SpaceX Falcon 9 first stage Landing Prediction

Lab 1: Collecting the data

Estimated time needed: **45** minutes

In this capstone, we will predict if the Falcon 9 first stage will land successfully. SpaceX advertises Falcon 9 rocket launches on its website with a cost of 62 million dollars; other providers cost upward of 165 million dollars each, much of the savings is because SpaceX can reuse the first stage. Therefore if we can determine if the first stage will land, we can determine the cost of a launch. This information can be used if an alternate company wants to bid against SpaceX for a rocket launch. In this lab, you will collect and make sure the data is in the correct format from an API. The following is an example of a successful and launch.

Several examples of an unsuccessful landing are shown here:

Most unsuccessful landings are planned. Space X performs a controlled landing in the oceans.

Objectives

In this lab, you will make a get request to the SpaceX API. You will also do some basic data wrangling and formating.

- Request to the SpaceX API
- Clean the requested data

Import Libraries and Define Auxiliary Functions

We will import the following libraries into the lab

```
In [1]: # Requests allows us to make HTTP requests which we will use to get data fro
        import requests
        # Pandas is a software library written for the Python programming language f
        import pandas as pd
        # NumPy is a library for the Python language, adding support for
        import numpy as np
        # Datetime is a library that allows us to represent dates
        import datetime

        # Setting this option will print all collumns of a dataframe
        pd.set_option('display.max_columns', None)
        # Setting this option will print all of the data in a feature
        pd.set_option('display.max_colwidth', None)
```

Below we will define a series of helper functions that will help us use the API to extract information using identification numbers in the launch data.

From the `rocket` column we would like to learn the booster name.

```
In [2]:    # Takes the dataset and uses the rocket column to call the API and append th
           def getBoosterVersion(data):
               for x in data['rocket']:
                   if x:
                     response = requests.get("https://api.spacexdata.com/v4/rockets/"+str
                     BoosterVersion.append(response['name'])
```

From the `launchpad` we would like to know the name of the launch site being used, the logitude, and the latitude.

```
In [3]:    # Takes the dataset and uses the launchpad column to call the API and append
           def getLaunchSite(data):
               for x in data['launchpad']:
                   if x:
                       response = requests.get("https://api.spacexdata.com/v4/launchpads/"
                       Longitude.append(response['longitude'])
                       Latitude.append(response['latitude'])
                       LaunchSite.append(response['name'])
```

From the `payload` we would like to learn the mass of the payload and the orbit that it is going to.

```
In [4]:    # Takes the dataset and uses the payloads column to call the API and append
           def getPayloadData(data):
               for load in data['payloads']:
                   if load:
                     response = requests.get("https://api.spacexdata.com/v4/payloads/"+lo
                     PayloadMass.append(response['mass_kg'])
                     Orbit.append(response['orbit'])
```

From `cores` we would like to learn the outcome of the landing, the type of the landing, number of flights with that core, whether gridfins were used, wheter the core is reused, wheter legs were used, the landing pad used, the block of the core which is a number used to seperate version of cores, the number of times this specific core has been reused, and the serial of the core.

```
In [5]:    # Takes the dataset and uses the cores column to call the API and append the
           def getCoreData(data):
               for core in data['cores']:
                       if core['core'] != None:
                           response = requests.get("https://api.spacexdata.com/v4/cores
                           Block.append(response['block'])
                           ReusedCount.append(response['reuse_count'])
                           Serial.append(response['serial'])
                       else:
                           Block.append(None)
                           ReusedCount.append(None)
                           Serial.append(None)
                       Outcome.append(str(core['landing_success'])+' '+str(core['landir
                       Flights.append(core['flight'])
                       GridFins.append(core['gridfins'])
```

```
            Reused.append(core['reused'])
            Legs.append(core['legs'])
            LandingPad.append(core['landpad'])
```

Now let's start requesting rocket launch data from SpaceX API with the following URL:

