International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395 -0056
Volume: 04 Issue: 06 | June-2017 www.irjet.net p-ISSN: 2395-0072

Disaster Risk Reduction: A Case Study on Missing Aircrafts and Damage of Bridges due to Flood

Priya Menon K[1], Deepa V[2], Kala L[3]

[1,2]*M Tech Student, Dept. of ECE, NSS College of Engineering, Palakkad, Kerala, India*
[3]*Associate Professor, HOD, Dept. of ECE, NSS College of Engineering, Palakkad, Kerala, India*

Abstract - *The purpose of this study is twofold: to create awareness about the recent aviation tragedies in Indian Air Force including the causes of accidents and the problem of identification of missing aircrafts and to create a knowledge base on Bridge damages due to flood in different parts of the region with diverse climatic and socioeconomic conditions in order to understand existing flood risk management mechanisms, including policies and institutional mechanisms, and increase awareness among people. Here we discuss the recent missing of Indian Air Force aircraft AN-32 and fighter jet Sukhoi SU-30, the collapse of the Mahad bridge in Mumbai-Goa highway linking Mahad and Poladpur over the Savitri River in Ragad district in Konkan due to floods caused by torrential rainfall. The paper concludes by providing a countermeasure for the two cases.*

Key Words*: *Aviation tragedies, AN-32, Sukhoi SU-30, Bridge damages due to flood, Torrential rainfall

1. INTRODUCTION

This paper highlights the missing tragedy of IAF aircrafts AN-32 and SU-30, the collapse of the Mahad Bridge in Mumbai-Goa highway. Aviation is considered a high risk industry, not because of the likelihood of accidents; rather because of the consequences of such accidents [1]. Proper study about the reason of this missing case is needed. Generally, aviation accidents and missing occurs due to human errors, bad weather conditions and poor maintenance of aircraft.

Bridges are one of the most important elements in the transportation system, its failure or defective performance will result in serious disruption of the traffic flow. It is well known that absolute safety is the criteria in building bridges as their number of are the risks of failure associated with the bridges. Its failure will result in loss of lives and property and also will affect people. Bridges constructed over rivers, seas and waterways are vulnerable to disaster such as flooding and the tsunami, and they are facing unexpected loadings due to floods and tsunamis. Section 2 and 3 describes the case studies respectively.

2. CASE STUDY #1:

Missing tragedy of IAF AN-32 and SU-30: Aviation tragedies are common nowadays. Generally, this occurs mainly due to human errors, bad weather conditions and poor maintenance of aircraft. Proper study about the reason of this missing case is needed. Aviation hazard is any dangerous condition that leads to injury / death to people, loss of a system or damage to the environment. This can be due to natural hazards (geophysical events, severe weather events like heavy rain, snow, etc.) and technical hazards (deficiencies regarding aircraft and aircraft components, systems and related equipments) [3]. Failure of an aircraft structural component can have ruinous consequences, with resultant loss of life and the aircraft. The investigation of defects and failures in aircraft structures is, thus of vital importance in preventing further incidents.

More than 20 years ago, the three major causes of failures in the Israel Air Force were investigated [2]: maintenance (-16% of failures), manufacturing (~14%), and design (-12%). While fatigue (~34%) and overload (~23%) were the two major failure mechanisms, more than 10% of the failures were related to corrosion mechanisms. These include stress corrosion cracking, corrosion fatigue, localized corrosion, hot corrosion, uniform corrosion, etc. The IAF should ensure whether they are taking enough precautions, or should do more to prevent harm. Since the beginning of aviation, detection of missing aircraft and its subsequent location has been a serious problem.

