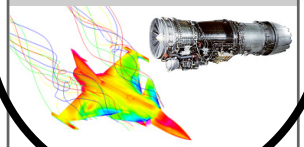
Perspective on aircraft design and HPC development over 20 years

Mattias Sillén

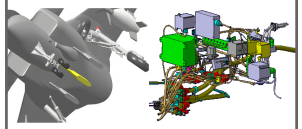
14 October 2009

AIRCRAFT DESIGN COMPETENCE AREAS

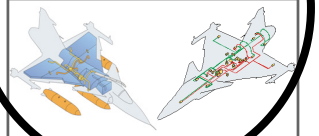
Aeronautical Engineering



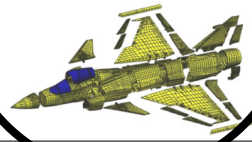
Airframe Design



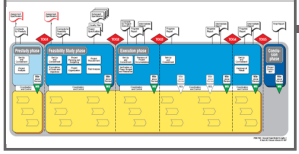
Vehicle Systems



Structural Technology



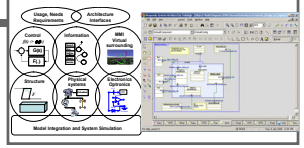
Project Management



SYSTEMS INTEGRATION

- Overall Design and Architecture
- Survivability
- Systems Safety and Reliability
- ILS, Availability and Maintainability

Engineering Methods & Tools



Weapons Integration

Tactical System

Simulators, Training & Support

Operational Analysis and HMI

Support Systems & Software Platforms

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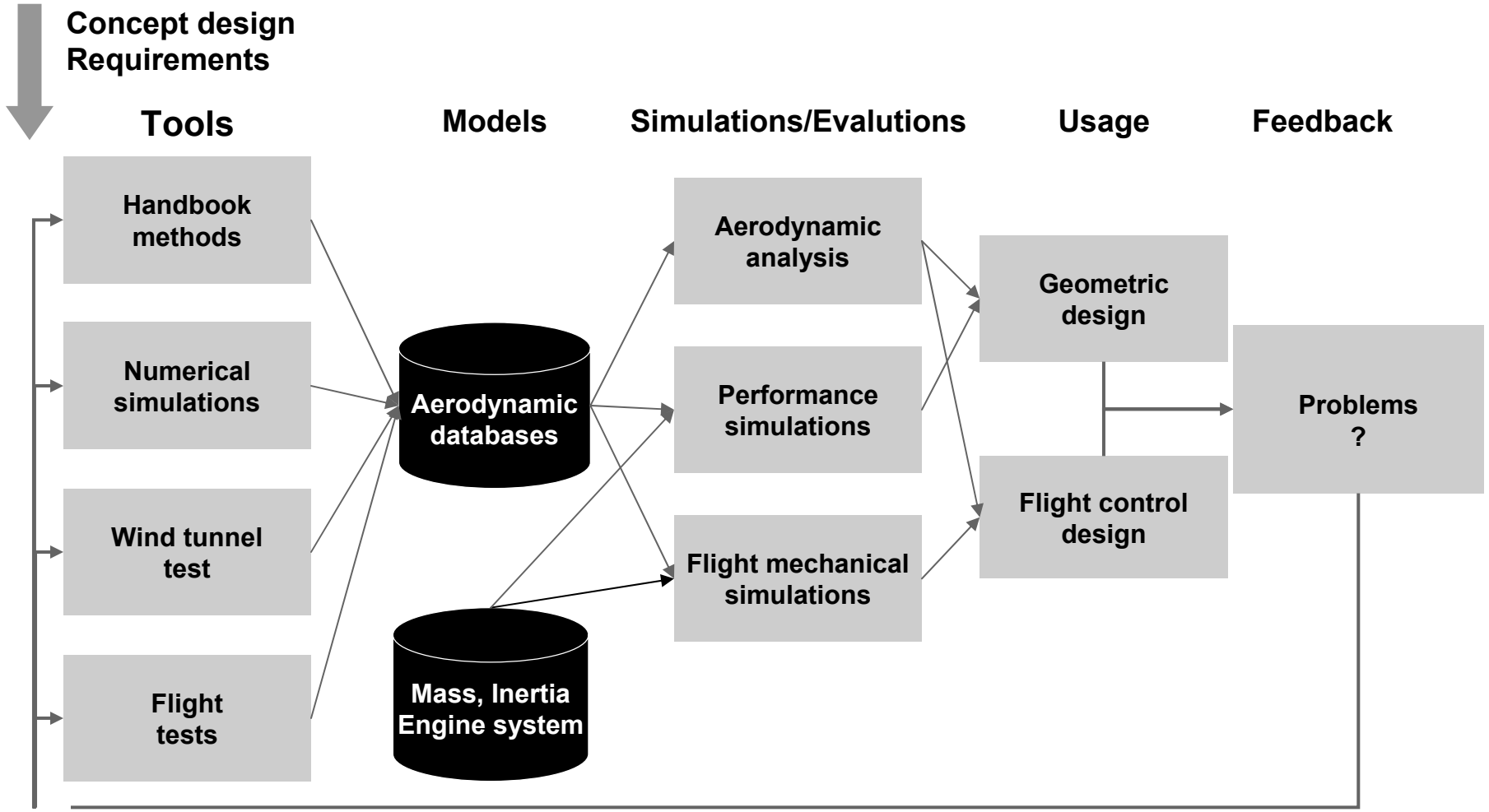
AERODYNAMIC SHAPING PROCESS



