Space IP based components (Grid and Web Services Projects)		
Organization, Project Name, POC	**Technology/Application**	**Finished Products/status**
NASA Ames IPG POC: Piyush Mehrotra Piyush.Mehrotra-1@nasa.gov 650-604-5126 Tom Hinke thinke@mail.arc.nasa.gov Global Grid Forum Applications http://www.cs.vu.nl/ggf/apps-rg/index.html http://www.ipg.nasa.gov/	The **IPG (Information Power Grid)** is being used to test "middleware" such as the Globus metacomputing toolkit, grid-enabled applications such as OVERFLOW, and improved accounting, security, and scheduling functions. Management of the testbed is decentralized and democratic, with each site retaining full control over the use of their resources.	Operational Grid connecting NASA Centers (Ames, Glenn, Langley) with supercomputers, mass storage devices, large clusters of computers (including new Columbia (10,240 processor Linux machine Columbia (10,240 processor Linux machine), Common Grid Services, Information Environments,
CEOS Grid pilots All CEOS projects below Yonsook Enloe, NASA/SGT yonsook@harp.gsfc.nasa.gov yonsook@mindspring.com, Allan Doyle, adoyle@intl-interfaces.com http://lennier.gsfc.nasa.gov/grid/ (started 2002)	**CEOS** (Committee on Earth Observation Satellites) Working Group on Information Systems Services (WGISS) CEOS GRID Task Team	Grid Security (CA Certification Authority) Cookbook for Virtual Organizations; security and firewall best practices
CEOS/ESA European Space Agency (ESA), Open GRID services for Earth Observation	**Open GRID services for Earth Observation** : To allow GRID-based applications to discover & retrieve information about relevant datasets in any global coverage area of interest, transfer large amounts of EO data products to the GRID, and trigger hundreds of concurrent processes to carry out data processing & analysis on-the-fly.	

CEOS/NOMADS (NOAA Operational Model Archive and Distribution System) , POC Glenn Rutledge NOAA NCDC Glenn.Rutledge@noaa.gov Danny Brinegar NOAA NCDC Danny.Brinegar@noaa.gov	**NOMADS** is a network of data servers to access and integrate model and other data stored in geographically distributed repositories in heterogeneous formats. NOMADS enables the sharing and inter-comparing of model results and is a major collaborative effort, spanning multiple Government agencies and academic institutions.	DODS-OPeNDAP http://opendap.org/ servers (OPeNDAP as transport standard for ocean science data products) , Globus 2.4.2, Work Flow manager Pegasus, MCS (Metadata Catalogue Services), GDS,
CEOS/GMU George Mason University, OGC & Grid/Web Services (NASA ESTO Funding), POC : Liping Di GMU lpd@rattler.gsfc.nasa.gov Aijun Chen GMU aijunchen@gmail.com	**OGC** : Demonstrate the feasibility of the integration of Grid and OGC web service technologies for providing interoperable, personalized, on-demand data access and services at the NASA data pools environment. Grid technology geospsatially enabled and OGC standard compliant and make OGC tech Grid enabled. The integration allows researchers to focus on science and not issues with data receipt, format, and manipulation. The built-in OGC geospatial services include subsetting, resampling, georectification, reprojection, reformatting, and visualization.	ESTC 2004 paper http://www.esto.nasa.gov/conferences/estc2004/papers/a3p3.pdf presentation http://www.esto.nasa.gov/conferences/estc2004/presentation/A3/a3p3.pdf
CEOS/ESTO University of Alabama in Huntsville (UAH), Grid-Enabled Scientific Data Mining Prototype, POC : Sara Graves, sgraves@itsc.uah.edu Helen Conover, hconover@itsc.uah.edu Sandra Redman, sredman@itsc.uah.edu	**Data mining** and machine learning applications targeting the Earth sciences. UAH will also investigate the use of the Earth Science Markup Language (ESML) to address both data format/interoperability issues, and data semantics for the Grid. Bring in tech from NSF Middleware Initiative (http://www.nsf-middleware.org/) and MEAD Expedition on the TeraGrid Alliance.	Globus Toolkit 3, GridFTP? HTTP / FTP DODS / OpenDAP ESML Registry THREDDS Algorithm Development and Mining System (ADaM) [http://datamining.itsc.uah.edu/adam/]

