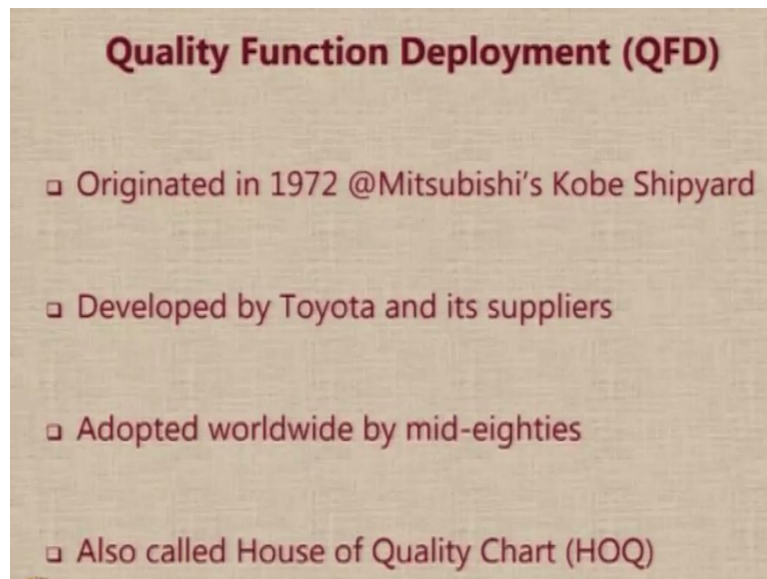


Introduction to Aircraft Design
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Lecture – 9
Quality Function Deployment

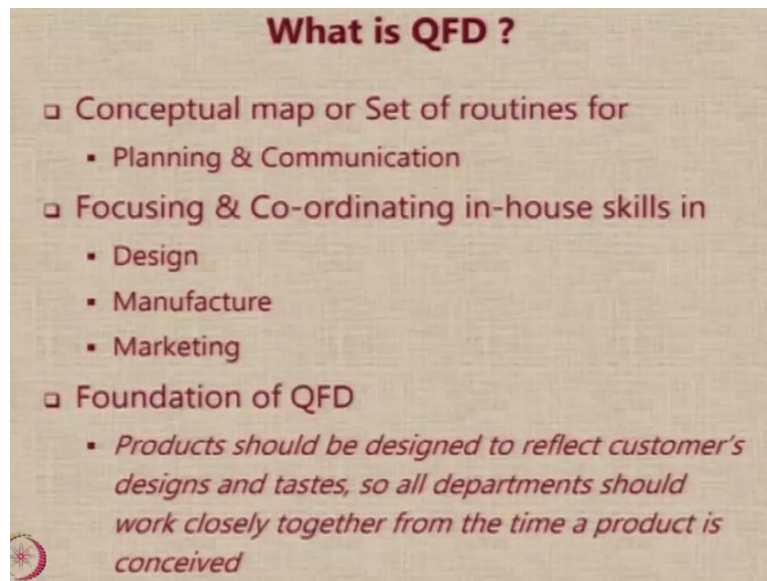
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Now I mentioned that requirements capture is a very important aspect of aircraft design. So we need to understand tools which are used for requirements capture. One of the very popular tools is called as the quality function deployment or QFD. So let us spend a few minutes trying to understand this particular tool and let us see how it helps us in capturing the requirements.

The origin of this tool goes to the Mitsubishi's Kobe Shipyard way back in 1972. It was developed by the Toyota company for improving the quality of its vehicles and those of the suppliers okay and it became very popular and began adopted by mid-eighties by all over the world and because of the look or the way it appears on a piece of paper, because of the look this is also called as sometimes as the house of quality or the HOQ chart.

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What is QFD? Basically, it is a conceptual map or a set of routines which allow many activities it helps in planning and communication. It focuses and helps a company to coordinate within its various departments and sections to put the skills together to improve the quality of their product. Departments such as design, manufacture and even marketing they work together and sit together to try and improve the quality.

