National Aeronautics and
Space Administration

Jet Propulsion Laboratory
California Institute of Technology
Pasadena, California

Patents and Technology Transfer at JPL
NAC Technology and Innovation Committee
August 2, 2011

Ken Wolfenbarger
NASA Jet Propulsion Laboratory
California Institute of Technology

National Aeronautics and Space Administration

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California Institute of Technology
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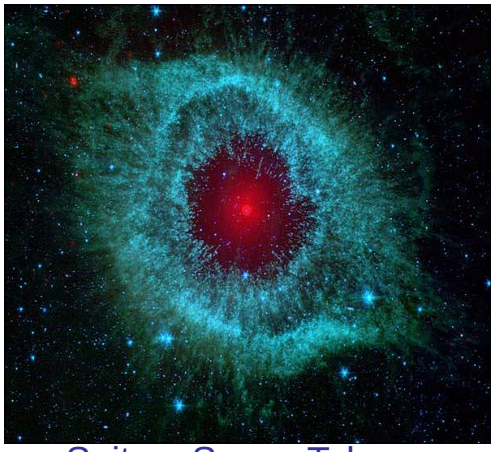
JPL: From Caltech students testing rockets to exploring the planets in our lifetime

Caltech students (1936)

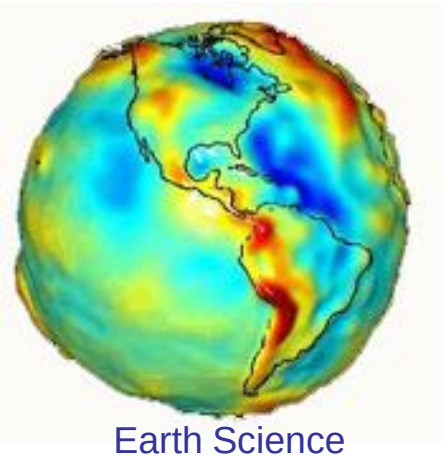
Missiles (1940s)

Explorer 1 (1958)

Mars Exploration Rovers
(2004 – present)



Spitzer Space Telescope
(2004 – present)



Earth Science
(1978 – now)

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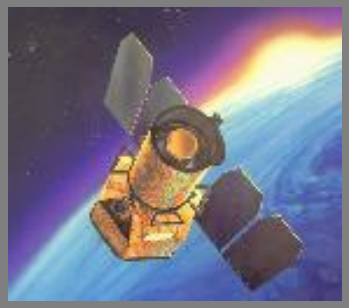
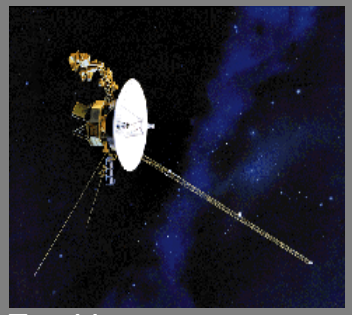
Seventeen spacecraft, nine instruments across the solar system (and beyond)

