

Investigating Impact Force whilst modelling a Mars Lander – Technician's Guide

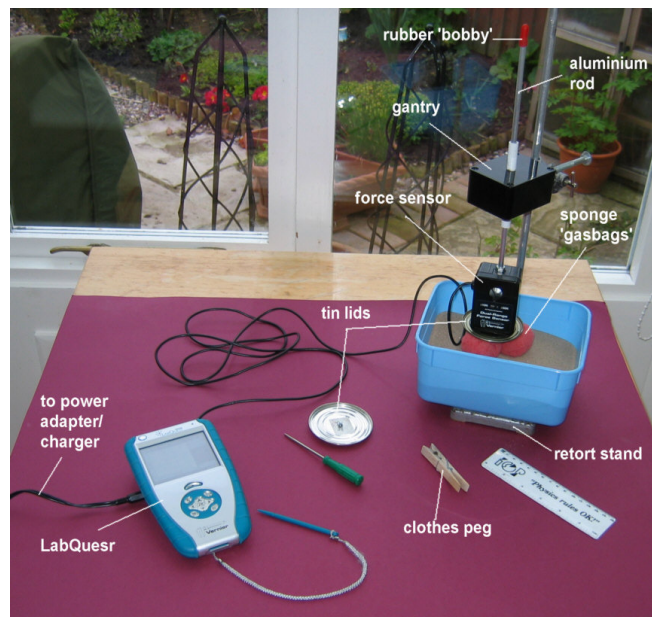


Figure 1 Setup of Vernier LabQuest with Mars lander

Equipment required

Vernier LabQuest and power adapter
Vernier force sensor
clothes peg
silver sand (DIY or B&Q)
icecream container
ruler
retort stand
bosshead
screwdriver
gantry (see construction details)

Construction details for gantry

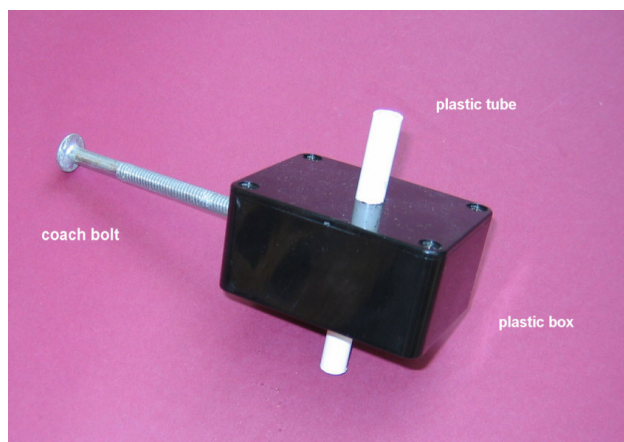


Figure 2 Gantry

plastic box 79 x 62 x 39mm or similar ref MB1 (Maplin)
plastic tubing to just allow aluminium rod to slide freely inside (model shop, B&Q or W Hobby)
aluminium rod 6mm diameter (DIY or B&Q)
pvc 'bobby' ref RST 030 020 (Scientific and Chemical)
10cm long coach bolt (DIY or B&Q)
2 x nuts to fit coach bolt (DIY or B&Q)
nut to fit thread that is put onto the aluminium rod (DIY or B&Q)
access to tap and die set

Saw off a 10cm length of the plastic tubing. Using a vertical drill-stand drill a hole to take the plastic tubing centrally through the top and bottom of the plastic box. Make it a tight fit. Also drill a hole centrally in one end of the plastic box to take the coach bolt. Insert the plastic tube through the top and bottom of the box so that about 3cm or so protrudes on each side. Remove the box lid. Place a nut onto the coach bolt, insert the coach bolt into the hole on the end of the box, place another nut onto the coach bolt. Do up the two nuts against the wall of the plastic box to secure the coach bolt. Screw the box lid back on.

Saw off a 30cm length of aluminium rod and put a 1cm length of thread onto one end of it to fit the thread of the force sensor. Thread a nut onto the 1cm length of thread, screw the rod into the force sensor's support rod hole and screw the nut up tight against the support hole.

Other assembly details - parts required

foam bath sponge (c. 3.5cm thick – very inexpensive type)
2 x jam-jar lids (2lb jar type)
2 x small bolts to fit into the force sensor's base
Velcro™ adhesive loop and hook
aluminium rod 6mm diameter (DIY store or B&Q)

Drill small holes centrally into each of the tin-lids to take the small bolts.

Cut the sponge into three cubes roughly 4cm x 4cm and 3.5cm thick and then round off the corners of each one to model the 'gasbags' on the Mars lander. Attach a piece of Velcro™ loop 1.5cm x 1.5cm to each of them on one of their 4cm x 4cm faces. Although the Velcro™ is sticky it may be wise to stitch it to the sponge 'gasbags' for a firmer fix. Stick three pieces of Velcro™ hook 1.5cm x 1.5cm to the top of a 2lb size jam-jar lid such that the 'gasbag' sponges will fit evenly onto it when required – space them at 120° intervals.

Bolt the tin-lid with sponge 'gasbags' onto the base of the force sensor.

Mount the gantry in a bosshead on a retort stand. Taking the force sensor with jam-jar lid and 'gasbags' attached, slide the force sensor's rod into the gantry's tube and arrange it so that it can move vertically up and down. Anchor the rod with the clothes peg just above the tube. Fit a pvc 'bobby' to the end of the rod to provide a degree of protection. Place the container of silver sand on the retort stand base immediately below the force sensor.

Set the force sensor on its $\pm 50\text{N}$ range.

Supplier

W Hobby Limited
Knight's Hill Square
London SE27 0HH
Tel: 020 8761 4244
Web: <http://www.hobby.uk.com>
E-mail: mail@hobby.uk.com

Scientific and Chemical Supplies Limited
Carlton House
Livingstone Road
Bilston
West Midlands WV14 0QZ
Tel: 0845 165 0845
Fax: 01902 402 343
E-mail: customerservices@scichem.co.uk
Web: <http://www.scichem.co.uk>

Key setup details for activity

Vernier force sensor
Set Zero and Reverse
Time based mode
Sample Rate: 1000 samples/s
Sampling length: 3s
Points before trigger (pre-trigger): 200
Triggering: 0.5N Rising