

# Searching for the SS Central America

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University of South Carolina

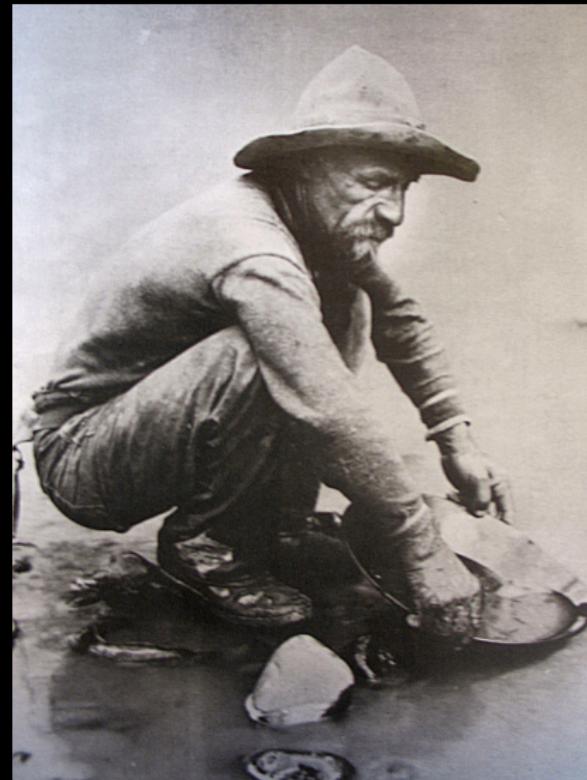




# THE CALIFORNIA GOLD RUSH

MARCH 15, 1848

- Californians, Oregonians



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A Mine of Her Own  
—Sally Zanjani

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- ▶ Latin-Americans (from Sonora and Chile mainly)
- ▶ Asian merchants (from China mostly)
- ▶ Aussies, New Zealanders, Filipinos, Turks



# THE PANIC OF 1857

## THE SINKING OF THE SS CENTRAL AMERICA



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## CHRONOLOGY OF A DISASTER

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  - SS Central America leaves Havana
- Wed, 09/09/1857
  - SS Central America runs into a storm
  - Storm develops into category II hurricane
- Fri, 09/11/1857 07:00 AM
  - SS Central America springs a leak
  - Capt. Herndon takes last celestial fix
- Sat, 09/12/1857 12:00 PM
  - Women and children taken to brig *Marine*
- 06:00 PM
  - SS Central America conveys position to schooner *El Dorado*
- 08:00 PM
  - SS Central America sinks
- Sun, 09/13/1857 08:00 AM
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SOURCE: COLUMBUS-AMERICA DISCOVERY GROUP

From each *clue* devise a scenario, and simulate a large number of possible situations.

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- ▶ Last celestial fix taken by Capt. Herndon at 7 AM on Friday was verbally shouted to C. Sherlock—first mate of the *El Dorado*—at 6 PM on Saturday.  
*31°25'N, 77°10'W*

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- ▶ Capt. Burt of the brig *Marine* recorded the position of the SS Central America at 12:45 PM on Saturday.  $31^{\circ}40'N, 76^{\circ}50'W$

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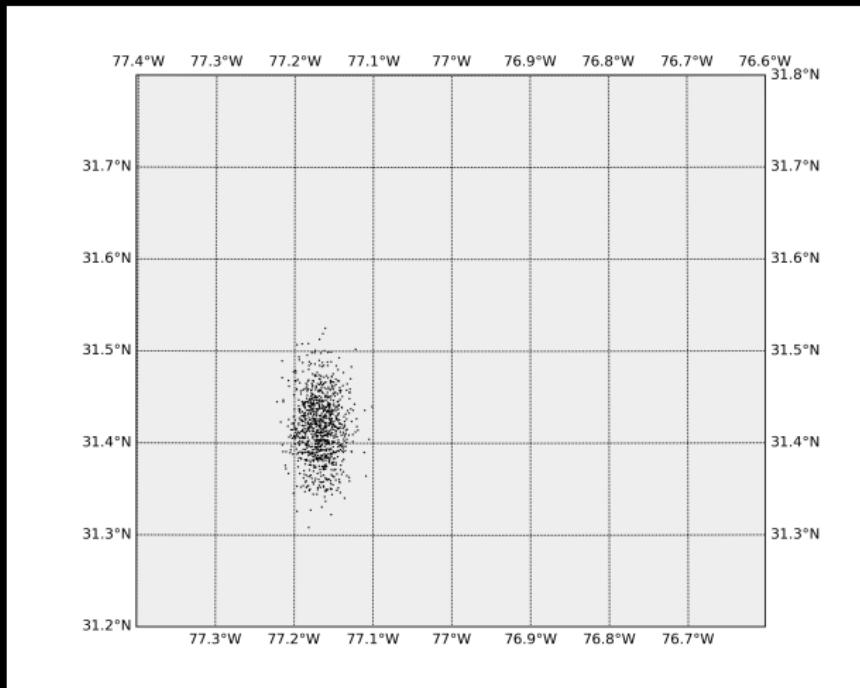
## ► Ellen Scenario

