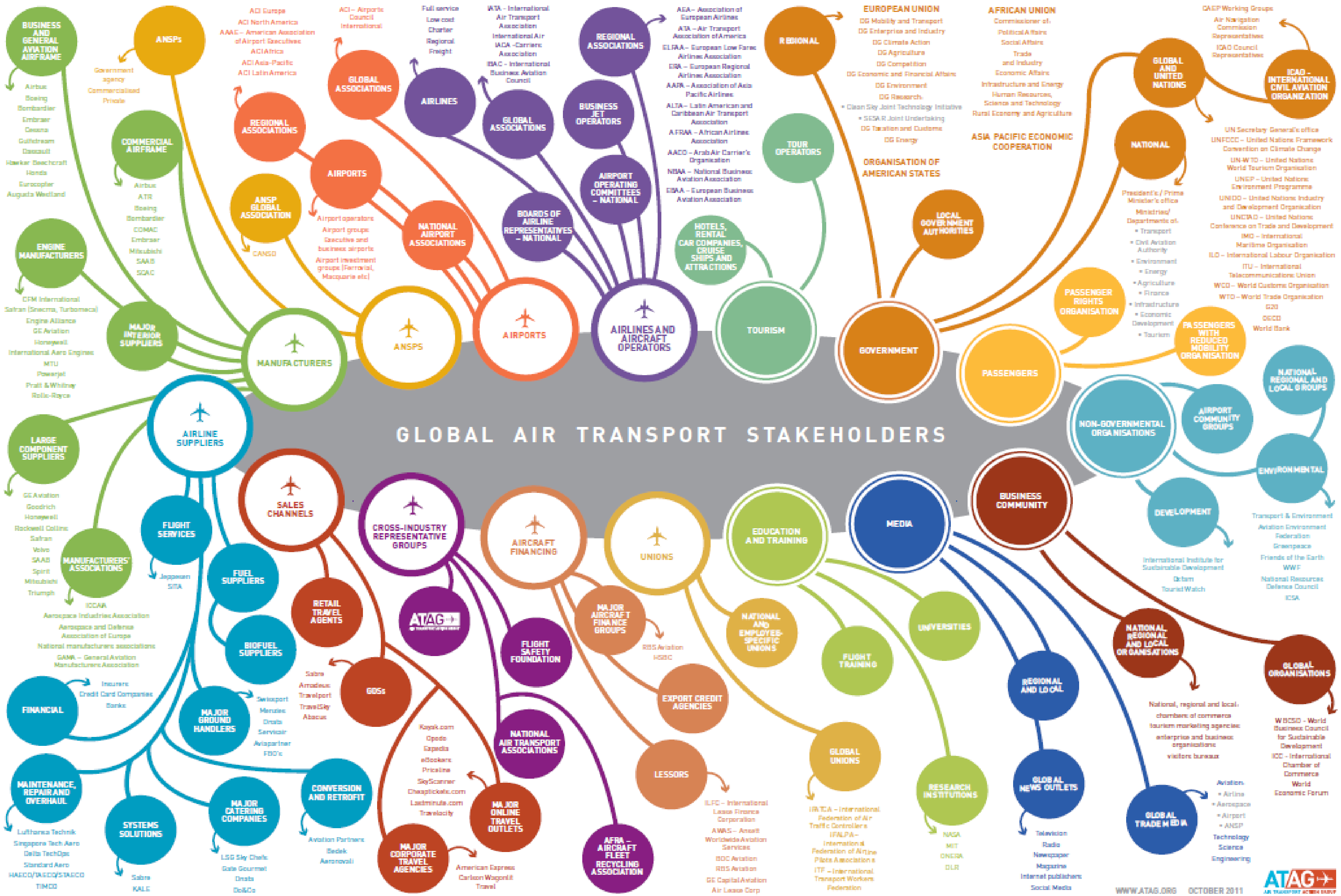
Overtime regulations can be found in overtime compensation of maintenance staff.

Off days

Number of off days can be found in Table 68: Off days per service year.

The second day of Easter, Ascension Day, Whit Monday, New Year´s Day, Kings Day, Christmas, Boxing Day and Liberation Day, if not on a Sunday, are additional off days.

Appendix XXV Stakeholders aviation



Appendix XXVI Alliances

In the aviation industry, the alliance and joint ventures cannot be missed. SkyTeam, Onewold and Star alliance are known to have high standards within the organisations. In these alliances, there are many benefits to be gained once an airline is part of the alliance. Many benefits are for the customer as they will be supported more by frequent flyer programs across the alliance and a wider range of routes can be offered.
However, the airline willing to join an alliance has to comply with very strict rules and requirements. SkyTeam will be used in this case as an example. In order to apply for SkyTeam the airline needs to comply with tough rules regarding safety, quality, ICT and customer services. Some specific examples are:

- IATA operational safety audit (IOSA) registration
- Lounge access
- Elite recognition[13]

IOSA registrations means that the airline needs to be registered with IATA as a quality audit organization.

