Commercial Aspects of Aircraft Customization

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Abstract

Aircraft manufacturers provide the flexibility for their airline customers to customize a wide variety of airplane features needed to properly differentiate individual brands and to satisy operational requirements. Beginning with a standard specification, airlines then modify or add among a wide variety of pre-qualified selections available from a large pool of industry-leading suppliers.

This report provides an introduction to the aircraft customization process by examining how airlines choose among the enormous number of selectable options available, primarily in the form of Seller- Furnished Equipment (SFE) and Buyer-Furnished Equipment (BFE). An analysis of the economics associated with the customization process is also discussed and quantified. Lastly, the research highlights why & how the major manufacturers are forgoing a traditional BFE approach and advancing the industry into a new era with increased standardization and fewer options.

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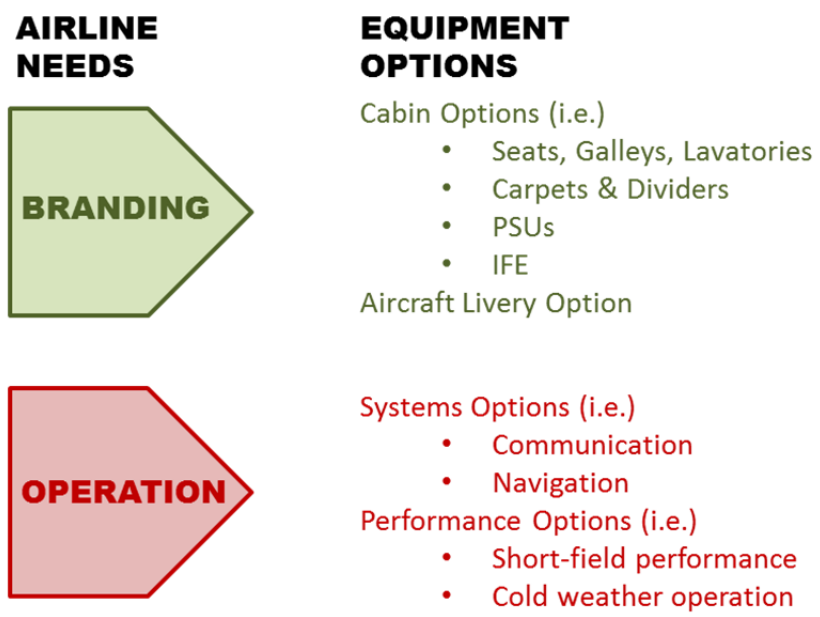
1. INTRODUCTION

Airframers facilitate the aircraft customization process by enabling airlines to select among a wide variety of optional equipment, ranging from the type of engines used to a wide variety of cabin interior offerings. This flexibility allows airlines to incorporate popular features needed to differentiate their individual brands as well as satisfy particular operational requirements – see example in Figure 1 below.

Branding establishes an airline's distinctive identity. In particular, it is the cabin architecture that creates the strongest impression, and generally frames passenger emotions and expectations for their flight experience. For example, today many airliners emphasize cabin designs that offer passengers more options for work and leisure while airborne through more space and premium seats, dynamic lighting, in-flight connectivity, and entertainment systems. Such amenities give airlines the flexibility to differentiate services and the airline brand.

Airlines also have the option to purchase a large number of operational equipment direct from competing suppliers. For example, many of the communication and navigation systems are defined by industry standards (i.e. ARINC characteristics) and offered by suppliers such as Honeywell and Rockwell-Collins. An airline will usually select a supplier for their entire fleet and then have the supplier adapt it to the particular airplane installation. With this standardization, the airline is also able to obtain spares from the vendor or other airlines at locations where he does not have a spares depot.

FIGURE 1- EXAMPLE CUSTOMIZATION REQUIREMENTS



2. AIRCRAFT SELECTABLE FEATURES

Today, airliners can choose from among a wide range of selectable features that provide value to their operation. Optional provisions such as satellite communications for long-range overwater operation, In-Flight Entertainment (IFE) systems, and premium seats, give airlines the ability to improve passenger experience and enhance operating efficiencies. Selectable features are generally made up of independent selections and package selections, which are discussed in greater detail below.

2.1 Independent Selections

Independent selectable features are pre-qualified equipment options offered from wide variety of industry-leading suppliers. The options offered are used to modify or add to the standard features described in the aircraft's baseline specification.

Independent selections are made up of selectable Seller- Furnished Equipment (SFE), which is optional equipment offered directly by the aircraft manufacturer, and Buyer-Furnished Equipment (BFE), which is optional equipment which the airlines choose during the production of the aircraft, and which the airline is fully responsible for negotiating directly with the OEM for all terms of the purchase. Another category used is Seller Purchased Equipment (SPE), which is simply (BFE) that the aircraft manufacturer purchases on behalf of the customer.

2.1.1 Supplier Furnished Equipment (SFE) – SFE is standard equipment which makes up the bulk of the hardware installed on an aircraft. SFE is generally sole-sourced to suppliers under a partnership/cost-sharing agreement and includes equipment used in avionics, hydraulic, electrical, environmental, and fuel systems. Generally, there are limited SFE options for the operator to choose from, and when available they are commercially managed between airline and the aircraft manufacturer. The price of all SFE is commonly included in the airframe price.

