Making it Small

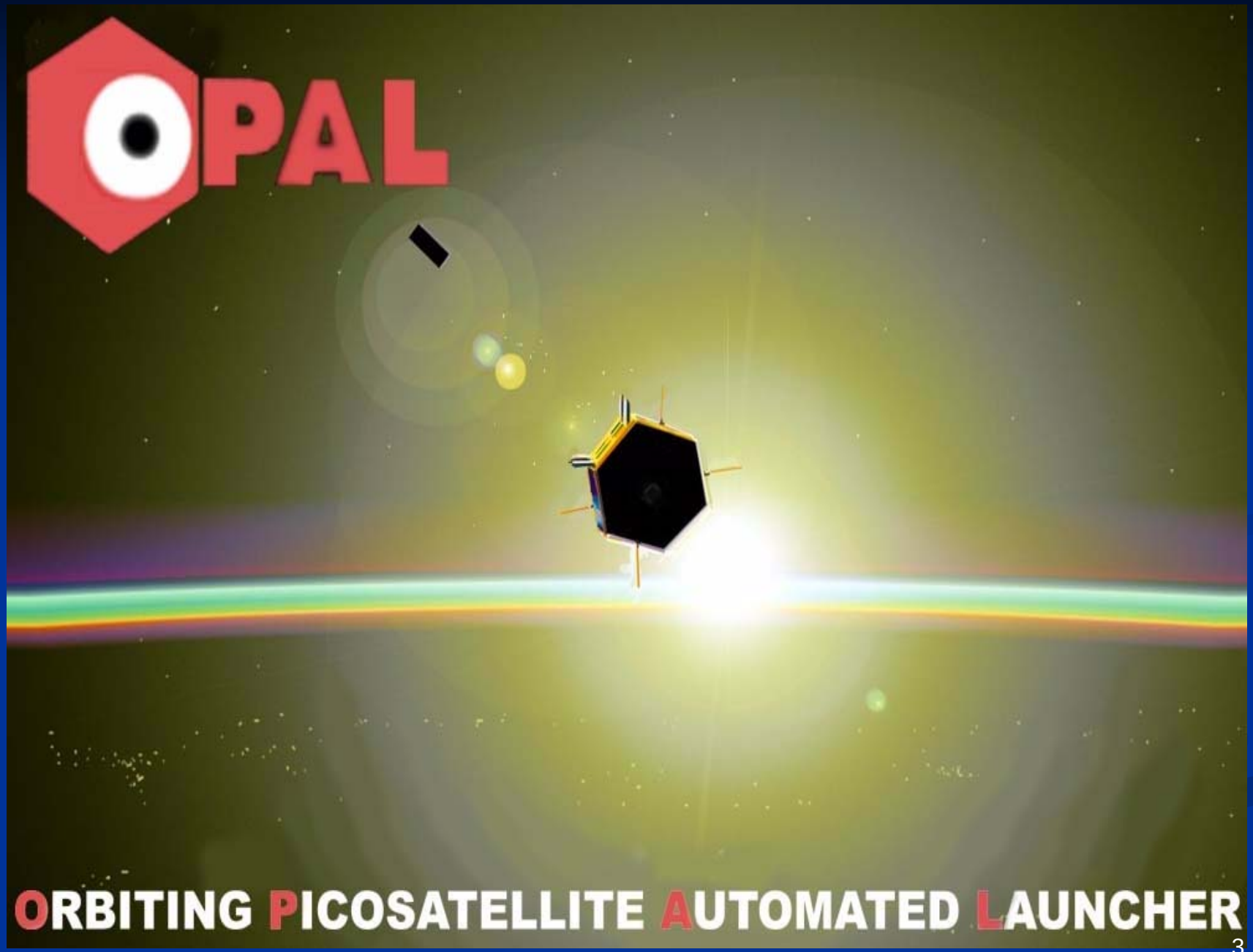
April 22-24, 2009

2009 Cal Poly Developers' Workshop
California State Polytechnic University
San Luis Obispo, CA

Prof. Bob Twiggs
Bob.Twiggs@Stanford.Edu

What started the miniaturization trend?

