



MODELLING OF EDDY CURRENT CONTROLLED AABS

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Abstract— Aircraft Arrester Barrier Systems (AABS) are installed at the end of the runway to overcome the runway length on war ships. This system is used for the purpose of stop the combat aircraft due to aborted take-off and emergency landings. The conventional AABS is uncontrolled and highly non-linear system during the operation of aircraft arrestment system. Energy absorbing system is an important part of the AABS. In the conventional system hydraulic energy absorption is used as per the capacity of the aircraft. To overcome the drawbacks of the conventional AABS, we have proposed eddy current based aircraft arrester barrier system. We have developed the proposed system. In this system braking torque is controllable which developed by eddy current system. In this paper, modelling of eddy current controlled AABS has been done and developed.

Index Terms— Eddy current, Aircraft arrester barrier system (AABS), Energy absorbing system,

I. INTRODUCTION

The conventional aircraft arrester barrier system is shown in Fig.1 it consists of the following main sub-systems: Stanchion system, Energy absorbing system, Engagement system, Tape retrieval system, Drive tape, Electrical control. These subsystems perform various functions during the operation of aircraft arrester barrier

system. After the landing of the aircraft, aircraft arrester barrier system initiates its operation when the aircraft stuck in the net assembly, then operation of EAS start working which are installed at both ends of the run-way and hence the braking torque is applied through net tape so that the aircraft stops within the prescribed length of the run-way.

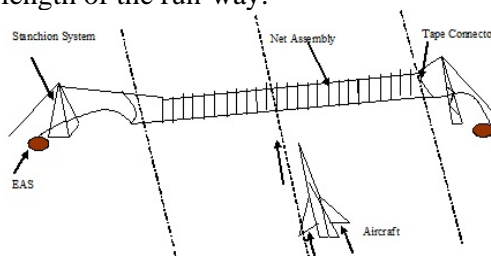


Fig. 1 Conventional Aircraft Arrester Barrier System

Two stanchion systems one at each end of the net are required in a system to support and to provide electrically controlled movement to the net. During deployment of the net certain forces are generated and imposed on the sub-system of the Aircraft arrester barrier system. Arrestment of an emergency landing or aborted take-off of Aircraft is accomplished by engagement of the Aircraft with multiple element net assembly stretched across the runway which is lifted by two stanchion systems. The conventional energy absorber used in the AABS is a hydraulic energy absorber [1-7]. The existing hydraulic energy absorbing system has no control. The Existing EAS is highly nonlinear in nature. The initial braking torque is very high but once it starts

rotating, torque reduces to a significant low value, There is no control on braking torque of Existing EAS, For different types of aircrafts (according to weights) needs different EAS i.e. different drum diameters), Braking torque depends upon the type of fluid in existing EAS. All the energy is wasted in the form of heat. To overcome the above mentioned drawbacks of existing EAS and provide back up to it, an Eddy current controlled aircraft arrester barrier system (Fig.7) is proposed which works on the principle of Eddy current Brakes as shown .The eddy current EAS can be used in parallel, series or in combination of hydraulic energy absorber [8-14].

II. EDDY CURRENT SYSTEM

Magnetic braking works based on a metal plate to the end of a pendulum and let it swing, its speed will greatly decrease when it passes between the poles of a magnet. induced currents and Lenz's law. If you attach When the plate enters the magnetic field, an electric field is induced and circulating "eddy currents" are generated. These currents act to oppose the change in flux through the plate, in accordance with Lenz's Law. Eddy current is a swirling current set up in a conducting medium in response to a changing magnetic field. By Lenz's law, the current swirls in such a way as to create a magnetic field opposing the change; to do this in a conductor, electrons swirl in a plane perpendicular to the magnetic field, because of the tendency of eddy currents to oppose the cause by which it is produced and the energy is to be lost in the form of heat. The eddy current braking can be used in automobiles, railways, aircrafts, heavy vehicles and high speed machines. [15-19].

III. MODEL DEVELOPMENT OF EDDY CURRENT CONTROLLED AABS

Proposed eddy current controlled aircraft arrester barrier system (AABS) has been developed and implemented in the Electrical Machine Lab of Jamia Millia Islamia, New Delhi as shown in Fig.7 and experimentation is going on.

The developed model consisting of the followings parts: 1. Eddy Current EAS, 2. Net Assembly with stanchion system, 3. Runway

path, 4. Net Retrieval System, 5. Aircraft Model, 6. Control Panel

1.Eddy Current EAS: Eddy current Energy Absorbing System (EAS) is the main part of the aircraft arrester barrier system. It consist of electromagnet with sensor, an dc motor which are coupled and connected to the control panel as shown in Fig.2

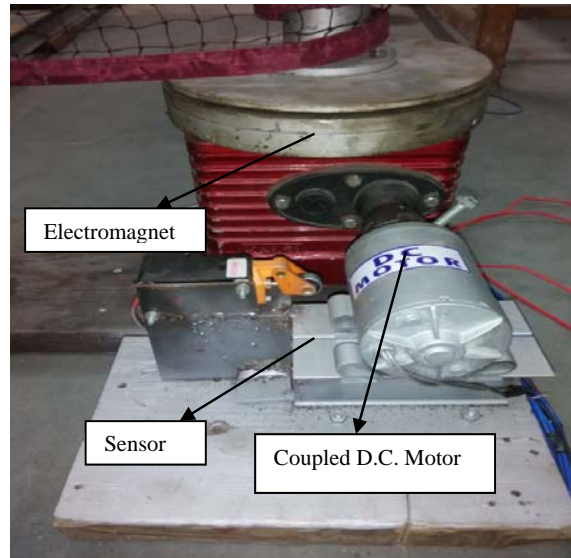


Fig.2 Eddy Current EAS

This system is controlled by eddy currents. The eddy current is produced by electromagnets through excitation which is controlled by the input voltage applied to the electromagnet. Input voltage is controlled as per the speed of the aircraft.