In [6]:
```
spacex_url="https://api.spacexdata.com/v4/launches/past"
```

In [7]:
```
response = requests.get(spacex_url)
```

Check the content of the response

In [8]:
```
print(response.content)
```

b'[{"fairings":{"reused":false,"recovery_attempt":false,"recovered":false,"sh
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-fails-reach-orbit.html","wikipedia":"https://en.wikipedia.org/wiki/DemoSa
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nd stage, maximum altitude 289 km, Premature engine shutdown at T+7 min 30 s,
Failed to reach orbit, Failed to recover first stage","crew":[],"ships":[],"c
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news/2013/02/11/falcon-1-flight-3-mission-summary","wikipedia":"https://en.wi
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with improved 13-tonne to LEO capacity. Following second-stage separation fro
m the first stage, an attempt was made to perform an ocean touchdown test of
the discarded booster vehicle. The test provided good test data on the experi
ment-its primary objective-but as the booster neared the ocean, aerodynamic f
orces caused an uncontrollable roll. The center engine, depleted of fuel by c
entrifugal force, shut down resulting in the impact and destruction of the ve
hicle.","crew":[],"ships":["5ea6ed2d080df4000697c903"],"capsules":[],"payload
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e":"https://www.nasaspaceflight.com/2013/12/spacex-falcon-9-v1-1-milestone-se
s-8-launch/","wikipedia":"https://en.wikipedia.org/wiki/SES-8"},"static_fire_
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m/38959spacex-delivers-thaicom-6-satellite-to-orbit/","wikipedia":"https://e
n.wikipedia.org/wiki/Thaicom_6"},"static_fire_date_utc":"2013-12-28T00:00:00.
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nch for Falcon 9. The USAF evaluated launch data from this flight as part of
a separate certification program for SpaceX to qualify to fly U.S. military p
ayloads and found that the Thaicom 6 launch had \\"unacceptable fuel reserves
at engine cutoff of the stage 2 second burnoff\\"","crew":[],"ships":[],"caps
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pacex/31671/","wikipedia":"https://en.wikipedia.org/wiki/SpaceX_CRS-3"},"stat
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e,"failures":[],"details":"Following second-stage separation, SpaceX conducte
d a second controlled-descent test of the discarded booster vehicle and achie
ved the first successful controlled ocean touchdown of a liquid-rocket-engine