SFE suppliers are generally not required to bid for contracts at each phase of the design and manufacturing process, but are expected to be highly responsive to the needs of the manufacturer as part of a longer term partnership. This strategy reassures equipment suppliers of the manufacturer's commitment, avoids costs associated with frequent re-competitions, and puts SFE suppliers in a position to influence the establishment of future industry standards and specifications for new equipment.

Aircraft Independent Selection Perspective

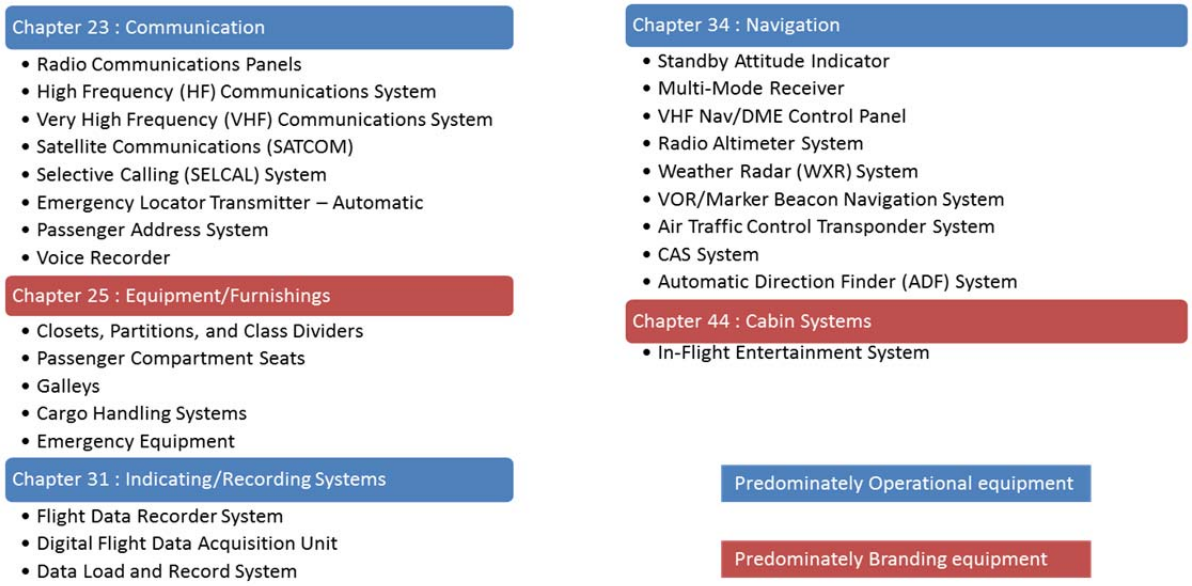
The avionics equipment on a commercial airliner can be divided into two general categories, Seller Furnished Equipment (SFE) and Buyer-Furnished Equipment (BFE). The BFE avionics comprises the type of equipment that is largely standard from airplane to airplane, such as radios, sensors, and entertainment systems. The SFE avionics consists of the type of equipment that is specific to the airplane type, and is provided by the airframe manufacturer. It includes such systems as the Auto-Flight System (AFS), the Electronic Instrument System (EIS), and the Flight Management System (FMS).

More recently, airframers and system integrators have taken to make risk-sharing more attractive by reducing the number of suppliers with whom they contract with. For example, on the 787 and A350 both Boeing and Airbus have preselected four to six seat manufacturers from a choice of over twenty currently in the market. The airlines like this concept because it offers them a choice of equipment without requiring them to make contract arrangements with suppliers. And the manufacturers prefer this alternative given it gives them better control of the production process and reduces manufacturing costs.

2.1.2 Buyer Furnished Equipment (BFE) - BFE is optional equipment chosen during the production of the aircraft and is commercially managed between the airline and the BFE suppliers. Aircraft manufacturers offer customers a choice of BFE equipment from a catalog listing qualified suppliers. The customers would then have to negotiate with the suppliers themselves, and would be contractually responsible for choosing the right equipment and ensuring it is delivered on time. Generally the price of BFE is not included in the airframe price.

Figure 2 below illustrates commonly used BFE equipment on commercial aircraft categorized by ATA chapters. Most of this equipment is largely standard from airplane to airplane, such as navigation, communication, and entertainment systems. An airline will thus usually select a supplier for their entire fleet and then have the supplier adapt it to the particular airplane installation. This allows for the owner to standardize BFE on other aircraft and take advantage of interchangeability and bulk purchases.

FIGURE 2- POPULAR BUYER FURNISHED EQUIPMENT



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Equipment highlighted in ATA Chapters 25 and 44 – Equipment/Furnishings & Cabin Systems respectively - are used primarily for airline branding purposes. These items generally include cabin interior equipment such as seats; carpets; galleys & galley inserts; cabin dividers, toilets; and In-Flight Entertainment (IFE) equipment. With selections from many suppliers, operators can choose the look and product features needed to properly differentiate their brand. An example of a partial BFE list is illustrated in Figure 3 below. The list shows the BFE equipment and provides the relevant information on P/N, On-Dock Delivery Date (ODD), Supplier, and ship-to destination.