- The IOSA registered airlines need to have a quality audit program under stewardship of IATA. Continuous updating of standards to reflect regulatory revisions and best practices is mandatory.
- Elimination of audit redundancy, reducing costs and audit resource requirements
- Accredited audit organization with formally trained and qualified auditors
- Accredited training organization with auditor training courses
- Structured audit methodology, standardized checklists.[14]

Elite recognition is regarding the frequent flyer program. In this program, the customer shall be able to select an elite service package, which has extra service added on to the standard packages.
The airline should be able to have access to lounges on airports. This adds extra services to the customers' expectation.

[13] (SkyTeam, 2015)
[14] (IATA, IATA Operational Safety Audit (IOSA), 2015)

Appendix XXVII Different types of business models

There are several types of business models for airlines, the characteristics[15] are shown in each section.

1. Full Service Network Carrier
2. Low Cost Carrier
3. Holiday Carrier
4. Regional Carrier
5. Traditional Freight Carrier
6. Integrators
7. Hybrid Carrier

Full Service Network Carrier

Fleet: Different aircraft types, from small regional feeder aircraft to B747 / B777 / A340 / A380 long range widebody aircraft

Geographical network range: Domestic, European and worldwide flights (some smaller FSNCs, however, stick to Europe) with focus on the respective home country

Network structure: Hub-and-spoke network (feeder flights from the respective hubs), often complemented by selected decentralised non-hub flights

Schedules: wide range of O&D's (origin & destinations) offered via the respective hub, high frequencies

Service range: 2-4 service classes, dedicated services in business and first class

Pricing: complex yield management, price discrimination

Low Cost Carrier

Fleet: Young homogenous medium sized aircraft like the B737 or A320

Geographical network range: European

Network structure: Point to point, flights from and towards second place ranked airports such as Eindhoven Airport instead of Schiphol Airport

Schedules: City pairs or triangles, high frequencies

Service range: 1 service class, bare basics in the aircraft

Pricing: No price discrimination

Holiday (leisure) Carrier

Fleet: Homogenous fleet of medium sized aircraft like the B737 or A320

Geographical network range: European

Network structure: Point to point

Schedules: City pairs or triangles, weekly / seasonal

Service range: 1-2 service classes, dedicated services in 'full tourist' class

Pricing: average cost prices, complemented by seasonal surcharges or discounts and by occasional promotional fares

[15] Characteristics copied from Topical Report: Airline Business Models, a report made for the European Committee. http://ec.europa.eu/transport/modes/air/doc/abm_report_2008.pdf

Regional Carrier
Fleet: small aircraft, 20-100 seaters
Geographical network range: Geographical limited area
Network structure: Point-to-point and feeder structure for FSNCs
Schedules: City pairs
Service range: 1-2 service classes
Pricing: average cost prices, usually higher than holiday carriers

Traditional Freight Carrier
Fleet: Full cargo / combi or full pax aircraft
Geographical network range: worldwide
Network structure: unidirectional (full cargo) or hub-and-spoke (combi and full pax)
Schedules: scheduled or chartered flight
Service range: Cargo: 1 class. Pax: 1-4 classes
Pricing: complex yield management, price discrimination
Only the cargo leg by air is done by these kind of carriers (e.g. Cargolux, Air France, MartinAir) The full pax aircraft use belly compartments for their cargo.

Integrators
Fleet: Full cargo aircraft
Geographical network range: worldwide
Network structure: unidirectional and / or hub-and-spoke
Schedules: scheduled or chartered flight
Service range: 1-2 service classes (for cargo: normal and express forwarding)
Pricing: complex yield management, price discrimination
The full transport from beginning to end is done by these kind of carriers (e.g. DHL, FedEx, UPS)

Hybrid Carrier
Fleet: Mix of medium sized aircraft
Geographical network range: Depends of main business
Network structure: Point-to-point or hub-and-spoke
Schedules: scheduled or chartered flight
Service range: 1-2 service classes
Pricing: complex yield management, price discrimination

Appendix XXVIII Business model

Qjet transports (business and holiday) customers around Europe. During the holiday periods, more destinations are added and the frequency is increased providing travel opportunities towards holiday destinations.

Type of carrier

Qjet has a mixed fleet of B737-300 / -700 / -800. These are currently used for holiday charters as well as business travellers. Next to that, Qjet has its own hangar with a technical services department. Due to the type of fleet the regional carrier and integrator can be removed. According Appendix XXVII the hangar will eliminate the possibility to be a LCC, therefore the FSNC, holiday carrier, traditional freight carrier and HC are possibilities for Qjet.
The final differentiation can be done by means of the mission, vision and strategy (7.4). These terms dictate a mix of the FSNC, leisure and traditional freight carrier business models. Qjet will operate with a business model comparable to a HC.

