

Inter–Agency Space Debris Coordination Committee



35th Inter-Agency Space Debris Co-ordination Committee Meeting, Darmstadt, Germany. WORKING GROUP 1 (Measurements) Minutes

Issued by IADC Working Group 1

IADC 35 Minutes

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Revision History

Issue	Revision	Date	Reason for Revision
1	0	2016-04-01	Initial Version

List of Abbreviations

Abbreviation	Description
Member Agencies	
ASI	Agenzia Spaziale Italiana (Italian Space Agency)
CNES	Centre National d'Etudes Spatiales
CNSA	China National Space Administration
CSA	Canadian Space Agency
DLR	Deutsches Zentrum für Luft- und Raumfahrt (German Aerospace Center)
ESA	European Space Agency
ISRO	Indian Space Research Organisation
JAXA	Japan Aerospace Exploration Agency
KARI	Korea Aerospace Research Institute
NASA	National Aeronautics and Space Administration
ROSCOSMOS	Russian Federal Space Agency
SSAU	State Space Agency of Ukraine
UKSA	United Kingdom Space Agency
Other	
ADR	Active Debris Removal
AFRL	(US) Air Force Research Laboratory
AI	Action Item
AIUB	Astronomical Institute of the University of Berne
ANU	Australian National University
BPE	Beam Park Experiment
CAESAR	Conjunction Analysis and Evaluation, Assessment and Recommendations
CCD	Charge-coupled Device
CMOS	Complementary metal-oxide semiconductor
COSMOS	Centre Opérationnel de Surveillance Militaire des Objets Spatiaux
DGA	La Direction Générale de l'Armement
EOL	End of Life
EQUO	Equatorial Italian Observatory
FoV	Field of View
GEO	Geostationary Earth Orbit
GRAVES	Grand Réseau Adapté à la Veille Spatiale
GTO	Geostationary Transfer Orbit
HAMR	High Area-to-Mass ratio
HEO	Highly Eccentric Orbit
HUSIR	Haystack Ultrawideband Satellite Imaging Radar
IAC	International Astronautics Congress
iOTA	in-Orbit Tumbling Attitude model
ISON	International Scientific Optical Network

IT	Internal Task
JGT	James Gregory Telescope
JSpOC	(US) Joint Space Operations Center
KIAM	Keldysh Institute for Applied Mathematics
KSGC	Kamisaibara Space Guard Centre
LED	Light Emitting Diode
LEO	Low Earth Orbit
MASTER	Meteoroid and Space Debris Terrestrial Environment Reference
MCAT	Meter-Class Autonomous Telescope
MEO	Medium Earth Orbit
MITO	Mid latitude ITalian Observatory
MLI	Multi-Layer Insulation
NICO	Networked Instrument Coordinator
OGS	Optical Ground Station
ONERA	Office National d'Etudes et de Recherches Aéropatiales
POPACS	Polar Orbiting Passive Atmospheric Calibration Sphere
PROOF	Program for Radar and Optical Observation Forecasting
RAS	Russian Academy of Sciences
RCS	Radar cross-section
RMS	Root mean square
SATAM	Système d'Acquisition et de Trajectographie des Avions et des Munitions
SDS	Space Debris Sensor
SEMO	Southern (h)EMisphere Italian Observatory
SG	Steering Group
SLR	Satellite Laser Ranger
SOCIT	Satellite Orbital Debris Characterization Impact Test
SPADE	Italian SPACe DEbris observatory
SSA	Space Situational Analysis
SST	(EU) Space Survey and Tracking programme
TLE	Two-line Element
TIRA	Tracking and Imaging Radar
UIST	UKIRT Imaging SpecTrometer
UCT	Un-correlated target
UKIRT	UK Infrared Telescope
URSA MAIOR	University of Rome La Sapienza– Microsatellite for Attitude In ORbit test
WFCam	Wide Field Camera
WG	Working Group

1 Attendees

Delegation members attending the IADC 35 WG1 sessions:

