

History of aircrafts and innovations

Design Research Seminar

MVDSPL 24

By

Jinesh P Bhaskaran

146390001

Guide: Prof. Ramachandran Kadiru



Industrial Design Centre
Indian Institute of Technology
Bombay 2016

Declaration

The content in this project report is original work and cited and acknowledged where reference is taken. The thoughts expressed herein remain the responsibility of the author undersigned and have no bearing on or does not represent those of IDC, IIT Bombay

Jinesh P Bhaskaran
146390001
2014-16 Batch
IDC, IIT Bombay

Approval

Design Research Seminar

History of Aircrafts and Innovations in Aircrafts

By. Jinesh P Bhaskaran

M.Des Mobility & Vehicle Design 2014-2016

Is approved as a partial fulfillment of requirements of a post graduate
Degree in Mobility & Vehicle Design at IDC, IIT Bombay

Project guide

Acknowledgement

I would like to sincerely thank Prof. Ramachandran Kadiru for guiding me on this special project and giving me creative and output freedom. I would also like to thank my classmates for their support and suggestions on this project.

Jinesh P Bhaskaran

Contents

1. Innovations in cargo movement
2. Boeing Clipper & C5 Galaxy
3. Antenov 124/ Myria
4. History of all Airbus models
 - 4.1 First Flight Simulator & Airbus A300B2
 - 4.2 A310
 - 4.3 Fly by Wire System
 - 4.4 Beluga Super transporter
 - 4.5 A318
 - 4.6 A330/340
 - 4.7 A380
5. Cabin innovations

Innovations in cargo movement

World War I



The biplanes which can carry upto 5 tonnes

sikorski, russian who designed single engines biplanes. He later added four engines on the wings to carry more weight. During world war I. First time wars were fought both on land and air. Planed need to carry heavy bombs from one place to another for russian air force. Merely after 10 years since the invention of first aircraft.

Biplane wings created a lot of drag so he combined the wings of biplanes to create an airofoil shape which reduced drag.

Introduction

The Wright brothers invented and flew the first airplane in 1903, recognized as "the first sustained and controlled heavier-than-air powered flight. Between 1867 and 1896, the German pioneer of human aviation

The Douglas Aircraft Company was an American aerospace manufacturer based in Southern California. It was founded in 1921 by Donald Wills Douglas, Sr. and later merged with McDonnell Aircraft in 1967 to form McDonnell Douglas. Douglas Aircraft Company largely operated as a division of McDonnell Douglas (MD) after the merger. MD later merged with Boeing in 1997

Airplane and boeing History

1903- First flight

1916- First Boeing airplane

1921- First Douglas airplane

1923- World cruiser- first around the world flight

1929- first McDonnell Airplane

1933- model 247 – first modern airliner

 Dc-2 set 19 American speed and distance records

1935- DC-3

1938- stratoliner, first airline with a pressurized cabin



model 247



First Boeing airplane



Strato liner



Douglass world cruiser



DC 3

1942- DC-4 First us presidential airliner

1947- Stratocruiser, luxurious wide cabin, double decks, circular stairway

1953- DC-7 first airlines to cross US nonstop

1954- Dash 80- prototype of the boeing 707

1957- 707 First Boeing commercial jetliner

1958- DC-8, First Douglas commercial jetliner

1963- 727, first with fully powered flight controls

1965- DC9, Designed for short runways and short to medium routes

1967- 737, Best selling jetliner in history



Strato cruiser



DC 4



Boeing 707



DC 7



DC 9



DC 8



727

1969- 747 First jumbo jet

1970- DC10 First to meet FAA stage 3 sound regulations

1981- 767 First two person flight deck on a widebody airplane

1982- 757 Most fuel efficient jetliner of its time

1988- 747-400,. Worlds fastest sub-sonic jetliner

1993- MD-90, Largest, most powerful rear mounted jetliner engines

1994- 777, first jetliner to be 100 percent computer-designed

1997- 737NG, flies faster, higher and farther than the previous 737s

1998- 717, Exceeded designed target of 99.1 Percent dispatch reliability

2008- 787

777x Biggest airplane from Boeing yet.



