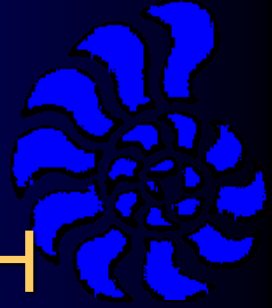


NAUTILUS MARINE SERVICE GmbH

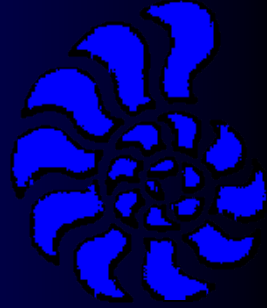


**History of VITROVEX**

# NAUTILUS MARINE SERVICE GmbH

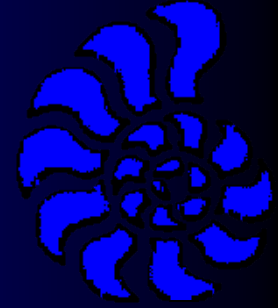


- VITROVEX, Glass products for marine science and technology
- Scientific systems and instruments



# The Start

- 1989 First contact with **JENAer Glaswerke, GDR**
- 1990 Experiments with mouth-blown hemispheres and unsuccessful pressure tests
- 1991 First samples form steel mould and hydraulic stamp, pressure tests now successful
- 1994 Production by PILOTEC GmbH
- 1997 Production by QVF Pilotec GmbH



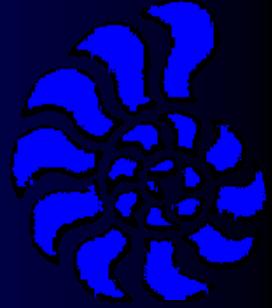
# Present Status

1998 Glass moulded by SCHOTT in Mainz

2002 QVF closes factory in Jena

2003 Nautilus takes over the marine product line

Since 1992 the same staff works for the VITROVEX line of products ensuring constant high quality derived from experiences gained in 16 years.



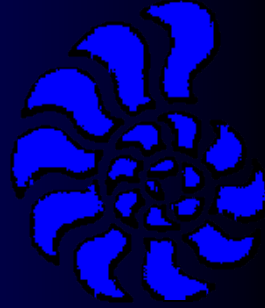
# Material and Properties

**VITROVEX** products use SCHOTT borosilicate glass 3.3

Glass has properties which makes it ideally destined for deep sea use. It is

- corrosion resistant
- light
- chemically, electrically and magnetically inert
- transparent
- inexpensive

# Production

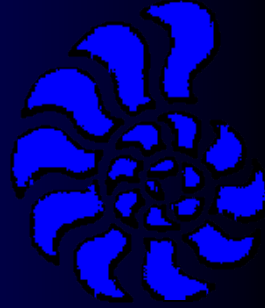


Liquid glass flows from  
the dispenser into the mould  
(covered)