ASI:	Fabrizio Piergentili
	Pierluigi Di Lizia
	Giuseppe D'amore
CNES:	Pascal Richard
CNSA:	Changyin Zhao
CSA:	Brad Wallace
DLR:	Ludger Leushacke
ESA:	Delphine Cerutti-Maori
	Thomas Schildknecht
	Merz Klaus
	Quirin Funke
	Benedikt Reihs
	Jan Siminski
ISRO:	—
JAXA	Hideaki Hinagawa
	Toshifumi Yanagisawa
KASI	Eun Jung Choi
	Jung M Jo
NASA	Joseph Hamilton
	Sue Lederer
	Tim Payne
	Heather Cowardin
Roscosmos:	Igor Molotov
	Vladimir Agapov
	Sakva Nikolay
SSAU:	—
UK Space Agency	Phil Herridge
	Andrew Ash
	Sean Goldsbrough
	Laurence Blacketer

1.1 Contact details

Contact details for WG1 delegates are listed in the Annex B.

1.2 Chairs

For this meeting WG1 Chair was Toshifumi Yanagisawa (JAXA) and Deputy Chair was Changyin Zhao (CNSA).

2 Agenda

The agenda of this meeting can be found in Annex A.

3 Minutes

3.1 First day — Monday 24th April 2017

3.1.1 14:00 – 15:30 Session 1.3 General

Delegates briefly introduced themselves.

The agenda, circulated in advance of the meeting, was accepted without alteration although minor changes were made during the course of the meeting. The final version of the agenda is reproduced in Annex A, Section 4.

3.1.1.1 Agency status reports

Status reports were presented by 8 agencies: ASI, CNES, CNSA, ESA, JAXA, NASA, Roscosmos and UK Space Agency. Two agencies were not represented at the meeting: ISRO and SSAU.

ASI:

ASI is preparing the bi-static radar in Italy. Current system consist of one 4kW transmitting antenna and one receiving antenna. The minimum RCS is 0.4m² at 1000km. In the near future, a 10kW transmitting antenna and two receiving antennas will be ready. The minimum RCS is 0.1m² at 1000km. Multi-band photometry of GEO objects using TNT were carried out. Software tools used for optimization of network observation, orbit determination, lightcurve data analysis and attitude determination were developed. Observation network consisting of 4 telescope in Italy and Kenya are maintained. LEDSAT, a cubesat with LEDs on-board are being developed.

CNES:

CNES used the CAESAR anti-collision system to monitor French satellites in 15 LEO and 8 GEO satellites, resulting in 17 LEO collision manoeuvres. Air Force COSMOS followed the re-entry of 15 objects. For optical measurements, image processing and astrometric reduction were improved. A new telescope was integrated on Reunion Island in the TAROT network. 4 Galileo satellites were successfully tracked with the telescope during their launches.

CNSA:

CNSA completed the observations and data analysis for AI31.2. One 40cm telescopes and the Quad-Channel Refractor consisting 4 telescope with BVRI filters were used. Routine optical tracking for the 109 rocket upper stages launched by China were carried out. For the future works, CNSA will participate the AI of WG1, continue observations of the rocket upper

stages launched by China, simulate optical properties of the rocket bodies in the laboratory and do some experiments to estimate the rotational state of some targets using SLR.

ESA:

ESA continued to use the OGS telescope for GEO and GTO surveys, with specific observations to maintain the catalogue of HAMR objects. Attitude characterisation techniques of uncontrolled objects were improved. ESA joined IADC re-entry test campaign 2016-1 and -2. For databases and reports, IADC REDB front-end was successfully used in 2016-1 and -2 re-entry test campaign and 19th issue of the classification of GEO objects covering 2016 was published. For models, DRAMA, MASTER, DELTA and DOSCOS3 were maintained. MASTER upgrade activity(MASTER-8) has started. 13 collision avoidance manoeuvres were carried out.

JAXA:

R&D directorate of JAXA established the remote observation site at the Siding Spring Observatory in Australia. A 25cm telescope and FLI CCD camera were installed. JAXA is also constructing a 60cm telescope which has SLR capability at Mt.Nyukasa in Japan. LEO survey was carried out using a large CMOS sensor. Minimum detectable size at the survey was 6.7cm. 53% of the detected objects were un-catalogued. Space Track Communications Center is operating Bisei Space Guard Center(BSGC) for optical observation and Kamisaibara Space Guard Center(KSGC) for radar observation. Observations and re-entry predictions for 8 particular objects including 2 re-entry campaign objects were performed the radar of KSGC.