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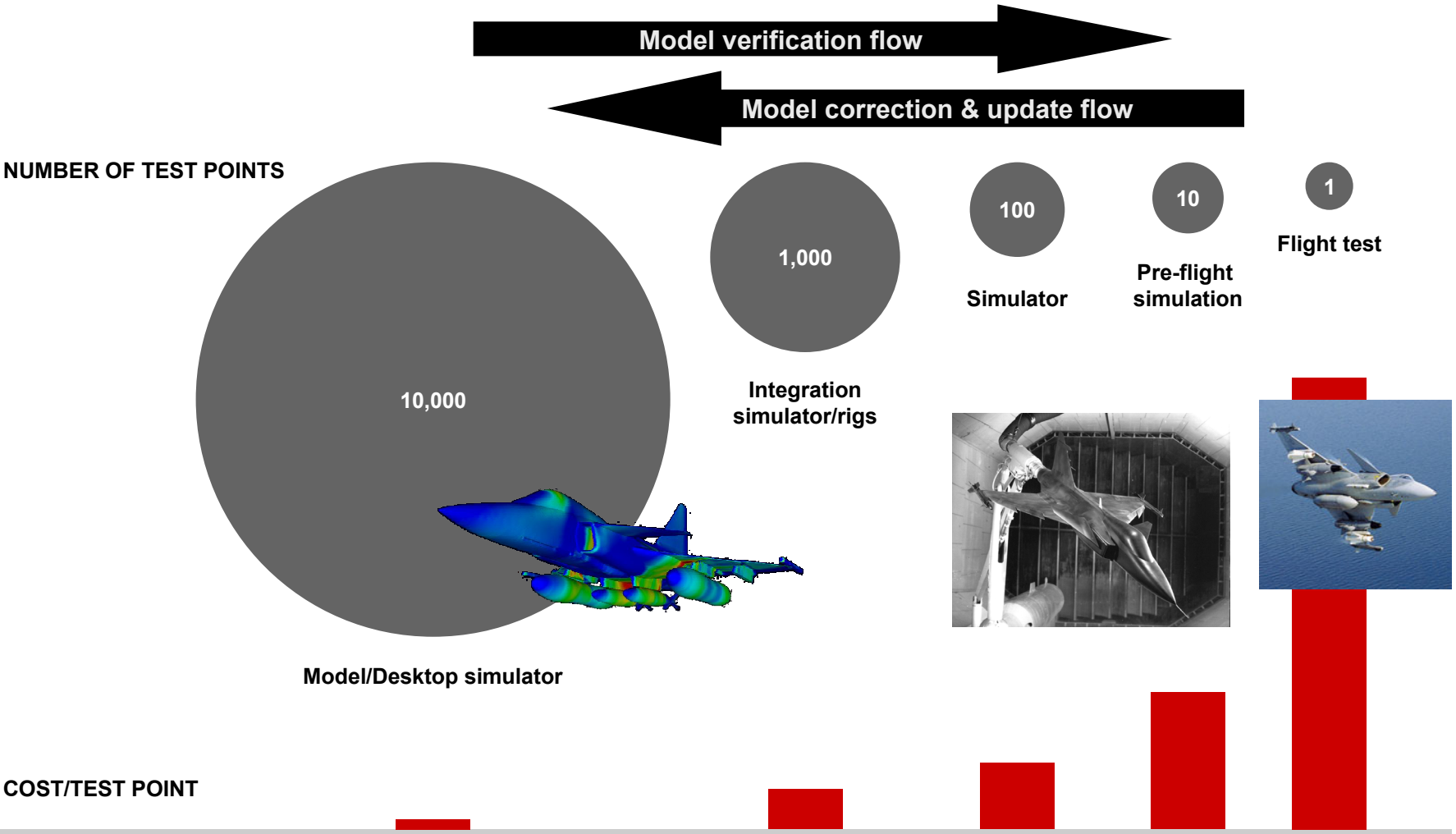
MODEL BASED DESIGN
TEST COVERAGE USING MODELS



