

# Lost at Sea

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## a Photo Essay

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# Composing the Scene

Scene should incorporate all four elements from Greek mythology:

- Sky
- Ocean
- Boat
- Lightning



# Sky

what didn't work

- 2D Photon Mapping
- Heightfield-based Geometry
- Flat Procedural Texturing
- Metaballs



# Sky

final strategy

- Volumetric Photon Mapping
- Pass 1: Photon Tracing
  - Monte Carlo scattering simulation
- Pass 2: Render the Photon Map as a Luminous Volume



$$I = c \int_{t_1}^{t_2} \rho(t) e^{-\tau \int_t^{t_2} \rho(u) du} dt$$

Jensen, Henrik W.: "Realistic Image Synthesis Using Photon Mapping." AK Peters, 2001.

Williams, Peter L.: "A Volume Density Optical Model." ACM Press, NY, 1992.

Background information:

Ebert, David S.: "Procedural Volumetric Cloud Modeling, Animation, and Real-time Techniques."



# Ocean

- 2D-IFT of discrete frequency deltas
- Ripple simulation in ocean's surface from circular wave patterns
- Physically-based motion through solutions of simple PDEs
- Approximate subsurface scattering

Strauss, Walter A.: "Partial Differential Equations, An Introduction." John Wiley & Sons, Inc., New York, 1992.

Finch, M.: "Effective Water Simulation from Physical Models." in GPU Gems. Addison-Wesley, Boston, 2004.



# Lightning

- Geometry Creation
  - Stochastic Branch Formation
  - “Lightning Modeling Studio” for Finishing Touches and Artistic Effects
- Rendering Curvilinear Light Sources
  - Monte Carlo sampling for Efficient Illumination Calculations
  - Closed-form Analytic Solution to Single-Scatter Volume Rendering for Glow Effect

Dobashi, Y. et al: “Efficient Rendering of Lightning taking into Account Scattering Effects due to Clouds and Atmospheric Particles.”





















# Video Clip





# Summary

IN 480 BC, THE PERSIAN RULER XERXES SENT A FLEET TO CONQUER GREECE. HERODOTUS CLAIMED THAT THE ARMY CONSISTED OF OVER TWO-AND-A-HALF MILLION FIGHTING MEN. ALTHOUGH LARGE, THE ARMY LACKED PROPER LOGISTICS— NATIVE TRIBAL LEADERS SHARED CONTROL OVER THEIR REGIMENTS. BOOM! LIGHTNING STRIKES, AND WE DISTINGUISH A SHIP LOST AT SEA. PERHAPS IT LOST ITS PRECIOUS MAPS. PERHAPS THE WRATH OF POSEIDON CAST THE SHIP OUT OF ITS WAY TOWARDS CONQUEST. SOMEHOW, THE CONQUERORS BECOME THE CONQUERED. CLOUDS GATHER, LIGHTNING STIKES AGAIN. WAVES THROW THE SHIP FROM SIDE TO SIDE. THE SAILORS HOLD ON FOR THEIR LIVES— LOST AT SEA. THROUGH RAY-TRACING, WE DISCOVERED A PIECE OF ANCIENT HISTORY.