CEOS/USGS Data delivery utilizing GridFTP, Data Sharing, POC : Stuart Doescher, USGS/EDC, doescher@usgs.gov, (605)-594-6013 Mike Neiers, neiers@usgs.gov (605) 582 6834 Technical contact	**GridFTP** & certificate authority process for data delivery to the scientific user community and with receiving data into the archive from producer/reception sites. Explore utilization of GRID technologies to improve the scalability WTF (WGISS Test Facilities) cal/val to promote and ease the sharing of data between the Cal/Val collaborators and with NASA Data Pools.	Globus Toolkit 3 GridFTP The catalog manager services : Metadata Catalog Service (MCS) and the Storage Resource Broker (SRB) Metadata Catalog (MCAT).
CEOS/Dutch Space, GridAssist POC : GridAssit: Mark Vacher Dutch Space m.vacher@dutchspace.nl Ruud Grim r.grim@dutchspace.nl http://tphon.dutchspace.nl/grease/public/index.html	**GridAssist** as interface for legacy system to grid services. GridAssist provides a portal for access to applications, resources and data using high-speed networks, a scenario builder that can be used to construct scenarios consisting of chains of data and applications, and a controller that schedules the jobs on a Computational Grid.	GridAssist is a Grid-based workflow management tool that allows the user to execute workflows in a Grid environment. Was GREASE (Grid Aware End-to-end Analysis and Simulation Environment)
CEOS/GSFC ADG (Advanced Data Grid), NPOESS Preparatory Project (NPP) - funding cancelled, POC : Jeffrey Lubelczyk, Project Lead NASA/GSFC jeffrey.t.lubelczyk@nasa.gov Samuel Gasster, Aerospace Corp samuel.d.gasster@aero.org Robert Harberts GST harberts@gst.com	**Advance Data Grid** Prototype Project goal is to address sizing, performance & scalability of grid technology for a peta-byte class Earth Science ground system., GSAW March 2003 presentation on the GSFC Data grid pilot http://sunset.usc.edu/gsaw/gsaw2003/s7/gasster.pdf GlobusWorld 2004 http://www.globusworld.com http://www.globusworld.org/program/slides/8c_3.pdf	Globus Toolkit Storage Resource Broker / Metadata Calalog (SRB/MCAT) Metadata schema for MODIS Level 0/1 data in SRB/MCAT data ingest and MCAT updates

CEOS/GSFC EOSDIS Data Pools, POC : Mike Moore, NASA,/GSFC, mike.moore@gsfc.nasa.gov, (301) 614-5123 Liping Di, George Mason University, lpd@rattler.gsfc.nasa.gov, (301) 552-9496 Chris Bock, NASA/GSFC, chris.bock@gsfc.nasa.gov, (301)614-5241	Integration of Grid & OGC (http://www.opengeospatial.org/) web service technologies for providing interoperable, personalized, on-demand data access and services at the NASA data pools environment (distributed active archive centers (DAACs) at GSFC, Langley, EDC, and NSIDC).	OGC web service technology for the interoperability of geospatial data (with Web Coverage Services (WCS), Web Map Services (WMS), Web Feature Services (WFS), and Web Registries Services (WRS))
LandSat Mission Data Continuity (LMDC), POC : Samuel Gasster, Aerospace Corp samuel.d.gasster@aero.org		

National Virtual Observatory (NVO) Teragrid (US) , POC: Roy Williams, PI California Institute of Technology, Andrew Connolly, coI University of Pittsburgh Jeffrey Gardner, coI Pittsburgh Supercomputing Center http://www.us-vo.org/ NASA GSFC NVO Resouce http://nvo.gsfc.nasa.gov (since 2000)	**NVO** : NSF funded multiyear effort to build tools,services, registries, protocols, & standards that can extract the full knowledge content of massive, multi-frequency data sets. Observations from networked space telescopes - - Montage Grid - a portable, compute-intensive, custom astronomical image mosaicking service for NVO (Atlasmaker), - (Authentication) Science Gateways - HotGrid resource allocation to science user using the "Clarens" software from the High Energy Physics community, - General framework for time domain surveys data integration such as QUEST and PanSTARRS. - Very Long Baseline Interferometry (VLBI), this network of 17 radio telescopes collected data to pinpoint the European Space Agency's Huygens probe during its descent through Titan's atmosphere	Suite of applications at http://www.us-vo.org/apps/ - User portal using JSP & COG kit - GridShell - grid-enabled shell scripting environment using Globus to spawn large multi-processor jobs & Condor Glidein scheduler (http://www.tacc.utexas.edu/gridshell and http://www.psc.edu/~gardnerj/talks/SC04-Gridshell.ppt) - NVO Registry Portal at STScI (access services for catalog, image, spectral data, descriptions of organizations & data collections) Mosaicking gateway - Montage :ESTC 2004 paper http://www.esto.nasa.gov/conferences/estc2004/papers/a3p4.pdf presentation . - Data replication (Caltech, SDSC, NCSA) - Web Enabled source identification and cross-matching service (WESIX) http://nvo.phyast.pitt.edu/) to analyze imaging data & to cross-match catalogs with existing multi-frequency data sets.
International virtual observatory (IVOA) 14 member projects (ESO/ESA, US, UK, Canada, China, Russia, Korea, Hungry, France, Germany, Italy, Australia, Japan, India) http://www.ivoa.net/ International OPTICON Interoperability Working Group	**IVOA** : seeks to ensure that the essential VO infrastructural technologies and interoperability standards are developed to enable a VO capability on a global scale. ; - Demonstrations utilized new standard interfaces and protocols for accessing catalog and image data, and the galaxy morphology demo employed grid-based computing for doing parallel computations..	VOTable (XML format for tabular data), - Resource Discovery - Astronomical Query Language , Data Format Description Language (DFDL) - language for describing formats http://www.epcc.ed.ac.uk/dfdl,… others