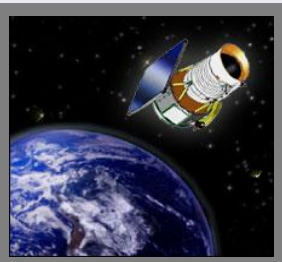


GALEX

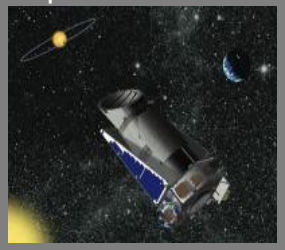
Spitzer



Two Voyagers

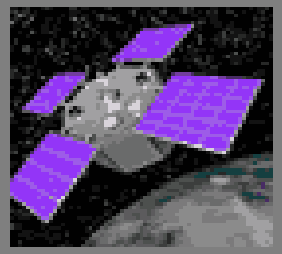


Kepler

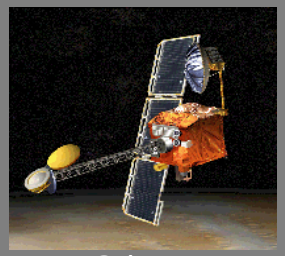


ACRIMSAT

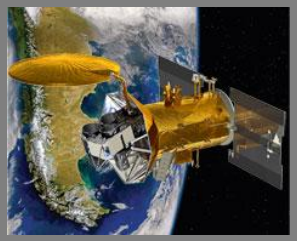
Dawn



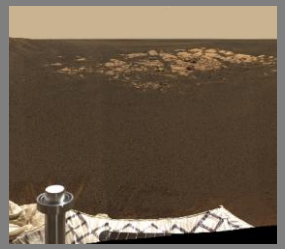
Wide-field Infrared Survey Explorer (WISE)



Mars Odyssey

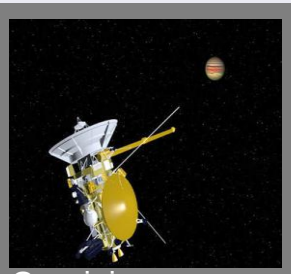


Aquarius



Opportunity

Mars Reconnaissance Orbiter



Cassini

Jason 1 and Jason 2

CloudSat

GRACE

Plus Instruments:

- ASTER
- MISR
- TES
- MLS
- AIRS
- MIRO
- Herschel
- Planck
- Diviner

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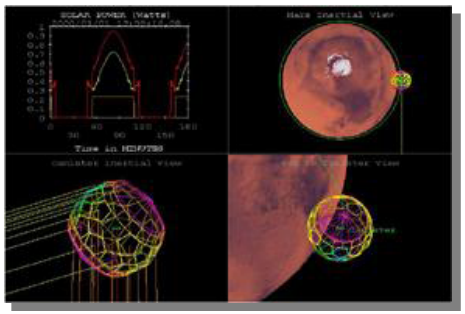
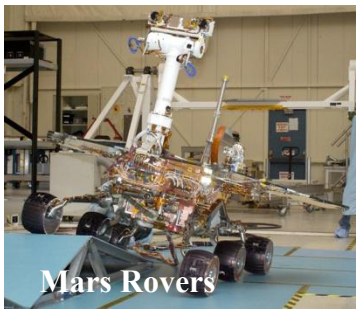
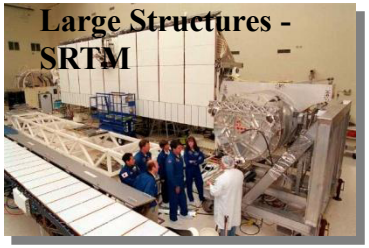
End-to-end capabilities needed to implement missions

