

Fifth European Conference on Space Debris

Program

Day 1 - Monday, 30 March 2009

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| Session 1 | Introduction & Selected Papers Room: H-I/H-IV Chairs: R. Crowther (STFC); F. Alby (CNES) | |
| 09:00 | Welcome Address ESA, NoC SD, IAA, COSPAR | |
| 09:20 | Keynote Lecture on Space Debris G. Brachet | |
| 09:40 | IAA and their Activities on Space Debris J.M. Contant | |
| 10:00 | Space Debris Activities in Europe Klinkrad, H.1; Alby, F.2; Crowther, R.3; Portelli, C.4; Wirt, U.5 1ESA (Germany); 2CNES (France); 3BNSC (United Kingdom); 4ASI (Italy); 5DLR (Germany) | |
| 10:20 | Coffee break | |
| 10:50 | About Russian Federation Activity on Space Debris Problem Loginov, S.1; Yakovlev, M.1; Mikhailov, M.1; Makarov, Yu.2; Bulynin, Yu.3; Popkova, L.1; Gorlov, A.1 1TSNIIMASH (Russian Federation); 2ROSCOSMOS (Russian Federation); 3ISS Reshetnev Company (Russian Federation) | |
| 11:10 | Invited Speaker U.S. Naval Space Surveillance Upgrade Program 1999-2003 Schumacher, P. Air Force Research Laboratory (United States) | |
| 11:30 | Invited Speaker The Jules Verne (ATV-1) Reentry Observation Campaign Preliminary Results Hatton, J.1; Giannopapa, C.1; Ellwood, J.1; Jenniskens, P.2; Steinkopf, M.3; de Pasquale, E.3 1ESA (Netherlands); 2SETI Institute (United States); 3ESA/ATV Control Center (France) | |
| 11:50 | Lunch break | |
| | Session 2 Space Surveillance I Room: H-I Chairs: T. Donath (ONERA); P. Schumacher (USAF) | Session 3 Modeling Room: H-IV Chairs: A. Rossi (ISTI); H. Krag (ESA/ESOC) |
| 14:00 | Architectures Analysis for the Future European SSA System Donath, T.1; Donath, T.1; Saunders, C.2; Martinot, V.3; Elluin, E.3 1ONERA (France); 2QinetiQ (United Kingdom); 3Thales Alenia Space (France) | Invited Speaker The MASTER-2009 Space Debris Environment Model Flegel, S.1; Gelhaus, J.1; Wiedemann, C.1; Stabroth, S.2; Oswald, M.2; Krag, H.3; Klinkrad, H.3; Vörsmann, P.1 1Institute of Aerospace Systems, Technische Universität Braunschweig (Germany); 2Astrium GmbH - Satellites, Friedrichshafen (Germany); 3Space Debris Office ESA/ESOC, Darmstadt (Germany) |
| 14:20 | Analysis of Object Observations Using A 1.8-Meter Telescope Kervin, P.1; Bolden, M.1; Sydney, P.2 1US Air Force Research Laboratory (United States); 2Pacific Defense Solutions (United States) | Size Distribution of NaK Droplets for MASTER-2009 Wiedemann, C.1; Flegel, S.2; Gelhaus, J.2; Klinkrad, H.3; Vörsmann, P.2 1Technische Universität Braunschweig (Germany); 2Technische Universität Braunschweig, Institute of Aerospace Systems (Germany); 3ESA/ESOC (Germany) |
| 14:40 | ISON Worldwide Scientific Optical Network Molotov, I.; Agapov, V.; Akim, E. Keldysh Institute of Applied Mathematics RAS (Russian Federation) | Solid Propulsion Solutions for Orbital Debris Mitigation Guery, J.F. SNPE Materiaux Energetiques (France) |

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| 15:00 | Catalogue Correlation of Space Debris Objects <i>Früh, C.; Schildknecht, T.; Musci, R.; Ploner, M.</i> <i>Astronomical Institute, University of Bern (Switzerland)</i> | Active Removal Study for On-orbit Debris Using DAMAGE <i>Lewis, H.G.; Swinerd, G.G.; Newland, R.J.; Saunders, A.</i> <i>University of Southampton (United Kingdom)</i> |
| 15:20 | Satellite Based Solutions for beyond-LEO Space Surveillance <i>Oswald, M.; Stabroth, S.; Wagner, A.</i> <i>EADS Astrium Satellites (Germany)</i> | Results of Updating the Parameters of the Space Debris Model (SDPA) in 2007 <i>Nazarenko, A.</i> <i>Scientific Technological Center of Space Monitoring of the Earth (Russian Federation)</i> |
| 15:40 | Coffee break | |
| 16:10 | Consolidated Ground Segment Requirements for a UHF Radar for the ESSAS <i>Muller, F.1; Vera, J.2</i> <i>1Onera (France); 2Indra (Spain)</i> | Invited Speaker Effectiveness of the De-Orbiting Practices in the MEO Region <i>Rossi, A.1; Anselmo, L.1; Pardini, C.1; Jehn, R.2</i> <i>1ISTI-CNR (Italy); 2ESA-ESOC (Germany)</i> |
| 16:30 | Simulation of Phased-Array Wide-Field of View Radars for Space Surveillance <i>Gelhaus, J.1; Flegel, S.1; Wiedemann, C.1; Stabroth, S.2; Wagner, A.2; Klinkrad, H.3; Vörsmann, P.1</i> <i>1Institute of Aerospace Systems, Technische Universität Braunschweig (Germany); 2Astrium GmbH - Satellites (Germany); 3Space Debris Office, ESA/ESOC (Germany)</i> | Conclusions from ESA Space Debris Telescope Observations on Space Debris Environment Modelling <i>Krag, H.1; Klinkrad, H.1; Jehn, R.1; Flegel, S.2; Schildknecht, T.3</i> <i>1ESA/ESOC, (Germany); 2TU Braunschweig, (Germany); 3University of Berne, (Switzerland)</i> |
| 16:50 | Comparison of Bi-Static Radar Performance with an Equivalent Mono-Static Model <i>Dauron, G.B.R.; Martinez de Mendijur, M.; Sessler, G.M.A.; Besso, P.</i> <i>ESA/ESOC (Germany)</i> | Influence of High Eccentricity Objects in the Evolution of the GEO Environment <i>Rossi, A.; Anselmo, L.; Pardini, C.</i> <i>ISTI-CNR (Italy)</i> |
| 17:10 | A Potential Integrated Multiwavelength Radar System at The Medicina Radiotelescopes <i>Montebugnoli, S.1; Pupillo, G.2; Salerno, E.1; Pluchino, S.1; Di Martino, M.2; Bartolini, M.1; Bianchi, G.1; Monari, J.1; Perini, F.1; Schillirò, F.1</i> <i>1INAF-IRA (Italy); 2INAF-OATO (Italy)</i> | The Small Sise Debris Population in the GEO Belt <i>Drolshagen, G.; Nehls, T.</i> <i>ESA/ESTEC (Netherlands)</i> |
| 17:30 | Measuring Space Debris with Phase Coded Aperiodic Transmission Sequences <i>Vierinen, J.1; Markkanen, J.2; Lehtinen, M.S.1</i> <i>1Sodankylä Geophysical Observatory (Finland); 2EISCAT Scientific Association (Finland)</i> | Estimating Solar Radiation Pressure for GEO Debris <i>Chao, C.C.; Campbell, W.S.</i> <i>The Aerospace Corporation (United States)</i> |
| 17:50 | End | |