747



DC 10



777



MD 90



757



767

Boeing Clipper & C5 Galaxy



C5 Galaxy

These planes are used to carry mail between London and Berlin. Junkers used the space inside the wings for accommodating one seat

The new design could carry 6 tonnes.(G38).

by the time of second world war, there was a need of plane that could fly trans Atlantic. Pan-am raised a challenge to design an aircraft that could carry 40 tonnes of cargo, 70 passengers and fly across Atlantic ocean.

Boeing came up with a concept called Boeing clipper, which is an amphibian plane that could fly trans Atlantic and take off only from water. A modified version of clipper later introduced as ME 321, which is a 40 tonner cargo plane.

The plane was so heavy that two small planes assisted ME321 for takeoff and once it is landed in enemy territory it is impossible to take off again and they used to destroy the plane after landing.

The next generation came with a proper landing gear in 1941. which could land and take off with the 40 tonne cargo.

These pilots may not be able to land in battle fronts, so the next possible solutions was to airdrop cargo. For airdropping the shell of the aircraft should be stronger than conventional aircrafts.

C5 galaxy was the first plane to come up with reinforced fuselage and airdropping capabilities

Antenov 124/ Myria

cargo capacity also was significantly improved upto 349 tonnes.

Then came the antenov 124 also known as Myria, One of the biggest cargo planes on the planet.

Antenov was later modified to carry overhead cargo. total 6 engines and a split rudder.



History of all Airbus models

In mid 90s when American aircraft companies dominated the industry, European countries decided to work together to compete against Boeing.

Concord was the first supersonic plane but it was a failure because of reliability issues. Only air France bought some of the planes. During 1969 Paris air show Airbus launched A300B-first twin engine wide body jet. Parts were made at locations across Europe and final assembly was done in France. The parts were transported via road. The general electric engines on these planes were powerful and fuel efficient.

by 1972 airbus A300B started getting orders and the company needed better ways to transport parts. So they bought a Strato cruiser from Boeing, known as super guppies from their shape. These planes could transport large components across the manufacturing plants in Europe. These planes improved the production capability of airbus plant. Airbus soon bought two more to satisfy the demand from the industry.



Strato Cruiser

First Flight Simulator & Airbus A300B2

In 1972 Airbus built its first aircraft simulator, which reduced the time for testing and pilot training. The also developed new composites to save the weight. An improved version A300B2 and A300B4 were introduced later, which had more range and technologies like

Composite fin

Advanced Aerofoil

Auto throttle

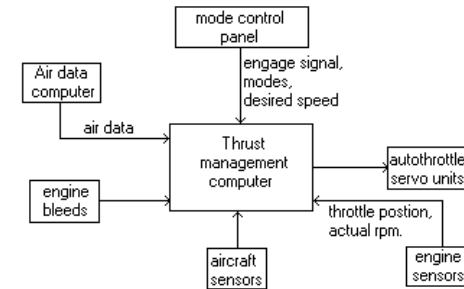
Automatic windshield protection etc

In 1973 Airbus expanded its production line.

by 1974 first A300B2 was delivered. In 1973 global fuel crisis hit all the airline companies, so they started looking at fuel efficiency and emission. American aircraft manufacturers were doing good at that time.