FIGURE 3- EXAMPLE PARTIAL BFE LIST

Airline: XYZ
Operator: XYZ
A/C Type: 320-200

Issue 3 **Type** BFE

Contractual Delivery Date	Dec-11
FAL-MSN	NT-4959
Contractual Rank	N33T004

ATA/Item	Status	Description	Remark	Manufacturer	Type P/N	P/N	Alternate linked to P/N	Destination Code	RFC Catalog Item(s)	Open	Unit	A/C Qty	ODD
25.30.00.00	R	Transversal galley, full-size, 7 tr - area 33.051		DRIESSEN AEROSPACE CZ SRO (GALLEY)		601401-1		HL	VRD25D001C			1	25-Nov-11
25.30.00.00	R	Transversal galley, full-size, 4 tr. - area 31.010		DRIESSEN AEROSPACE CZ SRO (GALLEY)		601410-1		HL	VRD25D001C			1	25-Nov-11
25.35.10.00	R	Serving pot (coffee)		B/E AEROSPACE ISG, LENEXA		3530-0305-01		HL	VRD25D015C			3	18-Nov-11
25.35.10.00	R	Beverage Maker (Endura)		B/E AEROSPACE ISG, LENEXA		4510-12UF-00		HL	VRD25D006C			3	18-Nov-11
25.35.10.00	R	Steam oven LH		B/E AEROSPACE NIEUWEGEIN		4323100-01-6622		HL	VRD25D006C			1	18-Nov-11
25.35.10.00		Steam oven LH		B/E AEROSPACE NIEUWEGEIN		4323100-00-66-22	4323100-01-6622						
25.35.20.00	R	Oven meal carrier		B/E AEROSPACE NIEUWEGEIN		236152		HL	VRD25D015C			1	18-Nov-11
25.35.20.00	R	Meal Tray Atlas(8 per carrier)		B/E AEROSPACE NIEUWEGEIN		236153		HL	VRD25D015C			8	18-Nov-11
25.35.30.00	R	Beverage Maker mounting rail		B/E AEROSPACE ISG, LENEXA		416-0201-15		G	VRD25D006C			3	29-Sep-11
25.60.10.12	R	Remote control panel		THALES AVIONICS SA		S1820513-15		T	VRD23D0013239C			1	17-Oct-11
25.60.10.13	R	Emergency Locator Transmitter (ELT) bracket		THALES AVIONICS SA		S1820511-01		HL	VRD23D0013239C			1	18-Nov-11
25.60.10.13	R	ELT bracket AS (portable)		THALES AVIONICS SA		S1820511-02		HL	VRD25D002C			1	18-Nov-11
25.60.10.13	R	Emergency Locator Transmitter (ELT)		THALES AVIONICS SA		S1821502-02		HL	VRD23D0013239C			1	18-Nov-11
25.60.10.13	R	Portable ELT		THALES AVIONICS SA		S1823502-05		HL	VRD25D002C			1	18-Nov-11
25.60.10.14	R	Programming dongle ATP (fix)		THALES AVIONICS SA		S1820514-04		HL	VRD23D0013239C			1	18-Nov-11
25.65.00.10	**N**	**Safety belt, extension**		**AMSAFE INC**		**1028-1-021-2396**		**HL**	**VRD25D021C**			**5**	**18-Nov-11**
25.65.00.10	R	Safety belt, extension		AMSAFE INC		2010-2-01X2251		HL	VRD25D009C			2	18-Nov-11
25.66.00.00	R	Life vest, infant		AERAZUR		216200-0		HL	VRD25D002C			10	18-Nov-11
25.66.00.00	R	Life vest, passenger		AIR CRUISERS		63600-169		HL	VRD25D002C			10	18-Nov-11
25.66.00.00	R	Life vest, cockpit/cabin crew		AIR CRUISERS		63600-501		HL	VRD25D002C			10	18-Nov-11
25.66.00.00	R	Life vest, demo		AIR CRUISERS		63914-101		HL	VRD25D002C			2	18-Nov-11
46.21.04.00	R	AOC database diskette for ATSU		HONEYWELL INC. REDMOND, OLATHE		998-2449-507		T	VRD46D2110214C			1	17-Oct-11
46.21.04.00	R	AOC application software diskette for ATSU		HONEYWELL INC. REDMOND, OLATHE		998-2459-510		T	VRD46D2110214C			1	17-Oct-11

Also illustrated in Figure 2 is a summary of the most popular BFE used for operational requirements. This consists of equipment that is largely standard and interchangeable from airplane to airplane, such as communication and navigation systems. On 737NG, for example, Boeing offers BFE choices for High Frequency (HF) communication systems from Honeywell or Rockwell Collins. Airlines often will use common suppliers for a suite of communication & navigation equipment for multiple fleets of aircraft.

Aircraft Galley Standard Perspective

While galleys have been traditionally multi-source Buyer Furnished Equipment (BFE) products the major airframers are now only offering single-source Supplier Furnished Equipment (SFE) galleys on new long-range aircraft developments such as with B/E Aerospace on the A350 and Jamco on the 787.

In parallel, the airframers have moved to reduce the permutation of galley standards and layouts offered with both Airbus and Boeing by only offering ATLAS standard galleys (the prevalent galley standard utilized on over 80% of the world's commercial aircraft fleet) on the A350 and 787.