Day 2 - Tuesday, 31 March 2009

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| | Session 4 Space Surveillance II Room: H-I <i>Chairs: P. Kervin (USAF); S. Veniaminov (SRC Cosmos)</i> | Session 5 Measurements I Room: H-IV <i>Chairs: L. Leushacke (FGAN); G. Drolshagen (ESA/ESTEC)</i> |
| 08:30 | Surveillance Radar Design Options as a Function of Cataloguing Performance Requirements <i>Krag, H.; Klinkrad, H.</i> <i>ESA (Germany)</i> | Italian Activity in Space Debris Measurements <i>Graziani, F.1; Cappelletti, C.2; Paolillo, F.2; Portelli, C.3; Piergentili, F.4</i> <i>1University of Rome (Italy); 2School of Aerospace Engineering (Italy); 3Italian Space Agency (Italy); 4University of Bologna, DIEM (Italy)</i> |

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| 08:50 | Optimization of Space Surveillance Resources by Innovative Preliminary Orbit Methods <i>Milani, A. 1; Gronchi, G.F. 1; Dimare, L. 2; Farnocchia, D. 1</i> <i>1University of Pisa (Italy); 2University of Roma "La Sapienza" (Italy)</i> | First Results from the Multibeam Bistatic Beampark Experiments at FGAN <i>Letsch, K. 1; Leushacke, L. 1; Rosebrock, J. 1; Jehn, R. 2; Krag, H. 2; Keller, R. 3</i> <i>1FGAN-FHR (Germany); 2ESA-ESOC (Germany); 3MPIfR (Germany)</i> |
| 09:10 | Orbits and Pointing Strategies for Space Based Telescopes into an European Space Surveillance System <i>R-Lerate, M.; Sanchez-Ortiz, N.; Olmedo, E.; Bello-Mora, M.</i> <i>Deimos Space S.L (Spain)</i> | EISCAT Space Debris during the IPY - a 5000 Hour Campaign <i>Markkanen, J. 1; Jehn, R. 2; Krag, H. 2</i> <i>1EISCAT (Finland); 2ESA/ESOC (Germany)</i> |
| 09:30 | Improving ESA's Collision Risk Estimates by an Assessment of the TLE Orbit Errors of the US SSN Catalogue <i>Flohrer, T. 1; Krag, H. 2; Klinkrad, H. 2; Bastida Virgili, B. 2; Früh, C. 3</i> <i>1Aboa Space Research Oy (ASRO) at ESA/ESOC (Germany); 2ESA/ESOC Space Debris Office (Germany); 3Astronomical Institute University Bern (Switzerland)</i> | Bi-Static Radar Measurements Using ESA's 15 Meter Ground Stations <i>Sessler, G.M.A.; Smeds, B.; Krag, H.; Flohrer, T.; Martinez Gil, R.</i> <i>ESA/ESOC (Germany)</i> |
| 09:50 | Optimum Planning of the Search for a Space Object Taking into Account the Temporal Structure Transformation of the Space Object Position Uncertainty Domain <i>Veniaminov, S. 1; Aksenov, O. 2; Lapukhin, V. 2</i> <i>1Scientific Research Center "Kosmos" (Russian Federation); 2SRC "Kosmos" (Russian Federation)</i> | Space Debris Radar Experiments at the Medicina VLBI Dish <i>Pupillo, G. 1; Salerno, E. 2; Montebugnoli, S. 2; Di Martino, M. 3; Bartolini, M. 2; Pluchino, S. 2; Schillirò, F. 2; Zoni, L. 2</i> <i>1OATO-INAF (Italy); 2INAF-IRA (Italy); 3INAF-OATO (Italy)</i> |
| 10:10 | Coffee break | |
| 10:40 | Cataloguing Performance of a Proposed European Space Situational Awareness System <i>Sanchez-Ortiz, N.; Olmedo, E.; R-Lerate, M.; Bello-Mora, M.</i> <i>Deimos Space S.L. (Spain)</i> | In Situ Measurement Activities at the Nasa Orbital Debris Program Office <i>Liou, J.-C. 1; Burchell, M. 2; Corsaro, R. 3; Drolshagen, G. 4; Giovane, F. 5; Pisacane, V. 6; Stansbery, E. 7</i> <i>1NASA Johnson Space Center (United States); 2University of Kent (United Kingdom); 3NRL (United States); 4ESA/ESTEC (Netherlands); 5Virginia Tech (United States); 6USNA (United States); 7NASA/JSC (United States)</i> |
| 11:00 | SSASIM: An Earth-Orbiting Objects Catalogue Maintenance Simulator <i>Águeda Maté, A.; Juárez Villarés, I.; Muñoz Muñoz, P.; Martínez Fadrique, F.</i> <i>GMV (Spain)</i> | In-situ Detector AIDA - Advances, Recent and Future Developments <i>Herbst, C. 1; Bunte, K.D. 1; Kessler, E. 2; Hemken, G. 3; Hagedorn, D. 4</i> <i>1etamax space GmbH (Germany); 2Institut fuer Photonische Technologien (Germany); 3Institut fuer Fuege- und Schweisstechnik (Germany); 4Physikalisch-Technische Bundesanstalt (Germany)</i> |
| 11:20 | Classification and Characterization of GEO Population Based on Results of the ISON Observations <i>Agapov, V. 1; Molotov, I. 1; Khutorovsky, Z. 2; Titenko, V. 3</i> <i>1Keldysh Institute of Applied Mathematics RAS (Russian Federation); 2ISC "Vympel", JSC (Russian Federation); 3S.A. Zverev Krasnogorsky Zavod, JSC (Russian Federation)</i> | Micrometeoroid Impacts on Spacecraft: Can Asteroidal and Cometary Dust Be Distinguished? <i>Kearsley, A.T. 1; Burchell, M.J. 2; Price, M.J. 2; Graham, G.A. 1; Wozniakiewicz, P.J. 1; Cole, M.J. 2</i> <i>1Natural History Museum (United Kingdom); 2University of Kent (United Kingdom)</i> |
| 11:40 | The Use of Satellites Limits Improving their Detectability <i>Bourez-Laas, M. 1; Klotz, A. 2; Blanchet, G. 3; Boër, M. 4; Ducrotté, E. 3</i> <i>1Observatoire de Haute-Provence (France); 2Centre d'Etude Spatiale des Rayonnements (UPS-CNRS) (France); 3Centre National</i> | Diurnal and Annual Variations of Meteor Rates and Entry Velocities at High, Middle, and Low Latitudes <i>Singer, W. 1; Latteck, R. 1; Batista, P.P. 2</i> <i>1Leibniz-Institute of Atmospheric Physics (Germany); 2Instituto Nacional de Pesquisas Espaciais, Sao Jose dos Campos SP (Brazil)</i> |