Qjet

The business model of Qjet is built by the following values:

1. Key partners
2. Key activities
3. Key resources
4. Value proposition
5. Customer relationships
6. Methods to communicate
7. Customer segments
8. Revenue streams

Ad 1. Key partners

The key partners for Qjet are the airports, air traffic control and governmental entities. It is impossible to function as an airline without these partners.

Ad 2. Key activities

Transporting passengers with their belongings safely and efficiently from A to B is the key activity for the airline. This is done by selling available seat miles. The safety aspect will be handled by the management, crew and the engineering department. They will keep the continuous airworthiness of each aircraft up to date.

Ad 3. Key resources

The fleet of B737-300 / -700 / -800s with their respective crews are key resources. Not only the crews on board, also employees in general are vital for the success of the airliner.

Ad 4. Value proposition

Passengers have the ability to choose 2 different classes in the aircraft: business and economy. The inflight services for business passengers are different then the services for the economy passengers. This creates complex yield management and price discrimination between classes.

Ad 5. Customer relationships

At the airport, there will be self-check-in services as well as the regular check-in service at a desk. There will be an information desk for questions. The internet site will accommodate a booking page and FAQ section. By implementing a frequent flyer program, the customers will be kept updated on relevant developments and promotions. The updates will also be visible through social media.

Ad 6. Methods to communicate

The web platform will be a gateway to the information services and booking facilities. Payments can be done by a range of online and offline services such as PayPal, iDeal and Visa. Booking can also be done via third parties like travel agencies. The customers can ask questions by using email, the web page, social media and the information desk at the airport. Surveys give an additional channel between the customers and the airline.

Ad 7. Customer segments

The attention of the airline focuses on holiday and business travellers who travel around Europe for vacation and work.

Ad 8. Cost structure

All aspects of an airline produce costs such as aircraft, hangar, maintenance, office space, employees, training of employees, web platforms, servers, handling fees, fuel, landing fees and Air Navigation Service Provider (ANSP) services.

Ad 9. Revenue streams

Revenues can be obtained by selling tickets and in-flight services. The sold cargo holds give additional revenue.