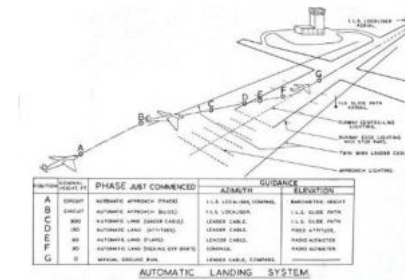


A300 B2



Auto throttle

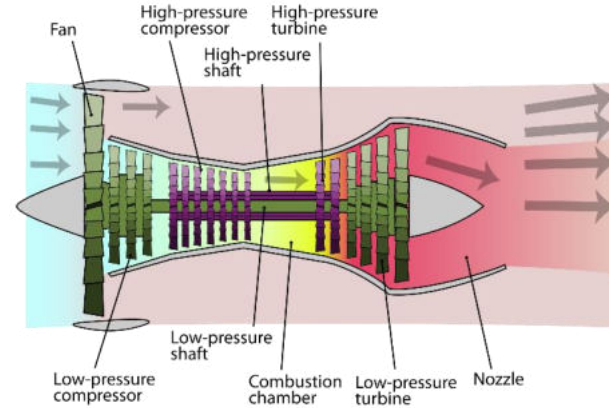
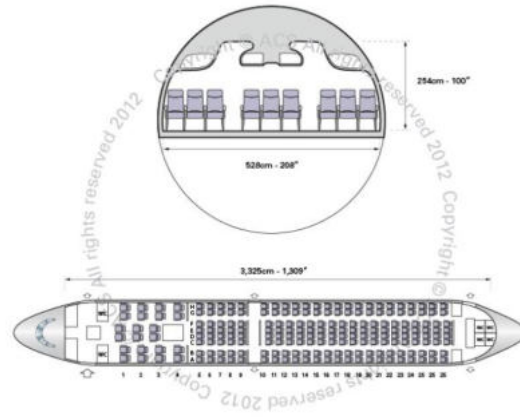
A310



By 1097 the sales of the older model was completely stopped. major shakeup was happened in late 70s in the airline industry. Airbus introduced Auto landing system in poor visibility situations. Airbus was designing a new aircraft called A310, which was the successor of older A300. A310 was more technologically advanced than the previous models. It was the first twin aisle plane that can be piloted by two pilot crew avoiding the need of flight engineer. All the analogue dials were give way to CRT monitors. In 1981 Airbus delivered the first A310-200

In aviation, auto land describes a system that fully automates the landing procedure of an aircraft's flight, with the flight crew supervising the process. Such systems enable aircraft to land in weather conditions that would otherwise be dangerous or impossible to operate in.

Innovations-A310



Only 6 computers needed to run Autopilot, Auto thrust and flight director compared to the 18 computers in A300B2 & B4. A310 were twin engine, single aisle, wide body and was the first aircraft to completely designed in computer.

It used composites on main frame.

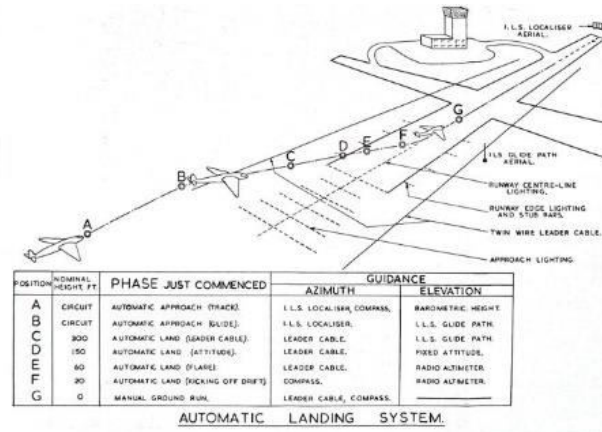
First to feature Fly by wire

Turbofan engine

1987 A310 made its maiden flight

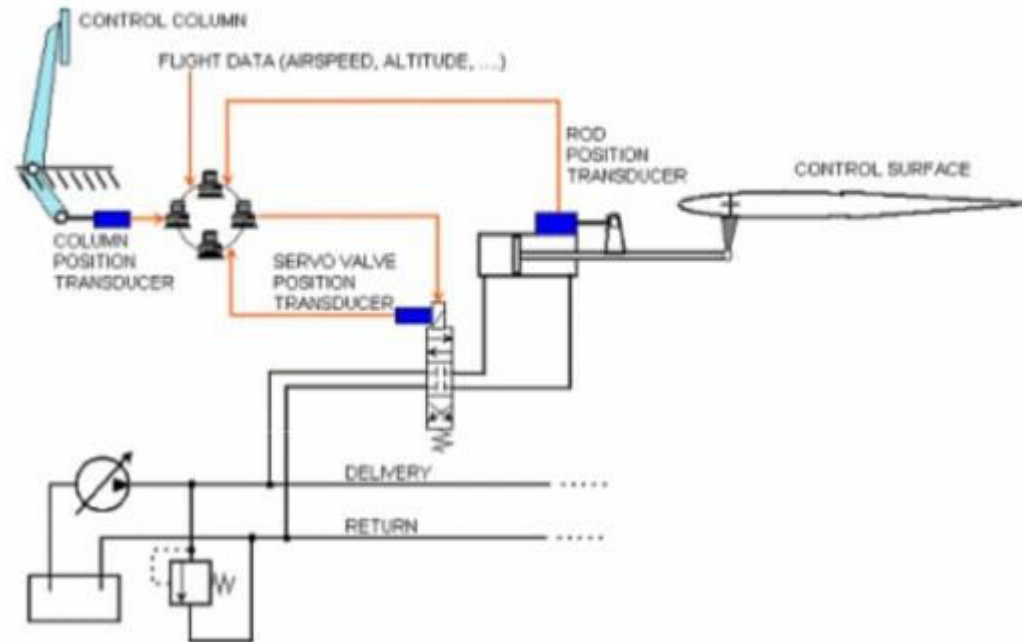
It got a whopping 600 orders before certification. It had one of the most elaborate testing of that time included stress and behavioural pattern for the crew. They still continued to use the Beluga super transporter.

