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SPACE2016

Commercial Suborbital Spacecraft in China

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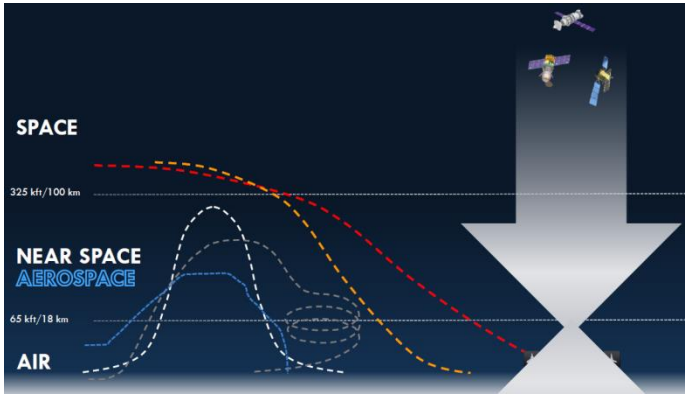
Background

- Commercial Suborbital Flight
- Max altitude >100km,usually 35-300km
- Provide suborbital flight service
- For commercial profit
- Different from government space activities mostly operated by private companies



Background

- Remarkable points

✓ High Risk

✓ Huge investment

✓ Attractive returns or reward

Typical programmes

- Commercial suborbital flight industry is becoming more and more popular recently

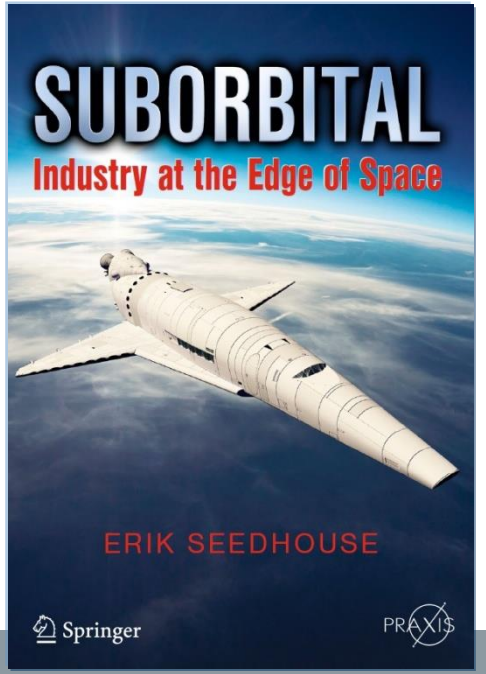
Company	SRLV	Seats	Locker equivalents	Cargo (Kg)	Price	Operational date
UP Aerospace	SpaceLoft XL		0.5	36	$360k/launch	2006
Armadillo	STIG A		1	10		2012
Aerospace	STIG B		2	50	Not announced	2013
	Hyperion	2	12	200	$120k/seat	2014
XCOR	Lynx Mark I	1	3	120	$95k/seat	2013
Aerospace	Lynx Mark II	1	3	120	$95k/seat	2013
	Lynx Mark III	1	28	770	$95k/seat	2017
Virgin Galactic	SpaceShip Two	6	36	600	$200k/seat	2014
Masten Space Systems	Xaero Xogdor		4	25	Not announced	2013
Blue Origin	New Shepard	3+	5	120	Not announced	Not announced