January 2000



Shipping to Utah
May 14,1999

Last Checkout at Vandenberg, AFB

January 2000

Launch at Vandenberg, AFB

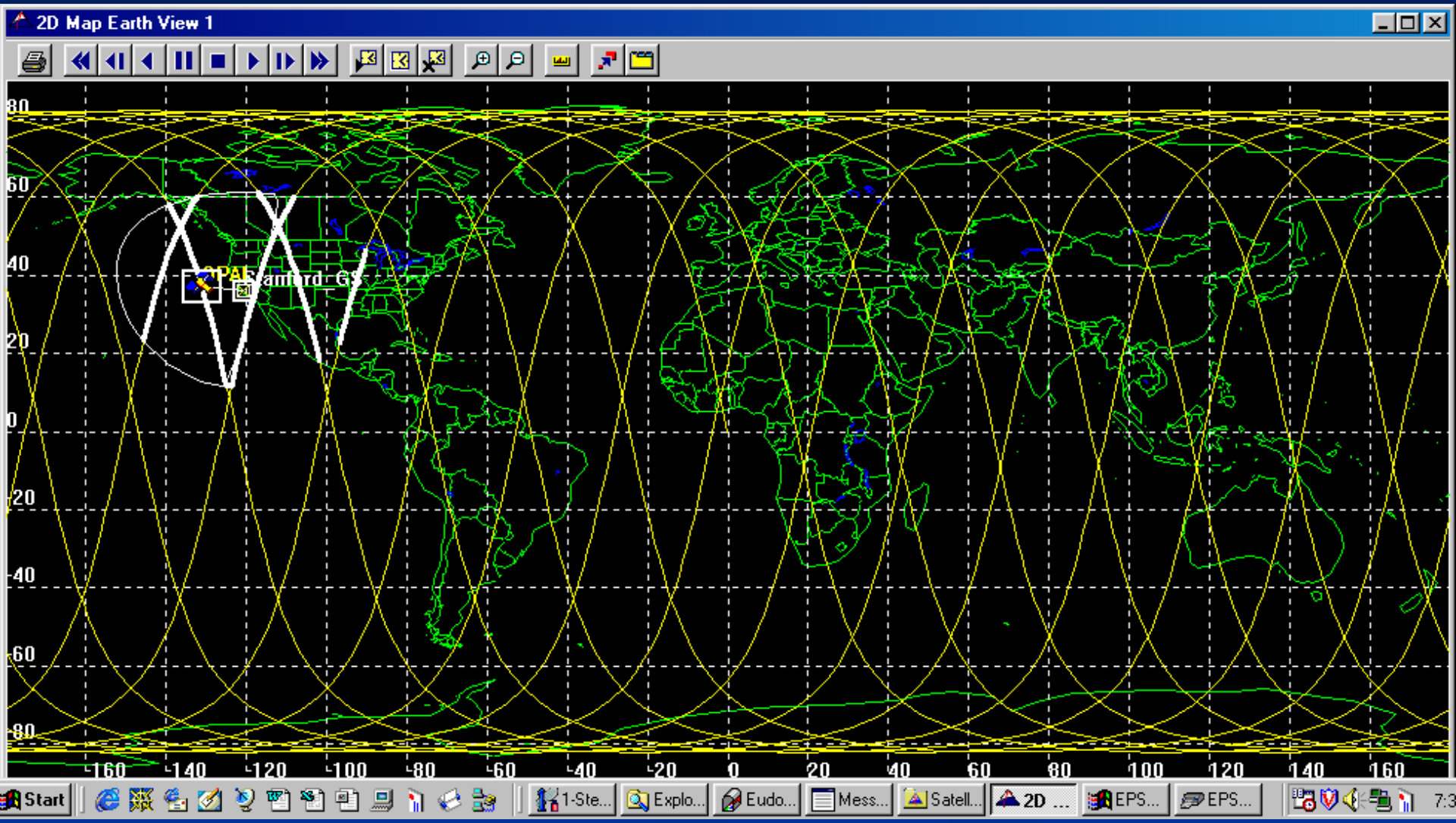
Operational Antenna at Stanford

January 2000