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| | <i>d'Etudes Spatiales (France); 4Observatoire de Haute Provence (CNRS) (France)</i> | |
| 12:00 | End | |
| Optional | Technical & Cultural Tour to Speyer | |

Day 3 - Wednesday, 1 April 2009

| | Session 6 Measurements II Room: H-I Chairs: <i>P. Graziani (La Sapienza); T. Schildknecht (AIUB)</i> | Session 7 Mitigation Room: H-IV Chairs: <i>C. Bonnal (CNES); C. Portelli (ASI)</i> |
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| 08:30 | Orbit Determination for Various Regimes with TAROT <i>Ducrotté, E.1; Bourez-Laas, M.2; Klotz, A.2; Blanchet, G.1; Boer, M.2</i> 1CNES (France); 2Observatoire de Haute Provence - Saint Michel l'Observatoire (France) | Invited Speaker European Launchers: A Review of the Compliance to Space Debris Mitigation Measures <i>Bonnal, C.1; Gigou, J.2; Aubin, D.3</i> 1CNES (France); 2ESA (France); 3Arianespace (France) |
| 08:50 | Photometric Studies of Orbital Debris at GEO <i>Seitzer, P.1; Abercromby, K.J.2; Rodriguez-Cowardin, H.M.3; Barker, E.4; Foreman, G.1; Horstman, M.5</i> 1University of Michigan (United States); 2California Polytechnic State University (United States); 3ESCG/JSC (United States); 4NASA/JSC (United States); 5ESCG/ERC (United States) | The International Space Station and the Space Debris Environment: 10 Years On <i>Johnson, N.1; Klinkrad, H.2</i> 1NASA (United States); 2ESA (Germany) |
| 09:10 | Surveying for Debris in MEO Orbits with Optical Sensors <i>Herridge, P.1; Crowther, R.2; Davey, J.3; Dick, J.1</i> 1Space Insight Ltd (United Kingdom); 2Science & Technology Facilities Council (United Kingdom); 3British National Space Centre (United Kingdom) | The Aerobraking Sail for Launcher Upper Stage Deorbiting: Concept Feasibility & Technological Solutions <i>Santerre, B.; Cerf, M.</i> EADS Astrium (France) |
| 09:30 | Preliminary Results from Reflectance Spectroscopy Observations of Space Debris in GEO <i>Vananti, A.1; Schildknecht, T.1; Krag, H.2</i> 1Astronomical Institute, University of Bern (Switzerland); 2ESA/ESOC (Germany) | Constellation and "Graveyard" Collision Risk For Several Meo Disposal Strategies <i>Jenkin, A.; McVey, J.P.</i> The Aerospace Corporation (United States) |
| 09:50 | Reflectance Spectra Comparison of Orbital Debris, Intact Spacecraft, and Intact Rocket Bodies in the GEO Regime <i>Abercromby, K.1; Abell, P.2; Barker, E.3</i> 1California Polytechnic State University San Luis Obispo (United States); 2Planetary Science Institute (United States); 3NASA Johnson Space Center (United States) | Reorbiting of Satellites in High Altitudes <i>Jehn, R.1; Rossi, A.2; Flohrer, T.1; Navarro, D.3</i> 1ESA/ESOC (Germany); 2Istituto Scienza e Tecnologie dell'Informazione (Italy); 3ESA/ESOC (Netherlands) |
| 10:10 | Coffee break | |
| 10:40 | Ten Years of Observations at the ESA Space Debris Telescope - Discoveries, Highlights and Lessons Learned <i>Schildknecht, T.1; Musci, R.1; Jehn, R.2; Kuusela, J.3</i> 1Astronomical Institute AIUB, University of Bern (Switzerland); 2ESA/ESOC, Darmstadt (Germany); 3Aboa Space Research Oy (ASRO), Tenerife (Spain) | Space Debris Environment Remediation Concepts <i>Klinkrad, H.1; Johnson, N.L.2</i> 1ESA (Germany); 2NASA/JSC (United States) |