Appendix XXIX Comparison of DGP growth / Passenger traffic Airbus

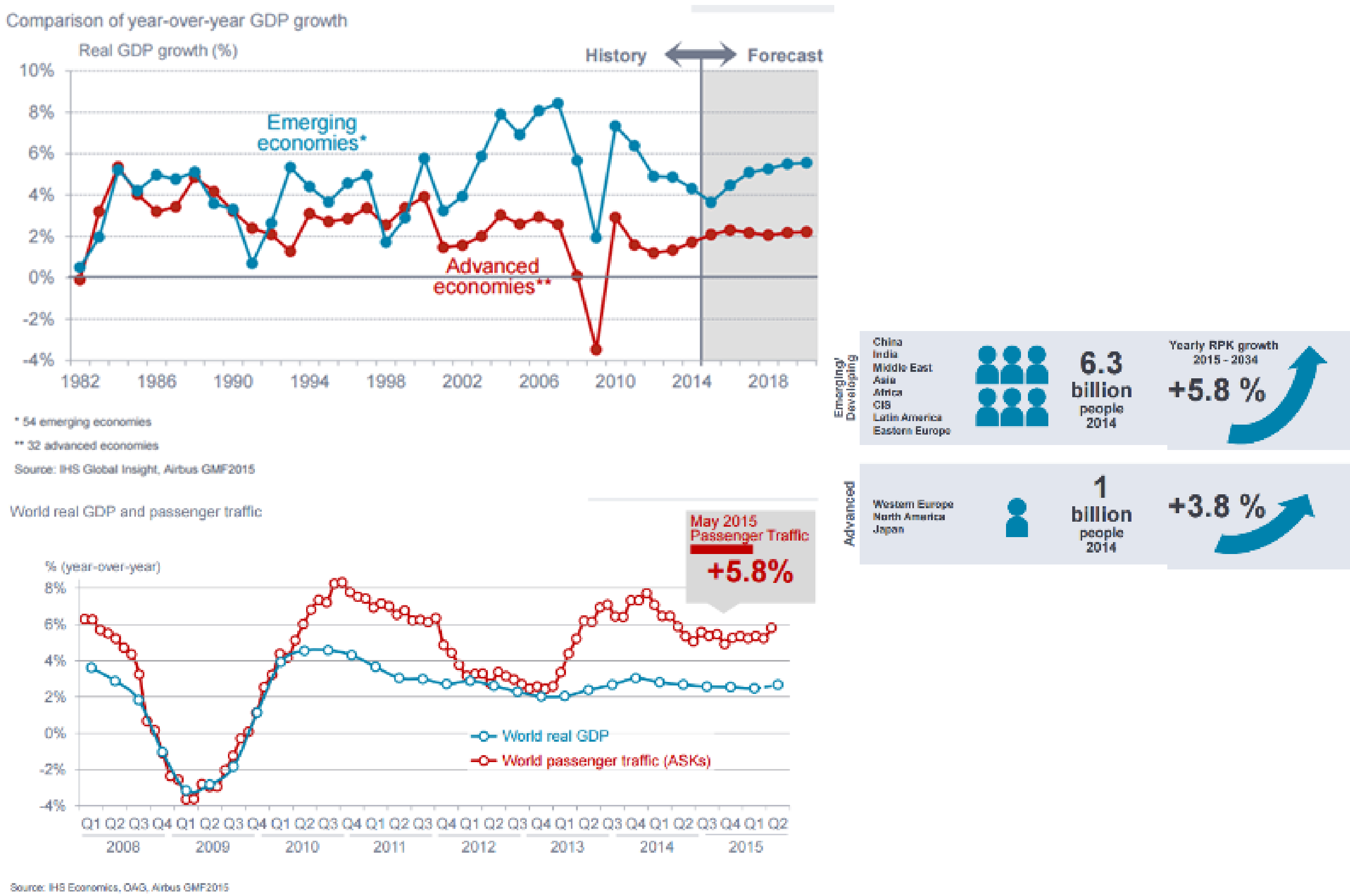
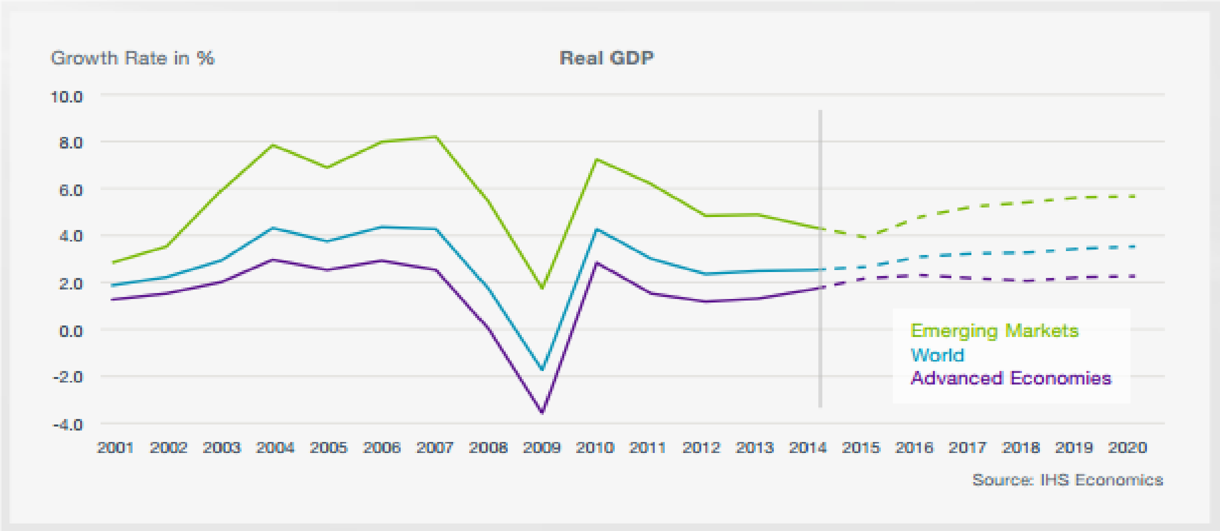


Figure 11: Comparison of DGP growth/Passenger traffic Source: Airbus Global Market Forecast 2015-2034

Appendix XXX GDP forecast / RPK growth Boeing



Region	Asia	North America	Europe	Middle East	Latin America	C.I.S.	Africa	World
World Economy (GDP %)	4.3%	2.5%	1.8%	3.8%	3.4%	2.4%	4.5%	3.1%
Airline Traffic (RPK %)	6.1%	3.1%	3.8%	6.2%	6.0%	3.7%	5.7%	4.9%
Cargo Traffic (RTK %)	5.7%	2.9%	3.1%	6.3%	5.5%	3.7%	6.9%	4.7%
Airplane Fleet (%)	5.2%	1.7%	2.7%	5.2%	4.6%	1.9%	4.5%	3.6%

Figure 12: GDP forecast/RPK growth Source: Boeing Current Market Outlook 2015-2034

