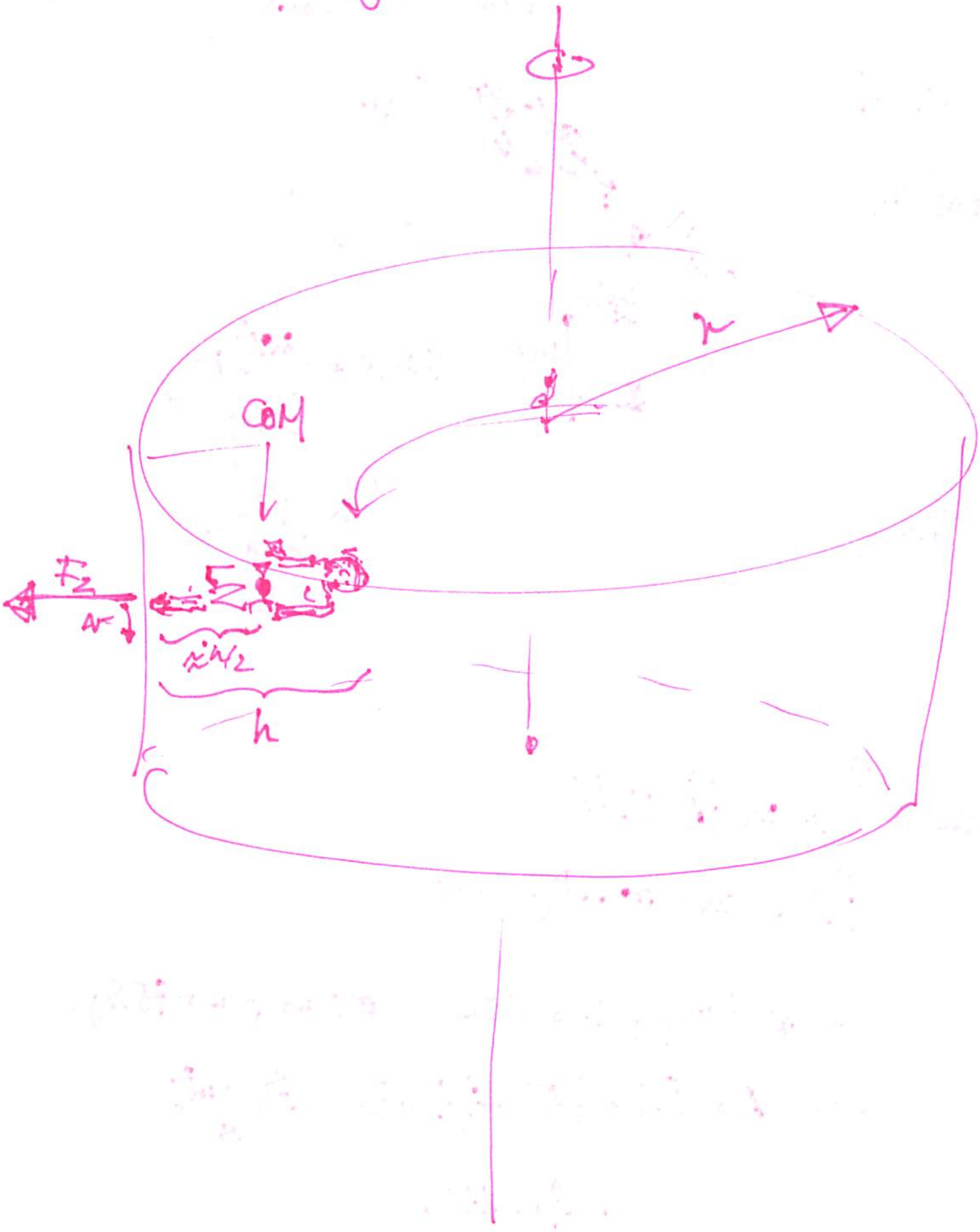
„Hill" Running in Space

McDonnell 14.4.2010



Radius needed to get Xg on the COM?