Operation at Stanford

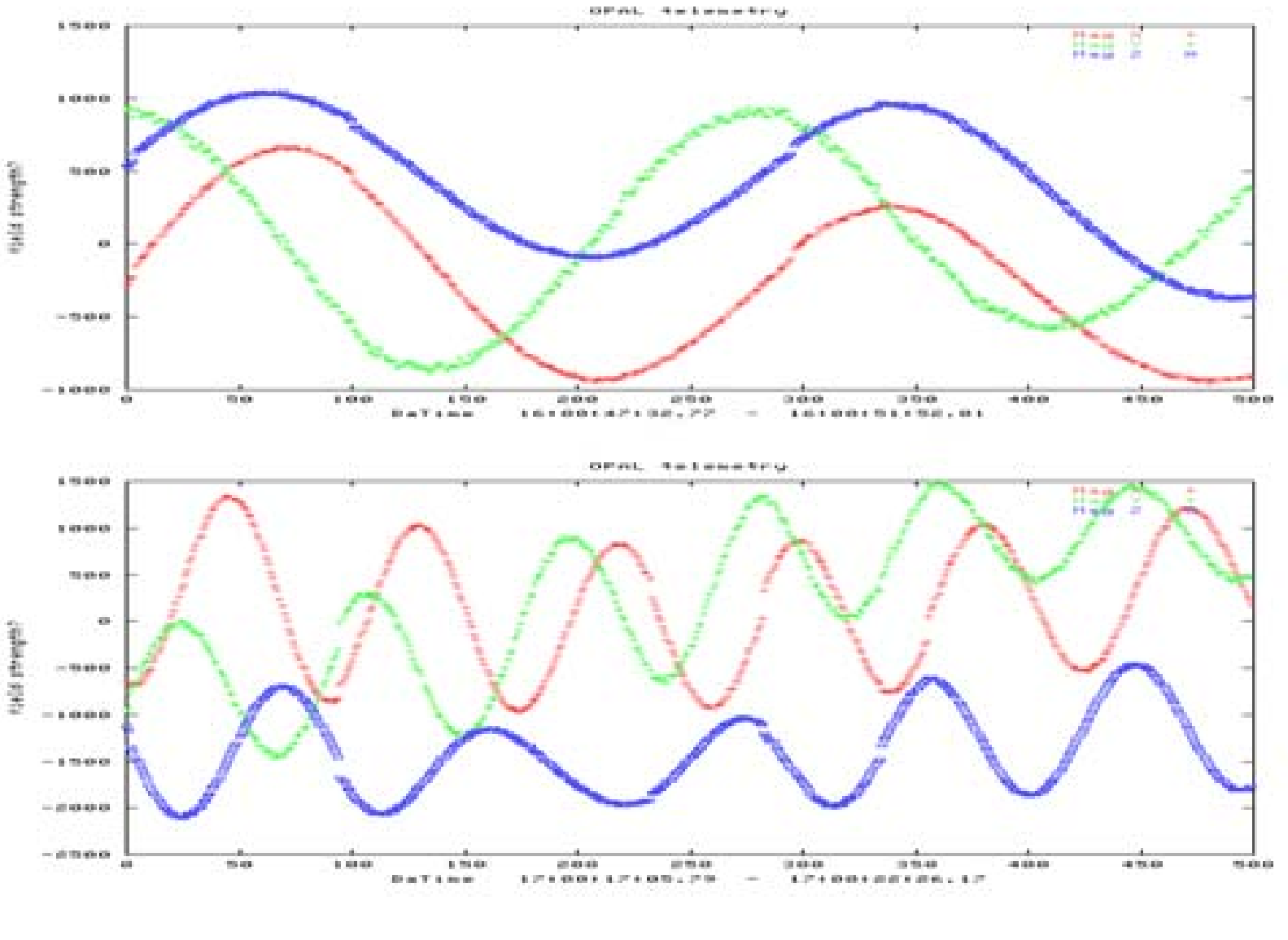
January 2000

Operation at Stanford



Operation at Stanford

Operation at Stanford showing satellite rotating



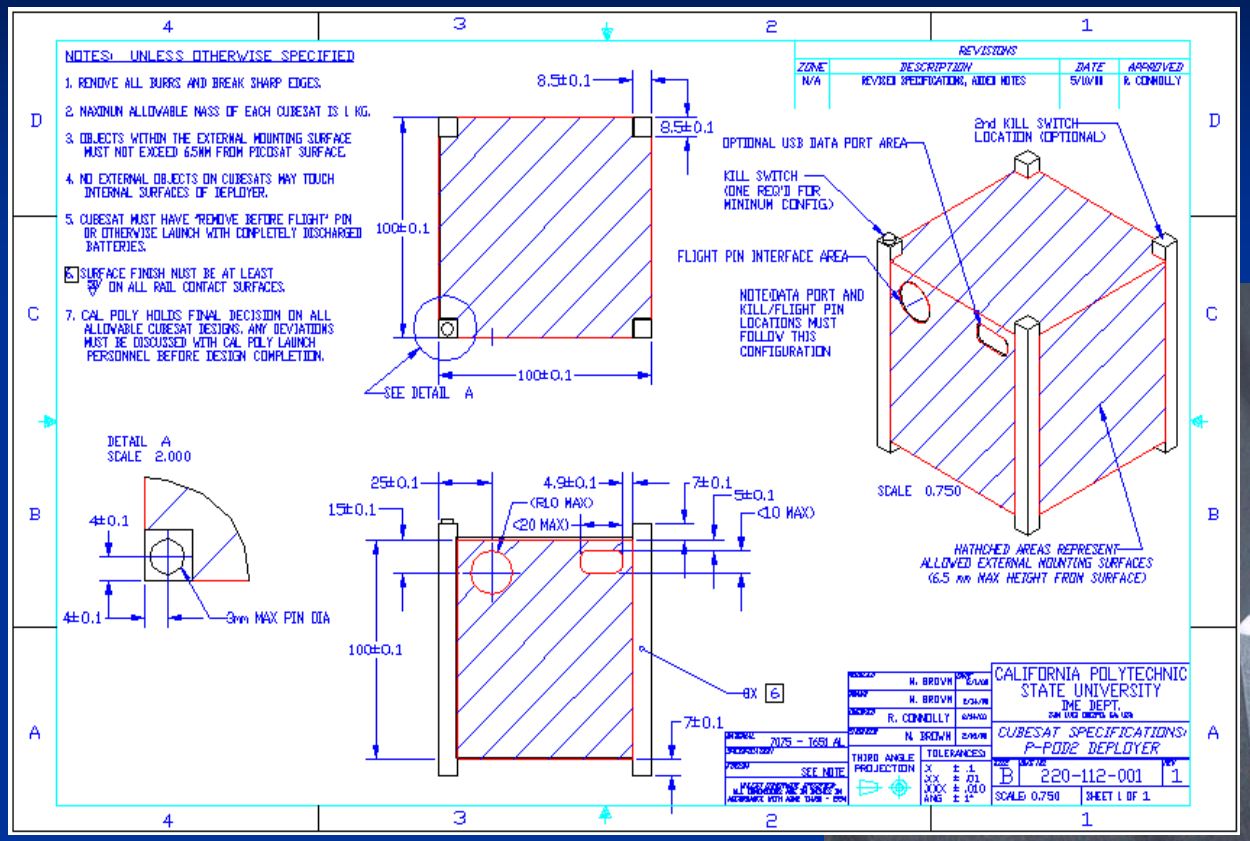
Problem?