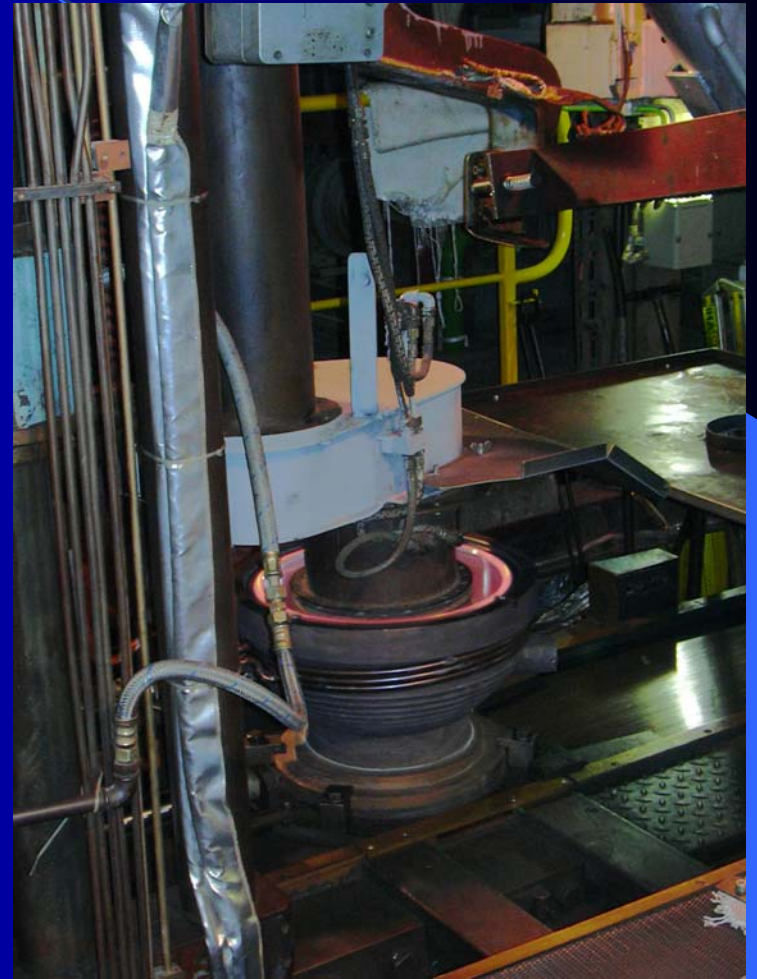


Photo: SCHOTT

# Production 2



A 17" hemisphere  
in mould



Ühoto: SCHOTT



# Production 3

Vacuum lifter  
transfers hemi-  
sphere from mould



Photo: SCHOTT



# Production 4



Transfer from moulding  
station to transport



Photo: SCHOTT

# Annealing

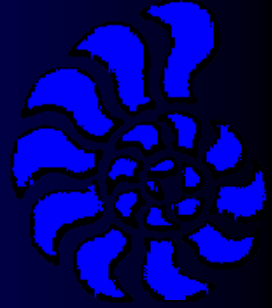
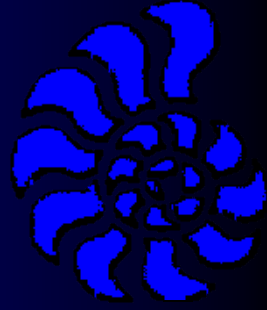


Photo: SCHOTT



# Grinding

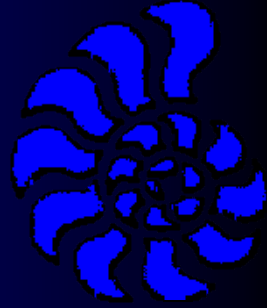


1. Equator ground  
by milling  
machine and  
diamond tools (today  
grinding compound)

2. Manual smoothing

3. Manual polishing

# Drilling



1. Adjustment of hemisphere on a rotatable and tiltable platform
2. Drilling according to specified location and diameter
3. Flat ground for sealing



# Assembly of Connectors

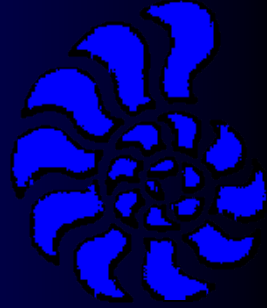


Penetrators assembled according to customer's specification for use as a glass instrument housing for an ocean bottom seismometer (OBS)



Photo: WHOI

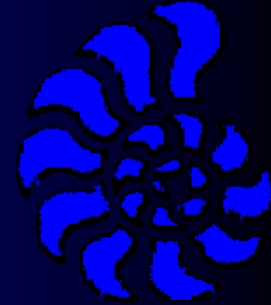
# VITROVEX Products 1



- **Glass Floatation**
- 17 inch for 6.700m, 9.000m and 12000m waterdepth
- 13 inch for 7000m waterdepth
- Other sizes upon request