NASA:

NASA had used the HUSIR radar for 770 hours and the Goldstone radar for 50 hours to get the data of AI33.3. For Space Debris Sensor (SDS), Payload is in storage at KSC, waiting for launch integration. Expected Launch Date to the ISS is November 2017. There are some progresses on DebrisSat analysis. For MCAT, Engineering Testing has commenced. GEO survey, TLE tracking, and Software/hardware testing were carried out. Spectral campaigns using UKIRT were done in August, September 2016. GEO survey and GEO breakup survey using WFCam of UKIRT were carried out in January and February 2016.

Roscosmos:

Regular operation of Automated Warning System on Hazardous Situations in Outer Space (ASPOS OKP) started on Jan 1, 2016. Its tasks are Measurements processing, orbital parameters estimation, Estimation of physical properties of objects, Conjunction analysis, Analysis of operations on re-orbiting to graveyard orbits, Pre-launch conjunction assessment, Fragmentation analysis, and Analysis of uncontrolled re-entries. ASPOS OKP consists of 21 instruments around the globe. For ISON, six new telescopes, including a 80-cm telescope at Terskol Peak (North Caucasus), were put into operation. The second observatory in Mexico (Monterey) started to provide observations.

UK Space Agency:

UKSA runs UK Space Operations Centre which is hub for UK data and analysis for EU SST. UKSA observed fragments of the R/B(ssn11564) with Dstl EO sensor. At least four separate objects were identified. For Chilbolton Observatory, UK sensor is under development for EU SST. For St Andrews Observatory, upgrade for flexible non-sidereal tracking was done. At Herstmonceux Geodetic Observatory, the laser ranger with passive mode for LEO and MEO and optical sensor for astrometry for GEO were used EU SST. At Starbrook, two sensors were used for EU SST

3.1.2 15:45 – 16:00 Session 1.4

3.1.2.1 Status of report on AI 23.2 - HAMR (T. Schildknecht, ESA)

T. Schildknecht has reported the status of AI23.2. V. Agapov came back to WG1 which will help to finalize this AI. Since the AI is really old one, Roscosmos will provide additional data. T. Schildknecht will combine those data to previous ones and get some interpretations. The draft will be ready by end of June 2017.

3.1.2.2 Status of report on AI 31.2 - LEO light curves (T. Yanagisawa, JAXA)

T. Yanagisawa has reported the status of AI31.2. The draft version of the report were circulated in WG1. ESA and NASA will provide their observation and analysis parts to the report by the end of June. Roscosmos will provide additional data. T. Yanagisawa will add the data and re-analyse whole data to extract final interpretation.

3.1.2.3 Status of report on AI33.3 – Beam Park Experiment (J. Hamilton, NASA)

J. Hamilton has reported the status of AI33.3. He will send the draft to new ESA PI(D.Cerutti-Maori) so that she can add some extra information. Complete draft version will be ready by the end of June 2017.

3.1.2.4 Status of report on IT34.1 – Campaign for Molniya (F.Piergentile, ASI)

F. Piergentile has reported the status of IT34.1. ASI simulated the optimum observation region under some conditions. We have to consider how to distinguish Molniya objects from contamination. ASI proposed to observe two regions with the separation of 1 hour angle. ESA asked if the two regions are enough. UKSA proposed multiple sensors may solve the problem. Roscosmos has the data of Molniya objects already. It can provide the data for statistical analysis of observation strategy. Observation from southern hemisphere may solve the problem. Angular velocity and apparent brightness distribution will be effective for the distinction. ASI will consider all the possibilities raised in this sessions for the better observation strategy.

