LAST CHANCE SURVIVAL SYSTEM

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ABSTRACT

LCS System is nothing but LAST CHANCE OF SURVIVAL System. The main aim of this system is to rescue the people on board of crashing aircraft if nothing works out. It can be deployed only once in a life span of the aircraft as it dismantle the crashing plane to bring the passengers to the safety. When an aircraft fail to operate in midair there is always a probability of losing all the passengers .Here people in the aircraft are killed not in midair, as they lose their life during crash landing because of mainly impact from the high velocity fall, ignition of fuel which vaporizes the whole aircraft and the people who are on board. There is also a probability that the aircraft will fall on the heavily populated area and causes heavy causality. To avoid all these drastic events we introduce LCS System.

KEYWORDS

Aircraft, Reaction Control system [1], Vernier Thrusters [1], Parachutes, Airbags, Control unit, Sensors and radars

1. INTRODUCTION

LCS system mainly rely on structural integrity of the aircraft, parachutes, jet thrusters and sensors and control system. As mentioned above the LCS system can only be employed once in a life time of the aircraft .LCS System should only be used below the altitude of 1000m. LCS system is controlled by separate set of electronics and control system apart from regular flight electronic system .Altitude detector, Jet thrusters and heavy duty parachute are the main components of this system .By activating LCS system, the wings and fins of the plane are jointed with explosive bolts which produce minor explosion to remove wings and fins along with fuel to produce free fall .The velocity and altitude of the plane is constantly monitored by the control system. When the aircraft reaches the altitude of 700m the control system deploys the primary parachute which is attached to fin section of the aircraft, this decelerates the velocity of free fall. If it is not enough, the system fires jet thrusters which are incorporated with the fuselage of the aircraft, firing pattern of the thrusters are controlled by the system in a systematic order to reduce the free felling velocity. When aircraft reaches the altitude of 150m system fires the bottom thrusters and parachute from the top of the fuselage to make the plane upright. After reaching altitude of 50m bottom thrusters are continuously fired to bring the aircraft to rest

2. LITERATURE SURVEY

2.1 Air India Express Flight 812 (case study)[2]

Air India Express Flight 812 overshot the runway on landing, fell over a cliff, and burst into flames. Out of 160 passengers and six crew members on board, only eight passengers survived. The accident involved a Boeing 737-800 aircraft, which was commanded by Captain Zlakto Glusica and Ahluwalia. After touching down on the 8088 foot (2448m) runway 24, the plane overran and crashed down the hill at its far end. The pilot reported to air traffic control that it was established on an Instrument Landing System approach about 4.3 miles from touchdown; landing clearance was given at 2000 feet from touchdown. The aircraft concluded it ILS approach on runway, leaving 2800 feet in which to stop. It overran the runway and ploughed through a 90metre sand arrestor bed which did not stop it. The wings of the aircraft collided with the concrete socket of the ILS localizer antenna; it finally plunged over the edge of the table-top about 790 feet beyond the end of the runway and down the steep hillside coming to a stop 660 to 980 feet past the top of the slope. Due to the impact the plane broke into two and the aircraft was engulfed in fire killing all the members on board of the plane

2.2 Air India Flight 855 (case study)[3]

In January 1, 1978 Air India Flight 855 was crashed on Arabian Sea, near Bombay, India killing all persons on board of the aircraft. The reason of the crash was found to be instrumentation malfunction resulting to spatial disorientation of the pilots. The altitude meter was found to be malfunctioning while conducting the investigation. Due to the inaccurate altitude and careless attitude from the pilot the plane crashed into the Arabian sea. All the crew members and the passengers were killed in this deadly disaster.

