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Key buying factors and added value – a new approach to aircraft evaluation

KEY BUYING FACTORS AND ADDED VALUE - A NEW APPROACH TO AIRCRAFT EVALUATION

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1. ABSTRACT

The aircraft industry in the coming years will produce airliners of different categories for a constantly growing market. Despite this apparently advantageous position it seems increasingly difficult to design new products and new technologies which promise the same rate of economic improvements the customers enjoyed in the past. Projects being developed today will no longer achieve the level of cost savings which were experienced between previous aircraft generations. By realizing this, the analysis of the future market driven aircraft requirements becomes increasingly important. The identification of the Key Buying Factors (FIG. 1-1) shows that in addition to economy also aspects like performance, operating flexibility, commonality, comfort, noise and emission as well as the integration of the aircraft into the air transport infrastructure are of growing importance for its competitive positioning.

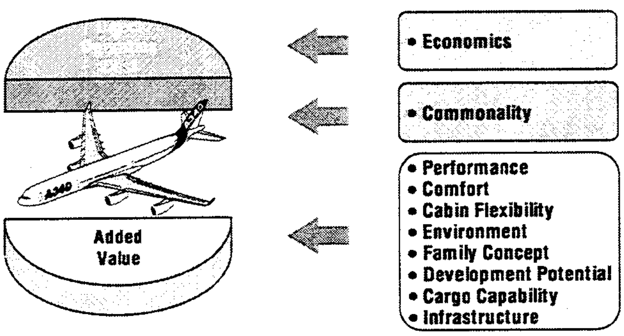

FIG. 1-1: Key Buying Factors

Daimler-Benz Aerospace Airbus involvement in the definition of new civil aircraft projects led to the identification and valuation of such Key Buying Factors [1], [3], [6] not included in the 'classic' DOC formulae.

2. OPERATING ENVIRONMENT

2.1 The Problem

Increasing demand for air travel growing on average by more than 4% per year, supported by continuously declining ticket prices, has converted air transportation from an previous luxury good into a commodity accessible to the broad public. This development forces the airlines to focus on a permanent adjustment to the market requirements by a variety of competitive supplies and service. The competitiveness of the airlines depends to a large degree on how well their aircraft fleets correspond to the demand of the operating environment in the coming decades. Competing aircraft of similar size are often perceived by the airlines as providing comparable levels of technology and therefore no longer offer distinct advantages in direct operating cost (DOC). By applying 'classic' DOC comparisons as the only yardstick in an aircraft evaluation, manufacturers run the risk of designing aircraft types and capacities not fully suited to long term transportation needs.

2.2 The decision process of an airline

A multitude of criteria influences an airline's selection of new aircraft. Whereas economic considerations (purchase price, operating costs) are still leading parameters, operators base their purchase decisions more and more on competitive and operational reasons. However, any rational decision can be overcome by 'unquantifiable' elements which do not relate to the quality and configuration of the aircraft. 'Unquantifiables' are for instance manufacturer's image, quality of product support, personal and political relationships. Very often such considerations are also decisive in concluding a contract (FIG. 2-1).

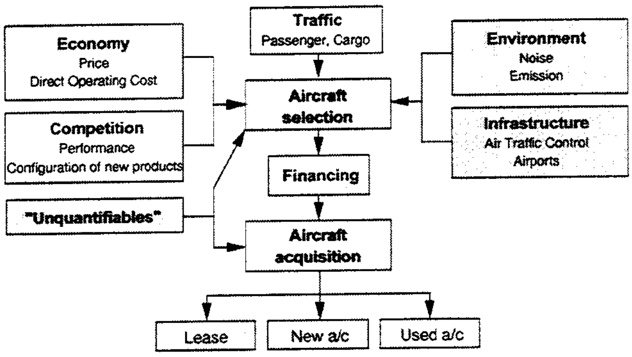

FIG. 2-1: Typical airline decision process

The decision-making process within an airline for the purchase of a new product is influenced by many individuals within the entire organization. The concept of a new product has to provide a superior value to the decision makers in the airline. Here it becomes clear that the ideal airplane, suiting all requirements and expectations, does not exist. A purchase decision is, similarly to the design objectives of the manufacturer, at best a compromise between diverging interests (FIG. 2-2).