Typical Suborbital spacecraft

Typical programmes

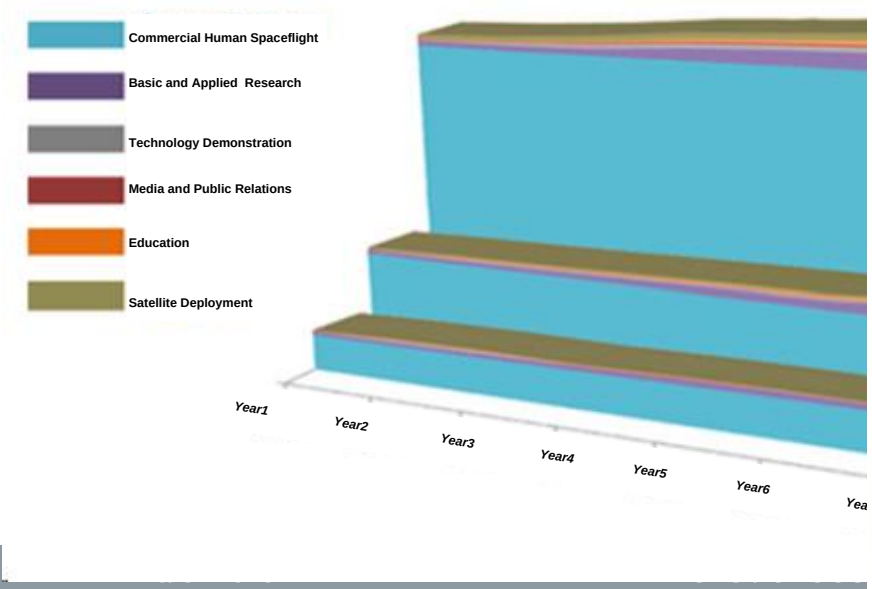
- Multiple Application

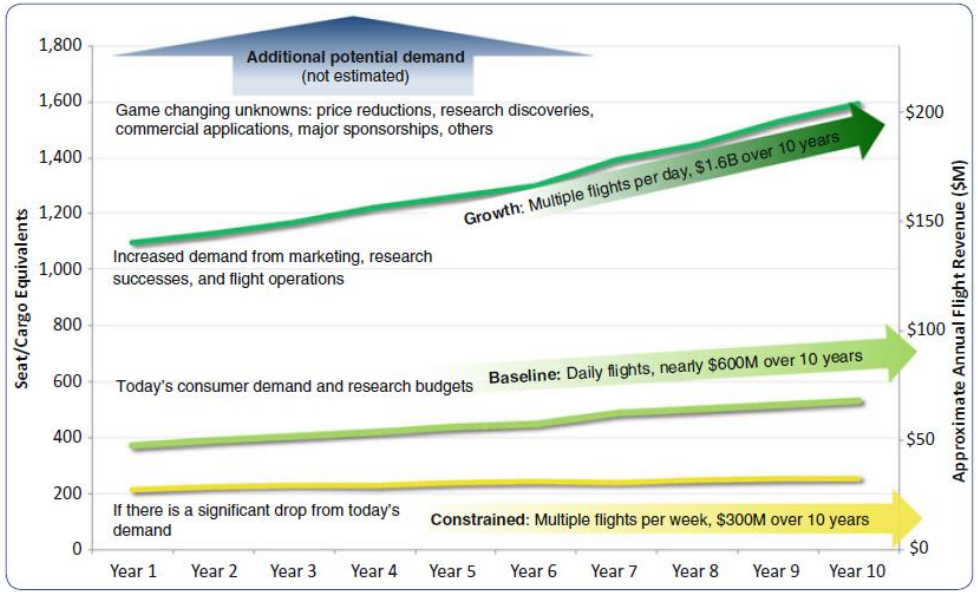
Commercial Spaceflight	Basic and Applied Research
Human spaceflight experience for tourism or training	Basic and applied research (Biological, physical, earth science, human research)
Aerospace Technology Test and Demonstration	**Media and Public Relations**
Aerospace engineering to advance technology maturity, achieve space demonstration	Film and television, media advertising, public relation and outreach, space novelties and memorabilia
Education	**Satellite Deployment**
Providing opportunities to K-12 schools, colleges and universities access to and awareness of space	The use of SRLV to launch small payload into orbit
Remote Sensing	**Point-to-point Transportation**
Acquisition of imagery of earth systems for commercial, civil government or military application	Future transportation of cargo or humans between different location



Typical programmes

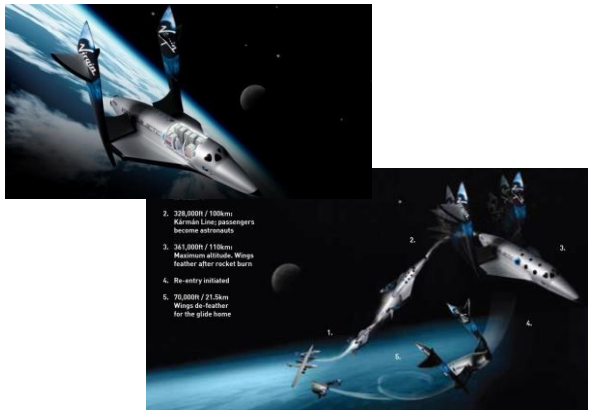
- Extremely attractive potential revenue



