Aircraft Stability and Control
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Lecture – 60
History of Aviation

So today we will discuss about important aircrafts from the technology and business stand point for our course. We are trying to do it in actually the pre -world war era where we started the aviation then we talk about the world war two era and then cold war and modern era this will be the mixture of both.

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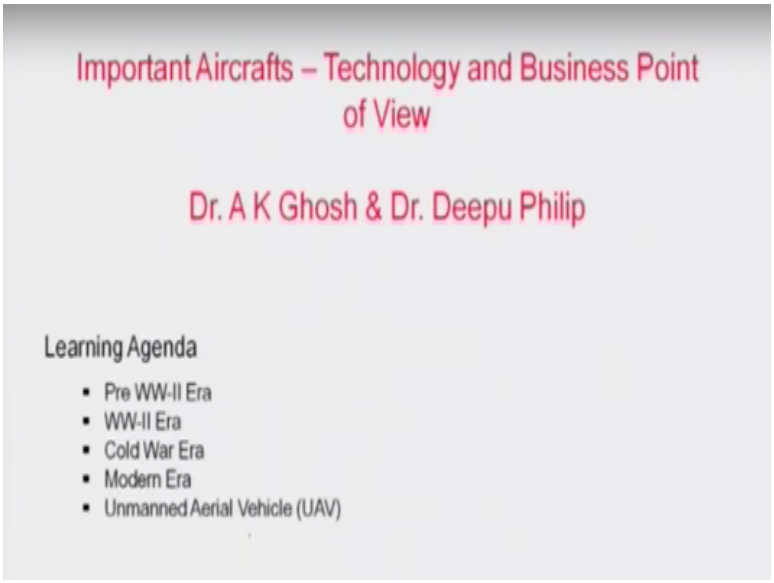

This will be the mixture of both commercial simple and as well as military aviation aircraft, and finally we will conclude the discussions with the help of unmanned aerial vehicles.

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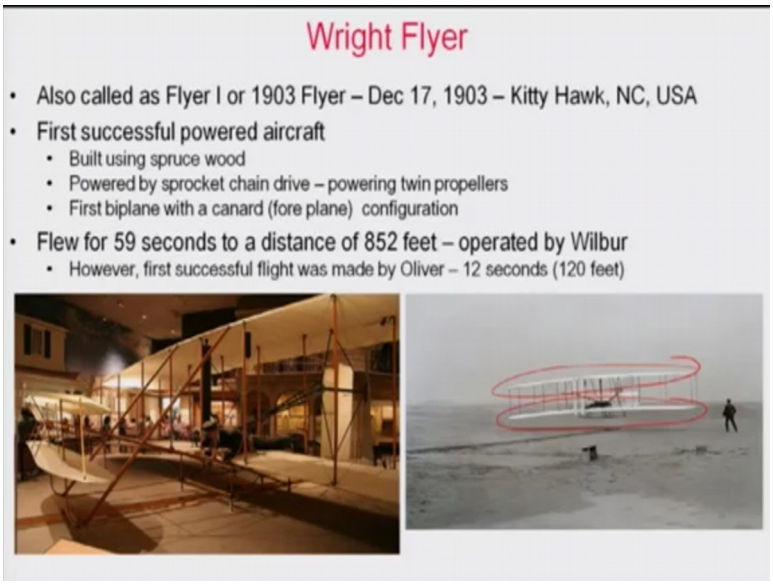

So we all know that, the importance of Wright Brothers in the development of air aviation industry. The one that you see here is the Wright flyer also known as the Flyer one the first aircraft that is actually to fly ok.It is happened in the north Korea in USA 1903, December 17 th. This was the aircraft that was built using wood and as well as chain and sprocket drive for running the propellers and as well as they growth to cover the aerofoil you can see that its actually a bi plane.

Bi plane means you have two aero foils connected highlighted by the red color. and the propeller in the back and you can see here that all over lying down and operating the propeller. And also see that this aircraft also has two four planes and canons in the front which is used for controlling the direction. That's why interesting story in this aircraft because both the Brothers, Wright brothers finally took a task who will fly that.

The toss was won by Oliver he flew for 12 seconds and then he crashed but it was very small air flight 120 feet and their wing was damaged and they repaired it. And Since, Oliver got the first chance and Wilbur do the second one he flew for 59 second to a distance of 852 feet that is recorded as first official flight of human begins.

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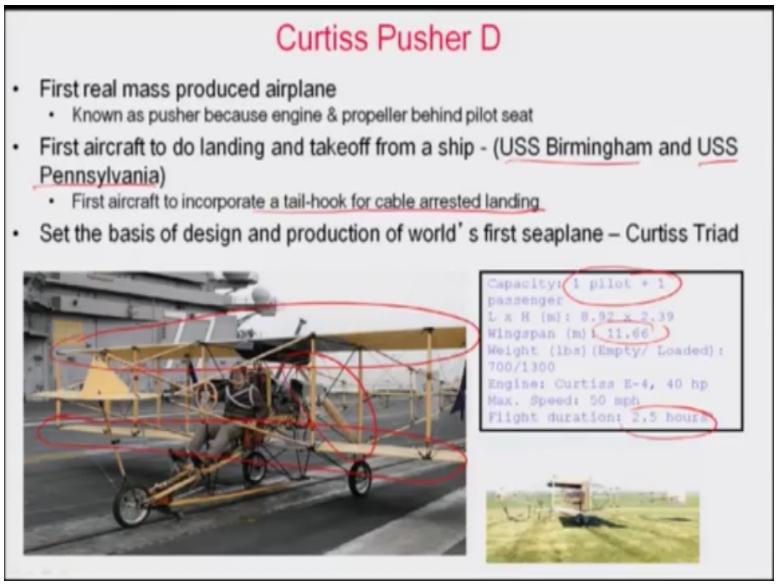

So next one we will talk about another important aircraft called as Curtiss Pusher D. Lot of the UAV that you have seen unmanned air vehicles which do not have any pilot on board that operates on pusher configuration and this is the also from the business stand point. This is where the mass production of the aircrafts happened, mass production means large scale production and this is also called pusher because you can see that the engine is at the back.