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Customers have the obligation to ensure delivery of all BFE on time, on quality and in full compliance with aircraft manufacturer specifications. If the aircraft manufacturer considers the procurement of any BFE equipment is not in line with their requirements, the airline shall be responsible to promptly put in place all necessary actions in order to reach an agreement on such issue and keep on managing the BFE supplier until on time delivery. A summary of key differences between SFE and BFE is illustrated in Figure 4.

FIGURE 4- INDEPENDENT SELECTION DIFFERENCES

INDEPENDENT SELECTIONS

Supplier-Furnished Equipment

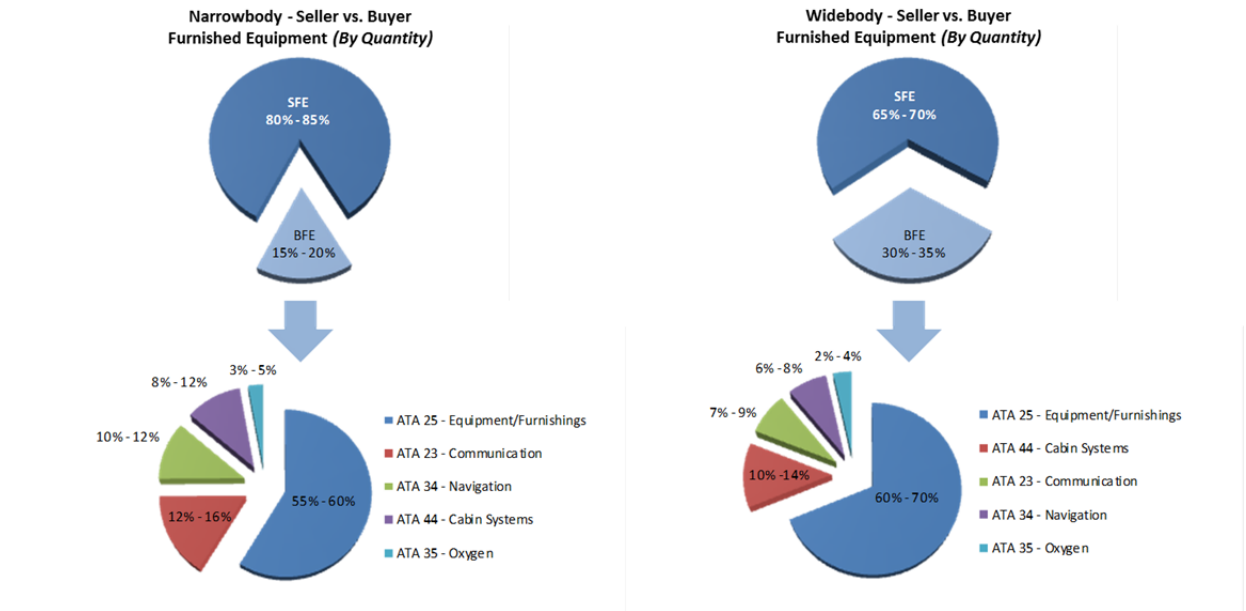
- Commercially managed between airline & aircraft mfg.
- Generally included in airframe price
- Limited selectable options/suppliers
- Supplier & aircraft mfg. often in long term partnerships
- Typically covered under aircraft OEM warranty
- Warranties set forth will apply to SFE

Buyer-Furnished Equipment

- Commercially managed between airline & BFE suppliers
- Generally not included in airframe price
- Many selectable options/suppliers
- Airline responsible for ensuring on-time delivery
- Allows for more branding & differentiation
- Warranties set forth will not apply to BFE

As illustrated in Figure 5 below, the percentage of selectable equipment depends on: a.) the type of aircraft (narrowbody vs. widebody) they are equipped on, and b.) the level of branding an airline chooses to offer. Most widebody aircraft are used on mainline operations and, as such, are configured to offer multiple levels of service, each with distinct amenities to enhance passenger comfort and distinguish airline brand identity. The cabin architecture of widebodies is customized to include, not only more BFE equipment, but also a greater variety. In contrast, most narrowbodies have fewer choices of selectable BFE offerings, particularly in the area of cabin interior options.

FIGURE 5- NARROWBODY AND WIDEBODY INDEPENDENT SELECTION BREAKDOWN BY QUANTITY



2.2 Package Selections

In addition to independent selections, aircraft manufacturers often offer feature packages, which are selections composed of groups of popular options. Generally these feature packages offer the option groups at a more attractive pricing than would be possible by selecting each option independently. The most popular feature packages are itemized below:

- Certification Feature Packages (i.e. FAA, EASA, JCAB, etc.)
- Avionics Feature Packages
- Communications & Navigation Feature Packages

Certification Feature Packages - All US manufactured airplanes are issued a Type Certificate (TC) by the Federal Aviation Administration (FAA) of the United States. Similarly, the European Certification (EASA) feature package addresses requirements for airplanes delivering to EASA member nations. The airplanes may also be configured to meet the Type Certification requirements of other agencies (e.g., Japan Civil Aviation Bureau [JCAB]).

Avionics Feature Packages - Most of this avionics consists of the type of equipment that is specific to the airplane type, and is provided by the airframe manufacturer. It includes such systems as the Auto-Flight System (AFS), the Electronic Instrument System (EIS), Flight Management System (FMS), and the various system controllers. On most commercial aircraft the avionics systems are supplied by select equipment suppliers, such as Honeywell, Rockwell-Collins, Thales, etc.