Traditional controllers were replaced by joysticks.



Fly by Wire System

Fly-by-wire system



The Fly by wire technology run on 5 computers. There were two sets of computer from two different manufactures, which ensured that even there are some bugs it won't affect the operation of the system.

It also featured large overhead storage and 4500 range with 185 passengers.

Airbus also introduced A319, a smaller version

Beluga Super transporter

In 1991 Airbus designed A300-600 super transporters to help increasing orders. These have twice the payload of super guppies



The Airbus A300-600ST (Super Transporter) or Beluga, is a version of the standard A300-600 wide-body airliner modified to carry aircraft parts and oversized cargo. It received the official name of Super Transporter early on; however, the name Beluga, a large whale, gained popularity and has since been officially adopted



Sharing of body parts in the construction of Super transporter

A318

Airbus later introduced a smaller aircraft A318 which can carry 107 passengers. the main specialities are steeper approach angle and ultra low noise. these aircrafts are ideal for downtown airports.

A330/340

They used same fuselage and added more engines up to 4. More computerisation happened both inside the plane and manufacturing technologies. Modular approach was introduced in manufacturing. Components can be manufactured at different locations and assembled in one plant.

Super guppies could handle inland cargo movement. Airbus bought Soviet built Antenov for intercontinental cargo movement.

A330 was the first quad engine long range plane in 25 years.

in April 1991 first A340 came out. To demonstrate the capability of the plane they flew the plane from Paris-new Zealand non-stop. and came back after a refill. A total of 19,000 km. It took less than 48 hours.



© AIRBUS S.A.S. 2010 - COMPUTER RENDERING BY FOXON - GENEVE

A380

double-deck, wide-body, four-engine jet airliner

It was Airbus's latest addition in 21st century, The A380. It could carry 555 passengers, 35% more than its rival the Boeing 747. It provided more open space. The full double decker configuration needed many of the airport equipment to be redesigned. New terminal built in many major airports in Britain.

A380 had lower fuel consumption lead to less cost per seat. resulted in lower airfare and air travel for all.

15000km range

79m wingspan

24.1m Height

It also user 25% composites and 22% carbon fibre. Windshields were made of clear fibre metal laminate.

Introduced many advancements like Heads Up display and interactive displays

It had brake to evacuate system which could select a particular runway exit while landing to ease taxiing and save time.