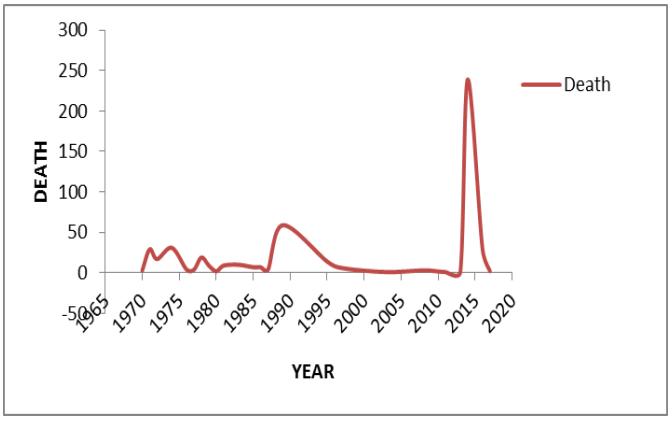

Chart-1 : Death Analysis [4]

The chart 1 shows the death analysis from 1970 to 2017 and chart 2 shows number of the missing aircraft's versus year in the world [4]. The shocking disappearance of Malaysia Airlines Flight MH370 carrying 239 passengers and crew has captured the attention of millions around the world as the search for the airplane and its passengers and crew ends with no results. Proper technology should be developed for search and rescue of passengers/flight. In the past two

decades, radar and satellite based systems for tracking planes have proliferated to the point that as soon as 2020 aviation around the entire globe will be comprehensively tracked by satellite. It would be comforting to hope that technological advances will eventually put an end to all aviation tragedies.

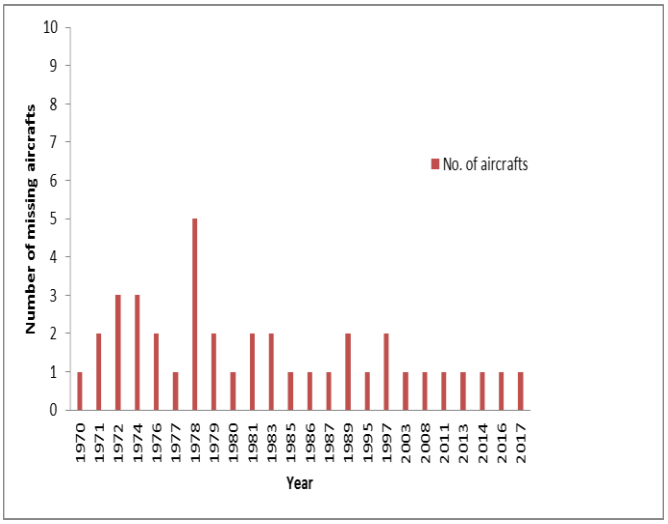

Chart-2 : Number of missing aircrafts versus year [4]

This paper highlights the missing tragedy of IAF aircrafts AN-32 and SU-30. Though AN-32 is one of the biggest mysteries to date, if we look back over the last century, there exist multiple aviation mysteries that still remain unsolved. For monitoring airspace two radar systems are used: primary and secondary. Primary radar detects and measure an estimate of the plane's position using reflected radio signals. Secondary radar relies on targets equipped with a transponder that asks for the plane's identity and altitude. This is the data sent to air traffic controllers, who monitor the airspace. While travelling over the ocean we are merely about 150 miles away from land.There is no radar coverage because oceans are incredibly vast and therefore gaps in radio coverage.

2.1 WHAT HAPPENS TO AN-32?

On 22 July 2016, An-32 a twin engine turboprop transport aircraft of the Indian Air Force disappeared while flying over the Bay of Bengal. The aircraft was en route from Tambaram Air Force Station in the city of Chennai on the western coastline of the Bay of Bengal to Port Blair in the Andaman and Nicobar Islands (Fig 1). There were 29 people on board. Radar contact with the aircraft was lost at 9:12 am, 280 kilometers (170 mi) east of Chennai. The search and rescue operation for AN-32 became India's biggest search operation for a missing plane on the sea in history.

