

BioLaunch: a novel Stanford faculty and student-run program in suborbital and small payloads

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The Problem.

*Need fast, small missions for astrobiology.
High scientific return on investment.
Train new mission scientists.*

The Answer.

*High altitude balloons, gliders, rockets
and nanosatellites.*

*These can test equipment, operate
science experiments, plus educational
participation and public outreach.*

High altitude balloon

Long history, even within Agency.

*Types of experiments: Atmospheric
and equipment testing*

*Advantages for Astrobiology: quick
local access to space, aerobiology of Earth,
excellent analog for extraterrestrial
environments, good testbed, repeatable.*

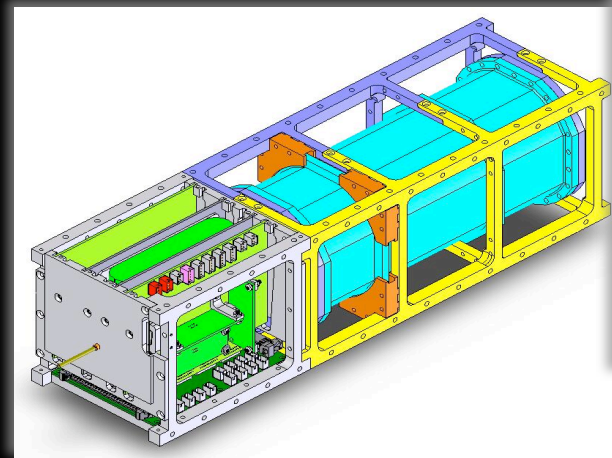
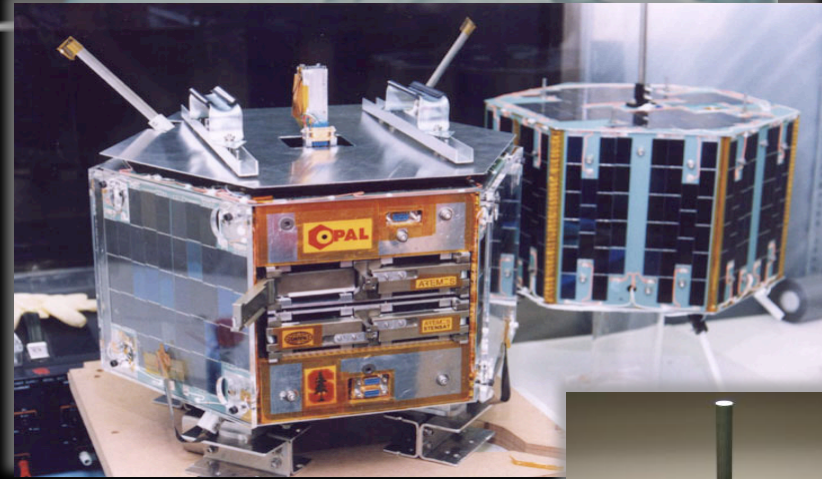
Introducing
BioLaunch