orbital booster. Following touchdown the first stage tipped over as expected and was destroyed. This was the first Falcon 9 booster to fly with extensible landing legs and the first Dragon mission with the Falcon 9 v1.1 launch vehicle.","crew":[],"ships":["5ea6ed2d080df4000697c902"],"capsules":["5e9e2c5bf3591859a63b2668"],"payloads":["5eb0e4bbb6c3bb0006eeb1f1"],"launchpad":"5e9e4501f509094ba4566f84","flight_number":14,"name":"CRS-3","date_utc":"2014-04-18T19:25:00.000Z","date_unix":1397849100,"date_local":"2014-04-18T15:25:00-04:00","date_precision":"hour","upcoming":false,"cores":[{"core":"5e9e289ff3591829343b2630","flight":1,"gridfins":false,"legs":true,"reused":false,"landing_attempt":true,"landing_success":true,"landing_type":"Ocean","landpad":null}],"auto_update":true,"tbd":false,"launch_library_id":null,"id":"5eb87ce4ffd86e000604b337"},{"fairings":{"reused":false,"recovery_attempt":false,"recovered":false,"ships":[]},"links":{"patch":{"small":"https://images2.imgbox.com/a4/44/YWAUBkOe_o.png","large":"https://images2.imgbox.com/fd/41/FUnfqHHH_o.png"},"reddit":{"campaign":null,"launch":"http://www.reddit.com/r/spacex/comments/2aany2","media":null,"recovery":null},"flickr":{"small":[],"original":["https://farm8.staticflickr.com/7585/16602893909_1181317089_o.jpg","https://farm9.staticflickr.com/8747/16581738577_83e0690136_o.png","https://farm8.staticflickr.com/7285/16581736047_6fd536ab11_o.jpg","https://farm8.staticflickr.com/7597/16789021675_35f0148f78_o.jpg","https://farm8.staticflickr.com/7631/16236321533_829ae07b42_o.jpg","https://farm9.staticflickr.com/8726/16830422056_26c2265bbc_o.jpg","https://farm9.staticflickr.com/8591/16670149079_33d6cc3631_o.jpg"]},"presskit":"http://www.spacex.com/sites/spacex/files/spacex_orbcomm_presskit_final.pdf","webcast":"https://www.youtube.com/watch?v=lbHnSu-DLR4","youtube_id":"lbHnSu-DLR4","article":"https://www.orbcomm.com/en/networks/satellite/orbcomm-og2","wikipedia":"https://en.wikipedia.org/wiki/Falcon_9_flight_10"},"static_fire_date_utc":"2015-12-19T04:57:00.000Z","static_fire_date_unix":1450501020,"net":false,"window":0,"rocket":"5e9d0d95eda69973a809d1ec","success":true,"failures":[],"details":"Total payload mass was 1,316 kg (2,901 lb) : 6 satellites weighing 172 kg each, plus two 142-kg mass simulators. This was the second Falcon 9 booster equipped with landing legs. Following second-stage separation, SpaceX conducted a controlled-descent test of the first stage, which successfully decelerated from\xc2\xa0hypersonic velocity in the upper atmosphere, made reentry and landing burns, deployed its legs and touched down on the ocean surface. As with the previous mission, the first stage then tipped over as expected and was not recovered.","crew":[],"ships":[],"capsules":[],"payloads":["5eb0e4bcb6c3bb0006eeb1f2"],"launchpad":"5e9e4501f509094ba4566f84","flight_number":15,"name":"OG-2 Mission 1","date_utc":"2014-07-14T15:15:00.000Z","date_unix":1405350900,"date_local":"2014-07-14T11:15:00-04:00","date_precision":"hour","upcoming":false,"cores":[{"core":"5e9e28a0f3591870a63b2631","flight":1,"gridfins":false,"legs":true,"reused":false,"landing_attempt":true,"landing_success":true,"landing_type":"Ocean","landpad":null}],"auto_update":true,"tbd":false,"launch_library_id":null,"id":"5eb87ce4ffd86e000604b338"},{"fairings":{"reused":false,"recovery_attempt":false,"recovered":false,"ships":[]},"links":{"patch":{"small":"https://images2.imgbox.com/dd/4d/szidadu8_o.png","large":"https://images2.imgbox.com/60/3f/hwK01Qce_o.png"},"reddit":{"campaign":null,"launch":"http://www.reddit.com/r/spacex/comments/2fenrv","media":null,"recovery":null},"flickr":{"small":[],"original":["https://farm9.staticflickr.com/8638/16855192031_962f7b1113_o.jpg","https://farm8.staticflickr.com/7603/16648925347_769a6009c7_o.jpg","https://farm9.staticflickr.com/8687/16789027675_cde1bd098a_o.jpg","https://farm8.staticflickr.com/7629/16668638138_7acf13cfb5_o.jpg","https://farm8.staticflickr.com/7281/16668845950_7680146525_o.jpg","https://farm8.staticflickr.com/7626/16233865484_10d9925b5d_o.jpg"]},"presskit":"https://spaceflightnow.com/falcon9/011/presskit.pdf","webcast":"https://www.youtube.com/watch?v=essrkMGlw5s","youtube_id":"essrkMGlw5s","article":"http://spacenews.com/41497spacex-launches-first-of-two-satellit

