Knowledge Management and Advanced Visual Environments

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Code Y Briefing

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Breadth of Ames Research in Adv Viz and KM

- Distributed Remote Analysis and Management (DReAM) System
- Virtual Wind Tunnel - Collaborative, 3D Full immersion Viz Tools
- Pedagogically-Based Browsers (UWF) - Linking by Concepts , not just words

- *Distributed Intelligent Agents for Information Management & Sharing*
- *Science Desk - Remote operation of science acquisition systems*
- *Feature Extraction - Identifying feature in large datasets*
- *LivePicture Corp - Web-based high resolution virtual imagery*
- *Wavelet Method for Hierarchical Representation of Large CFD Data Sets (CalTech)*
- *PostDoc - Web-based access to data documents and process flows*
- *Multi-Resolution Methods for Multi-Source Data Vis.*
- *Memory System Performance for Modeling for Large Data Access*
- *Etc...*

Distributed Remote Analysis and Management (DReAM)

- Science Information Architecture - seamless, user transparent access to all data, tools, and information resources, regardless of fidelity (DARWINnet and Distributed Meta-databases)
  - Acquire and share design, test, and production data
  - Capture and communicate requirements/constraints
  - Derive information from data and knowledge from information
  - Provide broad, secure, computational and communication infrastructure
  - Dynamically reconfigurable
- Components - extensible and scalable system (Distributed services)
  - Capable of incorporating additional AI and presentation tools, computational resources, and data sources as needed
  - Supports federations of users
  - Links to heritage NASA and Industry tools, models, and data
- Support Evolutionary Prototype Projects (DARWIN, ESE, etc...)
  - Rapid Prototype projects, embed Developers with Users
  - Support other NASA Enterprise elements with toolkits of components and architecture implementations

Similarity to Earth Science Data Management

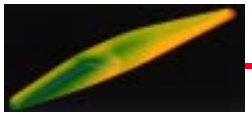
- Requirement to manage and share resulting knowledge
- Multiple, geographically distributed data sources
- Cross comparison and analysis of distinct data sets
- Both Experimental and Computational datasets are available
- Secure multiple user account management, multiple login sites
- Consistent naming conventions of variable for the databases is critical

DARWIN / DReAM tools provide a system to permit intitial data analysis and information reduction and knowledge management

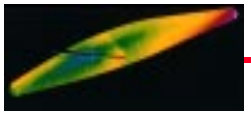
NASA's DReAM System

Distrbuted Analysis and Management

On-line information:



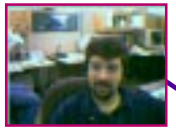
Numerical Results



Experimental Results

User Specific Knowledge

Visualizations



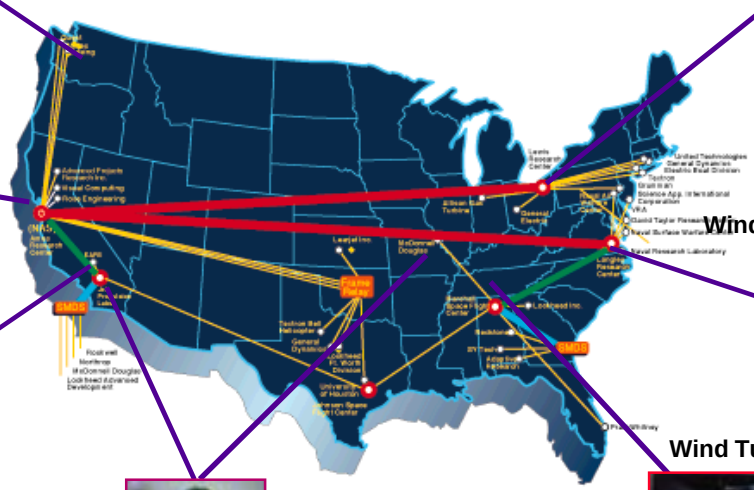
Boeing

Wind Tunnel Test & CFD

Ames

DARWIN/AERONet Mgmt.

Lockheed Martin



Boeing (McDonnell-Douglas)

Propulsion Test & CFD

Lewis

Wind Tunnel Test & CFD

Langley

Wind Tunnel Test

USAF Arnold Eng & Dev Center

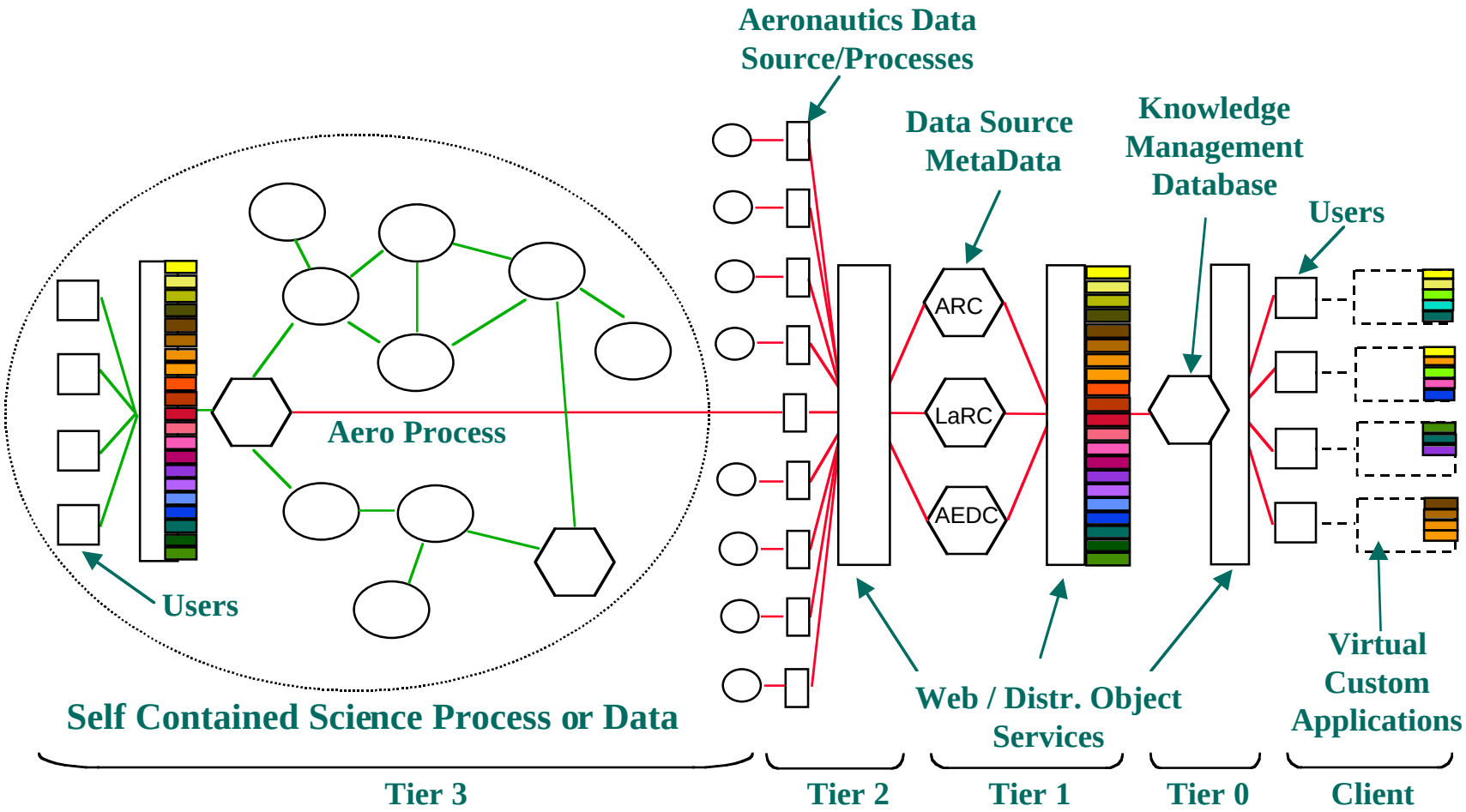
Advantages of DReAM Technologies:

- Enhanced NASA/Industry collaboration with data security
- Easy industry access to all NASA aeronautics centers
- Faster information delivery and broader utilization
- Integrated knowledge from distributed NASA databases

