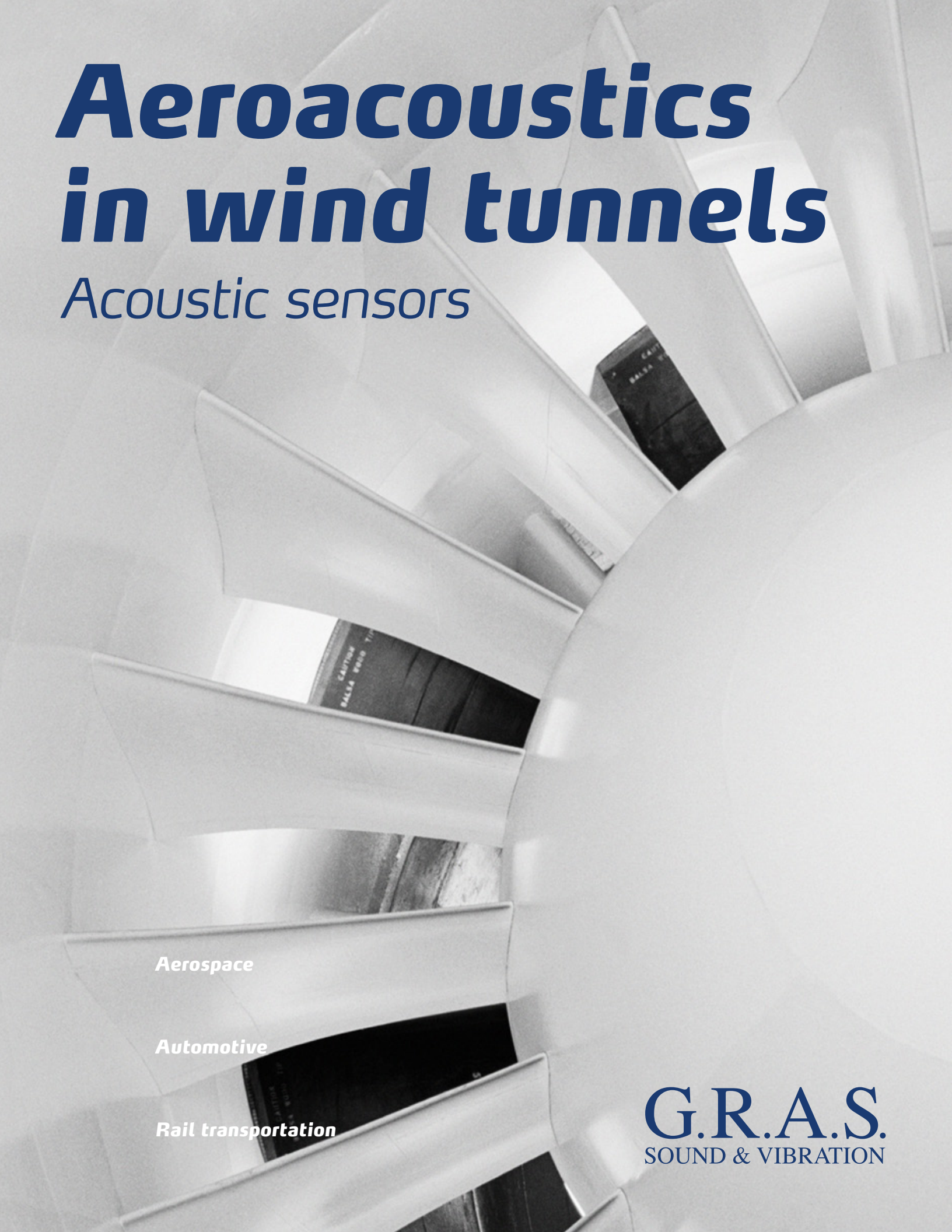
Aeroacoustics in wind tunnels

Acoustic sensors



Aerospace

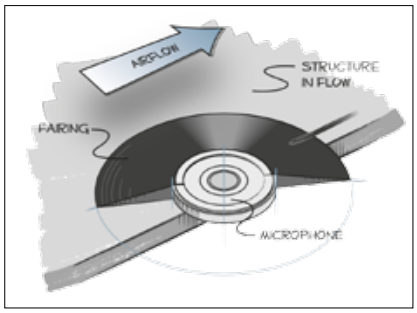
Automotive

Rail transportation

G.R.A.S.
SOUND & VIBRATION

The aeroacoustic toolbox

G.R.A.S. has developed a wide range of acoustic sensors and dedicated accessories for testing in both anechoic and hard-walled wind tunnels in the near and far field, at low and high wind speeds.