So I am high lighting the engine, the propeller on the engine with the red colour and this behind the pilot seat. And it is also the first aircraft to do the naval operation. Naval operation means take off and landing from the ship and you can see that the first landing was USS Birmingham it is an American aircraft carrier and after that it also took off from USS Pennsylvania. So, in a way this is the first aircraft to do the naval operations.

But you should also be surprised to know that the concept of Tail- Hook arrangement, which means the hook that is at the back of the aircraft that drags that connects to a landing wire the cable for arresting the landing. This was the first aircraft actually developed it and that the same technology used for naval aircraft naval ship aircraft also this became the fore father for the world's first sea plane called Curtiss Triad this aircraft the important features are there is a pilot plus one so that one passenger can travel in this one.

It has wing span of 11.66 meter so that big aircraft. We can again see inspiration of Wright Brother, you can see the one aerofoil on the top and second aero foil on the bottom connected by the same way Wright Brothers have connected their aircraft. It has a E -4, 40 hp engine which actually turn the propeller and it could fly at the maximum speed of 50 minutes and we see that from the 950 meters 59 seconds of flight.

You can see that this aircraft can fly upto 2 .5 hours.

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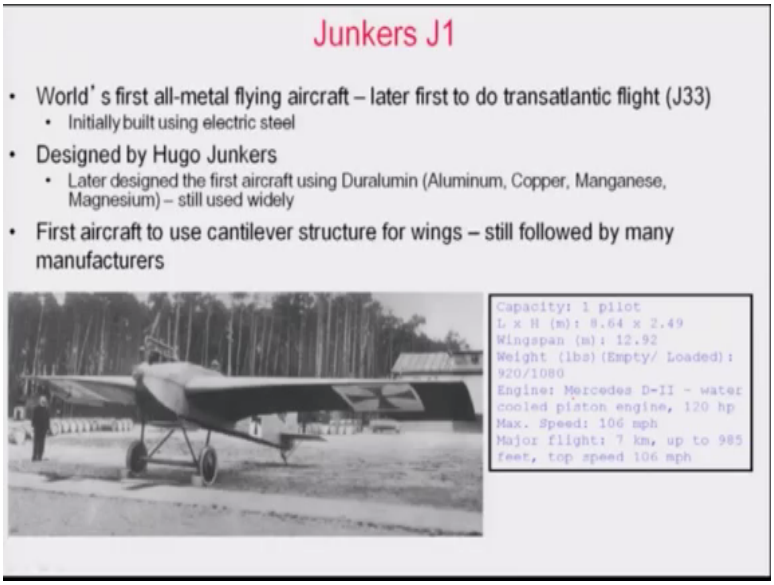

Now we will talk about another aircraft. This is also an important aircraft in the case of the human begin because up to this point people were making aircraft using wood and cloth. This is the first aircraft converted moved from wood and cloth to metal.

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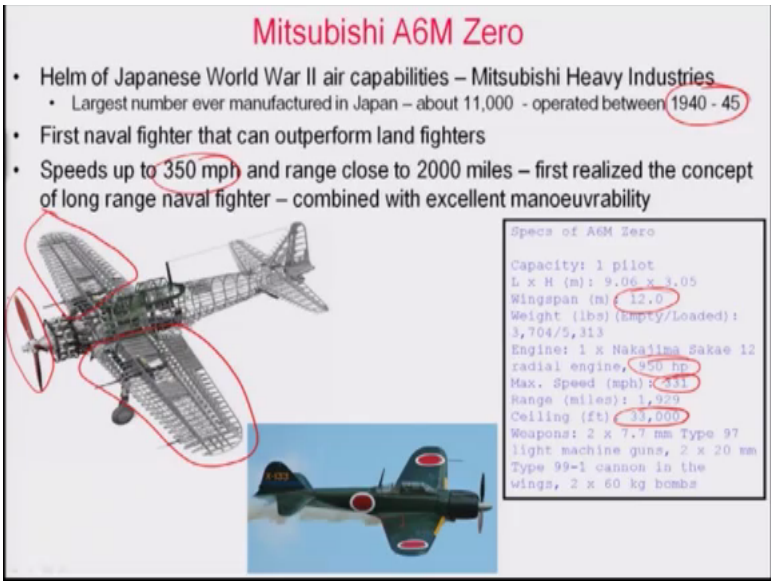

This is a Junkers aircraft as well as the engine here in the pusher it is actually in the front like a puller engine. This aircraft large extent I will put it here because it has its significant with respective Indian independence.