Tiers of DARWIN

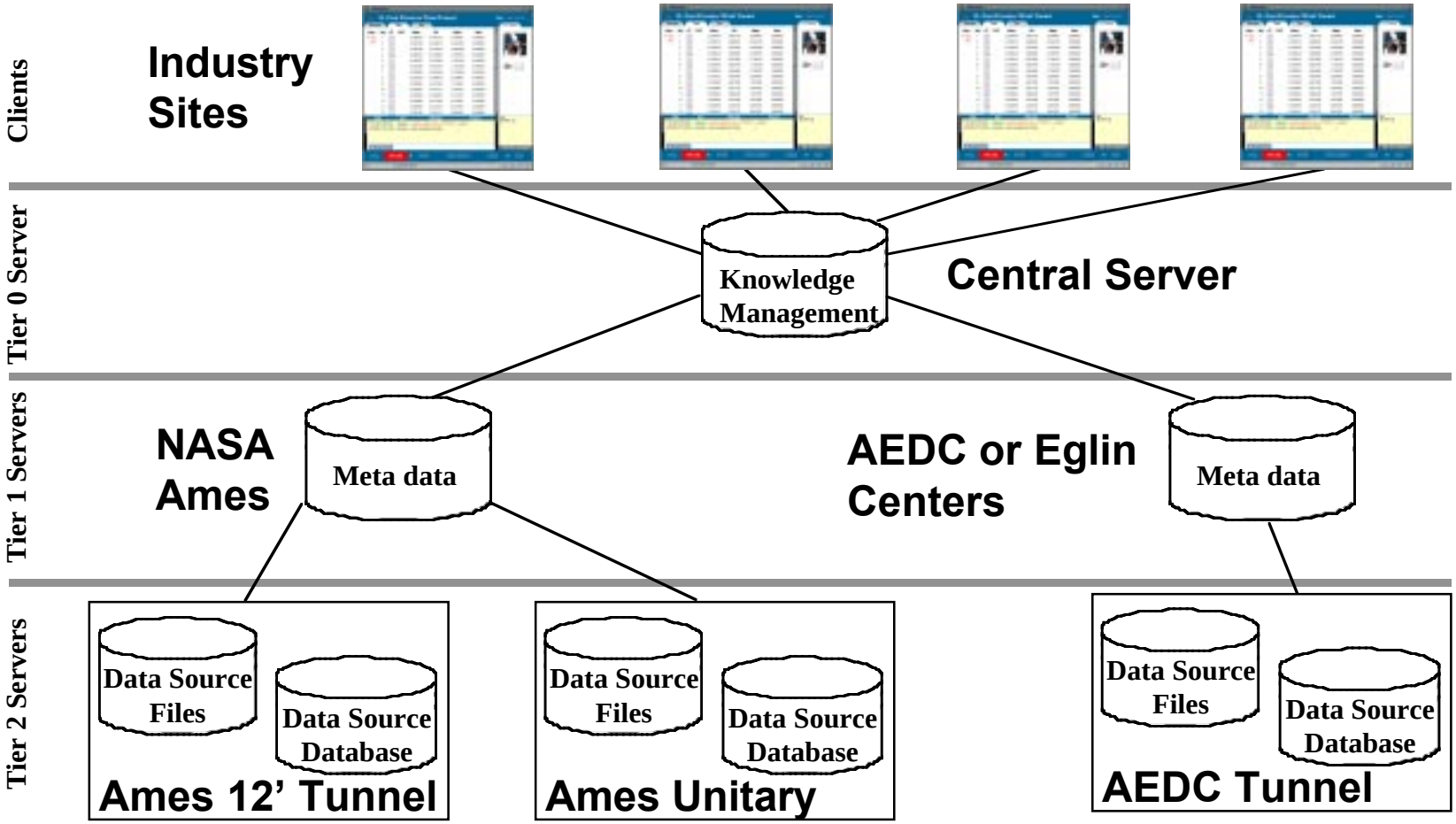
- **Tier 3** - Scientific process and generation of raw data.
- **Tier 2** - ***Data*** source proxy stores the data (raw or in a database).
- **Tier 1** - Meta-data captures the ***Information*** (who, where, why, what) about the raw data.
- **Tier 0** - ***Knowledge*** management database (coordinates the grouping of information sets and manages User information).
- **Client** - Presentation and ***Analysis*** of the selected data for the User.

Aerospace Science Data Integration



DReAM Approach - Enable Scientific Data Dissemination and Integration

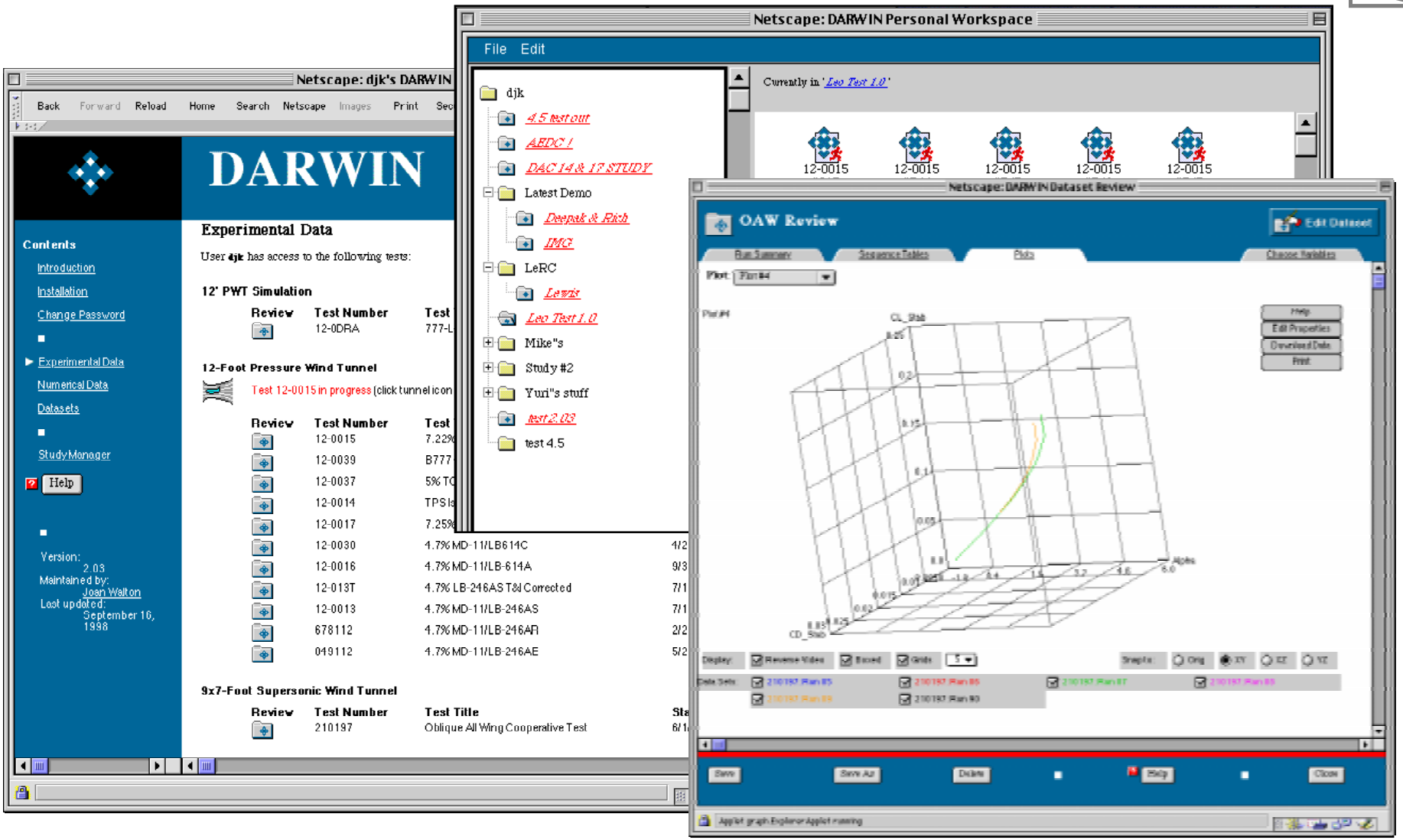
Distributed DARWIN Model



Current DReAM Applications in Development

- DARWIN (DReAM applied to the Wind Tunnels experimental data)
  - Ames Wind Tunnels (v1 operational at Ames, v2 for June 30, 1998)
  - Langley Wind Tunnels (v1 operational in Unitary WT, 9/97)
  - Provide remote access to design CFD results from ADTT aero-design system. Cross compare with experimental data
- SpaceIDS (DReAM tools to support TPS/Reentry analyses)
  - Aerothermophysics CFD and TPS results between LaRC, JSC, Ames, and JPL
- SIMBA / ScenBAD
  - Coupling DARWIN with the Simulation facilities to assess handling characteristics
  - Assessing Operations Scenarios utilizing DARWIN experimental data

Workspace for Data and Knowledge Management



ESE Research Drivers

- Extend the Database Mediation and Federation research to address much larger schemas and datasets
- Assess the scalability of the DReAM system from 100GBs to Terabyte-level databases
- Implement Human Centerd Computing studies to tune the tools within work systems to maximally amplify and leverage, both people and machines

