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How do planes work?

Interview with TATA Steel Employees

Coke to Coke Project 2014
Henk Gotlieb, Piet Gotlieb,
Robin Wacanno and Wilco Stam
Ir S. Ramgolam

Preface

The magazine you are about to read was written for the Coke to Coke project which is organized by Jet-Net and our school. The purpose of this project is to interest students to pick a scientific study. With school we've visited TATA Steel in Ijmuiden where we got a tour around some important parts of the steel production. We also interviewed some TATA Steel employees there.

The main subject of our magazine is aeroplanes. Thus this magazine will give you some essential information about aeroplanes and how they function. Our writers and editors have visited Schiphol Airport on the 29th of April 2014 to get a better look at the aeroplanes and the Airport itself. Sadly The weather was not on our side and we weren't able to take pictures of aeroplanes outside.

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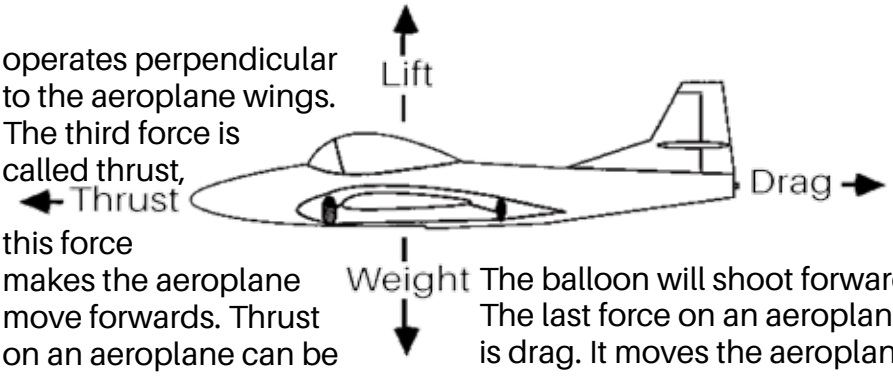
AIRPLANE PHYSICS

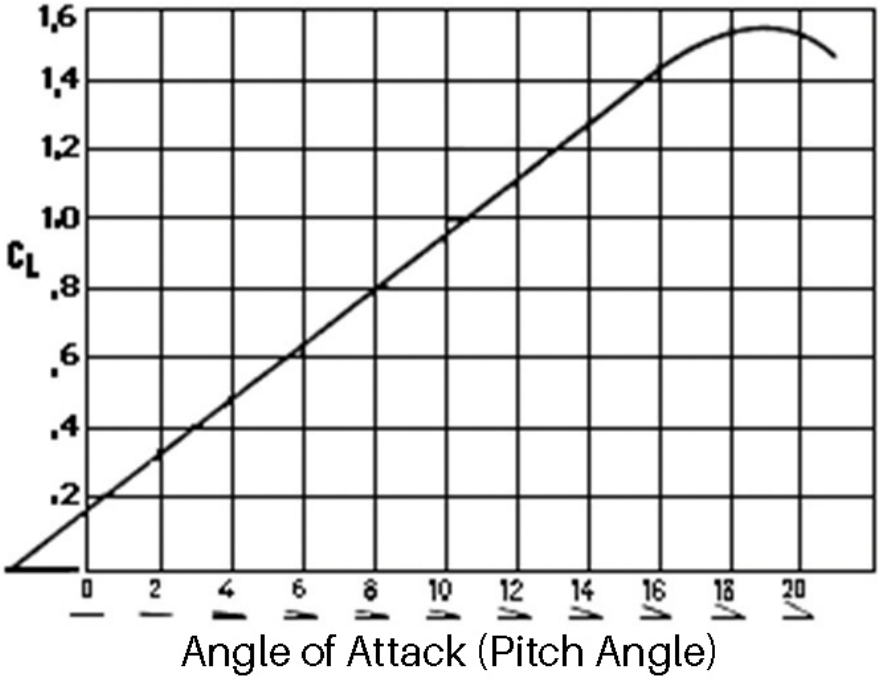
To explain how an aeroplane flies you should start by thinking of the forces. There are 4 forces on an aeroplane. The first one is applied to everything on earth, this one is called the weight force or gravity. This creates a downwards force. We can calculate the downwards force with the formula m * g. M being the mass and g being gravity which on earth is about 9.81. But of course an aeroplane moves up. For this we have a force called lift. Lift operates perpendicular to the aeroplane wings. The third force is called thrust,