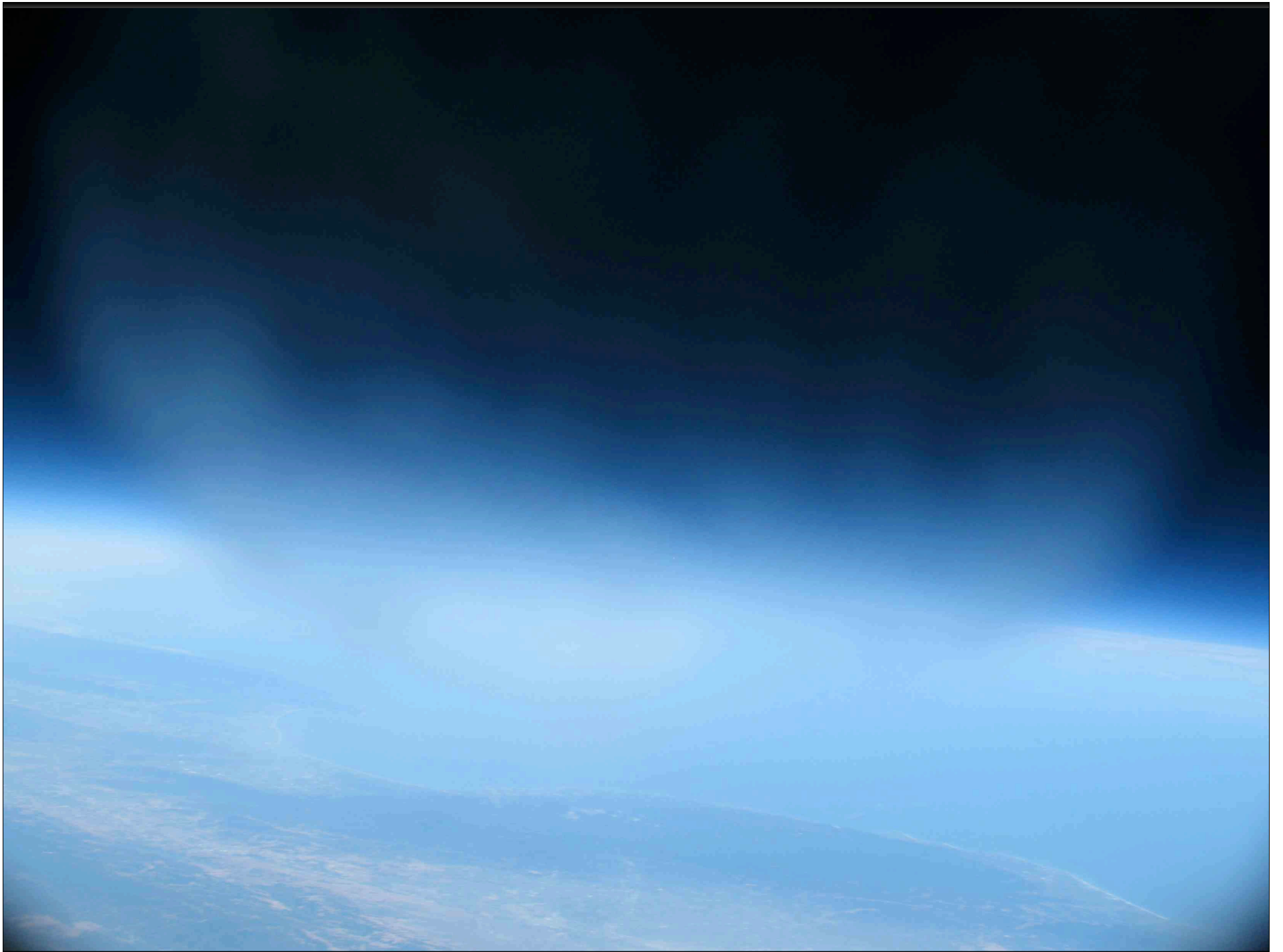
*Conceived by Stanford faculty in
2007 as a novel multidisciplinary
educational and scientific project with
a focus on astrobiology payloads.*

SSDL

Space and Systems
Development Laboratory

- *Space Systems Development Laboratory (SSDL)*
 - *Established ~ 1994*
- *Missions*
 - *Sapphire, Opal, QuakeSat-1, Genest*
 - *MAST*
 - *PolarBot, Antarctic weather stations*
- *Student demographics:*
 - *~400 students throughout the years*
 - *Before 2000, all Stanford students*
 - *Now a mixture of industry and Stanford*
 - *Expansion to SCPD (distance learning)*