2.3 Charkhi Dadri mid-air collision (case study)[4]

The Charkhi Dadri mid-air collision occurred on 12 November 1996 over the village of Charkhi Dadri, to the west of New Delhi, India. The aircraft involved were a Saudi Arabian Airlines Boeing 747-100B returning from Delhi to Dhahran, Saudi Arabia, and a Kazakhstan Airlines Ilyushin Il-76 returning from Chimkent, Kazakhstan, to Delhi. The crash killed all 349 people on board both planes, making it the world's deadliest mid-air collision the deadliest aviation accident to occur in India

The Saudi Arabian Airlines Boeing 747-168B, registration HZ-AIH, was due to operate the first leg of a scheduled international Delhi–Dhahran –Jeddah passenger service as Flight 763 (SVA763) with 312 occupants on board; the Kazakhstan Airlines Ilyushin Il-76TD, registration UN-76435, was on a charter service from Chimkent to Delhi as KZA1907. SVA763 departed Delhi at 18:32 local time. KZA1907 was, at the same time, descending to land at Delhi. Both flights were controlled by approach controller VK Dutta. The crew of SVA763 consisted of Captain Khalid Al Shubaily, First Officer Nazir Khan, and Flight Engineer Edris. On KZA1907, Gennadi Cherepanov served as the pilot and Egor Repp served as the radio operator. KZA1907 was cleared to descend to 15,000 feet (4,600 m) when it was 74 nautical miles (137 km) from the beacon of the destination airport while SVA763, travelling on the same airway as KZA1907 but in the opposite direction, was cleared to climb to 14,000 feet (4,300 m). About eight minutes later, around 18:40, KZA1907 reported having reached its assigned altitude of 15,000 feet (4,600 m) but it was actually lower, at 14,500 feet (4,400 m), and still descending. At this time, Dutta advised the flight, "Identified traffic 12 o'clock, reciprocal Saudia Boeing 747, 10 nautical miles (19 km). Report in sight." When the controller called KZA1907 again, he received no reply. He warned of the other flight's distance, but it was too late. The two aircraft had collided, the tail of KZA1907 cut through SVA763's left wing and horizontal stabiliser. The crippled Boeing quickly lost control and went into a rapidly descending spiral motion toward the ground with fire trailing from the wing. The Boeing broke up in the air under the stresses before the wreckage hit the ground at almost 1,135 km/h (705 mph).

2. Existing System[5]

The World Bank has published the reliable data of the frequency of passengers carried by Air Transport in the Year 2012 obtained from the International Civil Aviation Organization (ICAO). The United States of America has the largest number of Commercial Air Transport Passengers. 756,617,000 cf. China the next largest with 318,475,924. The United States had an International Flight frequency of 9,560,451 in 2012. The Civil Aviation Authority, JAR and EASA have published that there is a fatal accident ratio of one per million flights. The main cause is Pilot in Command error

Another aspect of safety is protection from attack currently known as Security (as the ISO definition of safety encompasses non-intentional (safety_safety) and intentional (safety_security) causes of harm or property damage). The terrorist attacks of 2001 are not counted as accidents. However, even if they were counted as accidents they would have added about 2 deaths per 2,000,000,000 person-miles. Two months later, American Airlines Flight 587 crashed in New York City, killing 256 people including 5 on the ground, causing 2001 to show a very high fatality rate. Even so, the rate that year including the attacks (estimated here to be about 4 deaths per 1,000,000,000 person-miles), is safe compared to some other forms of transport when measured by distance traveled.

One of the first navigation aids to be introduced (in the USA in the late 1920s) was airfield lighting to assist pilots to make landings in poor weather or after dark. The Precision Approach Path Indicator was developed from this in the 1930s, indicating to the pilot the angle of descent to the airfield. This later became adopted internationally through the standards of the International Civil Aviation Organization (ICAO).

landing aid for civil aviation in the form of ground-controlled approach (GCA) systems, joined in 1948 by distance measuring equipment (DME), and in the 1950s by airport surveillance radar as an aid to air traffic control. VHF omnidirectional range (VOR) stations became the predominant means of route navigation during the 1960s, superseding the low frequency radio ranges and the non-directional beacon (NDB). The ground based VOR stations were often co-located with DME transmitters. With the proper receiving equipment in the aircraft, pilots could know their radials in degrees to/from the VOR station, as well as the slant range distance.[3]

Ground-based navigation aids are being supplanted by satellite-based aids like Global Positioning System (GPS), which make it possible for pilots to know their position with great precision anywhere in the world. With the arrival of Wide Area Augmentation System (WAAS), Satellite navigation has become accurate enough for vertical (altitude) as well as horizontal use, and is being used increasingly for instrument approaches as well as en-route navigation. However, because the GPS constellation is a single point of failure, on-board Inertial Navigation System (INS) or ground-based navigation aids are still required for backup.