- ▶ The position of the *Ellen* at 8 AM on Sunday was  $31^{\circ}55'N, 76^{\circ}13'W$
- ▶ Apply a *reverse drift* to the position of the rescued survivors to model trajectory.

# SEARCHING FOR THE SS CENTRAL AMERICA

## SIMULATIONS—CENTRAL AMERICA SCENARIO

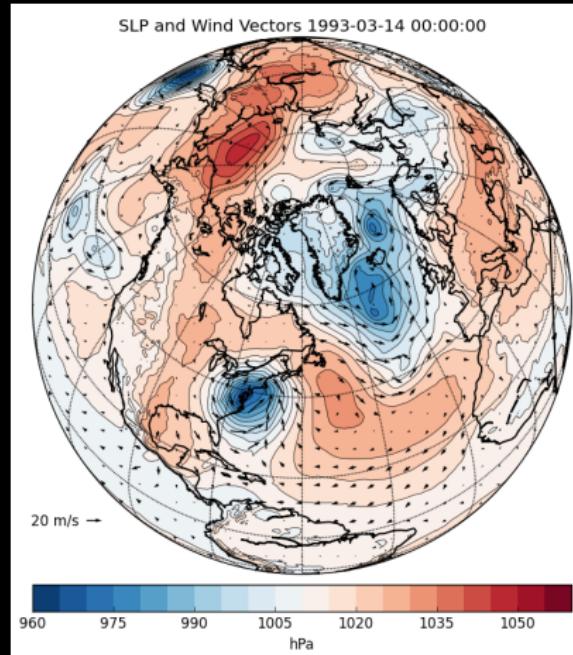
- Uncertainty in the estimation of latitude and longitude is characterized as a **bivariate normally distribution** with standard deviations  
 $\sigma_{\text{lat}} = 0.9 \text{ nm}$ ,  $\sigma_{\text{lon}} = 3.9 \text{ nm}$



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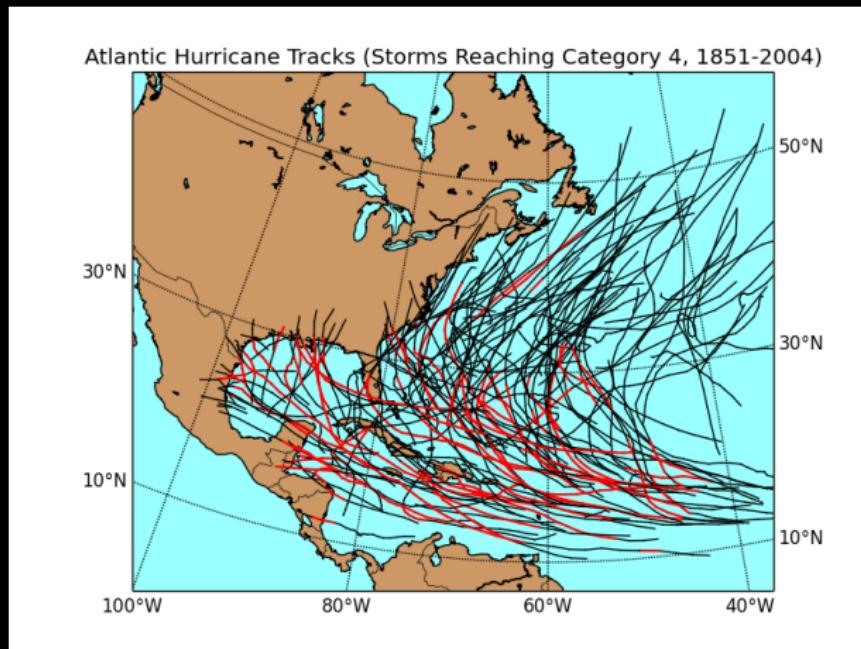
- ▶ According to the Naval Oceanographic Data Center, the ocean current in the area is characterized as a **bivariate normal distribution** with mean vectors having a speed of 1.0 to 1.5 nautical miles.