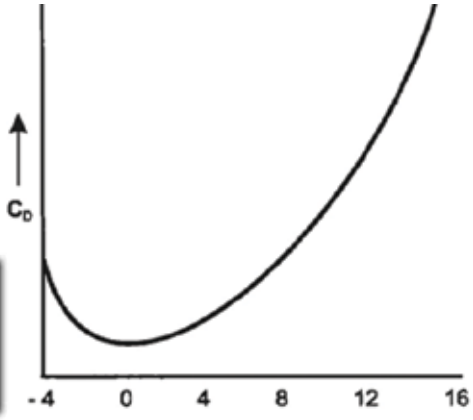
this force makes the aeroplane move forwards. Thrust on an aeroplane can be created by a propeller or a jet engine. The principal of such an engine is that it accelerates air out of the back and then follows newton's third law. This can be proven by a balloon filled with air an opening it. The balloon will shoot forward. The last force on an aeroplane is drag. It moves the aeroplane backwards. Drag is created mostly by air resistance. We can minimalize this drag by making the aeroplane aerodynamic. This means that it has smooth lines.

We can calculate the lift with the equation of magnitude of lift per unit wing area. This equation is L=0.5 * P * Cl * V squared. In this formula L is of course lift. P is the density of the air which creates the resistance. This resistance is normally 1.2754 kg/m cubed. Cl is the coefficient of the lift. This coefficient has to do with the wings and changes with the angle of attack. The angle of attack is the angle between the nose of the aeroplane and the horizontal line formed underneath the wings. This horizontal line is formed because even if an aeroplane is taking of it is still partially moving horizontally. As you increase the angle of attack the lift rises until a certain point. At this point the wings are almost vertically and create a surface of drag force. This point is called stall.

Graph of the coefficient of lift



There is a similar equation for the drag on an aeroplane. This equation is $D = 0.5 \times P \times C_D \times V^2$. This formula works the same accept for that Cd is the coefficient of drag. This also has to do with the angle of attack. As the angle of attack increases the coefficient of drag also increases. This is because as the aeroplane is pitching there is more wing area perpendicular to the flow.



Facts about aeroplanes

Air transportation is the safest form of travelling in the world.

A plane lands somewhere in the world every 3 seconds.

If the chance of daily disaster was only 0.01%, this would mean that 13 air-planes must crash. The odd of a plane crash are around 0.001%.

Donkeys kill more people annually than plane crashes.

A person is 10 times more likely to be killed by a car while standing at a crosswalk waiting for the green light.

Before each take-off, the plane goes through complex technical inspection.

Plane crashes are never a coincidence, but always a combination of highly unusual faults inside a plane's infrastructure.

More than 80% of the population human is afraid of flying. 5% completely abandons flying and takes alternative forms of travel. The scientific name of fear and flight altitude - aerophobia.

More people fall in love with flight attendants than representatives of other professions.

Source: http://owip.net/cool/191-12-interesting-facts-about-airplanes.html#.U2I9_Pl_vHU

Tata Steel Assignments

Chapter 1

Question 1: What are the main three raw materials used to make iron?

The main three raw materials used to make iron are, Iron ore, coal and limestone.

Question 2: Where do the raw materials come from and how are they transported to the plant?

Limestone comes from all over the world because it's found almost everywhere. It's transported by ship and truck. Coal comes from rests of plants which died during the Carboniferous period. Due to compression it became rock solid and there are coal mines now a days. Coal is transported by truck or mostly by ship. Coal is found mostly in China and the U.S.A. Iron comes from mines mostly from Australia, Asia and South America. It is mined in mines and transported by ship and truck as well.

Question 3: How and why are the raw materials processed before they are used in the blast furnace?

