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Autonomous Emergency Landing for Fixed-Wing Aircraft with Energy Constrained Closed-Loop Prediction

Samuel Deal, Hayden Nichols, *Anirban Mazumdar*

G. W. Woodruff School of Mechanical Engineering

Daniel Guggenheim School of Aerospace Engineering (Courtesy)

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Loss of Thrust Incidents Remain Prevalent and Dangerous

- Complete loss of thrust can result from bird strikes, mechanical failures, or fuel exhaustion.
- Gliding flight situations are dangerous and require rapid decision-making.
- Pilot must consider aircraft energy, runway locations, max/min landing speed, and danger to individuals on the ground.
- These situations may become more challenging with unmanned aircraft.

Image courtesy of Wikipedia

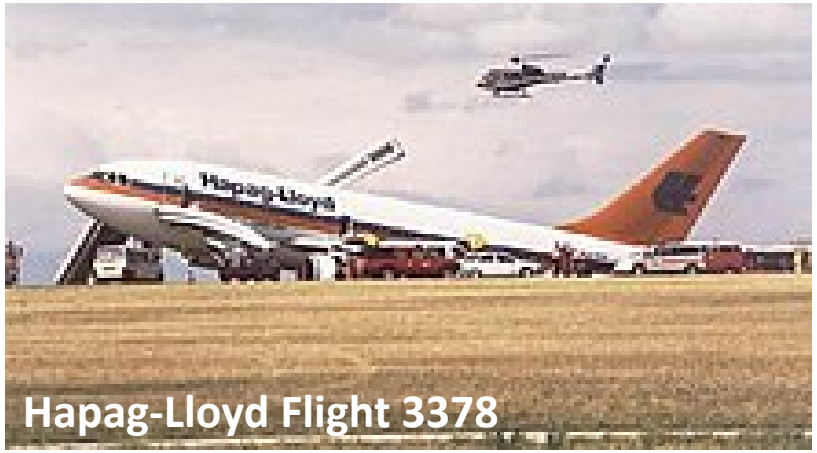


Image courtesy of Wikipedia

Commercial Aircraft requiring gliding since 2010

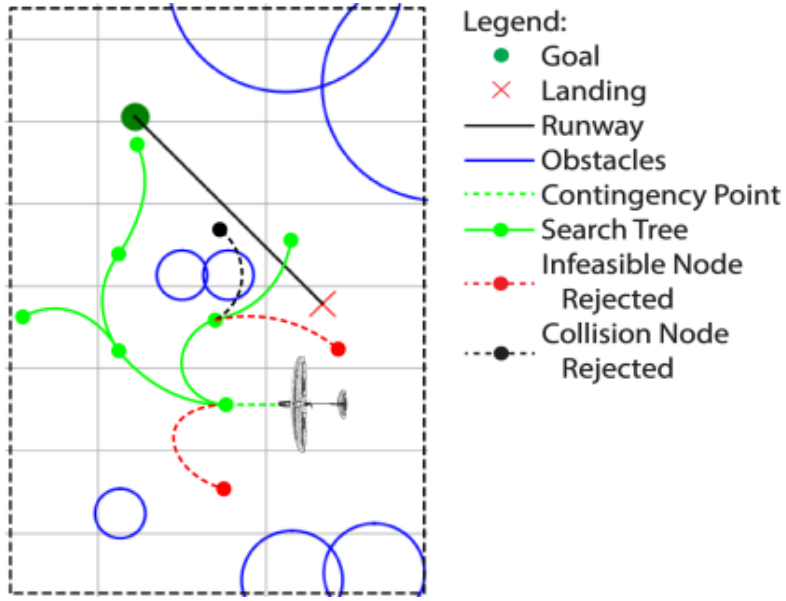
Date	Flight	Aircraft	Location	Cause	Result	Total fatalities	Occupants
22 May 2020	Pakistan International Airlines Flight 8303	Airbus A320-214	Model Colony, Karachi	Dual engine failure after belly landing and go-around, loss of engine oil	Crashed into buildings on approach, 97 on board were killed and one person on the ground was also killed.[18]	98	99
15 August 2019	Ural Airlines Flight 178	Airbus A321	Near Zhukovsky International Airport, Moscow, Russia	Complete dual engine failure due to bird strikes	Occurred moments after takeoff from Zhukovsky International Airport. Aircraft glided & successfully landed in corn field.	0	233
28 November 2016	LaMia Flight 2933	Avro RJ85	Near Medellín, Colombia	Fuel exhaustion	Took off with insufficient fuel reserves, crashed about 10 nmi (19 km) short of destination after short holding delay.	71	77
4 February 2015	TransAsia Airways Flight 235	ATR 72-600	Keelung River, Taipei, Taiwan	One engine autofeathered due to fault in its control module; pilots shut down wrong engine.	Crashed into Keelung River three minutes after take-off.	43	58
3 June 2012	Dana Air Flight 0992	McDonnell Douglas MD-83	Iju-Ishaga, Lagos	Dual engine failure from improper maintenance of fuel lines, failure for crew to divert to alternate airport when first engine failed	Crashed during landing approach into densely populated neighborhood. All 153 on board were killed and an additional six on the ground were killed.[17]	159	153
13 October 2011	Airlines PNG Flight 1600	De Havilland Canada Dash 8-103	Near Madang, Papua New Guinea	Pilot selected beta (ground braking) prop mode in flight, props oversped, engines failed	Pilots attempted an off-airport forced landing; aircraft struck trees and caught fire. Pilots, flight attendant, and one passenger survived with injuries.[16]	28	32

Image courtesy of Wikipedia

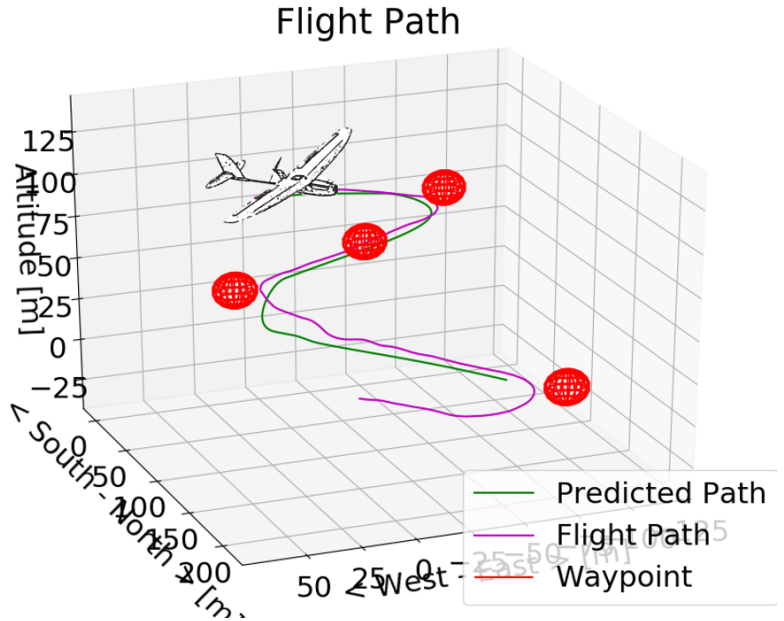
Technical Overview

Propeller disabled in flight

Examine loss of thrust emergencies for fixed-wing aircraft



Create a sampling-based 6-DoF motion planner for rapidly computing landing trajectories



Demonstrate rapid planning and emergency landing with physical experiments

Video Illustration

Acknowledgements

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