3.2 Day 2: Tuesday 25th April 2017

3.2.1 08:30 – 10:30 Session 2.1

3.2.1.1 ISON network development in 2015-2016 (I. Molotov, Roscosmos)

I. Morotov presented an update on ISON network. ISON network is splitting on 3 segments that may be independent in near future, KIAM scientific international cooperation, Roscosmos segment (ASPOS OKP), and industry organizations (JSC Vimpel & ASC). New segment of ISON network for observations under commercial contracts is arranged as part of KIAM cooperation. 13 new telescopes are installed/involved in observations (3 for Roscosmos, 4 of scientific cooperation, 2 of industry and 4 for commercial segment), including MMT-9 that provides fast photometry observations of bright LEO objects (10.5 star magnitude). Quantity of ISON telescopes in Western Hemisphere is allowing already to provide the conjunction analysis at GEO. New ISON telescope elaborations are carried out – series of 40 cm telescopes with FOV 5.5x5.5 degree and prototype of barrier telescope 20 cm x 6 with FOV 42 x 4.5 degree for detection of LEO&HEO objects are in producing.

3.2.1.2 *First results of observations with 80-cm telescope at peak Terskol, North Caucasus(I. Molotov, Roscosmos)*

I. Morotov presented the first results of the updated 80cm telescope. ISON project is replenished with new respectively large telescope situated at 3100 m altitude in place with good quality of atmosphere. This is very powerful instrument for faint space debris observations. Now this is most large telescope that can spent 100% observation time for the project goals. Limiting magnitude is down to 18.5 now. It is expected that it will be improved down to 19.5 after re-aluminization of the main mirror. Current FOV is 55 x 55 minutes. It is expected that this will be enlarged to 75 x 75 minutes with new CCD camera. Obtained measurements are used to calibrate the space debris population SDPA model.

3.2.1.3 *Experience of use the MMT-9 telescope for observation of brightness variations of LEO space debris objects (V. Agapov, Roscosmos)*

V. Agapov presented the lightcurve data of LEO objects using MMT-9. MMT is developed and built by «Parallax» company for Kazan Federal University (KFU) with the goal to detect and characterize fast optical transients of various origin (cosmological, galactic, near-Earth). Institute of physics of KFU together with SAO RAS use MMT for fundamental scientific research projects. Analysis of optical transients associated with near-Earth objects is performed by Institute of physics of KFU in cooperation with Station “Arkhyz” of Research and Production Enterprise “Precision Systems and Instruments”. ASPOS OKP receives data from MMT under contract by Roscosmos. The MMT system includes a set of nine individual channels. Each channel has a coelostat mirror installed before the Canon EF85/1.2 objective for a rapid adjusting of the objective direction in a limited range, sCMOS detector and a set of colour and polarimetric filters. Field of view of each channel is 100 sq. deg (11x9.5 deg), total FOV of the system is 900 sq. deg. Temporal resolution of the system is 0.1 s (10 frames per second).

3.2.1.4 *Results of observations of space debris at high near-Earth orbits with electro-optical sensors of ASPOS OKP system in 2016 (V. Agapov, Roscosmos)*

V. Agapov presented the operational network of optical facilities of ASPOS OKP. Optical facilities of ASPOS OKP have collected more than 8 millions of measurements in 2016 for more than 3400 space objects at high orbits (GEO, MEO, HEO). Instruments of the network have discovered 530 new and re-discovered more than 410 lost GEO and HEO space debris objects during 2016. At present ASPOS OKP provides for more than 90% of discoveries of new objects at high orbits.

3.2.2 11:00 – 13:00 Session 2.2

3.2.2.1 *The Italian Contributions to AI31.2 (F. Piergentili, ASI)*

F. Piergentili presented the new software for the analysis of streak created by LEO objects. It can extract the lightcurve of the objects which will contribute AI31.2. In the framework of the agreement between ASI (Italian Space agency) and S5Lab (Sapienza - University of Rome) research group, a software for light curve data analysis has been developed. Rapid changes in brightness are investigated as possible implication of rapid changes in attitude. To study the short-term brightness variability of uncontrolled objects in LEO (Low Earth Orbit), observations are obtained while the telescope is tracking at the sidereal rate, and the object is trailed across the field of view (FOV). Analysis of intensity changes along the trail reveals

the primary frequencies of the object's brightness variations on time scales of a second or less.