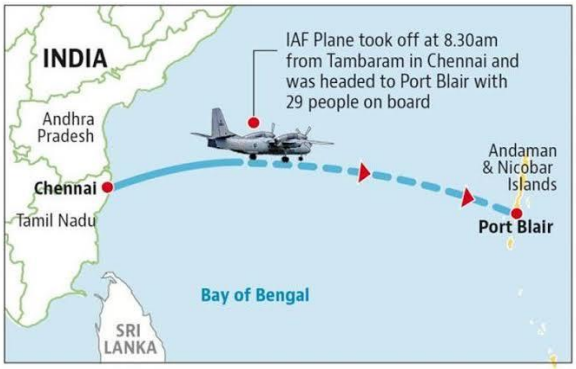

Fig-1: AN-32 Route

There were twenty nine people on board the aircraft: eleven IAF personnel, six crew members, two Indian Army soldiers, one each from the Indian Navy and Indian Coast Guard and eight defense civilians working with Naval Armament Depot (NAD). The eight civilian passengers were from Visakhapatnam in Andhra Pradesh. The Antonov An-32 took off from Tambaram Air Force Station, Chennai at 08:30 local time on 22 July 2016. It was expected to land at Port Blair around 11:45 local time[5]. The weather was overcast when the plane disappeared from the radars. The pilot had asked for a little deviation from the route to avoid multi-layered cloud before it went missing. The Indian Navy and the Indian Coast Guard launched a large search and rescue operation, using a submarine, twelve surface vessels and five aircraft. The AN-32 aircraft (shown in Fig 2) does not have the Automatic Dependent Surveillance - Broadcast. This system relies on navigational satellites to automatically transmit an aircraft's journey in real time and it can be switched on and off based on operational needs. Also the plane did not have an underground locator system, making it difficult for rescuers to pinpoint the position of the plane.

Fig-2: AN-32

Three days after the disappearance, sixteen ships, a submarine and six aircrafts were deployed to search for the missing An-32 in the Bay of Bengal about 150 nautical miles east of Chennai. On 1st August, it was confirmed that the aircraft had no underwater locator beacon. On 15th September 2016, the search and rescue mission was called

off, and all 29 people on board were presumed dead and their families were notified [5].

Fig-3: Search for AN-32 by Geological Survey of India's ship

As a result of search for the missing Indian Air Force AN-32 aircraft, a Geological Survey of India's ship (shown in Fig 3) has spotted 75 pieces of debris about 200 nautical miles off the Chennai coast. The pieces of debris are suspected to be part of the ill-fated IAF plane. The GSI said that the pieces were spotted by the camera installed on the ship, Sagar Nidhi. They suspect that the pieces might be the parts of AN-32 aircraft, which might have crashed in the sea.

2.2 WHAT HAPPENS TO SUKHOI SU-30 FIGHTER JET?

The Sukhoi Su-30 is a twinjet air superiority fighter developed for Indian Air Force by Sukhoi, Russia and built under license by HAL, India. The first of the Su-30 planes were inducted by the IAF in the late 1990s. The IAF has already lost at least seven of its 240 Sukhoi-30MKIs, which are the latest and the most potent fighters in its combat fleet.

Fig-4: Sukhoi SU-30 Fighter jet

The Su-30 jet (as shown in Fig 4) took off from the IAF Tezpur air base, located about 172 km from the India-China border in Arunachal Pradesh around 9.30 am on a routine training mission on May 23, 2017. The aircraft was on a routine training mission as part of a two aircraft formation. It lost its radar contact with ATC around 11.10 am near the Arunachal Pradesh's Doulasang area, near China border, 60 km north of Tezpur [6]. Last year, a Sukhoi-30MKI crashed near Nagaon town of Assam during a routine sortie. While the two pilots ejected safely, some locals suffered splinter injuries from the crash.

The aircraft has been found in a heavily forested area about 60 km from Tezpur in Assam. There is no word on the two pilots on board the jet so far. A Sukhoi-30, C-130 aircraft with electro-optical payload and ALH helicopters of the IAF are being utilised to retrieve the remains of the combat jet. Fig 5 shows the remains of SU-30 aircraft in a forested area as reported by the IAF [7]. On 30 May, 2017 IAF declared that pilots of SU-30 were died of injuries.

Fig-5: Remains of SU-30 in a forest area

2.3 PROPOSED SOLUTION

The proposed idea deals with replacing aircraft detection using radar and GPS technology to Hyperspectral imaging (HSI). HSI deals with dividing images into spectral bands. This wide spectrum range offers high spectral resolution for easy detection and understanding. Spectral analysis of remotely sensed images provides more accurate information even for a small target. There are numerous applications for Hyperspectral imaging such as species detection in agriculture, rare minerals in geology, biomedical uses, military, etc. Detection of aircrafts from the spectral signature of Hyperspectral images can be useful in cases like missing of aircrafts, ships, etc.