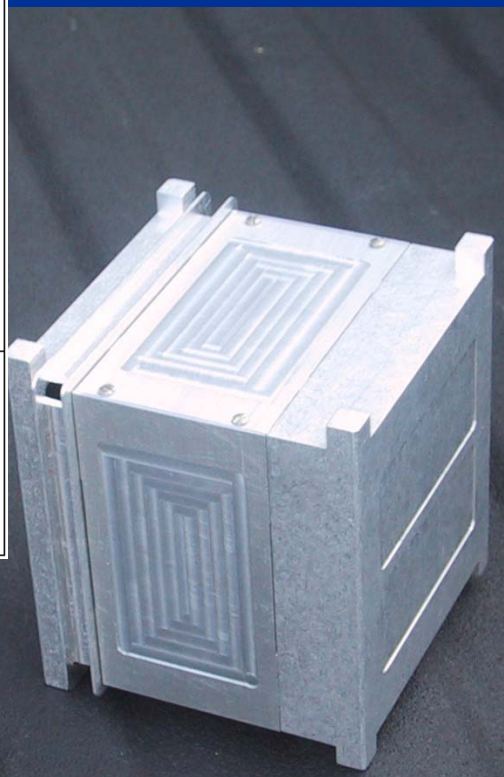
Too Big
Too Long to Build
Too Costly to Launch

Proposed CubeSat – The Next Generation

Make a Standard

CubeSat





4” x 4” x 4” cube → 10cm cube

1 kg

CubeSat

Poly Picosatellite Orbital Deployer
(P-POD)

Example of Standard CubeSat
(Cal Poly: CP1)

Who is now using smallsats?

- International Universities
- Science Foundation- Space Weather
- DARPA- ??
- NRO- ??
- US Army- ??
- NASA ARC- Biological Research
- NASA Goddard- ???
- Boeing- Proof of Concept
- The Aerospace Corp.- MEPSI Technology
- ESA- ??
- Lockheed Martin – University of Florida

The Future?

Further Miniaturization?

What was so unique about the Volkswagen produced in Germany after WW II?

It was “the people’s car”.

Practical and affordable.

What was the Apple computer?

It was “the people’s computer”.

Practical and affordable.

What is Twitter?

140 character messages

If you could get 140 characters from space twice/day, what would you do with it?

Could you conduct any meaningful space activity for 140 characters from space twice/day?

Twitter is “the people’s messenger”.

Practical and affordable.

Now, how about “a peoples satellite”?

Practical and affordable.

Comments - present satellites

- Present CubeSat too Big?
- Cost too much to launch!
- Everyone needs new challenges.

How about a “VolksSat”?

How about a VolksCube”?

How about a “TwitterSat”?

Group name	Wet Mass	
Large satellite	>1000kg	
Medium sized satellite	500-1000kg	
Mini satellite	100-500kg	
Micro satellite	10-100kg	
Nano satellite	1-10kg	Small Satellites
Pico satellite	0.1-1kg	
Femto satellite	<100g	

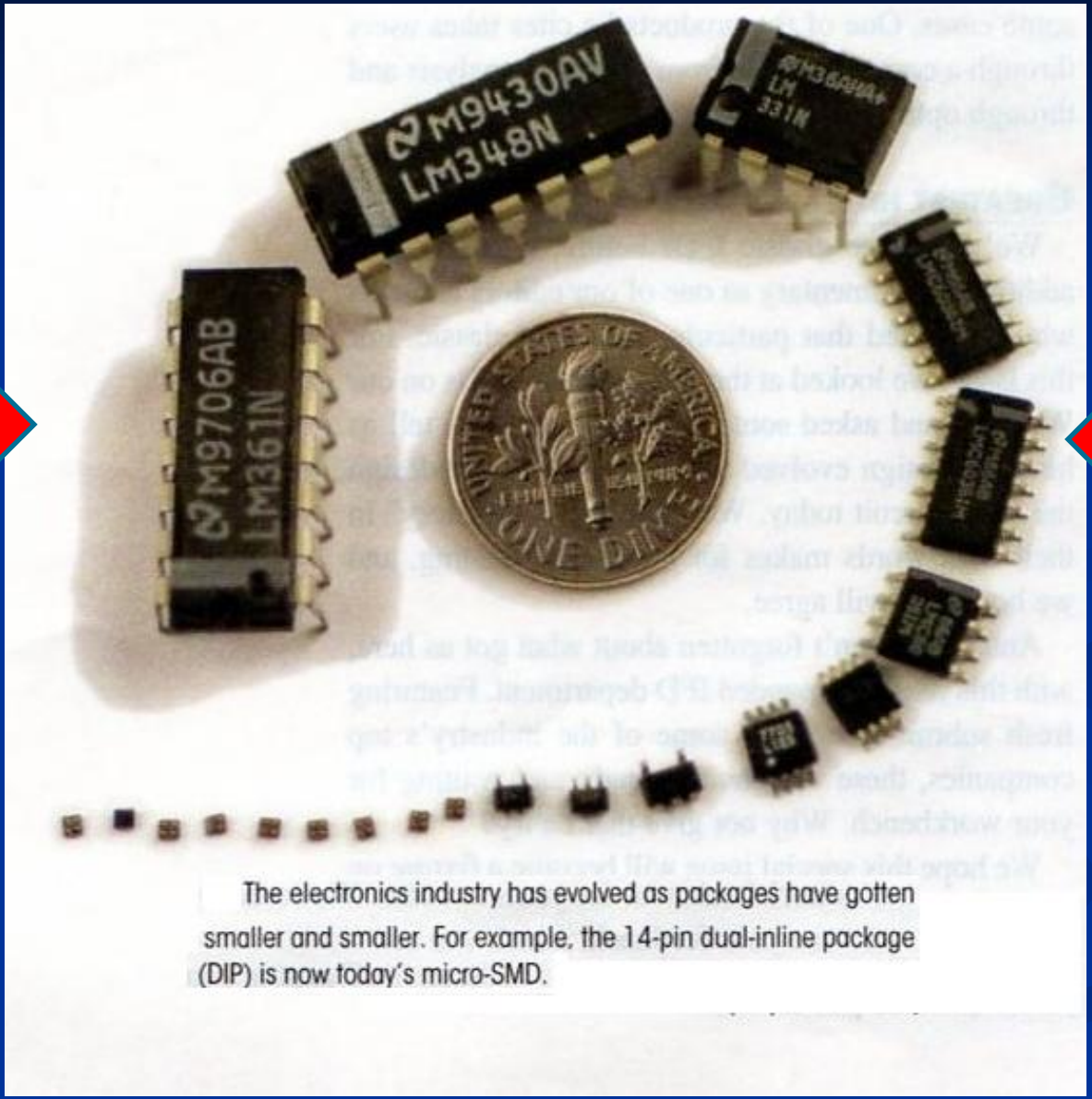
How about a satellite that fits in your Pocket?

