

OOS 2002

Workshop Synthesis

Based on Workshop Progress Meetings
& Breakout Group Summary Reports



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OOS 2002 IN BRIEF

The OOS 2002 Workshop was the **first** international event entirely dedicated to on-orbit servicing and attracted **52 participants from 11 countries**. The 2-day workshop was held at a remote venue and was composed of plenary **presentations** in the mornings and **breakout group sessions** in the afternoons followed by **progress meetings** and **social dinners** and **networking opportunities**. OOS 2002 was a **real workshop** and **very successful** as for its **results**, the creation of an **OOS community** and an outstanding **spirit and atmosphere** during the event. It was suggested unanimously to repeat such event in a bi-annual basis.

With an **innovative format**, on the first day the workshop **set the scene** and **validated the future of OOS**, it then on its second day provided **stakeholder perspectives** and defined **a way forward for OOS**. A **facilitator** supported the various program elements. Four breakout groups (the “Whigs”, the “Suits”, the “Boffins” and the “Navvies”) took on the perspectives and roles of OOS stakeholders (space industry, agencies, regulatory bodies, finance, insurance, space A&R, systems engineering and mission architecture).

WORKSHOP RESULTS

Based on the participants backgrounds and the plenary presentations four breakout groups were set up (see website), which worked through given issues to develop a vision and recommendations towards OOS led by captains familiar with the field:

Why is OOS Not Yet a Common Practice?

Although several astronaut-supported missions have been conducted and the ISS is being serviced on a regular basis, OOS has not become a common practice in space yet. Major reasons have been identified as follows:

- Benefits are not evident
- Other priorities in space
- Missing link: not all OOS-related elements are in place yet
- OOS was not clearly defined to date
- Technology readiness not proven because of chicken & egg (utility vs. end-to-end demonstration)
- Co-operative design not implemented yet
- Missing ground infrastructure
- High cost of space access (launch, transportation)
- Complex communication (bandwidth and latency)
- OOS and its issues especially commercial implications are not fully understood yet
- Culture and attitude are not taking into account OOS principles (on both agency and industry level)
- General lack of vision and innovative approaches
- Non-traditional/technical aspects (insurance, finance, etc) not considered



Selected OOS Issues (Identified by the Breakout Groups)

- OOS to become an integral element of space (and to be called “OOS”)
- Evolution of regulatory framework (debris, disposal)
- Investigation of security and risk issues (insurance and national assets)
- Export control (e.g. ITAR) with respect to COTS
- Cost effects of co-operative design need to be investigated
- Trade-offs with respect to launch costs for servicing and logistics are needed
- Observation services could be available in the short-term, but cost-benefit is not clear, while GEO Telco Sat servicing seems most obvious
- Economics of serviceable constellations to be investigated
- Potential economy of scale effects to be verified
- Business case studies (including on-orbit assembly)
- Application in MEO or for navigation

- Huge technology investment made and sound heritage in space A&R
- Technology demonstration and readiness are key and role of space agencies
- The role of OOS as an enabling technology/approach to be explored
- Demonstrators based on micro sat technology and COTS
- Near-term focus on non-co-operative servicing
- Dual track end-to-end technology demonstration approach proposed:
 - Orbital Recovery (commercial feasibility) followed by Mark II for science
 - TECSAS (technological leapfrog towards more sophisticated OOS)

- Full exploitation of secondary payload volumes and e.g. utilization of Russian low-cost launch capacity
- Less reliable/cheaper launchers for low-value items
- Protocols and frequencies dedicated to OOS
- CCSDS vs. high-speed communications
- Integrated simulation facilities and full mission planning
- 1st mover issue and learning curve

Visions Supporting OOS

The four breakout groups developed visions supporting their definition of a way forward to OOS (workshop theme). These visions, although different and partly reflecting the cultures represented by the breakout groups, are not in conflict but complementary to each other.

- **“Realization of a Fully-Fledged Economic Orbit Infrastructure Based on OOS” – Observation Services (0-5 Years) – Motion Services (5-10 Years) – Manipulation Services (10+ Years)** (Breakout Group “The Whigs”)
- **“Realistic Evolutionary Approach to OOS”** (Breakout Group “The Suits”)
- **“OOS Increasing Flexibility of Space Missions & Enabling for Future Space Exploration”** (Breakout Group “The Boffins”)
- **“Full Launch and Ground Infrastructure”** (Breakout Group “The Navvies”)

WORKSHOP SYNTHESIS - A WAY FORWARD & RECOMMENDATIONS

During the progress meetings on both days of the workshop results of the breakout groups were presented, discussed and streamlined (see progress meetings and breakout group summary reports). As a conclusion the following outlook was developed and supported by the participants:

Years	Governments Agencies	Industry	Leg&Reg Bodies
0-5	<ul style="list-style-type: none"> "OOS Policy & Budget Line" Intl. Agency Coordination & Collaboration ISS-Related OOS Technology Development Roadmap 	<ul style="list-style-type: none"> Development of Commercial Cases OOS Demonstration "Maintenance" (US) "De-Orbiting" "Re-Orbiting" (ORC) 	<ul style="list-style-type: none"> Frequency Band for OOS
5-10	<ul style="list-style-type: none"> Paradigm Shift to Infrastructure Availability 	<ul style="list-style-type: none"> Creation of Partnership <ul style="list-style-type: none"> OOS-SP's Sat Mans Gov'ts/Agencies 1st Generation OOS Business 	<ul style="list-style-type: none"> Satellite Disposal & Debris
10-15	<ul style="list-style-type: none"> Large Space Infrastructure Assembly 	<ul style="list-style-type: none"> 2nd Generation OOS Business 	
15-20		<ul style="list-style-type: none"> Orbital Supply Platforms 	

VISION

Immediate Actions!

OOS could serve to **enable and improve future space activities** in various respects. It seems therefore obvious that **OOS needs to be addressed** by space agencies, industry and regulatory bodies and could provide **benefits to all stakeholders**.

OOS will have multi-level implications and should be considered by **dedicated policies and budget lines**. Public organizations should support **technology demonstration**, make use of the **ISS** and secure **communication**, while the private sector should develop **commercial applications** and **first OOS movers** (short-term: 0-5 years).

Future space activities should be driven by **new paradigms** focused at advancements in **infrastructure availability** and increased efficiency as well as on **new partnerships** between stakeholders involved. Space **debris and disposal** of space objects will generate an additional momentum paving the way for **OOS business** (mid-term: 5-10 years).

Large space structures and their **assembly** and most **exploration** programs will require OOS and build the basis for additional levels of OOS business involving **orbital platforms and other routine logistics** (long-term: 10-20 years).

Details and documents as well as other OOS-related information can be found here: http://www.on-orbit-servicing.com/workshop_2002/index02.html.