The raw materials are processed to remove most of the impurities. The process is called coking coal, the coking process consists of heating coking coal to around 1000-1100°C in the absence of oxygen to drive off the volatile compounds (pyrolysis). This process results in a hard porous material - coke. Coke is produced in a coke battery which is composed of many coke ovens stacked in rows into which coal is loaded.

Question 4: What role does each of these three raw materials play in the iron-making process?

Coal is used to burn everything. Of course the oxygen is used in this as well because you can't have fire without oxygen and of course iron ore is molten to make iron liquid which can be shaped.

Question 5: What can you say about the ecological effects of using these raw materials?

Transportation = a lot of pollution. Due to mining the amount of iron ore in the country of origin will become less until it will finally run out

Question 6: How can these side effects be reduced?

By following the environmental laws and implementing innovative technics. Also they make use of solar energy and put filters in the exhaustion tube.

Question 7: Why is scrap used?

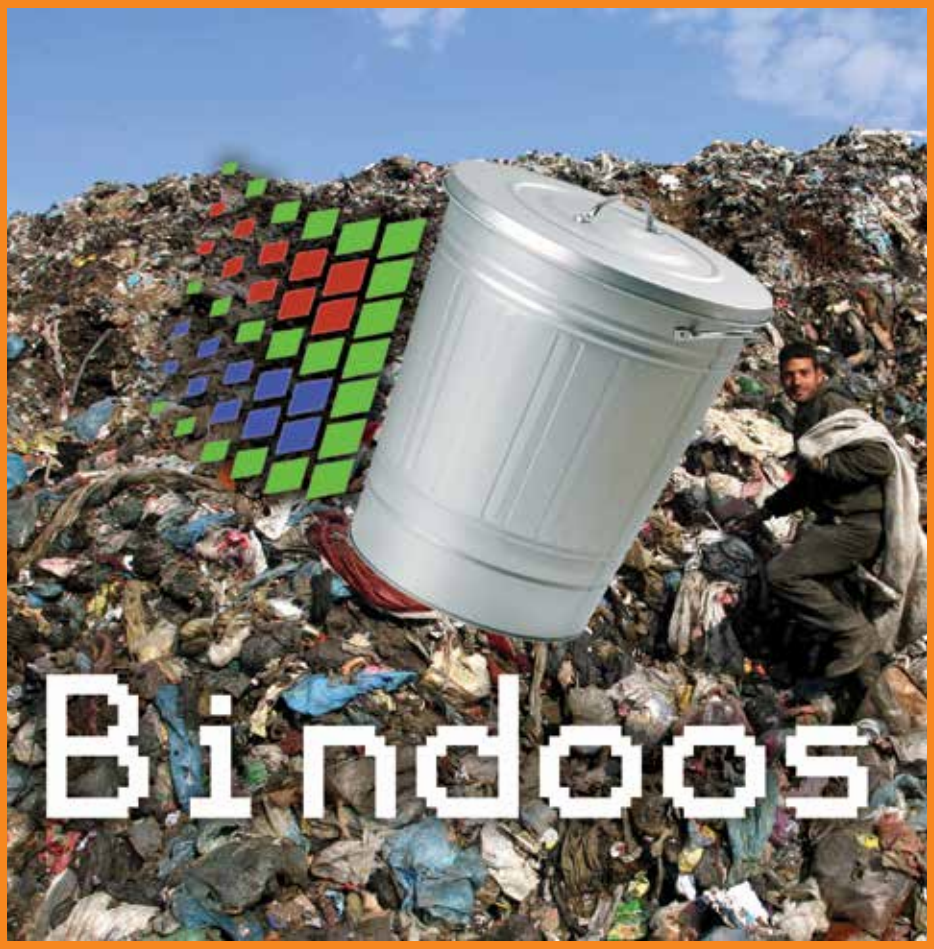
Scrap is cheaper and by recycling we don't run out of the resources earth gave us. By using this method you also automatically take out the unwanted toxics.

Question 8: what are the advantages and disadvantages of using scrap in the steel making process?

Advantages: by using scrap you can save up to 74 percent of the money and 86 percent of environmental damage. Also, the demand for processed scrap has risen dramatically.

Disadvantages: they need to use more energy and transporting it is more expensive.

