

ZARM Vibration Test Facility



Example of Flight Units: MT140-2, MT80-1, MT30-2-GRC, MT30-2-CGS and MT6-2 (Top to Bottom)

ZARM, University of Bremen, is the Center of Applied Space Technology and Microgravity, established in 1985. Being one of the largest university space research centers in Europe, we are specialized in providing low cost, customized attitude determination and control system solutions covering special hardware and software developments.

Microcosm, Inc., established in 1984, specializes in reducing space mission costs. Our experience covers commercial, military, and scientific missions from small, low-cost programs to multi-million dollar, multi-satellite constellations and a family of launch vehicles.

The **ZARM Technik** is the commercial arm of the university department.

For further information on the torquers contact:

ZARM Technik GmbH
Oliver Matthews
Space Technology Dep.

Am Fallturm
28359 Bremen, Germany

Phone: +49 - 421 - 218 - 3635
FAX: +49 - 421 - 218 - 4356

Email: Oliver.Matthews@zarm-technik.de
Web: www.zarm-technik.de

In the United States:

Microcosm, Inc.
Paul Graven
ACS Engineer

401 Coral Circle
El Segundo, California 90245

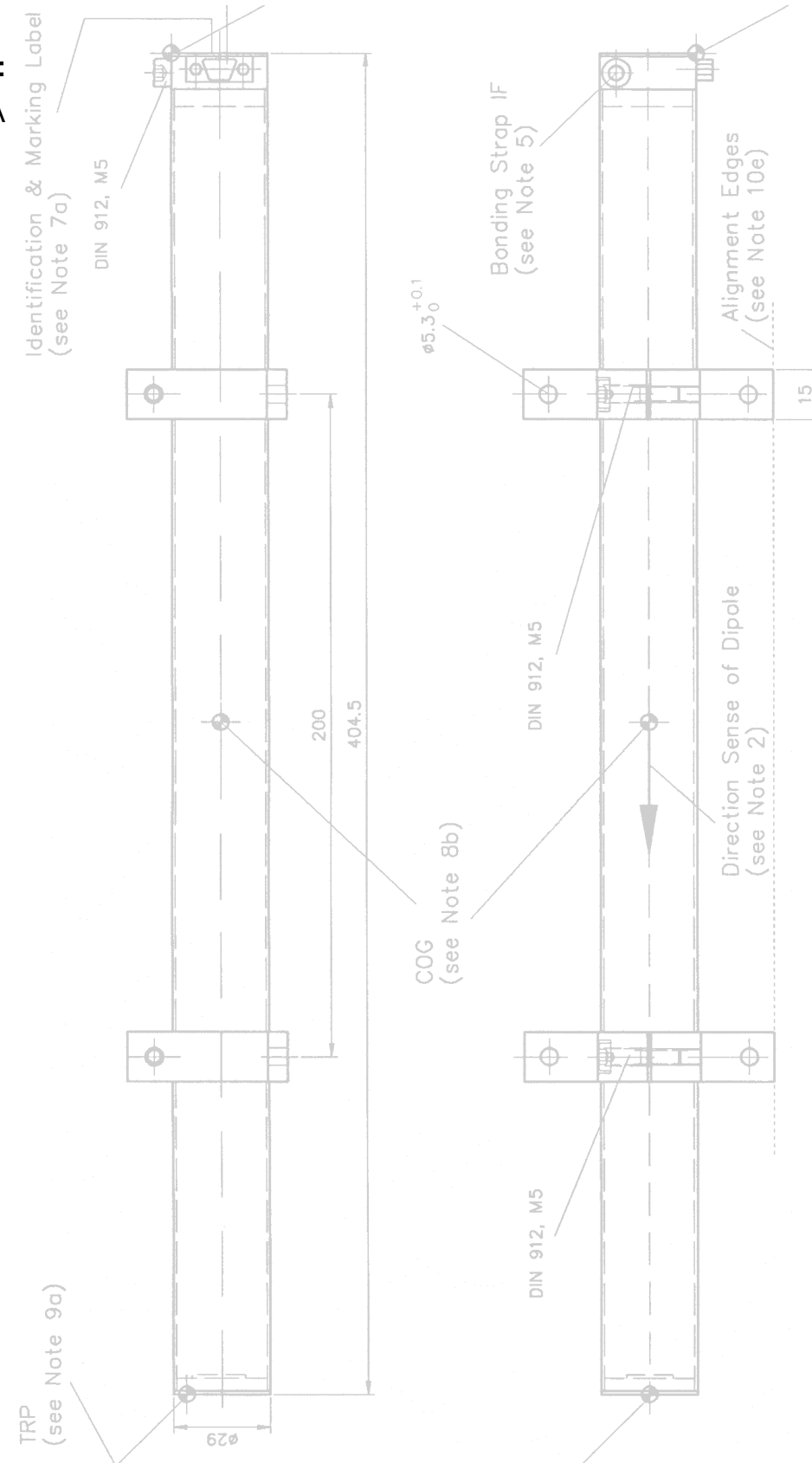
Phone: (310) 726 - 4100
FAX: (310) 726 - 4110