The foundation of QFD are basically rooted in this particular statement which says that the product should be designed to reflect customer's designs and tastes. So all department should work closely together from the time a product is conceived till the time it is finally developed and brought in the market. So we should always look at the customer's perspective when we do design. This basic idea is enshrined in QFD. QFD consists of various steps as we will see and very soon we will also take up a worked exam.

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Steps in QFD

- What do the customers want ?
- How can we change the product ?
- How can engineers influence product qualities ?
- How does one engineering change affect the other characteristics ?

Let us have a look at the various steps in QFD. The first step in QFD is to try and address what do the customers exactly want. Once we get some idea about it, we should look at how can we change the product? The product could be something that is already existing or it could be something that we are planning or conceiving or it could be something that is still on paper and it is going to be taken up for design.

The key question that we want to answer in QFD is how can the engineers influence the product qualities. Many people had this wrong impression that the quality of a product depends only on the people who manufacture it, the people who assemble it and the people who finally deploy it, but how can quality be brought into the design phase itself that is the basic aim of QFD.

Secondly how does one engineering department or one engineering change affect the characteristics of the other department, other aspects. So the interrelationship between changes in one section or department on the product and the other departments this interrelationship is also investigated in QFD.

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Identifying Customer Attributes (CAs)

- What is a CA ?
 - Phrases that customers use to describe products and their characteristics
 - Typical CAs for a passenger car
 - Low Fuel Consumption
 - Spacious boot
 - Good road grip
 - Good Acceleration
 - Good Looks

So the key aspect of QFD is to identify the customer attributes or CAs. What are these CAs? CA is a phrase and that phrase is used by the customer to describe the product and their characteristics. Now to take an example we will work on the customer attributes of a passenger car because most of the people are quite familiar with what are the expected features they would like to see in a car okay.

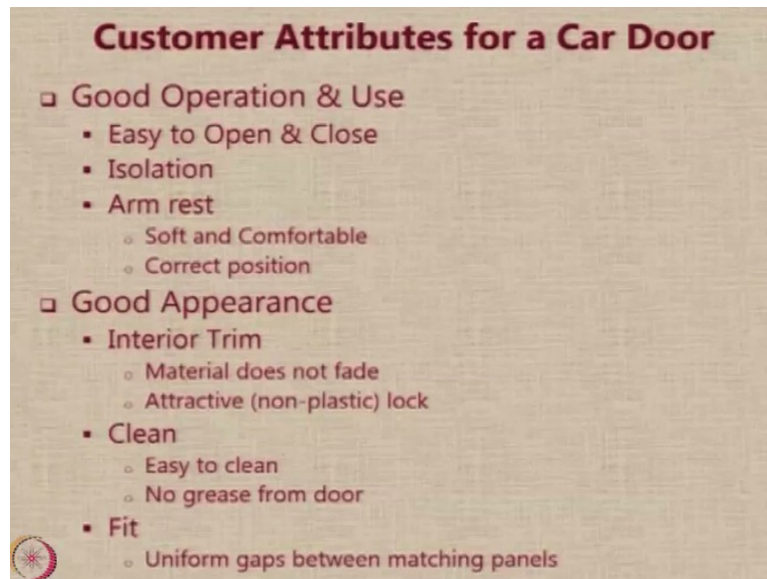
Since many of us do not buy aircraft routinely, therefore for us to be able to elaborate the customer attributes for an aircraft may be a bit difficult. So that is why we have chosen an example of a passenger car. So if you ask somebody about what is the customer attribute for a good car. Most people would say okay low fuel consumption could be one customer attribute. It is not that this is the only attribute or this is the first thing that comes to the mind.

For some customers the first attribute that comes to the mind could be acceleration or looks, but for most average customers the first requirement for a car would be low fuel consumption and then some customers might say okay we need a spacious boot so that the luggage can be stored in the boot. There should be enough volume and size dimensions available for us to load the luggage.

Good road grip is another possible customer attribute which many people would be interested in, this is from safety point of view. Then good acceleration, this comes from the requirement of performance. Good looks are also very important and for some customers good looks may be more important than boot or road grip also. We do not know. Customers have different requirements and different customers have a different way of looking at things and qualifying

what is good. So, these are the typical customer attributes.

