

The Deadliest Plane Crash

PROGRAM OVERVIEW

Note: This program contains graphic information about two planes that crashed into each other and the lives that were lost. Please preview it to determine its appropriateness for your classroom.



NOVA investigates what can be learned from the worst aviation accident in history—the 1977 crash on the Spanish island of Tenerife that killed 583 people.

The program:

- reviews information about the two 747 jets involved in the crash—a KLM flight from the Netherlands and a Pan Am flight out of Los Angeles, both bound for Las Palmas in the Canary Islands.
- relates how Las Palmas controllers began diverting airplanes when a bomb exploded at the airport.
- notes how both 747s were diverted to, and landed at, Los Rodeos airport on the island of Tenerife.
- recounts the personal story of three young tour guides on board the KLM jet who lived and worked in Tenerife.
- details the series of events that occurred leading up to the crash.
- provides accounts from surviving Pan Am passengers about what it felt like when their plane was hit by the departing KLM flight.
- explores the reasons for how and why the crash occurred, including why the KLM pilot took off without proper clearance.
- notes that runway incursions—when a vehicle is on the runway when it should not be—occur in the United States with surprising regularity.
- reports on air safety improvements that have been made and others that are being tested to help avoid accidents.
- concludes with remarks from survivors about how their lives have been affected by the 1977 crash.

Taping Rights: Can be used up to one year after program is recorded off the air.

BEFORE WATCHING

- 1 Have students use a world map to locate the origination and destination points in the program: Los Angeles, California, and Amsterdam, Netherlands (origination), and Las Palmas, Canary Islands (destination). Also have them find Tenerife, Canary Islands, the location to which the jets were diverted.
- 2 Have students find the distance from California to the Canary Islands and from the Netherlands to the Canary Islands. If a plane flies an average speed of 925 kilometers per hour, how much time would it take to travel to the Canary Islands from each location?
- 3 As students watch, have them collect information on the factors that contributed to the crash.

AFTER WATCHING

- 1 Have students give their initial impressions about reasons for the crash based on what they saw in the film. Which events seemed to contribute the most to the crash? Which events seemed less important? To help students more closely consider the role of each of the events leading up to the crash, have them complete the “Thinking Things Through” activity on page 2.
- 2 Fatigue can be dangerous when driving a car. Ask students to propose ways that drivers can keep themselves and others safe when driving on long trips. (*Some ways include taking breaks early and often, getting a full night’s sleep before a trip, not driving during normal sleeping times, sharing the driving, and stopping when signs of fatigue are apparent.*)

CLASSROOM ACTIVITY

Activity Summary

Students examine the contributing role of each event that led to the 1977 crash on Tenerife in the Canary Islands.

Materials for Each Team

- copy of the “Thinking Things Through” student handout
- copy of the “Events Chart” student handout

Background

On March 27, 1977, a series of events led to an air crash that resulted in the largest loss of life in the history of flight. Two 747s heading for the Canary Islands—a KLM flight from Amsterdam and a Pan Am flight from Los Angeles—were diverted to Los Rodeos airport at Tenerife when a bomb exploded at the Las Palmas airport, their original destination. After both planes landed at Tenerife, a series of circumstances led to the KLM plane crashing into the Pan Am aircraft as the KLM plane attempted takeoff.

Five hundred and eighty-three people died in the disaster. Because the crash involved American and Dutch flights on Spanish soil, multiple governments were involved in a difficult and sometimes acrimonious investigation.

According to the Dutch report, the cause of the crash was the failure of the Pan Am pilots to turn off at the appropriate taxiway and the fact that the Tenerife controllers used non-standard terminology and were listening to a soccer match while they worked. While the American and Spanish reports acknowledged that the Pan Am mistake played a role, they held that the main fault for the crash lay with the KLM crew, which took off without the proper clearance.

In this activity, students consider which events played a major role in contributing to the 1977 crash and what the underlying cause of each major event may have been.

LEARNING OBJECTIVES

Students will be able to:

- state what events contributed to the 1977 crash on Tenerife.
- identify some of the variables involved in air traffic safety.
- understand that air traffic safety relies on both technology and the people who control it.

STANDARDS CONNECTION

The “Thinking Things Through” activity aligns with the following National Science Education Standards (see books.nap.edu/html/nses/).

