

Summary - Subcommittee on Mission Diversity

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Non-Flagships Advantages

- Everything that a general purpose observatory cannot do:
 - Time-domain
 - Missing wavelengths: $<1150 \text{ \AA}$
 - All-Sky surveys: UV only, has to be better than GALEX
 - Specific set of targets: e.g. All transiting planets around M-dwarfs
 - Specific Capabilities
 - High precision photometry: 10 ppm, for example
 - High contrast imaging
 - Deep wide-field imaging
 - Better than current PSF (GALEX: $5''$, HST: $0.05''$)
- Other?

What Astro2010 said

- “Maintaining a balanced program is an overriding priority for attaining the overall science objectives”
- **Second recommendation after WFIRST:**
Augment the Explorer program (2012-2021).
\$100M/year by 2015.
 - 2 new MidEx (\$300M each)
 - 2 new SMEX (\$160M each)
 - 4 MoO (\$30M to \$70 M each)
- Unranked: 15M/year additional funding for suborbitals

Status of recommendations

- Very good overall progress:
 - Explorers
 - The plan is to have a Explorer call every 2 years: SMEX: 2014 (launch NLT 2020); MidEx: 2016;
 - *Notional: SMEX 2018; MidEx 2020*
 - Suborbital
 - Investments above recommended levels
 - Increased number of balloons and rocket launches (15/yr).
 - Private LVs may become available for future missions: Launcher 1 from Virgin Galactic for \$10M.

Status of recommendations, cont.

- Intermediate Technology development
Augmentation, Future Ultraviolet-Visible
Space Capability
 - Established Strategic Astrophysics Technology:
 $3 \leq \text{TRL} < 6$
 - Strong investments in TDEM, TPCOS, TCOR



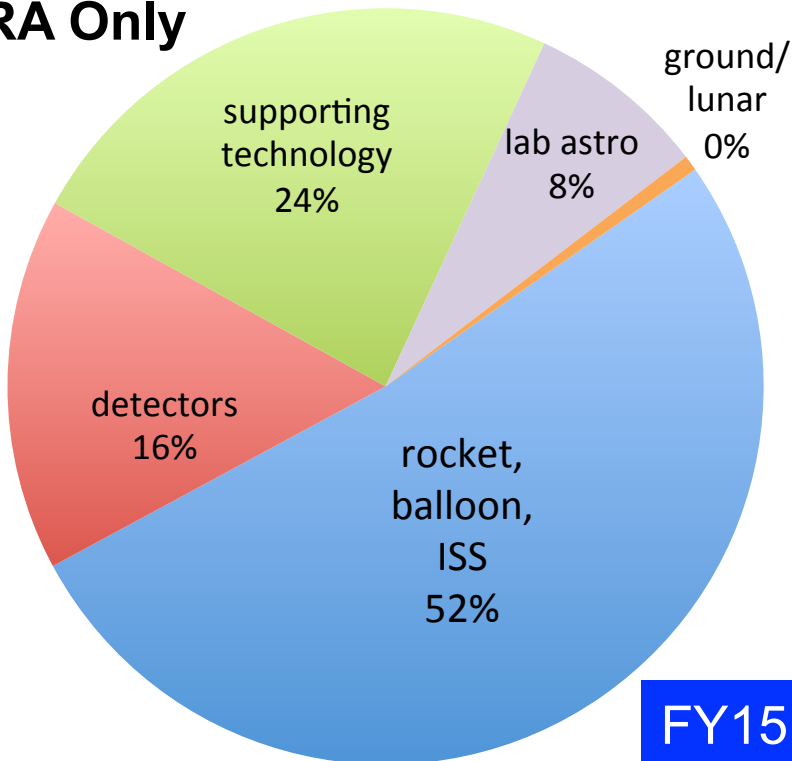
Astrophysics Research Program Funding

Snapshot: Most Recent Year

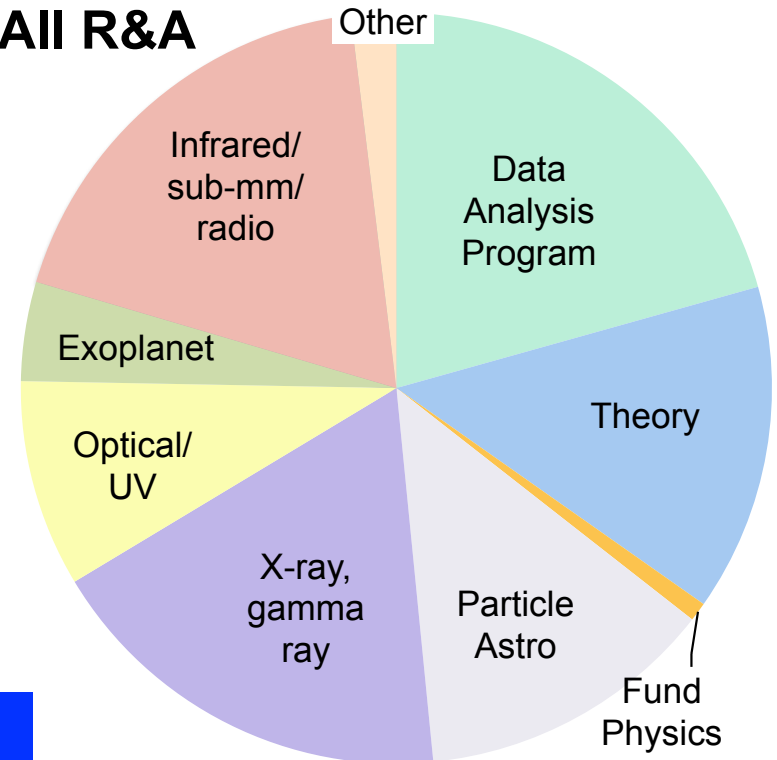
	Proposals Rec'd	Year-1 \$M	Proposals selected	Success Rate	Proposals Rec'd 2015
APRA-13	179	10.0	43	24%	151
SAT-13	18	5.4	10	56%	28
ADAP-14	300	7.5	62	21%	
XRP-14	62	1.3	11	18%	
ATP-14	214	4.7	31	14%	
TOTAL	773	28.9	157	20%	