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RS-4_PressKit.pdf","webcast":"https://www.youtube.com/watch?v=7YkCh7uOw1Y","y
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r/nasa-cargo-launches-to-space-station-aboard-spacex-resupply-mission-0","wik
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x-SumbynI","youtube_id":"p7x-SumbynI","article":"https://spaceflightnow.com/2
015/01/10/dragon-successfully-launched-rocket-recovery-demo-crash-lands/","wi
kipedia":"https://en.wikipedia.org/wiki/SpaceX_CRS-5"},"static_fire_date_ut
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ht which attempted to return the first stage of the Falcon 9 through the atmo
sphere and land it on an approximately 90-by-50-meter (300 ft x 160 ft) float
ing platform-called the autonomous spaceport drone ship. Many of the test obj
ectives were achieved, including precision control of the rocket\'s descent t
o land on the platform at a specific point in the Atlantic ocean, and a large
amount of test data was obtained from the first use of grid fin control surfa
ces used for more precise reentry positioning. The grid fin control system ra
n out of hydraulic fluid a minute before landing and the landing itself resul
ted in a crash.","crew":[],"ships":["5ea6ed2e080df4000697c906","5ea6ed2f080df
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now.com/2015/02/12/space-weather-observatory-blasts-off-after-17-year-wai
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y"},"static_fire_date_utc":"2015-01-31T00:00:00.000Z","static_fire_date_uni
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ltitude many times the distance to the Moon: Sun-Earth libration point L1. Th
e first stage made a test flight descent to an over-ocean landing within 10 m
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s://www.reddit.com/r/spacex/comments/2xmumx","recovery":null},"flickr":{"smal
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ttps://farm9.staticflickr.com/8641/16490359747_c043b8c61a_o.jpg","https://far
m9.staticflickr.com/8636/16510241270_ca83157509_o.jpg","https://farm8.staticf
lickr.com/7618/16601658850_13b826e705_o.jpg","https://farm9.staticflickr.com/
8617/16510041628_883af57512_o.jpg"]},"presskit":"http://www.spacex.com/sites/
spacex/files/abs-eutelsatfactsheet.pdf","webcast":"https://www.youtube.com/wa
tch?v=mN7lyaCBzT8","youtube_id":"mN7lyaCBzT8","article":"https://www.space.co
m/28702-spacex-rocket-launches-satellites-video.html","wikipedia":"https://e
n.wikipedia.org/wiki/ABS-3A"},"static_fire_date_utc":"2015-02-25T19:10:00.000
Z","static_fire_date_unix":1424891400,"net":false,"window":0,"rocket":"5e9d0d
95eda69973a809d1ec","success":true,"failures":[],"details":"The launch was Bo
eing\'s first-ever conjoined launch of a lighter-weight dual-commsat stack th
at was specifically designed to take advantage of the lower-cost SpaceX Falco
n 9 launch vehicle. Per satellite, launch costs were less than $30 million. T
he ABS satellite reached its final destination ahead of schedule and started
operations on September 10.","crew":[],"ships":[],"capsules":[],"payloads":
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f509094ba4566f84","flight_number":21,"name":"ABS-3A / Eutelsat 115W B","date_
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02T23:50:00-04:00","date_precision":"hour","upcoming":false,"cores":[{"cor
e":"5e9e28a0f35918c0893b2637","flight":1,"gridfins":false,"legs":false,"reuse
d":false,"landing_attempt":false,"landing_success":null,"landing_type":nul
l,"landpad":null}],"auto_update":true,"tbd":false,"launch_library_id":null,"i
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kr.com/7658/17170624462_2efc977fee_o.jpg","https://farm8.staticflickr.com/761
1/17171659711_42597fefed_o.jpg","https://farm9.staticflickr.com/8774/17170624
412_7091dbd04a_o.jpg"]},"presskit":"https://www.nasa.gov/sites/default/files/
files/SpaceX_NASA_CRS-6_PressKit.pdf","webcast":"https://www.youtube.com/watc
h?v=csVpa25iqH0","youtube_id":"csVpa25iqH0","article":"https://spaceflightno

