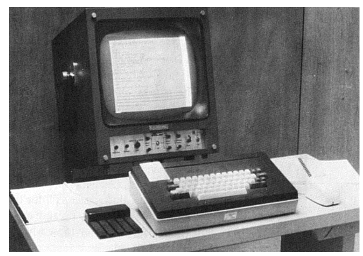
Motivation

Interactive Graphical User Interfaces

- **Desktop metaphor**
  - **Input: Mouse, keyboard**
  - **Output: CRT**
- **Immersive interfaces**
  - **Input: Gloves, 3D tracking**
  - **Ouput: HMD, RWB**

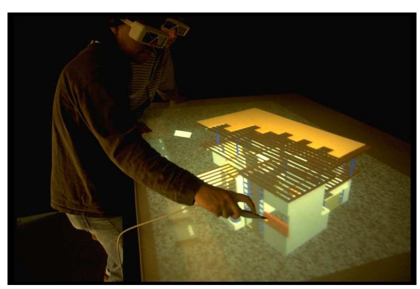
Sutherland's Sketchpad
1960's



Xerox Alto
1970's

Immersive Interfaces

Head-Mounted Display
Glove
From W. Krueger



Responsive Workbench
3D Stylus

Motivation

Digital Media Technologies

Traditional media (analog to digital transition)

- Printing (done)
- Television and video (underway)
- Cameras and Film (underway)
- Theatres?

New media

- Multimedia personal computer
- Networked graphics and the www

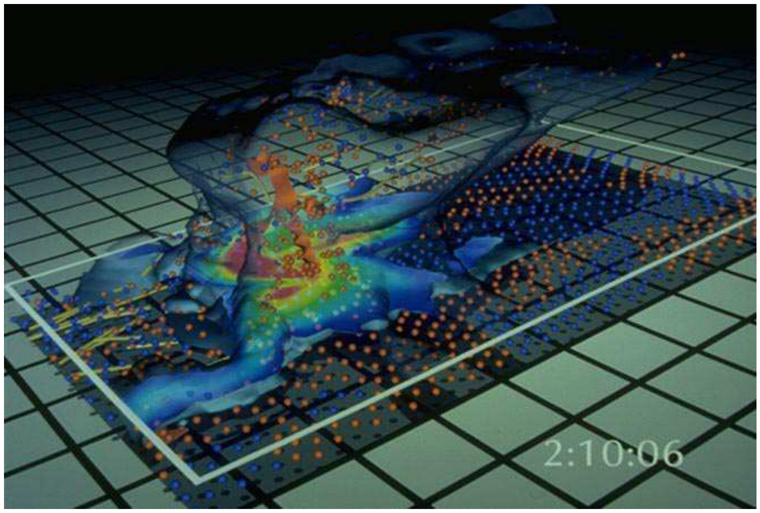
Motivation

Visualization

Examples

- Science: Thunderstorm simulation
- Mathematics: Sphere eversion
- Engineering: Computation fluid dynamics
- Medicine: Visible human
- Computer Science: Software system

Thunderstorm Simulation



Numerical model of a thunderstorm
Bob Wilhelmson, Univ. Illinois

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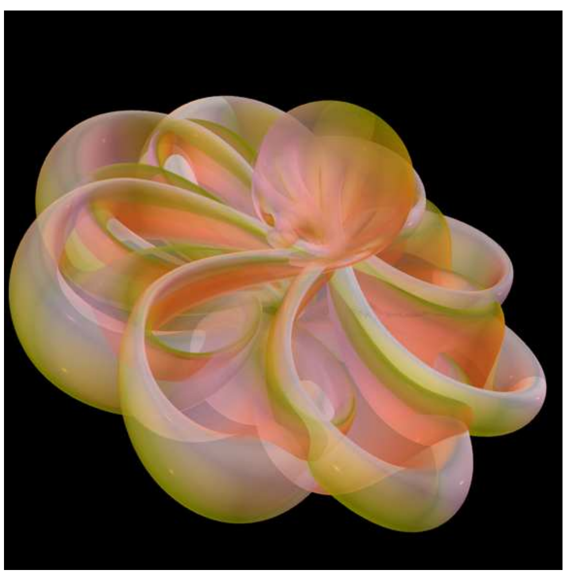
Outside In