Communications & Navigation Feature Packages – The majority of communication systems are highly integrated, designed to reduce the workload of the two-man crew while providing the required levels of redundancy. It includes voice communication with the ground via VHF, HF, and SATCOM, as well as data link communications using an optional Aircraft Communications Addressing and Reporting System (ACARS) over the VHF radio, SATCOM, or HF data link (HFDL).

Buyer-Furnished Equipment – A Lenders Perspective

Assigning security in the BFE purchase agreements can be time consuming and, in some cases, futile. It is generally not practical to get an assignment of all BFE contracts where they require the consent of the BFE manufacturer. Where the BFE involved is core to the operation of the aircraft in revenue service, a lender may wish to obtain a security assignment of those two or three core purchase agreements so that it has the option and benefit of the airline's price. Aircraft owner/operators should take care when negotiating BFE contracts to obtain the right to assign them as security without the BFE manufacturer's consent.

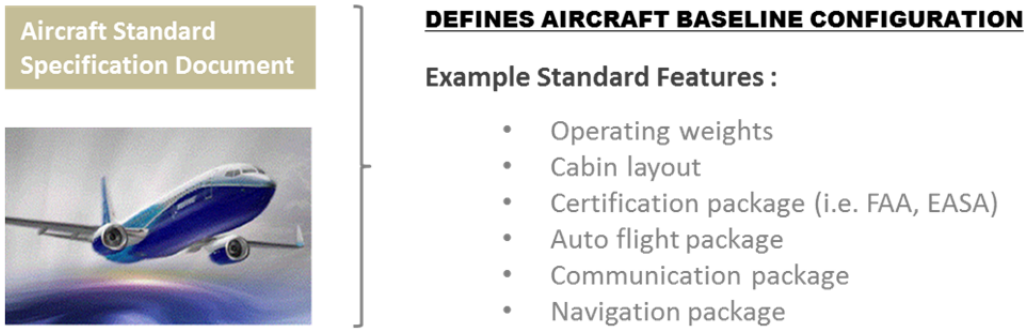
3. AIRCRAFT CUSTOMIZATION PROCESS

Before airplane delivery, the aircraft manufacturer will prepare a Customer Specification Document that defines the delivered configuration. As illustrated in Figure 6, the Customer Specification Document is a byproduct of an aircraft's Standard Specification plus features added/modified by both the customer and manufacturer. Thus, the aircraft's Customer Specification is either (a) the standard specification if no changes are applicable or (b) if specification changes are issued, the aircraft's customized specification as amended by all applicable specification changes (customer and/or manufacturer). The following section explains each of the constituent steps aimed at developing a customer's aircraft specification.

FIGURE 6- AIRCRAFT CUSTOMIZATION PROCESS

Step 1 - Standard Specification Document Review – The customization process commences once the customer has selected the aircraft, usually a minor model of an aircraft family (i.e. 737-800, A320 etc.). For each minor model, the aircraft manufacturer develops a Standard Specification Document, which details the baseline, or generic, contracted configuration of an aircraft. As illustrated in Figure 7, the Standard Specification Document describes features such as operating weights, cabin layout, communication & navigation equipment, autoflight equipment, and certification packages (i.e. FAA, EASA). The document serves as a reference guide used to track and benchmark changes arising from customization through selection of optional buyer & seller-furnished equipment.

FIGURE 7- AIRCRAFT STANDARD SPECIFICATION DOCUMENT



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Step 2 – Defining Customer Specification Changes - Customization involves choosing optional equipment from a broad spectrum of suppliers in order to complete the definition of a customer's configuration. Changes to the Standard Specification are carried out by issuance of request for specification changes, which enable aircraft owner/operators to make selection of optional features, either in the form of BFE options, SFE options, and/or feature packages – see Figure 8. Additional specification changes consist of definition of cabin layout, external livery, and definition of interior color specification to define the cabin aesthetic design (colors, material, carpet, curtains, etc.) When approved by the customer and aircraft manufacturer, these specification changes become contractual commitments.

FIGURE 8- CUSTOMER SPECIFICATION CHANGES

Customer Specification Changes

ENABLES THE CUSTOMIZATION PROCESS

SFE Options – Independent selections commercially managed between airline & the aircraft manufacturer

BFE Options – Independent selections commercially managed between airline and the BFE suppliers

Feature Packages – Selections composed of groups of popular options

Step 3 – Identifying Manufacturer Specification Changes - The evolution and improvement of the standard aircraft specification is an ongoing process and therefore the aircraft manufacturer may amend the specification to reflect improvements in design and performance characteristics – see Figure 9. In most cases the manufacturer is required to notify the buyer of any specification changes except when the changes are minor modifications or necessitated by an aviation authority directive or by equipment obsolescence, in which case changes are often implemented without requiring the buyer's consent.

FIGURE 9 - MANUFACTURER SPECIFICATION CHANGES

Manufacturer Specification Changes

ENABLES IMPROVEMENT OF STANDARD SPECIFICATION

Airframe Manufacturer Product Improvements - The evolution and improvement of the standard aircraft specification is an ongoing process and therefore the aircraft manufacturer may amend the specification to reflect improvements in design and performance characteristics.

