BECOMING A MULTIPLANET SPECIES
“You want to wake up in the morning and think the future is going to be great - and that’s what being a spacefaring civilization is all about. It’s about believing in the future and thinking that the future will be better than the past. And I can’t think of anything more exciting than going out there and being among the stars.”

Elon Musk, CEO and Lead Designer, SpaceX
PROGRESS
DEEP CRYO LIQUID OXYGEN TANK TESTING

Pressure tested to 2.3 atmospheres
Carbon fiber matrix
Volume 1000m$^3$
Holds 1200 tons of liquid oxygen
ENGINE TESTING

Over 1200 seconds of firing across 42 main engine tests

Longest test 100 seconds; 40 seconds typical for Mars landing

Test engine operates at up to 200 atmospheres
PERFECTING PROPULSIVE LANDING

18 successful Falcon 9 landings as of 10/15/2017

Very high reliability demonstrated with single engine landings

Precision landing will allow for return to launch mount, no landing legs needed
Demonstrated automated rendezvous and docking to space station with Dragon 1

Dragon 2 will dock directly, not needing use of Canadarm

Perfected heat shield technology to withstand extremely high reentry temperatures
BFR OVERVIEW

By creating a single system that can service a variety of needs, we can redirect resources from Falcon 9, Falcon Heavy and Dragon to this system—which is fundamental in making BFR affordable.

Vehicle Length: 106 m
Booster Length: 58 m
Booster Thrust: 52,700 kN
BFR

Ship Length: 48 m
Body Diameter: 9 m

Ship Dry Mass: 85 t
Propellant Mass: 1,100 t

Max Ascent Payload: 150 t
Typical Return Payload: 50 t
PRESSURIZED VOLUME  825 m³  
Greater than an A380 main deck

MARS TRANSIT CONFIGURATION

40 cabins and large common areas
Central storage, galley and solar storm shelter
RAPTOR ENGINES
Chamber pressure 250 bar
Throttle 20% to 100% thrust

2 SEA-LEVEL ENGINES
Exit Diameter 1.3 m
Thrust (SL) 1,700 kN
Isp (SL) 330 s
Isp (Vac) 356 s

4 VACUUM ENGINES
Exit Diameter 2.4 m
Thrust 1,900 kN
Isp 375 s
REFILLING
Propellant settled by milli-g acceleration using control thrusters
ROCKET CAPABILITY
PAYLOAD TO LOW EARTH ORBIT IN TONS

BFR has larger payload capacity than a Saturn V, while being fully reusable.
LAUNCH COST

MARGINAL COST PER LAUNCH ACCOUNTING FOR REUSABILITY

Due to full reusability, BFR provides lowest marginal cost per launch, despite vastly higher capacity than existing vehicles.
VALUE OF REFILLING
SINGLE LAUNCH CAPABILITY FROM EARTH ORBIT

SHIP FLIES INTO EARTH ORBIT

BOOSTER ACCELERATES SHIP & RETURNS TO LAUNCH SITE

DELTA-V BEYOND LEO [km/s]

TOTAL PAYLOAD MASS [t]
VALUE OF REFILLING
FULL TANKS

TANKERS COMPLETELY FILL
SHIP & RETURN TO EARTH

DELTAV WITH FULL TANKS [km/s]

TOTAL PAYLOAD MASS [t]
INTERNATIONAL SPACE STATION
LUNAR SURFACE MISSIONS

SHIP LANDS ON MOON WITH SUFFICIENT PROPELLANT TO RETURN DIRECTLY TO EARTH

ELLIPITIC ORBIT PROP TRANSFER

TRANS-LUNAR INJECTION

O₂ CH₄
MISSIONS TO MARS
MARS TRANSPORTATION ARCHITECTURE

1. Booster accelerates ship/tanker & returns to launch site
2. Ship flies into Earth orbit
3. Tankers refill ship & return to Earth
4. Refilled ship travels to Mars
5. Ship refilled on Mars using local resources
6. Ship performs Mars ascent & direct return to Earth
MARS ENTRY AND LANDING

Hyperbolic entry at up to 7.5 km/s

Leverages ablative heat shield materials developed for Dragon vehicles

Peak acceleration of 5 g’s (Earth referenced)

Over 99% of energy removed aerodynamically

Supersonic retropropulsion for landing burn

WATCH ANIMATION
INITIAL MARS MISSION GOALS

2022: CARGO MISSIONS

- Land at least 2 cargo ships on Mars
- Confirm water resources and identify hazards
- Place power, mining and life support infrastructure for future flights

2024: CARGO & CREW MISSIONS

- 2 crew ships take first people to Mars
- 2 cargo ships bring more equipment and supplies
- Set up propellant production plant
- Build up base to prepare for expansion
EARTH TO EARTH TRANSPORTATION

BFR has the ability to support Earth to Earth transport, with most of what people consider to be long distance trips being completed in less than half an hour.

Consider how much time we currently spend traveling from one place to another. Now imagine most journeys taking less than 30 minutes, with access to anywhere in the world in an hour or less.
WATCH EARTH TO EARTH FILM