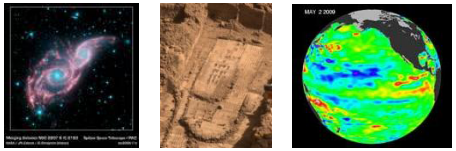
Project Formulation - Team X



Mission Design





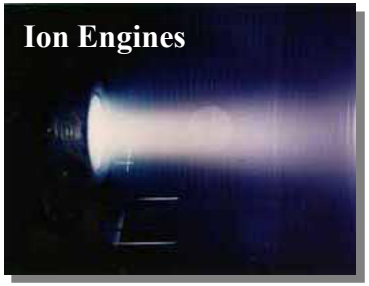


Scientific Research

Real Time Operations

Environmental Test

Integration and Test



Spacecraft Development

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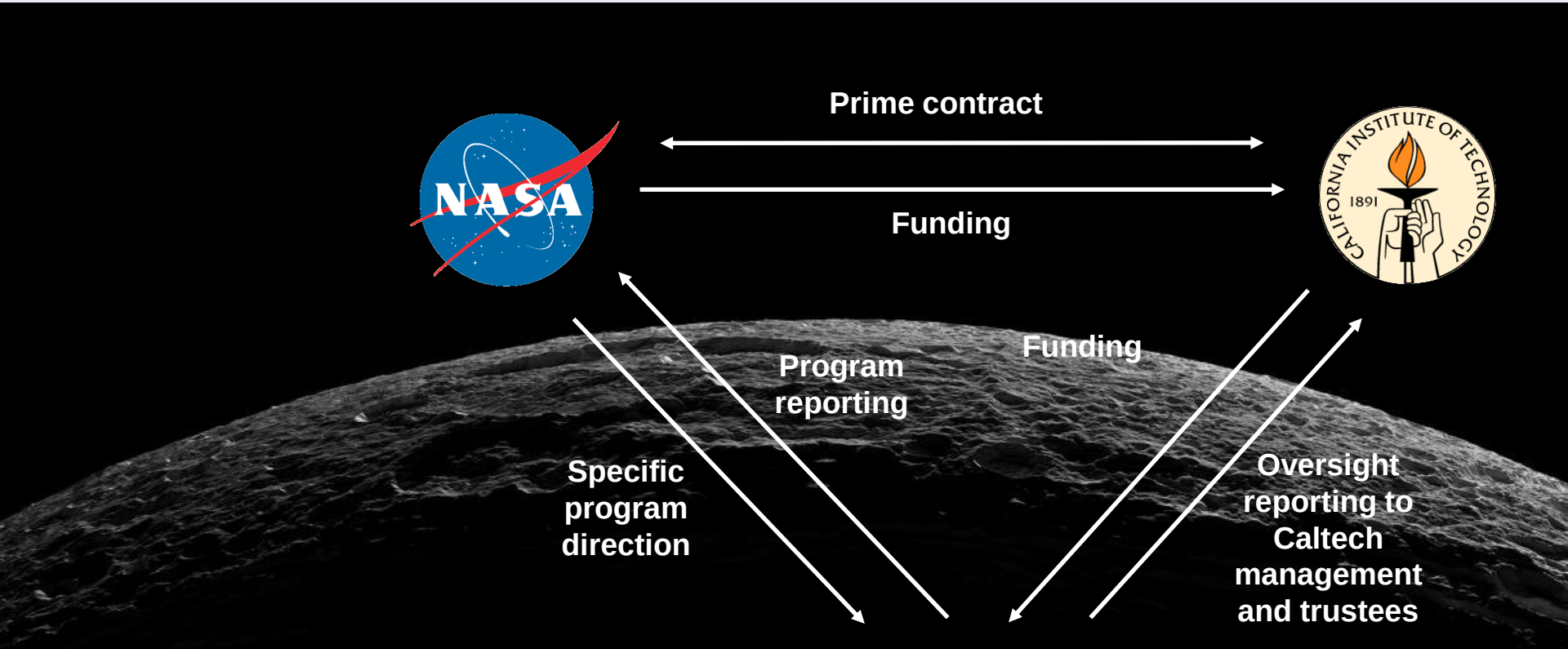
Caltech operates JPL for NASA



- Federally (NASA)-owned "Federally-Funded Research and Development Center" (FFRDC)
- University (Caltech)-operated
- 5,000 employees
- 177 acres (Includes 22 acres leased for parking)
- 139 buildings and 36 trailers
- 673,000 net square feet of office space
- 906,000 net square feet of non-office space (e.g., labs)

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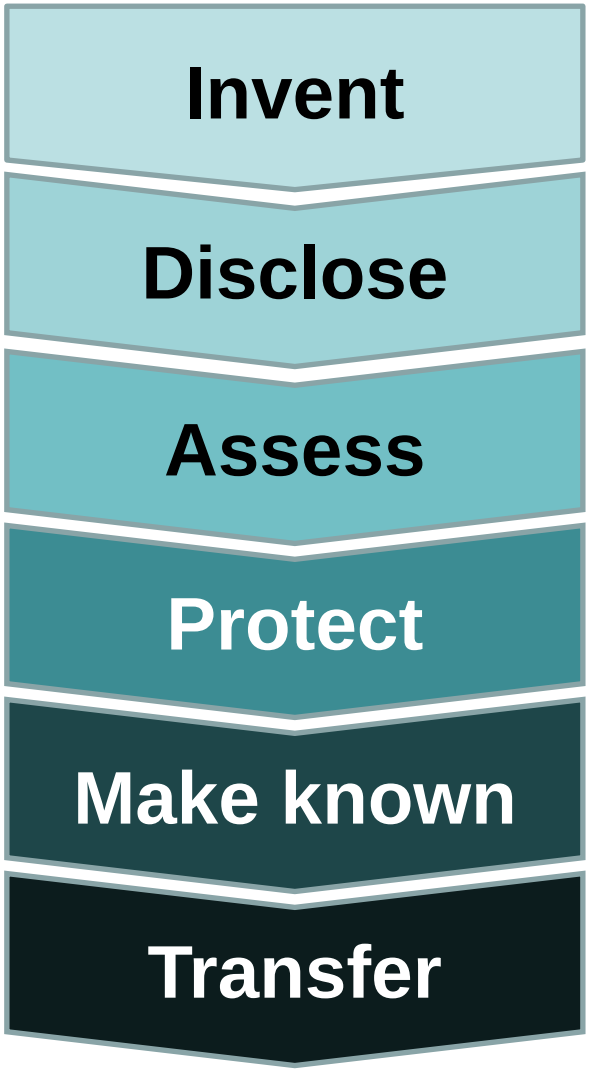
The Technology Transfer Process