4. AIRCRAFT CUSTOMIZATION & PRICE BUILD-UP

The Purchase Agreement defines the obligations of the customer and aircraft manufacturer concerning equipment to be furnished by the customer for installation in the airplane. Under a Purchase Agreement (PA), aircraft manufacturers' traditionally define net flyaway price as the invoiced price after discounts, cash credits, and other credits or concessions fairly allocated – see Figure 10.

FIGURE 10 – EXAMPLE AIRCRAFT PRICE BUILD-UP

Aircraft Price Build-Up	
Airframe Price [1]	$150,000,000
Engine Price	$30,000,000
Aircraft Base Price	$180,000,000
Seller Furnished Equipment Price	$3,000,000
Total Aircraft Price *(excluding BFE)*	$183,000,000
Credits	
Airframe Credits (40%)	($60,000,000)
Engine Credits (65%)	($19,500,000)
Net Aircraft Price	$103,500,000
Buyer Furnished Equipment Price	$10,000,000
Net Flyaway Price	$113,500,000

1 - based on standard specification

The price of all **SFE equipment** is included in the aircraft price and captured in Airframe Credits

The price of all **BFE equipment,** including all credits, is commercially managed between airline & BFE suppliers

Figure 10 illustrates how both BFE and SFE costs are accounted for in the flyaway price. The total aircraft price, as typically defined per the Purchase Agreement, is the sum of:

1. An Airframe Price, based on Standard Specification,
2. An Engine Price price, and
3. The price of all SFE

The net flyaway price includes all credits and the BFE budget estimate (paid directly by the airline to the BFE suppliers). Traditionally, credits are offered by the airframe and engine suppliers as purchase incentives, and these credits can vary considerably depending on the quantity ordered and the degree of leverage a buyer has. The BFE budget is paid directly by the airline to each of the BFE suppliers. Often BFE suppliers will provide purchase incentives as means to win highly competitive campaigns.

Aircraft Standardization & Purchase Price Perspective

One of the trends being adopted by both aircraft manufacturers and airlines is a shift to greater aircraft standardization. Under a more standardized approach aircraft manufacturers aim to reduce the number of equipment options available as well as transfer some multi-source BFE into single-source SFE. The effect of this initiative is improvements in aircraft commonality as well as potential reductions in airframe price given that more and more BFE equipment will be subject to airframe credits offered by the aircraft manufacturers.

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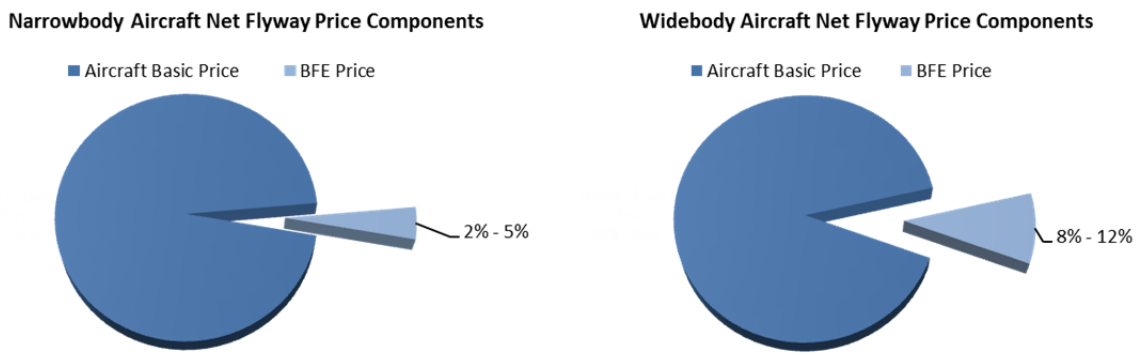
Figure 11 below illustrates breakdown of BFE costs as a percentage of the net flyaway prices for generic narrowbody and widebody aircraft. Assuming a $40M net flyaway price for a narrowbody aircraft, the customization costs will approximately range from $800K to $2.0M, and of this total approximately 60% - 65% will represent cabin customization. For a $100M widebody aircraft, customization costs will range from $8.0M - $12.0M, and of this total approximately 70% - 80% will be represented by cabin customization costs. IFE costs will oftem make up the bulk of cabin costs, particulary for widebody aircraft.