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## SIMULATIONS—CENTRAL AMERICA SCENARIO

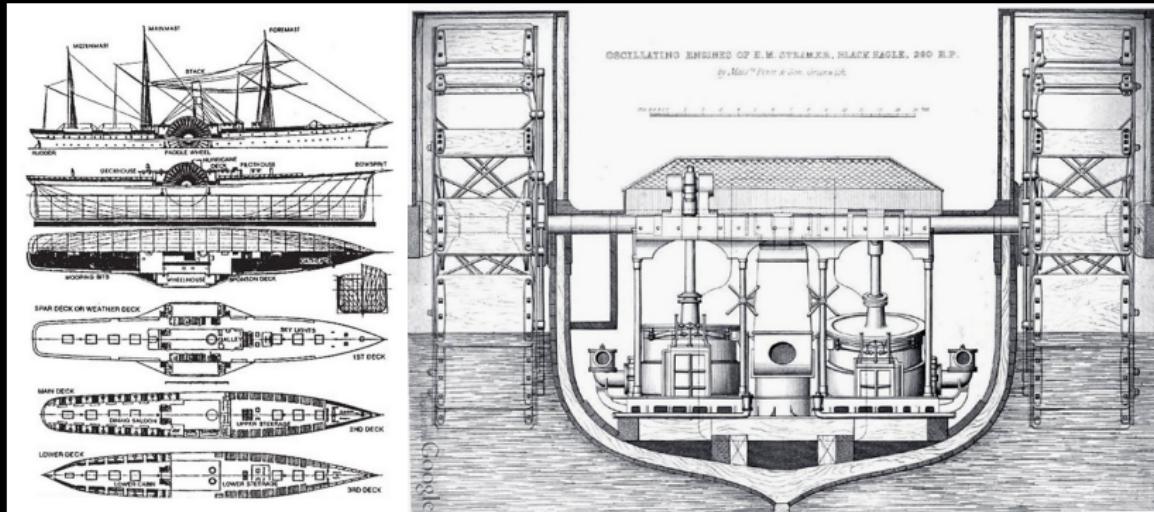
- Using a wind-driven current model supplied by the Naval Postgraduate School, we characterize a surface current as a **bivariate normal distribution** with means between 0.2 and 0.4 knots, and standard deviations equal to 0.1 knots along each axis.



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## SIMULATIONS—CENTRAL AMERICA SCENARIO

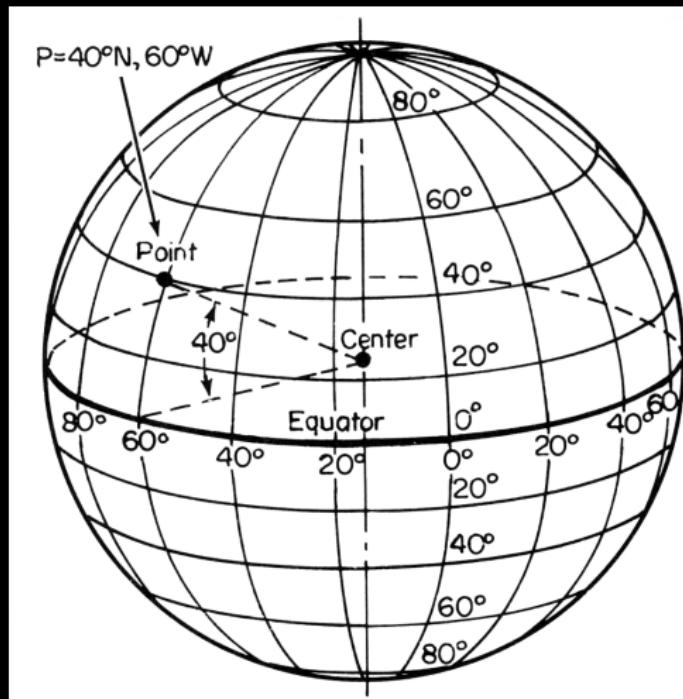
- ▶ Using blueprints for the *Central America*, we estimated a leeway of 3%.