GRADES 9–12

Science Standard F

Science in Personal and Social Perspectives

- Natural and human-induced hazards

*Video is required
for this activity.*

Classroom Activity Author

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CLASSROOM ACTIVITY (CONT.)

Procedure

- 1 The program contains scenes that may be emotionally difficult for some students. Preview the program before having students view it and choose any sections you may want to fast-forward over while students are watching.
- 2 Organize students into teams. As students view the program, have them take notes on events that led up to the crash.
- 3 When students have finished watching, provide a copy of the student handouts to each team. Have students work in teams to review the “Events Chart” and add any other events that led to the crash which they may have listed while watching the program.
- 4 After they have completed their lists, have students categorize whether they think each event was an action (a decision made or step taken that contributed to the crash that could have been changed at the time) or a condition (a feature of the situation that may have played a role in the crash but could not have been changed at the time). After they have determined the nature of each event, have students work in their teams to list the results of each event they categorized as an “action” event.
- 5 Next have students review each action and its results and choose the top three events they think contributed to the crash. After all teams have made their choices, have each team report its choices and reasons for making them.
- 6 After all teams have reported, conduct a class poll about which three events students think were most responsible. List on the board the top three events for which the majority of the class voted. Next, have students consider the underlying causes of these three events. *(Some underlying causes might include time limit policies as a reason for adding a sense of urgency to take off as soon as possible; the nature of cockpit interactions as a reason no one challenged the KLM pilot’s decisions to let passengers off, refuel, and take off; and lack of a standard international communications protocol as a reason for miscommunications between controllers and flight crews.)*
- 7 For each event, have students recommend changes to address some of the underlying causes. Conclude with a discussion about what it would take to implement some of the proposed changes.
- 8 As an extension, have students research changes that have been made in air safety since the onset of commercial flight.

ACTIVITY ANSWER

The following chart lists some of the events that contributed to the crash. Student responses may differ. Accept all reasonable answers.

Event	Action	Condition	Result
bomb explodes at Las Palmas' Gando airport	√ *	√	Gando airport is closed
Gando controllers divert traffic to Tenerife's Los Rodeos airport	√		too many planes back up at Tenerife, blocking taxiways and making it difficult to move traffic around
Los Rodeos too small to accommodate that day's traffic		√	
Los Rodeos controllers unaccustomed to handling that day's traffic load		√	
KLM pilot lets passengers off plane	√		additional delay on taxiway while passengers are rounded up and reboarded; pilot uses extra time to refuel the plane
KLM crew decides to refuel	√		Pan Am flight can't leave because it can't get around KLM plane; additional fuel weighs plane down more, which means it takes more time to get off the ground; added fuel contributes to bigger explosion when planes collide
Los Rodeos controllers decide to backtrack planes simultaneously	√		planes are on the runway at the same time
fog rolls in		√	
Pan Am pilots not sure where to turn	√		Pan Am flight remains on runway
visibility drops to 500 meters		√	
Los Rodeos controllers let planes move without seeing them	√		planes continue preparing for takeoff
KLM pilot initiates takeoff without clearance	√		planes crash; 583 people are killed

* Some students may consider this event an action in that better security measures may have prevented the bombing. Accept either answer.

ACTIVITY ANSWER (CONT.)

Student Handout Questions

- 1 Where in the chain of events could decisions have been made that could have affected the outcome? What were some actions that could have been taken that were not? *There are many places in the chain of events where different decisions may have affected the outcome. Students may note that:*
 - the Las Palmas tower crew could have diverted planes to other airports or put them in a holding pattern, thus lessening the traffic load on Tenerife.
 - the KLM pilot could have decided not to let the passengers off the plane, thus decreasing the plane's wait time on the runway.
 - the KLM pilot could have decided not to refuel, or to take on as much fuel as he did, thus decreasing both runway wait time and the plane's final takeoff weight.
 - the Los Rodeos controllers could have decided to not backtrack the planes, or to only backtrack the planes one at a time.
 - the Pan Am flight crew could have called in for better clarification of its turn-off coordinates.
 - the Los Rodeos controllers could have halted all air traffic movement when they could no longer see the planes.
 - the KLM pilot could have waited for proper clearance before taking off or aborted the takeoff altogether.
- 2 Choose three events that your team believes contributed most to the crash. Provide reasons for your choices. *Student answers will vary.*

LINKS AND BOOKS

Links

NOVA—The Deadliest Plane Crash

www.pbs.org/nova/planecrash

Find out to what degree human error can still happen in air travel today, read a transcript of communications during the 1977 disaster, learn about safety improvements following other major air crashes, and weigh the risks of different modes of travel.

