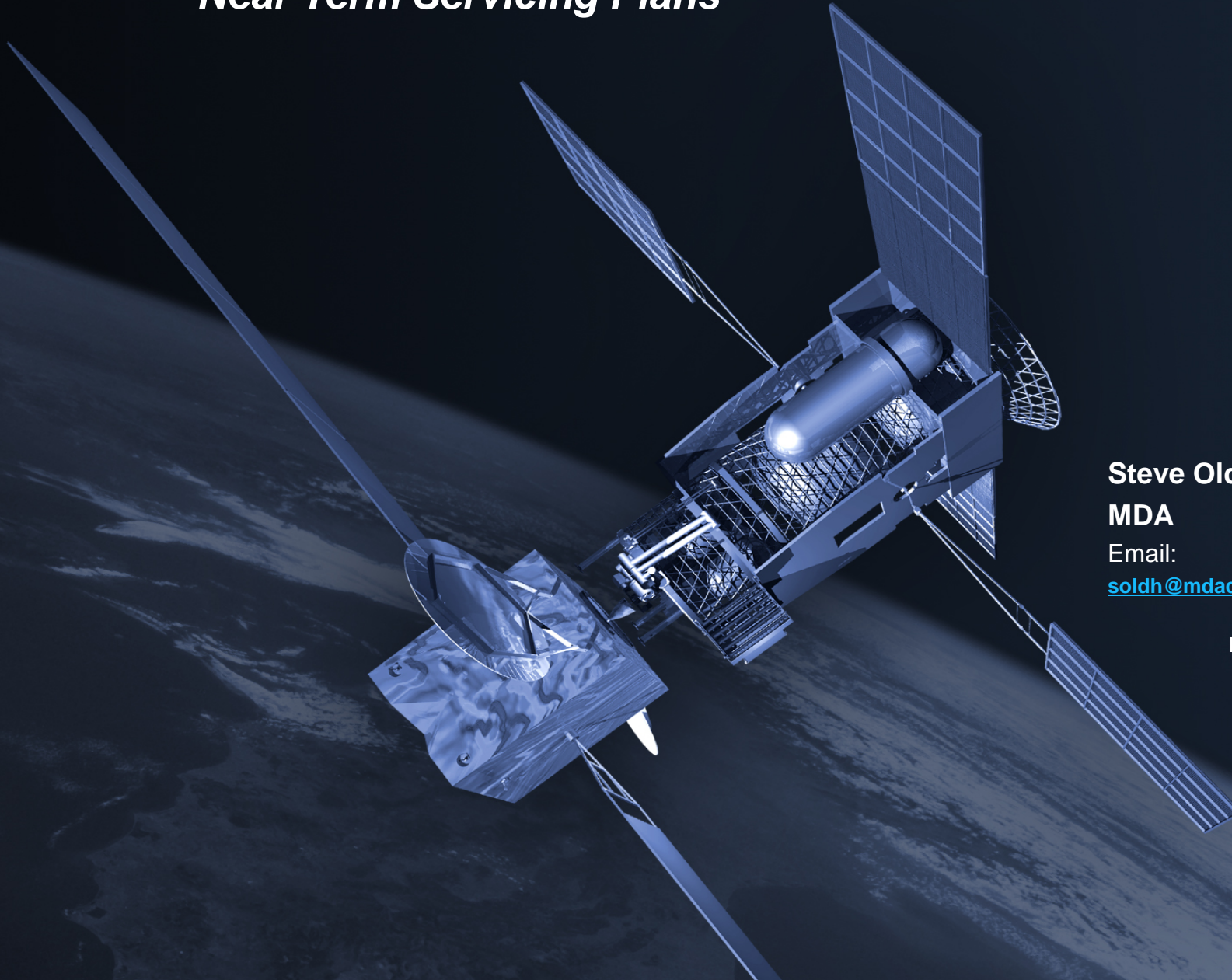


# What the Future Holds

## *Near Term Servicing Plans*



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# What On-Orbit Servicing Future Do We Want?

- A low risk capability offered as a service with insurance coverage
- Priced to provide a clear value proposition compared to other ways of maintaining / replacing satellites
- A scalable service, capable of a variety of on-orbit servicing capability



Commercial Operators

- An assured capability that meets the operational on-orbit servicing needs of all Government customers
- Consistency with the Government's Space Policy
- Avoid significant development expenses by leveraging existing capability and commercial funding
- US domestic capability

- Develop an on-orbit servicing capability that can meet the needs of identified customers (commercial and Government)
- Receive a financial return on invested private capital
- Mitigate market risk with initial customers and / or Government partners
- Utilize existing technologies, facilities and staff to minimize development risk



Government



On-Orbit Servicing Providers



# Are we solving a single problem?

Commercial Operators	Government Customers
Primarily GSO and station-kept	Many satellites are inclined
Life Extension & Relocation the main value	Limited life extension desire, more specialized servicing needs
Clear valuation proposition	Value of a service is not clear
Able to contract for service in advance	No ability to contract for service in advance
Multiple assets providing a capability	Lower numbers of more specialized satellites
Single decision maker for build vs service	Multiple agencies with unclear requirements