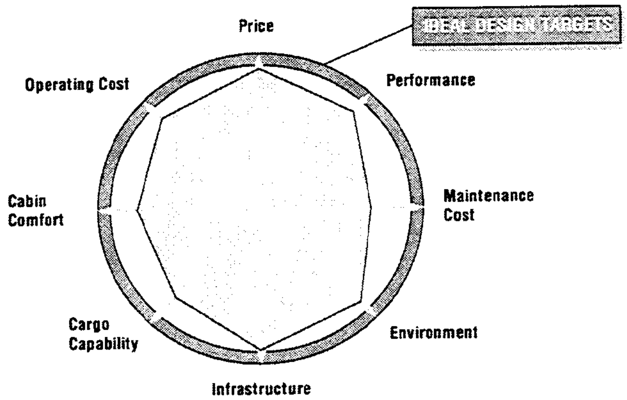

FIG. 2-2: „Table cloth" syndrome

2.3 Key Buying Factors

Airline surveys and analyses of sales campaigns indicate that on average roughly 60% of an airline's decision for equipment are made on the basis of merits of the aircraft, the remaining 40% on items related to the manufacturer [2], [3].

For the purpose of aircraft comparison and evaluation, **only aircraft related Key Buying Factors will be considered** in the following, such as

- Economics - Direct Operating Cost (DOC)
- Commonality - operational commonality[1]
- Added Values - aircraft performance
  - cabin comfort
  - environmental aspects
  - family concept
  - infrastructure compatibility

These 'Key Buying Factors', the combination of DOC, commonality and Added Value determine the competitiveness of an aircraft and play a major role in the decision process of an airline. The selection of these factors is a result of contacts with the marketplace as well as an inquiry [1] amongst 106 passenger carrying airlines, operating approximately 80% of today's world jet fleet. Particular attention has been given to **criteria which will dominate the airline market in the coming decade**. FIG. 2-3 indicates that on a global average more than 50% of an airline's decision is determined by factors other than economics and commonality. In the future the relative importance of these Added Value Factors in an aircraft selection process is expected to increase further. However, the relative significance of the criteria varies quite substantially from region-to-region and airline-to-airline.

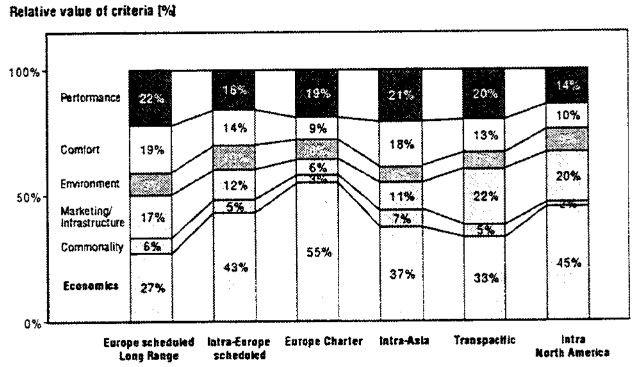

FIG. 2-3: Importance of future Key Buying Factors

3. GENERAL APPROACH

3.1 Elements of Evaluation

In order to structure the evaluation and to implement a systematic approach for comparison, the assessment of an aircraft's competitiveness is conducted in three steps (FIG. 3-1):

[1] Operational commonality = cockpit commonality/Cross Crew Qualification (CCQ) and Mixed Fleet Flying (MFF) is considered as the main effect of commonality

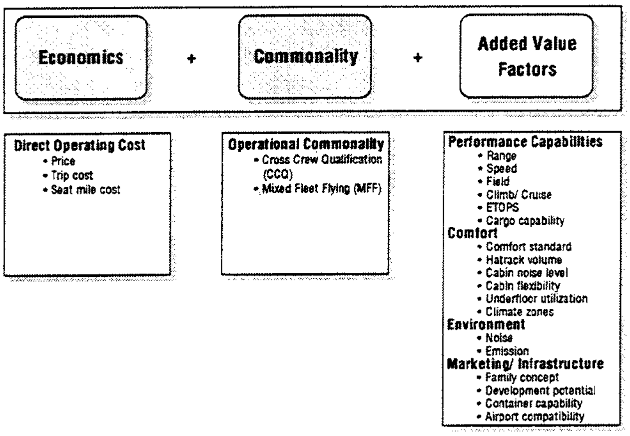

FIG. 3-1: Elements for aircraft evaluation

Step 1: Economic comparison
by applying established DOC formulae

Step 2: Commonality effects
on the basis of future fleet combination forecasts

Step 3: Added Value quantification
for analyses of Key Buying factors

Whereas DOC and commonality directly measure an aircraft's quality in terms of economic value, a complementary approach has been established to compare and quantify the Added Value Factors.