3. CASE STUDY #2:

Mahad Bridge Collpase: Mahad is considered as the Land of freedom fighters. Mahad is a city and a municipal council in Raigad district in the Indian state of Maharashtra. It has become a tourist destination because of its beautiful surroundings and pleasant climate. Mahad has a personality of its own due to its mythological, historical, social and cultural importance. In Raigad district, Mahad Taluka is the biggest one by area. Savitri River is one of the 5 rivers which originates from Mahabaleshwar in Maharashtra state in India. It originates from Mahabaleshwar and flows through the Raigad district and eventually meets the Arabian Sea at Harehareshwar. It passes through Poladpur, Mahad, Mangaon and Shrivardhan Taluks. Along the banks of river Savitri, there were lots of Shiva temples situated. In the last

100km it forms the border between Raigad and Ratnagiri. Fig 6 shows the overview of Mahad.

Fig-6: Overview of Mahad

In August 2016 a bridge on the Mumbai-Goa highway linking Mahad and Poladpur over the Savitri river collapsed in Ragad district in Konkan due to floods caused by torrential rainfall [9]. In this paper attempts has been made to understand the structure and framework of Disaster Management system in India and to identify its strength and weakness through the case study of Mahad bridge collapse due to Flood, 2015 for assessing the performance of the system while dealing with disasters in India. Fig 7 shows the collapsed bridge [10].

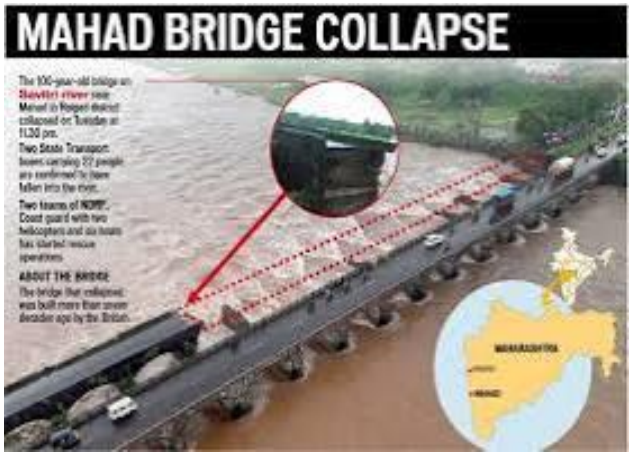

Fig-7: The collapsed bridge

3.1 RESCUE, RELIEF AND ASSISTANCE:

Two buses were washed away in the Savitri River near Mahad after the British-era bridge collapsed on 2 August 2016. The Indian Navy team comprising personnel specializing in diving have been searching for the wreckage and survivors since the morning of 4 August [8]. The effort was in response to a request received from the state government for undertaking a search along the river for survivors and bodies. So far, 26 bodies have been recovered after two State Transport buses and some other vehicles fell in the river following the bridge collapse on Mumbai-Goa Highway near Mahad in Raigad .

The bridge collapsed around midnight on Tuesday, so that the vehicles were unable to see the missing section in the dark. Two Maharashtra State Road Transport Corporation (MSRTC) buses were among the vehicles, carrying 17 passengers in total. Twelve of the 17 passengers were identified on Wednesday. A family of five who live in the city are among them. Even after hours of searching, the rescue teams were unable recovering anyone suspected to have been washed away. Fig 8 shows the search and rescue operations The three teams of the National Disaster Response Force (NDRF), two helicopters each from the Navy and the Indian Coast Guard along with local river rafting teams were carrying out the search and rescue operation. Locals, however, found the bodies of two men 8 km downstream from the site of the collapse.

