

# regarding the excavation of lunar regolith

by: bradley grzesiak

photo: NASA



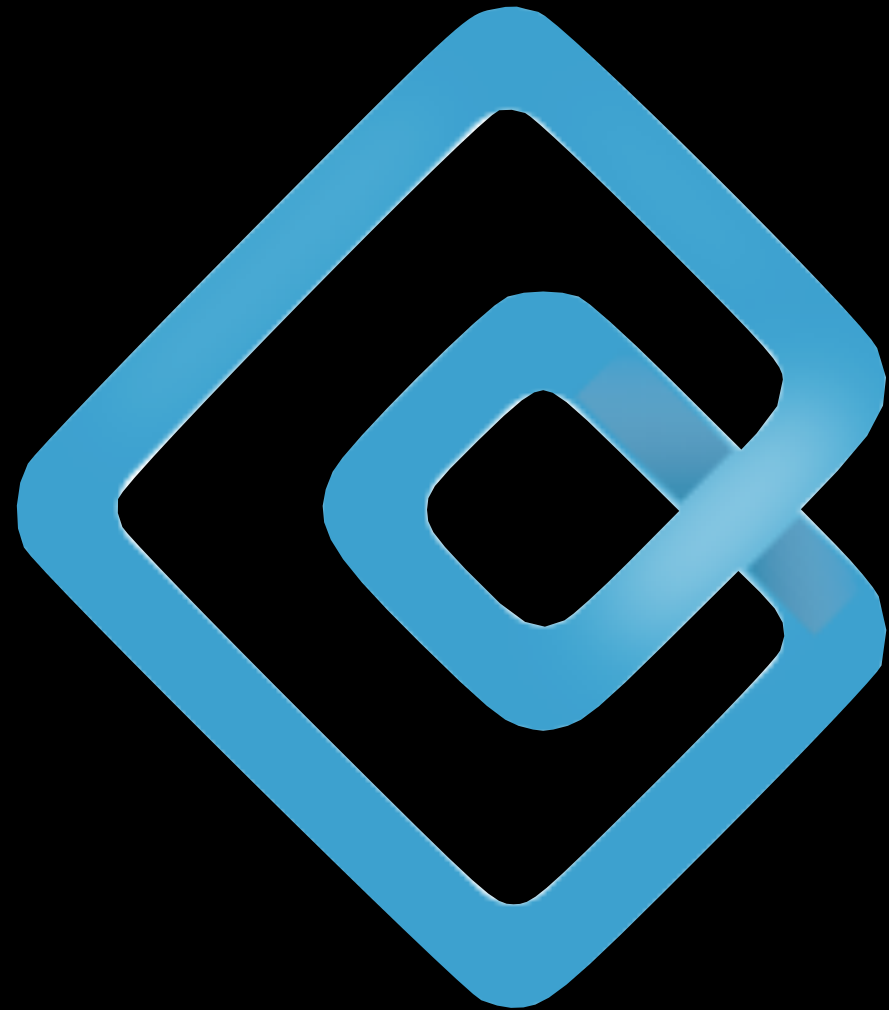
# about me

- grew up w/ erector set & linux
- university of wisconsin-madison:
  - bs computer sciences
  - bs engineering mechanics and astronautics (ema)
  - some ema masters work
- 5 years as aerospace engineer
  - rat cages for space
  - life support for ng space station
  - lunar excavation