NASA Earth Sciences, Earth Science Technology Office, NASA Earth Science AIST (Advanced Information Systems Technology) POC: Peter Thornton, (National Center for Atmospheric Research (NCAR) http://www.esto.nasa.gov/info_technologies_aist1.html	**GRID-BGC**, A grid-compute architecture for terrestrial biogeochemical modeling. The objective of the GRID-BGC project is to create an end-to-end technological solution for high-end Earth system modeling that will reduce the costs and risks associated with research on the global carbon cycle and its coupling to climate. Implementing an efficient supercomputer-based Grid Compute Engine for end-to-end operation of a high-resolution, high data-volume terrestrial carbon cycle model.	1. Data ingest & interpolation engine that acquires ground-based observations of surface weather as its lowest-level input data & produces high-resolution gridded outputs of surface weather fields. Prototype at http://www.daymet.org ; 2. A state-of-the-art model of terrestrial carbon, water, and nitrogen cycles 3. A post-processing engine 4. A visualization engine 5. A mass storage system with high-speed connection to the computational engines. Mass Storage System (MSS) at www.scd.ucar.edu/main/mss.html http://www.cgd.ucar.edu/tss/staff/thornton/grid_bgc/
NASA Earth Sciences, Earth Science Technology Office	Roadmap to an Earth Science cyberinfrastructure. Demo: NASA scientist at Wallops Island, Virginia used a grid-enabled portal (developed by the San Diego Supercomputer Center) to control an electron microscope at the University of California at San Diego, with the data from that work being shipped over the grid to a storage system at Ames.	ESTC 2004 paper http://www.esto.nasa.gov/conferences/estc2004/papers/a3p1.pdf ESTC 2004 presentation http://www.esto.nasa.gov/conferences/estc2004/presentation/A3/a3p1.pdf
NASA Earth Sciences, Earth Science Technology Office, Earth Science Data Systems Working Groups ESDSWG http://spg.gsfc.nasa.gov/spg (Since 1998 SEED Study)	**ESDSWG** (Earth Science Data Systems Working Groups) REASoN (Research, Education & Applications Solutions Network) Program http://lennier.gsfc.nasa.gov/seeds/ (SEEDS (Strategy for Evolution of ESE Data Systems study 1998)	Next-generation Evolvable Web-based Distributed Interoperable Services (NEWDIS) Road Map Distributed Interoperable Services Road Map REASoN Services & Interface Inventory Key interface types categorized

NASA Earth Sciences ESTO ECHO (Earth science Clearing House) , POC : Keith Wichmann wichmann@gst.com ECHO (Earth science Clearing House http://www.echo.eos.nasa.gov/	**ECHO** : Public clearinghouse into EO data, ECHO services Data services – provide earth science data subsetting, reprojection, science algorithm, conversions, invoked by clients Search services – thesaurus, Gazetteer, coincident search, query preview, invoked by client Adm services – billing, accounting, LDAP,	ECHO Earth Science Metadata Conceptual Model (EESMCM), Client IF : Mercury-EOS for Web-based search and order system for the ORNL DAAC. Use of UDDI
NASA MSFC, OASIS, Space Development and Operations Grid Prototype (SpaceDOG), POC : Bob Bradford bob.bradford@msfc.nasa.gov donna.sellers@msfc.nasa.gov	**OASIS** : Grids for Space Operations- provide through a portal all the services (command, control, telemetry, voice and video) required to conduct collaborative efforts whether on a small scale like between several engineers/scientists to program/project level collaboration. These efforts could be supporting space ops or developments.	SpaceOps 2002 and 2004 http://www.spaceops2004.org/downloads/ppts/final/bradford_283_131_final.ppt
NASA MSFC Huntsville Operation support Center , HOSC Ground System for ISS, STS, Chandra, POC : Barry Bryant, barry.s7.bryant@lmco.com	**HOSC** : EHS (Enhanced HOSC System), PDSS (Payload Data Services System - for ISS Science data), PPS (Payload Planning System), TReK (Telescience Resource Kit for Remote users/Principle Investigator), IVoDS (Internet Voice Distribution System), Launch Information Exchange Facility (LIEF), connectivity to European Space Operation Center and User Support and Operations Centres (USOC)	Unix to PC Migration & Linux; migration to web 3 tier architecture; security with firewall/VPN, SAN/NAS storage; remote operations
NASA JSC Mission Control and Grid projects, POC: Steve Gonzalez steven.a.gonzalez1@jsc.nasa.gov	Investigation of how to use grid technologies for Distributed control center, working with vendor http://www.datasynapse.com/;	Grid for Exploration Conference.2004

