

# NEWTON'S 2<sup>ND</sup> LAW

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## Space Plan From China Broadens Challenge to U.S.

BEIJING — Broadening its challenge to the United States, the Chinese government on Thursday announced an ambitious [five-year plan for space exploration](#) that would move [China](#) closer to becoming a major rival at a time when the American program is in retreat.



**INTRODUCTION:** The liftoff mass and thrust are Listed in the table below and on the graphic at left.

**QUESTIONS:** (a) What is the gross mass (in kg) at liftoff? (b) What is the gross weight(in N) at liftoff? (c) What is the net force up on this china Rocket called the Long March? (d) What is the Liftoff acceleration of this rocket? (e) 10 seconds from liftoff what was the speed of the rocket? (f) 10 seconds from liftoff what was the distance traveled by the rocket?

**ANSWERS:** (a) 254,000 kg, (b) 2,489,200 N, (c) 481,800 N, (d)  $\sim 1.9 \text{ m/s}^2$ , (e)  $\sim 19 \text{ m/s}$ , (f)  $\sim 95 \text{ m}$

$2.971 \times 10^6 \text{ N. thrust up}$

$254 \text{ t} = \text{liftoff mass, } t = 1000 \text{ kg}$

A rocket carrying a Nigerian communication satellite blasted off at the (((((Xichang Satellite Launch Center)))))) in China's Sichuan Province on Dec. 20. ,2011

In 2003, China became the third country to send a human into space, behind the United States and the Soviet Union, when it put Yang Liwei into orbit around the earth. It launched a lunar probe in 2007 that orbited the moon and took pictures, and the next year completed its first spacewalk when Zhai Zhigang remained for 13 minutes outside the Shenzhou 7 spacecraft. **China's Long March 5 rocket**, currently under development, **would be able to lift about 25 tons to low-earth orbit**, comparable to the United States' Delta IV Heavy rocket and much smaller than the Saturn V rocket that launched the Apollo spacecraft to the moon four decades ago. **But that would be enough for China to get to the moon by launching its lunar spacecraft in pieces and assembling it in the earth's orbit.**

Model	Status	Stages	Length (m)	Max. diameter (m)	Liftoff mass (t)	Liftoff thrust (kN)	Payload (LEO, kg)	Payload (GTO, kg)
<a href="#">Long March 6</a> <sup>[12][13]</sup>	In development	3						(SSO) 500
<a href="#">Long March 5</a> <sup>[7][8]</sup>	In development <sup>[9][10][11]</sup>	3	N/A	N/A	N/A	N/A	25,000	14,000
<a href="#">Long March 4C</a>	Active	3		3.35		2,971?	4,200	(SSO) 2,800
<b><a href="#">Long March 5B</a></b>	<b>Active</b>	<b>3</b>	<b>44.1</b>	<b>3.8</b>	<b>254</b>	<b>2,971</b>	<b>4,200</b>	(SSO) 2,200
<a href="#">Long March 4A</a>	Retired	3	41.9	3.35	249	2,962	4,000	(SSO) 1,500