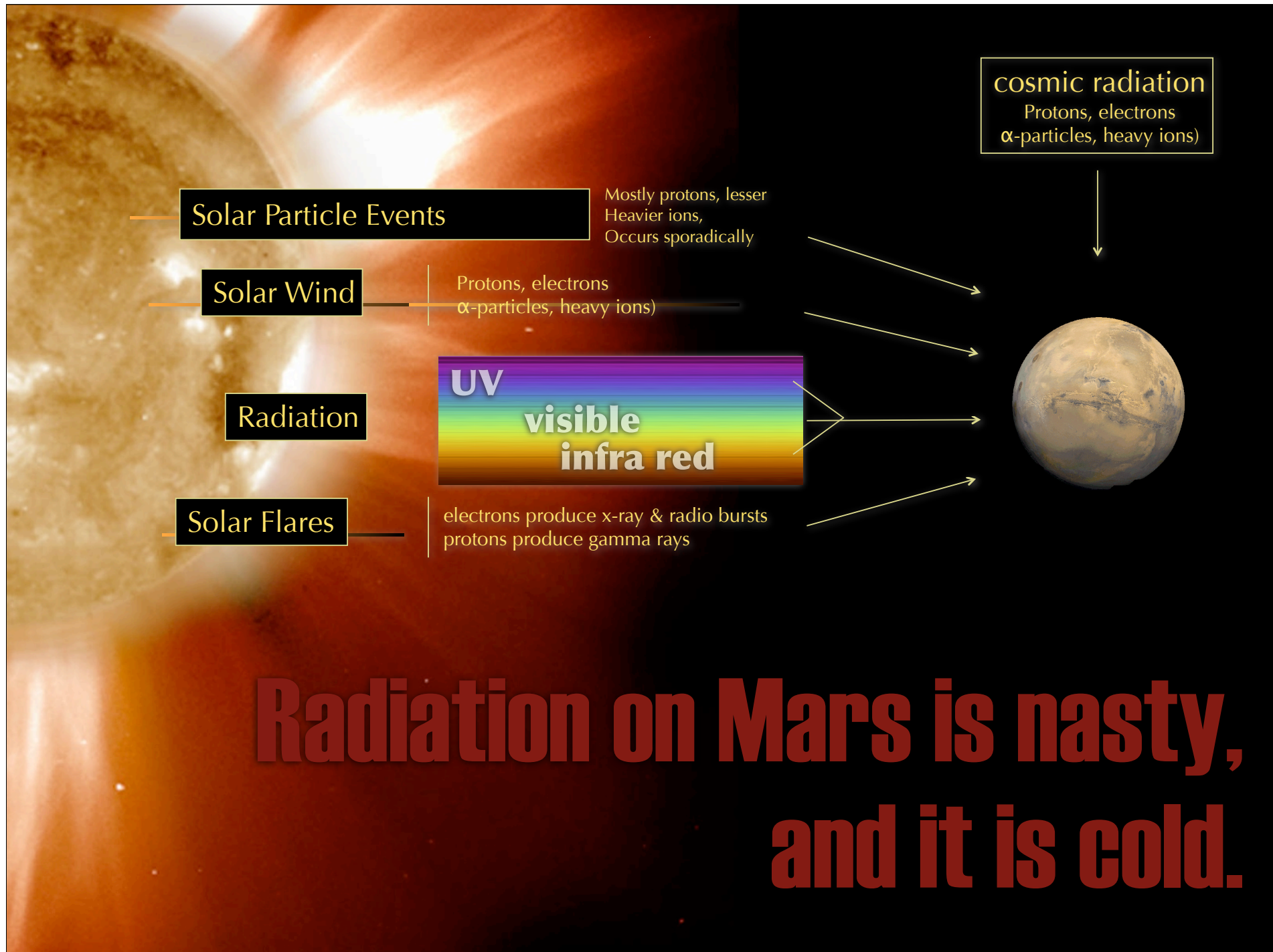




BioLaunch

local launches

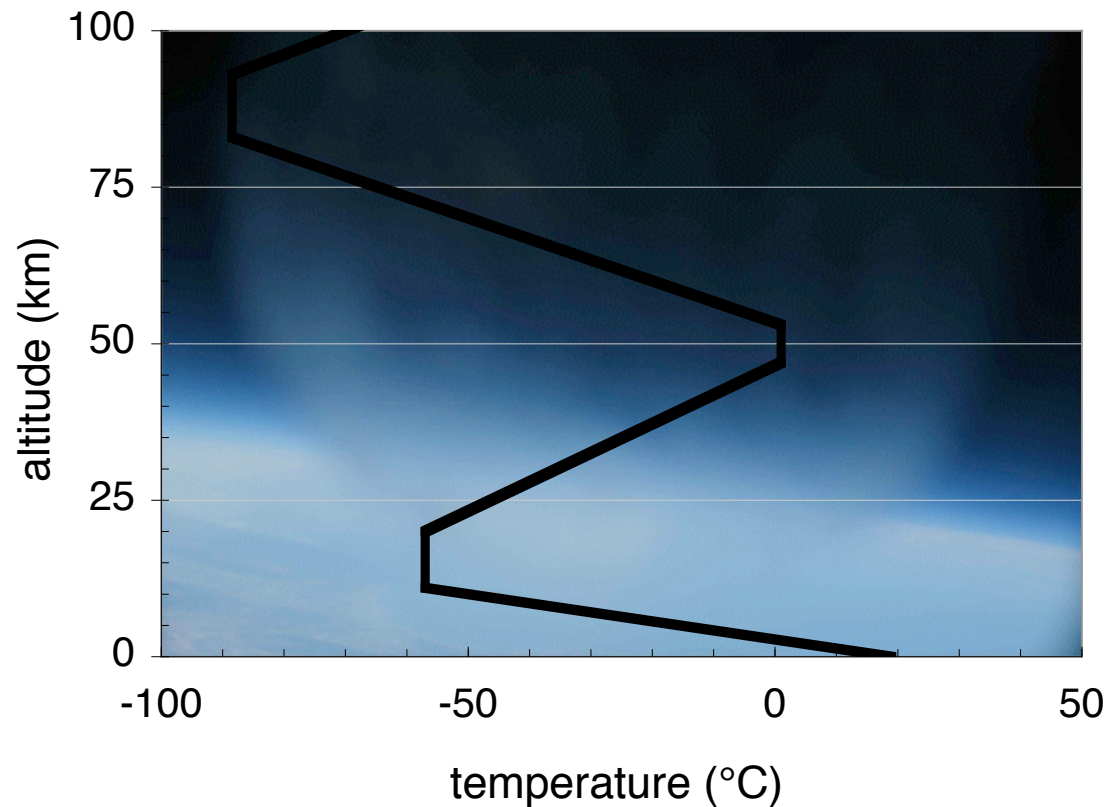




**Radiation on Mars is nasty,
and it is cold.**

BioLaunch is a:

Mars Analog



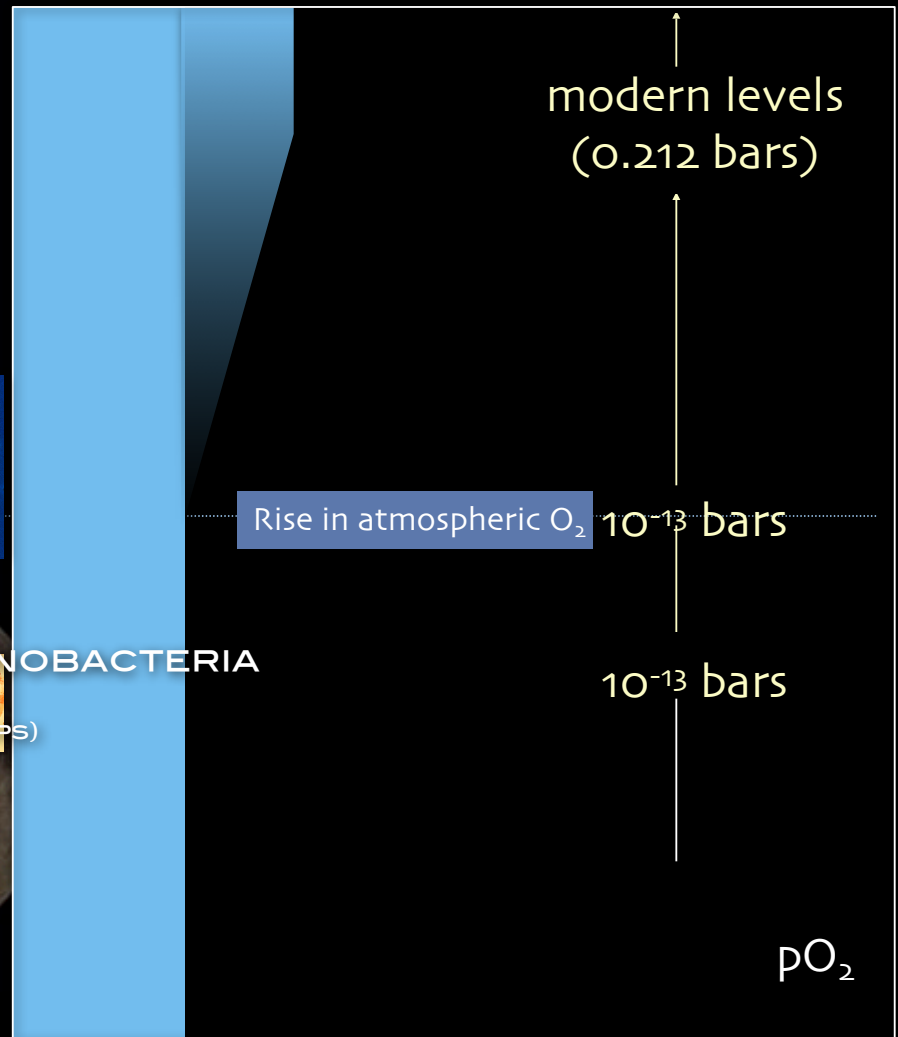