Summary

- DReAM information architecture currently supports IT base and Aviation Safety Programs (Data Sharing) within the Aeronautics Enterprise

- DReAM components to be released to all interested NASA element groups (Data management tools, applets, statistical components)

- DReAM technologies can be extended to integrate other NASA datasets including the Earth Science Enterprise's

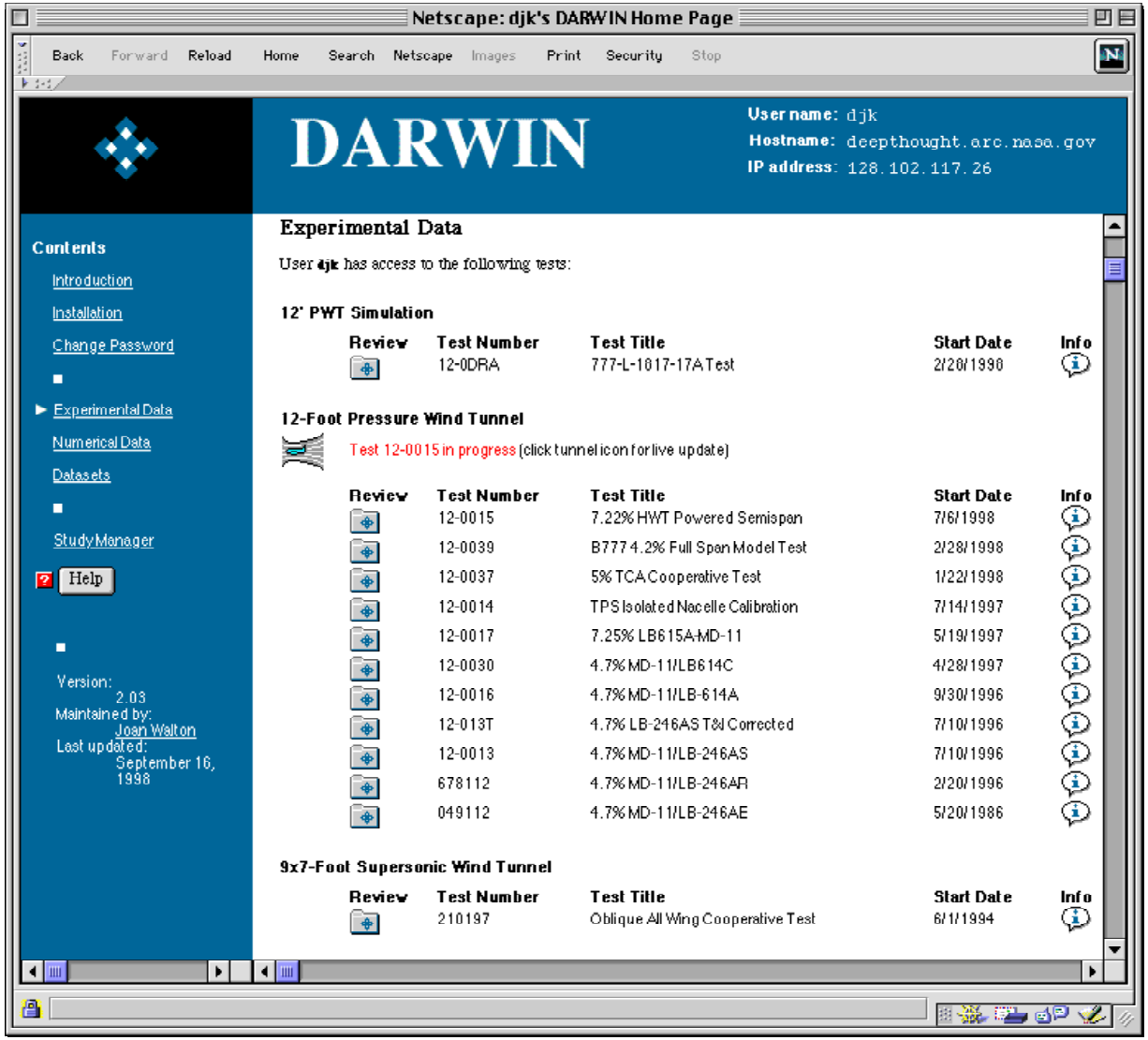
  Create a system analogous to DARWIN but tuned for Earth Science Data analysis and management to access a DAC.

  - Showcase as a prototype of capability for and ESIP
  - Highly leverage existing Aeronautics Enterprise Investments

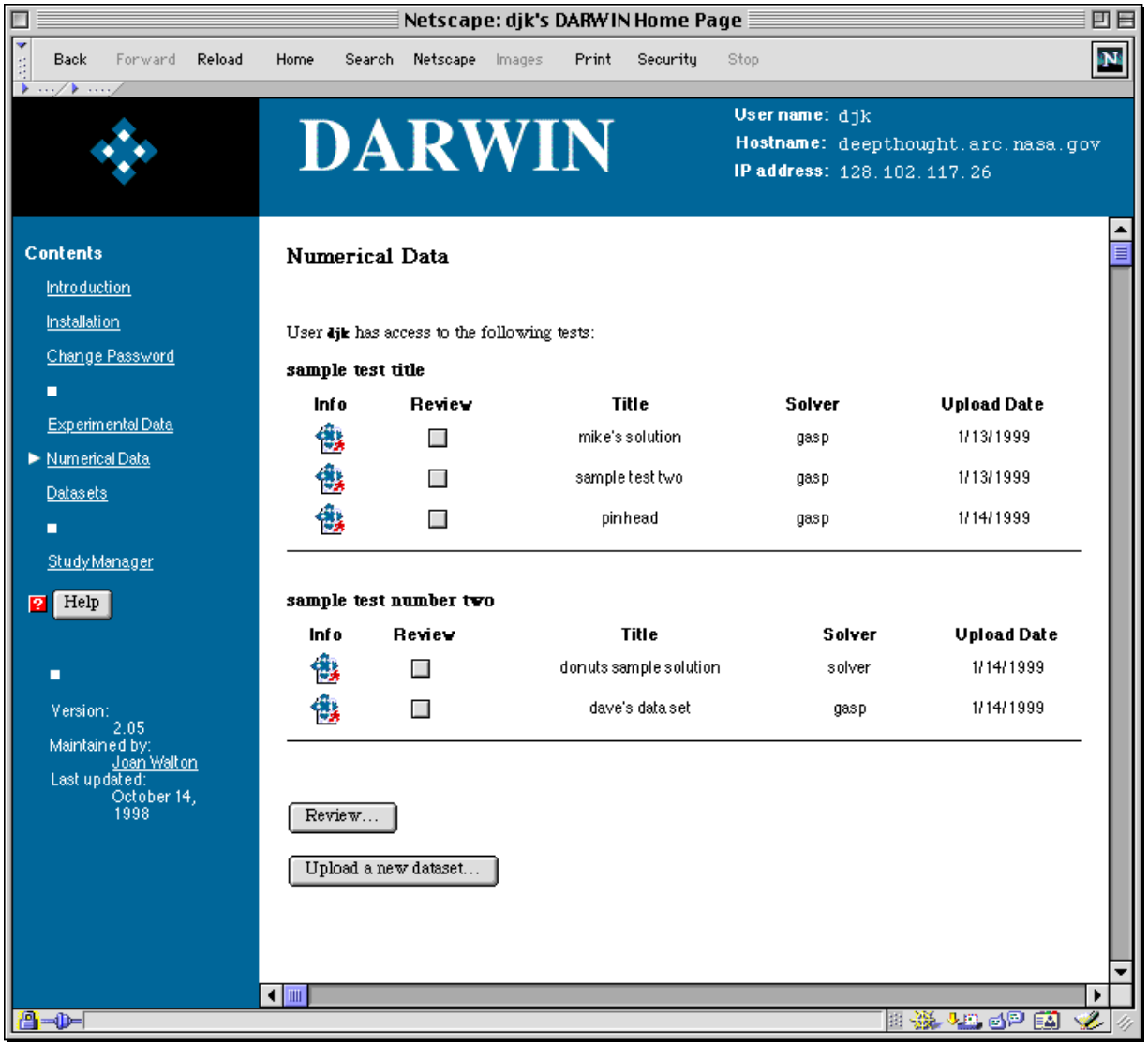
DARWIN Status

- DARWIN (version 2) is an Operational System at NASA Ames
  - Analyze, Compare and Share Wind Tunnel Test data (14 NASA (and other) data sets)
  - DARWIN v2 is designed to access multiple remote database (LaRC, AEDC, etc) and to address the DARWIN v1 issues
  - DARWIN v2 is operational at Ames for the High Wind Transport Test in July at the 12ft Pressurized Wind Tunnel
  - Derive information from data, Manage resulting knowledge
  - Provide broad, secure, computational and communication infrastructure
- DARWIN in NASA today
  - DARWIN v1 has been demonstrated at LaRC for several Unitary Wind Tunnel data set.
  - DARWIN compatibility is a design goal of the AEDC remote access Wind Tunnel team (IT-IS).
  - Plans to couple to LeRC Numerical Engine Simulations and Engine test cell data is underway

