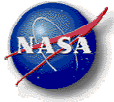# SPATIAL INFORMATION PROCESSING:

STANDARDS-BASED OPEN SOURCE VISUALIZATION TECHNOLOGY

WORLD WIND VISUALIZATION TECHNOLOGY

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WORLD WIND DEVELOPMENT TEAM

World-class NASA engineers

NASA Ames Research Center

WORLD-WIDE OPEN SOURCE COMMUNITY

Unlmited resource for advancing technology

Planet Earth

Abstract. Information security is a global issue that will increasingly affect our ability to survive as a species. Collectively we must better appreciate the complex relationships that make life on Earth possible. Providing spatial information in its native context can accelerate our ability to process that information. To maximize this ability to process information, three basic elements are required: data delivery (server technology), data access (client technology), and data processing (information intelligence). NASA World Wind provides open source server and client technologies based on open standards. The possibilities for data processing and data sharing are enhanced by this open infrastructure for geographic information. It is interesting that this open source and open standards approach, unfettered by proprietary constraints, simultaneously provides for entirely proprietary use of this same technology.

1. Geographic Visualization Technology

Virtual globes, or spatial visualization technologies, are well into their first generation, providing increasingly rich visualization of more types and quantities of information. However, they are still mostly single and proprietary programs, akin to a web browser whose content and functionality are controlled and constrained by the respective manufacturer. Today Google and Microsoft determine what we can and cannot see and do in these programs.

1.1 WHY WORLD WIND?

NASA World Wind began as a single program with specific functionality, to deliver NASA content. But as the possibilities for virtual globe technology became more apparent, we found that while enabling a new class of information technology, we were also getting in the way.

Researchers, developers and even users expressed their desire for World Wind functionality in ways that would service their specific needs. They want it in their web pages. They want to add their own features. They want to manage their own data. They told us that only with this kind of

flexibility, could their objectives and the potential for this technology be truly realized.

World Wind client technology is a set of development tools, a software development kit (SDK) that allows a software engineer to create applications requiring geographic visualization technology.

1.2 MODULAR COMPONENTRY

Accelerated evolution of a technology requires that the essential elements of that technology be modular components such that each can advance independent of the other elements. World Wind therefore changed its mission from providing a single information browser to *enabling* a whole class of 3D geographic applications. Instead of creating a single program, World Wind is a suite of components that can be selectively used in any number of programs.

World Wind technology can be a part of any application, or it can be a window in a web page. Or it can be extended with additional functionalities by application and web developers. Figure 1 shows satellite tracking technology. JSatTrak allows you to predict the position of any satellite in real time, or in the past or future, using advanced SGP4/SDP4 algorithms
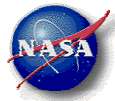
developed by NASA/NORAD to propagate the satellite orbits.
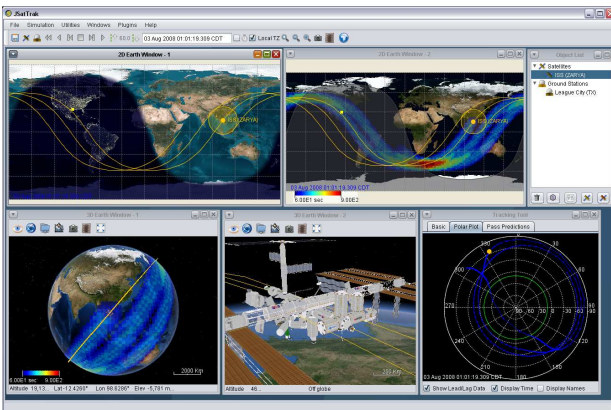

Figure 1. JSatTrak

World Wind makes it possible to include virtual globe visualization and server technology in support of any objective. The world community can continually benefit from advances made in the technology by NASA in concert with the world community.

EOLi (Earth Observation Link) is the European Space Agency's client for Earth Observation that allows you to browse the metadata and preview images of Earth Observation data acquired by satellites.

Figure 2. ESA's EOLi

2. Open Source and Open Standards

NASA World Wind is NASA Open Source software. This means that the source code is fully accessible for anyone to freely use, even in association with proprietary technology. Figure 2 shows open source satellite data analytical technology that will use World Wind for visualization.

Imagery and other data provided by the World Wind servers reside in the public domain, including the data server technology itself. This allows others to deliver their own geospatial data and to provide custom solutions based on their users' specific needs.

The Geoinformatics Group at the University of Alabama, Huntsville is enhancing their Satellite Imagery Visualization

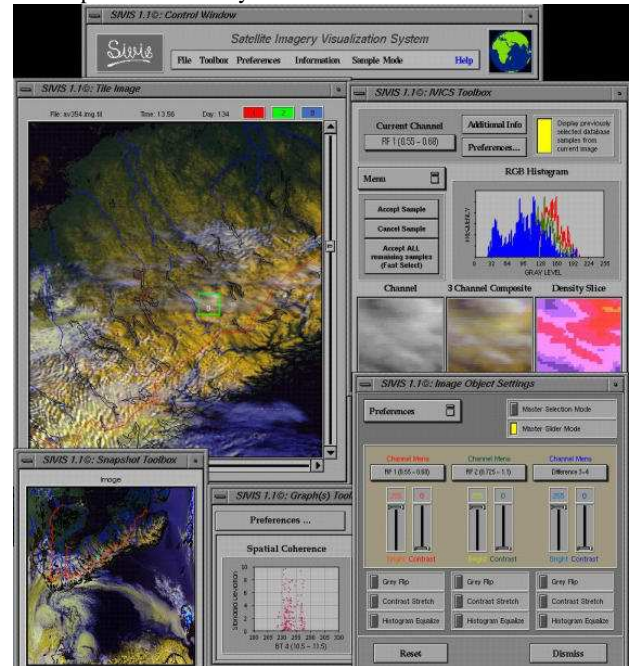System (SIVIS) with World Wind to improve access to multi-spectral data analysis.