- New concept to meet a NASA need
- File New Technology Report (NTR)
- Evaluate commercial potential
- Patent or copyright
- Create awareness
- License, SAA

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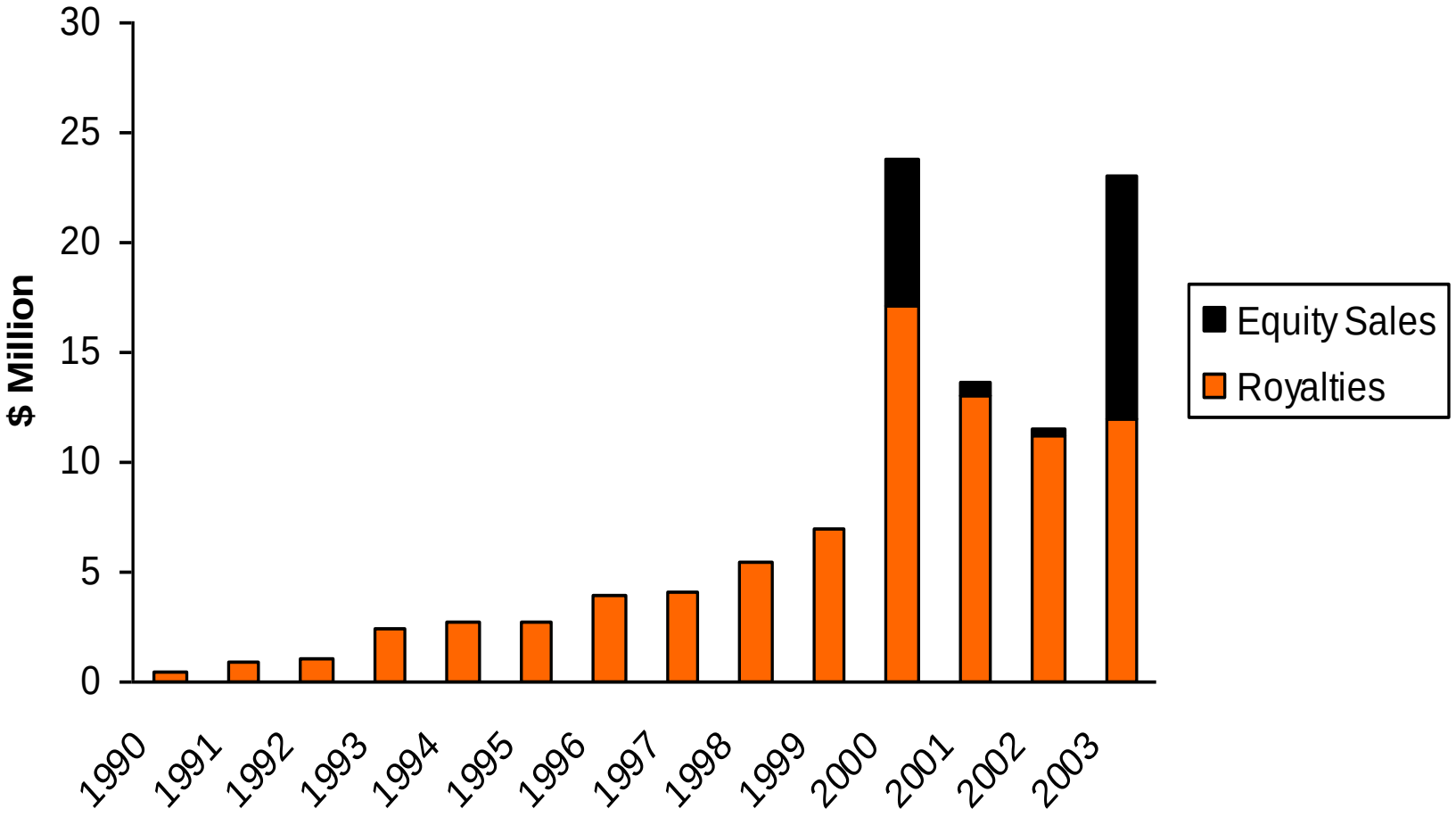
Historical Data