photo: bradley grzesiak

oh yeah

now i do rails at bendyworks



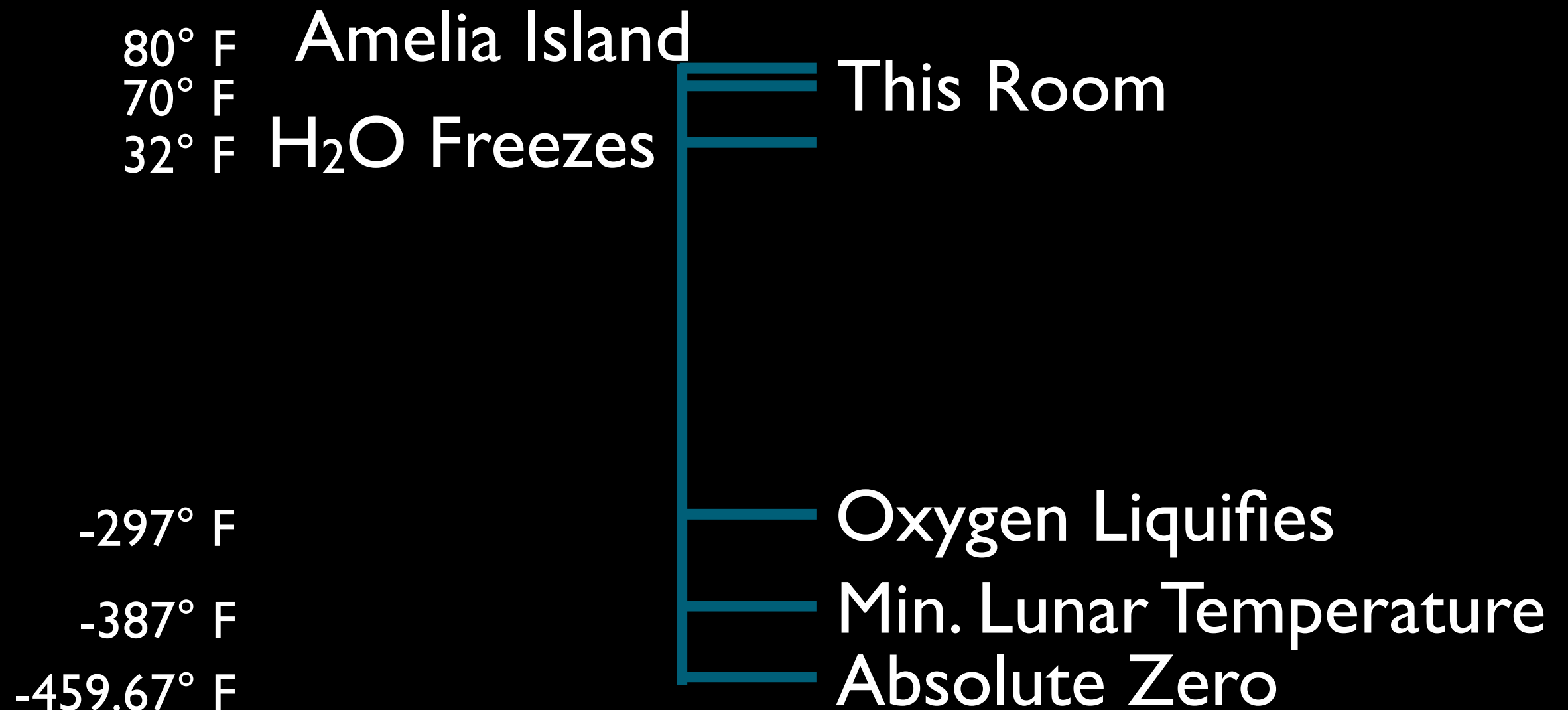




but back to lunar  
regolith excavation

flickr: gak, tambako

# Typical Temperatures





# so it's cold. so what?

- air liquifies
- polymers => sad face
- elastomers don't work
- typical hydraulic fluids freeze
- composites, many metals shatter



and the moon  
is itchy

zero erosion



barbed grains



flickr: extrajection





# barbed grains suck lots

- stick to space suits
- destroy bearings and bushings
- interlock extremely well