Sphere Eversion from *Outside In*

S. Levy,
D. Maxwell,
T. Munzner,
Geometry Center
Univ. Minnesota

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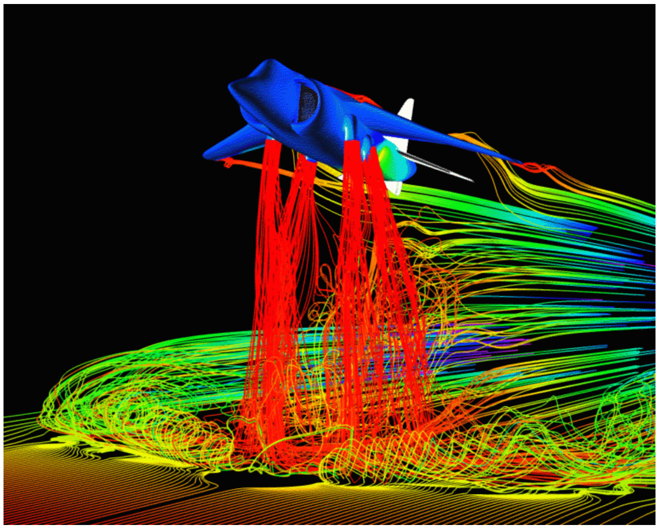
NASA's FAST



Airflow around a Harrier Jet
FAST System

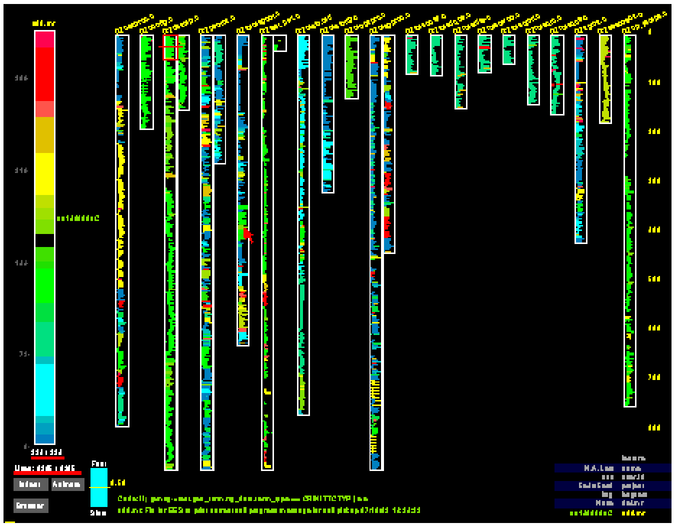
Nasa Ames

Visible Human

The Visible Man

K. H. Hoehne
Univ. Hamburg, GE

SeeSoft



SeeSoft

S. Eick
Lucent

Shows code age:
new -> red
old -> blue

Motivation

Art and Design

- **Electronic Art**
- **Drawings, Paintings, Blueprints**
- **Mechanical CAD**

Entertainment

- **Movies: *Jurassic Park* and *Toy Story***
- **Games and CDROM Titles**

Visual Simulation and Training

- **Airplane, ship, automobile simulators**

Interdisciplinary: Theory & Practice

Science

- Physics of light, color and appearance
- Projective geometry and perspective
- Mathematics of curves and surfaces

Engineering

- Hardware: Graphics/media processors
- Software: Graphics libraries, window systems

Art and Perception

- Color: harmony and perception
- Composition, lighting, ...

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Graphics

Bike Shop from *Red's Dream*
E. Ostby, B. Reeves, J. Lasseter
PIXAR

Animation: time

Modeling: shapes

Shading: reflection and lighting

Transformation: viewing

Hidden Surface Elimination

Geometry Pipeline

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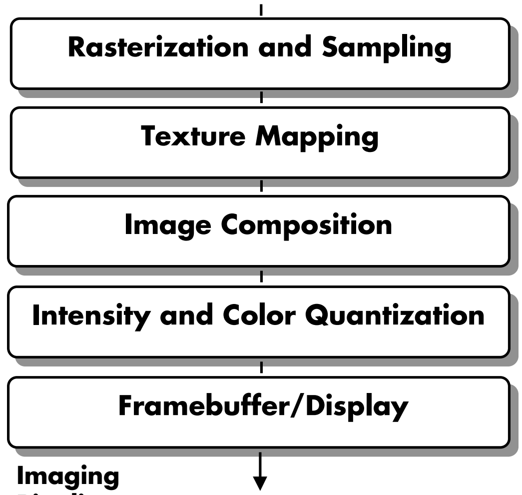
Imaging

Scenes from *Titanic*



Imaging Pipeline

Graphics Software Architecture

See *Programming OpenGL for the X Window System*, M. Kilgard