NTSB National Transportation Safety Board

Office of Marine Safety

M/V ETHAN ALLEN

Rob Henry

Stability Safety Issues

- Stability of the *Ethan Allen*
- Passenger weight criteria for stability – *Ethan Allen & Lady D*

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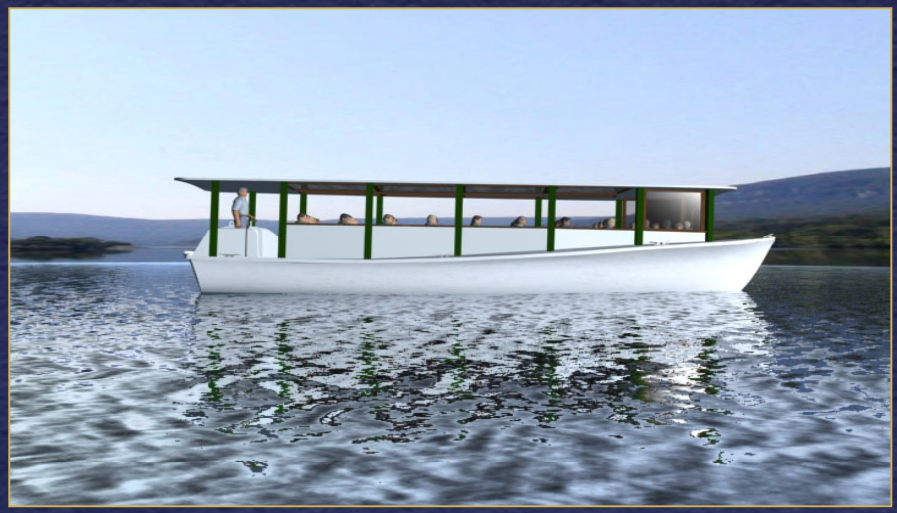
Ethan Allen's Last Voyage



- Routine conditions
- Nearly a full load of passengers
- No known previous incidents
- In good condition
- Capsized without warning

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Dyer 40-foot Hull - No Canopy

Photo from New York State

- *Ethan Allen* delivered in 1964-looked similar to photo of sister vessel, *Algonquin* (ex. *Sea Lyon*)
- Believed to have passed Simplified Stability Test (SST) for 48 passengers in 1966
- Two sister vessels delivered in 1966

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Metal Framed Canvas Canopy

Ethan Allen

de Champlain

- *Ethan Allen* with canvas canopy originally installed in Groton
- Stability assessment not done nor required by USCG
- New York State accepted passenger loading data from last Coast Guard COI in 1979
- *De Champlain's* canvas canopy installed at Lake George
- Stability assessment not done nor required by New York State

Photos courtesy of Shoreline Cruises

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Wood Canopy

- Wooden canopy replaced canvas canopy on the *Ethan Allen* in 1989
- *De Champlain* and *Algonquin* new wooden canopies installed in 1990 and 1991, respectively.
- No stability assessment done following these modifications.

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Post Accident Testing Results

- *De Champlain* failed on scene SST for 48 passengers
- *De Champlain* inclined to obtain vessel characteristic

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Coast Guard Stability Criteria Applicable to *Ethan Allen*

Ethan Allen variant canopy configurations	Numbers of passengers allowed by Subchapter T -- SST -- 140 lbs. Per person	Numbers of persons allowed by Subchapter S stability criteria -- 140 lbs per person
1964 as delivered without canopy	48	58
Groton, Conn. metal framed canvas canopy	None allowed	None allowed
1989 wooden canopy	None allowed	14

- Evaluated each configuration against SST and Subchapter S
- Only variant of *Ethan Allen* to pass SST with passengers was original 1964 configuration (without a canopy)
- Original “as delivered” version could carry up to 58 passengers and crew
- Canvas canopy variants failed to meet stability criteria
- Wood canopy passed for a reduced passenger load

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Ethan Allen Overloading

- 140 pounds average weight criteria used by USCG and NY State
- Average weight per passenger was almost 178 lbs per person
- *Ethan Allen* was carrying over 4 times the passenger weight
- Roughly ¾ of this excessive weight was attributable to certificating the vessel for too many passengers
- Stability was not reassessed after the canopies were added/modified
- ¼ due to the 38 pound difference in average passenger weight

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Ethan Allen's Margin of Stability

- *Ethan Allen's* departure condition had about 1/3 righting energy needed to pass USCG passenger vessel stability criteria
- Doesn't necessarily mean it would capsize
- Probability is higher because margin of safety is lower
- Influences contributing to the capsize

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Dynamic Analysis In Waves

- Numerical simulation software analyzed *Ethan Allen* for variables
- Speed, heading, wave height, wave frequency and movement of passengers
- Maximum roll produced was about 15 degrees to port
- Submerging about ½ the vessel's port freeboard
- No capsize produced

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Other Factors Contributed to Capsize

- Unique set of factors
- Vessel's marginal stability overwhelmed
- Roll induced from sharp turn to starboard
- Involuntary passenger movement to port

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Ethan Allen's Capsize

- Following slides represents staff's scenario of capsize
- Based on testimony, examination of the vessel, and the results of the stability study

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Initial trim by the bow

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Initial heel 2 degrees to port

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Approaching waves

Hard turn to starboard heels vessel further to port

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Wave or waves roll vessel further to port