Appendix XXXI Shortened rest period

Tabel bij Ops.1.1110 - 2 Verkorte rust

Lengte vekorte rust — Maximum FDP na een verkorte rust

FDP voorafgaande aan bekorte rust	Aanmelden na bekorte rust vanaf - tot	7:30	7:45	8:00	8:15	8:30	8:45	9:00	9:15	9:30	9:45	10:00	10:15	10:30	10:45	11:00	11:15	11:30	11:45	12:00	12:15	12:30	12:45	13:00	13:15	13:30	13:45
00:00 - 05:59	06:00 - 13:00	7:30	8:30	9:30	10:30	11:30	12:30	13:00	13:00	13:00	13:00																
	05:00 - 06:00 13:00 - 15:00	6:30	7:30	8:30	9:30	10:30	11:30	12:00	12:00	12:00	12:00																
	15:00 - 05:00	5:30	6:30	7:30	8:30	9:30	10:30	11:00	11:00	11:00	11:00																
06:00 - 06:59	06:00 - 13:00	6:30	7:30	8:30	9:30	10:30	11:30	12:30	13:00	13:00	13:00																
	05:00 - 06:00 13:00 - 15:00	5:30	6:30	7:30	8:30	9:30	10:30	11:30	12:00	12:00	12:00																
	15:00 - 05:00	4:30	5:30	6:30	7:30	8:30	9:30	10:30	11:00	11:00	11:00																
07:00 - 07:59	06:00 - 13:00	5:30	6:30	7:30	8:30	9:30	10:30	11:30	12:30	13:00	13:00																
	05:00 - 06:00 13:00 - 15:00	4:30	5:30	6:30	7:30	8:30	9:30	10:30	11:30	12:00	12:00																
	15:00 - 05:00	3:30	4:30	5:30	6:30	7:30	8:30	9:30	10:30	11:00	11:00																
08:00 - 08:59	06:00 - 13:00	4:30	5:30	6:30	7:30	8:30	9:30	10:30	11:30	12:30	13:00																
	05:00 - 06:00 13:00 - 15:00	3:30	4:30	5:30	6:30	7:30	8:30	9:30	10:30	11:30	12:00																
	15:00 - 05:00	2:30	3:30	4:30	5:30	6:30	7:30	8:30	9:30	10:30	11:00																
09:00 - 09:59	06:00 - 13:00	3:30	4:30	5:30	6:30	7:30	8:30	9:30	10:30	11:30	12:30																
	05:00 - 06:00 13:00 - 15:00	2:30	3:30	4:30	5:30	6:30	7:30	8:30	9:30	10:30	11:30																
	15:00 - 05:00	1:30	2:30	3:30	4:30	5:30	6:30	7:30	8:30	9:30	10:30																
10:00 - 10:59	06:00 - 13:00	2:30	3:30	4:30	5:30	6:30	7:30	8:30	9:30	10:30	11:30	12:30	12:45	13:00	13:00												
	05:00 - 06:00 13:00 - 15:00	1:30	2:30	3:30	4:30	5:30	6:30	7:30	8:30	9:30	10:30	11:30	11:45	12:00	12:00												
	15:00 - 05:00	0:30	1:30	2:30	3:30	4:30	5:30	6:30	7:30	8:30	9:30	10:30	10:45	11:00	11:00												
11:00 - 11:59	06:00 - 13:00	1:30	2:30	3:30	4:30	5:30	6:30	7:30	8:30	9:30	10:30	11:30	11:45	12:00	12:15	12:30	12:45	13:00	13:00								
	05:00 - 06:00 13:00 - 15:00	0:30	1:30	2:30	3:30	4:30	5:30	6:30	7:30	8:30	9:30	10:30	10:45	11:00	11:15	11:30	11:45	12:00	12:00								
	15:00 - 05:00	0:00	0:30	1:30	2:30	3:30	4:30	5:30	6:30	7:30	8:30	9:30	9:45	10:00	10:15	10:30	10:45	11:00	11:00								
12:00 - 12:59	06:00 - 13:00	0:30	1:30	2:30	3:30	4:30	5:30	6:30	7:30	8:30	9:30	10:30	10:45	11:00	11:15	11:30	11:45	12:00	12:15	12:30	12:45	13:00	13:00				
	05:00 - 06:00 13:00 - 15:00	0:00	0:30	1:30	2:30	3:30	4:30	5:30	6:30	7:30	8:30	9:30	9:45	10:00	10:15	10:30	10:45	11:00	11:15	11:30	11:45	12:00	12:00				
	15:00 - 05:00	0:00	0:00	0:30	1:30	2:30	3:30	4:30	5:30	6:30	7:30	8:30	8:45	9:00	9:15	9:30	9:45	10:00	10:15	10:30	10:45	11:00	11:00				
13:00 en meer	06:00 - 13:00	0:00	0:30	1:30	2:30	3:30	4:30	5:30	6:30	7:30	8:30	9:30	9:45	10:00	10:15	10:30	10:45	11:00	11:15	11:30	11:45	12:00	12:15	12:30	12:45	13:00	13:00
	05:00 - 06:00 13:00 - 15:00	0:00	0:00	0:30	1:30	2:30	3:30	4:30	5:30	6:30	7:30	8:30	8:45	9:00	9:15	9:30	9:45	10:00	10:15	10:30	10:45	11:00	11:15	11:30	11:45	12:00	12:00
	15:00 - 05:00	0:00	0:00	0:00	0:30	1:30	2:30	3:30	4:30	5:30	6:30	7:30	7:45	8:45	9:45	10:45	11:00	11:00	11:00	11:00	11:00	11:00	11:00	11:00	11:00	11:00	11:00