Vulnerable System: An Analysis of the Tenerife Air Disaster

www.slis.indiana.edu/faculty/arobbin/COURSES/IS47/readings/weick1990.pdf

Presents a detailed report of the 1977 Tenerife plane crash.

Books

Air Accident Investigation

by David Owen.

Motorbooks International, 2002.

Presents the major factors involved in a number of air crashes.

Aircraft Accident Analysis

by Robert Sumwalt.

McGraw-Hill Professional, 2000.

Summarizes findings from National Transportation Safety Board reports of famous air crashes.

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Google

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HHMI



Thinking Things Through

The deadliest air disaster in history occurred in 1977 at a small airport named Los Rodeos on the island of Tenerife in the Canary Islands. If the crash had a single, clear cause, it might be easy to prevent a future similar disaster. The program makes the point that many events led to the collision at Los Rodeos airport. In this activity, your team will review several causes of the crash, analyze what might have been done differently, and suggest strategies to prevent similar events from happening in the future.

Procedure

- 1 Review the notes you took while watching the program and add to the “Events Chart” any other events that you think may have contributed to the crash. After the list has been completed, read each event and determine whether it was an action or condition based on the following definitions.

action: A decision made or step taken that contributed to the crash and that could have been changed at the time.

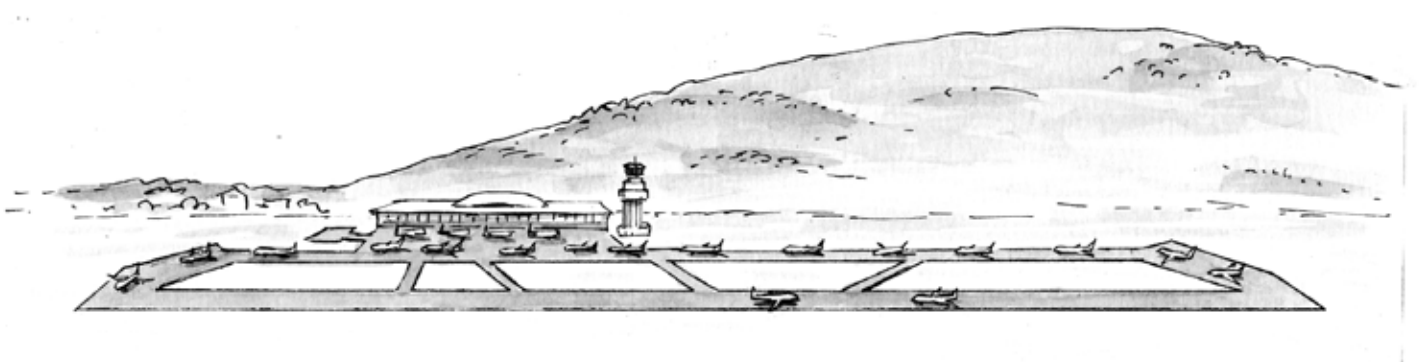
condition: A feature of the situation that may have played a role in the crash but could not have been changed at the time.

- 2 After your team has categorized each event, work together to list the results of each event you categorized as an “action” event in your chart. Then answer the questions to the right.

Questions

Write your answers on a separate sheet of paper.

- 1 Where in the chain of events could decisions have been made that could have altered the outcome? What were some actions that could have been taken that were not?
- 2 Choose three events that your team believes contributed most to the crash. Provide reasons for your choices.



Events Chart

Event	Action	Condition	Result
bomb explodes at Las Palmas' Gando airport			
Gando controllers divert traffic to Tenerife's Los Rodeos airport			
Los Rodeos too small to accommodate that day's traffic			
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KLM pilot lets passengers off plane			
KLM crew decides to refuel			
Los Rodeos controllers decide to backtrack planes simultaneously			
fog rolls in			
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