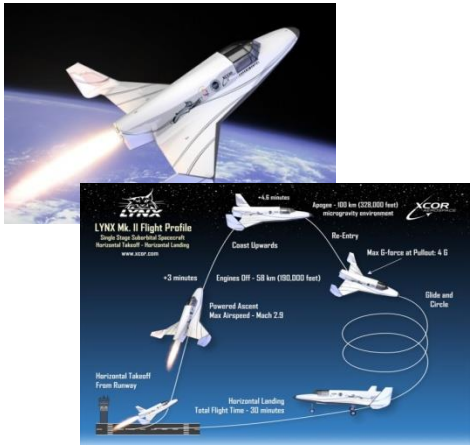


Typical programmes

- Suborbital tourism programme



Virgin Galactic SS2

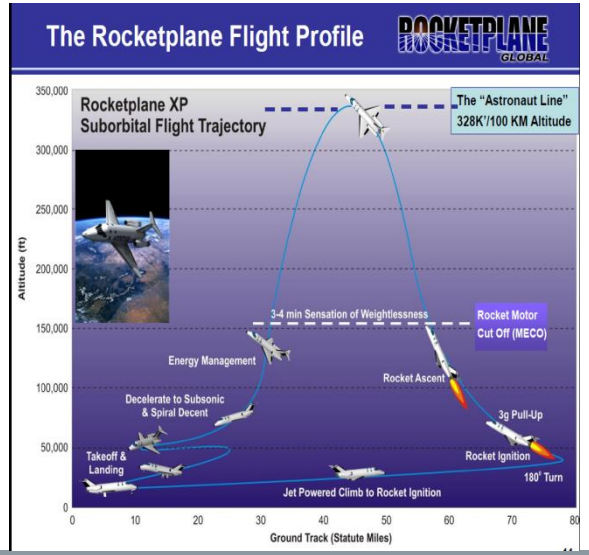


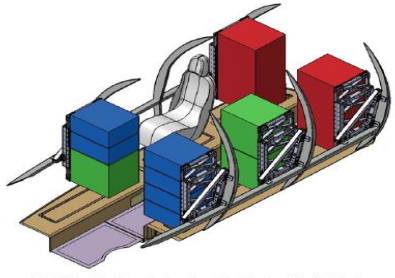
XCOR Lynx

Blue Origin New Shepard

Typical programmes

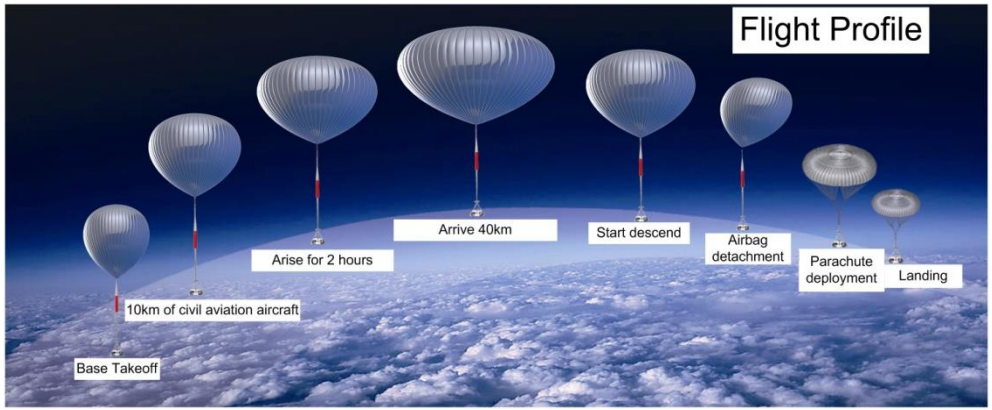
- Other Commercial Service

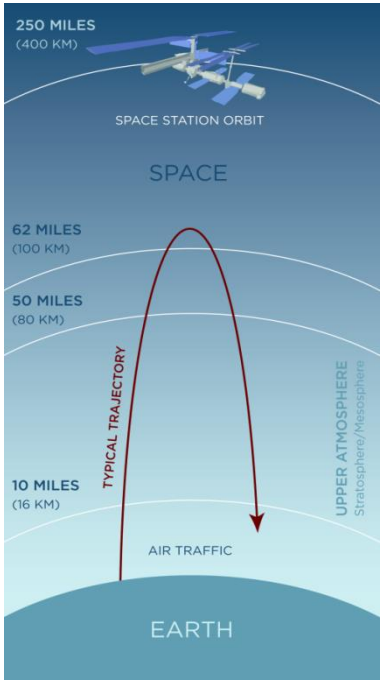




Spacecraft alternatives in China