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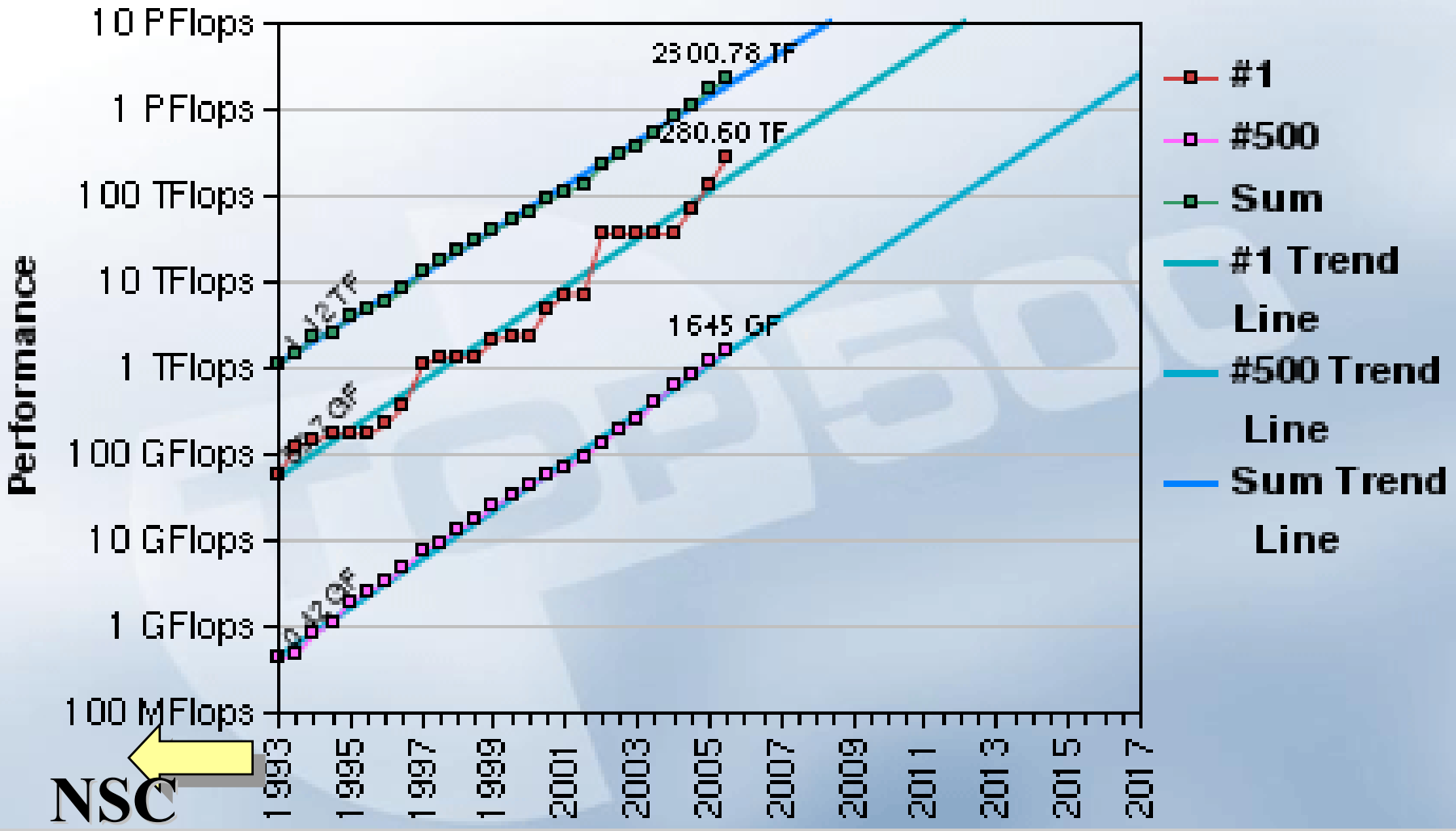
Projected Performance Development



NSC

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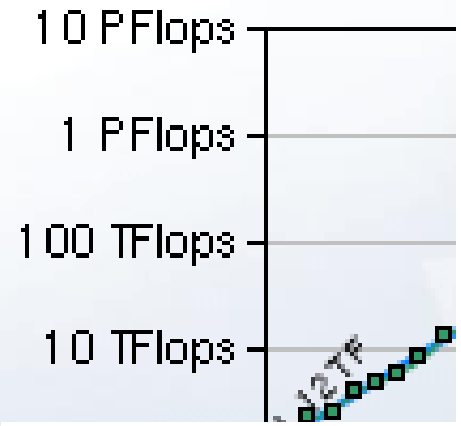
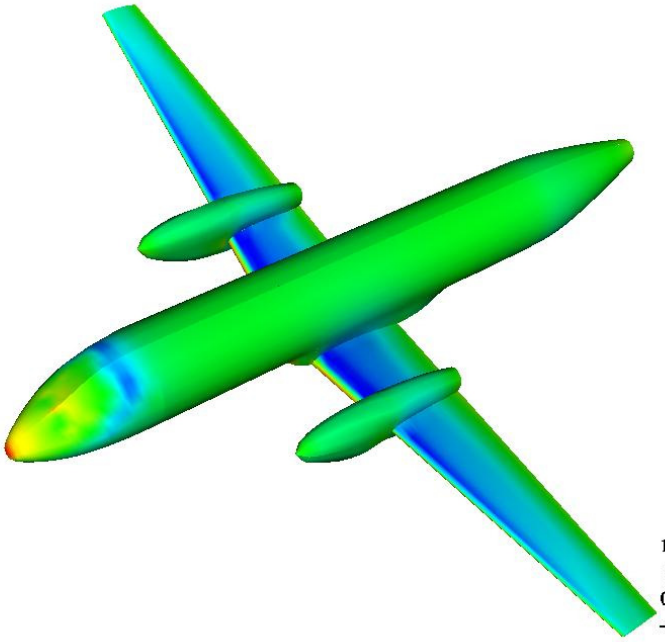
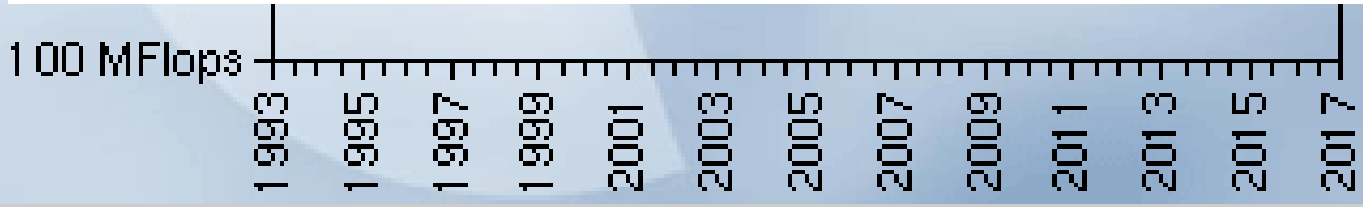
TOP500 SUPERCOMPUTER SITES