photo: NASA-JSC

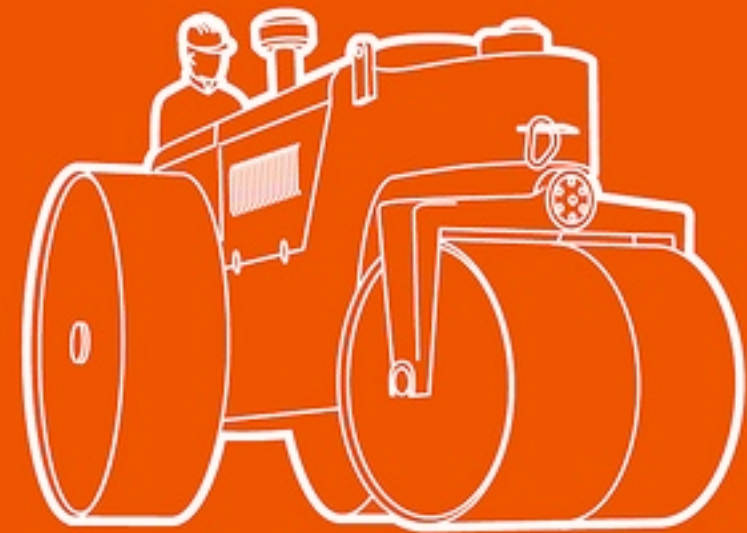


# rock-hard dust

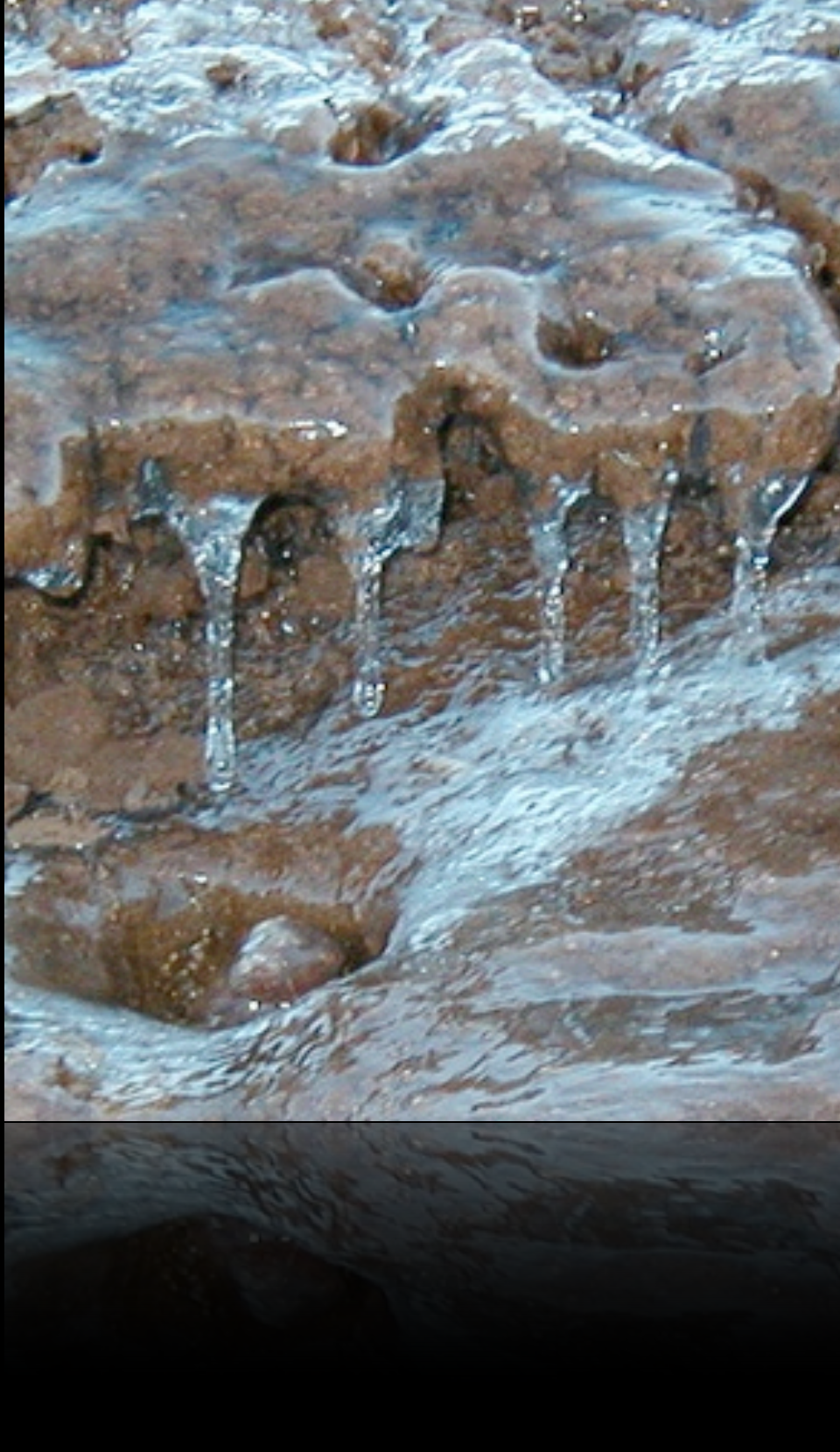
9cm deep



more compact than steamroller



flickr: wheatfields



# rock-hard mud

ice gets 10x stronger at 150K