- Suborbital Balloon Ride





Operation License

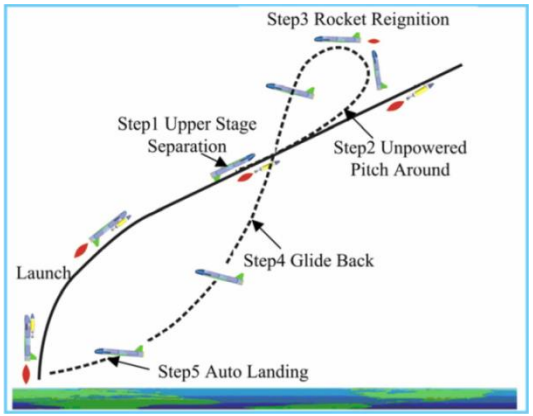
Spacecraft alternatives in China

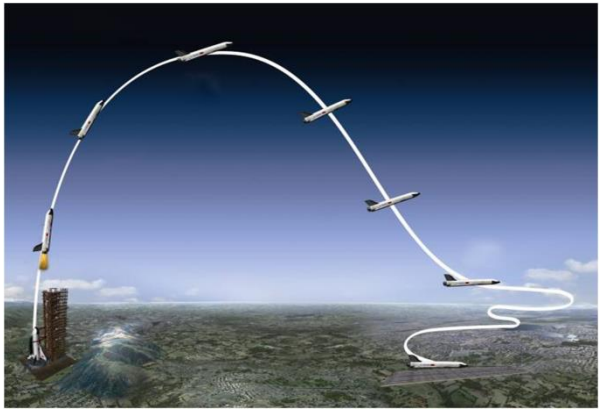
- Suborbital Balloon Ride

Spacecraft alternatives in China

- Rocket Powered Suborbital Vehicle

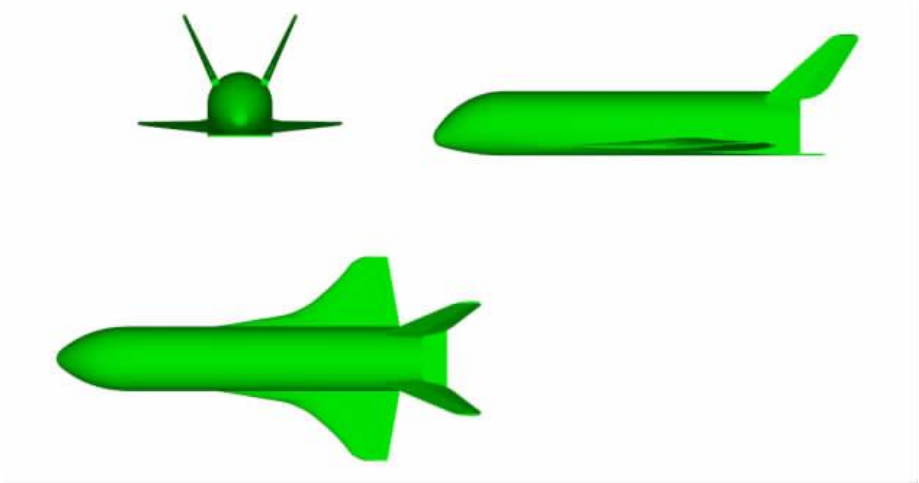
More quickly, low cost, on response into space and back safely, commercial operate