Miniaturize to fit in your pocket?

Here is an example.

Shrink

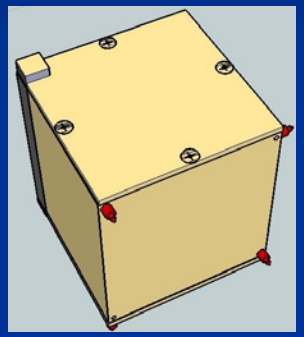
Shrink



The electronics industry has evolved as packages have gotten smaller and smaller. For example, the 14-pin dual-inline package (DIP) is now today's micro-SMD.

Shrink

How about a 5cm cube?

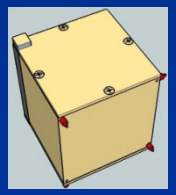


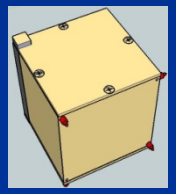
Fempto Sat?

What should we call it?

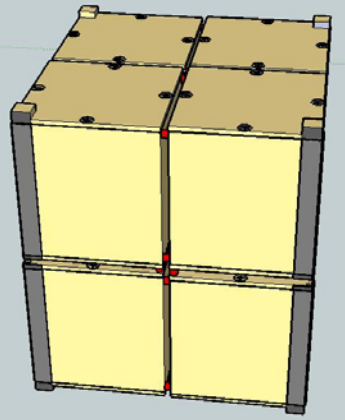
What should we call it?

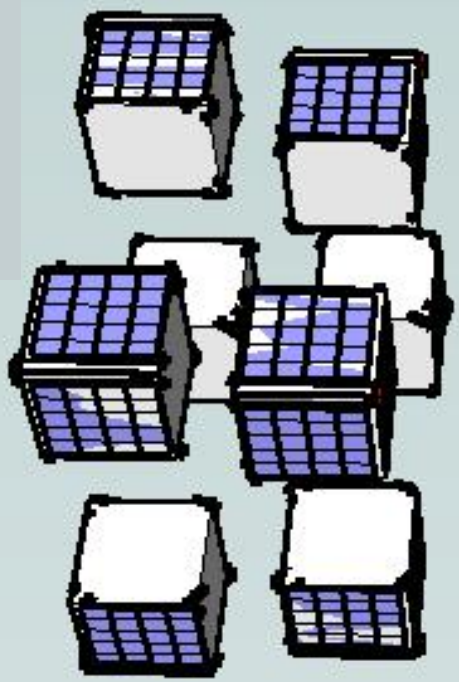
How about PocketQub?