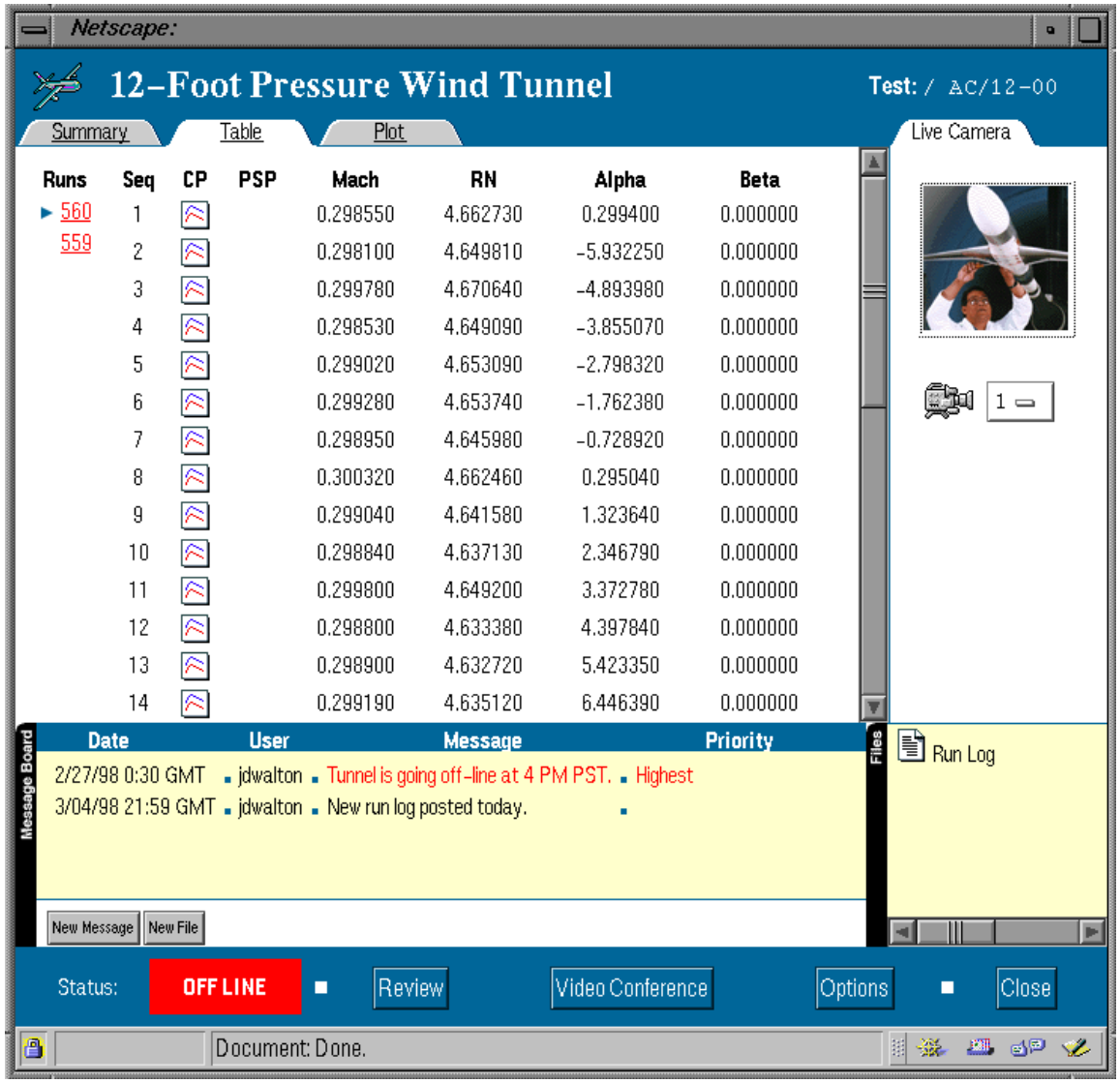
DARWIN Experimental Tests



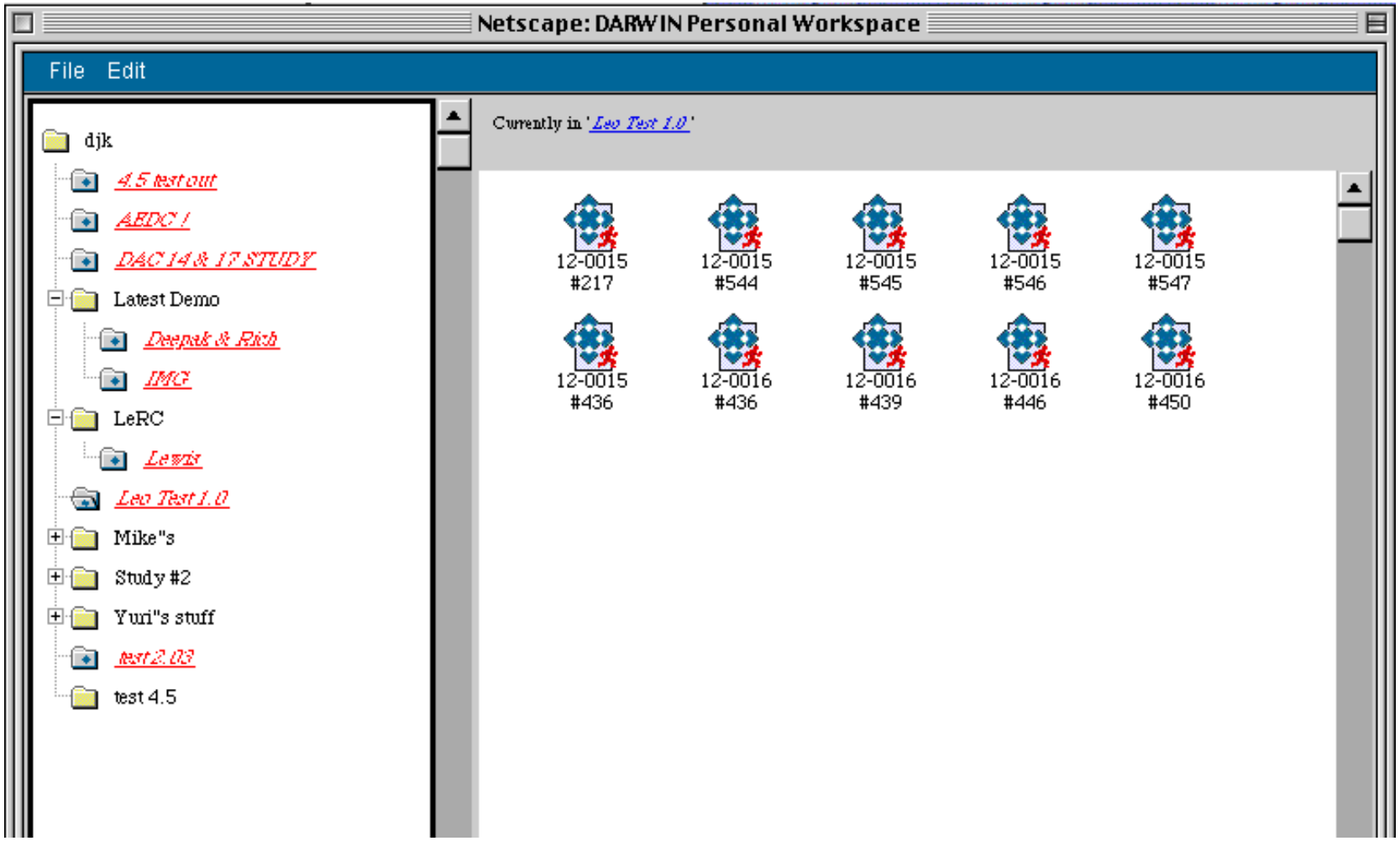
DARWIN Numerical Data



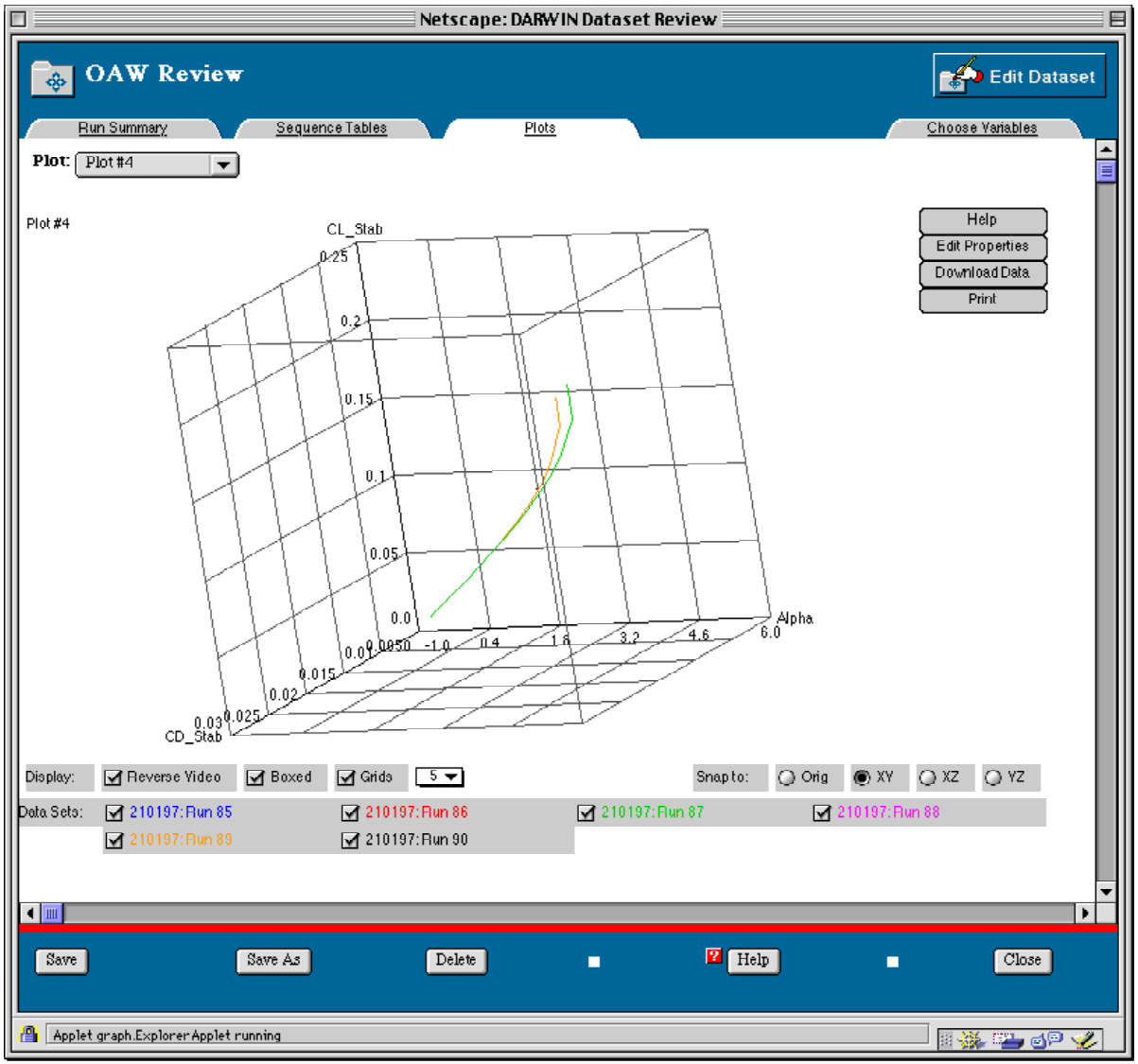
DARWIN "Live Test" Screen