1983 Cray 1 installed
Panel methods for subsonic flow
Surface discretization #1000 panels
Run time days/hours



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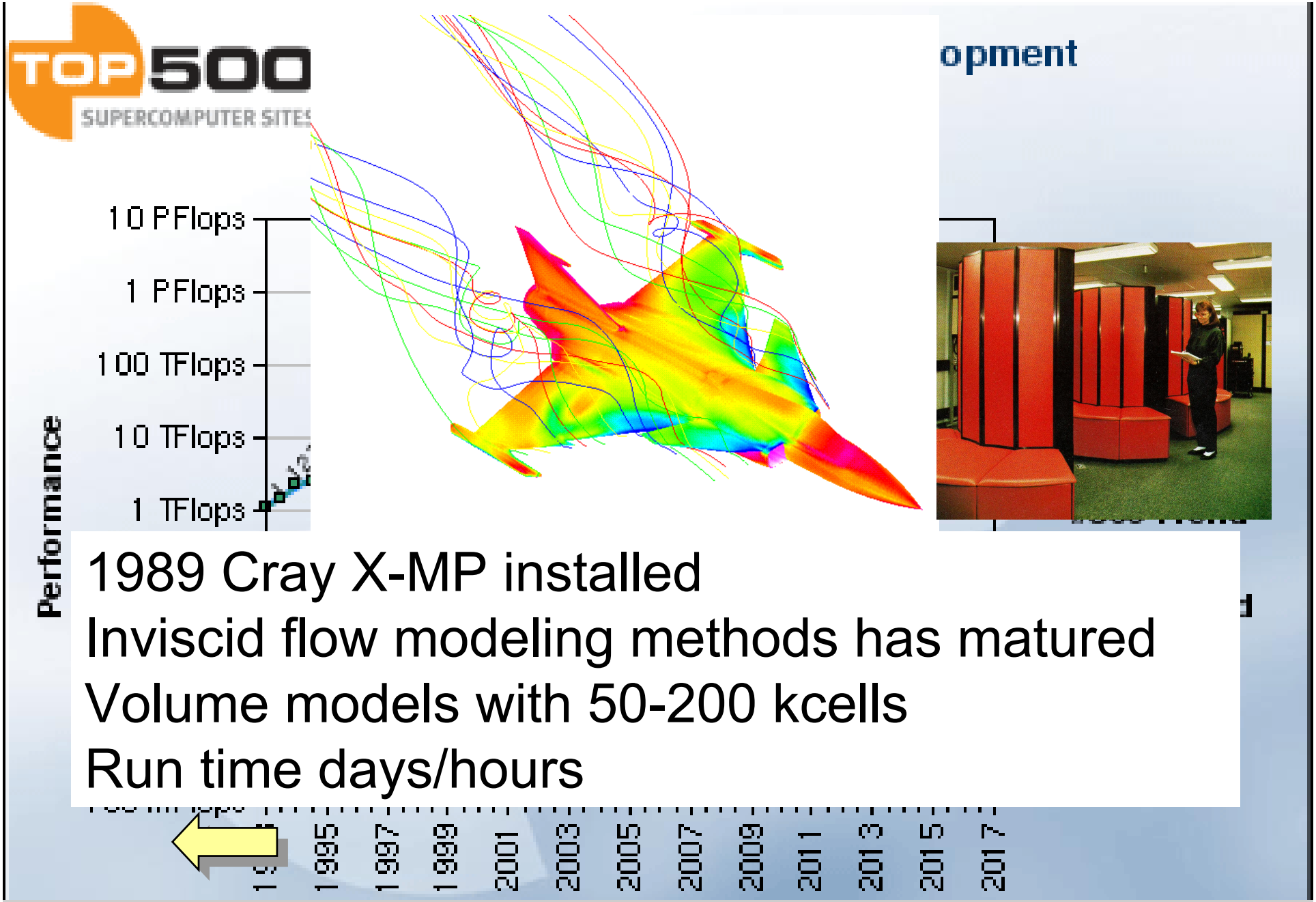
SAAB



1989 Cray X-MP installed

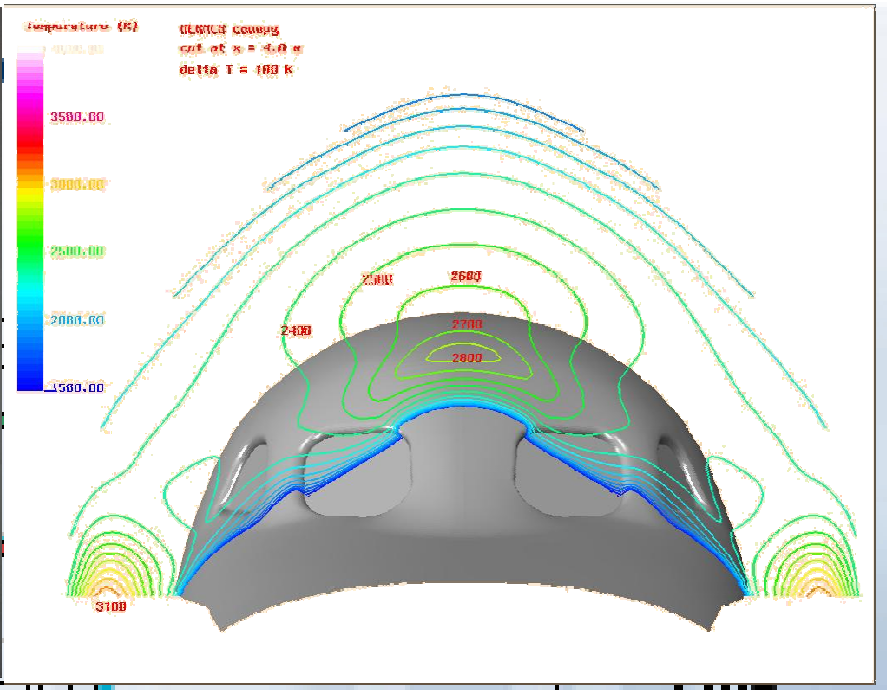
Inviscid flow modeling methods has matured