NASA OMNI (Operating Missions as Nodes on Internet) Program, POC : James Rash dave.israel@nasa.gov Dave Israel dave.israel@nasa.gov Keith Hogie http://ipinspace.gsfc.nasa.gov/	**OMNI** (Operating Missions as Nodes on Internet)., Space Network IP Services (SNIS) for IP services to NASA TDRS & GN (White Sands) IP Handbook for Space Mission Communications, Space Componenets (LPT/GRID, CFDP) http://ipinspace.gsfc.nasa.gov/documents/	More at Space Internet Workshop presentations http://ipinspace.gsfc.nasa.gov/siw.html
NASA GSFC GMSEC (GSFC Mission Services Evolution Center), POC : Dan Smith, dssmith@pop500.gsfc.nasa.gov GMSEC Ref Arch, GMSEC Applications Programming Interface (API) http://gmsec.gsfc.nasa.gov/	**GMSEC** architecture provides a scalable, extensible ground & flight system approach for future missions. The architecture enables quick and easy integration of functional components that are selected to meet the unique needs of a particular mission. The architecture enables the addition, deletion, and exchange of components to meet the changing requirements of missions as they progress through their lifecycles and provides a rapid, flexible, and cost-effective means to meet a wide variety of evolving mission concepts and challenges. GMSEC Development Lab, augmented with adapters,	Standardized messages formats, Plug-and-play components, Information software bus, Platform transparency, Mission Services Components :Telemetry & Command, Planning & Scheduling, Assessment & Archive, Guidance Navigation & Control, & Simulation & Modeling
NASA JPL/NASA Ames, Mars Exploration Rover Collaborative Information Portal (CIP) , POC : Joan Walton, Ames jdwalton@mail.arc.nasa.gov 650–604–2005 Ronald Mak, rmak@mail.arc.nasa.gov ron@apropos-logic.com 650–604–0727	**MER CIP** (Collaborative Information Portal):: MER Team time management, personnel management and scheduling, data handoff tracking and viewer navigation	SOA (Service Oriented Architecture) with J2EE Java, web services (including middleware, SOAP, XML data transfer, Enterprise Java Beans) using Weblogic from BEA system COTS, Java Virtual Machine (client), JMS Java Message Service for messaging event notification. Message-driven beans manage message archiving, Verisign digital certificates for security; JaveOne 2003 presentation www.sfbayacm.org/events/slides/2003-11-19_CIP.ppt

NASA Portal and Knowledge Management, POC : Jeanne Holm, Jeanne.Holm@jpl.nasa.gov , http://km.nasa.gov	**MERS portal** (example of **NASA portal**) - eTouch Systems, service provider of content management & document management, Speedera Networks, provider of distributed application and content delivery services, provides the networking, storage and computing services to disseminate images globally in a matter of seconds. http://www.kmworld.com/publications/magazine/index.cfm?action=readarticle&Article_ID=1888&Publication_ID=120	MERS portal won two Webby Awards, an international honor for Web sites presented by the International Academy of Digital Arts and Sciences. The portal achieved the No. 2 site for government customer satisfaction and was named a top-10 government site for sub-second response time
NASA GSFC, Virtual Mission Operations , POC : GSFC Julie Breed	**GSFC VMOC** Technology Develop : http://ldcm.gsfc.nasa.gov/tech_transfer/SOMO/07_SOMO_UserTools_AutoSys_Breed.pdf; Smallsat : Citizen-Explorer mission https://spacegrant.colorado.edu/vmocc/docs/downloads/pre_VMOCC_CDR.doc; https://spacegrant.colorado.edu/tiki-index.php?page=VMOCC	
NASA GRC, Virtual Mission Operations Control Center (VMOCC) security gateway	**GRC VMOCC** : Veridian Virtual Mission Operations Control Center security gateway www.cisco.com/application/pdf/en/us/guest/strategy/strategy/c644/ccmigration_09186a0080389c13.pdf	Security Gateway
NASA JPL, NASA JPL VMOC Framework, Meemong.Lee@jpl.nasa.gov (818) 354-2228;	**JPL VMOC** (Virtual Mission Operation Center) - used on Deep Space 1, by Team-X (spacecraft design team) and Team-I (instrument design team) at JPL	IEEE Aerospace Conference paper 2004, JPL Virtual Mission Operation Framework : http://ct-esto.jpl.nasa.gov/subpages/Reports/03report/dms/dms-03.html
DOD Office Force Transofrmation/AFRL, TACSAT VMOC, POC : Paul Zetocha, 505-853-4114 Paul.Zetocha@Kirtland.af.mil	**AFRL VMOC** : Air Force and Army Space Battlelabs’ work with the Virtual Mission Operations Center.	