2.Net Assembly with stanchion system: the net assembly and the stanchion system is used to engaged the aircraft on the runway to stop. Development of this system we have taken a net and this net is bound on the pole which is mounted on the Eddy current EAS. the poles are worked as a stanchion system and remain in standing position to give the support to the net as shown in Fig.3.

3.Runway Path: For this proposed model we have made the runway of the aircraft by using angle iron rods in parallel for smooth running of the aircraft. The parallel iron rods are separated by wood boxes. This runway is used to speed up the aircraft as shown in Fig.3.



Fig. Iron Rod assembly with Stanchion Poles

4. Net Retrieval System: The net retrieval system is used to bind up the net in its initial position. The purpose of tape retrieval system (Fig.4) is to provide electric drive to a vertical pole, through a net tape. This is done to rotate a pole which is also mounted on the same vertical shaft. Rotation of the tape pole is required to wound a tape on it. This action is called retrieval of net and hence this assembly has been named as net retrieval system.



Fig.4 Net Retrieval System

5. Aircraft Model: Aircraft model (Fig.5) is consisting of an motor engine which rated speed is 4000 rpm. The aircraft motor runs on D.C.



Fig.5 Aircraft Model

6. Control Panel: The control panel (Fig.6) consisting of display of all the measuring instruments. The speed of aircraft and the voltage supply to the electromagnet to produce eddy current is controlled through the switches mounted on the control panel. The mains supply is given to the control panel. The AC and DC supply can be controlled by this panel which given to the electromagnets.



Fig.6 Control Panel

IV. CONCLUSION

The energy absorbing system (EAS) of aircraft arrester barrier system (AABS) is very important

and critical part. If this system fails than whole system is collapsed. So, we have developed and implemented an eddy current controlled aircraft arrester barrier system to make it more controllable & strengthen this system. This model can overcome the drawbacks of conventional aircraft arrester barrier system. When aircraft runs at 4000 rpm and engaged in the net then by applying eddy current braking through electromagnet, it stops at a distance of 3 feet from the point of engagement within 2 seconds.

This developed model is having high braking and can slow down and stop any Aircraft within the prescribed runway limit. The design engineer can develop the actual system for the real environment by this model.

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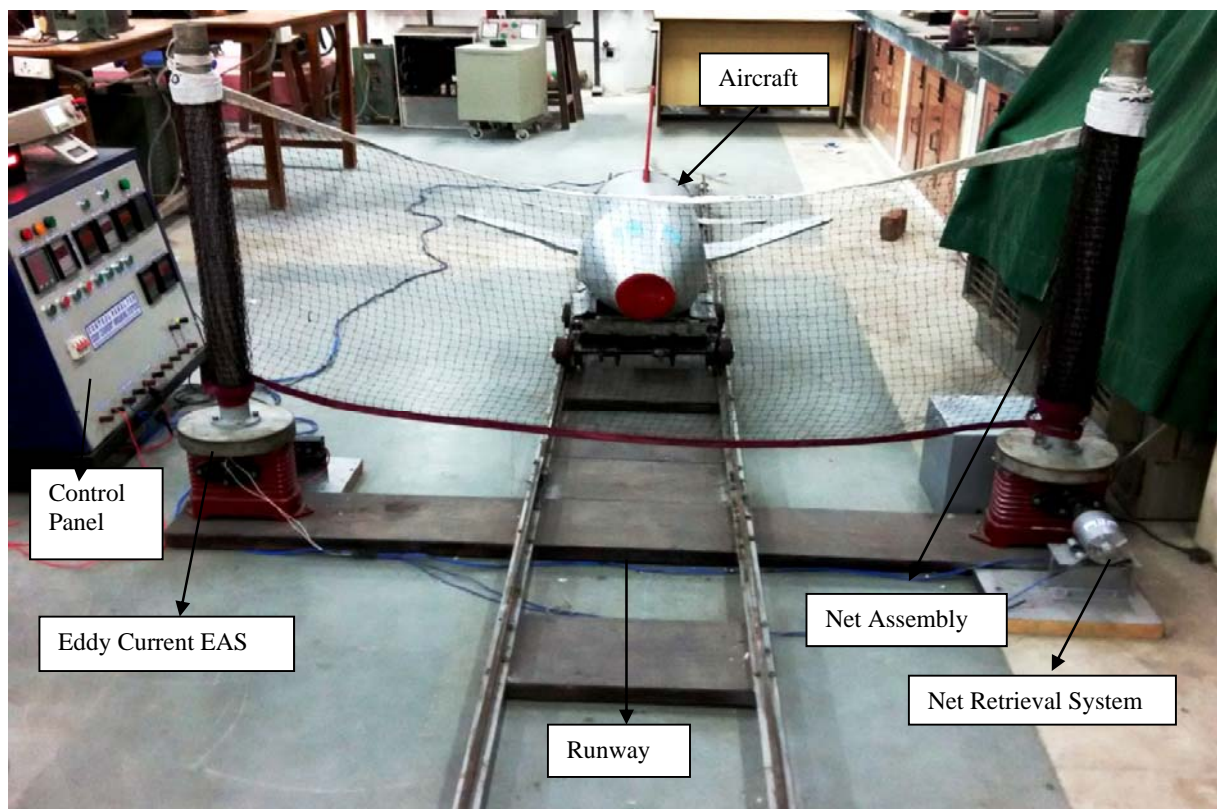


Fig.7 Eddy Current Controlled Aircraft Arrestor Barrier System