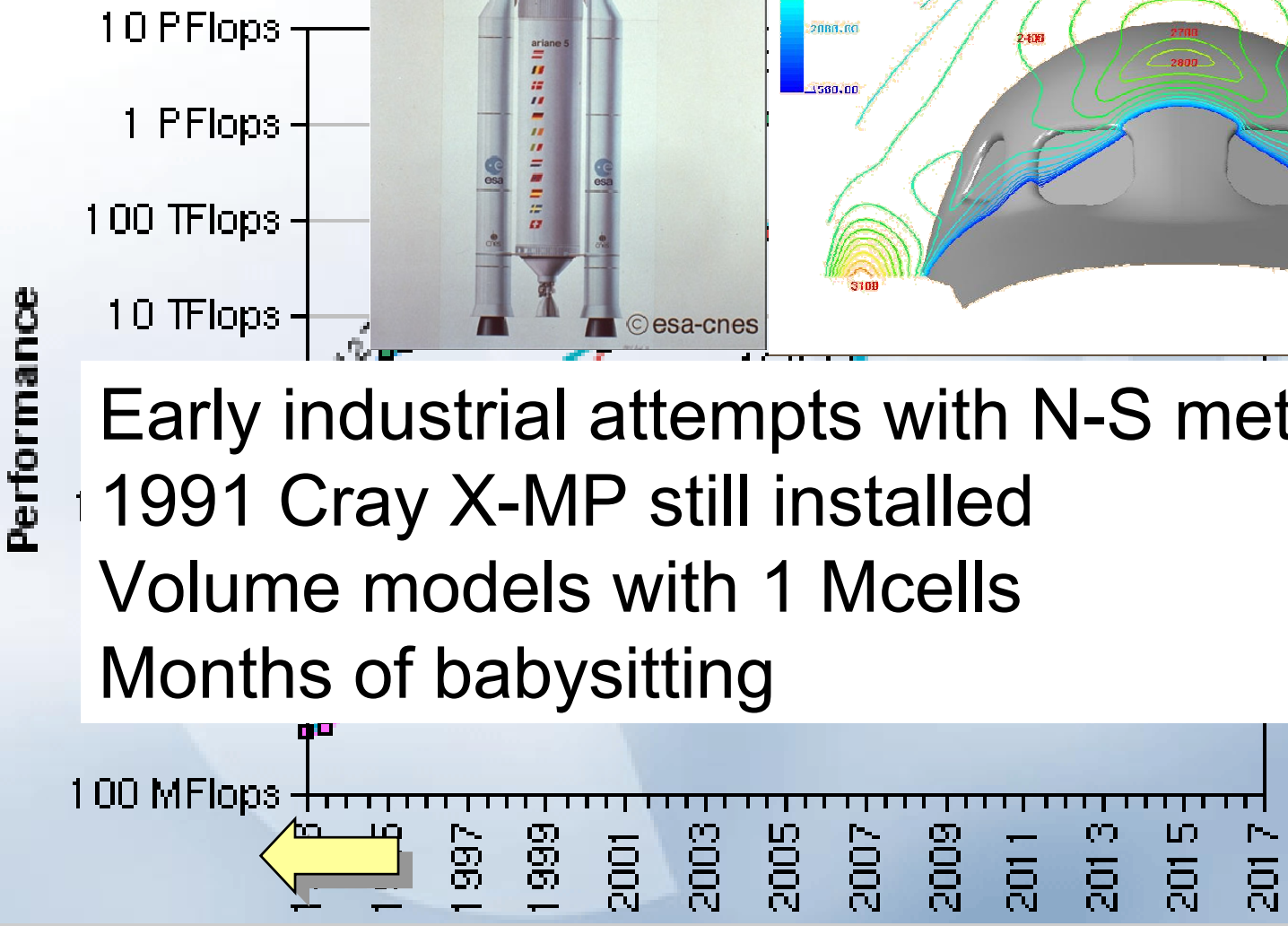
Volume models with 50-200 kcells

Run time days/hours

Saab proprietary information

SAAB





Early industrial attempts with N-S methods
1991 Cray X-MP still installed
Volume models with 1 Mcells
Months of babysitting

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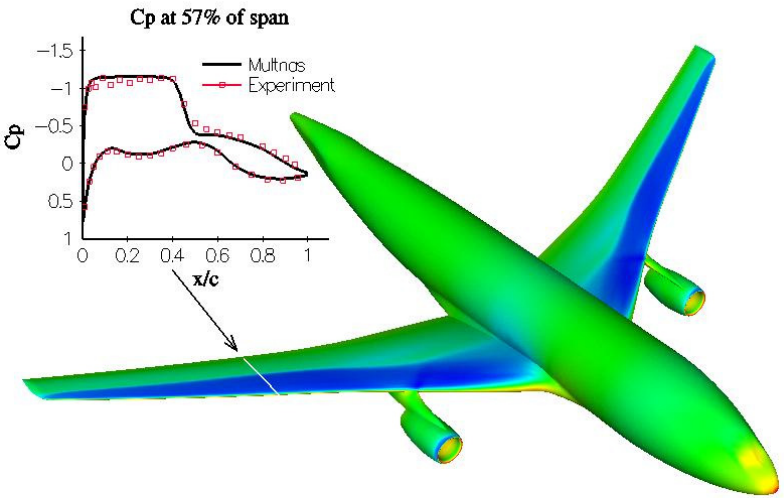