dust + water + 50K = limestone

mass

\$10k per pound







miners like it big

photo: kennametal

gravity  
1/6 on the moon

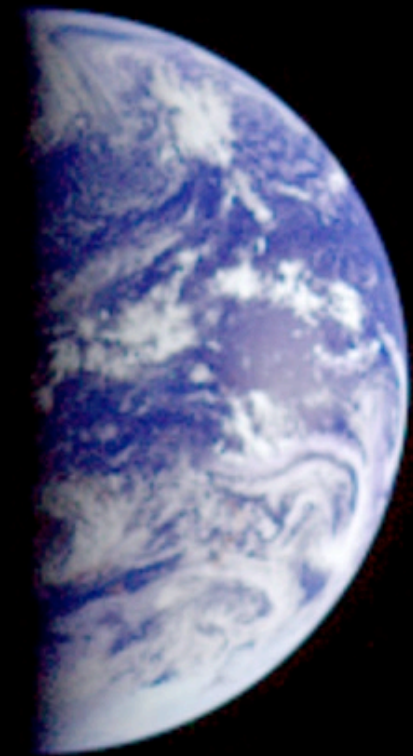


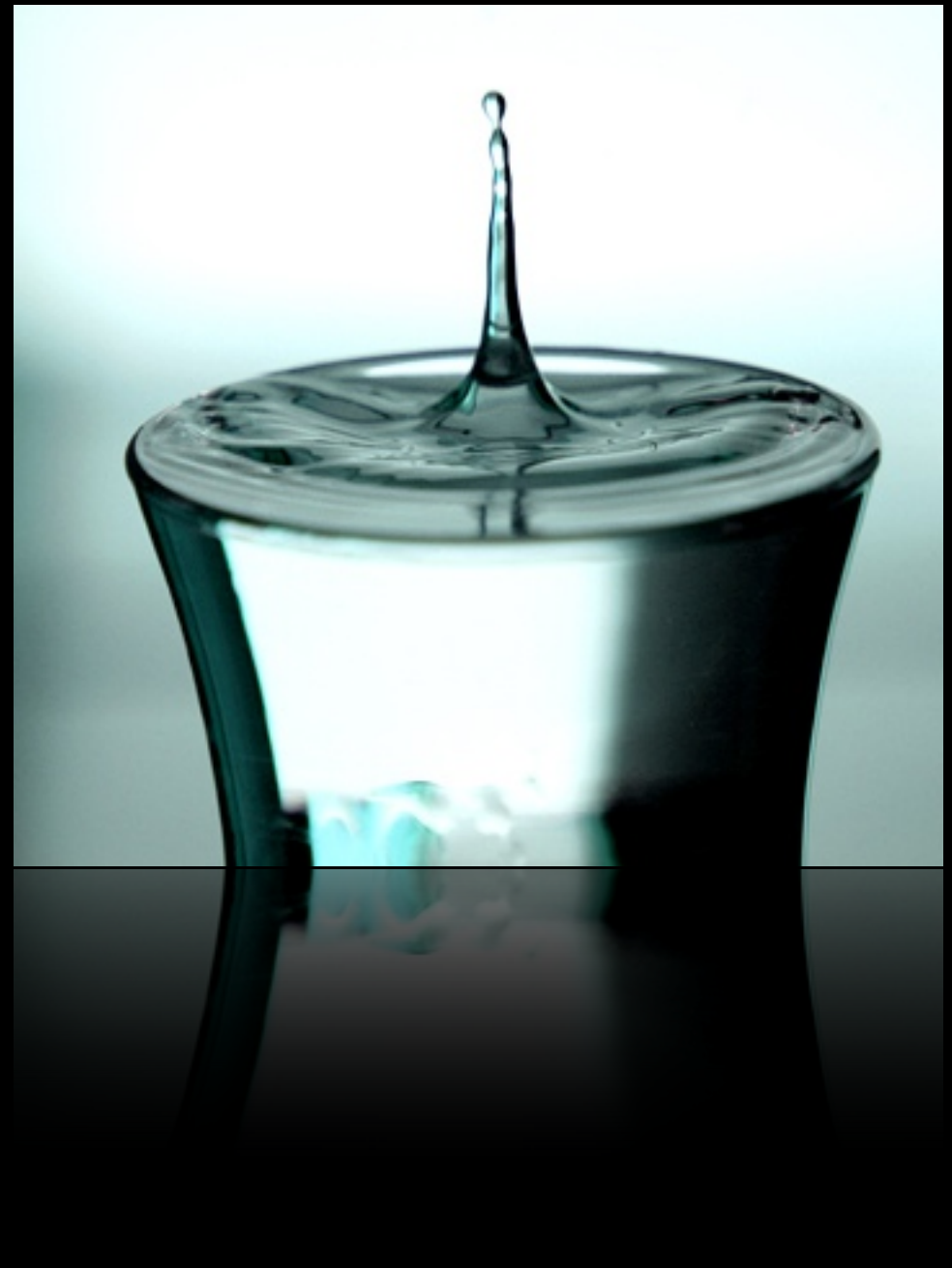
photo: NASA

but why mine?