w.com/2015/04/14/falcon-9-successfully-launches-descends-to-off-balance-landi
ng/","wikipedia":"https://en.wikipedia.org/wiki/SpaceX_CRS-6"},"static_fire_d
ate_utc":"2015-04-11T00:00:00.000Z","static_fire_date_unix":1428710400,"net":
false,"window":0,"rocket":"5e9d0d95eda69973a809d1ec","success":true,"failure
s":[],"details":"Following the first-stage boost, SpaceX attempted a controll
ed-descent test of the first stage. The first stage contacted the ship, but s
oon tipped over due to excess lateral velocity caused by a stuck throttle val
ve resulting in a later-than-intended downthrottle.","crew":[],"ships":["5ea6
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c","5ea6ed2f080df4000697c90f","5ea6ed30080df4000697c912"],"capsules":["5e9e2c
5cf359188bfb3b266b"],"payloads":["5eb0e4bdb6c3bb0006eeb1fa"],"launchpad":"5e9
e4501f509094ba4566f84","flight_number":22,"name":"CRS-6","date_utc":"2015-04-
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4:00","date_precision":"hour","upcoming":false,"cores":[{"core":"5e9e28a1f359
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32383ecb761634e7cb"}],"auto_update":true,"tbd":false,"launch_library_id":nul
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mpt":false,"recovered":false,"ships":[]},"links":{"patch":{"small":"https://i
mages2.imgbox.com/a6/9b/IzWT1pYC_o.png","large":"https://images2.imgbox.com/a
1/dc/grsyEfA5_o.png"},"reddit":{"campaign":null,"launch":"https://www.reddit.
com/r/spacex/comments/33xqcj","media":"https://www.reddit.com/r/spacex/commen
ts/3439s3","recovery":null},"flickr":{"small":[],"original":["https://farm8.s
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r.com/7677/16706406093_61a8f9c2f8_o.jpg","https://farm8.staticflickr.com/769
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400_b94ce1ff56_o.jpg","https://farm9.staticflickr.com/8739/17140415959_38b5ee
8bc6_o.jpg","https://farm8.staticflickr.com/7735/16704192574_e3a0a6fac2_o.jp
g"]},"presskit":"http://www.spacex.com/sites/spacex/files/spacexthalesfactshe
et_final.pdf","webcast":"https://www.youtube.com/watch?v=nBwAYT_ogj4","youtub
e_id":"nBwAYT_ogj4","article":"https://spaceflightnow.com/2015/04/28/falcon-9
-rocket-powers-into-space-with-satellite-for-turkmenistan/","wikipedia":"http
s://en.wikipedia.org/wiki/T%C3%BCrkmen%C3%84lem_52%C2%B0E_/_MonacoSAT"},"stat
ic_fire_date_utc":"2015-04-22T11:11:00.000Z","static_fire_date_unix":14297010
60,"net":false,"window":0,"rocket":"5e9d0d95eda69973a809d1ec","success":tru
e,"failures":[],"details":null,"crew":[],"ships":[],"capsules":[],"payloads":
["5eb0e4beb6c3bb0006eeb1fb"],"launchpad":"5e9e4501f509094ba4566f84","flight_n
umber":23,"name":"T\xc3\xbcrkmen\xc3\x84lem 52\xc2\xb0E / MonacoSAT","date_ut
c":"2015-04-27T23:03:00.000Z","date_unix":1430175780,"date_local":"2015-04-27
T19:03:00-04:00","date_precision":"hour","upcoming":false,"cores":[{"core":"5
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lse,"landing_attempt":false,"landing_success":null,"landing_type":null,"landp
ad":null}],"auto_update":true,"tbd":false,"launch_library_id":null,"id":"5eb8
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a/51/NfgiMpar_o.png"},"reddit":{"campaign":null,"launch":"https://www.reddit.
com/r/spacex/comments/3b27hk","media":"https://www.reddit.com/r/spacex/commen
ts/3berj3","recovery":null},"flickr":{"small":[],"original":["https://farm1.s
taticflickr.com/344/19045370790_f20f29cd8d_o.jpg","https://farm1.staticflick
r.com/287/18999110808_6e153fed64_o.jpg"]},"presskit":"https://www.nasa.gov/si
tes/default/files/atoms/files/spacex_nasa_crs-7_presskit.pdf","webcast":"http
s://www.youtube.com/watch?v=PuNymhcTtSQ","youtube_id":"PuNymhcTtSQ","articl
e":"https://spaceflightnow.com/2015/06/28/falcon-9-rocket-destroyed-in-launch
-mishap/","wikipedia":"https://en.wikipedia.org/wiki/SpaceX_CRS-7"},"static_f
ire_date_utc":"2015-06-26T05:00:00.000Z","static_fire_date_unix":143529480
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e,"failures":[{"time":139,"altitude":40,"reason":"helium tank overpressure le
ad to the second stage LOX tank explosion"}],"details":"Launch performance wa
s nominal until an overpressure incident in the second-stage LOX tank, leadin
g to vehicle breakup at T+150 seconds. The Dragon capsule survived the explos
ion but was lost upon splashdown because its software did not contain provisi
ons for parachute deployment on launch vehicle failure.","crew":[],"ships":
["5ea6ed2e080df4000697c906","5ea6ed2f080df4000697c90b","5ea6ed2f080df4000697c
90c"],"capsules":["5e9e2c5cf35918407d3b266c"],"payloads":["5eb0e4beb6c3bb0006
eeb1fc"],"launchpad":"5e9e4501f509094ba4566f84","flight_number":24,"name":"CR
S-7","date_utc":"2015-06-28T14:21:00.000Z","date_unix":1435501260,"date_loca
l":"2015-06-28T10:21:00-04:00","date_precision":"hour","upcoming":false,"core
s":[{"core":"5e9e28a1f35918683c3b263a","flight":1,"gridfins":true,"legs":tru
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e":"ASDS","landpad":"5e9e3032383ecb6bb234e7ca"}],"auto_update":true,"tbd":fal
se,"launch_library_id":null,"id":"5eb87ceeffd86e000604b341"},{"fairings":{"re
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s://www.reddit.com/r/spacex/comments/3xm83h/","recovery":null},"flickr":{"sma
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ttps://farm6.staticflickr.com/5806/23802550622_9ff8c90098_o.jpg","https://far
m1.staticflickr.com/571/23604164970_2a1a2366e4_o.jpg","https://farm6.staticfl
ickr.com/5773/23271687254_5e64d726ba_o.jpg","https://farm6.staticflickr.com/5
766/23526044959_5bfe74bc88_o.jpg","https://farm6.staticflickr.com/5723/237856
09832_83038751d1_o.jpg","https://farm1.staticflickr.com/715/23833499336_d3fde
6a25a_o.jpg"]},"presskit":"http://www.spacex.com/sites/spacex/files/spacex_or