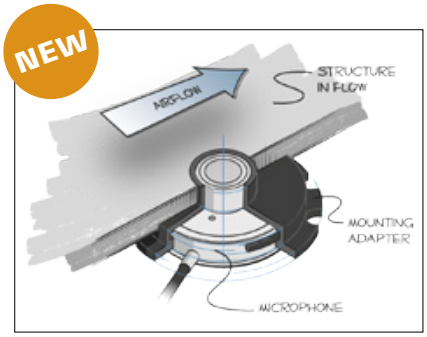


Surface microphones

The G.R.A.S. high-precision surface microphones are originally designed for in-situ boundary layer testing, where non-invasive mounting is a must. They are therefore also very suited for in-flow testing of full scale objects in wind tunnels. The height has been kept at 2.5 mm, and the microphone is surrounded by a fairing to reduce self-generated turbulence.

- High precision measurement microphones
- Non-invasive mounting and insignificant protrusion
- Integrated preamplifier with plug & measure functionality
- Wide linear frequency range
- Wide dynamic range

NEW

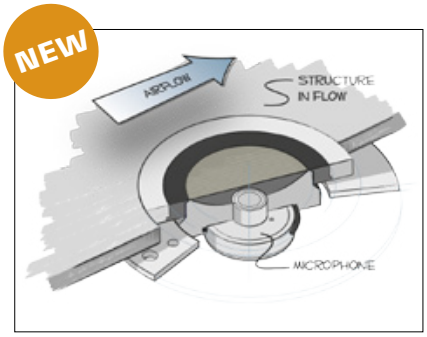


Flush-mount microphones

This new line of acoustic sensors combines the high precision and reliability of G.R.A.S. measurement microphones with the need for fitting sensors into very confined spaces and narrow structures, e.g. in acoustic antennas and beams. With an installation height of less than 10 mm and thin coax wiring, the flush-mount series can be integrated into literally any design without sacrificing aero-dynamic properties.

- High precision measurement microphones
- Very low installation height
- Integrated preamplifier with plug & measure functionality
- Wide linear frequency range
- Wide dynamic range

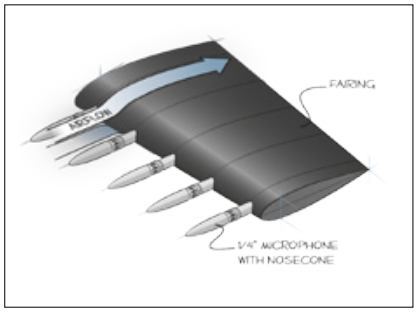
NEW



Flush-mount Turbulence Screen

The new G.R.A.S. turbulence screen is the latest innovation for aeroacoustic testing in solid-walled wind tunnels. By attenuating the hydrodynamic component of turbulence up to as much as 25 dB, the acoustic signals of interest can now be identified and diagnosed with a much more reliable resolution. The flush-mount turbulence screen integrates the flush and recessed mounting techniques with a special wire mesh into one single unit, and allows for adaptation of several mounting options.

- Very high induced flow noise reduction
- Very low acoustic attenuation
- Low installation height
- Front or rear mounting options
- Flush-mount and standard microphone accommodation



Nosecones

The nosecones are the result of a G.R.A.S. development project with DNW (German Dutch Wind Tunnel), being an updated alternative with better in-flow noise rejection compared to existing designs. The blunt tip design is now a NLR standard being used at relatively low wind speeds and in places where it is of interest to make near-field measurements in the flow.

- High induced flow noise reduction
- Low acoustic attenuation
- Lightweight design to reduce vibrations and wake noise
- Single or array mounting
- Standard microphone accommodation

CCP Special and Standard Microphone Sets and Accessories

1/4" surface
G.R.A.S. 40LA

Frequency range	5 Hz - 70 kHz*
Dynamic range	56 dB(A) - 178 dB
Sensitivity	0.5 mV/Pa
Venting	Front

1/4" surface
G.R.A.S. 40LS

Frequency range	5 Hz - 70 kHz*
Dynamic range	46 dB(A) - 167 dB
Sensitivity	1.8 mV/Pa
Venting	Front