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What we can do is to go deeper let us just look at one aspect or one component of the car that is the door of a car and let us start looking at the customer attributes for a door of the car okay. So for example if you ask a customer about a door of a car, good operation and use could be one. Then when I say good operation and use, it means it should be easy to open and close. It should provide isolation to the people sitting inside from the atmosphere outside.

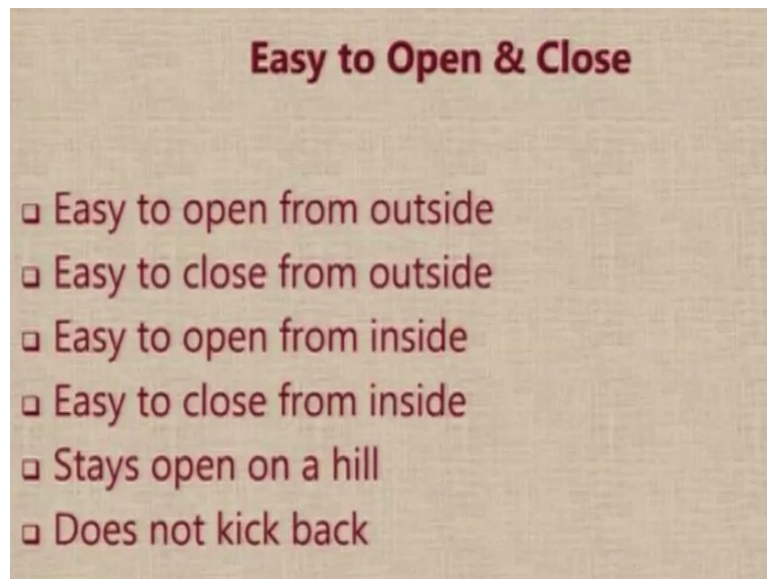
It should have an arm rest and that arm rest should be soft and comfortable and also it should not be too high or too low, it should be at the correct position. Good appearance of the door is also important for many customers. Now when I look at good appearance can also be an important customer attribute for many customers. Now when they talk about appearance, it may mean many things.

For example, one appearance attribute could be interior trim, how it looks from inside. The material of the door should not fade with time as you can see in many cars and it should have a lock that is very attractive to look at and it should not give the typical plastic look, this is what many people say. Then the door should be such that it allows the car to remain clean and it should be easy to clean the door.

And it should not be the situation that when you open or close the door or when you keep the door working, grease is coming from the door and making the person inside dirty and secondly fit. So if a door does not properly fit into the body of the car, it gives a very bad

appearance. It gives a very poor quality appearance. So between the matching panels of the door, the gap should be uniform, this could be one customer attribute okay.

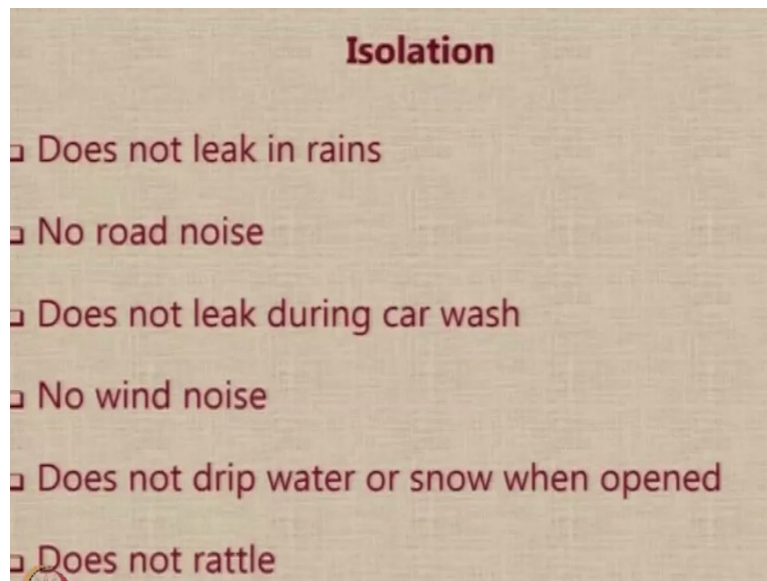
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Then if you go one step further if you look at what you mean by easy to open and close, so easy to open from outside, easy to close from outside, easy to open from inside, easy to close from inside. Please note each of these 4 requirements are connected with opening and closing from outside and inside, but they all are different aspects of the same door and different features in the door would affect the attribute okay.