3.2.2.2 *NASA MCAT Optical Program update (S. Lederer, NASA)*

S. Lederer presented the updates of MCAT. The first campaign through remote observation was carried out January 2016. Telescope is fully operative April 2016. NASA User Readiness Review was held August 2016. For the future goal, following things will be done. 1. Installation of 0.4m Benbrook telescope on nearby tower in 2017. 2. Coordinated observations with MCAT/Benbrook in miniCAT configuration. 3. Full testing of autonomous operations, all modes with both telescopes. 4. Full data collections to commence. 5. Establish MCAT as contributing sensor for SSN to fill GEODSS gap.

3.2.2.3 *Status of DebrisSat Project (H. Cowardin, NASA)*

H. Cowardin reported the status of DebrisSat Project. The purpose of the DebrisSat project is to replicate a hyper-velocity fragmentation event using modern-day spacecraft materials and construction techniques to better improve the existing DoD and NASA breakup models. Characterization of small fragments using 2D Imagers is underway. Validation of 3D imager is underway. Plans for optical and radar facility measurements are being developed. Plans to update existing breakup models and damage assessments using DebrisSat analysis are being discussed.

3.2.2.4 *Using of Photometric Data Obtained while Regular Coordinate Measurements of Near-Earth Space Objects (N. Sakva, Roscosmos)*

N. Sakva discussed the usage of massive lightcurve data sets provided by ASPOS OKP (Automated system of warning on dangerous situations in outer space). It has been confirmed that various ASPOS OKP telescopes used for coordinate observations of MEO and GEO space objects receive close brightness values of the observed objects without significant systematic errors. These values are in satisfactory agreement with the calculated values. The possibility of using photometric information obtained in the course of coordinate observations of near-Earth space objects by the ASPOS OKP for estimation of size, optic parameters, attitude and cinematic of object is demonstrated. Methods for analysis of this information are proposed. The proposed methods were used for analysis of photometric information obtained in the coordinate observations of GPS satellites, both operational and decommissioned. Estimation of dimensions, optical characteristics and stabilization of the observed objects is possible with the help of the proposed methods. It is possible to distinguish the types (models) of known space objects from the arrays of low precise photometric data obtained with coordinate measurements. The proposed approaches may be used for classification of observed space objects in an automated mode to create a catalogue of non-coordinate characteristics of observed MEO and GEO space objects.

3.2.3 14:00 – 15:15 Session 2.3

3.2.3.1 *Discussion about the New AIs.*

WG1 discussed about next lightcurve campaign observation(new AI). In order to reduce the burden of each agency, we should reduce the number of the targets. However, understanding the observed phenomena(one out of 50 lightcurves of same target shows

periodical change) is very important for ADR and requires appropriate number of the targets. On the other hand, it is difficult to understand the situation only with the lightcurve. We should consider other observation method like colour observation and radar. ESA suggested that it is possible to use the radar for this observation but quite expensive. And R/B is not good target for radar observation because it is symmetric. Target should have some complexities for radar imaging. JAXA suggested that one or two targets for optical and radar simultaneous observation and continue lightcurve campaign with one third of the targets in the next AI. Roscosmos is able to provide existing lightcurve data of the listed targets. We should combine Roscosmos data and check the entire result before submitting the report to SG. We should also discuss about the physics behind the rotation with WG2 before we decide the contents of new AI. Our duty is to decide what percentage of the targets shows the rotation. We got some answers (8% is rotating) but need confidence to our answers. We should continue some kind of observation to get the confidence to the answer we got.

3.2.4 15:45 – 16:00 Session 2.4

3.2.4.1 *TAROT telescopes network for SST (R. Pascal, CNES)*

R. Pascal reported the update of TAROT telescope network. It consists of 5 Automated autonomous telescopes (weather station, autonomous roof control). Several projects share the network. Three TAROT telescopes are owned by French CNRS and Zadko telescope is owned by University of West Australia. Those are installed and maintained by IRAP and ARTEMIS laboratories including one or two maintenance sessions per year on each site. The primary mission is to follow up of Gamma Ray burst and gravitational waves alerts (about one night per month and telescope). The secondary mission (not on Zadko) is SST by CNES (40% of each night). Other projects share the remaining 60 percent. TAROT Reunion joined the network which covers new longitudes and enables to obtain more measurements. The new quota of 40% for SST activities enables about 8000 measures per week. The network was used for three anti-collision tracking requests in 2016. About 200 orbits of COSMOS were produced daily using the data taken by the network. The image processing software for MEO orbits, astrometry at low elevation, and better separation of objects were improved.