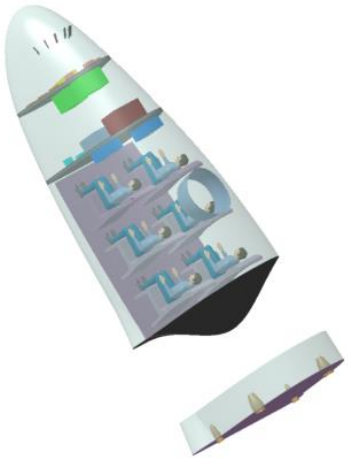




Spacecraft alternatives in China

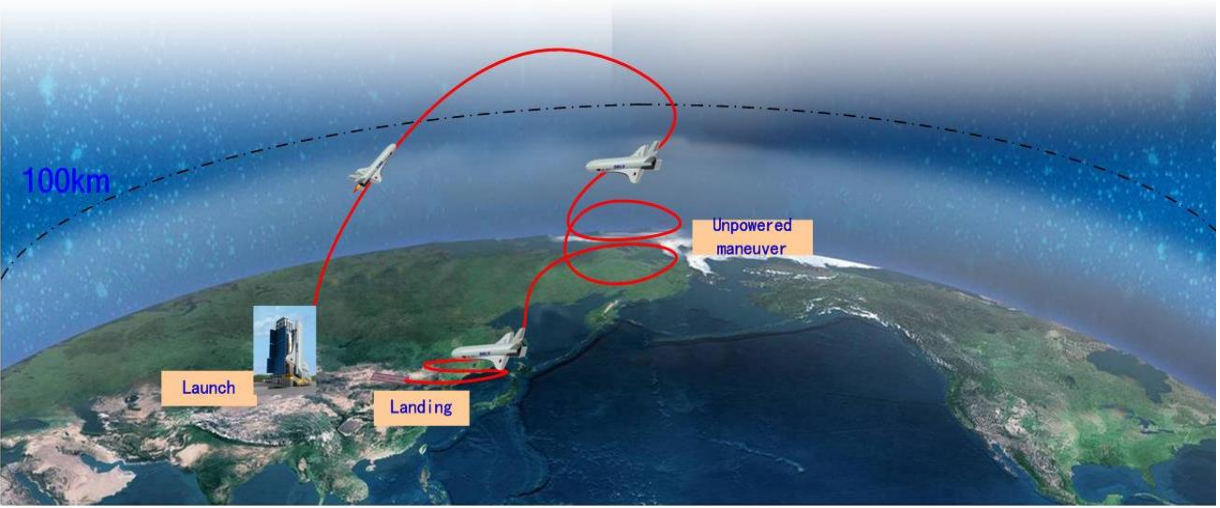
- Rocket Powered Suborbital Vehicle for tourism





Spacecraft alternatives in China

- Rocket Powered Suborbital Vehicle for tourism



Launch Weight	100t	10t
Reuse time	>50	>50
Tourist number	6-20	3-5
Altitude(km)	120-140	60-80
Mach Number	7-8	5-6

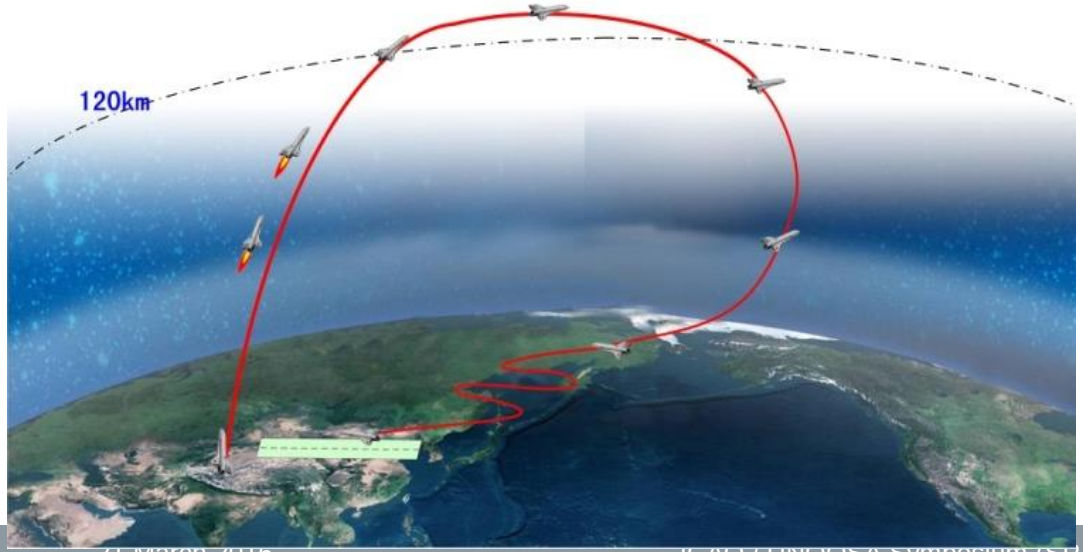
Spacecraft alternatives in China

- Rocket Powered Suborbital Vehicle for commercial launch

- ✓ As reusable booster
- ✓ Flyback to launch site autonomously
- ✓ Reduce launch cost significantly

Spacecraft alternatives in China

- Rocket Powered Suborbital Vehicle for commercial



	SRLV+ Small upstage	2 SRLV+ Core stage
SSO	500kg	1t
LEO	1t	2.2t
Launch cost	$3870k	$6450k

