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STEALTH TECHNOLOGY AND INDIA-A REVIEW

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Abstract— Stealth Technology so as to avoid detection by using combination of features so that Aircraft can interfere with RADAR and also reduce the visibility in radio frequency (RF) spectrum, audio and infrared visual. During the last decades, stealth technology has proven to be one of the most effective approaches as far as the Endeavour to hide from radar systems is concerned. Stealth means to avoid the detection or try to hide, for airplanes, hiding from radar meant stealth. The concept used in the stealth technology is not so difficult. It uses the principle to absorb and reflect the radar waves. Aircraft deflects the radar waves in various directions and minimizes the radar waves which return backs to radar. This paper reviews about the different aspects in stealth technology.

Keywords: Stealth, Radar Cross Section, Radio Absorbent Material.

I. INTRODUCTION

The aim of stealth technology is to make an aircraft invisible to radar system or any other detection system Which are following:
Shape of aircraft plays a very important rule in stealth application. So, the shape of aircraft should be choosing 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 a electromagnetic system which is used to detect the location and distance of an aeroplane or an aircraft from the radar system. 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 talks 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.

II. EARLY DEVELOPMENT

Development of modern stealth technologies in the United States began in 1958, where earlier attempts to prevent radar tracking of its U-2 spy planes during the Cold War by the Soviet Union had been unsuccessful. Designers turned to developing a specific shape for planes that tended to reduce detection by redirecting electromagnetic radiation waves from radars. Radiation-absorbent material was also tested and made to reduce or block radar signals that reflect off the surfaces of aircraft. Such changes to shape and surface composition comprise stealth technology as currently used on the Northrop Grumman B-2 Spirit "Stealth Bomber

III. STEALTH TECHNOLOGY AND INDIA

The Advanced Medium Combat Aircraft (AMCA) is an Indian programme to develop fifth generation fighter aircraft for the Indian Air Force and the Indian Navy which will also include sixth generation niche technologies. The design of the aircraft is carried out by Aeronautical Development Agency (ADA), an aircraft design and development agency constituted under Defence Research and Development Organisation (DRDO). It is expected to be produced by a public-private joint venture between the DRDO, Hindustan Aeronautics Limited (HAL), and an Indian private company. The programme has an aim to start production by 2028. The development cost is estimated to be around 15,000 crore

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IV. STEALTH CAPABILITIES OF INDIAN FIGHTERS

Table-1: Stealth Technology in Indian Fighter Jets

Aircraft	**Origin**	**Type**	**Variant**	**In service**	**Stealth Parts**
Dassault Rafale	France	Multirole	EH/DH	35	Advanced electronic warfare system.
Sukhoi Su-30	Russia	Multirole	Su-30MKI	260	Infrared search & track system
HAL Teja's	India	Multirole	Mk.1	32	Composite Material
MiG-29	Russia	Multirole	MiG-29UPG	65	Infrared search and track system, OESS, IRH
Dassault Mirage 2000	France	Multirole	2000 H/I	45	RDY-2synthetic aperture radar
SEPECAT Jaguar	United Kingdom	Ground attack	IM/IS	130	radar cross-section (RCS)
MiG-21	Soviet Union	Interceptor	Bison	128	Landing Gear

Table-1 shows the various fighter jets operated by India and its stealth capabilities. Most of the fighters which is used by Indian Air force is having limited technologies of stealth.

V. METHODS TO CREATE INVISIBILITY

The metal body of an airplane is very good at reflecting radar signals, and this makes it easy to find and track airplanes with radar equipment. The goal of stealth technology is to make an airplane invisible to radar. There are two different ways to create invisibility:

a) The airplane can be shaped so that any radar signals it reflects are reflected away from the radar equipment.
b) The airplane can be covered in materials that absorb radar signal.

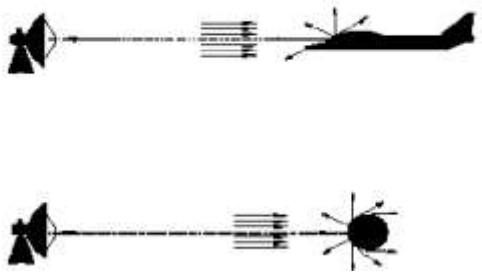

Figure-1: Reflections of Radar Signals in different directions

VI. RAS (RADAR ABSORBENT SURFACE)

RAS (Radar Absorbent Surfaces) are the surfaces on the aircraft, which can deflect the incoming radar waves and reduce the detection range. RAS works due to the angles at which the structures on the aircraft's fuselage or the fuselage itself are placed. These structures can be anything from wings to a refuelling boom on the aircraft. The concept behind the RAS is that of reflecting a light beam from a torch with a mirror. The angle at which the reflection takes place is also more important. When we consider a mirror being rotated from 0º to 90º, the amount of light that is reflected in the direction of the light beam is more. At 90º, maximum amount of light that is reflected back to same direction as the light beam's source. On the other hand, when the mirror is tilted above 90ºand as it proceeds to 180º, the amount of light reflected in the same direction decreases drastically. This makes the aircraft like F-117 stealthy.

VII. RAM

The radar works on the principle where micro waves are used to detect aircraft by analysing the reflected signal from the aircraft. All metal or objects will have their own reflecting properties, hence sometimes the aircraft, particularly the stealth aircraft are designed with such low reflecting material or coated with the material which will absorb the signal rather than reflecting the incident signal back to the source. These kinds of aircrafts possess a very poor result in radar's detecting performance. Radar absorbent surfaces absorb the incoming radar waves rather than deflecting it in another direction. RAM totally depends on the material with which the surface of the aircraft is made. Though the composition of this material is a top secret. When radar sends a beam in the direction of the B-2, the radar waves are absorbed by the plane's surface and are redirected to another direction after it is absorbed. This reduces the radar signature of the aircraft.

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VIII. FLIP SIDE OF STEALTH TECHNOLOGY

The advantages that stealth technology offers are not without attendant limitations. On account of the unique design features of the airframe of stealth aircraft that do not exactly enhance aerodynamic excellence, as compared to a normal aircraft, the stealth aircraft invariably suffer significant performance penalties. When compared with normal conventional combat aircraft of equal weight and size, stealth aircraft have relatively lower top speed, lower payload capacity due to limitations of internal space for the carriage of weapons, are generally not as easily manoeuvrable and are prohibitively expensive to procure and maintain. Even the US is finding it difficult to sustain its fleet of the B-2 Bomber and the F-22 Raptor. These aircraft are certainly less affordable for developing countries.

IX.CONCLUSION

The stealth aircraft is need of modern warfare technology. Every aviation related agencies have same agenda as they design and manufacture sixth generation fighter aircraft. Stealth has become the magic word in contemporary weapon systems. Contemporary work on stealth has its roots in longstanding efforts to reduce the visibility of military aircraft through camouflage paint schemes. However, as electronic sensors have replaced the eyes of pilots as the primary means of tracking other aircraft, more intricate means of defence were needed. This paper also concluded that potential of Nanomaterials with Stealth Technology in Aviation (Défense) Sector. Using Nanotechnology with Stealth Technology in aviation gives the Low Observability with Light Weight, High Strength, High Toughness, Corrosion Resistance, Less

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