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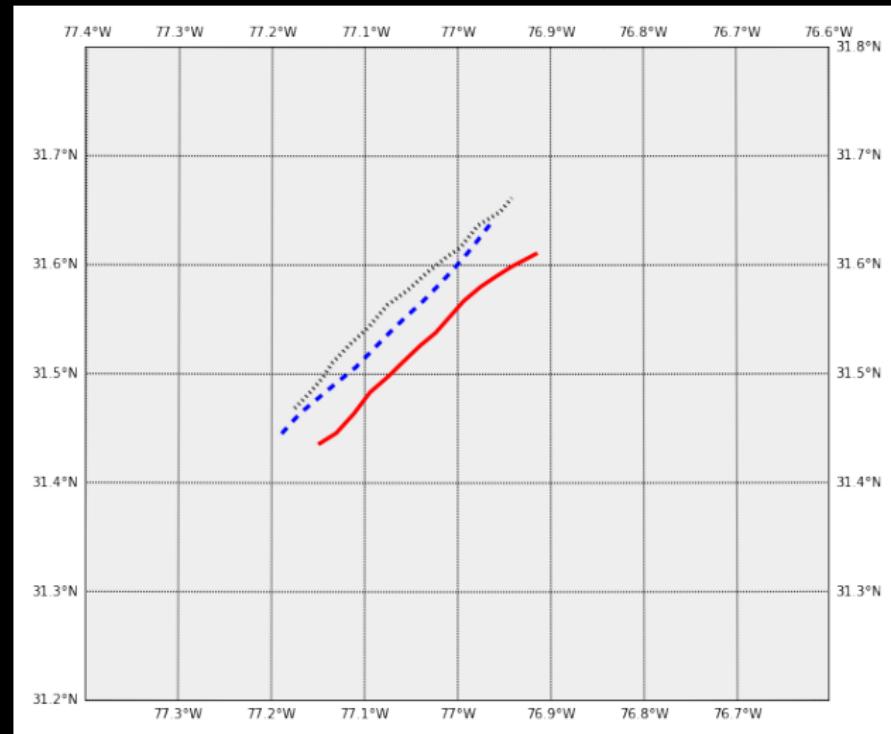
- For geodesic accuracy, employ [Vincenty's formulas](#) to calculate the distance between two points on the surface of a spheroid.



