Goddard Workshop on On-Orbit Servicing

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NEAR EARTH LLC

Providing *Investment Banking* and *Advisory Services*
to Companies and Investors in the Satellite, Aerospace and Wireless Telecom Sectors

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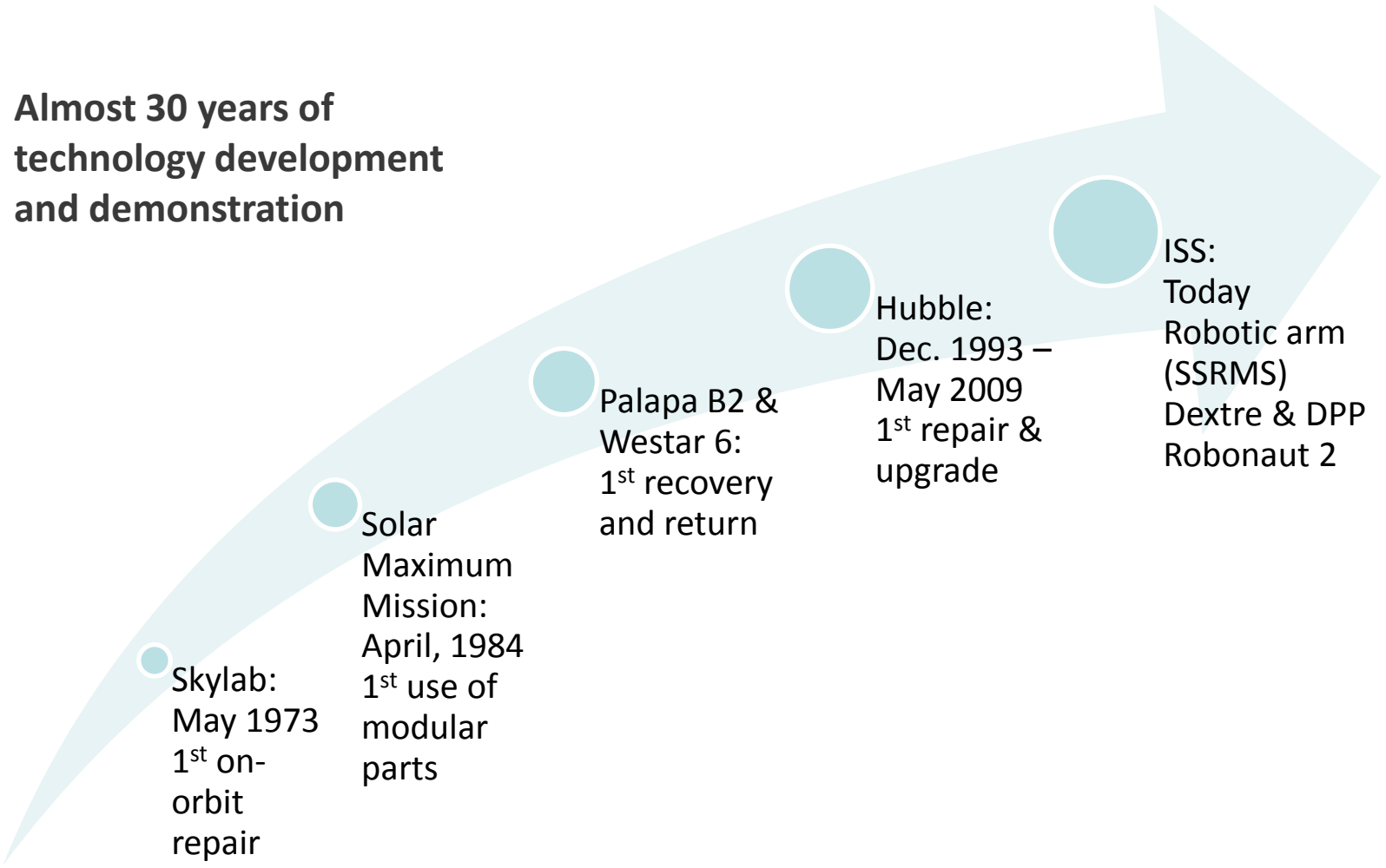
Market Opportunity