No – the needs of the commercial and Government customers are quite distinct

# MDA's Proposed SIS Capability

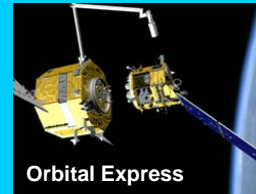
- Initial focus in GEO: able to refuel/service a multitude of commercial, civil and military satellites
- Fuel will be delivered as a service and transferred to a Client spacecraft on a “per kg” basis, and can work for a variety of satellite class or size with mono-propellant or bi-propellant fuel
- Service can be conducted quickly (within weeks) with minimal impact to client satellites
  - Client satellite restored to “normal” conditions and operations after refueling/servicing and does not rely on continuing reliable performance of Servicer
- Other services include inspection, surveillance, towing, repositioning and minor repair





# Why MDA?

## Technology Development & Flight Demonstrations



1980s

1990s

2000

2005

2006

2007

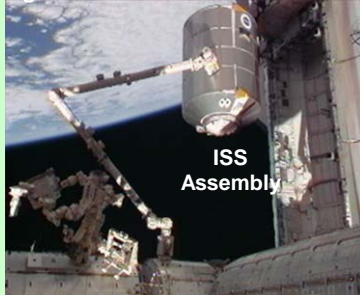
2009

2012

## Applications



Space Shuttle Self Inspection



MDA's proven heritage in orbital robotics has been established through our role on all the major orbital servicing missions performed to date

Our robots are trusted to perform in space, in nuclear reactors and in people's brains

# The MDA Design is Built for Flexibility

- Spacecraft is positioned in GEO, 'on call' for any customer need
- Can dock with multiple spacecraft types
- Carries multiple fuel types on board
- Fuel can be used to re-fuel or to maneuver / tow
- Carries multiple tools to allow orbital manipulation



- Cameras enable close inspection of satellites
- Spacecraft can re-fuel itself, allowing tankers to bring up additional fuel and / or tools
- Design allows for interface with other orbital servicing modules for more complex missions

# Government-Commercial Partnership Offers the Best Future

- Partnerships work best when
  - Each party needs the other
  - Each party's contribution (capability & financial) is aligned to its needs
- A Commercial partner should:
  - Provide a generic on-orbit servicing capability focused on the needs of the well understood commercial operators market
  - Provide accommodation for specialized capability required to meet USG requirements
  - Provide a capability able to be augmented to allow travel to higher inclinations (e.g. re-fueling on the servicing vehicle itself)
  - Operate and maintain the resulting assets to provide a secure and reliable service to both commercial and USG customers
- A Government partner should:
  - Provide the means to access highly inclined satellites (e.g. fuel depots)
  - Provide specialized capabilities and equipment for servicing not yet needed in the commercial market (e.g. re-purposing, repair, construction)
  - Ensure, through V&V, that any commercial on-orbit servicing offering, combined with any USG added specialized capabilities, can meet the needs of USG customers



# Space Servicing: The Future is Now

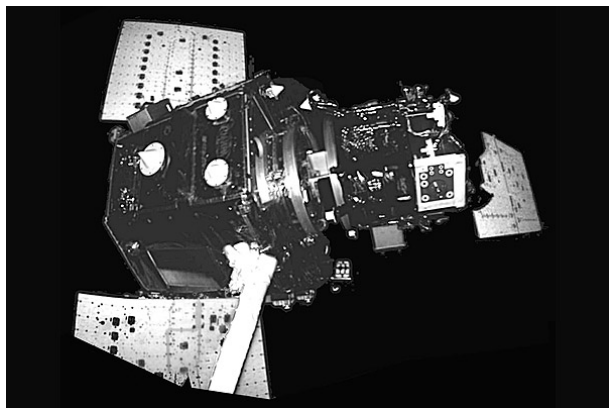
- Technology is here
  - Ground controlled ISS robotic maintenance now a routine operation
  - Critical satellite servicing techniques are being demonstrated
  - More sophisticated on-orbit servicing technologies are being developed
- Customer interest in On-Orbit Servicing is increasing
- The ingredients for successful partnership are in place .....



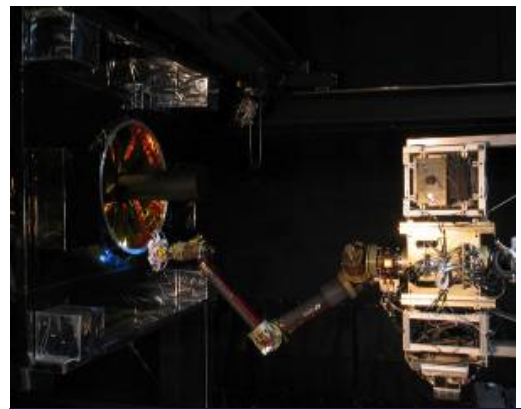
ISS Maintenance (SPDM)



Satellite Refueling (SPDM-RRM)



Satellite Servicing (Orbital Express)



Satellite Servicing (FREND)