Voor planningsdoeleinden zal in de FDP waarden, genoemd in deze tabel , een marge van 30 minuten t.o.v. de maximale FDP na verkorte rust aangehouden worden.

Een FDP, volgend op een verkorte rust als bedoeld in pt 1.4.1 en 1.4.2 mag niet worden verlengd als bedoeld in OPS 1.1105, pt 2

Een FDP volgend op een verkorte rust als bedoeld in pt 1.4.1 en 1.4.2 mag wel worden verlengd als bedoeld in OPS 1.1115 en 1.1120

Indien de FDP na een bekorte rust meer dan 2 sectoren omvat zal voor elke volgende sector de FDP met 30 min. gecorrigeerd worden.

Appendix XXXII Flight duty period

Infrastructuur, Leefomgeving & Transport (IL&T) is the Dutch Aviation authority and has several extra regulations, which are important for this project. These regulations have most in common with the operations side of the organization.

- Per year, a pilot can only work 2000 hours that has to be equally divided across the year.
- Rest and duty times must be according the following table (Table 75 Flight duty period):

Reporting for duty	Max working time no reserve	Max working time after 3 h reserve
00.00 - 02.59	10.00 h	8 h
03.00 - 03.59	10.30 h	8 h
04.00 - 04.59	11.00 h	10 h
05.00 - 05.59	10.30 h	11 h
06.00 - 12.59	12.00 h	12 h
13.00 - 14.59	11.30 h	11 h
17.00 - 18.59	10.30 h	9 h
19.00 – 23.59	10.00 h	8 h

Table 75 Flight duty period

- Whenever a pilot has not flown 3 take-offs and landings by day and 1 take-off and landing by night the past 90 days, the pilot needs to revalidate his license.
- An Air Transport Pilot License (ATPL) has a validation of 7 years and need to be renewed after[16].

[16] (IL&T, 2015)

Appendix XXXIII Process report

Issue

Qjet has requested an investigation whether or not a winglet modification on the aircraft will help Qjet reach their goals regarding environment, innovation and most important reduction of cost.

Group process

After the issue was explained by Qjet, the project group started with a literature research. With this literature research a project plan was produced. This process proved to be difficult due to the fact that the group was focused on details too early. Therefore it was needed to return to the overview phase several times which required to ask questions without answering them. With this method, the group eventually finalized the project plan and started the project. Keeping the planning up to date proved to be an issue. Although work packages where created in the planning, some of these packages where still overlapping and needed adjustments. Extra packages were added for the same reason. At the end of the project this proved to be critical since the workload rapidly increased. Even with the increased workload the initial submission date op 4-12-2015 was reached. The board however decided to suspend the submission date until 16-12-2015. With this extra time the project group has fine-tuned and adjusted the project. This was done based on of the comments the board made on the initial report. The main comment was the fact that it needed a more logical structure of argumentation.

Lessons learned

The biggest lesson learned is that the structure of the project has to be logical. This makes planning far more easy and it makes valuable. In the initial report the important cases were overruled by the less important ones. They were defined incorrect or at the wrong place. Furthermore lessons are learned on the aspect of planning. Creating work packages makes it possible to find missing links or subjects far more easy. In the future, all members of the project group will look back at the project as a big learning point for their future career.

Bibliography

Ackert, M. S. (2010, october 1). *basics of aircraft maintenance programs for financiers.* Retrieved November 13, 2015, from Aircraftmonitor.com: http://www.aircraftmonitor.com/uploads/1/5/9/9/15993320/basics_of_aircraft_maintenance_programs_for_financiers___v1.pdf

Airbus. (2015, 11 2). *Airbus_Global_Market_Forecast_2015-2034*. Retrieved from mijnhva.nl: https://studiedelen.mijnhva.nl/studiedelen/4100BDRK11/1516/Documents/Airbus_Global_Market_Forecast_2015-2034.pdf

American Airlines. (2011, December). *aircraft maintenance procedures.* Retrieved November 13, 2015, from Website of American Airlines: https://www.aa.com/content/images/aboutUs/newsroom/fs_aircraft_maintenance_procedures.pdf