Then many customers might say that if I am parking a car on a hill or an incline and if I open a door, then it should not be that by gravity it you know quickly comes and closes on its own because if I have to load or unload some items when I am parked on incline, I should not face the problem that I have to grapple with the door. Similarly, when you open the door, it should not give a kick back okay.

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Isolation. Isolation can also be defined as many ways. For example, one would be the isolation during rains so that the water should not come in from the door. The other isolation is acoustic isolation that means when you are sitting in the car and the car is being driven, the door should be able to cancel out the noise which is there on the road. Many customers use a car wash to clean the cars and there have been complaints in some cars that during a car wash operation, the door is such that some water comes inside.

So, this could be one attribute which a customer may give based on their past experience. Similarly, when you drive the car and because of the relative speed between the car and the atmosphere there is going to be some wind going past you and that should not create too much noise, so the door should be such that it does not vibrate or it does not give any wind noise, minimum wind noise.

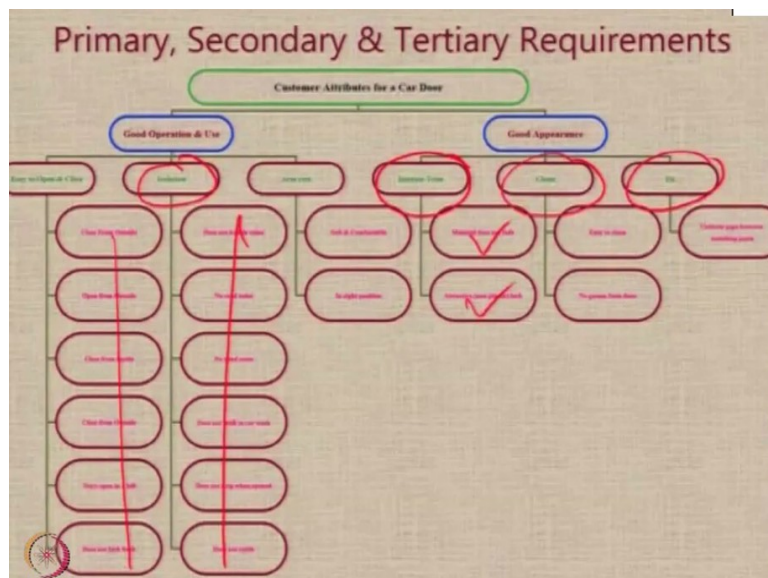
Many customers complain that when you open a car during snowy conditions, then snow collects on top of the door and it starts dripping water, so it does not drip water or snow when open is one particular requirement which many customers give and of course during the motion of the car it should not vibrate or rattle and that can create a lot of unpleasant feeling. So you can see isolation by itself is one word, but isolation when look deeper can actually give so many different specific aspects.

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Appearance. We have already seen interior trim, clean, fit okay.

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So with this, we understand that there are primary requirements, secondary requirements and tertiary requirements and you can take this exercise further and further and further and you can come to many, many levels of requirements. So here is one chart now, it is not very easy to read but you can understand that the one on the extreme top the green one, this particular aspect talks about the key requirement or the primary requirement which is the customer attributes for the car door.

The secondary requirements in this case, the secondary requirements are good operation and use and good appearance. So the primary requirement of a car door attribute come into two. Now when you look at the good appearance, you have tertiary requirements which are the

interior trim, the cleanliness and the fit okay and when you go further you can have another requirement like material does not fade, it should be attractive.

For isolation for example there are so many, so many other requirements. These are all requirements for isolation. These are all requirements for easy to open and close and one can go further and further and further and one can come up with many, many high-level requirements. Thanks for your attention. We will now move to the next section.