Ads



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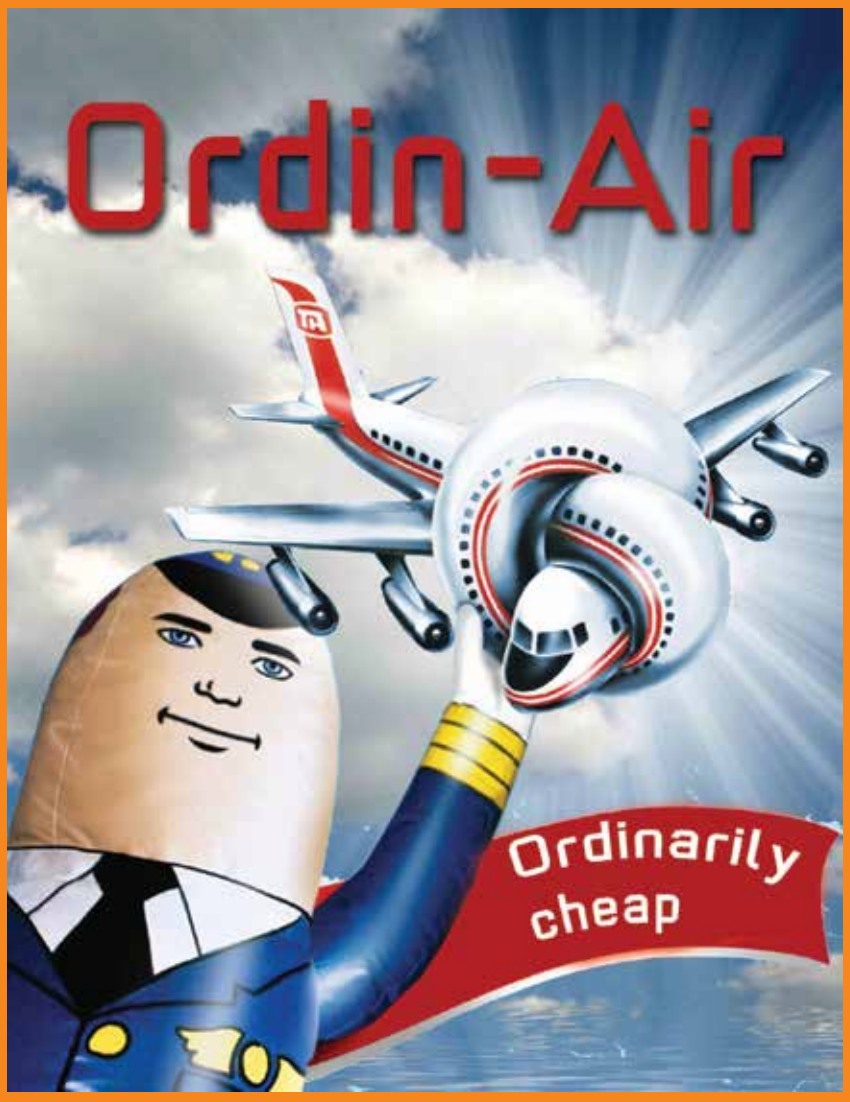
Actus Insurance

"Just in case"



Tata Steel Assignments

Chapter 2

Question 1: Calculate the mass of each element.

Fe = 94.9% of 100 = 94.9 kg

C = 4.55% of 100 =4.55 kg

Si = 0.25% of 100 =0.25 kg

Mn = 0.3% of 100 =0.3 kg

Question 2: How many kilograms of each element are oxidised of the 100 kg hot metal?

0.02x94.9 = 1.898 kg Fe

4.55-o.o5 = 4.5 kg C

0.3-0.1 = 0.2 kg Mn

Question 3: How many kilograms of steel are produced?

100-1.898-4.5-0.2 = 93.402 kg

Question 4: Calculate the amount of energy in megajoule that is generated during the process.

Fe = 4.3x1.898 = 8.1614 MJ

C = 11.7x4.5 = 52.65 MJ

Mn = 7.4x0.2 = 1.48 MJ

Total is 62.2914 MJ

Question 5: How much energy is used in natural gas a year per household?

