

Ammersee Resolution

Herrsching, June 29, 2007

1st International Symposium on Solar Sailing, ISSS 2007



The experts who gathered at the ISSS agree that solar sail technology is ready for demonstration in space. Many useful and important applications have been identified. The experts unanimously recommend agencies commit to realizing this unique capability for science and applications.

<p>Reported Status / Technology Readiness</p>	<ul style="list-style-type: none"> ▪ Germany/Europe (DLR/ESA, 1999): 20m sail structure deployed on ground in ambient, simulated zero-g environment ▪ USA (NASA, 2004/05): 10m and 20m sails using different types of boom technologies and sail materials deployed on ground in ambient and vacuum environments ▪ Japan (ISAS/JAXA, 2004): 10m sail deployed on sounding rocket and 20m sail from balloon ▪ China (2007): 10m deployable sail structure tested on ground ▪ Modelling and simulation tools including low-thrust navigation and attitude control developed and verified
<p>Mission Applications</p>	<ul style="list-style-type: none"> ▪ Displaced / artificial Lagrange orbits, both geocentric and heliocentric, for communication, remote sensing and space environment monitoring, including support for human exploration ▪ Solar polar imaging (≈ 0.5 AU) ▪ Fast missions to the outer solar system, heliopause and beyond the bow shock (≈ 200 AU), reaching interstellar space ▪ Highly inclined or retrograde heliocentric orbits to encounter NEOs for science and planetary defence ▪ Small body rendezvous and sample return missions ▪ Trojan asteroid fly-by using hybrid propulsion combining solar sailing with electric propulsion

<p>Next Steps</p>	<ul style="list-style-type: none"> ▪ Subscale deployment testing of booms and sails on a sub-orbital flight ▪ In-orbit deployment testing of booms and sails of 20m to 50m in size, and orbital maneuvering and sail thrust vector control ▪ Validation of engineering tools, methods and materials ▪ Germany/DLR will investigate and attempt to perform a sub-orbital flight of a small-scale solar sail, to test the deployment concept and sail unfolding behaviour, in collaboration with industry under DLR Agency funding.
<p>Recommendations</p>	<ul style="list-style-type: none"> ▪ Continue investment to sustain and extend demonstrated capabilities, otherwise capabilities will be lost ▪ The key next step is flight-validation of a solar sail in orbit ▪ International collaboration options should be investigated for an in-orbit test mission

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The Symposium Participants

The ISSS Symposium Participants, Herrsching am Ammersee, June 2007:

NameLast	NameFirst	Affiliation	City	Country
Baoyin	Hexi	Tsinghua University	Beijing	China
Circi	Christian	University of Rome	Rome	Italy
Campbell	Bruce	NASA/GSFC	Greenbelt	USA
Dachwald	Bernd	DLR	Wessling	Germany
Diedrich	Benjamin	NOAA	Silver Spring	USA
Eckersley	Steven	ASTRIUM UK	Stevenage	UK
Ellinghaus	Frank		Sinzheim	Germany
Fröbel	Ludger	DLR	Köln	Germany
Furuya	Hiroshi	Tokyo Institute of Technology	Tokyo	Japan
Gong	Shengping	Tsinghua University	Beijing	China
Greschik	Gyula	University of Colorado	Boulder	USA
Huang	Wenhao	USTC	Hefei	China
Johnson	Les	NASA/MSFC	Huntsville	USA
Kawaguchi	Jun'ichiro	ISAS/JAXA	Sagamihara	Japan
Kezerashvili	Roman	City University of New York	New York	USA
Lappas	Vaios	University of Surrey	Guildford	UK
Leipold	Manfred	Kayser-Threde	Munich	Germany
Lennon	Andrew	ABL Engineering Ltd.	Tipperary	Ireland
Li	Junfeng	Tsinghua University	Beijing	China
Lura	Franz	DLR	Bremen	Germany
McInnes	Colin	University of Strathclyde	Glasgow	UK
Mengali	Giovanni	University of Pisa	Pisa	Italy
Ohndorf	Andreas	DLR	Cologne	Germany
Quarta	Alessandro	University of Pisa	Pisa	Italy
Rios-Reyes	Leonel	University of Michigan	Ann Arbor	USA
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Tibert	Gunnar	KTH Mechanics	Stockholm	Sweden
Van Sant	Tim	NASA/GSFC	Greenbelt	USA
Vulpetti	Giovanni	Galileian Plus	Rome	Italy
Wang	ChunCheng	USTC	Hefei	China
Wang	Yong	USTC	Hefei	China
Waters	Thomas	University of Strathclyde	Glasgow	UK
Widani	Christoph	Kayser-Threde	Munich	Germany
Wie	Bong	Arizona State University	Tempe	USA
Zhang	Yang	USTC	Hefei	China