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| 11:00 | Small Aperture Telescope Monitoring of Geostationary Satellite Clusters undergoing Visual Conjunctions <i>Scott, L.</i> <i>Defence R&D Canada Ottawa (Canada)</i> | A Study on Active Removal System of Space Debris <i>Nishida, S.; Kawamoto, S.; Ohkawa, Y.; Kitamura, S.</i> <i>JAXA (Japan)</i> |
| 11:20 | Present Status of Space Debris Optical Observational Facility of JAXA at Mt. Nyukasa <i>Yanagisawa, T.; Kurosaki, H.; Nakajima, A.</i> <i>Japan Aerospace Exploration Agency (Japan)</i> | Solid Propulsion De-Orbiting and Re-Orbiting <i>Schonenborg, R.A.C.</i> <i>Schonenborg Space Engineering (Netherlands)</i> |
| 11:40 | MDD3-EMI's Upcoming Meteoroid and Space Debris Detector Experiment Onboard Russian Spektr-R Satellite <i>Schimmerohn, M.; Schafer, F.</i> <i>Fraunhofer Institute for High-Speed Dynamics (Germany)</i> | Strategies for Active Removal in LEO <i>Bastida Virgili, B.; Krag, H.</i> <i>ESA/ESOC (Germany)</i> |
| 12:00 | ESA RE-entry Black Box <i>Bavandi, A.; Sgobba, T.; Ortega, G.</i> <i>ESA/ESTEC (Netherlands)</i> | Lifetime Estimation of Upper Stages Re-Entering from GtO with Different Inclinations <i>Bandyopadhyay, P.; Sharma, R.K.; Mutyalarao, M.; Adimurthy, V.</i> <i>Indian Space Research Organization (India)</i> |
| 12:20 | Lunch break | |
| | Session 8 Protection Room: H-I <i>Chairs: R. Destefanis (TAS, Torino); H.G. Reimerdes (RWTH Aachen)</i> | Session 9 Risk Analysis Room: H-IV <i>Chairs: D. Finkleman (CSSI); S. Delavault (CNES)</i> |
| 14:00 | Improving the Significance of MM/SD Risk Analysis by Application of the SRL Ballistic Limit Equation <i>Schäfer, F.1; Putzar, R.1; Ryan, S.2; Lambert, M.3</i> <i>1Fraunhofer Institute for High-Speed Dynamics (Germany); 2NASA Johnson Space Center (United States); 3ESA (Netherlands)</i> | Invited Speaker Mathematical Concepts for Geo Collision Risk Assessment <i>Jenkin, A.</i> <i>The Aerospace Corporation (United States)</i> |
| 14:20 | Space Shuttle MMOD Threat Mitigation Techniques <i>Hyde, J.1; Christiansen, E.; Lear, D.; Kerr, J.</i> <i>NASA Johnson Space Center (United States)</i> | Space Debris Conjunction Risk Assessment for the ATV - Jules Verne Mission <i>Delavault, S.1; Perrachon, P.1; Gamet, P.1; Delattre, S.1; Dupuis, G.2; Salas, S.3; Perot, E.4</i> <i>1CNES (France); 2ATOS-ORIGIN (France); 3GMV (France); 4Thales-is (France)</i> |
| 14:40 | Shape Distribution of Fragments from Microsatellite Impact Tests <i>Hanada, T.1; Liou, J.-C.2</i> <i>1Kyushu University (Japan); 2NASA/JSC (United States)</i> | Approaches to Near Term Conjunction Risk Assessment <i>Finkleman, D.1; Oltrogge, D.2; Stokes, H.3; H. Ailor, W.4</i> <i>1Center for Space Standards and Innovation (United States); 2Earth Research (United States); 3Consultant to the British National Space Center (United Kingdom); 4Center for Orbital and Reentry Debris Studies (United States)</i> |
| 15:00 | Ballistic Limit of Thin CFRP Plates <i>Higashide, M.1; Nagao, Y.1; Kibe, S.1; Francesconi, A.2; Paverin, D.2</i> <i>1Japan Aerospace Exploration Agency (Japan); 2CISAS, University of Padova (Italy)</i> | CNES Operational Experiences in Collision Avoidance for LEO Satellites <i>Pena, X.; Moury, M.</i> <i>CNES (France)</i> |
| 15:20 | Hypervelocity Impact Shield Concept <i>Smirnov, N.N.; Kiselev, A.B.; Nikitin, V.F.</i> <i>Moscow M.V. Lomonosov State University (Russian Federation)</i> | Statistical Conjunction Analysis of LEO Space Objects: A Monte Carlo Approach <i>Anikumar, A.K.; Sudheer Reddy, D.</i> <i>VSSC/ISRO (India)</i> |
| 15:40 | Coffee break | |

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| 16:10 | Experimental Investigation of Hypervelocity Impact On Gas-Filled Stainless Steel Pressure Vessels <i>Huang, J.; Niu, W.X.; Xu, X.; Ma, Z.X.; Jian, H.X.; Liu, S.</i> <i>China Aerodynamics R&D Center (China)</i> | The COLA Collision Avoidance Method <i>Assmann, K.; Grothkopp, S.; Berger, J.</i> <i>LSE Space Engineering & Operations AG (Germany)</i> |
| 16:30 | Risk Analysis and Damage Prediction of Small Spacecraft <i>Noelke, D.; Reimerdes, H.-G.</i> <i>RWTH Aachen University (Germany)</i> | Collision Avoidance Practises for GEO Satellites in an Operational Control Centre <i>Lorda, L.; Fremeaux, C.</i> <i>CNES (France)</i> |
| 16:50 | MODAOSTi' s Application in M/OD Shield Optimization of Japan's Pressurized Module <i>Yuan, J.G.; Zheng, SH.G.; Han, Z.Y.; Qu, G.J.</i> <i>China Academy of Space Technology (CAST) (China)</i> | Wind Tunnel Aero-Heating and Material Destruction Tests for Improved Debris Re-entry Analysis <i>Koppenwallner, G.1; Lips, T.1; Alwes, D.2</i> <i>1HTG, Hypersonic Technology Göttingen (Germany); 2DLR, Deutsches Zentrum für Luft und Raumfahrt (Germany)</i> |
| 17:10 | Spacecraft Shielding Layout and Optimisation using ESABASE2/Debris <i>Bunte, K.D.1; Destefanis, R.2; Drolshagen, G.3</i> <i>1etamax space GmbH (Germany); 2Thales Alenia Space (Italy); 3ESA/ESTEC (Netherlands)</i> | Risk Assessment for Destructive Re-entry <i>Lips, T.1; Koppenwallner, G.1; Bianchi, L.2; Klinkrad, H.3</i> <i>1HTG - Hypersonic Technology Goettingen (Germany); 2ESA/ESTEC (Netherlands); 3ESA/ESOC (Germany)</i> |
| 17:30 | Experimental Space Debris Simulation at EMI's Calibre 4 mm Two-Stage Light Gas Gun <i>Putzar, R.; Schaefer, F.</i> <i>Fraunhofer Institute for High-Speed Dynamics (Germany)</i> | Computation of the Survivability of Spacecraft Fuel Tanks after Orbital Decay <i>Fritsche, B.</i> <i>HTG (Germany)</i> |
| 17:50 | End | |