3.2.4.2 *LEDSAT, a CubeSat equipped with LEDs for optical measurements (F. Piergentili, ASI)*

F. Piergentili explained the LEDSAT briefly. LEDSAT (LED-based SATellite) is a 1U CubeSat in Low Earth Orbit (LEO) equipped with LEDs (Light Emitting Diodes) and retroreflectors for optical tracking with ground-based telescopes. The idea has been conceived and designed by Sapienza - University of Rome and University of Michigan. The mission aims to be a milestone for calibrating orbit determinations systems based on optical measurements in LEO regimes. The collaborating institutes are University of Bern (Scientific background, Optical Measurements, Laser Ranging), Italia Space Agency – Matera Geodesy Center (Laser Ranging Operations, optical communication), and INFN National Institute of Nuclear Physics (Retroreflectors, optical communication). Moreover, it will also test the LED-based technology for attitude determination through light curve measurements and low rate light flashing communication using a pulse code.

3.3 Day 3: Wednesday 26th April 2017

3.3.1 09:00 – 10:30 Session 3.1 joint WG1/WG2

T.Yanagisawa briefly explained the result of the lightcurve campaign observation of AI31.2. Importance of understanding the strange phenomena (one out of 50 lightcurves of same target shows periodical change) was recognized by both WG1 and 2. In order to understand the phenomena clearly, WG1 should get more data. As the resource is limited, WG1 will shorten the list of the targets. Adding Roscosmos data is very important. WG1 should add and see what is going on the combined data. Then WG1 can decide what we should do in next campaign observation. For the lightcurve observations, WG2 wants to know the dependencies of the type of R/B, duration on the orbit and behaviours over time with statistics. These are very useful for ADR. Histories of the period and orientation are also important. These could contribute to the understanding the phenomena. Univ of South Hampton would like to handle the lightcurves. The people have resources and the data-mining algorithm which can help WG1. WG1 is considering new AI targeting Molniya objects and ask WG2 for advices for what kind of observation would be better. WG2 will discuss about this issue and will feed back. For HARM objects, there are ultra-fast rotators. WG2 would like to understand this phenomena. Roscosmos confirmed that some HARM objects were released from the operational space crafts. At least two cases were observed.

3.3.2 11:00 – 13:00 Session 3.2 About the new lightcurve campaign observation

For the new lightcurve campaign observation, radar will be useful to solve the problem but it costs a lot. UKSA will contribute with radar. UKSA will try to observe some objects. Extra data other than optical lightcurve must be very useful. Simultaneous observation with optical equipment should be better. We have to consider data format for simultaneous observation. Also in order to carry out simultaneous observations, we need to coordinate the observation very precisely. WG1 discuss these points next IADC.

4 Annex A — Agenda

4.1 IADC 35 Darmstadt – WG1 Agenda

4.1.1 Day 1: Monday 24th April 2017

08:00 — 09:00 Registration (main gate)

09:00 — 12:00 Opening Plenary of 35th IADC meeting

1. Opening Remarks
2. Plenary talk: Stijn Lemmens,
"Current adherence levels to space debris mitigation guidelines and recent trends"
3. Plenary Talk: Tom Huynh
"Commitment-to-compliance - Lessons-Learned"
4. Delegation Statements
5. WG status reports
6. Group photo session (H-Building, Rotunde)

12:00 — 13:00 Lunch break & Transition from "Plenary" to "WG" room configuration (rooms not accessible during this time period)