Enhanced central maintenance system

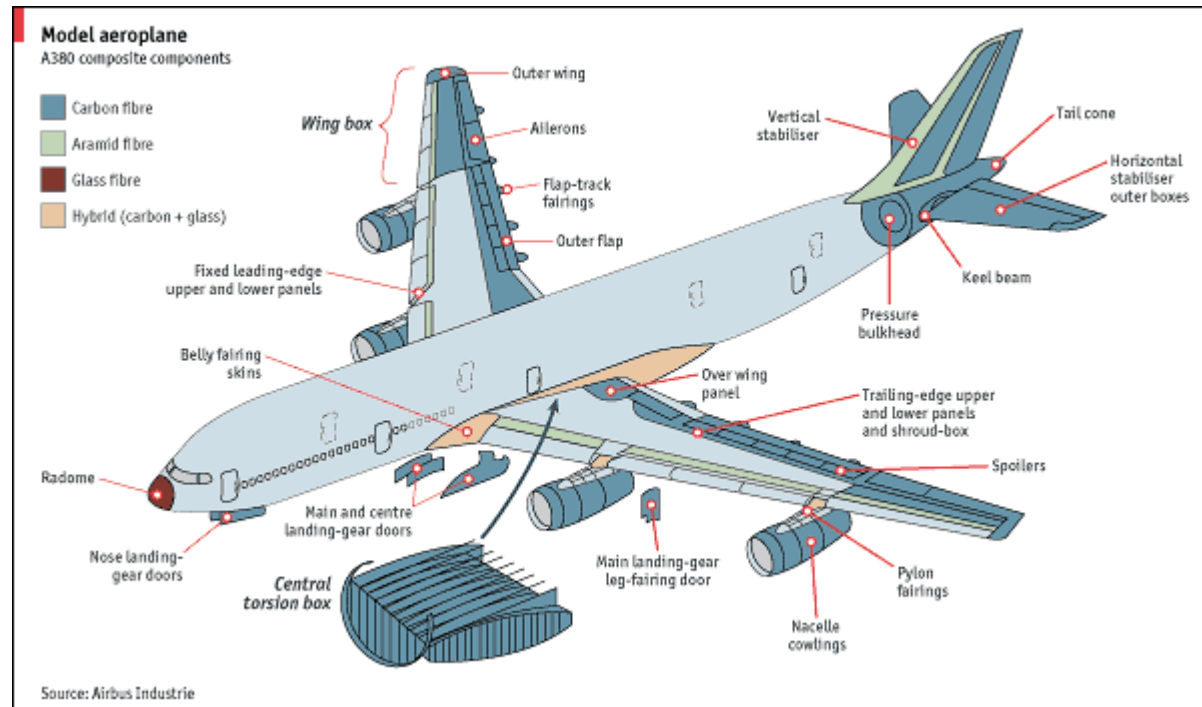
Airbus A380

The Airbus A380 is a double-deck, wide-body, four-engine jet airliner manufactured by the European aircraft company Airbus. It is the world's largest passenger airliner, and the airports at which it operates have upgraded facilities to accommodate it. It was initially named Airbus A3XX and designed to challenge Boeing's monopoly in the large-aircraft market. The A380 made its first flight on 27 April 2005 and entered commercial service in October 2007 with Singapore Airlines.

The A380's upper deck extends along the entire length of the fuselage, with a width equivalent to a wide-body aircraft. This gives the A380-800's cabin 550 square metres (5,920 sq ft) of usable floor space, 40% more than the next largest airliner, the Boeing 747-8, and provides seating for 525 people in a typical three-class configuration or up to 853 people in an all-economy class configuration. The A380-800 has a design range of 8,500 nautical miles (15,700 km), sufficient to fly nonstop from Dallas, USA to Sydney, Australia, and a cruising speed of Mach 0.85 (about 900 km/h, 560 mph or 490 kn at cruising altitude).



Use of composites



Cabin innovations

Family Seating

A method of improving aircraft seating efficiency is provided, including positioning a first plurality of seating rows within a first region of an aircraft interior. The first region comprises a first aircraft width and each of the first plurality of seating rows comprises a uniform first quantity of standard aircraft seats. The standard aircraft seats have a standard aircraft seat width. The method further includes locating a tapered region of said aircraft interior having a second aircraft width. The second aircraft width is sufficiently less than the first aircraft width such that the first quantity of standard aircraft seats cannot fit within the tapered region. The method includes positioning a second plurality of seating rows within the tapered region. Each of the second plurality of seating rows includes a second quantity of standard aircraft seats having the standard aircraft seat width. The second quantity of standard aircraft seats is aligned with the first quantity of standard aircraft seats to form a plurality of aircraft columns. The method includes positioning at least one reduced dimension youth aircraft seat within one of the second plurality of seating rows to increase a net aircraft passenger capacity.