Flight and Ground system automation, SCL (Spacecraft Command Language) & 'Software bus' from Interface & Control System	**SCL** (Spacecraft Command Language) : SCL uses the message bus architecture to provide a distributed and scalable system for both flight and ground automation. - See SML in XML section	1998: FUSE (Far Ultraviolet Spectroscopic Explorer) ground system that used the SCL messaging architecture to simplify the transition from integration & test to flight operations. 2002: NASA's EO-1 messaging to integrate the legacy flight software with SCL's expert system.
NASA JPL OODT (Object Oriented Datat Technology) & OODT Data Grid Framework POC : Daniel CrichtonDan.Crichton@jpl.nasa.gov http://oodt.jpl.nasa.gov/oodt-site/index.html,	**OODT** uses a plug-in framework approach. It provides the transports, query optimization, metadata, and data representation components. You add plug-ins that link the framework to your local data stores. You can provide OODT's features without impacting or changing existing operations. - Enterprise Data Management (EDM) Services: Catalog and Archive Management, Metadata Services, Object Identifier Service, Query Expression, Security Services, Server Management, Grid Services (product, profile, query), Meta Search, RMI Registry, XMLRPC Proxy	Used on PDS (Planetary Data System http://pds.jpl.nasa.gov/), Early Detection Research Network (EDRN) Resource Network Exchange (ERNE), SeaWinds, QuikSCAT, Earth Science Mission, Space, planetary, biomedical, National Institutes of Health. OODT is open source software available through the Open Channel Foundation http://openchannelsoftware.com/orders/index.php?group_id=332
	WISARD (Web Interface for Searching Archival Research Data) : Access Space Physics Data Facility (SPDF) with data from ROSAT, ASCA, XTE, and COBE	

NASA JPL, ESTO Funding, SERVO Grid (Solid Earth Research Virtual Observatory Grid), POC : Andrea Donnellan, Jay Parker JPL, Geoffrey Fox, Marlon Pierce Indiana University' John Rundle University of California Davis,	**SERVO** ((Solid Earth Research Virtual Observatory Grid) : Use web service technology to demonstrate the assimilation of multiple distributed data sources into a major parallel high-performance computing earthquake forecast model. Complexity Computational Environment (CCE) Architecture, GML Schemas as Data Models for Services • Fault and GPS Schemas are based on GML-Feature object. • Seismicity Schema is based on GML-Observation object. http://grids.ucs.indiana.edu/~gaydin/schemas/	http://servo.jpl.nasa.gov/ http://www.servogrid.org/ ESTC 2004 paper http://www.esto.nasa.gov/conferences/estc2004/papers/a3p2.pdf ESTC 2004 presentation http://www.esto.nasa.gov/conferences/estc2004/presentation/A3/a3p2.pdf also see http://www.isi.edu/ikcap/scec-it/
NASA JPL, ESTO Funding, Montage Architecture for Grid-Enabled Science Processing of Large, Distributed Datasets, POC : Joseph Jacob, Daniel Katz, Thomas Prince (JPL) Bruce Berriman, John Good, Anastasia Laity (IPAC) Ewa Deelman, Gurmeet Singh, Mei-Hui Su (ISI)	**Montage** image mosaic service on TeraGrid/NVO • Background modeled and matched across images • Modular “toolbox” design • Loosely-coupled engines for Image Reprojection, Background Matching, Co-addition • Order mosaics through web portal	ESTC 2004 paper http://www.esto.nasa.gov/conferences/estc2004/papers/a3p4.pdf presentation http://www.esto.nasa.gov/conferences/estc2004/presentation/A3/a3p4.pdf
Stanford University (NASA & other funding), Federated Ground Network & GSML (Ground System Markup Language), Networked Ground station, XML Data Definitions :, POC : Stanford Software Infrastructure Group (SWIG) - James Cutler jwc@stanford.edu, Armando Fox Started 2000	**FGN** (Federated Ground station Network) or Virtual Ground Station (VGS) - federate networked ground stations that are under different administrative domains. Ground station facilities can dynamically join and leave the federation. Users designate a subset of facilities as a "team" that collaboratively solves a high-level task with path and node redundancy within a team to deal with partial failures.	Models & abstract interfaces that allow a virtual ground station to be composed of team members. These models & interfaces are standardized to allow heterogeneous station implementations, extensible to allow for future technology development, hierarchical for composition of station operations & resources, & open to facilitate federation membership. http://swig.stanford.edu/space.shtml , SpaceOps 2002, IEEE Aerospace Conference 2004, GSAW 2003