Day 4 - Thursday, 2 April 2009

| | Session 10 Standards, Policies & Initiatives Room: H-I <i>Chairs: J. Davey (BNSC); K.U. Schrogl (ESPI)</i> | Session 11 Orbit Prediction & Determination Room: H-IV <i>Chairs: U. Fuecht (ESA); F. Martinez Fadrique (GMV)</i> |
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| 08:30 | An Overview of Legal Implications Governing Space-Based Activities Regarding Space Debris Mitigation: Shortcomings of Current Space Treaties and Conventions <i>Talebzadeh, A.; Tabeshian, M.; Chinnanpour, M.</i> <i>Iranian Space Agency (ISA) (Iran, Islamic Republic of)</i> | Orbit Determination Issues and Results to Incorporate Optical Measurements in Conjunction Operations <i>Vallado, D.1; Kelso, T.S.1; Agapov, V.2; Molotov, I.2</i> <i>1Center for Space Standards and Innovation (United States); 2Keldysh Institute of Applied Mathematics of the Russian Academy of Sciences (Russian Federation)</i> |
| 08:50 | Invited Speaker Status of the ISO Standards on Space Debris Mitigation <i>Davey, J.1; Stokes, H.2</i> <i>1British National Space Centre (United Kingdom); 2PHS Space Ltd (United Kingdom)</i> | Orbit Determination from Combined Radar and Optical Tracks during XMM Contingency Operations <i>Flohner, T.1; Krag, H.2; Klinkrad, H.2; Kuusela, J.3; Leushacke, L.4; Ploner, M.5; Schildknecht, T.5</i> <i>1Aboa Space Research Oy (ASRO) at ESA/ESOC (Germany); 2ESA/ESOC Space Debris Office (Germany); 3Aboa Space Research Oy (ASRO) (Finland); 4Forschungsgesellschaft für Angewandte Naturwissenschaften (Germany); 5Astronomical Institute University Bern (Switzerland)</i> |
| 09:10 | National Standard of the Russian Federation for Space Debris Mitigation <i>Loginov, S.; Mikhailov, M.; Popkova, L.; Yakovlev, M.</i> <i>TSNIIMASH (Russian Federation)</i> | Correlation of Space Debris Observations by the Virtual Debris Algorithm <i>Tommei, G.1; Milani, A.1; Farnocchia, D.1; Rossi, A.2</i> <i>1University of Pisa (Italy); 2ISTI-CNR Pisa (Italy)</i> |

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| 09:30 | A Global Strategy to Clear the "Space Protected Zones" from the Spacecrafts, at their End of Operative Life <i>Balduccini, M.1; Portelli, C.2; Rosati, R.1</i> <i>1AVIO S.p.A. (Italy); 2ASI (Italy)</i> | GMV Covariance Estimation, Propagation and Analysis Tools <i>Martínez Fadrique, F.; Juárez Villarés, I.; Escobar Antón, D.; Agueda Maté, A.</i> <i>GMV (Spain)</i> |
| 09:50 | Implementing Space Debris Mitigation Operational Processes <i>Finkleman, D.1; Oltrogge, D.2; Stokes, H.3; H. Ailor, W.4</i> <i>1Center for Space Standards and Innovation (United States); 2Earth Research (United States); 3Consultant to the British National Space Center (United Kingdom); 4Center for Orbital and Reentry Debris Studies (United States)</i> | Increasing the Accuracy of Orbit Forecasting on the Basis of Improvement of Statistical Methods for Processing Measurements <i>Nazarenko, A.</i> <i>Scientific Technological Center of Space Monitoring of the Earth (Russian Federation)</i> |
| 10:10 | Coffee break | |
| 10:40 | Invited Speaker Overview of the European SSA Preparatory Program <i>Bobrinisky, N.; Del Monte, L.</i> <i>ESA (Germany)</i> | Analysis of Orbital Prediction Accuracy Improvements Using High Fidelity Physical Solar Radiation Pressure Models for Tracking High Area-to-mass Ratio Objects <i>Jah, M.1; Kelec, T.2</i> <i>1Air Force Research Laboratory (United States); 2Boeing LTS (United States)</i> |
| 11:00 | Improved Conjunction Analysis via Collaborative Space Situational Awareness <i>Kelso, T.1; Vallado, D.1; Chan, J.2; Buckwalter, B.2</i> <i>1Center for Space Standards & Innovation (United States); 2Intelsat Corporation (United States)</i> | Estimation of Space Object Remaining Lifetime in Dependence on its Initial Orbital Elements, Ballistic Parameter and Environment Data <i>Kolyuka, Yu.F.; Afanasieva, T.I.; Gridchina, T.A.; Kirgetov, V.I.</i> <i>Mission Control Center (Russian Federation)</i> |
| 11:20 | Ephemeris Generation within the European Space Situational Awareness System <i>Sanchez-Ortiz, N.; R-Lerate, M.; Olmedo, E.; Bello-Mora, M.</i> <i>Deimos Space S.L. (Spain)</i> | On Re-entry Prediction of Near Earth Objects with Genetic Algorithm Using KS Elements <i>Sharma, R.K.; Anilkumar, A.K.; Xavier James Raj, M.; Sabarinath, A.</i> <i>VSSC/ISRO (India)</i> |
| 11:40 | Data Sharing to Improve Close Approach Monitoring and Safety of Flight <i>Chan, J.1; DalBello, R.2; Hope, D.3; Wauthier, P.4; Douglas, T.5; Inghram, T.6</i> <i>1Intelsat (United States); 2Intelsat General (United States); 3Inmarsat (United Kingdom); 4SES-Engineering (Luxembourg); 5Telesat Canada (Canada); 6EchoStar Satellite Services (United States)</i> | Orbit Evolution and Uncontrolled Re-entry of the "Molniya" Type Satellites <i>Kolyuka, Yu.F.; Afanasieva, T.I.; Gridchina, T.A.</i> <i>Mission Control Center (Russian Federation)</i> |
| 12:00 | Lunch break | |
| | Plenary Session - Conclusions & Press Briefing Room: H-I/H-IV 14:00-15:00 <ul style="list-style-type: none">• Round Table on Space Debris (with ESA Moderator)• Questions and Answers (with Media Representatives)• Concluding Remarks (ESA Conference Chairman) | |
| 15:00 | End | |
| | Poster Session: Debris Environment Modeling | |
| | Supporting the Development of Active Debris Removal Using Weighted Networks <i>Newland, R.J.; Lewis, H.G.; Swinerd, G.G.</i> <i>University of Southampton (United Kingdom)</i> About Techniques for Constructing of Orbital Debris Models <i>Meshcheryakov, S.A.</i> <i>TSNIIMASH (Russian Federation)</i> | |