3.2 Value and Price

Irrespectively of the methods and comparisons explained hereafter, the value of an aircraft is, however, not directly related to the price which a manufacturer hopes to achieve on the market. In any aircraft transaction realized market prices (FIG. 3-2) are influenced by considerations like:

- Objectives of competing manufacturers
- Mission requirements
- Market power of large airlines and mega-lessors
- Availability of surplus aircraft
- Cost of used aircraft
- Replacement aircraft versus growth aircraft
- Level of regulation
- Financial condition of airline industry

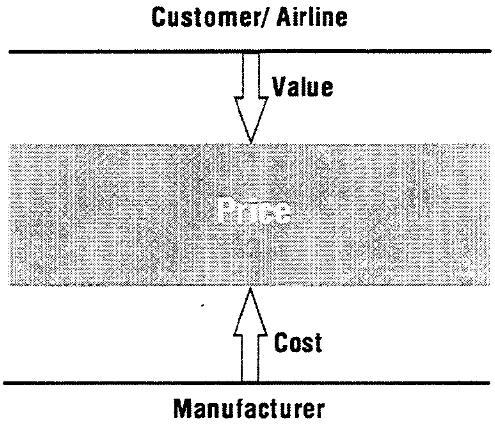

FIG. 3-2: Value versus price

3.3 Direct Operating Cost (DOC)

The 'classic' assessment of an aircraft's economic efficiency, measured through the Direct Operating Cost [7] per seat or per trip, focuses on cost elements for financing the aircraft plus insurance and components for operating like fuel, maintenance, crew cost and fees (FIG. 3-3).

Ownership Costs:	Depreciation Interest Insurance
Cash Direct Operating Expenses:	Fuel Landing Fees Navigation Charges
Crew Costs:	Flight Crew Costs Cabin Crew Costs
Maintenance:	Airframe Engine Maintenance Burden

FIG. 3-3: DOC components

The given example (FIG. 3-4) shows neutral comparisons not directly related to a particular manufacturer or aircraft type.

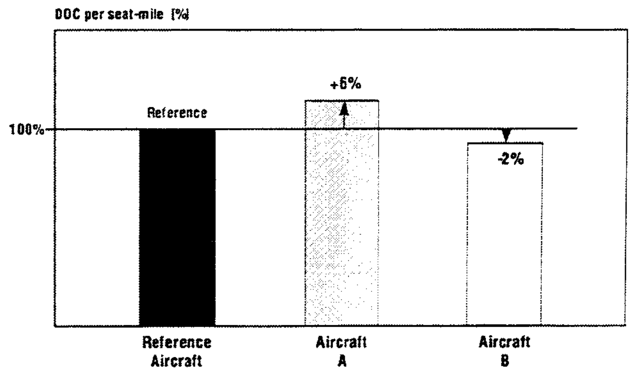

FIG. 3-4: 'Standard' DOC comparison

A reference aircraft operates in an airline's fleet; it produces relative DOC of 100%. The reference aircraft may also represent a set of theoretical requirements against which alternative proposals can be measured.

Aircraft A and B indicate alternative solutions to replace or complement the reference aircraft. Alternative aircraft A produces DOC 6% higher, aircraft B 2% below the reference.

3.4 Commonality effects

Main effects of commonality can be calculated from spares, maintenance and operational savings [8], [9]. The amount of dollar savings per year can be directly translated into a corresponding DOC benefit. Advantages of commonality are most noticeable in small and medium size fleets (FIG. 3-5).