ESA SpaceGrid study, 2001-2003	ESA **SpaceGrid Study** study is run by a consortium led by Datamat S.p.A. (I), with Alcatel Space (F), CS Systems d'Information (F), QinetiQ (UK), Rutherford Appleton Laboratory (UK), SciSys Ltd. (UK). http://www.spacegrid.org http://www.esa.int/export/esaSA/SEMXUES1VED_earth_0.html 2003 SpaceGRID presentations http://earth.esa.int/rtd/Events/SpaceGRID_2003/index.html	SpaceGrid Final report http://www.spacegrid.org/PublicDocs/SpaceGRID_Final_Report.zip, dissemination plan, Grid use for domains Earth Observation; Space Research (Spacecraft - Plasma Interactions; Space Weather; Radiation Transport), Solar System Research; Mechanical Engineering.
Dutch Space, GaiaGrid, GAIA :GMV Madrid Pedro Perez, astronomers at the University of Barcelona Jordi Torra	**GDAAS** : Gaia Data Access and Analysis Study (GDAAS) large-scale mission simulations and data analysis runs using the CESCA (Supercomputing Centre of Catalonia) facilities. A mission duration of 18 months, and simulated data for 200,000 stars distributed over the sky, has been used. Results demonstrate that the `global iterative solution', at the heart of the Gaia data processing challenge, can be implemented as anticipated	GaiaGrid with CESCA (Supercomputing Centre of Catalonia) facilities; GDAAS complete, GDAAS-2, are expected by June 2005.
ESA SCOS 2000 Grid Mission Control System, POC : Vicente Navarro, ESA - ESOC Darmstadt, Germany vicente.navarro@esa.int	**SCOS 2000 Grid Integration mode**l for MCS (Mission Control System) kernel & Portal for the provision of Ground Segment services within Spacecraft Control Operations System 2000 (SCOS-2000) Ground Systems	Grid-aware SCOS-2000 kernel, IEEE Aerospace Conference 2004 paper,
EGEE Planck satellite, POC : Dr. Pasian INAF-Osservatorio Astronomico di Trieste, ITALY (2007)	**Planck@EGEE** project is to port Planck simulation software on the EGEE Grid infrastructure (Enabling Grid E-science Europe http://egee-intranet.web.cern.ch/egee-intranet/gateway.html)	ESRIN "Grid & e-Collaboration for the Space Community" 02/02/2005 http://www.congrex.nl/05m04/

ESA EO Science User communities, THE VOICE (THEmatic Vertical Organizations and Implementation of Collaborative Environments), POC : Stefano Beco / Annalisa Terracina – DATAMAT S.p.A	**THE VOICE** (THEmatic Vertical Organizations and Implementation of Collaborative Environments) : Identification of the common and generic technology elements essential for the establishment of a collaborative environment that supports web-based domain-specific vertical organizations; Identification of common interface mechanisms for data, applications and service establishment, including "exchange languages" for the interaction and exploitation of available resources; Implementation of prototypes, i.e. the implementation of collaborative environments with representative applications and services for domain-specific vertical organizations involving the Earth science domain.	ESRIN "Grid & e-Collaboration for the Space Community" 02/02/2005 http://www.congrex.nl/05m04/
CCSDS Architecture Working Group, MOIS (Mission Operation Information System) POC : Takahiro Yamada http://www.ccsds.org/	**CCSDS** : Reference Architecture for Space Data Systems ,Architecture Working Group (AWG), MOIS, Space Link Extension (SLE), Spacecrafot Onboard Internface (SOIF)	
ESA SCOS 2000 and NoC (Network of Technical Centers), SCOS 2000 Mission Control System, POC : Nestor Peccia,	ESA **RASDS** (Ground System Software Roadmap) , Ground Segment Reference Architecture, Services, Requirements, - **NoC (Network of Technical Centers)** initiative from Agenda 2007	

ESA & VEGA IT GmbH XASTRO, POC : Anthony Walsh, VEGA IT GmbH, awalsh@vega.de Niklas Lindman, ESA/ESOC, nlindman@esa.int	Propose a general data model framework (UML) to support space missions. Proposed framework has two elements: - Astronautics reference Object Model (ASTROM) defined in UML, - XASTRO schemas (XASTRO is the XML based representation of the ASTROM UML model), - Apply framework to mission (CRYOSAT), - Automated Generation of schema(s) from UML model (UML -> XMI -> XML Schemas) if feasible, XASTRO Schemas, http://www.estec.esa.nl/conferences/aerospace-pde-2002/icon_ppt.gif	UML model, www.ssd.rl.ac.uk/ccsdsp2/Meetings/2002/OXF02/XPack/ETS_CAOSXML_TN.pdf XSP - Space Program Schema(s), XSS - Space Segment Schema (s), XSD - Space Domain Schema (s), XSF - System Framework Schema(s), (?Galileo ground segment)
ESA Wireless Onboard Spacecraft Working Group http://www.wireless.esa.int/		
SpaceLAN		
AFRL Space Plug-and-play Avionics (SPA) standard & Adaptive Avionics Experiment (AAE)., DOD OFT (Office Force Transformation) , POC : 'william.foster@kirtland.af.mil', http://www.oft.osd.mil	Part of **Responsive Space** initiative, **SPATSS** (Space Plug-and-play Avionics Testbed Simulator / Stimulator) BAA http://www2.eps.gov/spg/USAF/AFMC/AFRLPLSVD/SPATSS%2D01/SynopsisR.html	IEEE Aerospace 2005 paper: Plug & Play Testbed to Enable Responsive Space Missions, Jeff Summers, MicroSat Systems Inc. 303-285-5153 jsummers@microsatsystems.com
DOD Network Centric Warfare initiatives, DOD NCES (Network Centric Enterprise Services), Policy : Standards : http://www.opengroup.org/public/member/proceedings/q104/03gs.htm	DOD NCW initiatives, NCOW Reference model, Global Information Grid	