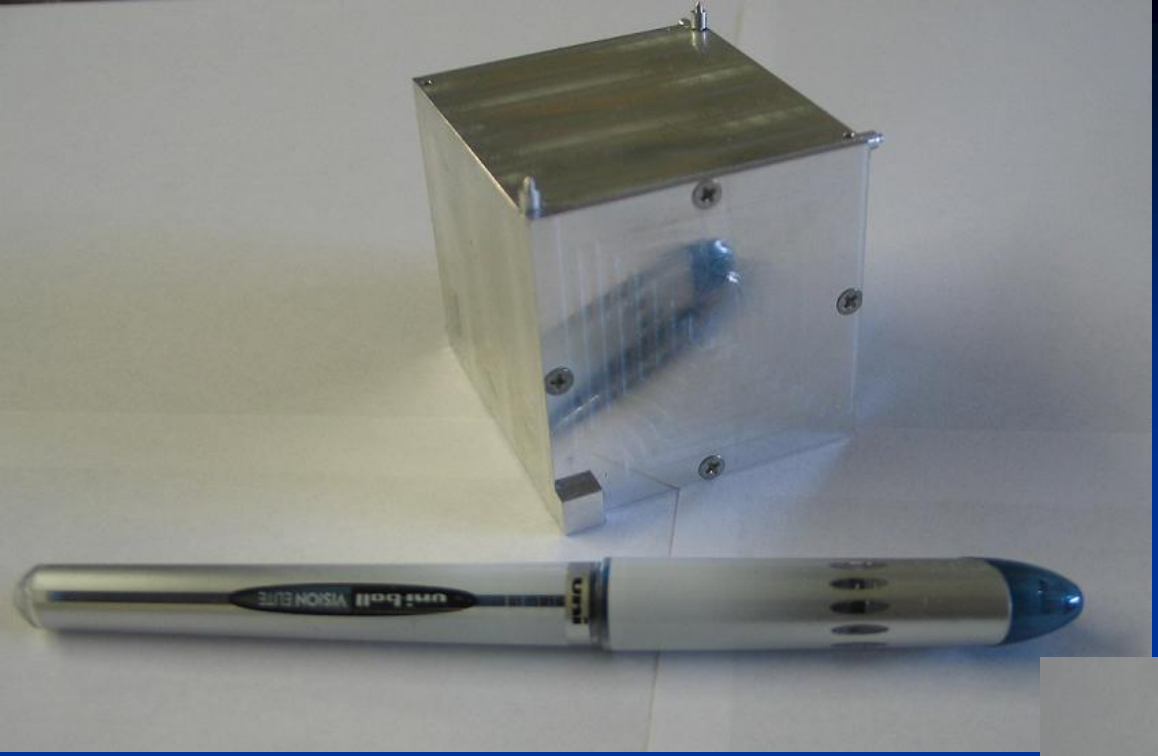


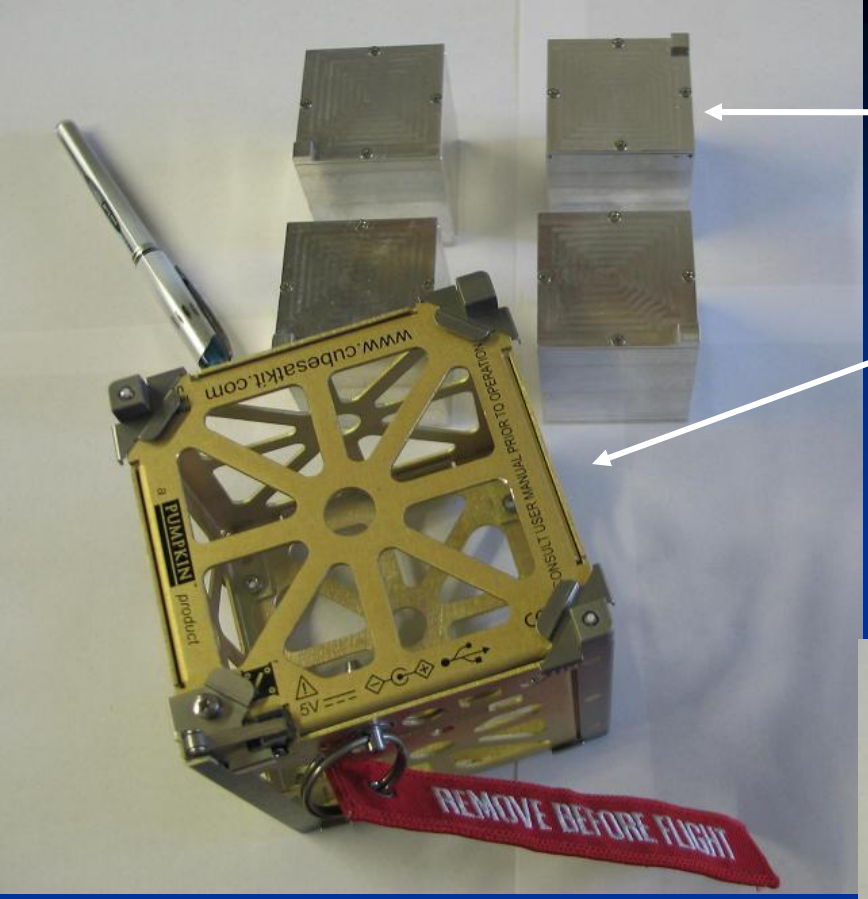
Put 8 together -





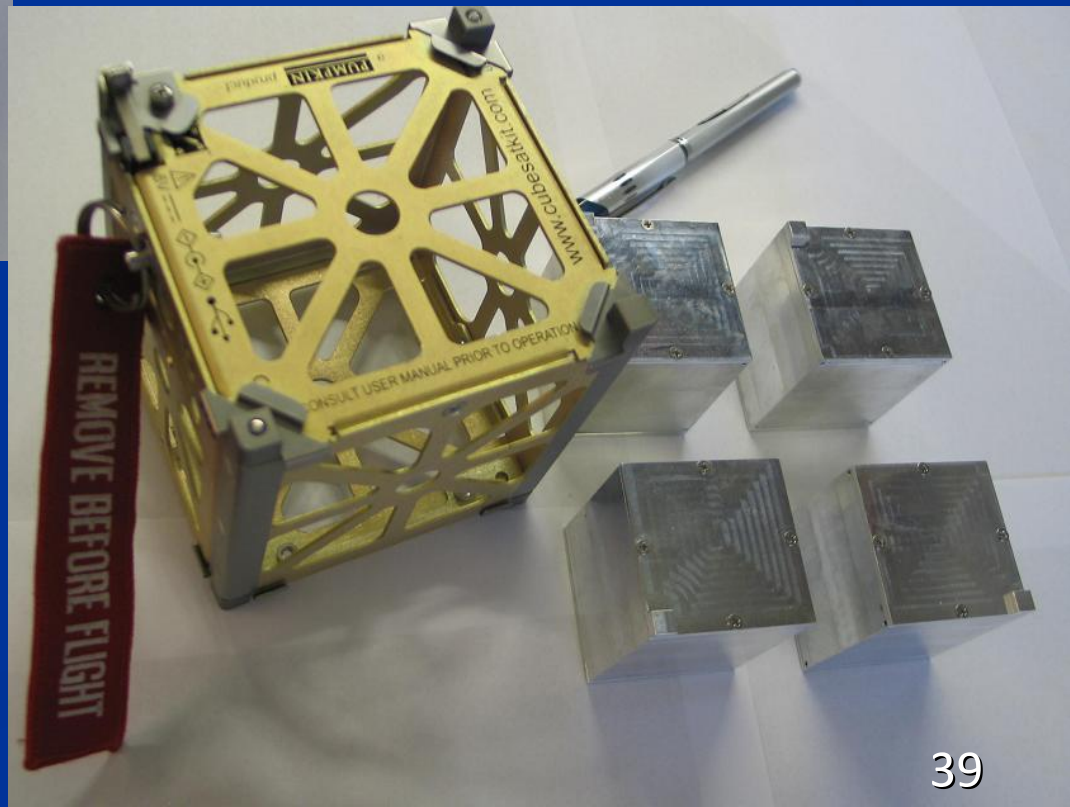
Use P-POD concept to launch 8


uni-ball VISION ELITE

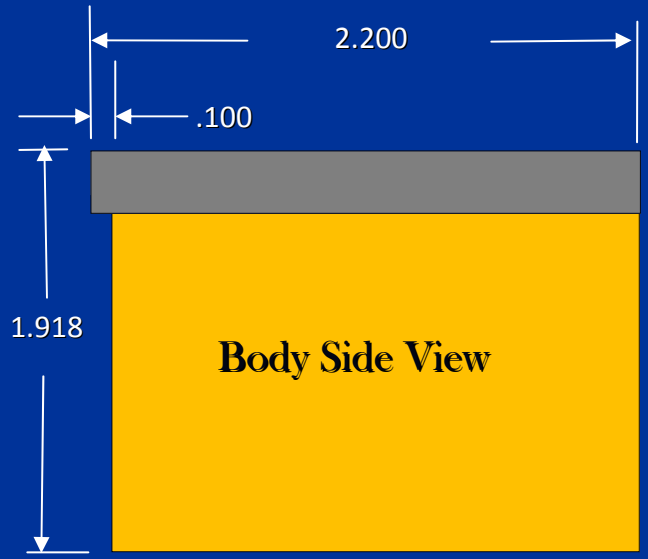


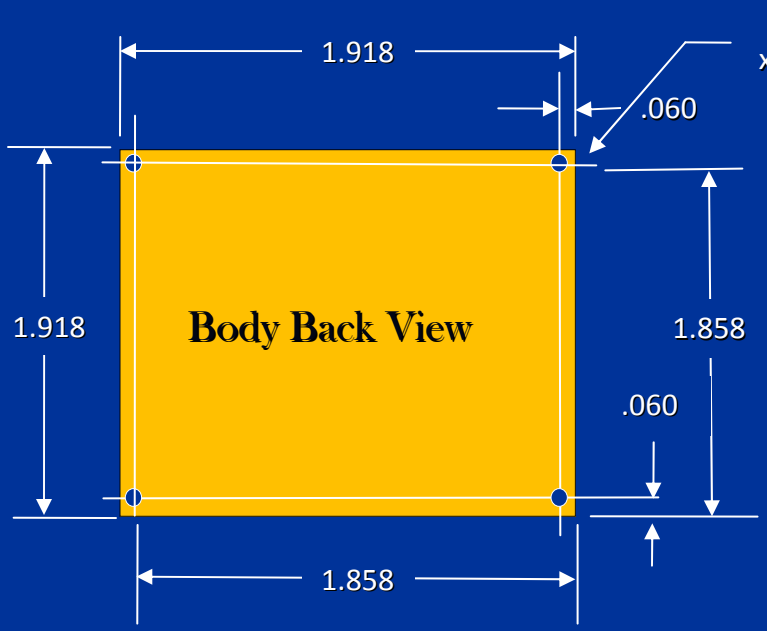
PocketQub