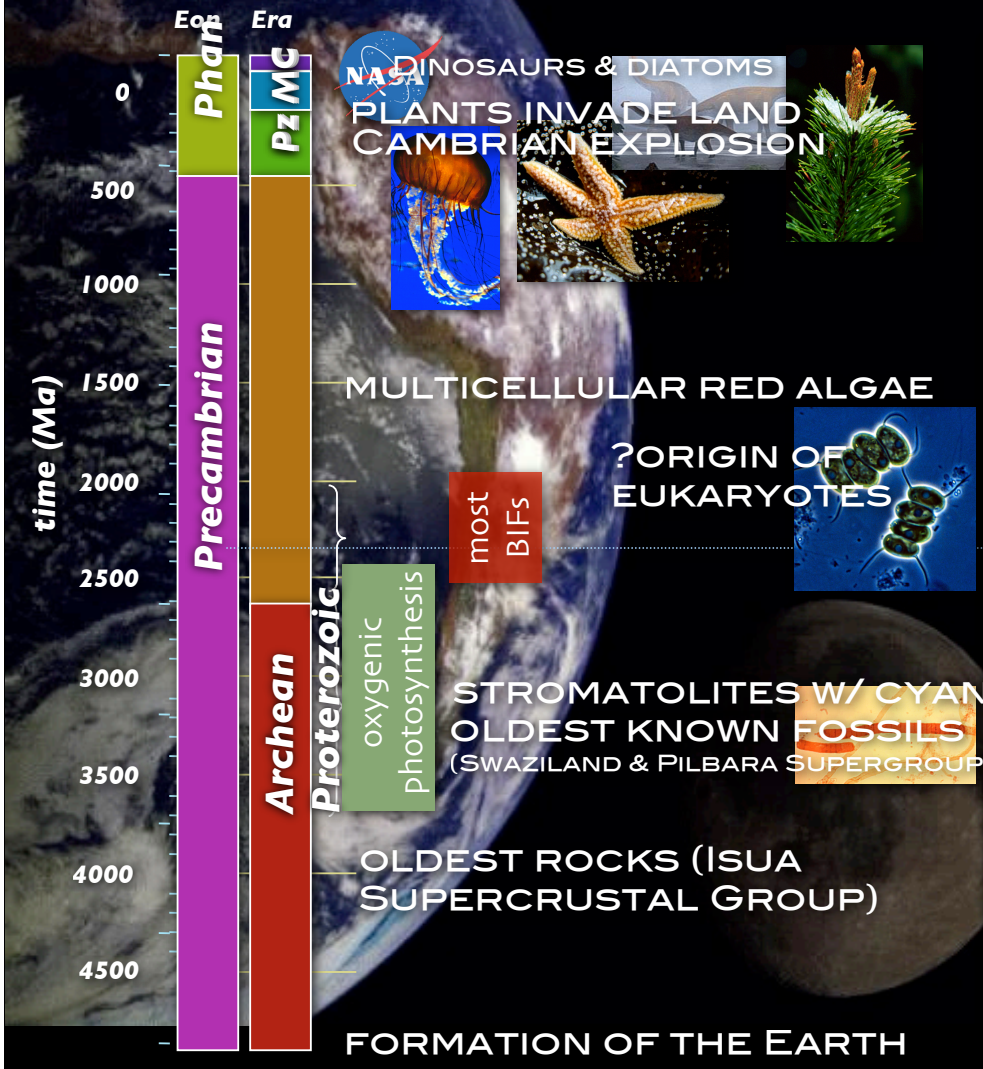
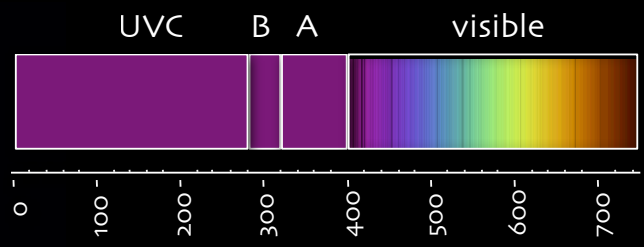
temperature