bcomm_press_kit_final2.pdf","webcast":"https://www.youtube.com/watch?v=O5bTbV
be4e4","youtube_id":"O5bTbVbe4e4","article":"https://spaceflightnow.com/2015/
12/22/round-trip-rocket-flight-gives-spacex-a-trifecta-of-successes/","wikipe
dia":"https://en.wikipedia.org/wiki/Falcon_9_flight_20"},"static_fire_date_ut
c":"2015-12-19T00:09:00.000Z","static_fire_date_unix":1450483740,"net":fals
e,"window":0,"rocket":"5e9d0d95eda69973a809d1ec","success":true,"failures":
[],"details":"Total payload mass was 2,034 kg (4,484 lb) : 11 satellites weig
hing 172 kg each, plus a 142-kg mass simulator. This was the first launch of
the upgraded v1.1 variant (later called Falcon 9 Full Thrust), with a 30 perc
ent power increase. Orbcomm had originally agreed to be the third flight of t
he enhanced-thrust rocket, but the change to the maiden flight position was a
nnounced in October 2015. SpaceX received a permit from the FAA to land the b
ooster on solid ground at Cape Canaveral, and succeeded.","crew":[],"ships":
[],"capsules":[],"payloads":["5eb0e4beb6c3bb0006eeb1fd"],"launchpad":"5e9e450
1f509094ba4566f84","flight_number":25,"name":"OG-2 Mission 2","date_utc":"201
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00-04:00","date_precision":"hour","upcoming":false,"cores":[{"core":"5e9e28a1
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ing_attempt":true,"landing_success":true,"landing_type":"RTLS","landpad":"5e9
e3032383ecb267a34e7c7"}],"auto_update":true,"tbd":false,"launch_library_id":n
ull,"id":"5eb87cefffd86e000604b342"},{"fairings":{"reused":false,"recovery_at
tempt":false,"recovered":false,"ships":[]},"links":{"patch":{"small":"http
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com/d9/c9/57ioWDgW_o.png"},"reddit":{"campaign":null,"launch":"https://www.re
ddit.com/r/spacex/comments/417weg","media":"https://www.reddit.com/r/spacex/c
omments/41cvdm","recovery":null},"flickr":{"small":[],"original":["https://fa
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m/1618/24151425850_1cb6040569_o.jpg","https://farm2.staticflickr.com/1622/241
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2ef932c96_o.jpg","https://farm2.staticflickr.com/1591/23778325594_08231286fc_
o.jpg","https://farm2.staticflickr.com/1542/24038722499_34c10216a3_o.jp
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_kit.pdf","webcast":"https://www.youtube.com/watch?v=ivdKRJzl6y0","youtube_i
d":"ivdKRJzl6y0","article":"https://spaceflightnow.com/2016/01/18/satellite-l
aunched-to-measure-motions-of-the-oceans/","wikipedia":"https://en.wikipedia.
org/wiki/Jason-3"},"static_fire_date_utc":"2016-01-11T18:42:00.000Z","static_
fire_date_unix":1452537720,"net":false,"window":0,"rocket":"5e9d0d95eda69973a
809d1ec","success":true,"failures":[],"details":"First launch of NASA and NOA
A joint science mission under the NLS II launch contract (not related to NASA
CRS or USAF OSP3 contracts). Last launch of the original Falcon 9 v1.1 launch
vehicle. The Jason-3 satellite was successfully deployed to target orbit. Spa
ceX again attempted a recovery of the first stage booster by landing on an au
tonomous drone ship; this time located in the Pacific Ocean. The first stage
did achieve a soft-landing on the ship, but a lockout on one of the landing l
egs failed to latch, so that the booster fell over and exploded.","crew":
[],"ships":["5ea6ed2f080df4000697c910","5ea6ed30080df4000697c912","5ea6ed3008
0df4000697c914"],"capsules":[],"payloads":["5eb0e4beb6c3bb0006eeb1fe"],"launc
hpad":"5e9e4502f509092b78566f87","flight_number":26,"name":"Jason 3","date_ut
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T08:42:00-07:00","date_precision":"hour","upcoming":false,"cores":[{"core":"5
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ad":"5e9e3033383ecbb9e534e7cc"}],"auto_update":true,"tbd":false,"launch_libra
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overy_attempt":false,"recovered":false,"ships":[]},"links":{"patch":{"smal
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r/spacex/comments/472k8c","recovery":null},"flickr":{"small":[],"original":
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883160354_b03cefd416_o.jpg","https://farm2.staticflickr.com/1653/25420915781_
8fc648b4a4_o.jpg","https://farm2.staticflickr.com/1610/25486858116_9c06dfea59
_o.jpg","https://farm2.staticflickr.com/1617/25168697841_00dfff89bb_o.jpg","h
ttps://farm2.staticflickr.com/1533/24631230904_83b1624807_o.jpg","https://far
m2.staticflickr.com/1627/25145624551_1b8743116f_o.jpg","https://farm2.staticf
lickr.com/1622/25120540712_7fc1a5ed72_o.jpg","https://farm2.staticflickr.com/
1550/24585667074_aa712b13a8_o.jpg"]},"presskit":"http://www.spacex.com/sites/
spacex/files/spacex_ses9_press_kit_final.pdf","webcast":"https://www.youtube.
com/watch?v=muDPSyO7-A0","youtube_id":"muDPSyO7-A0","article":"https://spacef
lightnow.com/2016/03/05/tv-broadcasting-satellite-finally-launched-on-falcon-
9/","wikipedia":"https://en.wikipedia.org/wiki/SES-9"},"static_fire_date_ut
c":"2016-10-02T14:11:00.000Z","static_fire_date_unix":1475417460,"net":fals
e,"window":5400,"rocket":"5e9d0d95eda69973a809d1ec","success":true,"failure
s":[],"details":"Second launch of the enhanced Falcon 9 Full Thrust launch ve
hicle. Following the launch, SpaceX attempted an experimental landing test to
a drone ship, although a successful landing was not expected because launch m
ass exceeded previously indicated limit for a GTO there was little fuel left.
As predicted, booster recovery failed: the spent first stage \\"landed hard
\\", but the controlled-descent, atmospheric re-entry and navigation to the d
rone ship were successful and returned significant test data on bringing back