ATAG. (2015, Novembre 13). *Airline Stakeholders.* Retrieved from www.atag.org/component/downloads/: www.atag.org/component/downloads/ATAG_StakeholdersMap.pdf

Boeing. (2015, Novembre 16). *Boeing*. Retrieved from Boeing Prices: http://www.boeing.com/company/about-bca/#/prices

Boeing. (2015, 11 2). *Boeing_Current_Market_Outlook_2015.pdf*. Retrieved from mijnhva.nl: https://studiedelen.mijnhva.nl/studiedelen/4100BDRK11/1516/Documents/Boeing_Current_Market_Outlook_2015.pdf

Boeing. (n.d.). *Boeing*. Retrieved Oktober 10, 2015, from Boeing aeromagazine: http://www.boeing.com/commercial/aeromagazine/articles/qtr_03_09/article_03_1.html

Boeing. (n.d.). *Boeing aeromagazine*. Retrieved Oktober 10, 2015, from Boeing: http://www.boeing.com/commercial/aeromagazine/articles/qtr_03_09/article_03_1.html

Boeing. (n.d.). *Boeing Aircraft wingspan*. Retrieved Oktober 10, 2015, from Boeing wingspans: http://www.boeing.com/assets/pdf/commercial/airports/faqs/wingletspans.pdf

Boeing Commercial Airplanes. (2013, September). *Airplane Characteristics for Airplane Planning.* Retrieved Oktober 27, 2015, from Boeing: http://www.boeing.com/assets/pdf/commercial/airports/acaps/737.pdf

Boeing, A. p. (n.d.). *Blended winglets*. Retrieved Oktober 10, 2015, from Aviaition partners Boeing: http://www.aviationpartnersboeing.com/products_737_300.php

Bradly, C. (2013, December 03). *winglets*. (Boeing) Retrieved Oktober 10, 2015, from b737.org.uk: http://www.b737.org.uk/winglets.htm

Bucharest Henri Coandă International Airport. (2015). *Airport Charges*. Retrieved November 5, 2015, from Bucharest Airports: http://www.bucharestairports.ro/en/about/airport-charges

(2007). *CAO voor KLM-cabinepersoneel.* Amstelveen: De Koninklijke Luchtvaart Maatschappij N.V.

Cederholm, T. (2015, 11 5). *low-entry-barries-intensify-competition-airline-industry*. Retrieved from marketrealist.com: http://marketrealist.com/2014/12/low-entry-barriers-intensify-competition-airline-industry/

Civil Aviation Authority. (2015). *Charges*. Retrieved November 5, 2015, from Hellenic Republic Ministry of Infrastructure, Transport and Networks: http://www.ypa.gr/en/air-transport/charges/

(2014). *Collectieve arbeidsovereenkomst Transavia cabinepersoneel.* Schiphol-Oost: Luchtvaartmaatschappij Transavia airlines CV.

(2012). *Collectieve arbeidsovereenkomst Transavia gronspersoneel.* Schiphol: Transavia airlines CV.

(2012). *Collectieve arbeidsovereenkomst Transavia Vliegers.* Schiphol-Oost: Tranavia Airlines CV.

(2013). *Collectieve Arbeidsovereenkomst Voor Gronspersoneel Martinair Holland N.V.* Schiphol-Oost: Martinair Holland N.V.

Deurwaarder, A. (2015, 11 14). *DLWO Studiedelen.* Retrieved from HvA: https://studiedelen.mijnhva.nl/studiedelen/4100BDRK11/1516/Documents/2015-10-12%20college%204%20Logistiek.pdf

Deurwaarder, A. (2015, Novembre 12). *Studieinformatie.* Retrieved from DLWO: https://studiedelen.mijnhva.nl/studiedelen/4100BDRK11/1516/Documents/DLR%20Airline%20Business%20Models%202008.pdf

Deurwaarder, A. (2015, Novembre 12). *Studieinformatie.* Retrieved from DLWO: https://studiedelen.mijnhva.nl/studiedelen/4100BDRK11/1516/Documents/Airline%20ManagementTxt.pdf

Deurwaarder, A. (2015, Novembre 12). *Studieinformatie.* Retrieved from DLWO: https://studiedelen.mijnhva.nl/studiedelen/4100BDRK11/1516/Documents/2015-10-12%20college%204%20Logistiek.pdf

EASA. (2011). *AMC and GM to Part-FCL.* Brussels: European Aviation Safety Agency.

EASA. (2014). *AMC and GM to Part ORO.* Brussels: European Aviation Safety Agency.

EASA. (2014). *AMC and GM to Part-CAT.* Brussels: European Aviation Safety Agency.

