

A Review of Stealth Technology

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ABSTRACT

From many past years, Stealth Technology has become very effective approach for aircraft to hide it from radar system. Especially for military operations, "Low Observable" technology is best these days. These days all countries are using "Low Observable" principles and techniques for making their aircraft, also the many countries are upgrading their old generation aircraft by making modification to hide from radar system.

However, Low observable means not completely invisible but complete disappearance from radar system. Stealth technology have many advantages but besides advantages it has also some disadvantages like its development cost, flyaway cost and maintenance cost are much higher than normal aircraft. Due to capabilities of Stealth technology many countries have been developing anti-stealth technology [2] These days United States of America taking advantage of stealth technology.

This paper will begin by a brief history of development of stealth aircraft and short introduction of most popular stealth fighter aircrafts [2].

KEYWORDS: Stealth Aircraft, Low Observable, Anti-Stealth

INTRODUCTION

Stealth Technology is one of the best technology these days. It is also known as LOT(Low Observability Technology) which includes a range of best techniques used in aircrafts, ships, and missiles for making them invisible so that nobody can trace it. In simple means stealth technology provides a better way to aircrafts, ships, missiles to hide from radar system or any other detection system[1].

The stealth application was first used in WW2 by the German

Navy in submarines to it hide from sonar system. Later on Americans worked on it and succeeded. In present time when we think about stealth technology then immediately pictures of B-2 bomber or F-117 A Nighthawk Comes in our mind. First Flight of F-117 A was in 1981[1]. After sometime U.S decided to develop long range strategic bomber. So U.S developed B-2 stealth bomber with air refueling system. Some of B-2 bomber are still in operational service in U.S force.

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Figure 1 (Image Courtesy Google)

B-2 Bomber

Literature Review-

The aim of stealth technology is to make an aircraft invisible to radar system or any other detection system. This can be achieved in two ways

Which are following:-

Shape of aircraft plays a very important role in stealth application. So the shape of aircraft should be chosen such that it should be able to deflect the direction of incoming radio waves in many directions.

Aircraft should be covered with the absorbent material so that it can absorb radar signals.

Radar System Working

Radar stands for Radio Detection and Ranging System. It is basically an electromagnetic system which is used to detect the location and distance of an aeroplane or an aircraft from the radar system[4]. The radar dish or we say that radar antenna transmits pulse of radio waves and these radio waves fall on aircraft and get back to the receiver antenna. These reflected signals tell about the location and distance of an aircraft. Radar system is very powerful for identification of aircraft but due to stealth technology more advancement is required in the radar system.