pressure

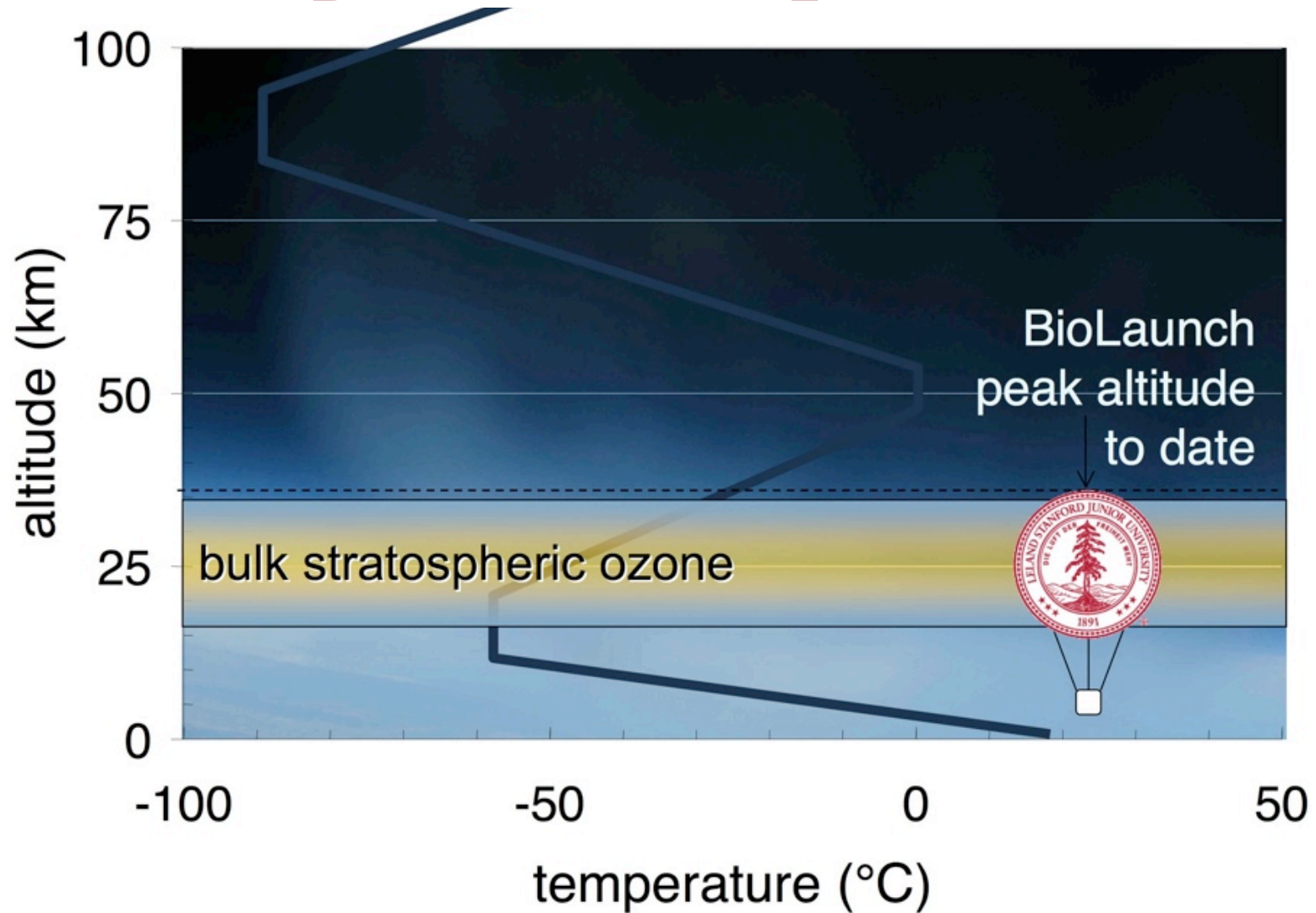
UV

cosmic radiation

Early Earth Analog



BioLaunch is a:
Journey to the past



BioLaunch

Payloads

1. Physical measurements

(solar & cosmic radiation, temperature, photos)

2. Prebiotic experiments

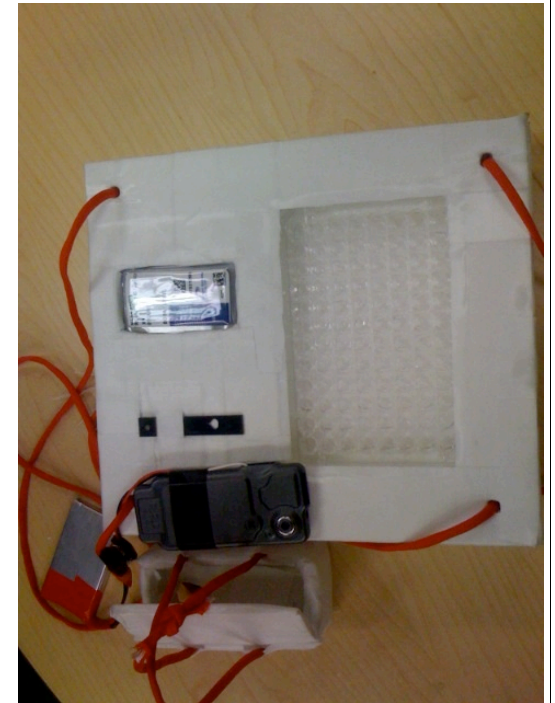