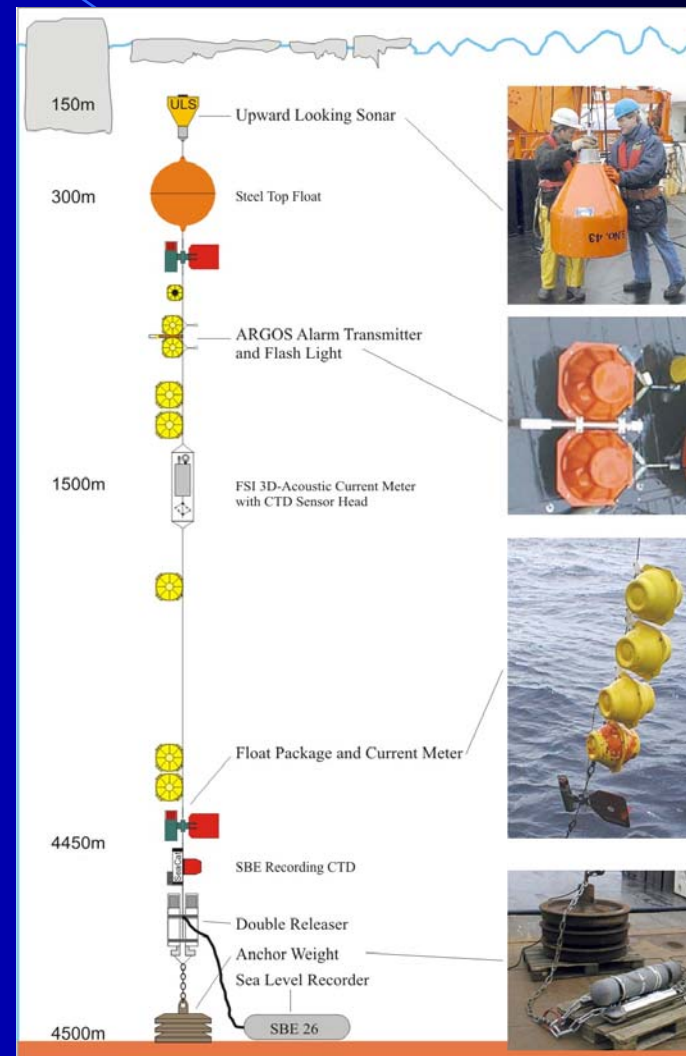


# Mooring System



Glass Floats are used as buoyancy material within oceanographic mooring

Typical Currentmeter mooring system (AWI)

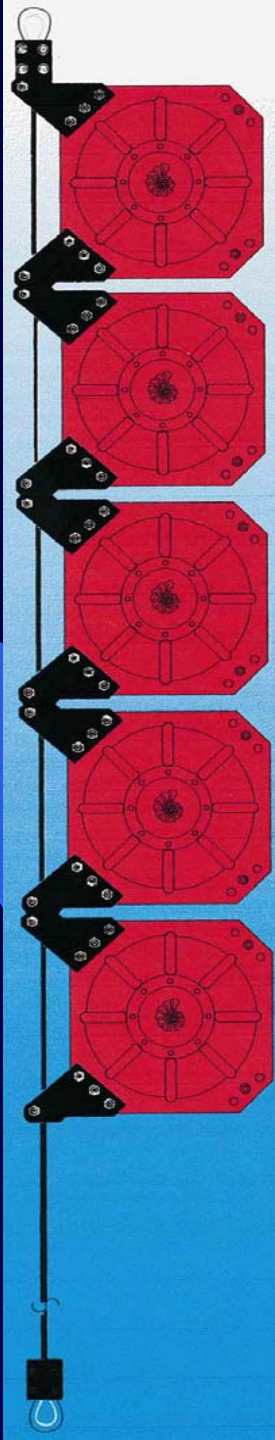


# EDDYGRIP Floatation Modules

**EDDYGRIP** is a swivelling sphere attachment. It is neutrally bouyant and seawater resistant. Developed, tested and patented by Alfred-Wegener-Institut for Polar- and Marine Research.

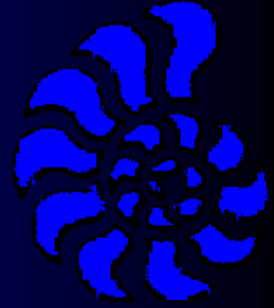
**Eddystop** is a stopper to keep floatation in place.