- Satellite monitoring
  - Deployment (20 new GEO satellites per year)
  - Fleet health (200+ GEO satellites)
- Satellite refueling
  - Life extension (20 GEO satellites per year reach end of useful fuel)
  - Launch dry (can save 40%+ on launch weight or do dual launch)
- Orbital transportation / transfer
  - Satellite relocation & de-orbiting (avg. 13 Geo belt relocations per year)
  - Rescue & recovery (avg. 1 satellite per year requires assistance)
- Satellite repair and maintenance
  - Life extension
  - Anomaly correction
    - Avg. annual failure rates: 4.4 component , 3.8 systemic, 0.3 deployment
- Propellant transfer and depot storage
- Orbital debris removal / mitigation
  - 19,000 > 10cm (but >95% LEO debris is Russian)
- On-orbit assembly (much further out, except for nanosat apps)

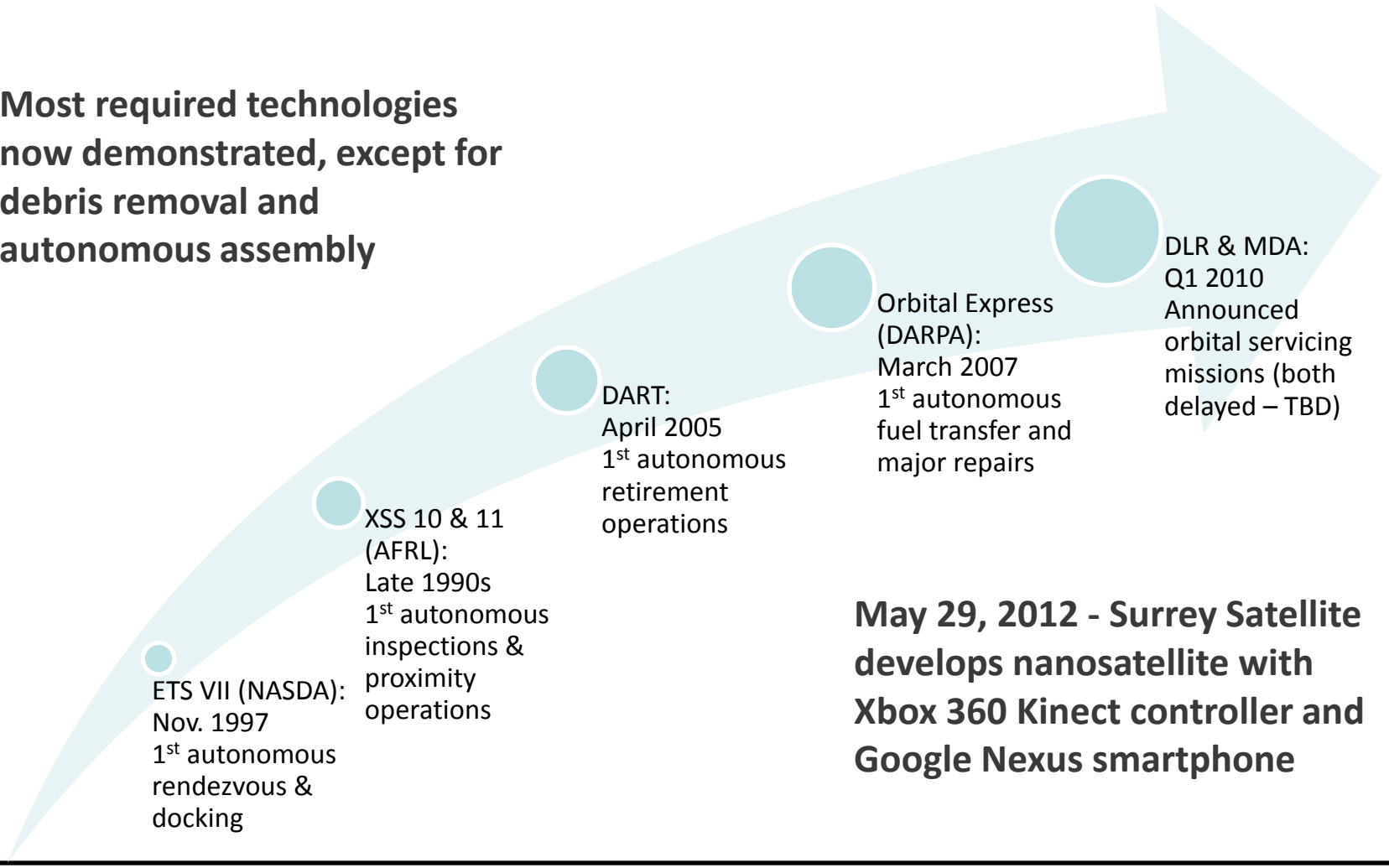
NASA: On-Orbit Servicing Efforts

Almost 30 years of technology development and demonstration



Other: On-Orbit Servicing Efforts

Most required technologies now demonstrated, except for debris removal and autonomous assembly