Does not include RTF, TCAN, WPS, GO programs

APRA Only



All R&A



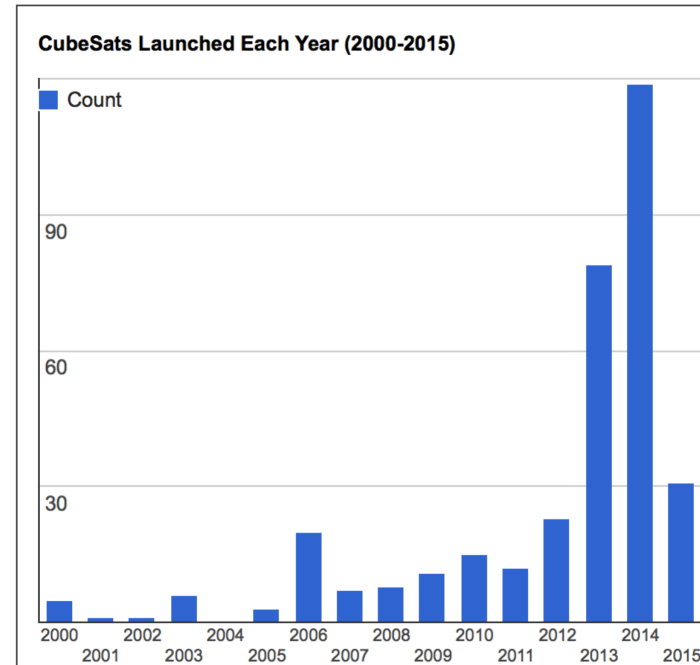
FY15: \$50M

Lots of talk about suborbitals...

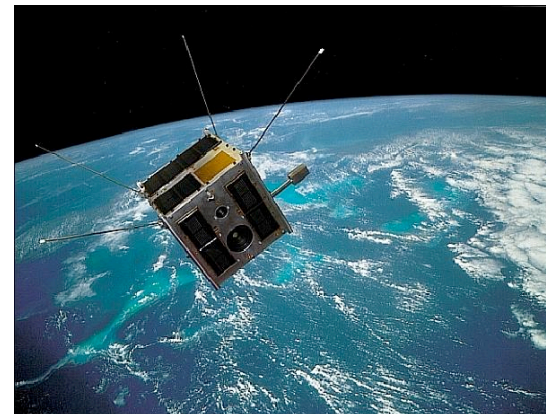
- 1950-2250Å
 - Balloons: 30 km. Long duration and ultra-long duration (+100d)
 - Airships:
 - Low: 4 km
 - Intermediate: 5-12 km
 - High: 20 km
- Sub-orbital aircraft (110 km)
- Sounding rockets (1500 km)
- Space planes (300-800 km)

Cubesats

- Small, standard-size satellites: 1U = 10 cm x 10 cm x 10 cm
- They can be 1U, 3U, or 6U
- 341 launched so far: Tech demos, university experiments, earth observation.
- Future launches for planetary exploration
- Maybe ≈ 6 have an astrophysics mission
- Aperture-challenged: Max aperture is 10 – 20 cm for monoliths
- Pointed (no survey) observations (Best pointing so far is $\approx 10''$)
- Time-domain: Difficult to do with other facilities
- Ultraviolet: Of course!



<https://sites.google.com/a/slu.edu/swartwout/home/cubesat-database#database>



directory.eoportal.org

BRITE

Outside the US

- Europe:
 - Grassroots - Network for Ultraviolet Astronomy (NUVA)
 - Concerned as the community ages
 - Wanted: High dynamic range, possibility of continuous monitoring
 - WSO: Collaboration with Russia, 2020 launch, 1.7 m telescope, >115 nm
 - Top-Down – ESA Cosmic Vision
 - S (\$50 M€), M (\$500 M€, every 3-4 yr), L (\$1 B€, every 7-8 yr), MO. Cost do not include payload

Outside the US, cont.

- Europe:
 - Top-Down – ESA Cosmic Vision
 - Strong UV interest. Arago (stellar astrophysics, 1m, 110-800 nm, R=55,000) to be re-submitted in M5 call 2015
 - ESA hierarchy interested in flagship involvement with US
 - Ad-hoc committee to promote links to ATLAST/HDST
- Canada:
 - Astrosat: Indian UV mission (40 cm telescope). Launch 2015
 - CASTOR study: 1 m, large FOV, surveys and GO. Looking for collaborators and partners.

Submitted WP

Name	Author	Science	Class	Aperture	Observables	Why unique?
Exoplanet Environment Monitor	Linsky/ France	Exoplanet monitoring	Probe?	1m	UV Spec – X ray flux	Time-domain observations of a particular set of targets
CASTOR	Cote/ Hutchings	Complement Euclid and WFIRST - GO + surveys	Probe?	1m	0.7 sq-deg FOV, 0.15-0.55 mic	Wide FOV
Life-Finder	Heap	Find life	MidEX?	4 m	Near UV	Coronagraphy
GESE	Heap	Galaxy evolution	?	1.5 m	0.2-0.4 mic (spec) 0.4-0.8 mic (img)	MOS

Discussion

- Cost reduction measures
 - Diversity of LVs
 - New Materials
 - Shorter development times
 - Public-private partnerships: Private institutions provides hardware contributions and cost sharing.