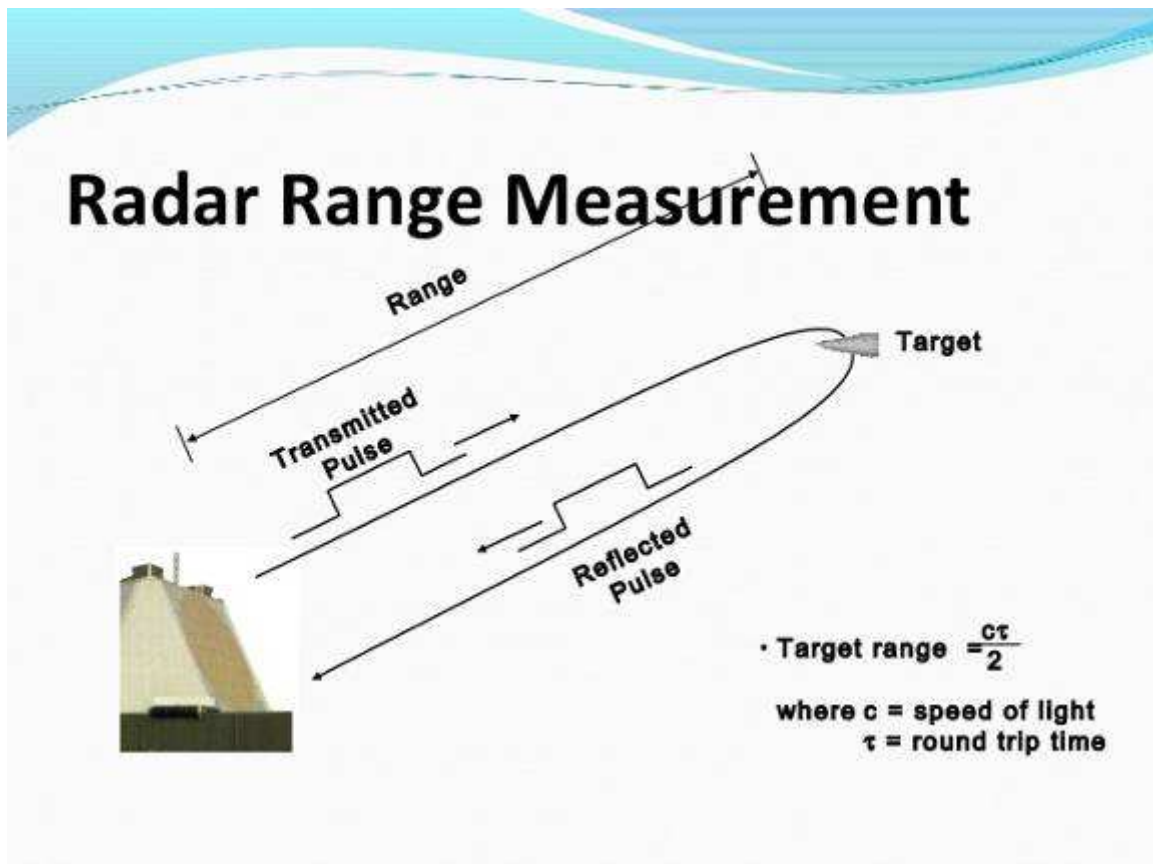


Figure 2 (slideshare.net)

To make aircraft invisible there are many techniques and by the use of these techniques any aircraft gain capability to avoid radar system without any trace. These techniques are following:-

1. Vehicle Shape and Design
2. Infrared Stealth
3. Radar Cross Section
4. Radar Absorbent surface
5. Stealth Material

Vehicle Shape and Design

The shape of aircraft plays a very important role in stealth technology in order to reduce the radar cross section. The shape of aircraft should be able to deflect the incident waves in different directions. The shape of the aircraft also depended on the type of materials that are used in the construction of the aircraft[1]. Smooth surface is much better than the rough surface because rough surface has poor aerodynamics properties.