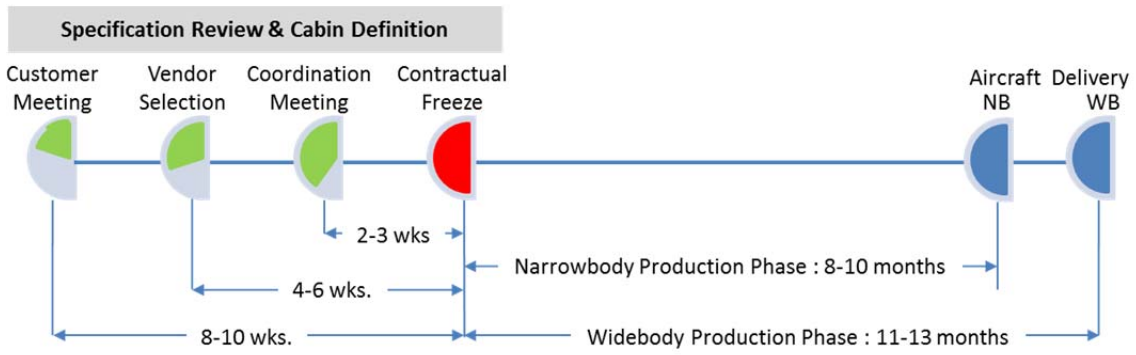
FIGURE 11 – NARROWBODY AND WIDEBODY NET FLYAWAY COMPONENTS



5. AIRCRAFT CUSTOMIZATION MILESTONES

Figure 12 below illustrates the series of events that make up the customization milestones for narrowbody and widebody aircraft. After the first customer meeting, the vendor selection stage sets forth the definition by the buyer of all selected cabin BFE vendors (i.e. seats, IFE, galleys, etc.). Following the equipment selection stage, arrangements will be made to have each BFE supplier, aircraft manufacturer, and buyer, meet to freeze the BFE requirements and prepare the definition of the aircraft Layout of Passenger Accomodation (LOPA). The last stage - Contractual Definition Freeze (CDF) stage - is the major contractual milestone when the aircraft specification is scheduled to be frozen. Key pre-requisite to achieving CDF is a complete aircraft cabin definition.

FIGURE 12 – CUSTOMIZATION MILESTONES



6. THE FUTURE OF AIRCRAFT CUSTOMIZATION

Over the past decade, there has been increasing pressure from airlines to reduce the cost of purchasing aircraft by shrinking the number of options offered. Options add to the cost of new aircraft not simply because of the manufacturing inefficiencies and costs to which they give rise, but also because many product offerings have long lead-times which inhibit the aircraft manufacture's ability to boost production rates. This is particularly true for much of the BFE equipment.

Financiers, and in particular lessors, are also seeking to minimize the proliferation of options as a means to reduce the cost and time constraints of retrofitting their aircraft when returned off lease. Critically, limiting the number of options also enhances aircraft resale value, which is significant to aircraft financiers.

To help slash production costs and enhance investor appeal, manufacturers have embarked on a drive towards a standard airplane philosophy – see Figure 13. Under a standard airplane philosophy, pre-qualified selections are available from a wide variety of industry-leading suppliers covering a wide range of equipment. Airlines are thus allowed the flexibility to customize the parts of the airplane needed to differentiate individual brands, but with as much of the airplane standard as possible. Features that were once optional, such as satellite communications, large cargo doors, dual head up displays, and IFE, have become standard under this new philosophy.

FIGURE 13 – STANDARD AIRPLANE PHILOSOPHY

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The key criterions of the Standard Airplane Philosophy are:

- Easy to Configure - The airplane must be easy to configure by ensuring that most popular, pre-qualified selectable features are standard.

- Easy to Re-configuration - The airplane must be easy to upgrade, update, and reconfigure. Design features such as adaptable provisions, common attachments, and multifunction parts make reconfiguring and upgrading the cabin interior easier and less expensive.

- Easy to Transition - The airplane must be easy to transition between fleets. Easy reconfiguration and reduced BFE options make transitions easier and increases residual values.

- Easy to Finance – Standardizing aircraft is an element in creating greater market opportunities and reduces the volatility of the value of the aircraft used as collateral for financing.

Aircraft Standardization Perspective – Boeing 787

Airframers are putting greater emphasis on reducing optional equipment by converting multi-source BFE equipment into single-source SFE. As illustrated below, Boeing's aims to reduce the number of equipment options on the 787 by allowing airlines to choose among a few suppliers whose products then become part of the standard aircraft package. The airframer is offering six economy seat suppliers versus sixteen on the 777 aircraft. In total, Boeing is projecting in using about 140 BFE suppliers versus over 600 for the 777 aircraft. The airlines like this concept because it offers them a choice of optional equipment without requiring them to make independent contract arrangements with suppliers.

For lessors and financiers a major challenge has been dealing with the high number of equipment options available, and correspondingly the high cost to replace and upgrade each of these equipment packages as aircraft transfer from one operator to another. Standardized aircraft offering flexible design solutions are easier to lease out, and tend to have a higher resale value. On the 787, Boeing significantly mitigated this exposure by offering significantly fewer choices relative to previous production widebody aircraft.

	Previous Aircraft				787	
Feature	Standard	Option	Interior selections	Buyer furnished	Standard	Option
Increased baseline takeoff weight capability		●			●	
SATCOM		●		●	●	
VHF and HF radios				●	●	
Dual head-up displays		●		●	●	
Dual EFB					●	
Quick Access Recorder (QAR)		●		●	●	
330 minute ETOPS type design		●			●	
Emergency and overwater equipment		●		●	●	
Foreign certification		●			●	
Standard seat tracks with standard power connections		●			●	
Plug and play IFE distribution system		●			●	
Large aft cargo door		●			●	
Provisions for overhead crew rest installation		●			●	
Galley shells and inserts			●	●		●
Premium and handicap-accessible lavatories			●			●
Overhead flight and cabin crew rests		●				●
Additional crew and passenger oxygen		●				●

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6.1 AIRCRAFT MANUFACTURER – EXAMPLE STANDARDIZATION INITIATIVES

Recognizing the aircraft industry is under huge market pressure on aircraft pricing and cost control, both Boeing and Airbus have revamped the process to facilitate the customization of choices in the cabin, and the way those choices are made and procured. Boeing aims to cut the lead time required for 787 customers to define their cabin specifications with help from its "Dreamliner Gallery", while Airbus intends to do the same by pre-certificating and logistically managing all cabin options under their new "Airbus Contract Supplier (ACS)" program.