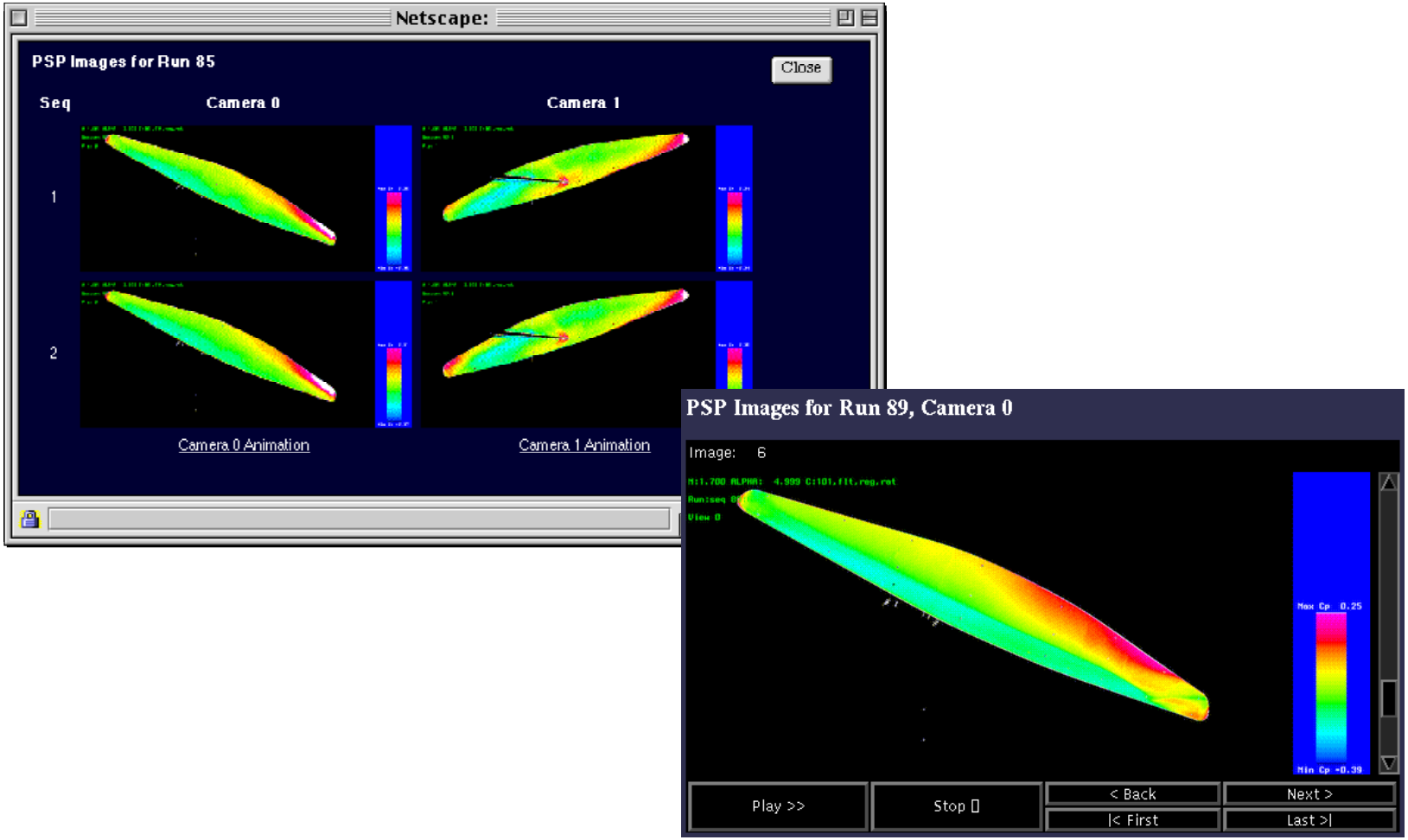
DARWIN Study Manager Screen



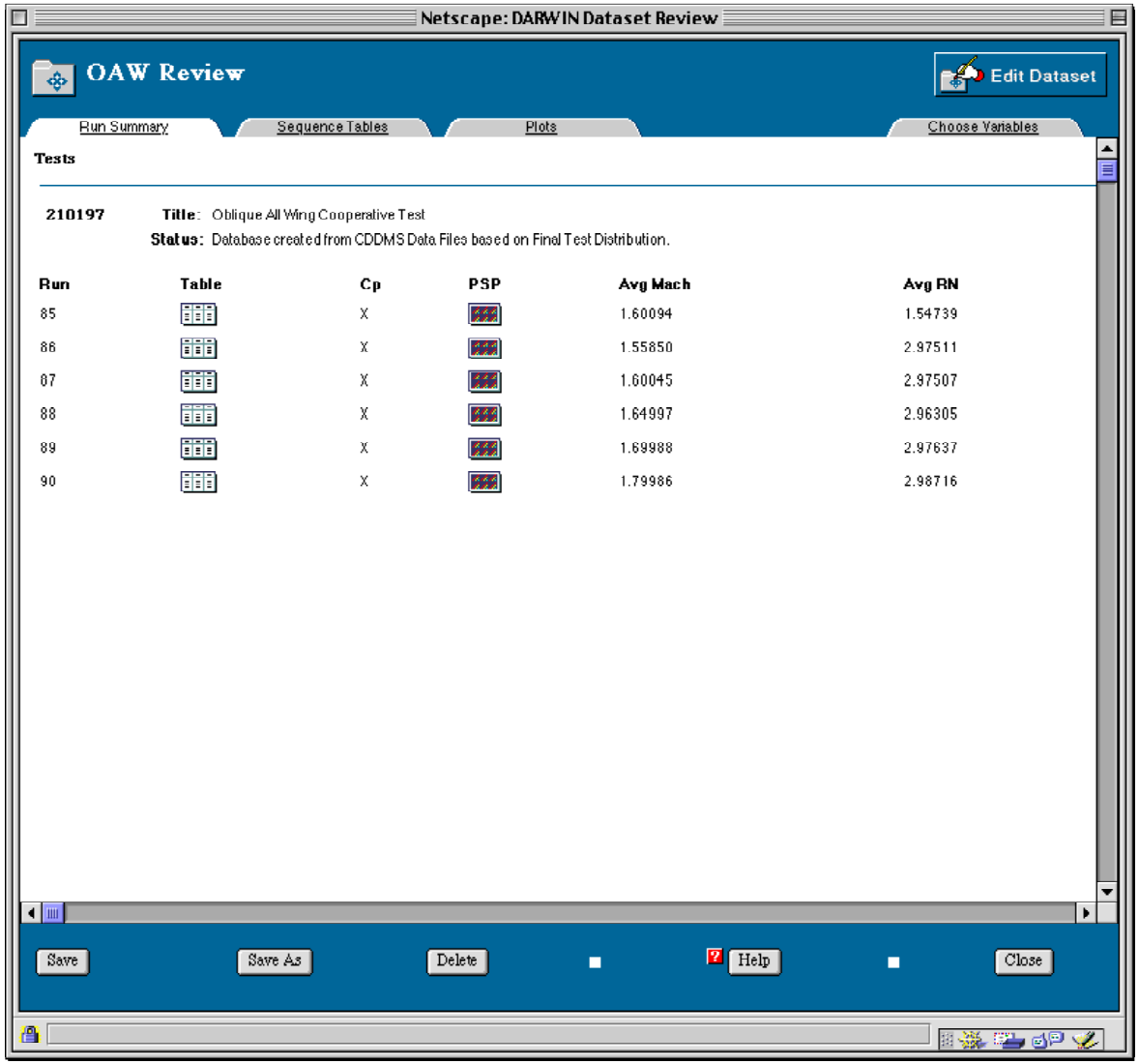
DARWIN Study Plots



DARWIN Image Management

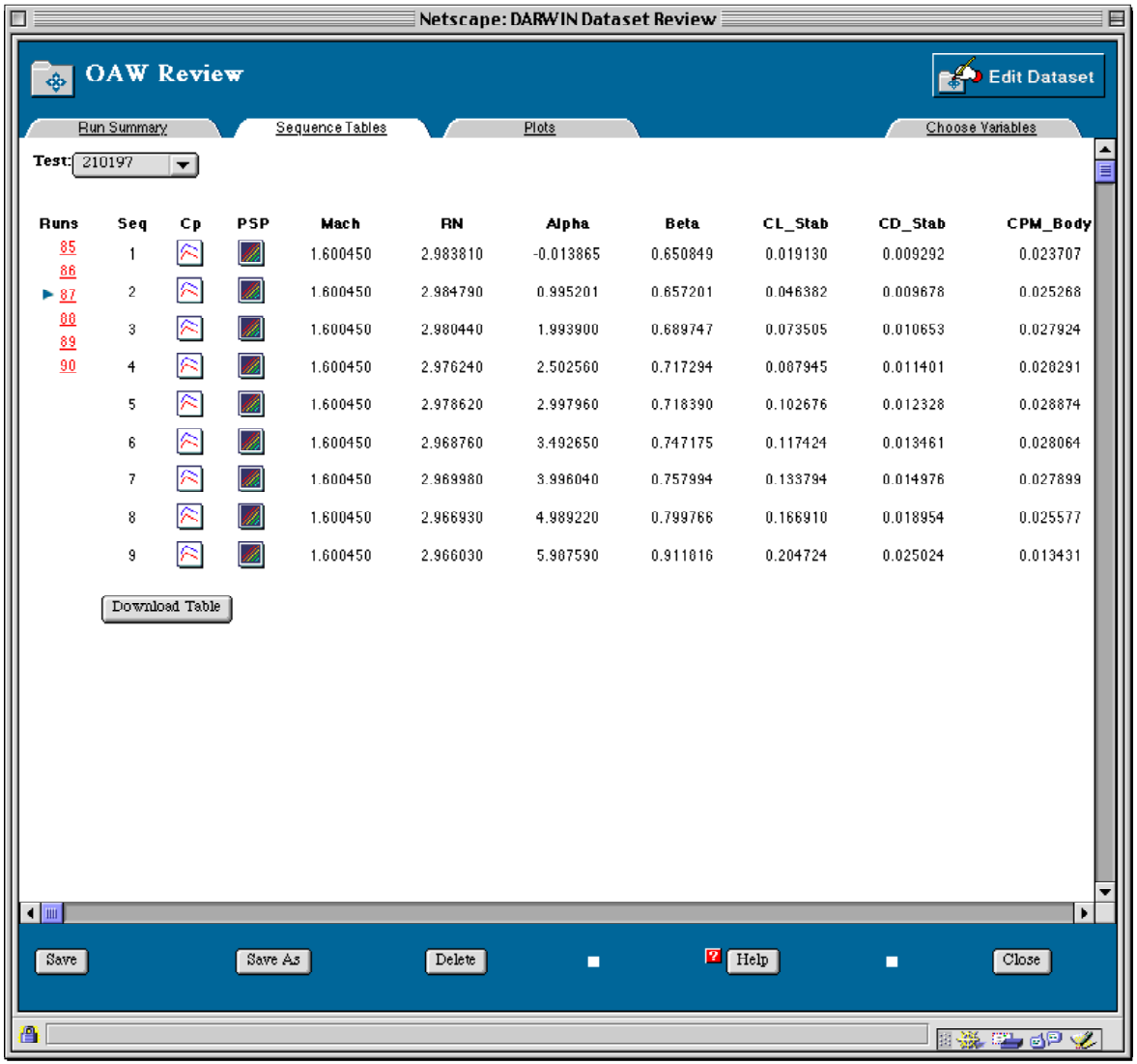


DARWIN Dataset Review Screen