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| | <p>Simulation of Near ISS Space Pollution by Secondary Microparticles Generated by ISS Solar Panels under the Impacts of Meteoroids and Primary Space Debris <i>Sokolov, V.G.; Konoshenko, V.P.</i> <i>RSC "Energia" (Russian Federation)</i></p> <p>Spatial Density Evolution of Space Debris Environment <i>Li, C.1; Pang, B.1; Ding, L.2; Zhang, W.1</i> <i>1Harbin Institute of Technology (China); 2University of Electronic and Science of China (China)</i></p> <p>On the Possibility of Long Time Existence of Man-Made Microparticles Injected on Oblong Elliptic Orbits with Low Perigee Altitude in The Near Earth Space <i>Kolesnikov, E.K.; Chernov, S.V.</i> <i>St. Petersburg State University (Russian Federation)</i></p> <p>On Bunching of Orbital Debris Microparticles in Circular and Elliptic Orbits <i>Myagkov, N.N.</i> <i>Institute of Applied Mechanics of RAS (Russian Federation)</i></p> <p>Statistical Analysis of Micrometeoroid and Space Debris Impacts Onboard the Space Station "Salyut-4" <i>Rebrikov, V.</i> <i>Federal State Unitary Enterprise "State Research Institute of Aviation Systems" (GOSNIIAS) (Russian Federation)</i></p> <p>Investigation of the Nanostructures on Solar Cells Exposed on Orbital Space Station "MIR" <i>Myagkov, N.N.1; Valiev, H.H.1; Rebrikov, V.N.2; Yanovsky, Y.G.1</i> <i>1Institute of Applied Mechanics of RAS (Russian Federation); 2State Research Institute of Aviation Systems (Russian Federation)</i></p> |
| Poster Session: Debris Mitigation Principles | |
| | <p>Active De-orbiting System ADS <i>Trushlyakov, V.I.1; Kudentsov, V.Yu.1; Odintsov, P.V.1; Costantino, A.2</i> <i>1Omsk State Technical University (Russian Federation); 2Politecnico di Milano (Italy)</i></p> <p>Space Debris Hazards from Fragmentations in Collinear Earth-Moon Points <i>Bandyopadhyay, P.1; Sharma, Ram Krishan1; Tewari, Ashish2; Adimurthy, V.1</i> <i>1Indian Space Research Organization (India); 2Indian Institute of Technology, Kanpur (India)</i></p> <p>Development Status of Electrodynamical Tethers for Debris De-orbiting <i>Kawamoto, S.; Ohkawa, Y.; Nishida, S.; Kitamura, S.</i> <i>Japan Aerospace Exploration Agency (Japan)</i></p> <p>A Discussion on the Space Debris Mitigation Measures in the Geostationary Orbit <i>Nascimento, J.M.</i> <i>Orbital Engenharia Ltda. (Brazil)</i></p> <p>GIOVE-A/B Fregat Disposal Assessment <i>Navarro Reyes, D.1; Zandbergen, R.2; Escobar, D.2</i> <i>1ESA/ESTEC (Netherlands); 2ESA/ESOC (Germany)</i></p> |
| Poster Session: Hypervelocity Impacts & Shielding | |
| | <p>Specialized Particle-Element Methods for Orbital Debris Impact Simulation <i>Fahrenthold, E.</i> <i>University of Texas (United States)</i></p> <p>Experimental Research on Performance of Al-Foam Stuffed Whipple Shield against Hypervelocity Impact <i>Jia, B.; Li, F.; Zhang, W.; Pang, B.J.</i> <i>Harbin Institute of Technology (China)</i></p> <p>An Experimental Investigation of Debris Cloud Generated by Hypervelocity Impact of Aluminum Spheres with Aluminum Sheets <i>Chi, R.Q.; Pang, B.J.; Guan, G.S.; Yang, Z.Q.; Wang, L.W.</i> <i>Harbin Institute of Technology (China)</i></p> <p>Experimental and Numerical Study of The Features of The Hyper-Velocity Interaction of A Projectile with A Discrete Bumper <i>Shumikhin, T.1; Bezrukov, L.2; Myagkov, N.1</i> <i>1Institute of Applied Mechanics of Russian Academy of Sciences (Russian Federation); 2FGUP GosNIIAS (Russian Federation)</i></p> |

Dynamic Fracture of Thin Structures under Impact Loading
Vishnar, G.
IIT Delhi (India)

Meshless Simulation of Impact Events and Shielding
Chen, L.
Beijing Institute of Technology (China)

Numerical Simulation of Hypervelocity Impact on Honeycomb Sandwich Panels
Lan, S.W.; Huang, J.; Ma, Z.X.; Zhou, Z.X.; Liu, S.
China Aerodynamics R&D Center (China)