(polyaromatic hydrocarbons as sunscreen)

3. Biological measurements

(D.N.A damage, microbes, tardigrades)

4. Equipment testbed

(Stanford Aero/Astro SPL)



DNA damage experiments

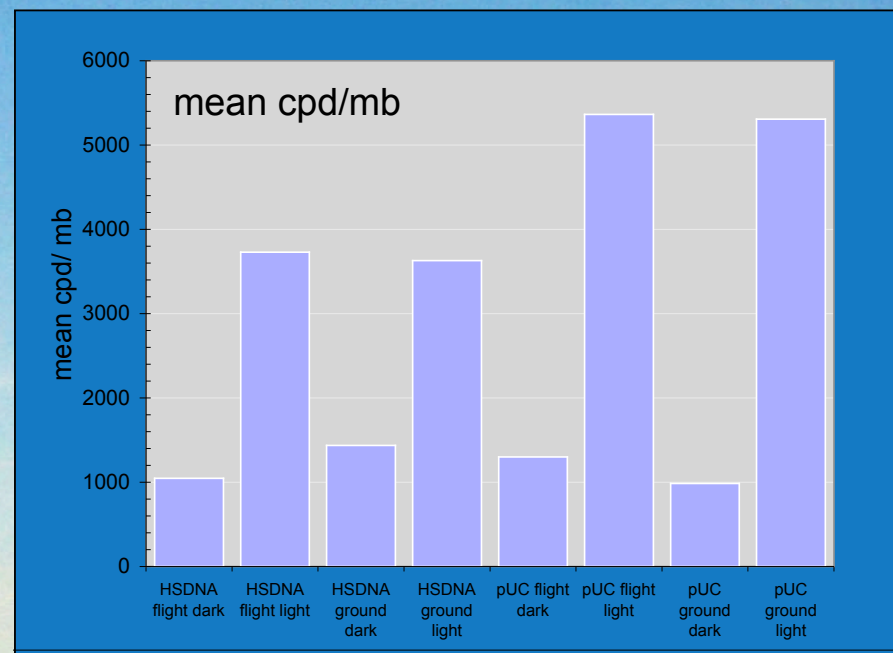
This includes two types of experiments.