# SEARCHING FOR THE SS CENTRAL AMERICA

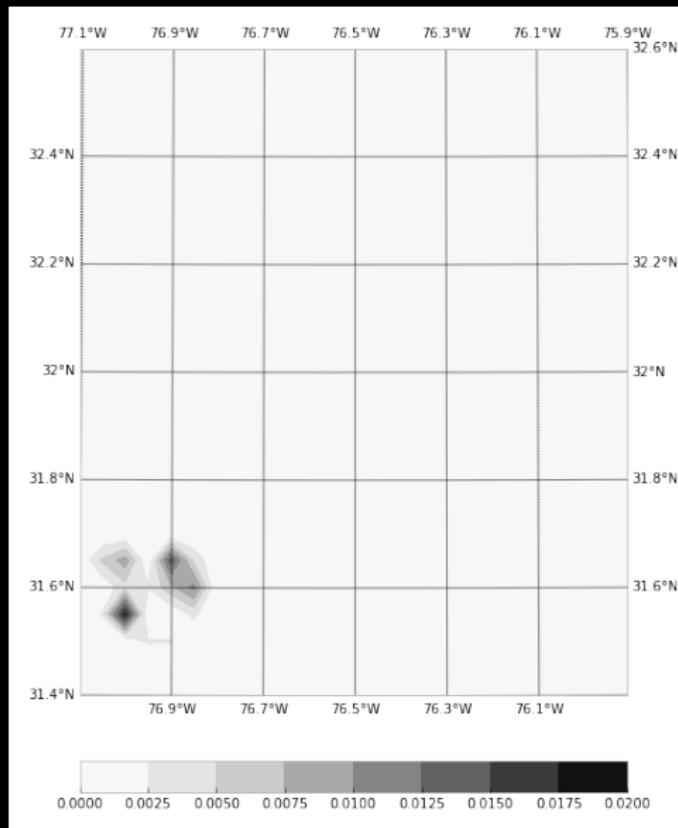
## SIMULATIONS—CENTRAL AMERICA SCENARIO

- Uncertainty in the estimation of latitude and longitude is characterized as a [normal distribution](#) with standard deviations  $\sigma_{\text{lat}} = 0.9 \text{ nm}$ ,  $\sigma_{\text{long}} = 3.9 \text{ nm}$ .
- According to the Naval Oceanographic Data Center, the ocean current is [approximately uniform](#) with mean vectors having a speed of 1.0 to 1.5 nautical miles.
- Using a wind-driven current model supplied by the Naval Postgraduate School, we characterize a surface current as a [bivariate normal distribution](#) with speeds between 0.2 and 0.4 knots, and standard deviations of 0.01 knots.
- Using blueprints for the Central America, we estimated a [beam of 3%](#).
- For accuracy, employ [Vincenty's formulae](#) to calculate the distance between two points on the surface of a spheroid.



# SEARCHING FOR THE SS CENTRAL AMERICA

SIMULATIONS—PUTTING ALL THE SCENARIOS TOGETHER



# SEARCHING FOR THE SS CENTRAL AMERICA

PUNCH LINE—FOLLOW THE FISH!



# FOR MORE INFORMATION, EXAMPLES, IDEAS, . . .

## RECOMMENDED READING

**WILEY  
informs**

COLUMBUS-AMERICA DISCOVERY GROUP  
and the *SS CENTRAL AMERICA*

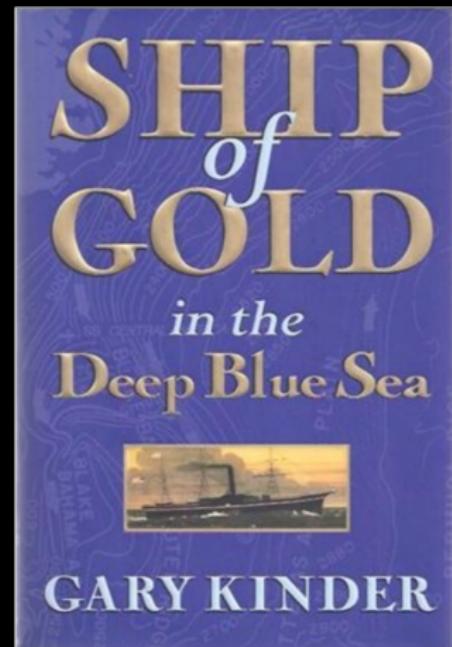
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In 1857, while carrying passengers and gold from California to New York, the *SS Central America* sank in a hurricane, taking gold bars and coins worth an estimated \$400 million to the ocean floor. One hundred, twenty-eight years later, the Columbus-America Discovery Group was formed with the objective of recovering the lost treasure of the *SS Central America*. In the summer of 1985, Thomas G. Thompson, director and founder of Columbus-America, assigned to Dr. Lawrence D. Stone the task of estimating the location of the wreck and participating in planning the search.



Figure 1: The *SS Central America* from a lithograph in Frank Leslie's *Illustrated Newspaper*, October 3, 1857.

Columbus-America Discovery  
research



Ship of Gold in the Deep Blue Sea  
—Gary Kinder



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**Francisco Blanco-Silva**

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**Searching (again!) for the SS Central America**

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**In the news:**  
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It was not until late 1990s that technology allowed recovery of shipwrecks at deep sea. But no technology would be of any help without an accurate location of the site. In the following paragraphs we would like to illustrate the power of the assay stack by performing a simple simulation that ultimately creates a dataset of possible locations for the wreck of the SS Central America, and mixes the data with a neural network to predict the most probable location.

We simulate several possible paths of the shipwreck [6] (e.g. 10,000 randomly generated possibilities), between 7:00 AM on Saturday and 13 hours later, at 8:00 pm on Sunday. At 7:00 AM on that Saturday the ship's captain, William Herndon, took a celestial fix and verbally relayed

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