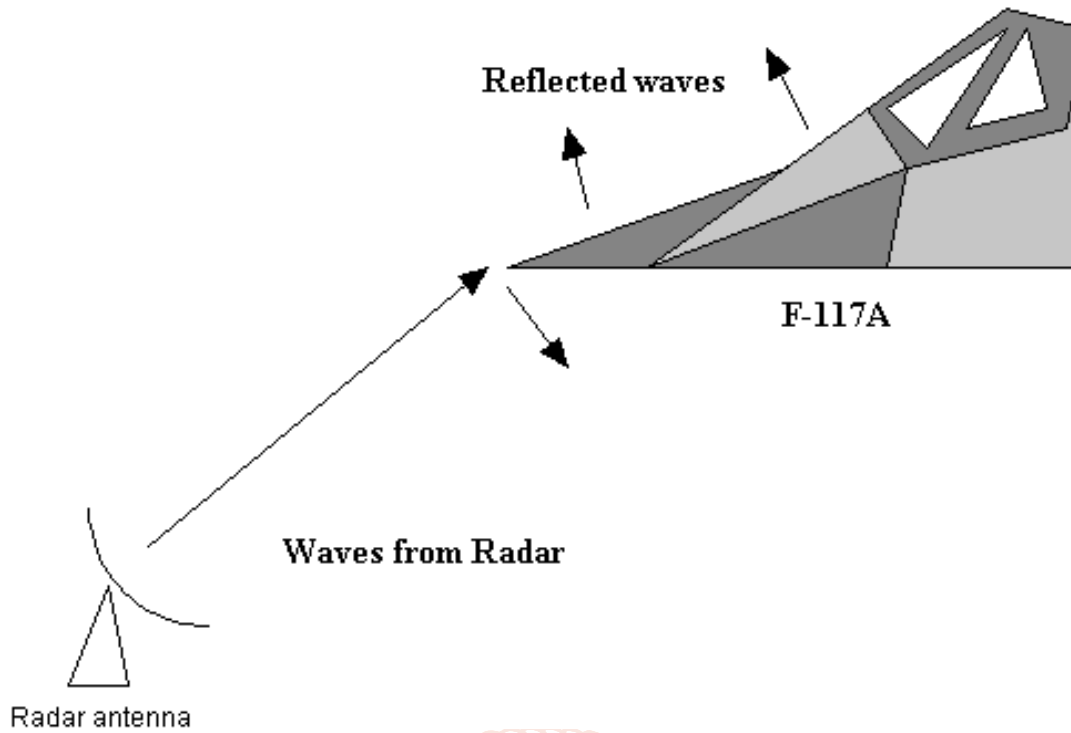


Figure 3 [1]

Infrared Stealth

All the matters above absolute zero emit infrared radiation. In aircraft exhaust gases from engine emits infrared radiation and also wings surfaces of aircraft also emits infrared radiation due the friction with air. Infrared stealth technique says that all hot parts of aircraft should be keep cool as much as possible.

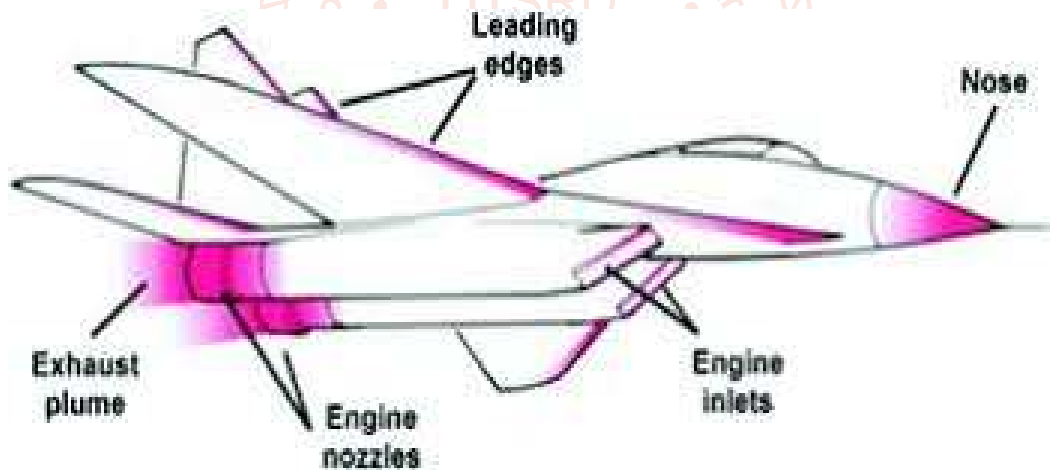


Figure 4 (Image Courtesy Google)

Radar Cross Section[6]

Radar cross section plays a significant role in the stealth technology. Radar cross section refers the target’s ability to reflect radar signal in the direction of radar receiver[3]. It is a ratio of back-scatter power per steradian in the direction of radar to the power density that is intercepted by the target. If radar cross section will high then aircraft or plane will be easily detectable by radar system. Concept of RCS assume all energy does not fall on the target. RCS can be visualized by following three parameters:-

- A. Projected cross section
- B. Directivity
- C. Reflectivity

$$\sigma = \text{Projected cross section} \times \text{Reflectivity} \times \text{Directivity}$$

Here reflectivity is the ratio of reflected amount of the radiation from the material to the incident amount of radiation on the material.