3. Proposed system

Safety norms employed already are for the smooth operation of the aircraft and there is no dedicated system for saving the life of passengers while an accident occurs. By LCS System we provide an alternate way that ensures safety of life. LCS is an efficient mechanism which can be proposed in the current system, so that we can overcome lapse of safety system. LCS system consist of parachutes, reaction control system, Vernier thruster, airbags, sensors and radars, control system. With this we aim to save the lives of all the passengers as well as the crew members. This system uses components which are already developed or implemented so the risk of failure is much less. When the aircraft equipped with this undergo a crash or equipment malfunction on air, the pilot can activate the system, where the system checks the fuel level on the wings , atmospheric condition and the altitude of the aircraft and the velocity of its descent and employ the methods of survival according to this.

In 5 conditions LCS system can be employed.

They are,

3.1 Case 1- Engine failure

this is the most dangerous and uncommon things to be happen during a flight. The obvious reason behind this is mechanical failure, debris falling into the jet engines. When a aircraft continues its flight with a single engine (in case of dual engine aircraft) the chance of failure of this engine is also high. But the pilots are forced to fly like this because to avoid losing altitude, momentum and control over the flight. Severe turbulence can also cause the failure of the engine. When the both engine fails pilot has no other option other than crash landing. The pilot can navigate the plane safely by controlling the fins and wings. Pilots are advised to dumb the fuel in order to reduce the weight of the aircraft and to prevent the fire while crash landing. If the aircraft reaches runway and pilot is not able to control the velocity of the descent the pilot can activate the LCS system. The thrusters incorporated on the hulls of the plane is fired manually to reduce the velocity of plane . After touching down the runway the brakes are engaged along with the thrusters and parachutes are deployed if necessary to bring the aircraft to rest

3.2 Case 2 - Crash on Landings

From the case study of Air India Express Flight 812 it is clear that crashes happen while attempt to land. By implementing the LCS system this can be avoided. The LCS System act like the following in this situation. If the aircraft does not stop after landing and continues to move towards the end of runway the pilot are advised to implement and take the control the LCS system manually without attempting to take off. Through the control system they can fire the backward thrusters which is incorporated into the hull of the aircraft. If necessary they can also deploy the parachutes which is attached to the tail section of aircraft. The thrusters, brakes and parachutes act as stopping agent and bring the aircraft to safety.

3.3 Case 3 - Engine stall and Engine fire

Fire on single or both engine is worst case scenario every aviators dreamt off. The pilot has left with no option other than to cut the power to the engine. The aircraft simply slides over the air due to aerodynamics and still the pilot can control movement of the craft with hydraulics and flaps. Pilot can execute the steps which is followed in the case of engine failure to bring the aircraft to safety

3.4 Case 4 - Total Flight System Failure

In this situation the craft has no control and all the flight system are dead due to short circuit etc and it is like a dead weight in an aircraft. Here the LCS system is powered separately and it does not have any dependency with flight electronics it can be executed in auto mode. When the system has been activated the LCS system read the output from the speedometer and radar altimeter. The system then calculate estimate the flight path according to the output from the altimeter, sensors and speedometer. Taking this flight path as the basics the system start to fire thrusters to decrease the velocity of descent. Before firing the thruster the aviation fuel in the wing is dumbed to avoid catching fire. System continuously moniters the altitude and velocity and changes the intensity and firing order of the thruster according to this. The landing gears can be brought down by opening the enclosure which also help to reduce velocity. System tries to attempt for smooth landing if it is possible as in the case of engine failure. If it is not possible it goes for crash landing procedure. If the aircraft is going to crash in terrains like forest, marshy areas, snow filled areas, deserts etc. except in water, At touch down the system fires the explosive joints (which is used in the fighter jets to eject the canopy if plane goes down) which is used to joints the wings of planes. This avoid the chance of catching fire. The backward thrusters and parachutes are fired at maximum rate to bring the aircraft to stall. If the plane lands on water surface like lakes, seas and oceans. The sensors detect the presence of water and system inflates the airbags which is fitted under the fuselage and below the wings at instant and holds the plane above the water surface and the system also sends distress signals to all available means if any type of disaster strikes.

