

Shuttle-Derived Heavy Lift Launch Vehicle Side Mount vs In-Line



**SPACE SHUTTLE PROGRAM**

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**Shuttle Derived Heavy Lift Launch
Vehicle Attributes**Presenter **Mack Henderson**Date **6/11/10**Page **2**

- A Shuttle derived heavy-lift launch vehicle (HLV) provides a logical next step to meet the forecasted Space needs, following the Space Shuttle retirement
- Shuttle Side configuration makes maximum use of existing Shuttle assets and facilities without the Expense and Risks of using an Orbiter vehicle
- It retains the contractor and civil servant technical skill-base. Ground and Mission operations, will be similar to the Space Shuttle Program
- HLV provides a near term capability that can meet the evolving needs of NASA
 - Expansion and Upgrades for the International Space Station
 - Fly missions that demonstrate FTD and enabling technologies that will be needed to safely and efficiently go beyond Low Earth Orbit (LEO)
- Side Mount can be flown simultaneously with a crewed or uncrewed Shuttle

**HLV PROVIDES A CAPABILITY SOON TO MEET
NATIONAL NEEDS WHILE FUTURE VEHICLES ARE
EVOLVING**



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HLV Near Term Customers

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- **Space Based Solar Power- multi Centers/DOE/DoD**
- **Technology demonstrations- Flagship technologies**
- **Inflatable habitat - commercial**
- **Satellite servicing- GSFC/DoD/commercial**
- **ISS repair/upgrades- ISS Program**
- **Propellant depot- exploration/commercial**
- **Robotic Precursors/Lunar ISRU- ESMD**

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**Shuttle Derived Heavy Lift Launch
Vehicle Assessment**Presenter **Mack Henderson**Date **6/11/10**Page **4**

- Utilizing existing Space Shuttle flight hardware and software, facilities, honed processes and trained skilled work force provides a High Confidence launch capability
 - Two shuttle derived launch configurations were evaluated
 - HLV Side Mount replaces the Orbiter with a Payload Carrier (PLC) on the side of the External Tank (ET)
- And/or
- HLV In-Line places the payload carrier shroud on top of the ET and the Boat Tail and engines on the bottom of the ET
- Both Side mount and In-line are feasible and can be developed using existing Space Shuttle assets and skills
- The Side mount is similar to the shuttle configuration and requires less changes to the existing infrastructure than the In-line

**A SHUTTLE DERIVED HLV PROVIDES CAPABILITY MUCH
SOONER THAN A NEW LAUNCH VEHICLE**

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Side Mount vs In-Line HLVPresenter **Mack Henderson**Date **6/11/10**Page **5**

- Side Mount can be developed sooner for less money using surplus Shuttle flight hardware and the existing infrastructure with only a few changes compared to In-Line
- The existing Shuttle infrastructure can support both Side Mount and Space Shuttle operations crewed or uncrewed
- Side Mount provides a opportunity for a heavy lift launch capability for any needed ISS heavy lift support and to perform large scale technology development demonstrations
- Shuttle and Side Mount can utilize current work force, close the gap and backup commercial launches while the In-Line or new launch system is being developed
- Side Mount takes maximum advantage of current SSP operational proficiency (highly “perishable”) sooner to reduce risk.