**Eddyrope** is a 10mm rope made of Kevlar or Dyneema provided with a polyester protection braid.





# VITROVEX Instrument Housings

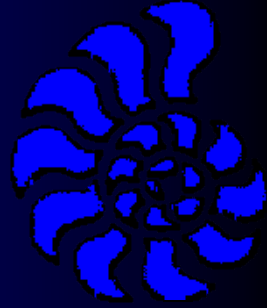


- Glass Instrument Housings
- 17" Spherical
- 13" Spherical
- Cylindrical



Photo: CPPM-Marseille

# VITROVEX CIH



- **Cylindrical Instrument Housings**

used as LED-Beacon for calibration of ANTARES strings

OAL	320mm
OD	187mm
ID	159mm
P	600 bar



# VITROVEX Laser Beacon



- Glass/Titanium Instrument Housing used as Laser Beacon
- Development in co-operation of University Valencia/Spain, SICO Quartz/IKTZ & NAUTILUS



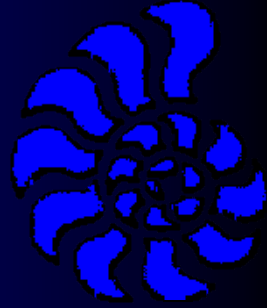


# VITROVEX Antennae

- Glass/Titanium Housings used as:
    - GPS antenna
    - DGPS antenna
    - GPS-Mouse
    - IRIDIUM antenna
- Submersible 3000m or 6000m



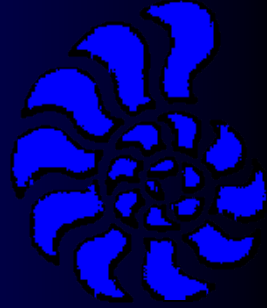
# VITROVEX O-Ring Seal



- Instrument Housings, spherical with O-ring seal
- Used as pressure housing for main control electronics of an Autonomous Underwater Vehicle (AUV) of BLUEFIN ROBOTICS



# VITROVEX Seismometer



- In co-operation with the University in Hamburg, Geophysical Institute we developed a long-time recording Multi-Parameter recording system for seismological Research



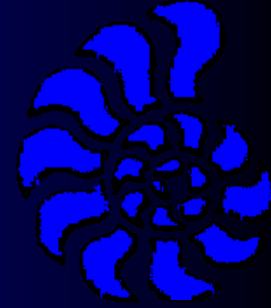
New version w/titanium frame

# VITROVEX Seismometer

## Measured Parameters

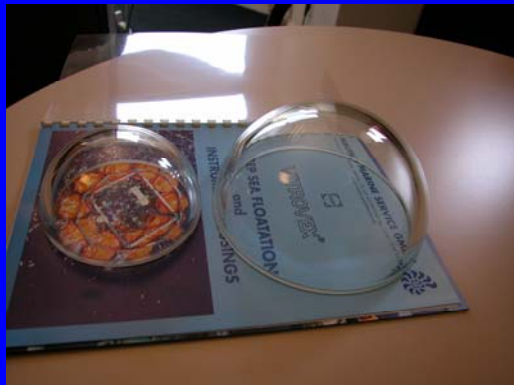


- Motion x,y & z 50 Hz to 50 (100) s
- Sound 10-3000Hz
- Current, temperature (optional)
- Attitude (heading, pitch and roll +/- 30° optional)
- Tilt 1° +/- 0,001° (optional)



# Optical Domes

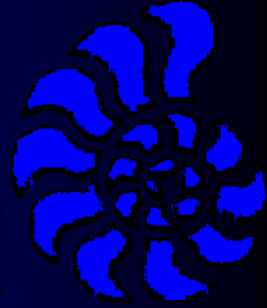
- Different optical quality
- 50-150mm diam.
- up to  $\lambda/2$  surface
- BK7, quartz or borosilcate glass



Optical Dome BK7 146/15mm



# Advantages of VITROVEX



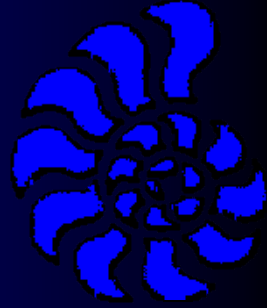
1. High dimensional constance, providing that hemispheres can be mingled.
2. Hemispheres need no orientation due to high accuracy polishing
2. High transparency allows simple optical applications



UW Crawler with pan&tilt video camera (VENUS)

Photo: IUB-Bremen

# VITROVdEX



- The technological know how of glass and combination of glass and metal is utilised to develop new products.
- The source of our glass is SCHOTT, the leading glass manufacturer.
- The manufacturing methods are appropriate to the material and guarantee first class products.