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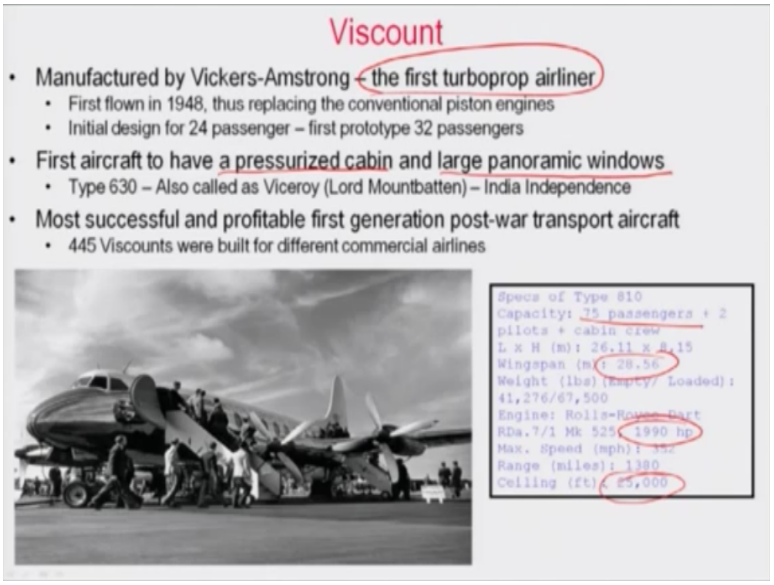

In most of the independence pictures of India you actually can see this for the discount for the Vickers Armstrong of turboprop air carft (R.S.T= 05:19 – 05:20). This aircraft has lot of importance in the commercial aviation field. There some important factors is, it is the first turboprop aircraft. This is the first aircraft that is used as turboprop airliner to transport people from one location to another.

It was flown in 1948, and it replacing the conventional piston engines with the turboprop engine. It was initially design for 24 passengers later it grow it upto 32 passengers. In Indian independence actually see Lord Mountbatten getting out of this aircraft as the last viceroy of India. So, the three major aspects are created by aircraft. Three, four of the pressurized cabin. Early cabin of the aircraft are never use to be pressurized.

So when you are flying at the altitude first difference start hurting your ear top avoid that the aircraft cabin started to get pressurized and that was first achieved by the aircraft also most of the time that the all the aircraft you might have seen in the pictures no windows. This was the aircraft came with the large panoramic window which means we can also sit inside and see the external views which reduce the fatigue of transportation.

And so that way this aircraft to large extent paved the way for being starting the aviation industry where moving the people from one location to another by using an aircraft.This was very profitable and successful business aircraft and there were about 455 were built and they were heavily used by lot of commercial airlines.

The world of era of commercial air transport originated with Viscount aircraft. We can see that different version are there the specs given here are the type 810 which upgraded all the 75 passengers.75 passengers in 1948, was a big achievement for many aircraft plus 2 pilot in cabin Crew it has the wing span of 28.56 you can again handle your design. It is also aircraft were Rolls –Royce entered into the business of manufacturing aircraft engines.

So these were 1990 hp engine made by Rolls- Royce and it could fly at the altitude of 25,000 feet and that is the reason why cabin was pressurized to make the flight off people comfortable.

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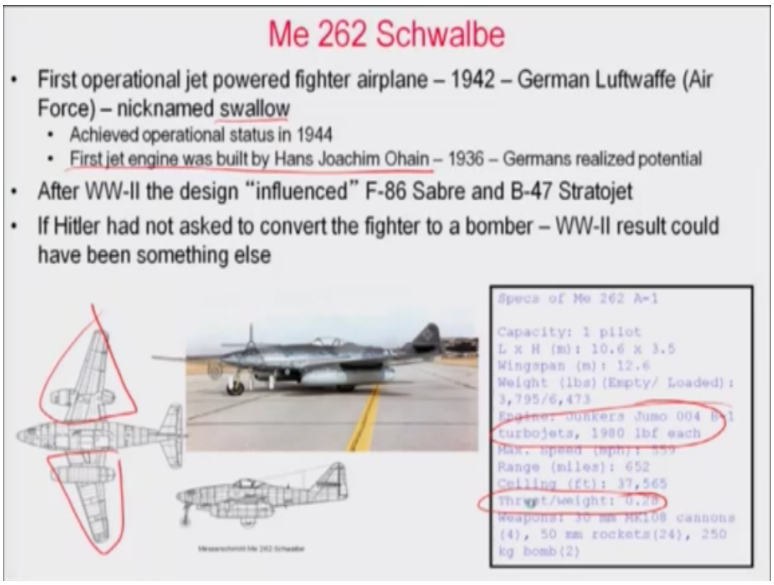

This aircraft Schwalbe Me 262 is a important aircraft because it is also the predecessor of lot of the fighter aircrafts in the world. This is the first operational jet powdered aircraft at this point we were talking about piston engines then turboprops. Now here is when we are introducing the concept of jet power or the jet engine was built by Obtain in 1936 and Germans were the first people to realize the potential of the jet engine and this was the aircraft where jet engine is intergrated to it.

It achieved its operation status in 1944 and we can see that the nick name of the aircraft is called Swallow because this was designed as the fighter aircraft and if this aircraft really materialized the way it was people still say that the world war two result would have been something else. It was designed as a fighter but the Hitler wanted to convert into a bomber in the process he turned up it took more time to do the development.

But you should understand if you look at this aircraft have again handle your wings just as we show from the junkers design and as well as it also had some very important characteristics it has the junkers turboprop 1980 pound feet of. It could reach the speed of 550 plus mile per hour it could reach the altitude of 37,000 feet.