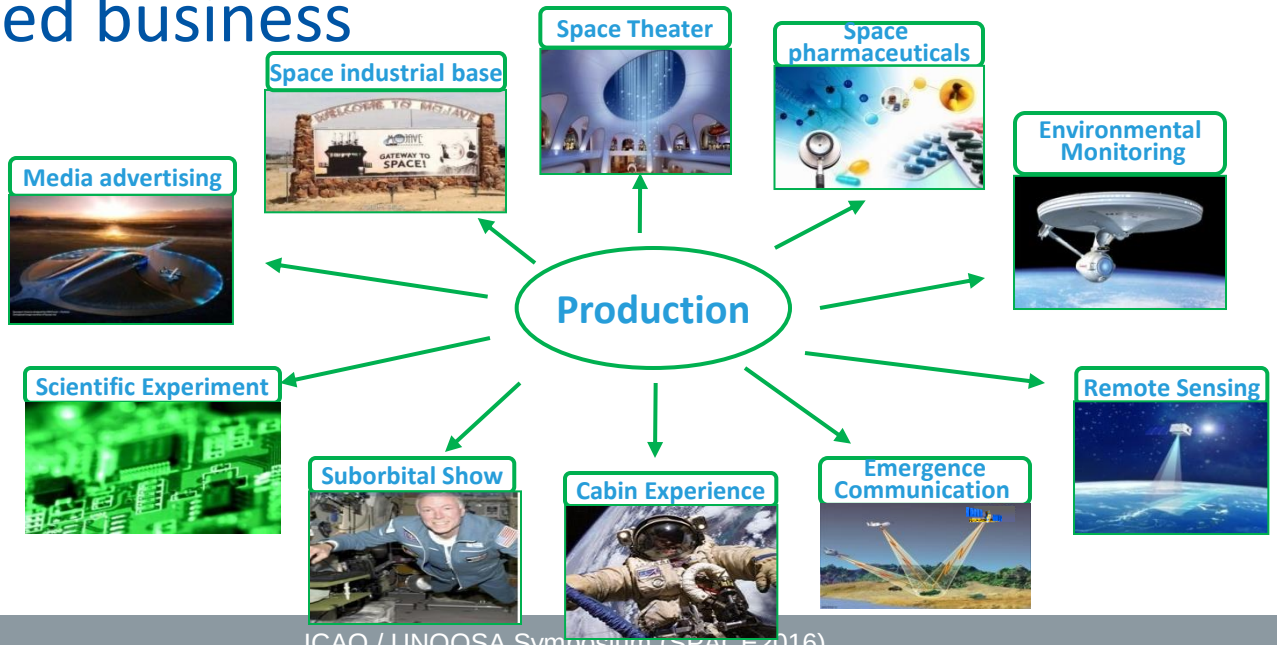
Spacecraft alternatives in China

- Extended business

- Suborbital tourism
- sky diving
- Tourist driving
- Suborbital show
- Suborbital culture garden
- Suborbital tourism business base
- Media advertising
- Science test
- Earth observation
- Telecommunication
- Remote sensing
- Suborbital flight training
- Hypersonic test
- Space rescue
- Emergence communication
- Security guarantee

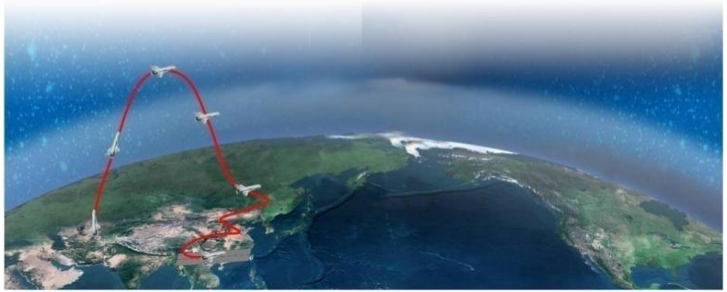
Spacecraft alternatives in China

- Extended business

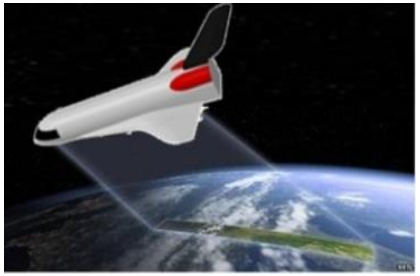


Spacecraft alternatives in China

- Commercial Suborbital flight



✓Rapid and low cost into space
✓Suborbital environment research
✓Emergency sensing
✓Low cost scientific research



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THANK YOU

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