1/2" flush-mount
G.R.A.S. 47AX

Frequency range	3.15 Hz - 20 kHz
Dynamic range	22 dB(A) - 150 dB
Sensitivity	12.5 mV/Pa
Venting	Front

1/4" flush-mount
G.R.A.S. 47BX

Frequency range	4 Hz - 70 kHz
Dynamic range	44 dB(A) - 166 dB
Sensitivity	1.6 mV/Pa
Venting	Front

1/8" flush-mount
G.R.A.S. 47DX

Frequency range	10 Hz - 100 kHz*
Dynamic range	52 dB(A) - 174 dB
Sensitivity	0.9 mV/Pa
Venting	Front

Flush-mount Turbulence Screen Kit
G.R.A.S. 67TS

Turbulence attenuation	Up to 25 dB**
Turbulence speed	Up to Mach 0.2
Frequency range (turbulence)	500 Hz - 10 kHz**
Acoustic attenuation	Less than 3 dB**
Approach	± 60 Deg
Frequency range (acoustic)	100 Hz - 70 kHz
Dynamic range	44 dB(A) - 166 dB
Venting	Front

Nosecones

RA0020 for 1/2" standard microphone sets
RA0022 for 1/4" standard microphone sets
RA0173 for 1/8" standard microphone sets

1/2" pressure
G.R.A.S. 46AO

Frequency range	3.15 Hz - 20 kHz
Dynamic range	25 dB(A) - 150 dB
Sensitivity	12 mV/Pa
Venting	Option for rear or front

1/4" pressure
G.R.A.S. 46BD

Frequency range	4 Hz - 70 kHz
Dynamic range	44 dB(A) - 166 dB
Sensitivity	1.45 mV/Pa
Venting	Option for rear or front

1/8" pressure
G.R.A.S. 46DD

Frequency range	6.5 Hz - 140 kHz*
Dynamic range	47 dB(A) - 175 dB
Sensitivity	0.62 mV/Pa
Venting	Option for rear or front

*±3 dB. All other ±2 dB. **Depending on flow-speed

Standards
Specials
Customized

We Make Microphones

Since the company was established in 1994, we have been 100% dedicated to develop and manufacture high-quality measurement microphones and related acoustic equipment.

Tradition
We are located in Denmark and founded by the Danish acoustics pioneer, Gunnar Rasmussen who for more than 60 years has contributed to the world of sound and vibration with his unique ideas and designs. In 1956 Mr. Rasmussen designed the first reproducible 1" condenser measurement microphones. And the commercialization of these measurement microphones enabled quality measurements and instrumentation which could be acoustically calibrated and accredited.

Mr. Rasmussen's ingenuity and understanding of not yet spoken customer needs soon lead to the world's most popular and probably most copied acoustic sensor: The 1/2" measurement microphone. Then the 1/4" and 1/8" microphones followed with outstanding dynamic and high-frequency capability that brought higher definition and transparency into impulse noise diagnostics. Many variants have been made available over the years; all based on Gunnar Rasmussen's original 1" pressure microphone design.

Innovation
At G.R.A.S., we and our customers benefit daily from Mr. Rasmussen's exceptional understanding of acoustics, physics, electronics and measurement needs. Not only in our R&D department but in the entire house we are proud to develop, produce and offer the broadest range of high-quality measurement microphones and accessories in the industry. And as a family company, now owned and managed by the two sons, Per Rasmussen and Peter Wulf-Andersen, we safeguard our heritage and knowledge to help create new opportunities with our customers. We work with everybody who has an interest in sound or noise within the fields of aerospace, automotive, audiology, consumer electronics, noise monitoring, building acoustics and telecommunications, metrology, education, consultancy, legislation and system integration.

Quality
All our microphones are solely produced in stainless steel and in a quality that allows for a 5 year warranty.

Unique repair service
Should you by mistake damage the diaphragm on a G.R.A.S. microphone, our special technique enables repair at a very reasonable price. A fact often valued not only by the users but also by their purchase departments who are guaranteed a long term investment with equipment from G.R.A.S. This service applies to both standard, special and customized microphones.

Partners
G.R.A.S. is represented worldwide in more than 40 countries by subsidiaries and partners. Whether you are searching for a multi-channel solution, a replacement microphone for your sound level meter or a customized sensor design, your local G.R.A.S. partner will in close cooperation with us be able to help solve your measurement needs.

Please visit gras.dk for your local G.R.A.S. partner.

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