It actually first aircraft you can think of it having a thrust weight ratio because of the jet engine the first aircraft of the jet engine. The German air force landed up using this but by the time this

aircraft was ready the result of the world war two was something else. So there is lot of discussions happening on this aircraft by the way whatever is available were taken by the United states and to the large extent lot of the modern fighter where the jet aircrafts are still inspired by design of this particular aircraft.

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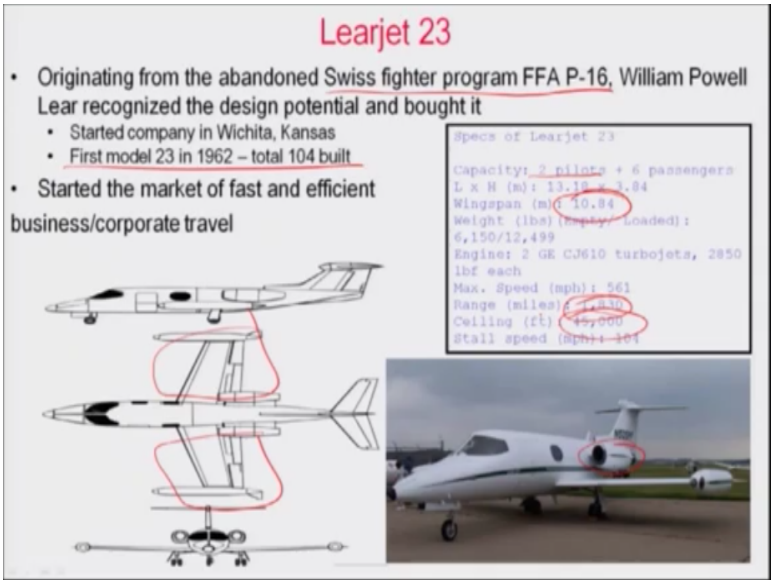

When we talk about all type of airplane we cannot really ignore the aircraft company Learjet and its products. The concept of business travel originated from Learjet this was the entrepreneur person who actually had William Powell Lear who understood the concept of large business corporations having executives business executives.

Who want to travel for one location to another quickly without getting tired and what he doing. He took abandoned Swiss fighter program FFAP – 16 and what he did is he took that design and then he built the business jet remember this was in 1962 which is the same place where it has been still getting built. You can see that it can carry two pilots, six passengers same again designer handle your wings which most of the air plane still follows.

This hours the engine built on the body so the engine on the body allows you to the engines are actually shielded by the wing in this regard. 10 meter 10 plus meter wing span and general electrics started providing wing engine for this stuff this aircraft. This started flying at the

altitude of 45,000 feet. It also has the range of 1,830 miles and had a maximum speed of 560 mile per hour.

This created the world the particular business category called corporate travel using business jets. So Learjet 23 is the important aircraft in this life in the history of aviation.

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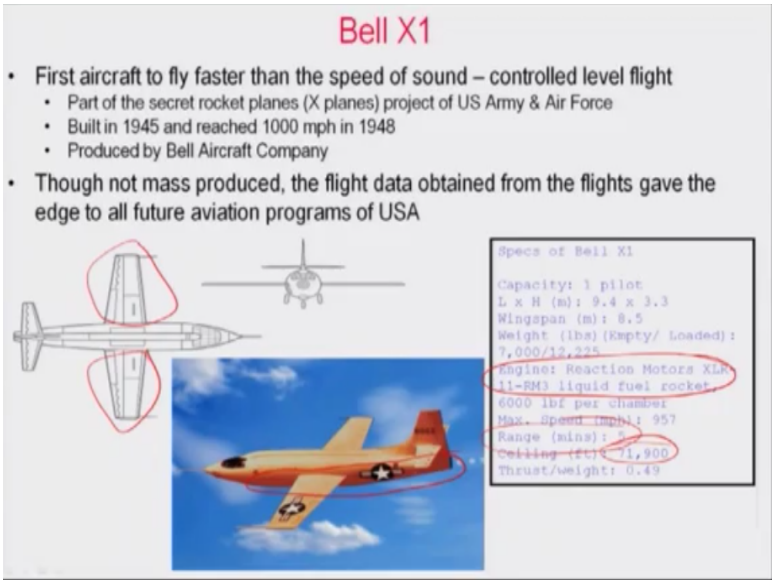

We cannot really call this as an aircraft constraining the fact that when it does not actually take off from the ground. This aircraft was the first one to fly faster than the speed of sound Bell X 1. It is experimental aircraft so aircraft to be carried by the another aircraft to the sky and then dropped from the altitude and then it used to fly.

So what is the rocket engine I can see that the engine itself the rocket set in the bottom and when it reaches the point of time you let the aircraft go and the pilot takes the rocket and then you fly. The aim was to break the speed of sound so this is the first aircraft that was faster than sound to obtain the controlled level flight.

Remember this was built in 1945 it was able to do this break the speed of sound in 1948 it was done by Bell aircraft company and to the large extent the data obtained by this flight by the United States air force was one of the reason you it is still nasty whole the advantages super

-sonic aircraft. Lot of datas are available. You can see handle your design and it is not a turbo jet actually a rocket engine.

You can see that the reaction motor XLR liquid fuel rockets were used in the engine and you can see that the speed is up to 957 miles per hour more than the speed of sound and it could fly to the altitude of 71,000 feet and the range it was in the minutes 5 minutes so once the rocket is burned off it come land and recover the aircraft that was the idea.