DOD Hortzontal Fusion http://horizontalfusion.dtic.mil/	To TPPU - tasking, posting, processing, & using from TPED tasking, processing, exploitation, and product delivery	NCW Toolkit (NG, MA McDonald Bradley), Horizontal Fusion Portal (Mars Portal for warrioers : BEA Weblogic Portal) , Collateral Space (a virtual workspace and data store on the SIPRnet - Autonomy Inc COTS)
DOD Integrated Network Enhanced Telemetry (iNET) project , Range Safety & Test and Evaluation Community https://www.jt3.com/iNET.html	**INET** (Integrated Network Enhanced Telemetry) https://www.jt3.com/iNET.html BAA Test and Training Enabling Architecture (TENA) middleware 3.0, TENA Repository, TENA Logical Range Data Archive. The TENA Object Model ; Funded via OSD's Central Test & Evaluation Investment Program (CTEIP)	

XML Data Definition Initiatives		
Spacecraft Mark-up Language (SML), ICS Interface & Control Systems, Inc, Columbia, Maryland (since 1994), Flown on Clementine (1994), ROMPS, FUSE (5 years), X33, EO-1 (2004) : Future : TacSat-2 (Techsat21), SBIRS High, RLV2, GLAST I&T., interface to AML and AIML http://www.interfacecontrol.com/sml.asp	**SML** (Spacecraft Mark-up Language) is an early extension of XML that provide definition of XML tags & concepts of structure to allow the definition of spacecraft & other support data objects. Command Interpreter/Expert System for On-Board Space Applications/Embedded Systems (pre XML DTD, Scheme, web services, SOA, uses scripting) Based on Record Definition Language (RDL), developed by GSFC for use on ASIST ground	Standardised representation of Spacecraft. SML elements can then be used to represent spacecraft command, telemetry, data storage entities; Application messages, Events, Science data, Status information for logging -OASIS Rpt :http://www.oasis-open.org/cover/spacecraftML.html -GSAW 2000 sunset.usc.edu/events/GSAW/gsaw2000/pdf/Cappelaere.pdf -papers : http://www.interfacecontrol.com/white.htm
Instrument Markup Language (IML), Astronomical Instrument Markup Language (AIML), Instrument Remote Control IRC Framework, POC : Troy Ames Troy.J.Ames@nasa.gov +1 301 286-5673 http://aaaprod.gsfc.nasa.gov/IRC/iml/index.cfm http://aaaprod.gsfc.nasa.gov/IRC (1997)	**IML, AIML, IRC** : Instrument Mark-up Language (IML) is a general language to describe instruments based on an XML Schema. Astronomical Instrument Markup Language (AIML) is the first implementation of the more general Instrument Markup Language, for astronomy domain (and infrared instruments in particular).. Instrument Remote Control (IRC) Framework provide an adaptive framework that provides robust interactive & distributed control and monitoring of remote instruments. IRC will eventually enable trusted astronomers from around the world to easily access infrared instruments (e.g., telescopes, cameras, and spectrometers) located in remote, inhospitable environments.	IRC for use on SOFIA (Stratospheric Observatory for Infrared Astronomy) project, a Boeing 747-SP aircraft modified to accommodate a 2.5 meter reflecting telescope. In 2001, SOFIA will be the largest airborne telescope in the world. AIML will be used on the HAWC (High Resolution Airborne Wideband Camera), .

GSML (Ground System Markup Language), Stanford University (NASA & other funding), POC : Stanford Software Infrastructure Group (SWIG) - James Cutler jwc@stanford.edu, Armando Fox http://swig.stanford.edu/space.shtml	Federated Ground station Network (FGN) - federate networked ground stations that are under different administrative domains. Ground station facilities can dynamically join and leave the federation. Users designate a subset of facilities as a "team" that collaboratively solves a high-level task with path and node redundancy within a team to deal with partial failures.	**GSML** (Ground Segment Mark-up Language) is to provide a hierarchical command and control language that implements the virtual ground station (VGS) abstraction levels; Models & abstract interfaces that allow a virtual ground station to be composed of team members. These models & interfaces are standardized to allow heterogeneous station implementations, extensible to allow for future technology development, hierarchical for composition of station operations & resources, & open to facilitate federation membership. , , SpaceOps 2002, IEEE Aerospace Conference 2004, GSAW 2003
XML Telemetry & Command, POC : Gerry Simon, OMG Space TF Chair, Kevin Rice GSFC GST http://www.omg.org/space/	**XTCE** (XML Telemetry & Telecommand Exchange) :	GSFC Prototype, XML DTD
XML Scheduling (new) http://www.omg.org/space/		
XML Procedural Language definition (new), POC : Geri Chaudhri/Sid Hollander Geraldine.a.Chaudhri@aero.org Sidney.Hollander@aero.org (310) 336-1091 (310) 336-3994 http://www.omg.org/space/		