EASA. (2014, November 26). *Commision regulation (EU) No 1321/2014.* Brussels: European Aviation Safety Agency.

EASA. (2015). *Noise Type Certificates - Approved noise levels.* Retrieved November 5, 2015, from European Aviation Safety Agency: https://easa.europa.eu/document-library/noise-type-certificates-approved-noise-levels

economics, F. (2015, 11 1). *competition-between-airports*. Retrieved from frontier-economics.com: http://www.frontier-economics.com/publications/competition-between-airports/

Enternext. (2015, Novembre 16). Retrieved from https://www.enternext.biz/nl/enternext/prospect/financier-uw-groei/waarom-noteren-op-de-beurs

IATA. (2014, Novembre). *IATA*. Retrieved Novembre 10, 2015, from Airline maintenance cost executive commentary: https://www.iata.org/whatwedo/workgroups/Documents/MCTF/AMC-ExecComment-FY13.pdf

IATA. (2015, 11 1). *Bedrijfskunde 13*. Retrieved from mijnhva.nl: https://studiedelen.mijnhva.nl/studiedelen/4100BDRK11/1516/Documents/airport-competition.pdf

IATA. (2015, 11 2). *Global Air Passenger*. Retrieved from iata.org: http://www.iata.org/publications/economic-briefings/WEF_TTCR_Chapter1.4_2015.pdf

IATA. (2015, Oktober 18). *IATA Operational Safety Audit (IOSA)*. Retrieved from IATA: https://www.iata.org/whatwedo/safety/audit/iosa/Pages/index.aspx

IATA. (2015, 11 2). *Jet Fuel Price Development*. Retrieved from iata.org: http://www.iata.org/publications/economics/fuel-monitor/Pages/price-development.aspx

IATA. (2015, 11 2). *New IATA Passenger Forecast Reveals Fast-Growing Markets of the Future*. Retrieved from iata.org: http://www.iata.org/pressroom/pr/pages/2014-10-16-01.aspx

IL&T. (2015, Oktober 08). *Arbeidstijdenbesluit vervoer*. Retrieved from Arbeidstijdenbesluit vervoer: file:///C:/Users/Jordy/Dropbox/Blended%20Winglets/4.%20Informatie%20&%20Bronnen/Regulations/Arbeidstijdenbesluit-vervoer.html

Intemarketing. (2015, Novembre 16). Retrieved from http://www.intemarketing.nl/marketing/marketingmix

Investsnips. (2015, Novembre 16). Retrieved from Listed Aviation Companies: http://investsnips.com/list-of-publicly-traded-aviation-companies/

Knoema. (2015, 11 9). *Crude Oil Price Forecast: Long Term 2015 to 2025 | Data and Charts*. Retrieved from knoema.com: http://knoema.com/yxptpab/crude-oil-price-forecast-long-term-2015-to-2025-data-and-charts

Malta International Airport. (2015). *Airport Charges*. Retrieved November 5, 2015, from Malta International Airport: http://corporate.maltairport.com/en/airport-charges.htm

Munich Airport. (n.d.). *Charger calculator*. Retrieved November 5, 2015, from Munich-Airport: http://www.munich-airport.de/en/business/branchen/aviation/entgelte/entgelt-rechner/index.jsp

N.V. Luchthaven Schiphol. (2015). *Aviation Charges and Conditions.* Retrieved November 5, 2015, from Schiphol: http://www.schiphol.nl/B2B/RouteDevelopment/ChargesAndSlots/AviationChargesAndConditions1.htm

Netherlands, G. o. (2008, 07 14). Regeling werk- en rusttijden luchtvaart. *Staatscourant*, 27.

Postma, R. (2015, 11 9). *waarom-de-olieprijs-maar-blijft-dalen*. Retrieved from nrcq.nl: http://www.nrcq.nl/2014/11/27/waarom-de-olieprijs-maar-blijft-dalen

Respectively airports/governmental instances. (2015, 10 28). *Respectively airports/governmental instances*. Retrieved 10 25, 2015, from see excelfile: "Destinations v1.xlsx".

SkyTeam. (2015, Oktober 18). *SkyTeam requirements*. Retrieved from SkyTeam requirements: http://www.skyteam.com/en/About-us/Our-members/Airline-Member-Requirements/

University, C. (n.d.). *Legal information institute*. Retrieved Novembre 10, 2015, from Cornell University Law School: https://www.law.cornell.edu/cfr/text/14/121.391

university, M. (2015). *Average In House Maintenance Employees per Aircraft*. Retrieved Novembre 04, 2015, from MIT education: http://web.mit.edu/airlinedata/www/2014%2012%20Month%20Documents/Employees%20and%20Productivity/MX/Average%20In%20House%20Maintenance%20Employees%20per%20Aircraft.htm