So if anybody understands the concept of reaching the speed breaking the speed of sound it was initially achieved using rocket engine meter developed with the concept of after burning turbo jets and that's how we can break the speed of sound.

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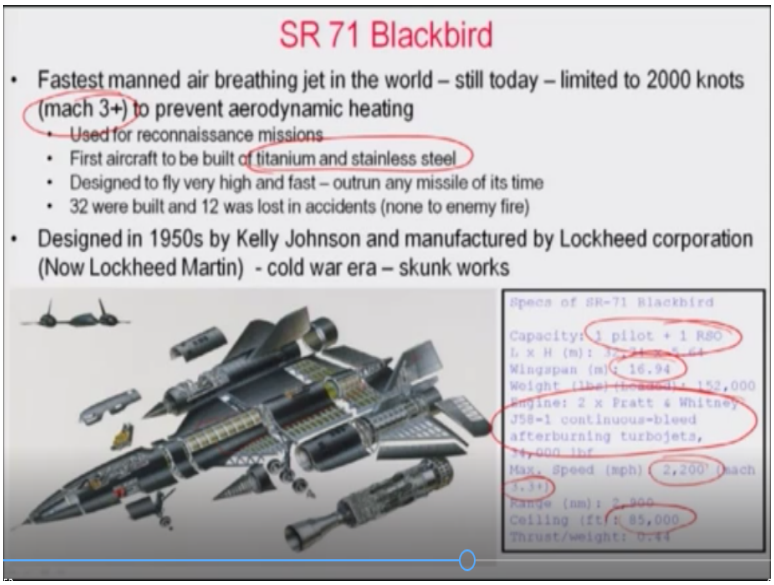
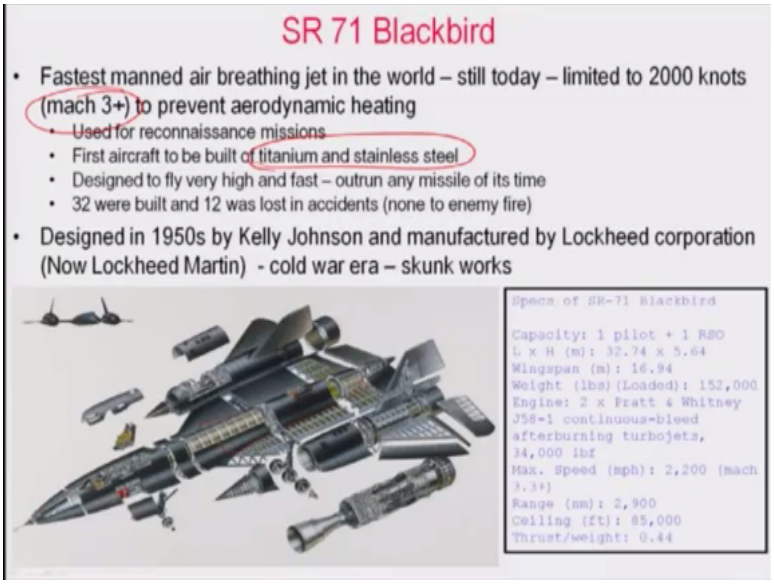


This aircraft, it is a kind of tricky aircraft. This is not really a commercial aircraft needed as the passenger or anything like that but it is actually a aircraft that created the new world of observing from the altitude called survey lines. The field of survey lines actually came with two aircraft SR 71. This is still fastest than anything aircraft in the world. It can fly three times with the speed of sound mach 3 plus ok.

This is typically used for reconnaissance missions. Reconnaissance mission means human begins fly the aircraft over the planes and you look for information that patenting to security like enemy

force movement and anything and from there you decide how do we compare that. It was also the first aircraft was to be built to this point we were talking about electric steel first we are talking about wood and cloth and e move to electric steel from electric steel we actually move to duralumin.

From duralumin we move to titanium and stainless steel because the speed it was going it was hard to actually many of the reading edge were they aircraft to be filled with built using titanium and stainless steel. This aircraft has to fly very high and fast it has no defense it has outer any missile available at that time. Remember this is actually built in 1950's so it is an old aircraft. **(Refer Slide Time:15:53)**



But still you know significant aircraft 32 aircraft were built and 12 lost none of them lost their missiles. All lost during landing and take off. You can see that the particular shape of the aircraft makes the most of the cumber sum aircraft to fly. It is a kind of a delta shaped aircraft. It has one pilot and one RSO. RSO is the person who actually do the surveillance operations handle the radar and all those things.

It had an 17 meter wings approximately and this aircraft was the first aircraft was Pratt Whitney a company developing high performance engine. To achieve very high speed flight. It could fly 3.3 times than speed of sound 2,200 mile per hour. It had an operating sealing of 85,000 feet from which is very very high and it has the range of 3000 nautical miles.

SR 71 though used for military purpose it was one of the very well guarded secrets of air force for some time. But this was the first aircraft to do the job of survey lines and reconnection operations were used the aircraft to observe an enemy countries.