3.5 Case 5 - Midair collisions

In disaster like this as in the case of Chakhri Dadri midair collision, there is always a chance of losing the wings, engines and even shattering of aircraft into pieces. If the fuselage remains in one piece and LCS system is working after the large impact piece by engaging the LCS system there is a chance of survival. The system fire the explosives bolts and loses its broken wings and fins in air itself and undergoes a free fall. The system ejects the parachute from the tail end and fires the thrusters in forward position in order to reduce the velocity of free fall. System monitors the velocity and altitude and fires the thrusters in necessary order. When the distance between aircraft and ground reaches below 200m the thrusters below the fuselage are fired to bring the aircraft into upright position and when the aircraft comes in upright position the parachutes at tail end is ejected and parachutes is deployed from the top of the fuselage. The bottom thrusters are fired continuously to decrease the velocity and to reduce the impact velocity. Thrusters are shut down when the distance reduce up to 10m to avoid spinning of fuselage. The passengers can be brought to safety by this method when midair collision take place.

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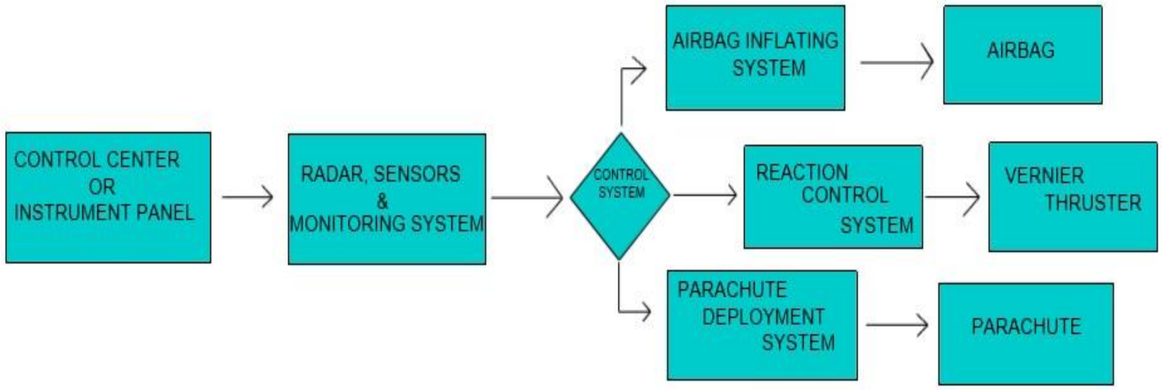
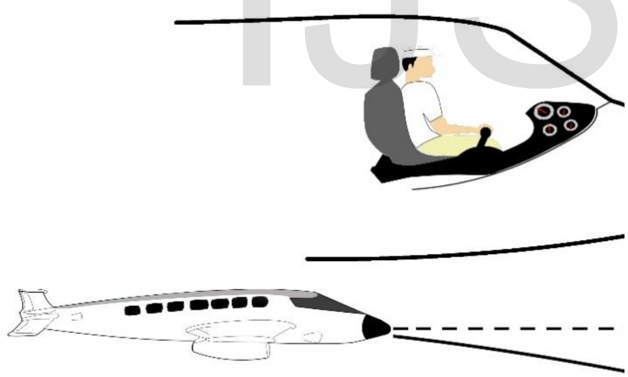
Block Diagram of LCS System