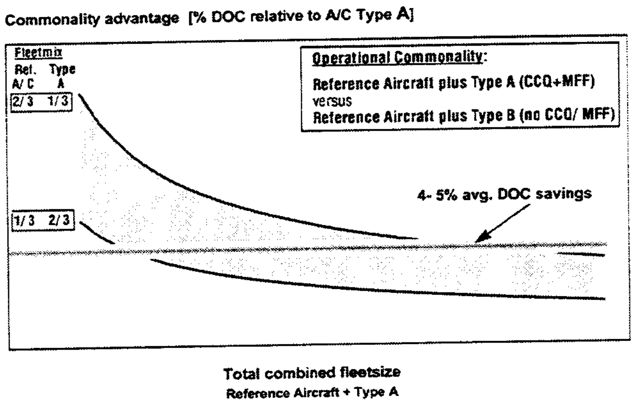

FIG. 3-5: Commonality effect versus fleet size

In the given example aircraft type A shows **operational commonality** with the reference aircraft, already in the airline's fleet. Type B does not offer these advantages. Depending on the projected fleet mix, an average DOC advantage of type A over type B in the order of 4-5% can be demonstrated, consequently improving the competitiveness of aircraft type A (FIG. 3-6). The DOC of type B remain unaffected since it offers no commonality benefits with the reference aircraft.

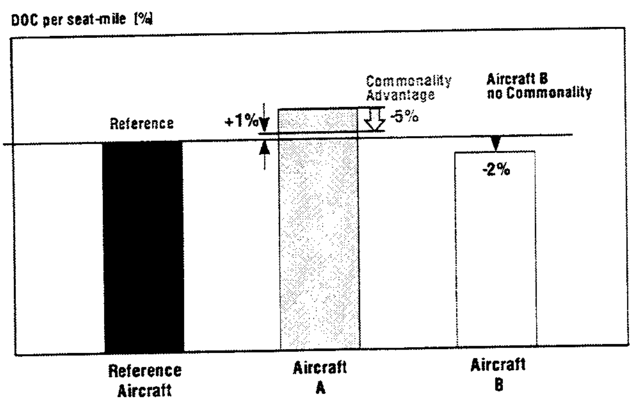

FIG. 3-6 Commonality effect on DOC

3.5 Added Value

The list of decision parameters consists of different weightings for each individual airline or group of operators when conducting an aircraft evaluation. As an example weight factors are applied reflecting typical intra-European scheduled operations (see FIG. 2-3). The average European airline [4] selects an aircraft by 48% on the grounds of economics and commonality, the remaining 52% of the decision consist of Added Value Factors. (FIG. 3-7).

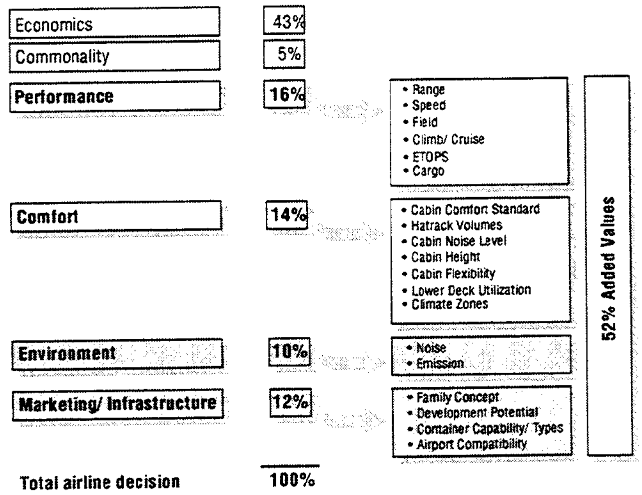

FIG. 3-7: Added Value Factors, reflecting typical intra-European scheduled operation

All items considered for the **Added Value comparisons have to be directly aircraft related, measurable parameters** and exclude personal opinions and feelings. It is assumed as a prerequisite that all competing aircraft in a decision process fulfill basic airlines' requirements. Each criterion may be a no-go item, if one aircraft offers capabilities largely below those of the competitive product.

To illustrate a comparison between different aircraft types the category **performance** has been broken down into 7 single items (FIG. 3-8).

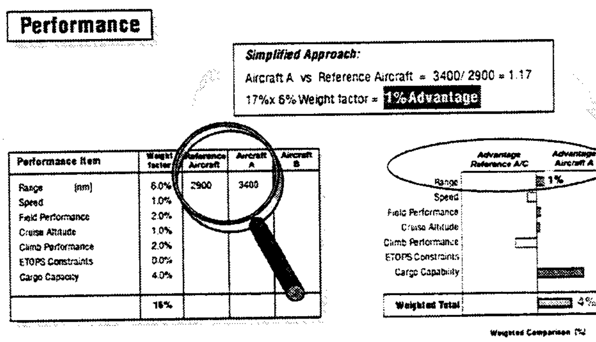

FIG. 3-8: Added Value comparison, example for performance category

In the given example aircraft A has a range capability 17% higher than the reference aircraft. Since range contributes with 6% to the overall decision, the Added Value of type A's higher range turns out to be a 1% advantage. It should be noted, however, that the items shown here cannot all be appraised by following the same arithmetic approach outlined in the given example. Certain values of aircraft characteristics are compared differently by applying other than just linear relationships.