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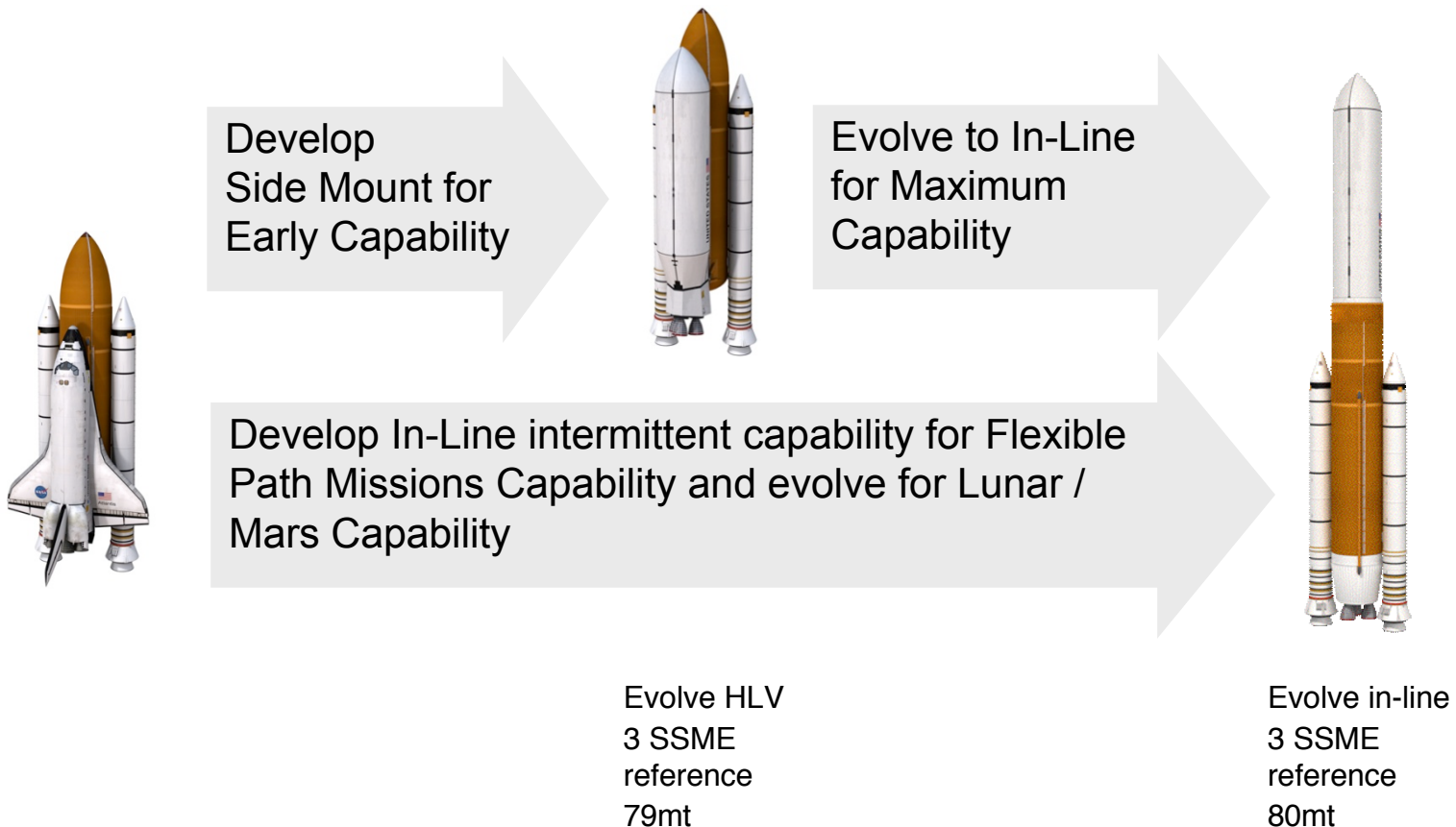
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HLV Sidemount vs. In-Line Commonality

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Simplest, Earliest IOC Shuttle Derived, evolution to Saturn V class heavy-lift

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HLV SM vs IL ComparisonPresenter **Mack Henderson**Date **6/11/10**Page **7**

	Stop Shuttle Dev IL	Fly Shuttle Dev IL	Stop Shuttle Dev SM	Fly Shuttle Dev SM	Fly Shuttle Dev SM&IL
Cost	\$15B	\$20B	\$11B	\$16B	\$22.5B
Schedule	FY'17	FY'17	FY'15	FY'15	FY'15
Risk	High	High	Low	Low	Medium
Tech Demos	Late	Shuttle DTO	Lge Scale	Shuttle DTO Lge Scale	Shuttle DTO Lge Scale
ISS	None	Commercial BU	Repair/UG	Comm BU Repair/UG	Comm BU Repair/UG
Benefits	Early IL	Closes GAP	HLV Soon	HLV Soon Closes GAP	HLV Soon Closes GAP

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**Extended Shuttle/Accelerated HLV
Advantages**Presenter **Mack Henderson**Date **6/11/10**Page **8**

- Utilizes the successfully demonstrated and certified Shuttle infrastructure and retains those critical skills
- Closes the gap- assured U. S. human spaceflight capability
- Supports heavy lift needs for the International Space Station
 - large replacements, new modules, expansion, emergencies, reboost
- Provides a backup or an alternative for the planned commercial crew launch vehicle(s)
- Provides a heavy lift launch capability soon to support Flagship Technology Demonstrations