Numerical Simulation of Hypervelocity Impacts on Aluminum Mesh
Chen, H.; Xu, X.; Huang, J.; Li, Y.; Zhou, Z.X.; Liu, S.
China Aerodynamics R&D Center (China)

Analytical Ballistic Limit Equation for Projectiles Hypervelocity Impacting on Dual Wall Structures
Ding, L.1; Li, C.2; Pang, B.2; Zhang, W.2
1University of Electronic Science and Technology of China (China); 2Harbin Institute of Technology (China)

New Concept of Spacecraft Protection against Meteoroids and Orbital Debris: Active Protective Shielding
Malkin, A.I.1; Kononenko, M.M.1; Shumikhin, T.A.2
1A.N. Frumkin Institute of Physical Chemistry and Elektrochemistry, RAS (Russian Federation); 2Institute of Applied Mechanics, RAS, (Russian Federation)

Numerical Simulation of Debris Cloud Propagation inside Gas-Filled Pressure Vessels under Hypervelocity Impact
Gai, F.F.1; Pang, B.J.1; Liu, X.2
1Harbin Institute of Technology (China); 2Harbin University of Science and Technology (China)

Space Debris Impact Craters Modeling
Smirnov, N.N.; Kondratyev, K.A.
Moscow M.V. Lomonosov State University (Russian Federation)

Micro-Satellite Impact Tests to Investigate Multi-Layer Insulation Fragments
Murakami, J.1; Hanada, T.1; Liou, J.-C.2
1Kyushu University (Japan); 2NASA/JSC (United States)

A LGG Arrangement for Cut-Off of the Projectile Sabot
Toilev, A.G.; Bebenin, G.V.; Kalmykov, P.N.; Shlyapnikov, G.P.; Lapichev, N.V.; Salnikov, A.V.; Sokolov, S.S.; Motlokhov, V.N.
RFNC-VNIIEF (Russian Federation)

Ballistic Properties of Mesh Shield Protection at Hypervelocity Impact
Bezrukov, L.1; Myagkov, N.2; Shumikhin, T.2
1FGUP GosNIIAS (Russian Federation); 2Institute of Applied Mechanics of Russian Academy of Sciences (Russian Federation)

Cyclical Dust Particles Accelerator
Semkin, N.D.; Piyakov, A.V.; Piyakov, I.V.; Pogodin, A.P.; Voronov, K.E.
Samara State Aerospace University (Russian Federation)

Debris Cloud Characteristics of Mono- and Multi-plates under Hypervelocity Impact
Liu, S.; Li, Y.; Zhou, J.F.; Xie, A.M.; Luo, J.Y.; Huang, J.
China Aerodynamics R&D Center (China)

Experimental Investigation of Ejecta Generated by the Hypervelocity Impact of Aluminum Projectiles on Continuous and Mesh Bumpers
Shumikhin, T.1; Bezrukov, L.2; Myagkov, N.1
1Institute of Applied Mechanics of Russian Academy of Sciences (Russian Federation); 2FGUP GosNIIAS (Russian Federation)

Geometrical Shapes Effect on Hypervelocity Impact
Monthienthong, A.
Cranfield University (United Kingdom)

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| | <p>Ion Formation and Photoemission at Interaction of High-Speed Dust Particles with Optical Glass <i>Semkin, N.D.1; Voronov, K.E.1; Piyakov, A.V.1; Novikov, L.S.2</i> <i>1Samara State Aerospace University (Russian Federation); 2Skobeltsyn Institute of Nuclear Physics Moscow State University (Russian Federation)</i></p> <p>Impact of Artificial Microparticles on Spacecraft Materials and Equipment <i>Novikov, L.S.1; Semkin, N.D.2; Bednyakov, S.A.1; Voronov, K.E.2; Ermolaev, I.K.3; Pilyugin, N.N.3</i> <i>1Skobeltsyn Institute of Nuclear Physics Moscow State University (Russian Federation); 2Samara Aerospace University (Russian Federation); 3Institute of Mechanics Moscow State University (Russian Federation)</i></p> <p>Research on Performance of Mesh Bumper Against Space Debris <i>Zheng, S.G.; Yan, J.</i> <i>CAST (China)</i></p> |
| Poster Session: Ob-Orbit and Re-Entry Risk Assessment | |
| | <p>Closeap: GMV's Solution for Collision Risk Assessment <i>Escobar Antón, D.; Pérez Cambriles, A.</i> <i>GMV (Spain)</i></p> <p>Historical and Future Satellite Failure Risk Due to Hypervelocity Impacts <i>Flegel, S.1; Wiedemann, C.1; Gelhaus, J.1; Dietze, C.1; Alwes, D.2; Vörsmann, P.1</i> <i>1Institute of Aerospace Systems, Technische Universität Braunschweig (Germany); 2Deutsches Zentrum für Luft- und Raumfahrt, Bonn (Germany)</i></p> <p>A New Tool for Satellite Re-Entry Predictions <i>Saunders, A.; Swinerd, G.G.; Lewis, H.G.</i> <i>University of Southampton (United Kingdom)</i></p> <p>Analytical Formulas for Evaluation of Meteoroid Distributions in the Near-Earth Space <i>Meshcheryakov, S.A.</i> <i>TSNIIMASH (Russian Federation)</i></p> <p>Conjunction Analysis Tool for Trajectory Optimization and Post-Optimality Analysis <i>Weikert, S.1; Wiegand, A.1; Bavandi, A.2; Erb, S.2; Filipe, N.2</i> <i>1Astos Solutions GmbH (Germany); 2European Space Agency (Netherlands)</i></p> <p>IADC Re-Entry Prediction Campaigns of EAS at PMO <i>Xiong, J.; Zhao, C.; Zhang, X.; Zhang, W.</i> <i>Purple Mountain Observatory (China)</i></p> <p>Mission Analysis and Space Debris <i>Delattre, N.; Chapelle, A.; Quinquis, I.; Cerf, M.; Outrey, D.</i> <i>EADS Astrium (France)</i></p> <p>Space Debris Collision Avoidance and Spacecraft Launch Risk Analysis <i>Liu, J.1; Wang, R.L.2; Zhang, Y.2; Wang, R.2</i> <i>1Chinese Academy of Science (China); 2CAS (China)</i></p> |
| Poster Session: Orbit Prediction & Determination | |
| | <p>Performances of Atmospheric Density Models during Satellite Re-entry Prediction Campaigns at Sunspot Minimum <i>Pardini, C.; Anselmo, L.</i> <i>ISTI/CNR (Italy)</i></p> <p>Space Debris with High A/M: a Web of Sub-Resonances <i>Delsate, N.; Lemaitre, A.</i> <i>University of Namur (Belgium)</i></p> <p>Accuracy of Estimating Solar Radiation Pressure for GEO Debris with Tumbling Effect <i>Chao, C.C.</i> <i>The Aerospace Corporation (United States)</i></p> <p>Parallel Computation of Orbit Determination for Space Debris Population <i>Olmedo, E.; Sanchez-Ortiz, N.; R-Lerate, M.; Bello-Mora, M.</i> <i>Deimos Space S.L. (Spain)</i></p> |