32x2000 = 64000 MJ

Question 6: The energy produced from how many kg of hot metal is equivalent to the energy used in natural of one household?

62.2914:100=0.622914

64000:0.622914=102742.9148 kg

Question 7: If 45% of the heat generated by the C combustions will leave the process through the waste gasses what will be the temperature of the liquid steel?

The energy produced per 100kg hot metal for heating steel is 47.0739mJ.temperature increase is 732.3841degrees Celsius. So the steel temperature is 2082.4 degrees Celsius.

Question 8: If we want to melt 1 kg of scrap and heat it to 1650 degrees how much energy is required?

27100+1630x690=1.3957 MJ.

Question 9: How many kg of scrap can be melted with the 100 kg of hot metal making steel of 1650 degrees?

27.791436:1.3957=19.91218457 kg of scrap.

Question 10: How many kg of steel are produced?

113.0642 kg of steel.

Question 11: If we want to make 320 tons of this steel how many tons of hot metal scrap are required?

320:113.0642x93.251=263.64 tons of hot metal.

320:113.0642x19.91218457= 56.36 tons of scrap.

Question 12: How many cubic meters of steel is that?

320:7=45.71m^3

Question 13: Suppose a steel ladle has an internal diameter of 4 meters. What is the required height of the ladle if the steel surface must be 50 cm below the top of the ladle?

ladle surface is 12.57m^2.

ladle height is 4.14 metres.

Chapter 3

Question 1: How long does it take for the steel to pass the section?

6/0.1 = 60 seconds

Question 2: What is the minimum rising velocity for an inclusion entering at the bottom required to reach the surface within the section?

Minimum rising velocity is 1.3 cm/s

Question 3: For which particle sizes given in the table, all particles will reach the surface within the sector?

All the particles with a size bigger than 0.2 mm will reach the surface within this section.

Question 4: After how many meters is the strand completely solidified when casting a slab with a thickness of 225 mm at 1.5 m/min?

It takes 30.375 meter to solidify completely.

Question 5: How many tons of slabs are produced per minute (density of liquid steel is 7000 kg/m^3).

6.1425 ton/min produced

Question 6: How many tons a year can be produced when operating 90% of the year?

6.1425 x 60 x 24 x 365 x 0.9 =2.9

2.9 megaton of slabs produced per year.

Question 7: Why is casting so critical for the cleanliness of the steel?

The steel wouldn't be usable otherwise.

Question 8: Which inclusion is worse: an inclusion that keeps his form during rolling or a participle that is rolled out like steel?

A particle that keeps his form because it's more difficult to make a shape from it than a part that can be rolled.

Question 9: Describe the process steps from steel slab to tinned coil

First the steel slab is rolled out to a coil, this is then taken through a bath of tin and the excess of tin is blown off with air.

Question 10: What is the length of the hot rolled coil?

The slab is 10.8m long and 225mm thick and the final thickness is 2.5mm. The begin and end are cut off.

10.8x225:2.5x0.98=952.56 The hot rolled coil is 952.56m long.

Question 11: How long is the cold rolled coil?

The cold rolled coil is 0.22mm thick

952.56x2.5:0.22=10824.5m long.

Question 12: What is the maximum inclusion size that is allowed in the material?

Wall thickness is 0.22:3=0.07333mm

Maximum inclusion size allowed is 0.07333:3=0.02444mm.

Important events in aviaton history

One of the first jet planes

The Fokker Dr.1. This plane was used during WW I

In 1910 the concept of a plane propelled by jet engines was patented by Henri Coandă.

The 1st World War was the first war during which aeroplanes were used to fight the enemy. This also meant that the current design of the time was improved to be suitable for warfare.

1903 was a very important year in aviation history. For on the 17th of December of that year the Wright brothers had succeeded in creating and flying an engine powered aeroplane. Many inventors had attempted to fly a plane before them, they used: gliders, balloons and airships.

A picture of the Wright Flyer

After the 2nd World War commercial aviation became more popular. This meant that the transportation of both passengers and cargo would happen much faster compared to the conventional methods of transport at the time.

The DC-10 used to be a very popular aeroplane.