Figure 3. Satellite Imagery Visualization System (SIVIS)

3. World Wind Vision

NASA World Wind has one overriding purpose, to enable rich use of the world's geographic data. The premise for this vision is simply "Now it can be done!" A concept map for this is Figure 4. Some of the enabling issues are:

- Hardware now supports 3D visualization cheaply
- Network access and bandwidth widely available
- Increasingly savvy public, largely due to ubiquitous geographic data
- The world's sense of global community increased
- Explosion in geo-data availability, much in the public domain
- Cheap software and distribution mechanism
- Hordes of programmers with the imagination to innovate and the desire to contribute
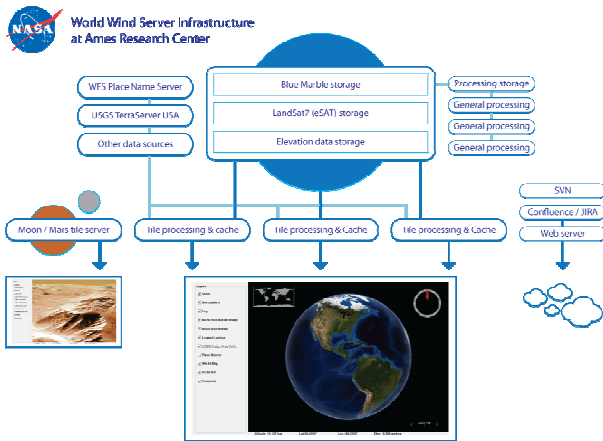- Manipulation and understanding of geographic data no longer a luxury, but a necessity

Figure 4. Data Processing and Infrastructure

4. World Wind Java (WWJ): What It Is, and Is Not

4.1 WWJ SOLVES THE GEO-BROWSER PROBLEM

- Makes the application master instead of servant

4.2 WWJ IS A COMPONENT

- WWJ is a plug-in providing an Earth context for applications
- WWJ does the hard stuff (see Figure 5)
  o Terrain generation from real, remote data at high frequency
  o Image display and selection from terabytes of remote imagery
  o Rapid management of data retrieval from distributed sources
  o Getting it all to show up when and where it's supposed to in one easily incorporated component
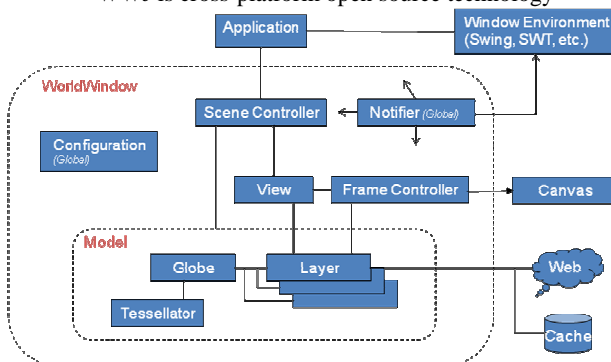- WWJ is cross-platform open source technology

Figure 5. WWJ Architecture and Operation

5. World Wind Future

Support for World Wind is provided by multiple U.S. federal agencies which have needs for open standards and open source visualization and server technology. World Wind provides the utmost in security and adaptability while also insuring for continual optimization of these core technologies.

Any application that will benefit from an Earth context can benefit from World Wind technology, from weather monitoring and climate modeling, to navigation, infrastructure management and emergency response. Figure 6 shows a NASA application of World Wind technology for Search and Air Rescue activities.
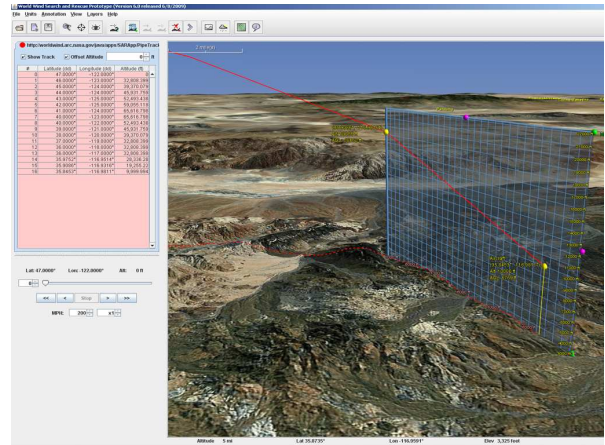

Figure 6. NASA Search & Rescue

Collaboration with other governments and business enterprises via Space Act Agreements offers the opportunity for others to benefit from expertise provided by the World Wind development team and also assure transparent integration of special interests with successive releases of World Wind technology.