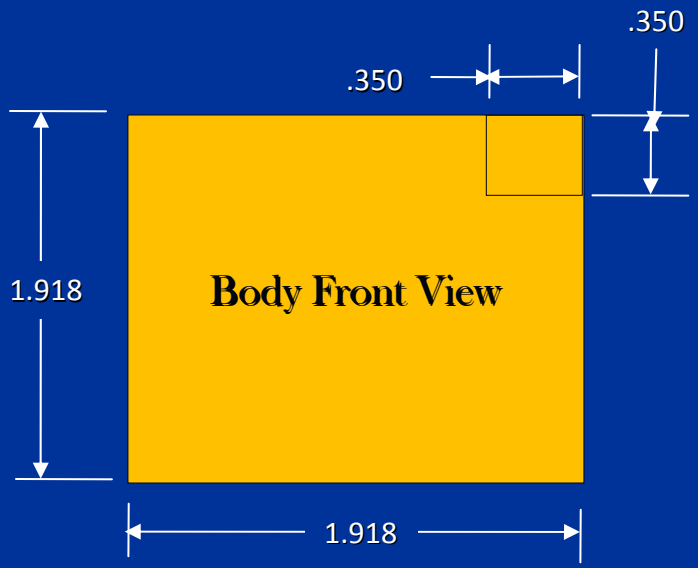
CubeSat picosatellite



P-POD compatible







Material:
Aluminum 6061-T6

Notes:
All dimensions in inches

PocketQub™

Title	PocketQub External Dimensions		
Drawn by: Bob Twiggs	Date: 03/20/09	Drawing No.: 0000018	Rev.: A

Using English Dimensions?

