TWA FLIGHT 800 MID-AIR BREAKUP

Cause Mapping is a Root Cause Analysis method that captures basic cause-and-effect relationships supported with evidence.

CAUSE MAPPING
Problem Solving • Incident Investigation • Root Cause Analysis

Step 1 **Problem** — What's the Problem?
Step 2 **Analysis** — Why did it happen?
Step 3 **Solutions** — What will be done?

1 Problem

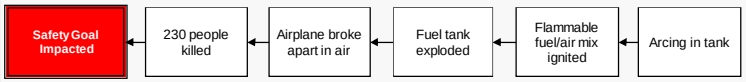
What	Problem(s)	Explosion, in-air breakup of plane
When	Date	July 17, 1996
	Time	8:31 p.m.
	Differences	Flight delayed for several hours
Where	Physical Location	Offshore at East Moriches, New York

Impact to the Goals

Safety	230 people killed (all onboard)	
Property	Plane destroyed	$11 M
		This incident
Frequency	Rare	
		Annual Total ?

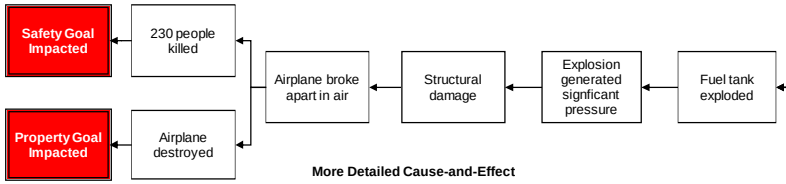
2 Analysis

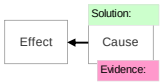
Basic Level Cause Map - Start with simple Why questions.



Basic Cause-and-Effect
230 people were killed when TWA Flight 800 broke apart in air. A fuel tank exploded when arcing in the tank ignited a flammable fuel/air mixture, causing the explosion which broke apart the plane.

More Detailed Cause Map - Add detail as information becomes available.





More Detailed Cause-and-Effect

Four things are necessary for an explosion:

Fuel: A flammable fuel/air mix was created when fuel that remained in the "empty" tank (which contained air as it was not refueled) was heated. The heating, from running the air conditioning on the ground during a 2 1/2 hour flight delay, increased the flammability of the fuel.

Oxygen: Because there was no inerting process used, oxygen was present in the fuel tank.

Ignition: It is believed that arcing from bare wires or silver-sulfide deposits, combined with a voltage surge, ignited the flammable mix. (The wires were destroyed, so it was impossible to determine the actual cause.)

Confinement: The other three elements of an explosion were confined within the fuel tank, setting the stage for disaster.

3 Solutions

No.	Cause	Action Item
1	Tank not refueled	Fill all tanks when refueling
2	Air conditioning run for 2 1/2 hours on ground	Use ground equipment for air
3	Inerting process not used	Use inerting process
4	Silver-sulfide deposits on wiring	Remove silver-sulfide deposits
5	Metal shavings remaining from repairs	Clean up thoroughly after repairs
6	Flamamble mix ignited	Prevent ignition sources
7	Wires used beyond design life	Replace wires at end of design life
8	Bare wires present	Do not allow bare wires
9	Ineffective inspections	Improve inspection criteria
10	Voltage surge into tank	Provide surge protectors
11	Short circuit in fuel quantity indication system	Provide short circuit protection
12	Inadequate separation of wires	Separate or shield wiring

For a free copy of our Root Cause Analysis Template in Microsoft Excel, used to create this page, visit our web site.