13:00 — 15:00 Session 1.3 General

Conference room, H.I

1. Meeting overview and objectives, status of AIs, summary of October 2016 SG meeting (T. Yanagisawa, C. Zhao, 15 mins)
2. Update and approval of agenda (T. Yanagisawa, C. Zhao, 5 mins)
3. Agency status reports space debris related activities in 2016/2017 (ASI, CNES, CNSA, CSA, DLR, ESA, ISRO, KARI, JAXA, NASA, ROSCOSMOS, UKSA, 5 mins per WG1 member Agency)

15:00 — 15:30 Coffee Break (foyer, in front of the rooms H.I and H.IV)

15:30 — 17:30 Session 1.4 General

Conference room, H.I

1. Status of report on AI 23.2 (T. Schildknecht, ESA, 15 mins)
2. Status of report on AI 31.2 (T. Yanagisawa, JAXA, 15 mins)
3. Status of report on AI 33.3 (J. Hamilton, NASA, 15 mins)
4. Status of report on IT 34.1 (F. Piergentili, ASI, P. Herridge, UKSA, 15mins)
5. Preparation of WG1 report to SG
6. WG reports to SG

17:30 — 18:30 Optional tour of ESOC

18:30 — 20:00 Reception in the ESOC Canteen

4.1.2 Day 2: Tuesday 25th April 2017

08:30 — 10:30 Session 2.1

Conference room, H.I

1. ISON network development in 2015-2016 (I. Molotov, Roscosmos, 20 mins)
2. First results of observations with 80-cm telescope at peak Terskol, North Caucasus (V. Viktor, Roscosmos, 20 mins)
3. Experience of use the MMT-9 telescope for observation of brightness variations of LEO space debris objects (V. Agapov, Roscosmos, 20 mins)
4. Results of observations of space debris at high near-Earth orbits with electro-optical

sensors of ASPOS OKP system in 2016 (V. Agapov, Roscosmos, 20 mins)

10:30 — 11:00 Coffee Break (foyer, in front of the rooms H.I and H.IV)

11:00 — 13:00 Session 2.2

Conference room, H.I

1. The Italian Contributions to AI31.2 (F. Piergentili, ASI, 10 mins)
2. NASA MCAT Optical Program update (S. Lederer, NASA, 15 mins)
3. Status of DebrisSat Project (H. Cowardin, NASA, 10 mins)
4. Using of Photometric Data Obtained while Regular Coordinate Measurements of Near-Earth Space Objects (N. Sakva, Roscosmos, 10 mins)

13:00 — 14:00 Lunch break

14:00 — 15:30 Session 2.3

Conference room, H.I

1. Discussion about the New AIs.
2. Preparation of the joint session with WG2/4

15:30 — 16:00 Coffee Break (foyer, in front of the rooms H.I and H.IV)

16:00 — 18:00 Session 2.4

Conference room, H.I

1. TAROT telescopes network for SST (R. Pascal, CNES, 20 mins)
2. LEDSAT, a CubeSat equipped with LEDs for optical measurements (F. Piergentili, ASI, 15 mins)
3. Preparation of WG1 report to SG
4. WG reports to SG

18:00 — 18:30 Bus transfer to the IADC dinner

18:30 — 20:30 Dinner (Burg Frankenstein)

20:30 — 21:00 Bus transfer back to ESOC

4.1.3 Day 3: Wednesday 26st April 2017

08:30 — 09:30 Session 3.1.1 Joint session with WG2/WG4

Conference room, Conference room

1. What should we do at the next lightcurve campaign observation? (T. Yanagisawa, JAXA, 20 mins)
2. Discussion on the next lightcurve campaign observation

09:30 — 10:30 Session 3.1.2

Conference room, H.I

1. About the next lightcurve campaign observation
2. Future direction of WG1

10:30 — 11:00 Coffee Break (Foyer, in front of the rooms H.I and H.IV)
note: WG's must clear their rooms prior to coffee break

11:00 — 12:00 Report of WG chairs to the SG

12:00 — 13:00 Lunch break (note: WG's must clear their rooms prior to lunch break)

13:00 — 14:30 Closing plenary session

14:30 — 15:00 Adjourn

5 Annex B — WG1 Delegate contact information

Name	Affiliation	E-mail
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