rmance Development

Performance

10

1

100

10

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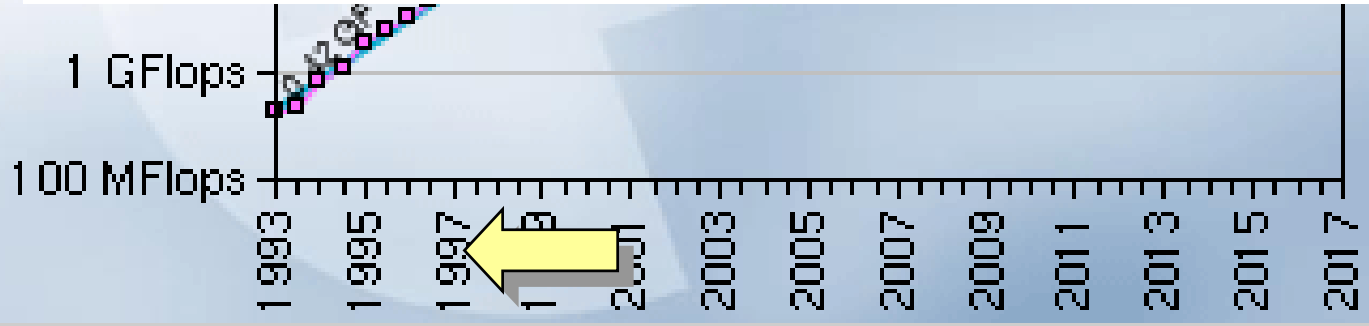
Viscous flow simulations enter design
Cray T3E
Run time 1-2 days



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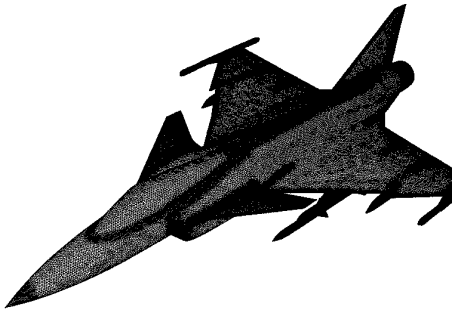
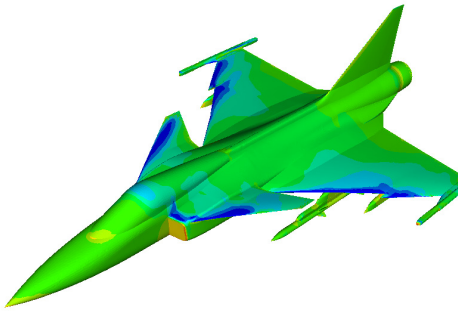
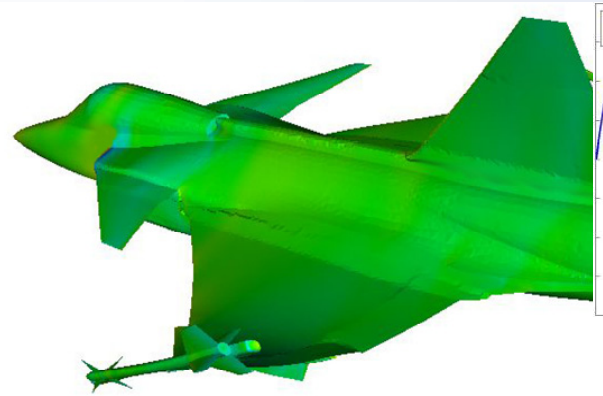
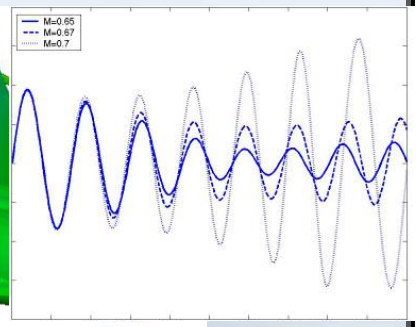
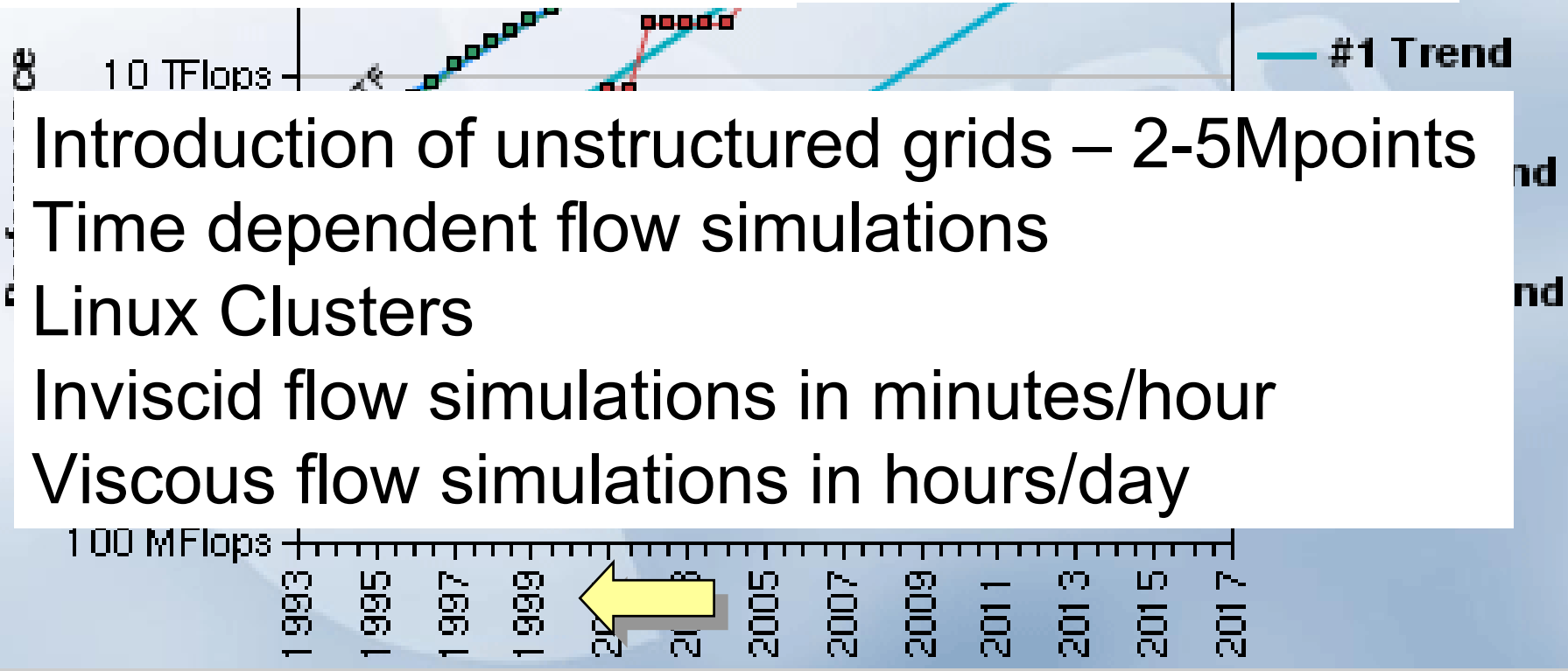
Projected Performance Development