# water

propulsion & consumption



flickr: darkpatator



oxygen

mmm... oxygen

flickr: tnarik

boom!  
helium-3

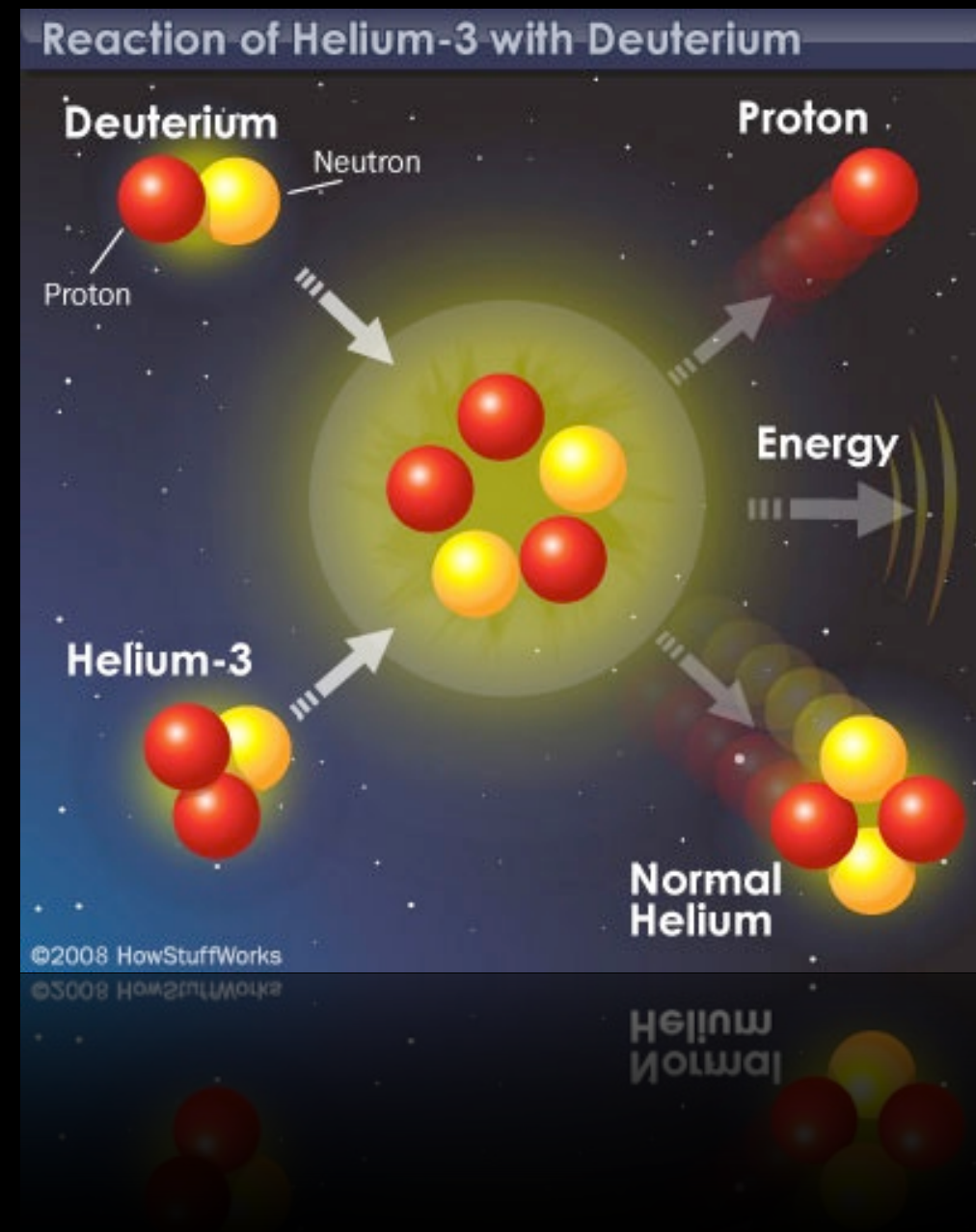
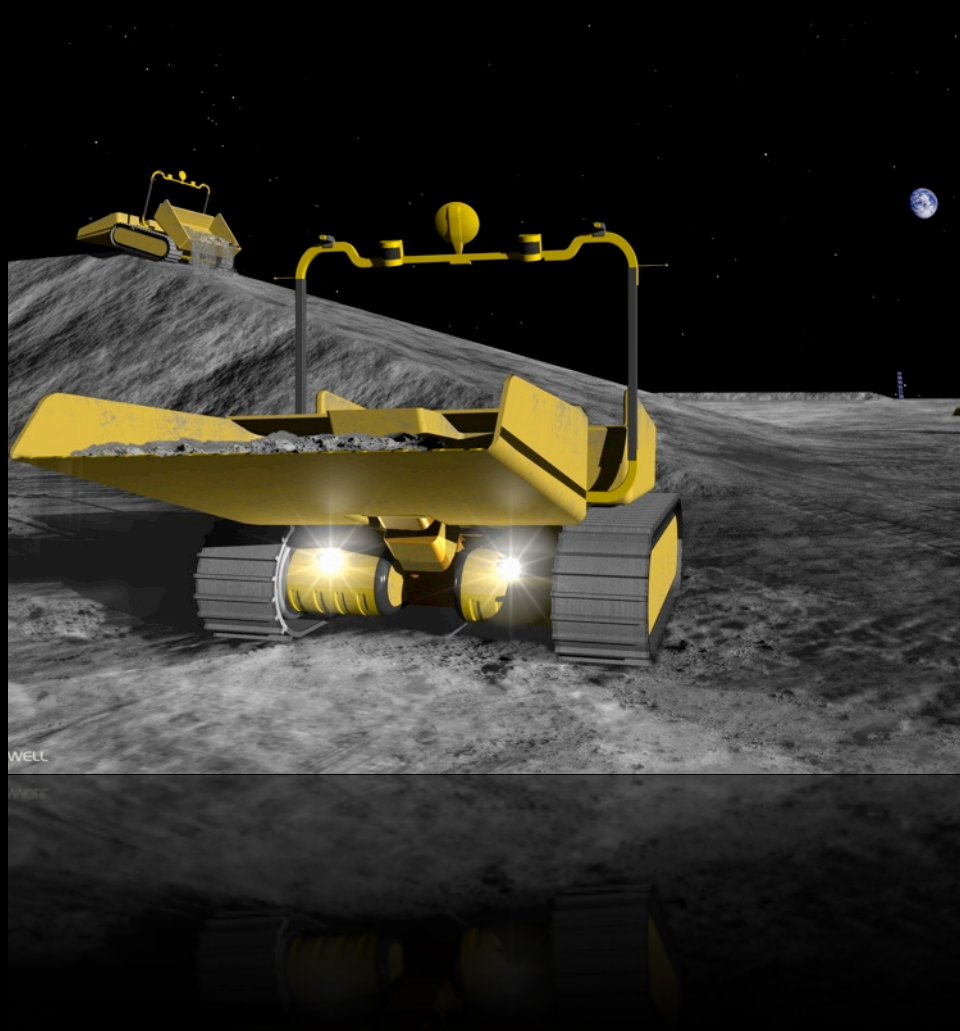


photo: [howstuffworks.com](http://howstuffworks.com)





berms  
for landing and stuff

photo: astrobotic technology



my little miner

photo: Orbital Technologies

ask me questions!