May 29, 2012 - Surrey Satellite develops nanosatellite with Xbox 360 Kinect controller and Google Nexus smartphone

Financing Issues / Risks: General

- **Significant normal business risks:**
  - **Technology development risks like high-tech**
    - **Requires highly trained STEM to execute**
  - **Generally very capital intensive**
    - **Often significant uncertainty in costs**
  - **Frequently involves long development periods**
  - **Significant regulatory burdens**
- **Plus numerous unique or heightened risks:**
  - **Catastrophic launch or in-orbit failures**
  - **Significant 3rd party liability risks**
  - **Difficult competitive dynamics:**
    - **International marketing restrictions (ITAR)**
    - **Highly subsidized international competition**
    - **Potential for direct or indirect U.S. government competition**
- **And, uncertain market demand**
  - **High government contract termination risks due to policy changes**
  - **Nascent or non-existent commercial markets biggest investor risk**

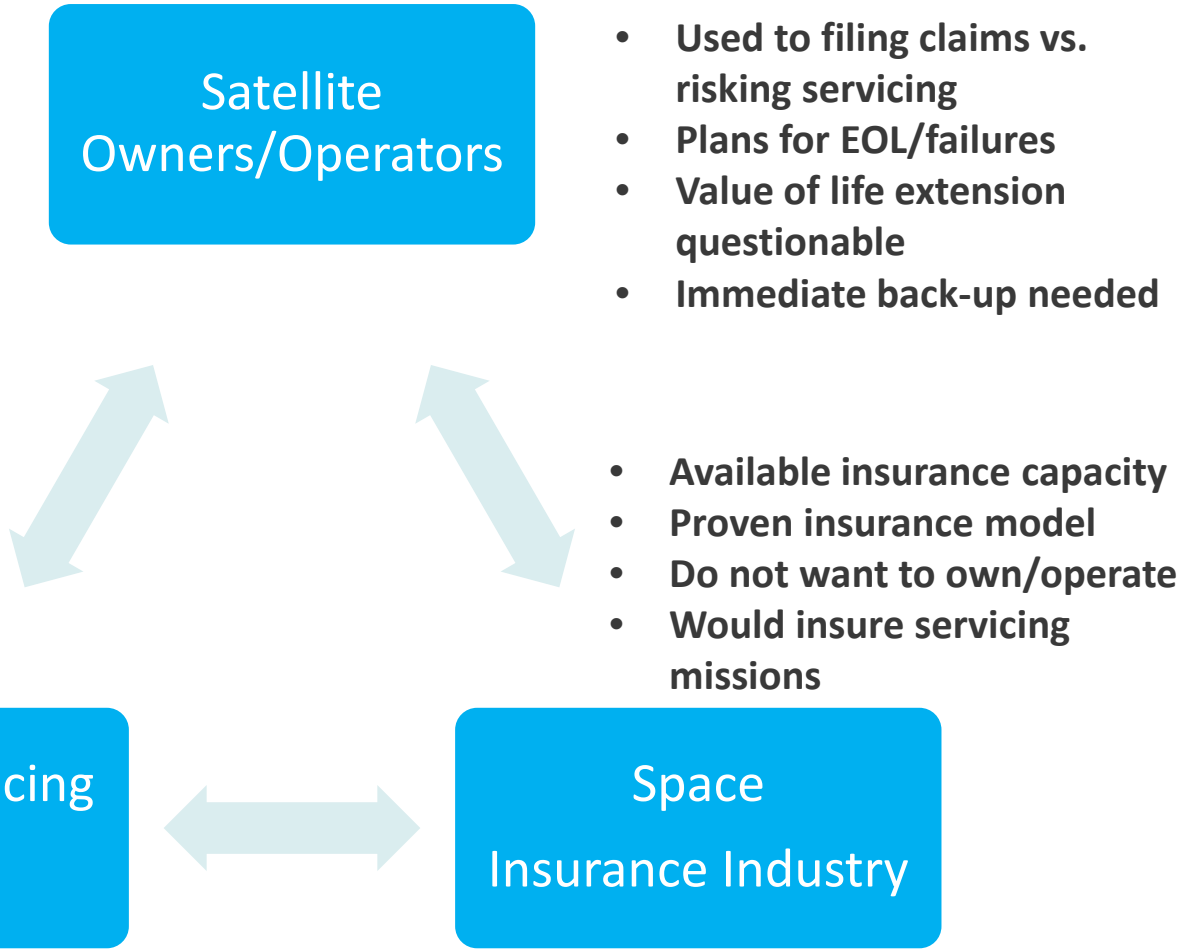
Financing Issues / Risks: Specific

	Technology	Market	Financing	Political/Reg	3rd Party
Monitoring	Easy / Cheap	Large, Low $	Low $, Short T	Spying / ASAT?	High $ satellites
Refueling	Doable	Uncertain	Med $, Med T	Low	GEO sensitive
Transfer	Uncooperative?	Small, High $	Med $, Med T	Low	Low
Repair	> w/design	Uncertain	High $, Med T	Low	GEO sensitive
Propellant	LT storage	Dual use/GEO?	High $, Med T	Mission Arch.	Low
Debris Removal	Large Δv	Gov't only	High $, Long T	Diplomatic	More debris?
Assembly	Complex	Gov't only	High $, Long T	Space policy?	Low

NASA Policy Issues

- **Improve perceptions:** NASA as a reliable commercialization partner
  - Publish a commercialization roadmap and adopt NASA-wide
- **Foster innovation:** Build technology base and expand solutions
  - Increase challenges, funded studies and STEM education support
- **Support technology development:** Prototyping through COTS availability
  - Phase 3 & 4 SBIRS, In-Q-Tel for NASA, super competitions, NASA facilities
- **Demonstration missions**: Prove new space systems & technologies
  - COTS/CRS type, free flight challenges, TDRS test bed, NACA like tech sharing
- **Validate market demand:** Serve as initial and repeat customer
  - Customer #1, anchor tenant, future purchase agreements, debris bounties
- **Enhance capital investment:** Reduce capital requirements and investor risk