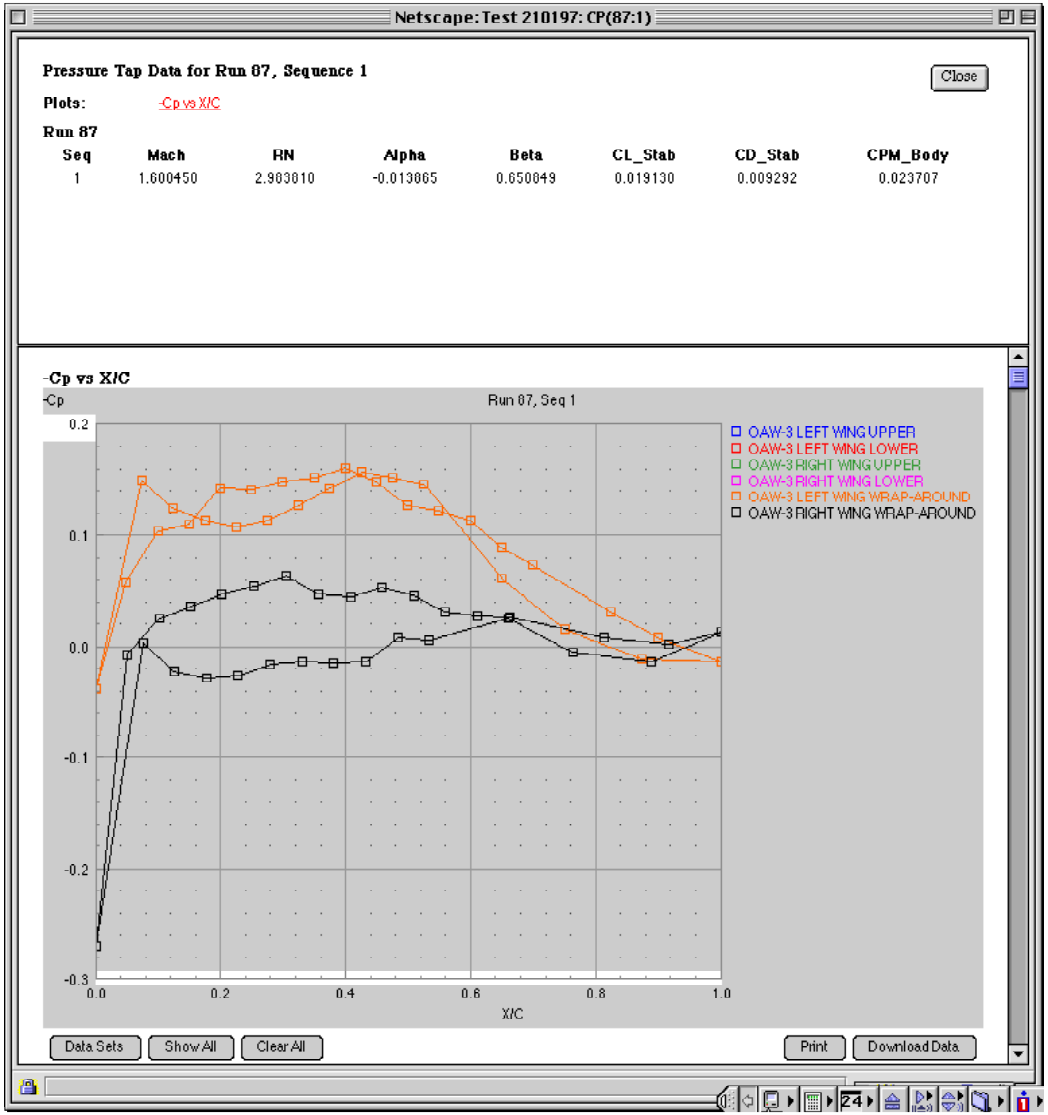
Run	Table	Cp	PSP	Avg Mach	Avg RN
85		X		1.60094	1.54739
86		X		1.55850	2.97511
87		X		1.60045	2.97507
88		X		1.64997	2.96305
89		X		1.69988	2.97637
90		X		1.79986	2.98716