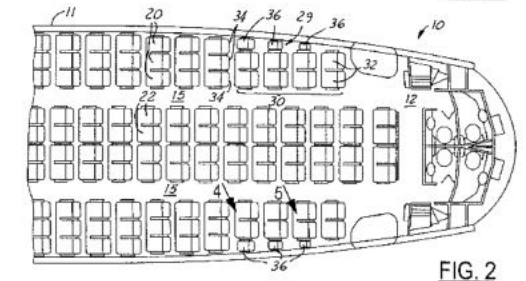
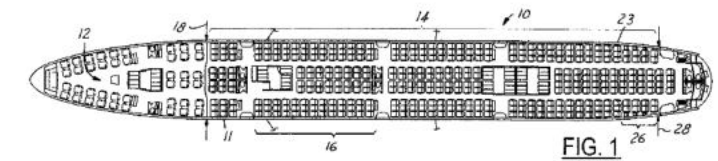
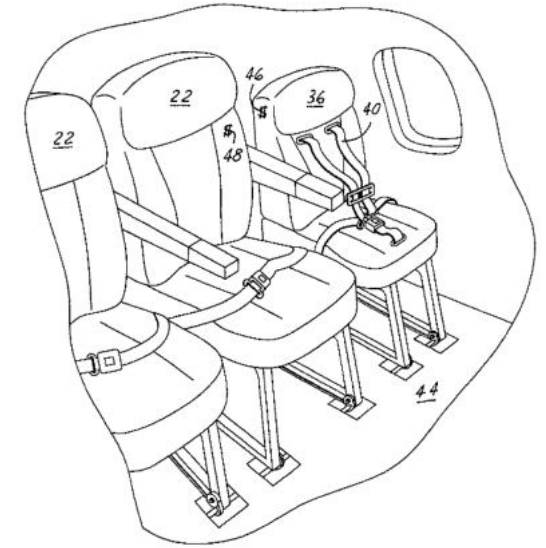
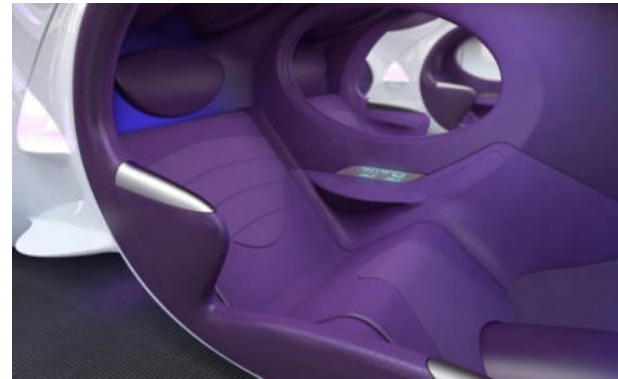
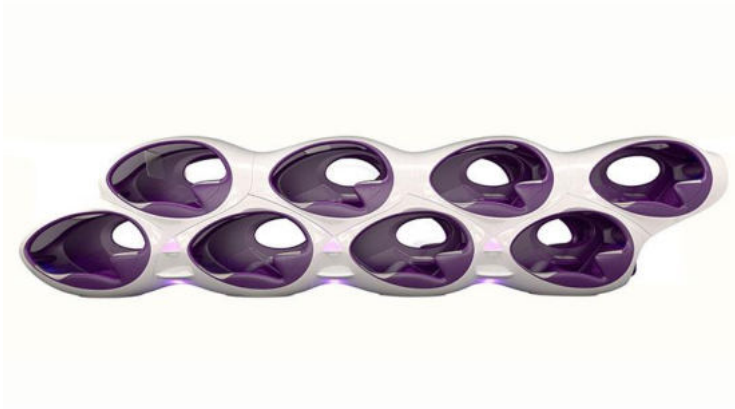


FIG. 2

Air Lair



Air Lair is a personal cocoon for the passenger with a double-decker configuration allowing for 30% more passengers within the same space.

Within this enclosed environment the passenger is able to control their own personal space without disturbing other passenger or, for that matter, being disturbed by other passengers.