1. Base modification, for example, the production of thymine dimers from adjacent thymines using a dosimeter made of herring sperm DNA.
2. Nicking and breakage of the phosphate backbone using supercoiled plasmid DNA.

treatment	mean cpd/mb	st dev
HSDNA flight dark	1047	100
HSDNA flight light	3729	679
HSDNA ground dark	1437	0
HSDNA ground light	3629	225
pUC flight dark	1300	50
pUC flight light	5365	704
pUC ground dark	986	0
pUC ground light	5308	682

666 A
659 T
675 C
686 G
total: 2686 bp
139 TT

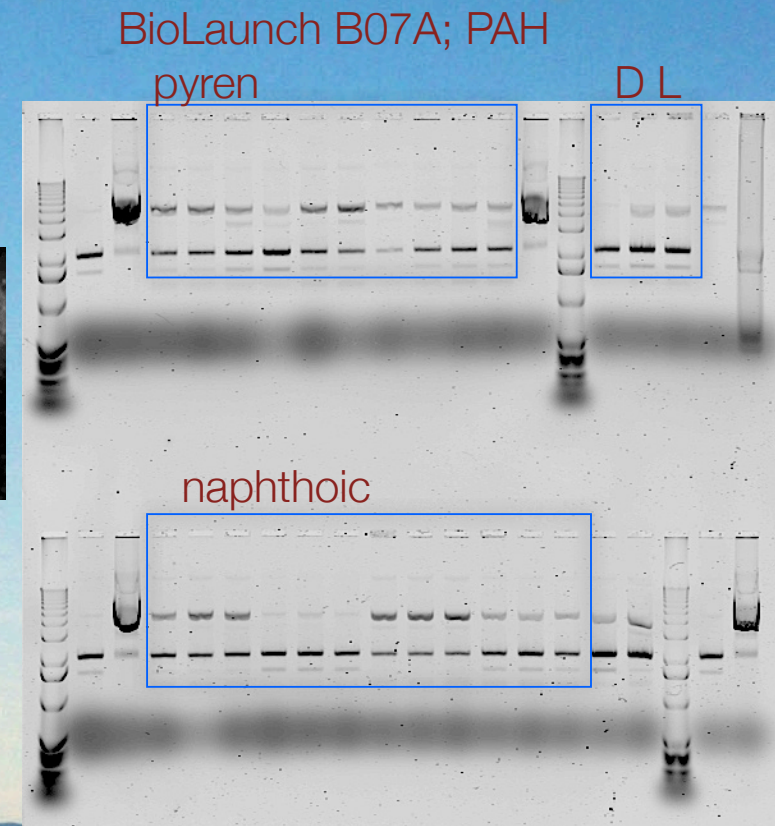
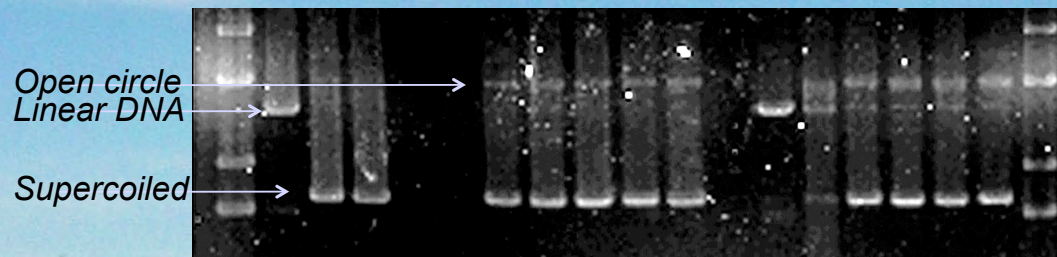
so, total potential of 139 dimers in 2686 bp,
or 51,749.8 dimers per megabase.



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Bio Launch: **Future plans.**

- Better temperature and radiation measurements; annual variation
- DNA damage - bases and breakage. Absolute amount. Correlate with both types of radiation.
- Expanded biologicals - survival including genetic basis, air capture, viral induction.
- Testbed for miniaturized flight instrumentation.