  - Contracts, SAAs, grants, loan guarantees, tax credits, exclusive rights

No Longer Just Operator & Insurer



Space Commercialization Lessons Learned

- **Technology Risks:**
  - **Every space infrastructure development plan is high risk**
  - **Launch and in-orbit failures do happen**
  - **"Baby steps" are better than bold efforts**
- **Market Risks:**
  - **Lack of predictable market demand is key barrier to attracting capital**
  - **Long development/deployment schedules heighten market risk**
  - **U.S. government often needs to be anchor tenant or early dominant customer**
  - **Having government as prime customer reduces control of business plan**
  - **Commercial practices can produce considerable savings for government**
- **Financial Risks:**
  - **Delays are costly and can kill a project due to ROI hurdle**
  - **Traditional aerospace contracting doesn't provide sufficient cost control**
  - **Super angel support very helpful, but rarely enough**
  - **Institutional investors are unforgiving and rarely revisit an opportunity**

Space Commercialization Lessons (cont.)

- **Competition Risks:**
  - **Two is a big number in space, rarely is there enough profits to support three**
  - **International competition can be subsidized and enjoy lower costs/regulation**
  - **NASA/U.S. government may compete against you directly or indirectly**

- **Political/Regulatory Risks:**
  - **NASA and U.S. government can change policy & support abruptly**
  - **Some purposely avoid any ties to NASA or government**
  - **ITAR is a serious limitation of market opportunity**
  - **Other regulatory risks are high, but manageable**
  - **Use of NASA facilities challenging and often uneconomic**
  - **Indemnification uncertainty is a key issue**

Conclusions

- **Historic opportunity to foster vibrant U.S. on-orbit servicing industry**
  - **Much of technology already developed by NASA and others**
  - **In best interest of U.S. to commercialize to share investment & risks**
- **Commercial space interest exists, but investors see risks as too challenging**
  - **Capital is available if risk/reward can be brought in balance**
  - **New initiatives and ongoing NASA support will be required**
- **First challenge will be changing industry perceptions**
  - **COTS/CRS was an excellent first step**
  - **Lots of hard work ahead to change culture**
  - **Biggest unknown is internal & external political will to provide adequate budgeting**