Used metrics for CubeSat.

Why not metrics for PocketQub?

It is time those metric guys learned English units.

What if you wanted to build and launch your own private satellite?

What is stopping you?

Don't know how to build it?

Not likely – get a kit.

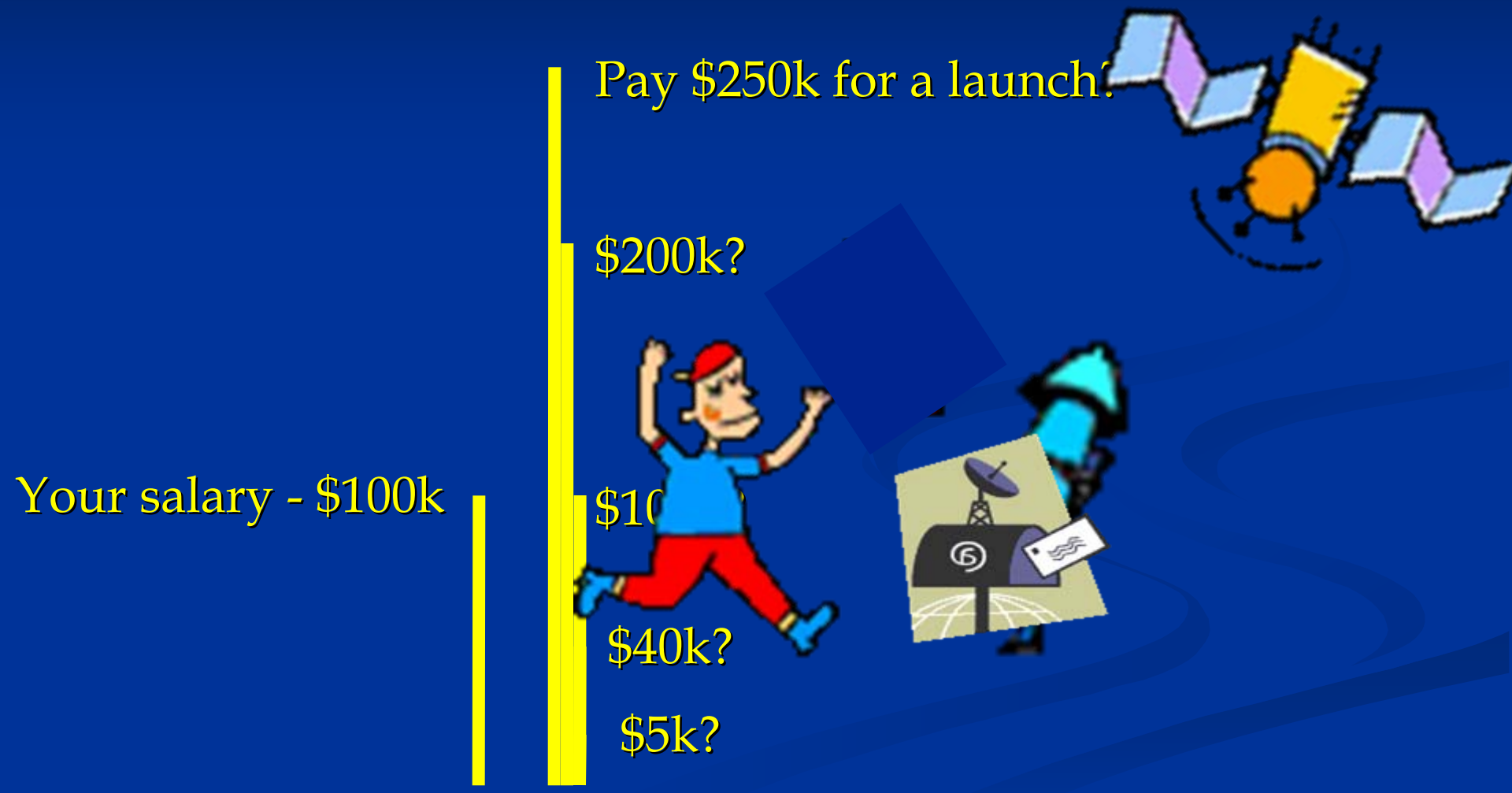
Too costly? – get easy payment plan.

What is the biggest single cost?

Launch Launch Launch

What is a private affordable launch cost?

What would be your budget?



What does PocketQub do?

Reduce launch cost.

$40k/CubeSat - $5k/PocketQub

$80k/CubeSat - $10k/PocketQub

Launch cost reduction?

$40k/CubeSat - $5k/PocketQub

$80k/CubeSat - $10k/PocketQub

Not the cost of an SUV anymore

Less than the cost of my last motorcycle.

New launch goals:

Kentucky launch of first PocketQub within one year – March 2010

Any other challenges?

Have your own vanity satellite!

Students won't get all of the fun.

It may say -

"Hello Jordi"

"Hello Jordi"

"Hello Jordi"

As it goes overhead.

Having fun before you go to orbit.

Thank You