DARWIN Dataset Review Screen

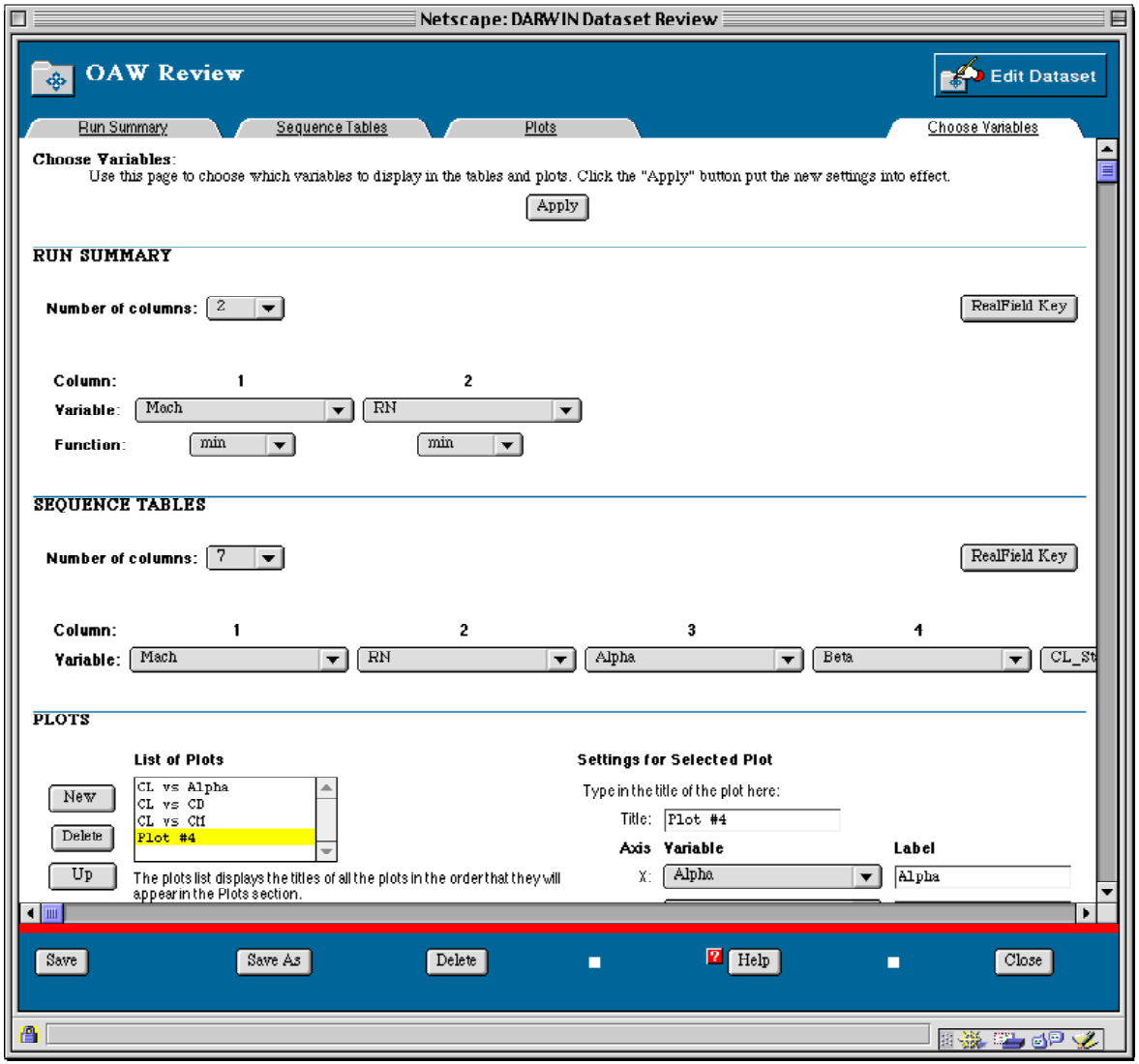


Runs	Seq	Cp	PSP	Mach	RN	Alpha	Beta	CL_Stab	CD_Stab	CPM_Body
85	1			1.600450	2.983810	-0.013865	0.650849	0.019130	0.009292	0.023707
86										
▶ 87	2			1.600450	2.984790	0.995201	0.657201	0.046382	0.009678	0.025268
88	3			1.600450	2.980440	1.993900	0.689747	0.073505	0.010653	0.027924
89										
90	4			1.600450	2.976240	2.502560	0.717294	0.087945	0.011401	0.028291
	5			1.600450	2.978620	2.997960	0.718390	0.102676	0.012328	0.028874
	6			1.600450	2.968760	3.492650	0.747175	0.117424	0.013461	0.028064
	7			1.600450	2.969980	3.996040	0.757994	0.133794	0.014976	0.027899
	8			1.600450	2.966930	4.989220	0.799766	0.166910	0.018954	0.025577
	9			1.600450	2.966030	5.987590	0.911816	0.204724	0.025024	0.013431