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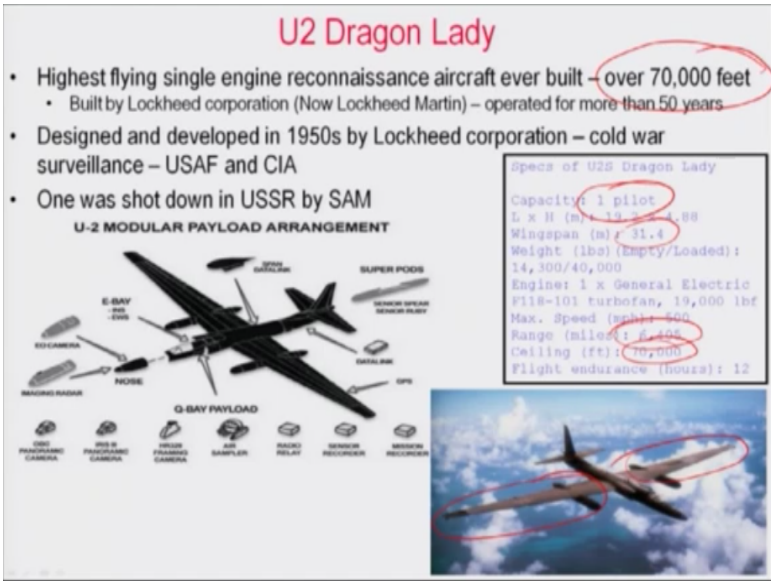

Another aircraft similarly what we call it as U 2 Dragon Lady. It is the single engine that is the distinction of this aircraft is the highest flying single engine reconnaissance aircraft ever built the previous one S R 71 had a turbo jet engine in that. But this is the single engine aircraft it could fly above 70,000 feet. It was built by Lockheed corporation actually called as Lockheed martin.

It is built in 1950 during the cold war time and UASF and CIA were using it to observe Russia, Russian nuclear missiles specifically. There was one aircraft that was shot down by Russians using the surfaced air missile. You read that time history you see almost created another world war because United States demand the aircraft and Russians denied the whole thing.

Any way if you look at this is, this is operated by one pilot and you can see that 31.4 meter wing span this is pretty big wings long wings in generate electric power it has single engine turbo fan with this aircraft and also it has the range of about 6,500 miles 70,000 and it can fly up to endurance of 12 hours. So this was the aircraft that assure the world the concept of long term long duration survey lines 12 S R 71 could fly for few hours which could actually.

Do half a missions so long duration survey lines was introduced by U 2 Dragon Lady.

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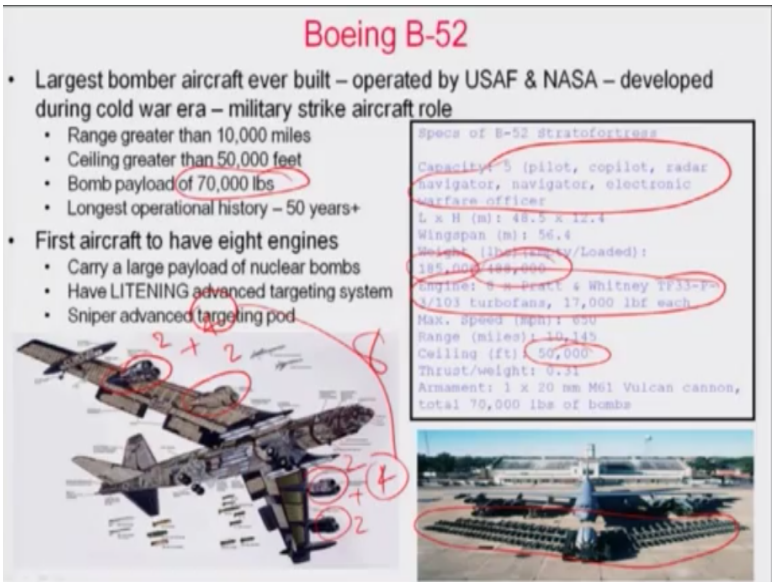

Similarly another aircraft this picture. Itself is many of this know about this aircraft form the Vietnam war got this distinction one of the largest bombers ever built but also this is one of the largest aircraft longest operational aircraft in the world as well. So it is a very good design very well thoughtful design as long as bomber aircraft ever built. It also has longest operation history still operating more than 50 years old.

This aircraft have 5 people to operate it one pilot, co pilot and radar officer and electronic war office and also navigational indicator. You can see that this aircraft can carry a huge amount of pay load. The empty weight of aircraft is 185,000 pounds and then fully loaded weight is 488,000 pounds which is approximately three times the weight and this is also the only aircraft which actually carry eight engines in it. So each one of this set with two engines.

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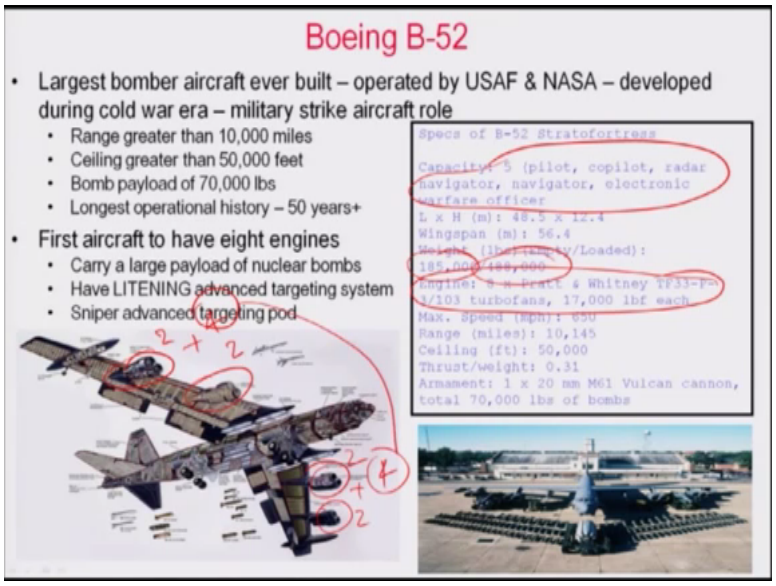

This is 2 plus 2 this is 2 engines this 2 engines 2 plus 2 , 4 engines in one side. Similarly this 2 this is 2 plus 2 then 4 engines in this side altogether 8 engines.is actually available with this aircraft and has sealing 50,000 feet and it has the range of 10,000 miles. You can see that it has bomb payload of 70,000 Ibs huge amount of bombs you can see how much it can actually carry the payload it can carry.