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A Dozen Features

1. Innovator relationships
2. Awards
3. Provisional Applications
4. Patent Attorneys
5. Enforcement
6. Outreach process
7. Empowered licensing agents
8. Option Agreements
9. VC Relationships
10. Start-ups, Equity
11. Innovator Participation Again
12. Leadership

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2009 Comparisons

	JPL	Lawrence Berkeley[1]	NASA[2]	MIT[1]
FY09 Budget (estimate)	$1.6 B	$ 800 M	$18 B	$ 2.4 B
NTRs (Disclosures)	376	109	1373	501
U.S. Patents Issued	32	26	114	153
New Options	3	7	0	18
New Commercial Licenses	23	10	67	67
Disclosures / $B Budget	235.0	136.3	76.3	208.8
Patents Issued / $B Budget	20	32	6.3	64
License / $B Budget	14.4	12.5	3.7	27.9

1. Source: Annual reports
2. NTTS

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2007 AUTM Average

	Per $1B R&D
Disclosures	400
Patent Applications	250
Patents Issued	80
Licenses	100
Licensing Revenues	$48M
Start-ups	120

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2009 University Revenues

- 1. Northwestern University, $161 million
  2. Columbia University, $154 million
  3. New York University, $113 million
  4. University of California System, $103 million
  5. Wake Forest University, $96 million
  6. University of Minnesota, $95 million
  7. University of Washington/Washington Research Foundation, $87 million
  8. University of Massachusetts, $71 million
  9. Massachusetts Institute of Technology, $66 million
  10. Stanford University, $64 million
  11. University of Wisconsin at Madison, $57 million
  12. University of Florida, $54 million
  13. California Institute of Technology, $48 million
  14. University of Rochester, $46 million
  15. University of Iowa Research Foundation, $43 million