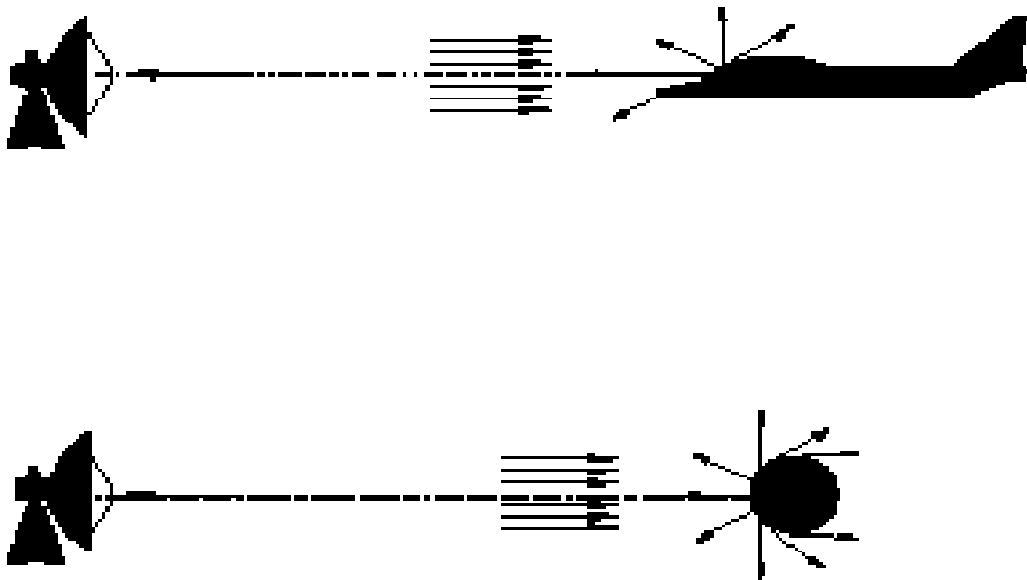


Figure 5 (rfcafe.com)

**Radar Cross Section concept
Stealth Material**

Stealth Material is the special class of polymer based material which is used on the surface of the stealth aircraft to reduce the radar cross section so that radar system or any other detection device could not find the aircraft[8]. Radar absorbent material is applied on the entire external surface of the aircraft or to high radar reflection such as surface edges.

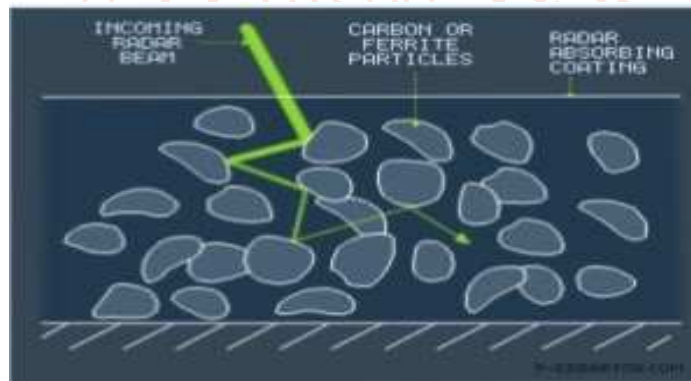


Figure 6 (scienceaid.net)

**Radar Beam Dissipation In RAM
Disadvantages**

Like other technologies Stealth technology have also some disadvantage:-

- A. Stealth aircraft have lower payload capacity in comparison with conventional aircraft
- B. Stealth aircraft have high development cost, high maintenance cost and high flyaway cost than normal planes.
- C. Stealth aircraft are less agile .
- D. Stealth aircraft is not maneuverable

Conclusion

Stealth technology is very popular now a days because it provides invisible characteristics to the aircraft or plane. It is need of every country in these days. Every country wants 6th generation aircrafts because stealth aircrafts can create much difference at the the time of war.

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