high-energy Falcon 9s.","crew":[],"ships":["5ea6ed2e080df4000697c906","5ea6ed
2f080df4000697c90b","5ea6ed2f080df4000697c90c","5ea6ed30080df4000697c913"],"c
apsules":[],"payloads":["5eb0e4beb6c3bb0006eeb1ff"],"launchpad":"5e9e4501f509
094ba4566f84","flight_number":27,"name":"SES-9","date_utc":"2016-03-04T23:35:
00.000Z","date_unix":1457134500,"date_local":"2016-03-04T19:35:00-04:00","dat
e_precision":"hour","upcoming":false,"cores":[{"core":"5e9e28a1f359188def3b26
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rue,"landing_success":false,"landing_type":"ASDS","landpad":"5e9e3032383ecb6b
b234e7ca"}],"auto_update":true,"tbd":false,"launch_library_id":null,"id":"5eb
87cf2ffd86e000604b344"},{"fairings":null,"links":{"patch":{"small":"https://i
mages2.imgbox.com/72/1e/mA23xHqe_o.png","large":"https://images2.imgbox.com/3
6/d8/RyPKsTpC_o.png"},"reddit":{"campaign":null,"launch":"https://www.reddit.
com/r/spacex/comments/4dtoly","media":"https://www.reddit.com/r/spacex/commen
ts/4dtpxn/","recovery":"https://www.reddit.com/r/spacex/comments/4ee2zy"},"fl
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e8_o.jpg","https://farm2.staticflickr.com/1486/25787998624_3ca213be1e_o.jp
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s://farm2.staticflickr.com/1670/26239020092_05e5e4c538_o.jpg","https://farm2.
staticflickr.com/1709/26305479266_76b4d01caf_o.jpg","https://farm2.staticflic
kr.com/1645/26239017922_28c7ac50e0_o.jpg","https://farm2.staticflickr.com/155
9/26288402056_6c5997ce66_o.jpg","https://farm2.staticflickr.com/1449/25709481
274_60f8c77358_o.jpg","https://farm2.staticflickr.com/1671/26217360302_b66c3e
384e_o.jpg","https://farm2.staticflickr.com/1704/26283822056_838c1103b9_o.jp
g","https://farm2.staticflickr.com/1508/26217345472_118767c608_o.jpg","http
s://farm2.staticflickr.com/1495/25916886442_821a152917_o.jpg"]},"presskit":"h
ttp://www.spacex.com/sites/spacex/files/spacex_crs8_press_kit.pdf","webcas
t":"https://www.youtube.com/watch?v=7pUAydjne5M","youtube_id":"7pUAydjne5
M","article":"https://spaceflightnow.com/2016/04/08/spacex-lands-rocket-on-fl
oating-platform-after-station-resupply-launch/","wikipedia":"https://en.wikip
edia.org/wiki/SpaceX_CRS-8"},"static_fire_date_utc":"2016-04-05T00:00:00.000
Z","static_fire_date_unix":1459814400,"net":false,"window":0,"rocket":"5e9d0d
95eda69973a809d1ec","success":true,"failures":[],"details":"Dragon carried ov
er 1500 kg of supplies and delivered (stowed in its trunk) the inflatable Big
elow Expandable Activity Module (BEAM) to the ISS for two years of in-orbit t
ests. The rocket\'s first stage landed smoothly on SpaceX\'s autonomous space
port drone ship 9 minutes after liftoff, making this the first ever successfu
l landing of a rocket booster on a ship at sea as part of an orbital launch.
The first stage B1021 was later also the first orbital booster to be used aga
in, when launching SES-10 on March 30, 2017.","crew":[],"ships":["5ea6ed2e080
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om/r/spacex/comments/4ihp1p"},"flickr":{"small":[],"original":["https://farm