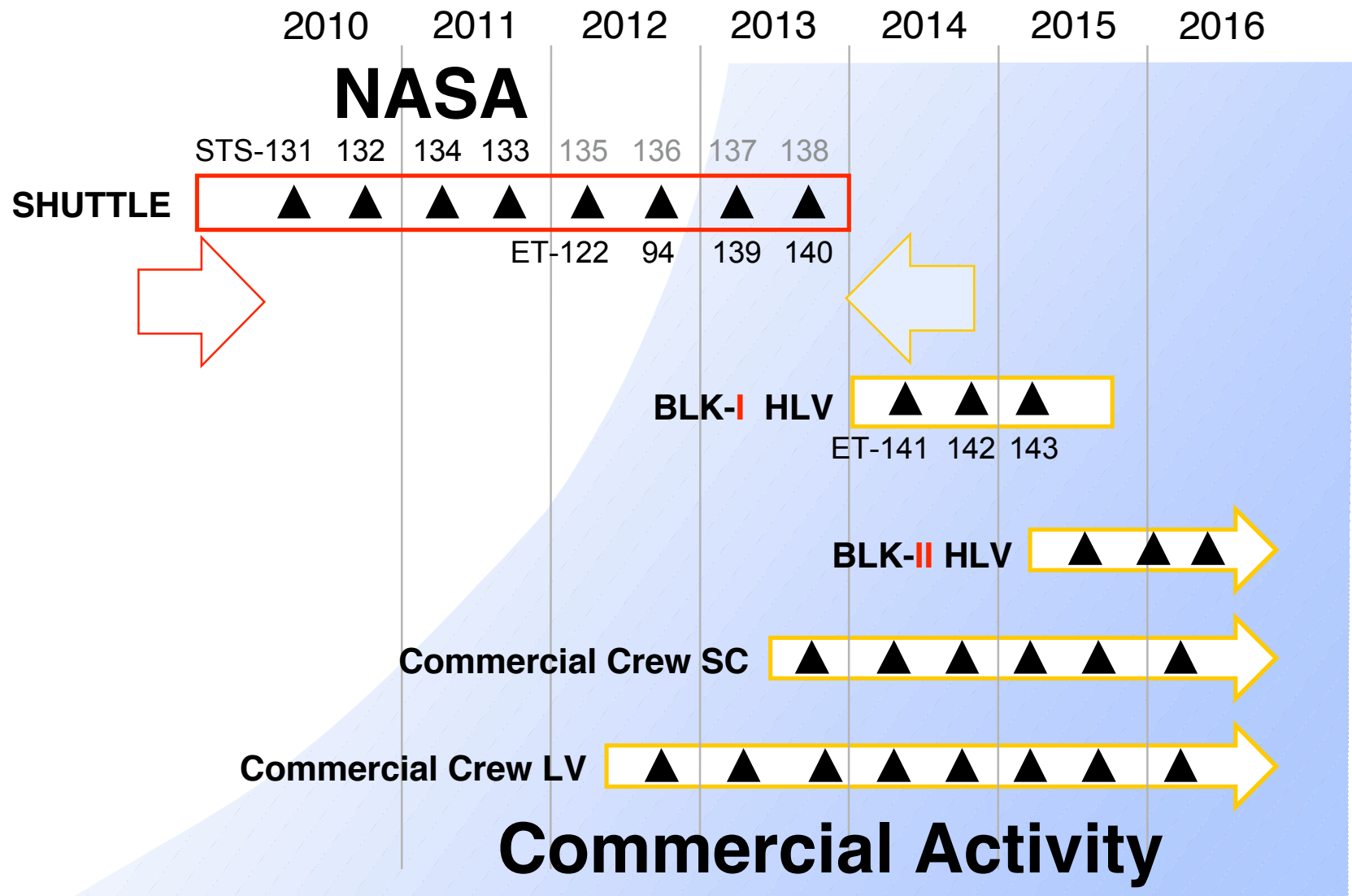
**Provides catalyst to bootstrap commercial heavy-lift and
Retains U. S. Space Leadership Role**



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Extended Shuttle/HLV Schedule Considerations

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Advantages for Side Mount Over the In-Line for the Initial HLV CapabilityPresenter **Mack Henderson**Date **6/11/10**Page **10**

- **Uses more of the existing Shuttle flight certified hardware and software**
- **Can use existing launch pad and mobile launch platform**
- **Residual ET hardware and tooling exist at MAF**
- **Existing Main Propulsion System require less change**
- **Retains Shuttle infrastructure to fly additional Shuttle flights if needed**
- **Main engine testing simpler and no MPTA required**
- **Side Mount would mature knowledge for large fairings that will be needed for future In-Line systems**

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Conclusions

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- **HLV can provide a foundational launch capability to meet the Nation's future space needs**
- **Performance for the Side Mount and In-Line are essentially the same**
- **The Shuttle Derived HLV Side Mount makes more efficient use of existing Shuttle assets**
- **HLV can provide a low cost and a high confidence approach for shortening the gap**
- **HLV retains essential contractor and civil servant skills**
- **HLV provides a backup capability to support the ISS for both crew and cargo**

Shuttle and HLV can perform useful Demonstrations that improve the technology readiness and mitigate risks for future Exploration