So it also came up with few more other things it was also the aircrafts which is actually came with the targeting system for dropping bombs now many people use that laser to designate the target but this was the first aircraft to introduce this concept into the world of warfare other than the significant as the air force based of bomber this aircraft also is one of the oldest longest operational history 50 years more than that.

That in itself shows the beauty of the design and how well built thought through this aircraft was. We also know since we are in the large size aircraft lets also talk about C 17 Globemaster which is also military aircraft it is also largest transport aircraft, one of the largest aircraft. It is a strategic operational aircraft which means actually it is not a tactical it is large range aircraft.

It is built by McDonnell Douglas in some point of time and now it is his boy is doing that, this boy is bought up by McDonnell Douglas is called C – 17 Globemaster if you look at it is actually big aircraft 51.75 per wing span again handle your wing two engines these are turbo fans and two

candle wings you can see that high T tail available with this aircraft it has 4 patterned Whitney turbo fans at 44,000 pounds Ibs.

It can fly 0.74 times the speed of sound 515 mile per hour it has the operation ceiling of 45,000 feet range up to 6000 miles and maximum wing loading 150 pounds per square feet. This aircraft also has one unique feature because it is built in for military conditions when you go and land in enemies scenario you might not have any apparatus to push you back this aircraft is capable of going backwards on its own power,So this is the first aircraft that can reverse by itself.

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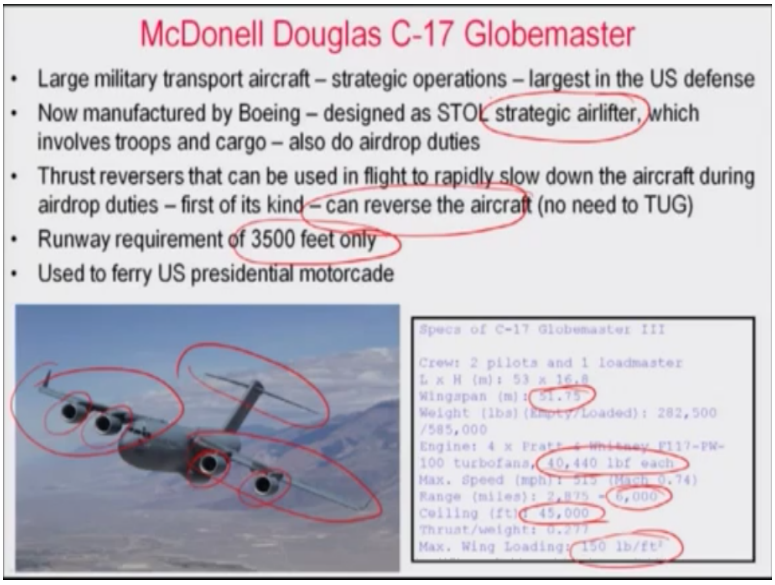

It does not require a special equipment to move from one place to another or back it up. It allows to reverse by itself by its own engine power it also can take off from the short runway STOL because of landing 3500 feet very very short operation for the size and also this is you can that this is used for move troops and cargo it is called as strategic air filter so moving large amount of cargo and everything from one location to another.

C – 17 Globemaster plays an important role in the desert storm operation where the troops moved from united States all the way to Iraq during the first Gulf war. So that's when the importance of this large scale strategic air lift was emphasized.

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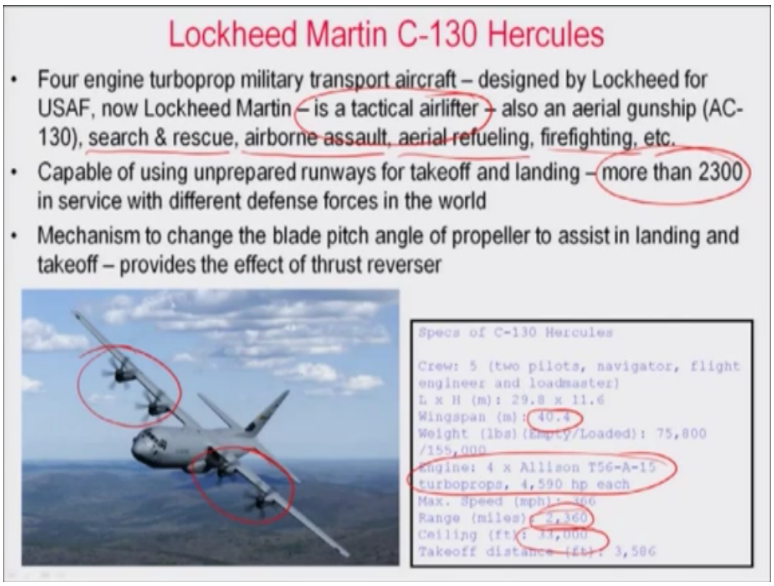

You also talk about another one which is (R.S.T = 23:45 – 23:46). India recently acquired from United States. This is also one important aircraft Lockheed Martin C – 130 Hercules it is not a turbo jet is a turbo prop that is using propellers it has 4 engine aircraft but the turbo prop. It is again a pretty bigger craft 40.4 meter wing span not as big as C -17 but it is big enough.

