WELCOME
Stealth technology

By

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Introduction

- Stealth technology also known as low observable technology.
- It provides the range of technique used in aircrafts, missiles, ships and submarines in order to make them less visible [ideally invisible] to radar, infrared, sonar and other detection methods.
- Stealth technology greatly reduces the distance at which a vehicle can be detected.
History of stealth

- With the advent of radar technology in second world war efforts were made to make radar detection in-effective.
- Germans were to work on stealth technology.
- The developed the anti-absorbent paint though its application was limited to submarines as it made aircraft too heavy.
- Experimental bomber yb- 49 flying wing paved the way for united states when it was not detected by radar for a period of time
Best spy bombers till date

- Night hawk
- Sea shadow
What’s the need for stealth?

- The rapid improvement of detection techniques like radar, sonar since 1930’s and 1940’s
- To reduce the causalities during war.
- More importantly strategic importance by countries to develop radar –aided anti detection systems in aircrafts missiles submariens.
The term signature of a vehicle?

- The signature can be stated as any activity or radiation or characteristic of the body that help to revile its presence at a particular point.
- Observability of an object on detection system can be called as signature of vehicle.
- All detection methods used either in military or civil applications use signature of body as reference to detect that object.
Signatures and applications where such signature are detected

- **visible signature**: predominantly for land vehicles, aircrafts and ships.
- **Infrared signature**: aircrafts, missiles, ships, land vehicles, submarines.
- **Acoustic signature**: predominantly for ships and submarines.
- **Plasma signature**: predominantly for land vehicles and aircrafts.
- **Awct**: predominantly for ships
What is radar?

- Radar is abbreviated as radio detection and ranging.
- Radar was developed for war application, now its applications had diversified.
- This is used to launch the missiles based on the target and also counter attack the missiles launched by other countries.
- Radio energy is transmitted by radar antenna in all direction in form of pulses.
- The object blocking these pulses act as target.
- Gaps in pulses allows radar to act as receiver as well.
What is radar?
Principles of radar

- Echo
  - Echo can be considered as a wave bouncing off the surface and coming back to source.
  - This principle can be used to detect time and distance of target.

- Doppler shift
  - This is second principle of radar.
  - This can be used to detect the speed of target approaching.
Radar cross section (rcs)

- Radar cross section is the measure of a target's ability to reflect radar signals in the direction of the radar receiver i.e. per unit solid angle.
- The conceptual definition of rcs includes the fact that not all of the radiating energy falls on the target.
Rcs

- The rcs is easily visualized as product of three factors.
- Rcs ($\pi$)=projected cross section
  *reflectivity*directivity.
- reflectivity=the percentage of power reradiated(scattered) by the target .
- Directivity=the ratio of power scattered back in radar direction.
RADIATION SCATTERING BY TARGET

The sphere is essentially same in almost all directions i.e. 360 degree

The flat plane has has almost no rcs except when aligned directly towards radar i.e. 90 degree

The corner reflector has an rcs almost high as flat plane over a wider angle i.e. 60 degree.
Minimizing Rcs

**GEOMETRIC DESIGN**

- Conventional aircraft use round shape cone as it support principle of aerodynamics.
- The stealth aircraft is made up of flat surface and very sharp edges.
- Radar signal heating the stealth plane are scattered in all directions by this.

**RADAR ABSORBENT MATERIALS**

- Metallic surfaces generally reflect the radar signals.
- There stealth aircraft should be coated with radar absorbent materials.
- Which deflect and absorbed incoming radar waves and reduce the detection range.
- Radar absorbent layer is present below the surface coating of aircraft using corner reflector.
Minimizing Rcs

GEOMETRIC DESIGN

Radar absorbent materials

Diagram showing reflected waves and radar antenna.
Visual stealth

- Low visibility is desirable for all military applications
- Earlier stealth aircraft were painted black and thus could be used during nights
- Now days an electro chromic polymer is being developed for daytime stealth
- These polymer sheets sense nature of the surrounding and change there color accordingly
Visual stealth
Infra-red stealth

- Infra-red radiation are emitted by all matter above absolute temperature zero
- Hot zones such as engine exhaust, wing surface [friction due to air] get heated which rather increases the visibility
- These part should be kept cool as possible it can be,
- Option would be mixing of cool air with the hot engine exhaust
Infra-red stealth
Acoustic stealth

- Acoustic cells involves the sound waves to detect the target.
- Knowing the fact that sound waves moves too slowly as compared to radio wave so it functionality should be directed towards low altitude flying aircraft and pre-dominantly ships and submarines.
Detection of submarines using acoustic stealth

- Thermo cline is a layer of water where the temperature gradient is less than the surface and more than the depth.
- Submarines generally move below thermo cline layer which makes almost difficult for sonar to detect it as sound waves get scattered towards depth.
- If the surface ship wishes to detect a submarine then the ships has to be fitted with towed sonar.
Detection of submarines using acoustic stealth
Plasma stealth

In this stealth the aircraft injects a stream of ionized gas which envelopes the aircraft due to which most of the radar wave are observe this make the aircraft completely invisible.
AWCT [ adoptive water curtain technology ]

This technology is to reduce surface ships vulnerability to RCS, infrared signature and visual signature reduction.

RCS reduction elements are generally implemented in ships to further reduce the remaining RCS. AWCT is used.

In which a water curtain is developed around the ships called as Clutter.
Advantages of stealth

- Reduces the causality rates during war
- Saving military budget
- Develop the military secretes
- Bluff the anti-detective device
Issues with stealth

- Stealth aircraft cannot fly as fast as conventional aircraft
- Can carry limited amount of load
- Very economic B-2 cost [$2 billion], F-22 [$100 million]
- Wing shape does not provide the optimum lift
Well to conclude the current scenario appears some things similar to the cold war both sides are accumulating weapons to counter each other and each side can be termed as ‘stealth technology’ and the other as ‘anti-stealth technology’.

It's an arm race except it isn't between specific countries.
Thank you........
ANY QUESTION...??