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| | <p>The General Mission Analysis Tool (GMAT): A New Resource for Supporting Resident Space Object (RSO) Orbit Determination, Tracking and Analysis <i>Wilkins, M.1; Jah, M.2; Hughes, S.3; Kelecy, T.4</i> <i>1The Schafer Corporation (United States); 2Air Force Research Laboratory (United States); 3NASA (United States); 4Boeing LTS (United States)</i></p> <p>Research on the Arithmetic for Space Debris Long-Term Orbit Propagation in LEO <i>Xu, K.; Pang, B.</i> <i>Harbin Institute of Technology (China)</i></p> |
| Poster Session: Radar, Optical & In-Situ Measurements | |
| | <p>A Multicolor Photometry and Spectrophotometry of The Space Debris Objects <i>Papushev, P.; Mishina, M.; Tsoukker, T.</i> <i>ISTP (Russian Federation)</i></p> <p>A Method Based on Isochrone Wave Front for Acoustic Emission Source Location in Laminated Plates <i>Liu, Z.D.; Pang, B.J.; Tang, Q.</i> <i>Harbin Institute of Technology (China)</i></p> <p>Simulation and Evaluation System for Space Surveillance Phased Array Radar <i>Song, R.; Hu, W.</i> <i>National University of Defence Technology (China)</i></p> <p>The Application of Linear Programming on the Space Surveillance of High-altitude Objects <i>Wang, X.; Xiong, J.; Wang, H.; Zhang, W.</i> <i>Purple Mountain Observatory, CAS (China)</i></p> <p>Capabilities of the Irkutsk Incoherent Scattering Radar for Space Debris Studies <i>Khakhinov, V.V.; Lebedev, V.P.; Medvedev, A.V.</i> <i>Institute of Solar-Terrestrial Physics (Russian Federation)</i></p> <p>Features of Space Debris Survey in LEO Utilizing Optical Sensors <i>Yurasov, V.; Shargorodsky, V.</i> <i>Institute for Precision Instrument Engineering (Russian Federation)</i></p> <p>Observations of Space Debris in GEO <i>Bakhtigaraev, N.1; Bakhtigaraev, N.1; Sergeev, A.2</i> <i>1Institute of Astronomy of RAS (Russian Federation); 2Terskol Branch of Institute of Astronomy (Russian Federation)</i></p> <p>Time Delay Integration Mode for Observations of Earth Satellites <i>Kozyryev, Y.; Shulga, O.; Sybiryakova, Y.; Kovalchuk, O.</i> <i>Nikolaev Astronomical Observatory (Ukraine)</i></p> <p>Astrometric-Photometric Surveillance of LEO Satellites and Monitoring of Earth Upper Atmosphere <i>Koshkin, N.; Shakun, L.; Dragomiretsky, V.</i> <i>Astronomical Observatory of Odessa University (Ukraine)</i></p> |
| Poster Session: Space Object Catalogs | |
| | <p>Status of the ESA/ESOC Database and Information System Characterising Objects in Space (DISCOS) and its Web Front-end <i>Choc, R.1; Krag, H.2; Klinkrad, H.2; Flohrer, T.3</i> <i>1etamax Space GmbH (Germany); 2ESA/ESOC Space Debris Office (Germany); 3Aboa Space Research Oy (ASRO) (Germany)</i></p> |
| Poster Session: Space Surveillance Techniques | |
| | <p>Assessing the Suitability of the Chilbolton Radars for Space Debris and Space Surveillance Applications <i>Eastment, J.</i> <i>Rutherford Appleton Laboratory (United Kingdom)</i></p> <p>Space Surveillance Observations at the Zimmerwald Observatory <i>Ploner, M.; Schildknecht, T.; Früh, C.; Vananti, A.</i> <i>Astronomical Institute AIUB, University of Bern (Switzerland)</i></p> <p>On Generalization of the Principle of Equivalence of the Search Plan Elements for Different Times <i>Veniaminov, S.</i> <i>Scientific Research Center "Kosmos" (Russian Federation)</i></p> |

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| | <p>GEO Debris Observation of PMO <i>Ping, Y.D.; Wang, X.; Zhao, H.B.</i> <i>Purple Mountain Observatory, CAS (China)</i></p> <p>Series of the Dedicated Survey Telescopes for the Observations of the Space Objects at High Orbits <i>Molotov, I.1; Agapov, V.1; Borisov, G.2; Terebizh, V.2; Chekalin, O.3; Koupryanov, V.4</i> <i>1Keldysh Institute of Applied Mathematics RAS (Russian Federation); 2Sternberg Astronomical Institute of Moscow University (Russian Federation); 3ISC "Vypel", JSC (Russian Federation); 4Central Astronomical Observatory at Pulkovo (Russian Federation)</i></p> <p>Space Debris Size Estimation Based on New Statistical Characteristics of Radar Cross Section <i>Huang, J.; Wang, Z.; Hu, W.D.</i> <i>National University of Defense Technology (China)</i></p> <p>The Use of FrFT in Radar Systems for Space Debris Surveillance <i>Yuan, Z.T.1; Hu, W.D.1; Yu, W.X.2</i> <i>1National University of Defense Technology (China); 2Shanghai Jiao Tong University (China)</i></p> |
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