$$\frac{mv^2}{(r - h/2)} = m \cdot xg \rightarrow r - h/2 = \frac{v^2}{xg}$$

$$r = \frac{h}{2} + \frac{v^2}{xg}$$

Suppose $h = 1{,}8\,m$ $v = 3\,m/s$

$\rightarrow h/2 = 0{,}9\,m$

$x = 1$

$$\rightarrow r = \left[0{,}45 + \frac{9}{9{,}81}\right] m \approx 1{,}5\,m$$

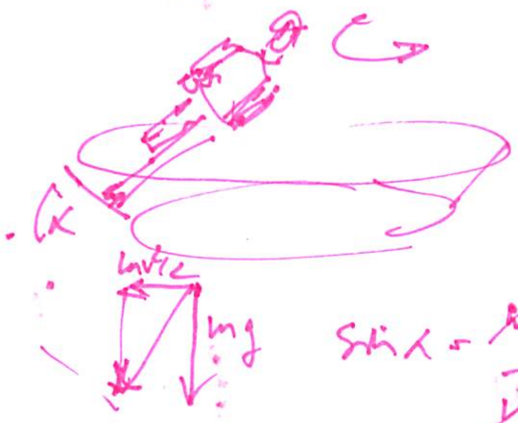
Ideas:

- Accept $x < 1$
- Adelphic radius

Questions:

- Risk for take off

Treading on earth



$\sin\alpha = \frac{mv^2/r}{m\cdot g} = \frac{v^2}{r g}$

Angular momentum: $\vec{L} = m\,\vec{x} \times \vec{v}$

$|\vec{L}| = m\cdot(r - h/2)\cdot v$

$v \approx 3\,m/s;\ h = 1{,}8\,m,\ r \approx 2\,m;\ m = 75\,kg$

$\rightarrow L = |\vec{L}| = 75 \cdot 1{,}1 \cdot 3 \ \frac{kg\cdot m^2}{s}$

$= \frac{9}{4} \cdot 110 =$

$= 9 \cdot 55 \ kg\,m^2/s$

$\approx 500\ kg\,m^2/s$

↳ Space station will rotate – but stops when runner stops..

Running in space

12 km/h

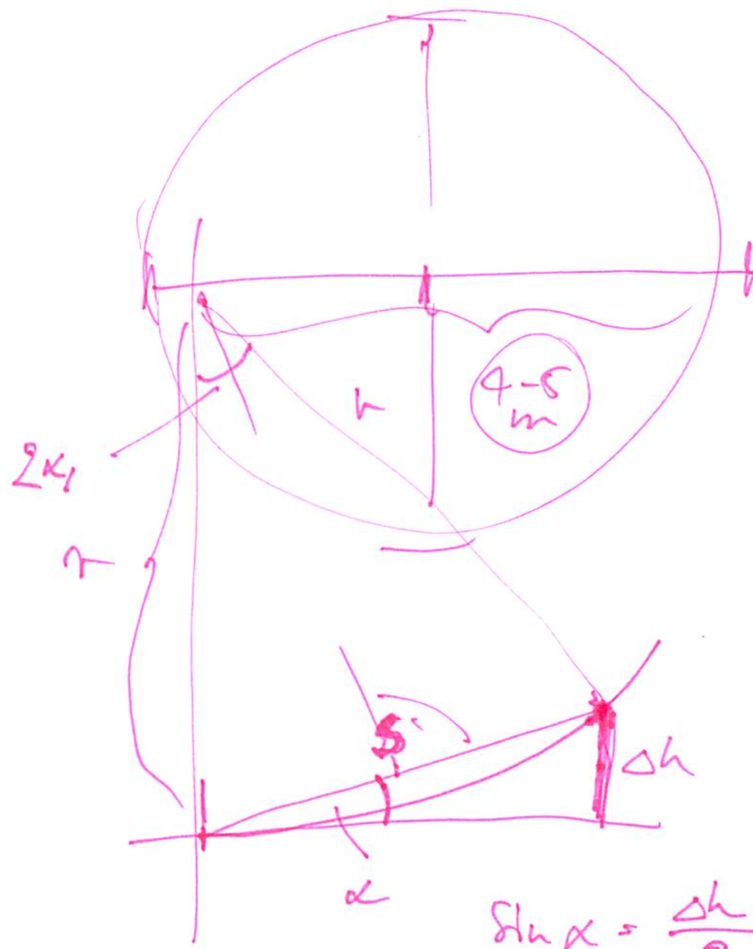
→ $12/3{,}6$

$3 * 3{,}6 = 9 + 1{,}8$

$= 10{,}8$

$+ 3{,}6$

→ 3 m/s – 4 m/s endurance speed



$\sin\alpha = \frac{s/2}{r}$

$\sin\alpha = \frac{\Delta h}{S}$

$S \approx 0{,}8\,m$

$r \approx 2\,m$

→ $\boxed{\Delta h = \frac{s^2}{2r}}$

→ $\Delta h = \frac{0{,}64}{4}\,m$

$\approx 16\,cm$!