As can be seen aircraft A, compared to the reference aircraft, in total shows a 4% advantage as a result of

- slight advantages in range capability
- considerable advantages in cargo capacity
- slight shortcomings in speed/climb performance
- almost equal characteristics in cruise altitude and field performance

Calculations for the remaining Added Value categories (comfort, environment, marketing / infrastructure) are conducted likewise:

Comfort aspects include only those **design features which can be influenced by the manufacturer**. Layouts and seat configurations which impact the perception of comfort by the passengers, depend on the policies of the operator. Main comfort criteria used for aircraft evaluation can be summarized as shown below (FIG. 3-9 and 3-10):

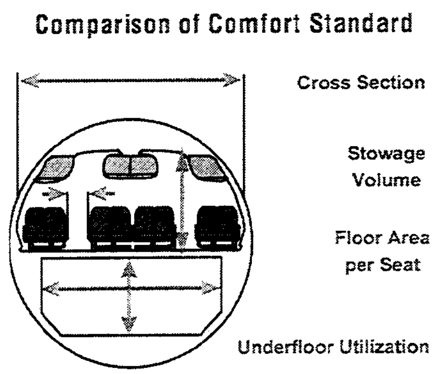

FIG. 3-9: Comparison of comfort standard

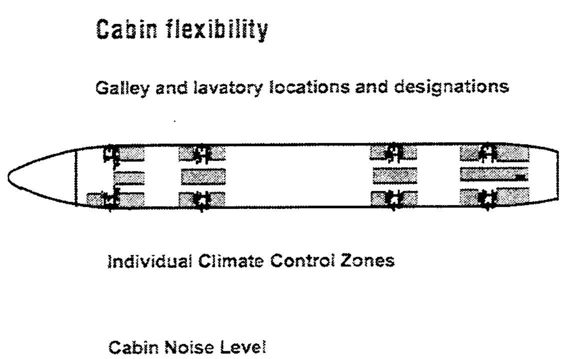

FIG. 3-10: Cabin features comparison

Environmental criteria consist of noise and emission. Noise regulations are focused on current Stage III levels for approach, sideline and take-off noise; emissions are measured with the help of defined landing and take-off cycles (LTO). Each aircraft which offers further environmental advantages, provides the airline with an additional value, especially in view of future tightening of the rules. Future regulations may also include in-flight emissions and might change considerably the fuel related cost as part of the DOC.

The **Marketing/Infrastructure** category consists of following elements:

- Family concept - Different aircraft sizes offered
  - Number of engine candidates
- Development potential - Future range developments
- Container capability - Container types
  - Structural/volume limitation
- Airport compatibility - Ground handling
  - Gate positioning, dimensions
  - Runway loading (ACN)

The results of the Added Value comparisons of the four categories performance, comfort, environment and marketing/infrastructure are summarized for type A and B relative to the reference aircraft (FIG. 3-11).

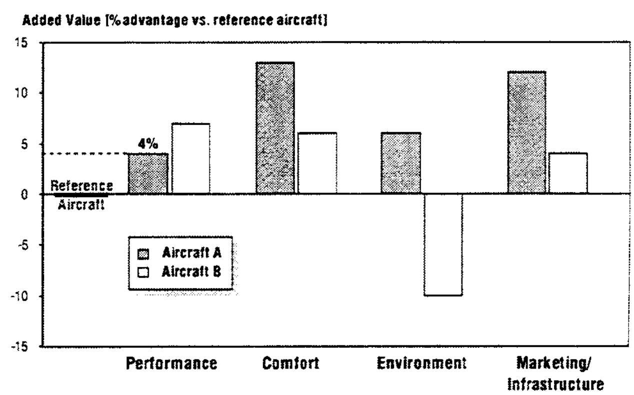

FIG. 3-11: Added Value comparison; summary of results

The totals of type A indicate an advantage over the reference aircraft in all categories. Type B appears to be the best aircraft in performance, but shows disadvantages compared to type A in the three remaining categories.