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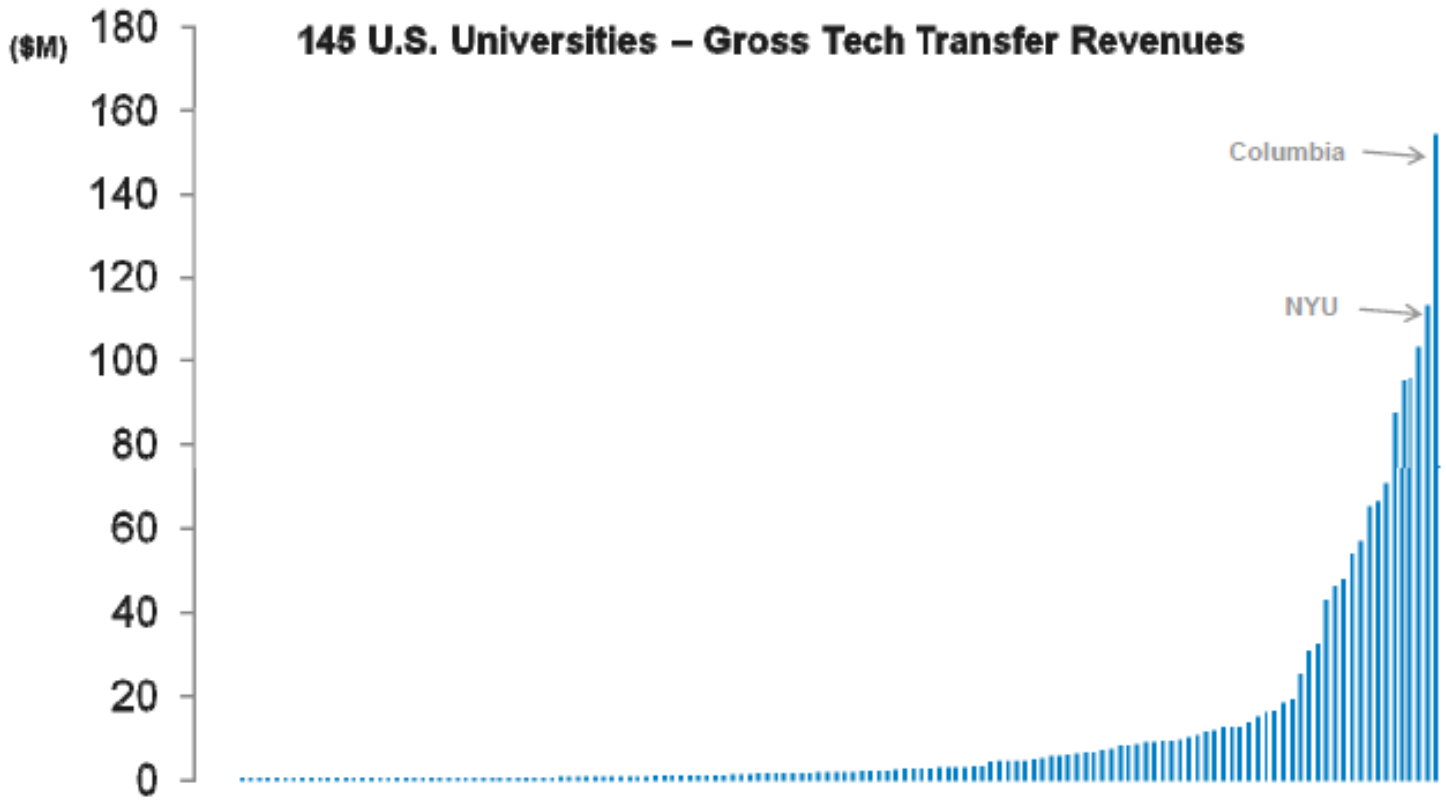
Some Winners



Source: AUTM 2009 Survey Data

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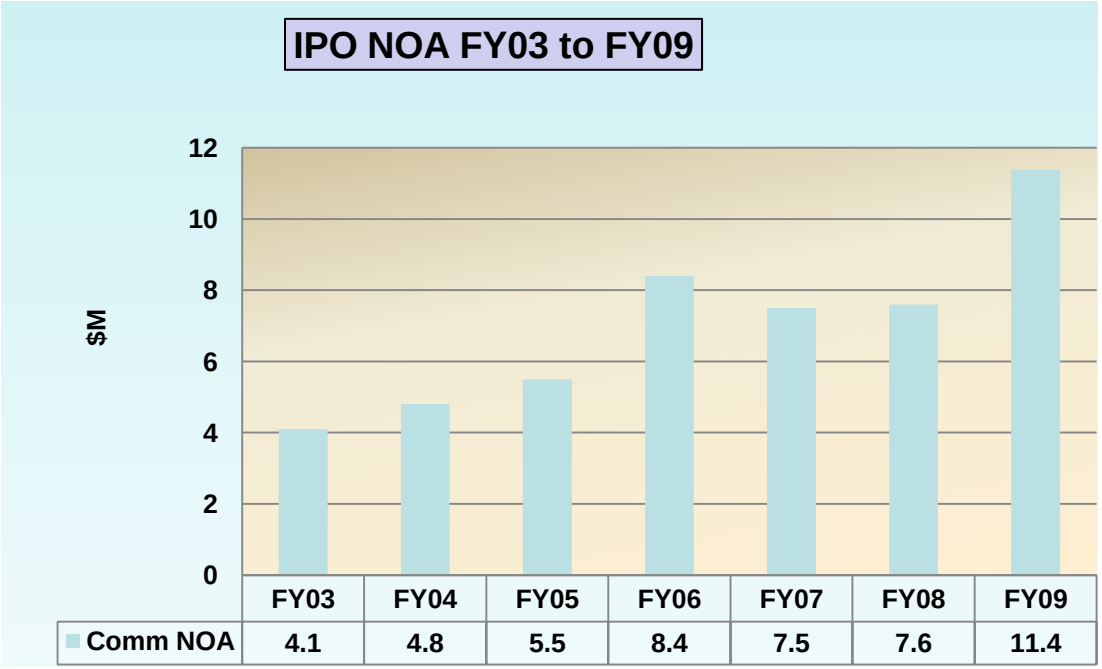
Reimbursable Agreements