- Introduction of unstructured grids – 2-5Mpoints
- Time dependent flow simulations
- Linux Clusters
- Inviscid flow simulations in minutes/hour
- Viscous flow simulations in hours/day

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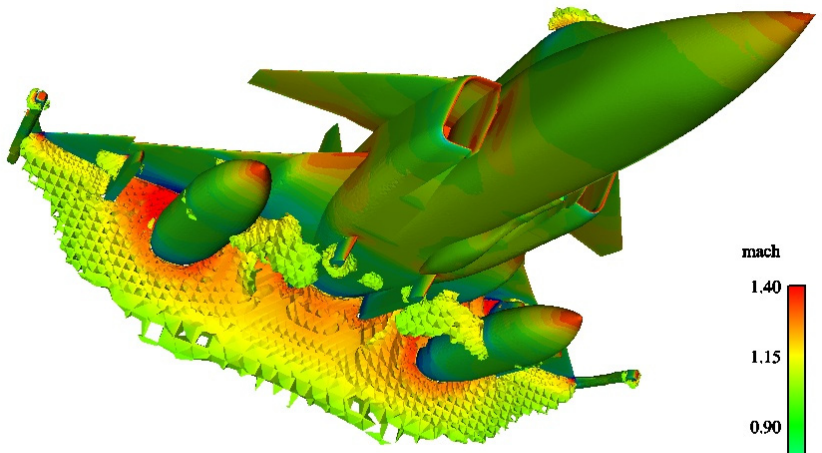
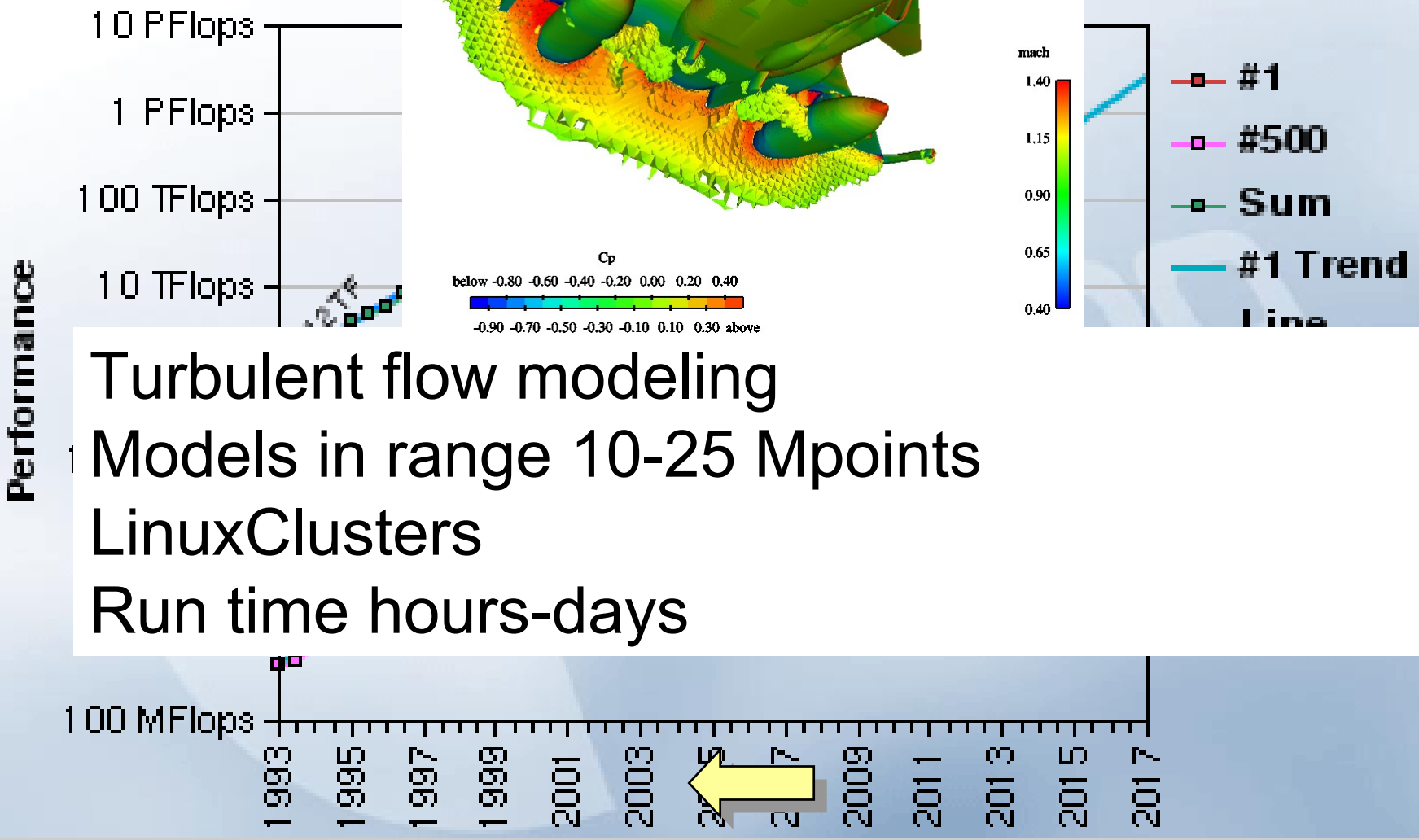
TOP500 SUPERCOMPUTER SITES