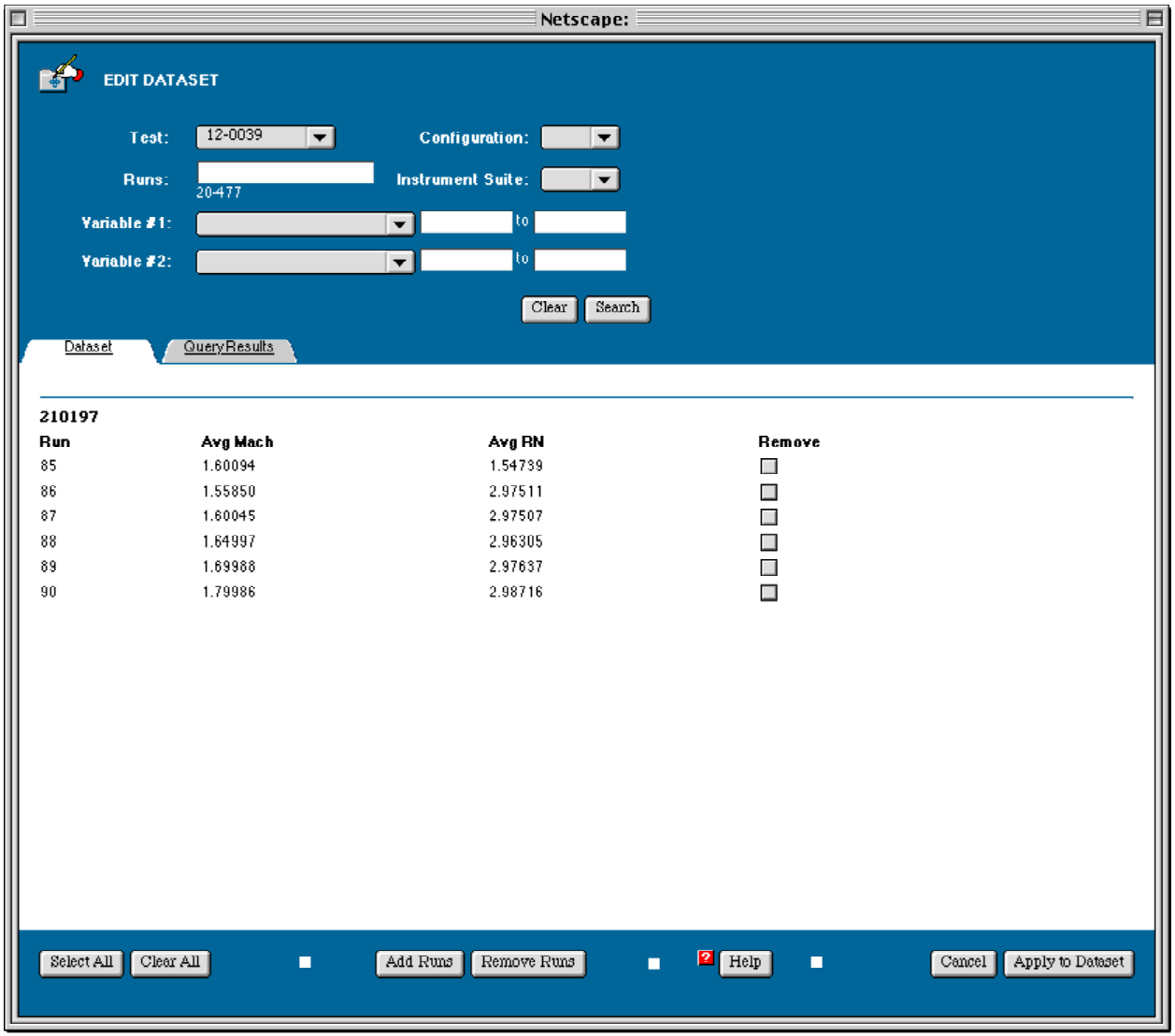
DARWIN Pressure Tap Plots



DARWIN Study Screen Options



DARWIN Edit Study Screen



DARWIN System Components

- DARWIN Workspace Environment
- Meta-Data, and Database Schema
- AeroNet, DARWINnet, and Security Issues

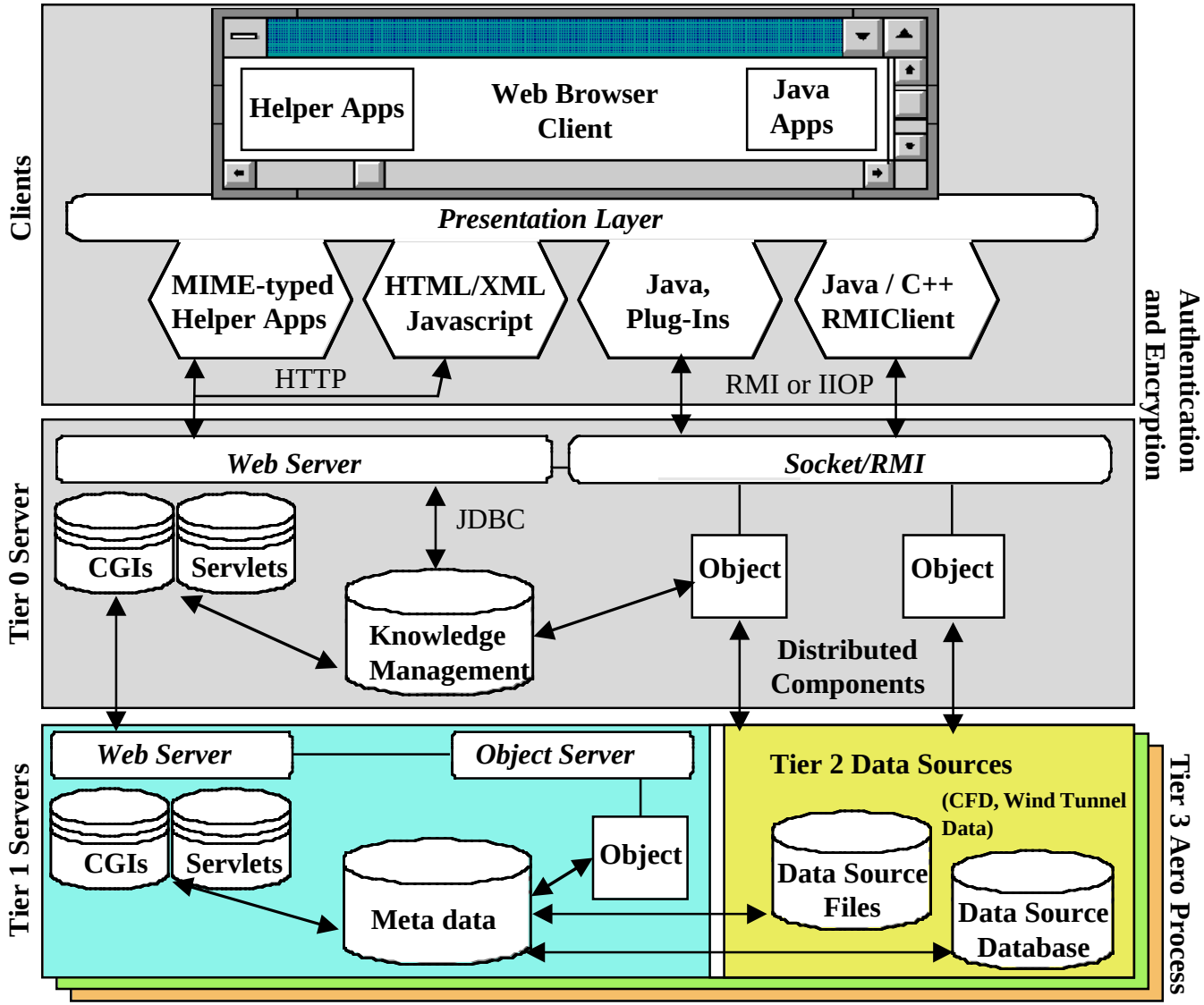
Aero/Space Analysis Architecture

DReAM Tools

Project Specific
(DARWIN, SpaceIDS, ScenBad, etc)

Data Proxies

Data Source Specific
(CFD Systems, Wind Tunnels, etc)



Publications

- DReAM
  - "Distributed Knowledge System for Spacecraft Design Data" D. J. Korsmeyer, A. Shaykevich, J. D. Walton, L. Chan, 18th International Conference on Intelligent Systems, June 1998, Melun France
  - "NASA Distributed Information Systems" D. J. Korsmeyer, Workshop on Compositional Software Architectures, January 6-8, 1998. Monterey, Ca
- DARWIN
  - "DARWIN v2 - A Distributed Analytical System for Experimental Test Data" D. J. Korsmeyer, J. D. Walton, Invited paper at the 20th AIAA Advanced Measurement and Ground Testing Technology Conference, June 1998, Albequerque, NM,
  - "The DARWIN Interface to Aeronautics Data", J. D. Walton and D. J. Korsmeyer, poster at the 1998 International Conference on Human-Computer Interaction in Aeronautics, May 1998,
  - "Experimental and Computational Data Analysis in CHARLES & DARWIN" ISCA 13th International Conference on Computers and their Applications, March 1998. D. J. Korsmeyer and J. D. Walton
  - "The DARWIN Workspace Environment for Remote Access to Aeronautics Data," Walton, J. D., Korsmeyer D. J., Batra, R. K., and Levy, Y., AIAA-97-0667, 35th Aerospace Sciences Meeting, January 6-10, 1997, Reno, NV.
  - "DARWIN Information System of NASA--An Introduction," Koga, D. J., Korsmeyer, D. J., and Schreiner, J. A., AIAA-96-2249, 19th AIAA Advanced Measurement and Ground Testing Technology Conference, June 17-20, 1996, New Orleans, LA.
  - "DARWIN--Remote Access and Intelligent Data Visualization Elements," Korsmeyer, D. J, Walton, J. D., Gilbaugh, B. L., AIAA Paper No. 96-2250, 19th AIAA Advanced Measurement and Ground Testing Technology Conference, June 17-20, 1996, New Orleans, LA.
  - "DARWIN--Integrated Instrumentation and Intelligent Database Elements," Schreiner, J. A., Trosin, P. J., Pochel, C. A., and Koga, D. J., AIAA-96-2251, 19th AIAA Advanced Measurement and Ground Testing Technology Conference, June 17-20, 1996, New Orleans, LA.
  - Articles in Byte, Information Week, Aviation Week, etc...