Fig-8: Search and Rescue operations

National Highway Authority of India's branch at Konkan is extremely short-staffed to be able to carry a thorough inspection of all such properties in the state. The inclement weather made the operations harder. Around 80 rescuers and divers are at the spot. Rescuers could be seen

fighting strong currents in inflatable dinghies. The air force, navy and coast guard have sent two aircraft and a Chetak helicopter to survey the river [11].

The bridge had trees growing on it. There is no official estimate of the number of people who may have been washed away as the bridge collapsed at 11.30 pm on Tuesday. But authorities confirmed that at least two state transport buses with 22 passengers and another 8 vehicles were there on the bridge at the time of the collapse. The Coast Guard and the Indian Air Force (IAF) on Wednesday deployed choppers for the search operation. The force of the river also makes it tough for rescue boats to scour the area. Experts said that it is likely that the victims and vehicles were washed into the sea. There are 36 bridges in Raigad district on Mumbai Konkan and Goa national highway.

3.2 PROPOSED SOLUTION

Even if this is not the first time, that an incident of bridge collapse due to the flood had become a great reason for the loss of lives. Apart from this many bridges has been damaged due to floods in various parts of the world. So in order to solve these problems an Early Warning System is designed to inform people about the failure of the bridge. Therefore, based on the currently used video surveillance systems and image processing methods, an easy method to automatically monitor the flood object of a specific area is used to obtain instant flooding and waterlogging event feedback. This helps to provide an early warning message and create awareness among people. And the warning is issued to the people through a Mobile App developed using Android and Java.

4. CONCLUSION

Loss of lives due to recent accident was discussed in this paper. Both missing aircraft tragedies and bridge damages are taken into account. Technology should be advanced such that these accidents can be avoided and Search and Rescue technology can be improved. HSI plays a vital role in detection of missing aircraft from Hyperspectral images. Bridges collapsed due to heavy rainfall and loss of lives due to this can be controlled and avoided by the above method.

REFERENCES

[1] Wayne L. Martin, Patrick S. Murray, Paul R. Bates, “P11 the Effects of Startle on Pilots During Critical Events: A Case Study Analysis”.
[2] Noam Eliaz and Ronald M. Latanision, “Preventative maintenance and failure analysis of aircraft components”, Vol.25, Nos. 1-2, 2007.
[3] S. J. Findlay and N. D. Harrison, “Why Aircraft Fail” , Elsevier Science, November 2002.
[4] List of missing aircraft- Wikipedia https://en.wikipedia.org/wiki/List_of_missing_aircraft
[5]In Hunt for missing AN 32 plane, ship detects underwater objects- NDTV News http://www.ndtv.com/india-news/in-hunt-for-missing an-32-plane-underwater-objects-suspected-to-be-debris 1446852
[6] http://www.ndtv.com/india-news/wreckage-of-indian-sukhoi-jet-that-went-missing-near-china-border-found-1704167
[7] http://www.firstpost.com/india/missing-iaf-flight-an-32-found-gsi-vessel-rv-samudra-ratnakar-finds-possible-debris-off-chennai-coast-2969450.html
[8] The Indian Express,New Delhi updated August 11,20168:07 pm
[9] Disasters Update, www.nidm.gov.in
[10] Bridges – Analysis, Design, Structural Health Monitoring & Design; Mufti, Bakht, & Jaeger, 2nd Ed, 2015, Springer
[11]http://www.firstpost.com/india/mahad-bridge-collapse Indias-developmental-priorities-are skewed-and-wrong-2934338.html

BIOGRAPHIES

Priya Menon K [1] received the B. Tech. Degree in Electronics and Communication Engineering From Mahatma Gandhi University, Kottaym, Kerala, India in 2015.
She is currently doing M. Tech in Communication Engineering, Dept. of ECE at NSS College of Engineering, Palakkad, Kerala, India.

Deepa V [2] received the B. Tech. Degree in Electronics and Communication Engineering From Mahatma Gandhi University, Kottaym, Kerala, India in 2014.
She is currently doing M. Tech in Communication Engineering, Dept. of ECE at NSS College of Engineering, Palakkad, Kerala, India

Kala L[3] is working as Associate Professor, HOD, Dept. of ECE , NSS College of Engineering, Palakkad, Kerala, India.