Boeing's Dreamliner Gallery – In December 2006, Boeing opened a completely new type of facility at its plant in Everett, Washington, intended to provide 787 customers with an environment where they could make all their interior configuration decisions. The manufacturer said the idea of its so-called 'Dreamliner Gallery' (Figure 14) is to trim lead times for 787 interior configurations to six months.

FIGURE 14 – BOEING DREAMLINER GALLERY

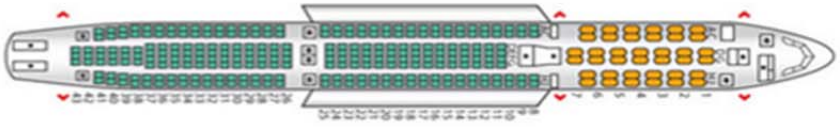
The Dreamliner Gallery covers an area of 54,000 square feet and presents customers with options covering seating, galleys, in-flight entertainment (IFE), emergency equipment, fabrics and other items. Here customers can make all major supplier decisions in one place, secure in the knowledge that everything on offer has been pre-certificated and will not cause problems in integration. Previously, carriers had to visit suppliers around the world to view and compare seats, galleys and other cabin-interior elements before they could define a configuration.

Airbus Contract Supplier Approach - Airbus has revamped its cabin supplier scheme for the A350 XWB along the lines of the way a powerplant choice is offered; customers will be able to choose from a catalogue of suppliers that are contracted with Airbus to meet certain technical and performance specifications, and then negotiate the price directly with the supplier.

The result is a new category of cabin supply line, which will substantially trim lead times compared with previous, more cumbersome, interior selection processes, while ensuring improved systems integration and offering better reliability from the start of service. Airbus said the A350 XWB interior selection system will offer a lead time of eight months – about 30 percent shorter than the current A330/340 widebody family. The manufacturer added that it will still agree to install BFE seats in its premium-class cabins to maintain the customer's ability to customize its product.

APPENDIX A – EXAMPLE CABIN EQUIPMENT FURNISHING COSTS

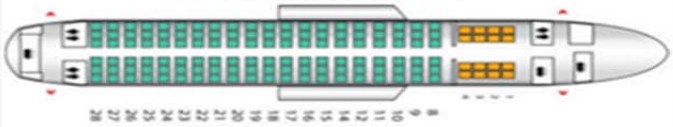
A330-300 Cabin Equipment/Furnishing Costs



Galley Shells (6 each) + Inserts + Carts	: $1.30M - $1.50M
Lavatories (8 each)	: $1.70M - $2.00M
Full Height Outboard Partitions (2 each)	: $38K - $44K
Closets	
• Outboard Full Height (1 each)	: $50K - $60K
• Centerline Full Height (1 each)	: $80K - $90K
Seats	
Premium Class Seats (38 each)	: $950K - $1.7M
Economy Class Seats (262 each)	: $780K - $1.0M
In-Flight Entertainment System	: $2.4M - $2.8M
Grand Total	**: $7.3M - $9.2M**

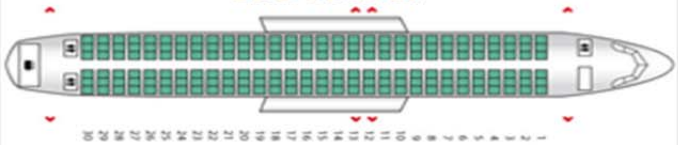
A320-200 Cabin Equipment/Furnishing Costs

Mainline Carrier



Galley Shells (3 each) + Inserts + Carts	: $250K - $300K
Lavatories (3 each)	: $700K - $750K
Full Height Outboard Partitions (2 each)	: $25K - $30K
Seats	
Premium Class Seats (16 each)	: $200K - $240K
Economy Class Seats (120 each)	: $350K - $400K
In-Flight Entertainment System	: $1.0M - $1.2M
Grand Total	**: $2.5M - $2.9M**

LCC Carrier



Galley Shells (2 each) + Inserts + Carts	: $150K - $200K
Lavatories (3 each)	: $700K - $750K
Economy Class Seats (180 each)	: $550K - $580K
Grand Total	**: $1.4M - $1.5M**

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About the author:

Shannon Ackert is currently Senior Vice President of Commercial Operations at Jackson Square Aviation where he has responsibility of the firm's commercial activities including technical services, contract development & negotiation, and asset selection & valuation. Prior to joining Jackson Square, Shannon spent over ten years working in the aircraft leasing industry where he presided over technical asset management roles as well as identifying and quantifying the expected risk and return of aircraft investments. Shannon started his career in aviation as a flight test engineer for McDonnell Douglas working on the MD-87/88 certification programs, and later worked for United Airlines as systems engineer in the airlines 757/767 engineering organization. He has published numerous industry reports dealing with aircraft maintenance economics and market analysis, and is a frequent guest speaker at aviation conferences. Shannon received his B.S. in Aeronautical Engineering from Embry-Riddle Aeronautical University and MBA from the University of San Francisco.