A Space Shuttle without the extra fuel tanks

In 1982 the U.S. began to use Space Shuttles to re-enter the atmosphere from space. This plane-like spaceship went up into space with three enormous fuel tanks/engines. These are detached when they run out of fuel.

1969 — **1982** — **2001** — **2014**

In 1969 the first test flight with the Concorde aircraft was performed.
The Concorde was one of the two supersonic planes to have ever been used as a commercial passenger aircraft. The Concorde has only crashed once this was on the 25th of July 2000.
On April the 10th 2003 the retirement of the Concorde was announced.

The Concorde Aeroplane with the iconic drooping nose.

The security on planes an in airports would change dramatically after the 11th of September 2001.
On this day a group of terrorists hijacked two planes and flew them into the Twin Towers.
Due to this event governments realized that the security on airports and aeroplanes was not strict enough.

The Twin Towers during the attack

Tata Steel Assignments

Chapter 4

Question 1: Describe the process steps in the making of a beverage can.

The modern method for making aluminium beverage cans is called two-piece drawing and wall ironing. First aluminium is rolled into a thin sheet. This sheet is cut into a circle which will form the bottom and the side of the can. The small ripples at the top of the metal are called "ears". This ears are ironed and shaped and then fit onto the can. The lid is made of a different kind of alloy then the base of the can. The centre of the lid is stretched upward slightly and drawn by a machine to form a rivet. The pull tab, a separate piece of metal, is inserted under the rivet and secured by it. A rivet is the shape of the opening of the can.

Question 2: How many coils of 10 tons can the plant process per year?

Per year it can process 100000 : 4 = 25000.

25000 x 24 x 365 = 219000000.

21900000 x 0.9 = 197100000.

197100000 : 10000 = 19710 coils of 10 tons.

Question 3: How many cans are produced per year?

Number of cans per hour times hours in a year and then times 90%

100000x24x365x0.9=788400000

Question 4: How many rejected cans per slab and per year are allowed?

788.4x2=1576.8

Question 5: How many square meters of storage is required to store a week's production?

A week's production is 100000x24x7x0.9=15120000

4000:12.5=320 cans per stack

15120000:320=47250 stacks

7.5x7.5=56.25 cm^2 per stack

47250x56.25=2657812.5 cm^2 = 26578.125 square meters of storage is needed for a week's production.

Question 6: How and where are cans recycled?

Cans are recycled by melting down the cans, aluminium slabs are made out of the molten aluminium and new cans are made from the aluminium slabs.

Question 7: What are the main differences between steel and aluminium cans from a recycling point of view?

Aluminium is lighter than steel, this means there are less transport costs.

Question 8: What happens after the separation process with the aluminium and the steel?

The whole cycle will start again for both. They will be processed into slabs again and made into can or other products.

There is a lot to tell about schiphol: shopping, air traffic, security, gates, check-in, arrivals etc. That is why it is quite the task to actually write about it. I decided to divide this article into different headings, so you could get to know the ins and outs of Schiphol as structured as possible.

Shopping - Schiphol is not just a place to take off and land just to get from one place to another. It can be for fun and exploring, having a good time with your family and friends and to be amazed by the overprized articles they sell because of the monopoly they have on it. Schiphol, with it's over 100 shops is like shopping mall. Also, they handle a unique system for you as a passenger to be able to bring things on your flight. The see, buy, fly system is something mainly known in Schiphol.

Departure - Schiphol has 3 terminals where you can check-in and go through passport control so you can fly off to your holiday destination. But behind that passport control it gets way more complicated. Which way do you go? Luckily there are signs everywhere telling you what is where, but it still can be pretty confusing with its total of 165 gates, and they are expanding all the time.

Arrivals - Arrival at Schiphol is pretty simple. You get of the aeroplane and you basically just follow the crowd. There are 14 luggage claim stations to choose from. After you got your bag, you go through security again and you are free to go and enjoy being home at last.

Charity - Schiphol, besides making money, has many different good goals. They are cooperating with Unicef and recently made an environmental friendly area in the European departure hall.

Aircrash Speculation: Malaysia Airlines

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Included on the disk:

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* A digital aeroplane encyclopedia
* A digital guid on "How to spot a potential terrorist"

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