Email: microcosm@smad.com
Web: www.smad.com

ZT-06/2005en-OM

Flight History:
ABRIXASMITA

- GRACE
- FalconSat
- QuikTOMS
- MOST
- ChipSat
- INDEX
- NPSSat
- TechSat-21
- CryoSat
- STPSat
- SAR-Lupe
- StarShine
- GOCE
- PalaMede
- ROCSAT-3
- TerraSAR-X
- GSTB-V2
- X-Sat
- SAFIR-3
- AEOLUS
- DSX
- AGILE
- PROBA 2
- MMP
- DFH Microsat
- Flying Laptop
- NSTB



- Customers:**
- OHB-System
 - Carlo Gavazzi
 - Astrium/JPL
 - US Air Force
 - Orbital Sciences
 - Dynacon
 - SpaceDev
 - ISAS/Kawasho
 - US Navy
 - ASI
 - AeroAstro
 - Astrium GmbH
 - Politecnico di Milano
 - EADS Astrium
 - Univ. of Nanyang, Singapore
 - MicroSat Systems
 - Verhaert
 - INPE, Brazil
 - Astro Research, Japan
 - IRS Univ. Stuttgart
 - NSPO Taiwan

Magnetic torquers orient your spacecraft's attitude and manage angular momentum onboard.

These relatively simple devices interact with the Earth's magnetic field and create control torque, which can be adjusted to a specified value. Combined with one or more wheels, they provide all the control you need to maintain your spacecraft's attitude, from low-Earth orbit up to geo-stationary orbit. And, unlike thrusters, torquers do not use valuable consumables, are low power, and very reliable. **ZARM** has teamed with **Microcosm** to provide high performance torquers and system support that meet all your program requirements and keep your budget and schedule on target.

Our production process meets the highest standards for performance and workmanship, with excellent quality control.

Design Features

- Nickel-alloy cores with special thermal treatment
- Al 7075-T73 brackets (custom designs available)
- Aluminum-alloy or composite tubular housing
- Resin protection encapsulates the wire-wrapped core inside the housing against thermal/mech. stress
- Double-insulated magnet wires (dual coils are simultaneously wound)
- MIL-C 24308 non-magnetic connectors or pigtail
- Titanium bolts and housing parts

Off-the-Shelf Sizes

(Fast custom design available – Please contact us)

Type	No. of Coils	Linear Dipole Moment [Am ²]	Saturation Moment [Am ²]	Linear Voltage [V]	Linear Power [W]
MT2-1	1	2.0	2.5	5.0	0.5
MT5-2-M	2	5.0	> 6.0	5.0	0.77
MT6-1	1	6.0	> 7.0	5.0	0.25
MT6-2	2	6.0	> 8.0	5.0	0.5
MT10-2-H	2	10.0	> 12.0	10.0	1.0
MT15-1-M	1	15.0	> 20.0	14.0	1.11
MT30-2-CGS	2	33.0	> 40.0	25.0	3.6
MT30-2-GRC	2	30.0	> 35.0	12.5	1.5
MT70-1	1	70.0	> 75.0	28.0	3.8
MT70-2	2	70.0	> 75.0	24.0	2.6
MT80-1	1	80	> 100	10.0	3.0
MT80-2-M	2	80	> 90.0	28.0	4.7
MT110-2	2	110	> 120.0	12.0	2.9
MT140-2	2	145	> 170	10.0	1.9
MT250-2	2	250	> 300	28.0	4.8
MT400-2-L	2	400	> 500	18.5	9.0
MT400-2	2	400	> 550	21.0	11.4
MT400-1	1	400	> 550	28.0	7.7