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Port roll causes passenger shift

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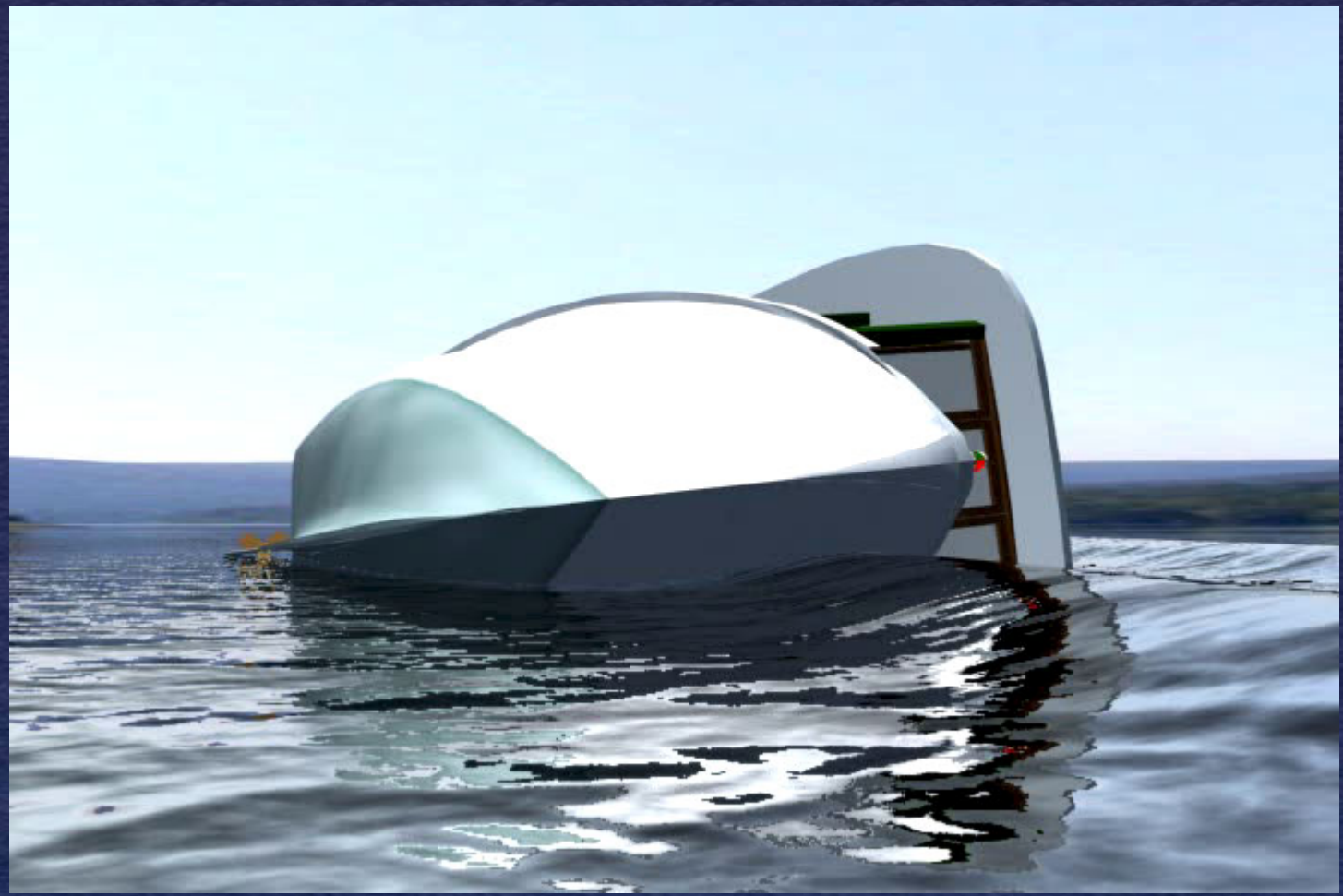

Capsize

Cause of the *Ethan Allen's* Capsize

- Insufficient stability due to overloading
  - Overloading from too many passengers
  - Passengers average weight exceeded criteria
- Unable to right itself :
  - Sharp turn
  - Passing waves
  - Involuntary movement of passengers

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Capsize of *Lady D* – March 6, 2004

US Navy photo

Domestic Passenger Vessel Weight Criteria for Stability

- Coast Guard to periodically update the average passenger weight criteria
- Provide operators a method for determining maximum safe load condition.
- New York State has adopted 174 lbs average
- Coast Guard's voluntary interim measures
- Coast Guard's on going regulation project

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New York State Passenger Load Criteria

- Use of manufacturer capacity plate data to determine public vessel passenger loading

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New York State's Use of Manufacturer Capacity Plate Data

- 382 New York State regulated public vessels passenger loading based on manufacturer's capacity plate data
- Capacity plate is attached to vessel by manufacturer
- Includes rated passenger load in pounds and number of person allowed
- USCG criteria found in 33 CFR 183

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Coast Guard Capacity Plate Standard

- Noncommercial standard based on recreational boating surveys
- Not used by Coast Guard for commercial small passenger vessel certification – 46 Subchapter T
- 1/3 of New York State public vessels using capacity plates carry more than that 6 passengers for hire
- Adopt Coast Guard Subchapter T & S passenger vessel stability criteria

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