Strategically placed lighting is used to set the mood, while an over-head projector provides the entertainment, and ergonomically designed lay-flat seat provides the comfort.

Morph

By Seymourpowell

Seymour Powell's concept provides an alternative to the standard economy seat, which ergonomically has been designed for everyone by averaging the sizes of the largest and smallest percentiles to a point where it fits relatively few people properly. Morph is still a standard product, but it can adapt to the changing needs of the passenger.

Morph uses smart architecture to adjust both the width of the seat, and individually control seat pan height and seat pan depth to suit varying sizes of passenger. This creates a scalable value offer for airlines, allowing them to arrange the economy cabin by people's willingness and ability to pay for space, blurring the boundaries between the classes.

The concept seat works by replacing traditional foam pads with a fabric that is stretched across the width of three seats, around a frame and over formers. One piece of fabric is used for the seat back and one is used for the seat base. The fabric is clamped down by the armrests and the upper dividers to form three individual hammock seats.

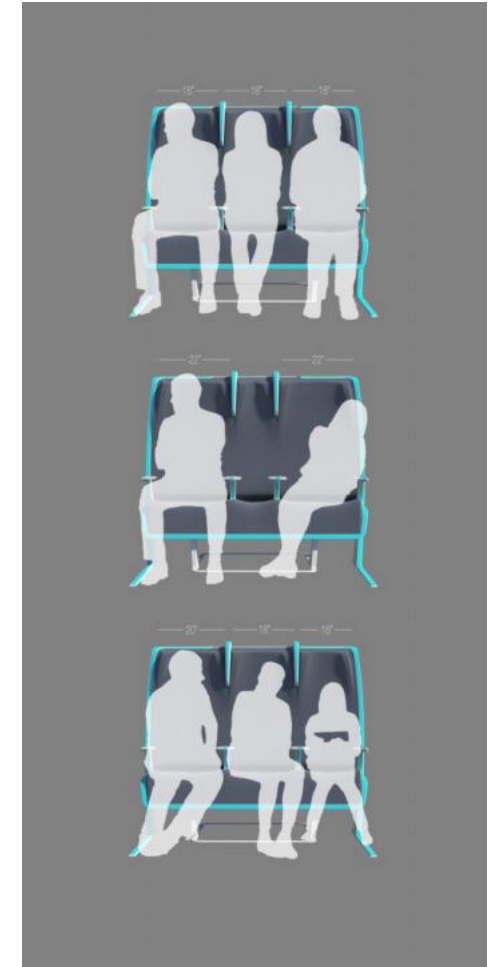
By moving the formers and pushing them through the fabric we can control the recline and a large range of ergonomic adjustments, morphing the fabric to provide a tailored fit and greater comfort.



As the recline happens within the soft furnishings, the solid seat back does not move. The semantics of the architecture and visual cues indicate that the back of the seat belongs to the passenger facing it. Passengers can extend the width of their armrests over their own lap, increasing that feeling of independence and control over their own space.

As just one sheet of fabric is used across three seats, the dividers can be moved laterally and then clamped down in a different position and so adjusting the width of each individual seat. Families travelling together can tailor their seats according to size, for example a Mum and Dad with an infant could pre-book a large, medium and a small space.

The mechanism and formers move too, so the comfort, recline and adjustability are all maintained. A properly fitted seat is not only more comfortable, but safer and it reduces health risks.



HD13

Zodiac



The project offers a solution to the issue of increasing the number of passengers in the cabin of a single-aisle airliner by increasing the space between seats by 15%, giving each passenger four more inches of available leg room. HD 31 stands for High Density at 31-inch spacing. The now-patented HD31 concept was presented at the Aircraft Interiors Expo in April 2014. Earlier that year, Zodiac Seats had presented the now-available L3 concept, the most lightweight seat on the market.

Standing Chairs

Spring airlines

China's first budget airline is poised to lobby industry regulators for permission to install standing-only 'seats' on its planes so it can cram more people on board. Shanghai-based Spring Airlines said it would offer cheaper fares to those who are willing to stand at a vertical seat, according to China National Radio. It's not the first time the idea has been floated – Dublin-based Ryanair famously proposed selling standing-only tickets in 2009 to increase passenger traffic and cut costs.