- Allows innovators to support Licensees
- ~20/year with commercial sector
- Access to low TRL funds
- Agreement cycle time important



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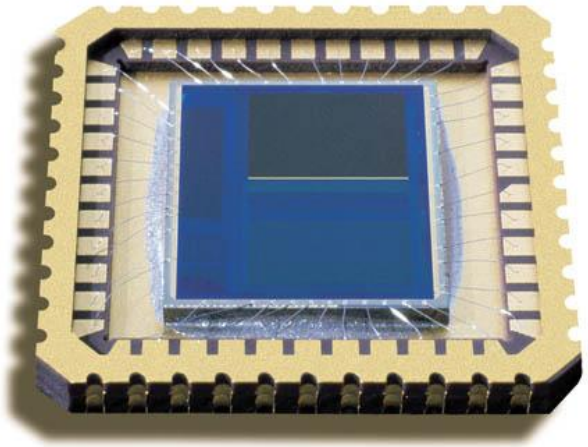
JPL Technology Startup
Photobit, Inc.

- **CMOS Active Pixel Sensor Camera now a default technology for cell phones, web cams and digital cameras**
- **Represents a Billion-dollar-per-year IC business**



Photobit was founded in 1995 by JPL researchers. In 5 years it grew to over 100 employees with $20 M in revenue, before being acquired by Micron in 2001

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Partnerships Benefitting NASA

Creating New Suppliers: BlackJack GPS receiver hardware and software design

Developed by NASA

Transferred and licensed to Broad Reach Engineering (BRE).

NASA now has a more cost effective resource for these receivers.

BlackJack has been used in eight NASA missions:

- SRTM (02/00)
- CHAMP (07/00)
- SAC-C (11/00)
- JASON-1 (12/01
- GRACE (03/02)
- FedSat (12/02)
- ICESat (01/03
- Cosmic (04/06)

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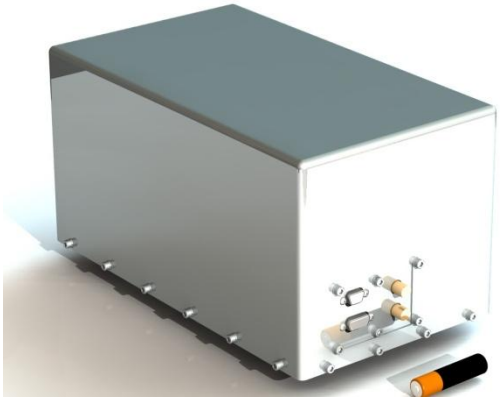
Collaborations

Advancing NASA Technology and Supporting Industry: The Mercury Atomic Frequency Standard (MAFS)



Initial development funded by NASA
- ground standards
- low TRL for flight unit to enable one-way navigation

GPS-III Program now funding NASA to mature flight hardware

Symmetricom working with JPL to become the commercial supplier

	System Engr.	Physics Unit	Electronics	Algorithms/SW	I&T
Phase I Brassboard	JPL	JPL	JPL/Symm	JPL	JPL
Phase II Prototype	JPL	JPL	Symm/JPL	JPL	JPL/Symm
Phase III EQM	Symm/JPL	Symm	Symm	Symm	Symm

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Backup