opment





Turbulent flow modeling
Models in range 10-25 Mpoints
LinuxClusters
Run time hours-days

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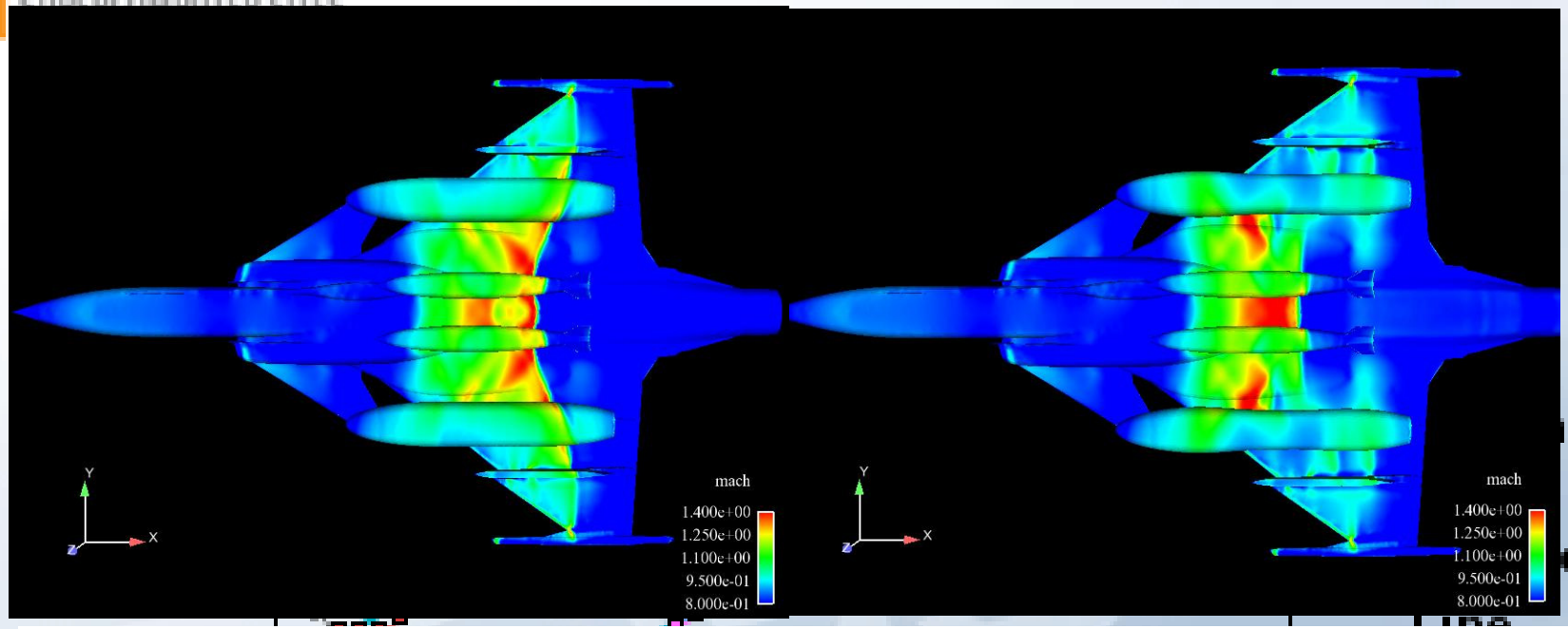
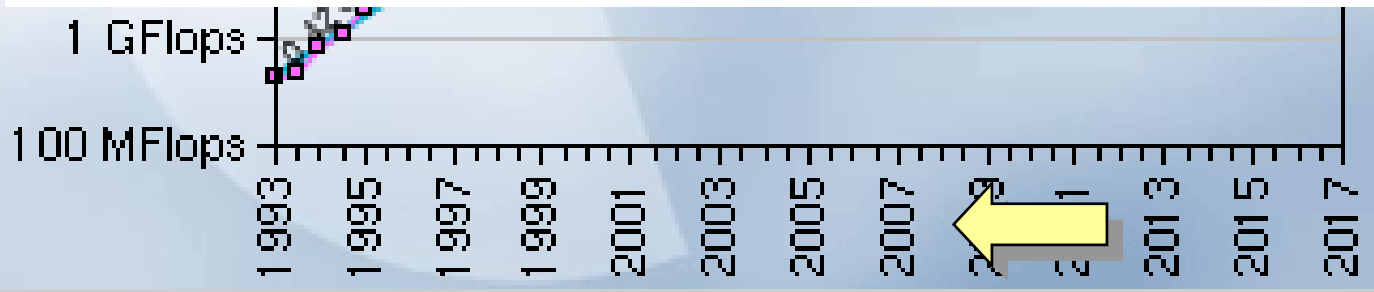
Projected Performance Development



Flow simulations coupled with shape optimization



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