This is actually find as a tactical air lifter the other C 17 is the strategic air lifter. Tactical is short duration operation is not meant for long duration operation. It is used in the typically transport, search and rescue when the Nepal earthquake happened lot of the supply from India Nepal was taken from this aircraft. It is also used for airborne assault, aerial gunship. It is also used for refueling other aircraft for the flight.

And it is also used in fighting 4 S fires big time in US and Canada and many other countries also used that. It can take off unrepaired in one way. Not even required a concrete or paved runway to do this and reason services different forces including India across the world. This is the large number 2300 of them across different part of the world itself says versatility of this aircraft.

This aircraft also was the first one to come up with the changing the blade pitch angle in transport aircraft to assist landing and take off by allowing this it can actually reverse by it can also work as thrust reverse by itself so it can back off by its own power also you can see that it has 4 engines 4 allison, T 56 A 15, turbopropa, 4600 hp each. It does not fly that height but it is

33,000 feet altitude and also it is capable flying it about 2,360 miles in range which why it is also called as a tactical air lifter

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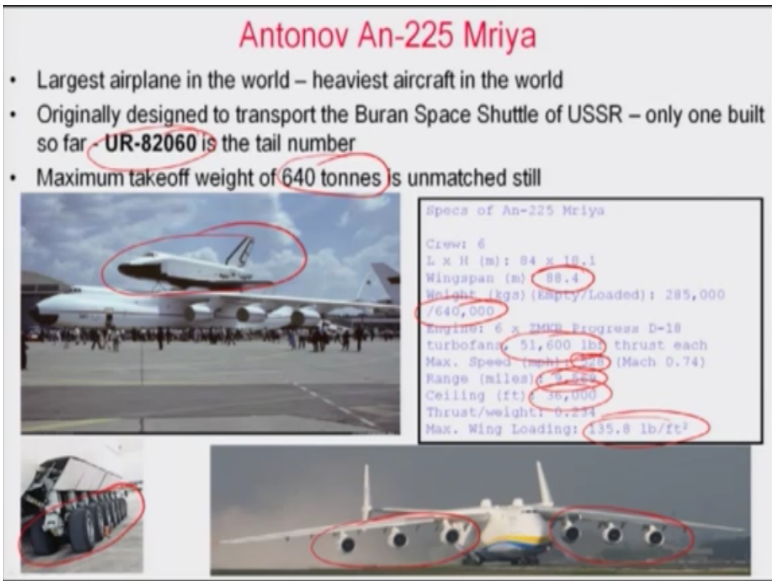

And One more so we will be wondering what is the Russians were doing at the same time. This is another aircraft which is actually the heaviest largest airplane in the world that is only one available now because that is two are being built but only one in operation .

The UR 82060 aircraft The tail UR 82060 that is the tail number. You can see that it has 6 engines literally, but all these are turbofans. The wing span 88.4 meters is the largest in its kind. It is also the heaviest one because you can see that it has 640,000 pounds when fully loaded and each aircraft engine provide 51,000 pound feet of thrust and it can fly 0.74 times speed of sound or 528 mile per hour.

It has the range of about 10,000 miles and 9500 miles fly it in the altitude of 3600 feet and as well as the wing loading is 135.8 pounds per square feet which very similar to what the C 17 Globemaster is. It is also another strategic airlifter but the trick in the aircraft is, is the one that is available in the world not the multiple use was never built. This all aircraft has the very unique design of under carriage you can also see that how the under carriage was looks as the wings of the trim.

It is originally design to transport the plane shuttle of USSR which actually at the top of the aircraft. But never realized now there is one that is used 640 tonnes capability being flown. I think out of UK An 225 Mriya is the aircraft.

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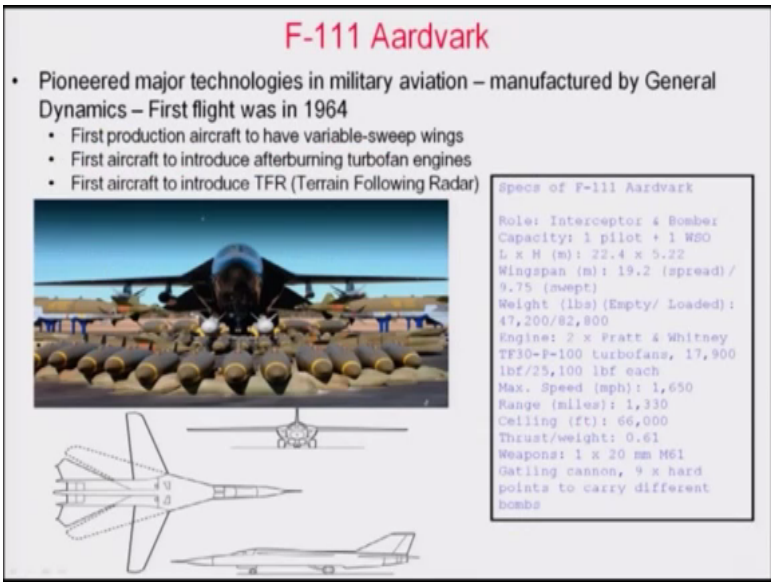

We will stop here. Thank you.