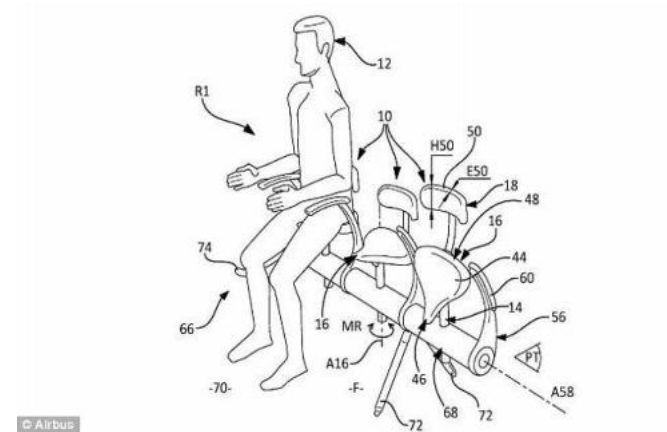
Spring Airlines plans to work with manufacturers on a design that would include a safety belt.

The low-cost carrier, founded in 2004, offers flights as cheap as £1 (\$1.50) and flies to destinations in China, Japan, Thailand and other Asian countries.

Even though designs have been proposed and no-frills airlines have expressed interest, the vertical seat concept has not taken off because it hasn't received approval from authorities.

Ryanair abandoned its proposal in 2012 after it was thwarted by an unnamed regulator.

The Irish carrier planned to install ten rows of vertical seats on its planes – increasing capacity by about 40 passengers – and charge less than £5 to travellers who were willing to stand.



Seats with VR Entertainment

Airbus

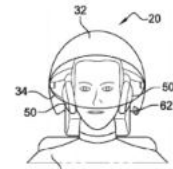
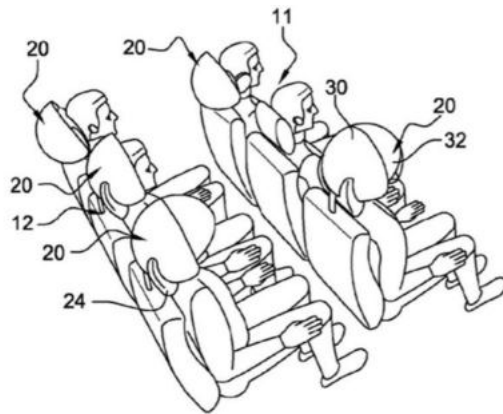


Fig. 5



Fig. 6

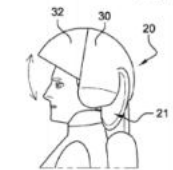


Fig. 7

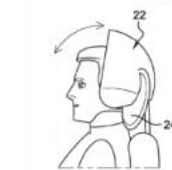


Fig. 8

Flying can be boring or stressful, which is why airlines provide music, movies and bad TV. The next step appears to be thoroughly immersing passengers in what they're watching. "The helmet in which the passenger houses his/her head offers him/her sensorial isolation with regard to the external environment," reads the patent filing.

The helmets feature headphones to provide music. You can watch movies (perhaps in 3D) on the "opto-electronic" screen or possibly through "image diffusion glasses." If you want to get some work done, turn on the virtual keyboard, which appears on your tray, don a pair of motion capture gloves, and type away. The helmet could even pipe in different odors for an olfactory treat, and the whole thing would be nicely ventilated.

CozySuite

thompsonaero



The unique Cozy Suite offers increased seat and shoulder width, individual armrests, a dedicated sleeping position and improved aisle access.

Increased seat and shoulder width

Individual armrests

Dedicated sleeping area

Fixed back shell

Improved egress

Bibiliography

<http://www.thompсонаero.com/cozysuite>

<http://blog.seymourpowell.com/2013/11/seymourpowell-designs-morph-a-concept-economy-seat-for-airline-travel/>

<http://factorydesign.co.uk/projects/air-lair/>

<http://www.paperclipdesign.hk/butterfly.html>

<http://www.outsideonline.com/1929946/7-airline-innovations-will-change-way-we-fly>

www.Wikipedia.org