PICTORIAL REPRESENTATION

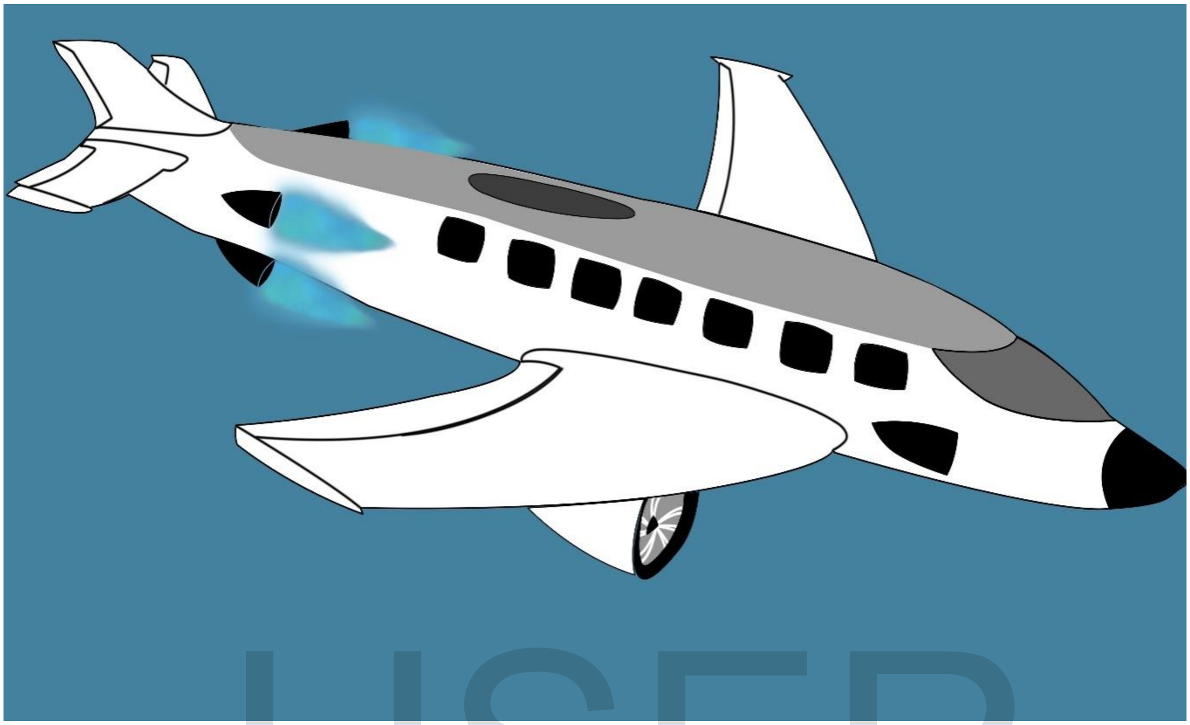
INTIATION 01



1. The picture consist 0f pilot console and LCS switch .The function is as follows, the pilot activates LCS switch in case of emergency and the process is done after ensuring the power supply to the engine is being shut down completely, followed by activation of LCS switch

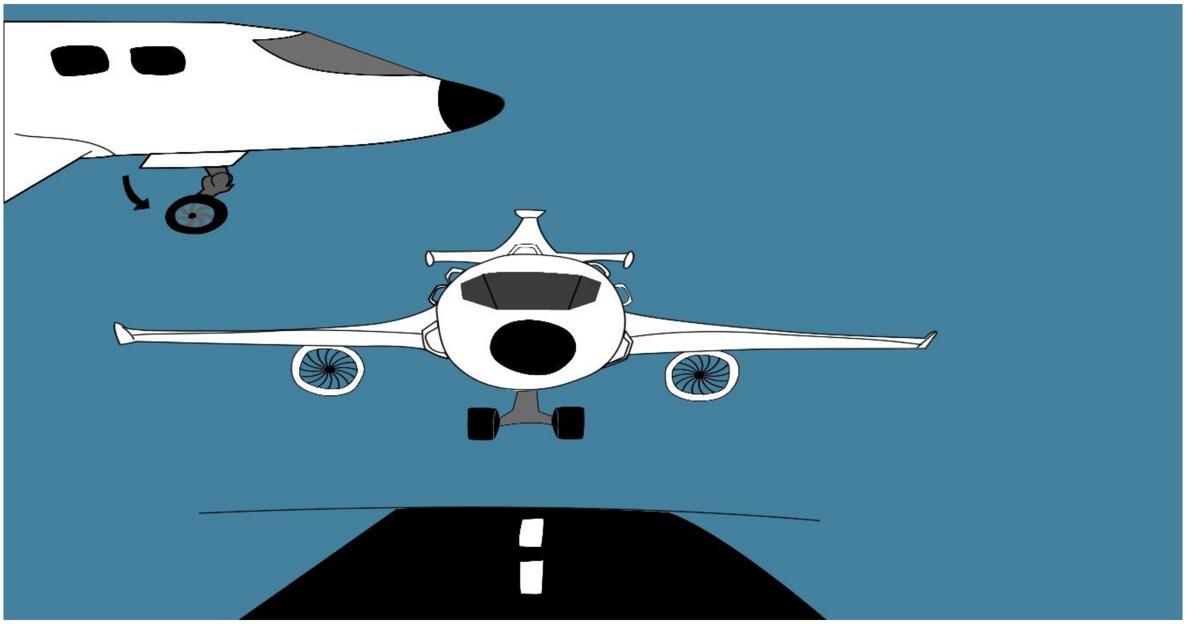
2. Expected motion of the aircraft is been represented by dotted lines. Actual trajectory of aircraft is represented by continuous lines.