4. AIRCARFT EVALUATION

4.1 Quantification of Added Values

In order to translate the identified advantages of aircraft into measurable and comparable values a method has been developed which will be explained by referring again to the performance category of the Added Value comparisons (see FIG. 3-8). The other Added Value Factors are treated likewise. As outlined before, aircraft type A shows a 4% performance advantage over the reference aircraft. Each Added Value category is then translated into „equivalent DOC".

The key element for the translation is the relative distribution of the Added Value items. Based on that distribution **each Key Buying Factor can be expressed as an equivalent of an aircraft's operating cost**. If, for instance, for a scheduled airline in Europe the relative importance of economics (DOC) is 43% and of performance is 16% (see FIG. 2-3), the value of performance turns out to be 16/43=37% of DOC.

Any advantage or disadvantage has a direct influence on each categories' equivalent DOC: Its impact on the value for the customer is expressed in a decrease or - in the case of any disadvantage - an increase in equivalent DOC. No credit has at this time been given to the question whether advantages could also be expressed in potential revenue gains. In the given example aircraft type A shows a 4% advantage in performance over the reference aircraft. Since the value of performance amounts to 37% equivalent DOC, a 4% performance advantage translates into a 4/37=1.5% equivalent DOC reduction.

Other Added Value characteristics can be translated into equivalent DOC by applying the same approach.

4.2 Summary of results

Total results can be obtained by summarizing the three steps of evaluation (TAB. 4-1):

Step 1 **Economic comparison** ('classic' DOC)

Aircraft A operates at 6% higher, type B at 2% lower DOC per seat mile compared to the reference aircraft.

Step 2 **Commonality**

The advantage of operational commonality of type A over the reference aircraft leads to a DOC reduction of 5%. There is no commonality advantage between type B and the reference aircraft.

Step 3 **Added Value quantification**

The Added Value features of aircraft A sum up to an equivalent DOC advantage of 10%, aircraft B of 3% compared to the reference aircraft.

		Reference Aircraft	Aircraft A	Aircraft B
DOC per Seat		100%	106%	98%
Commonality			-5%	-
Added Value	Performance		-1.5%	-2.0%
	Comfort		-4.5%	-1.5%
	Environment		-1.0%	+2.0%
	Marketing		-3.0%	-1.5%
	Added Value	Ref.	-10%	-3.0%
Equivalent DOC Results		100%	91%	95%

TAB. 4-1: Summary of results

Aircraft A, due to its large benefits from Added Value items, now achieves 'equivalent DOC' of some 9% below the reference aircraft. Aircraft B operates at 5% 'equivalent DOC' below the reference aircraft (FIG. 4-2).

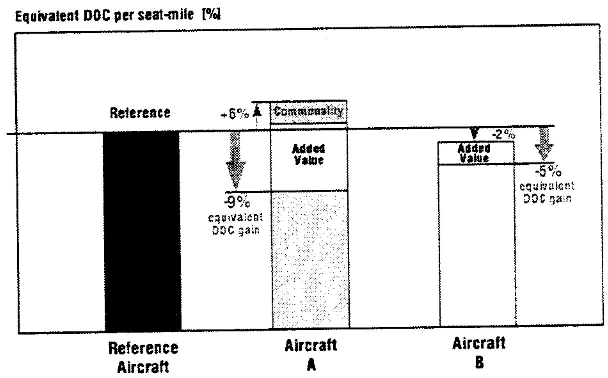

FIG. 4-2: Total effects including commonality and Added Value

Whereas aircraft B showed a superior cost picture over aircraft A when looking at 'classic' DOC alone, it looks inferior to aircraft A when considering Commonality and Added Values as well.

5. CONCLUSION

The aircraft evaluation approach provides a complementary product assessment beyond 'classic' DOC. Based on Key Buying Factors it combines economics, commonality effects and Added Value aspects and offers a systematic methodology to include factors of varying importance for the evaluation of overall aircraft efficiency. This proceeding can therefore be applied to subject areas like

- aircraft design objectives and priorities
- economic and operational targets
- competitive project evaluation
- value of technology research programs
- marketing and sales argumentation

This identification of product design objectives and technical risk areas assists in evaluating trade-offs between technology research and product cost. This enables the manufacturer to position the project competitivewise and supply the customer with the right value of an efficient product for the coming decades.

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