NOTES:

1. Reliability is 0.999975 for 10 years (1 coil).
2. Data are subject to changes



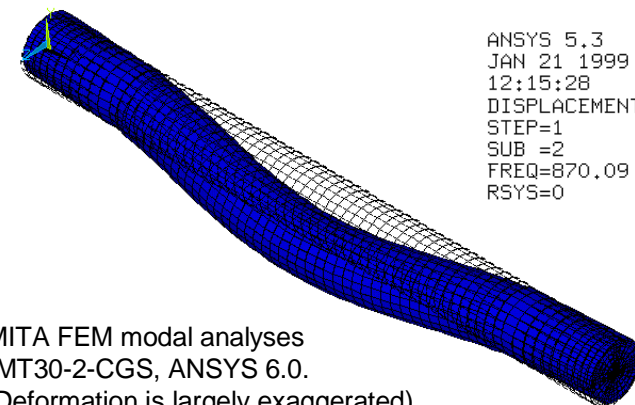
GOCE Magnetic Torquer MT400-2

Performance

- Near-zero hysteresis
- Excellent linearity
- High maximum dipole moment

While torquers appear to be relative simple devices, they require thoughtful design and careful assembly. ZARM/Microcosm's qualification and acceptance testing ensures that there is virtually no potential for degradation either on the ground or on-orbit. The torquer's most critical component -its core material- has been heat-treated to ensure optimal magnetic properties. Each unit is totally encapsulated and, except for the core, made with non-magnetic components.

Mass [kg]	Length [mm]	Diameter [mm]	Special Design Features	Programs
0.2	157.5	15	Small Sat Design	StarShine
0.3	240.0	18	Small Sat Design	MOST
0.23	325.0	14.5	Low weight	INDEX
0.3	325.0	14.5	Low weight	QuickSat, X-Sat, PROBA 2, Flying Laptop
0.35	330.0	17	Low weight	SAFIR-3
0.43	329.5	17	Opt.: 21 V	QuikTOMS, ChipSat, TechSat-21, STPSat, PalaMede, ROCSAT-3
1.050	349.0	27	–	MITA, NPSat-1, MMP, DFH
1.4	404.5	29	–	GRACE, CryoSat
2.6	400.0	39	Low length	Conf.
2.2	581.0	30	–	GSTB-V2
4.12	380.5	50	Opt.: 28 V	ABRIXAS, FalconSat, AGILE
2.3	500.0	32	–	AGILE
3.8	600.0	40	–	TerraSAR-X
5.3	680.0	43	Opt.: 28 V	ABRIXAS
5.5	883.0	37	–	SAR-Lupe
7.8	952.0	41	Low weight	AEOLUS
11.0	750.0	56	Low length	GOCE
9.2	750.0	50	Low length	DSX



MITA FEM modal analyses (MT30-2-CGS, ANSYS 6.0). Deformation is largely exaggerated)

ZARM's/Microcosm's experience includes specialists in both hardware definition as well as production.

Services include:

- Torquer system engineering and attitude control subsystem design support
- Fabrication and testing of high-performance torquers
- High-precision ACS system simulations
- Development of the overall solution of your project

ZARM was established 1985 and has become one of the most important centers for applied Space and production technologies in Europe. **Microcosm** has been in the business of finding technologies to reduce Space mission cost for more than a decade.

Together we have committed to providing cost-effective torquer solutions for Space projects from small, low-cost single satellites to large-scale constellations.