INTIATION 02



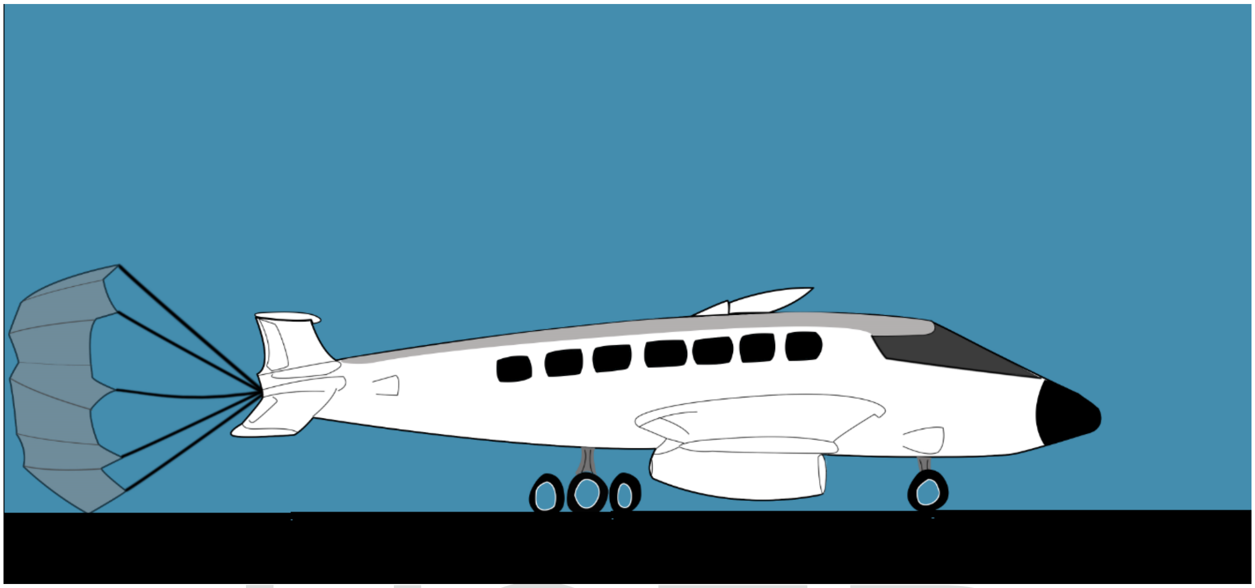
This picture represents the function of thrusters during LCS system. The LCS system activation and the firing of thrusters are co related, which means the thrusters fire only when the LCS system is activated. It's done in order to reduce the velocity.

INITIATION 03



This picture represents the crucial part of LCS system. The landing of the damaged aircraft is constantly monitored and controlled by reaction control system. The land gear gets deployed after reaching a specific altitude. This entire system is constantly monitored by LCS system to ensure safe landing.

INTIATION 04



Here comes the final and the crucial stage of the LCS system. System deploys landing gear at specific altitude. At the touch down point the reverse thrusters are fired as well as the parachutes are deployed to bring the aircraft to the static position

Conclusion

As we know in an aircraft crash the chance of the survival rate is very poor. So we introduce LCS system to avoid such drastic events to happen again in future and it also help to reduce the loss of human life and infrastructure. By implementing the LCS system the life can be saved to extent.

Future Enhancement

The future enhancement for this system is limitless. There are many area to be further improved. They are

1. This system should be applied to all aircraft.
2. The implementation of this system in big airliners like Airbus A380 need further research and development.
3. The airline company and aviation authority should regularly check and maintain the aircraft into an optimum level.

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