XML OrbitML, spacecraft Flight Dynamics markup language OrbitML Specification, POC : Francisco M. Martínez Fadrique(1), Alberto Águeda Maté (2), Gonzalo García (3) fmartinez@gmv.es aagueda@gmv.es ggarcia@gmvspacesystems.com http://www.orbitml.com GMV Space Systems (Spain)	**OrbitML** : Spacecraft Flight Dynamics Markup Language (OrbitML) is an eXtensible Markup Language (XML) implementation for the representation of information objects in the spacecraft Flight Dynamics problem domain. OrbitML encompasses all the range of space missions (scientific, telecommunications, earth observation, navigation, ...) and phases (LEOP, commissioning, routine, end of life, ...). By providing a standard definition of the involved concepts, their structure, relationships and interfaces based on an extensively used and well known underlying technology (XML), OrbitML allows easy interaction between different operators and agencies in the space field. The initial implementation aims to the operations support of a variety of satellite missions while allowing the extension of its coverage to incorporate new requirements for navigation missions, constellations, interplanetary scenarios and beyond.	IEEE Aerospace Conference 2005, focusSuite® (focusGEO), GMV's generic Flight Dynamics software, OrbitML proof of concept prototype, future use on NAPEOS (ESA's Navigation Package for Earth Observation Satellites)..
Open Archival Information System (OAIS), (Status? And deployment?) CCSDS Data Archive Ingest (DAI) Working Group.), POC : John Garrett (John.Garrett@gsfc.nasa.gov) +1.301.286.3575 http://ssdoo.gsfc.nasa.gov/nost/isoas/us/overview.html www.ccsds.org	**OAIS** (Open Archival Information System) reference model specifies an Archival Information Package (AIP) for defining the context of a digital entity. The archival collection is the aggregation of the archival forms of the digital entities.	Producer-Archive Interface Methodology Abstract Standard (PAIMAS) SpaceOps 2004 -Preservation metadata & digital library www.rlg.org http://www.oclc.org/research/projects/pmwg/default.htm 2004 preservation survey http://www.oclc.org/research/projects/pmwg/surveyreport.pdf

NASA Ames, NASA Ontonology taxonomy, POC : Jayne E Dutra, JPL Information Architecture NASA Taxonomy Manager, Jayne.E.Dutra@jpl.nasa.gov	NASA Taxonomy: Semantic-Based Technologies (with RDF) using the taxonomy to create a semantic search capability. http://nasataxonomy.jpl.nasa.gov	Iinstallation with DISA/NASA registry (will be part of v5.0 release)
NASA Earth Science Technology Office, http://sweet.jpl.nasa.gov/ontology/	**SWEET** Semantic Web for Earth and Environmental Terminology (SWEET) to encode semantic meaning into Web pages andIFs via ontology languages (RDF, DAML), and the creation of a Semantic Web for the Earth Sciences. http://oceanesip.jpl.nasa.gov/tech_workshop/sweetTalk.ppt	
NASA Earth Science Technology Office, Dist data mining, POC : Hillol Kargupta, University of Maryland & AGNIK, LLC http:// http://www.cs.umbc.edu www.cs.umbc.edu/~hillol /~hillol http://www.agnik.com http://www.agnik.com, hillol@cs.umbc.edu hillol@cs.umbc.edu	NASA **DAO/NOAA AVHRR** (Advanced Very High Resolution Radiometer) Pathfinder Data Model Mining a Network of Virtual of Virtual Observatories Observatories subsets from Sloan Digital Sky Survey (SDSS) & 2MASS all Sky Survey – Cluster the set of objects using attributes from both Clusters	http://www.cs.umbc.edu/~hillol/nasap.html NASA Data Mining resource http://nvo.gsfc.nasa.gov/nvo_datamining.html
NASA Earth Science Technology Office, U of Alamaba, POC : rramachandran@itsc.uah.edu http://esml.itsc.uah.edu/index.jsp	**ESML** (Earth Science Markup Language) is an interchange technology that enables data (both structural and semantic) interoperability with applications without enforcing a standard format within the Earth science community. http://esml.itsc.uah.edu/index.jsp	Products: ESML Schema, ESML Editor, ESML Library Formats Supported : ASCII, Binary, Grib, netCDF, HDF-EOS, WSR88D Level II Python Modules (PyESML) ESML for IDL

NASA Earth Science Data System Standards WG POC : Richard Ullman richard.ullman@nasa.gov Ming-Hsiang Tsou mtsou@mail.sdsu.edu, http://spg.gsfc.nasa.gov/standards/heritage/STSUM_brief	**ESDSSWG**: Global Change Master Directory, Directory Interchange Format (GCMD DIF), EOSDIS Core System science metadata model for Earth Science Data (ECS ESDT Data Model), Federal Geographic Data Committee content standard for geospatial metadata (FGDC Content Standard), EOS Clearinghouse data provider science data model (ECHO ingest data model), Data Format Standards, Hierarchical Data Format (HDF), Network Common Data Format (netCDF), Geographic Tagged Image File Format (GeoTIFF)	Fast Format (for distributing Landsat-7 data products), World Meteorological Organization Binary Universal Format for Representation (BUFR). Data Discovery & Access Protocol Standards, EOSDIS Clearinghouse Protocol (ECHO Procotol), Open-source Project for a Network Data Access Protocol (OPeNDAP)