8.staticflickr.com/7340/27044931232_7b755276ec_o.jpg","https://farm8.staticfl ickr.com/7444/27028105566_1d3413daa7_o.jpg","https://farm8.staticflickr.com/7 597/26778141961_e3bd237942_o.jpg","https://farm8.staticflickr.com/7079/267781 41661_559b48ac80_o.jpg","https://farm8.staticflickr.com/7682/26778141401_c437 b04b74_o.jpg","https://farm8.staticflickr.com/7706/26751237322_ceb6d56235_o.j pg","https://farm8.staticflickr.com/7677/26809210466_fc55835f3c_o.jpg","http s://farm8.staticflickr.com/7085/26809208046_d77bd31fd0_o.jpg","https://farm8. staticflickr.com/7103/26809207316_cdc7d582e6_o.jpg"]},"presskit":"http://www. spacex.com/sites/spacex/files/spacex_jcsat_press_kit_final.pdf","webcast":"ht tps://www.youtube.com/watch?v=L0bMeDj76ig","youtube_id":"L0bMeDj76ig","articl e":"https://spaceflightnow.com/2016/05/06/falcon-9-succeeds-in-middle-of-the- night-launch/","wikipedia":"https://en.wikipedia.org/wiki/JCSAT-2B"},"static_ fire_date_utc":"2016-05-01T21:32:00.000Z","static_fire_date_unix":146213832 0,"net":false,"window":7200,"rocket":"5e9d0d95eda69973a809d1ec","success":tru e,"failures":[],"details":"Launched the JCSAT 14 communications satellite for Tokyo-based SKY Perfect JSAT Corp. JCSAT 14 will support data networks, telev ision broadcasters and mobile communications users in Japan, East Asia, Russi a, Oceania, Hawaii and other Pacific islands. This was the first time a boost er successfully landed after a GTO mission.","crew":[],"ships":["5ea6ed2e080d f4000697c906","5ea6ed2f080df4000697c90b","5ea6ed2f080df4000697c90c"],"capsule s":[],"payloads":["5eb0e4bfb6c3bb0006eeb201"],"launchpad":"5e9e4501f509094ba4 566f84","flight_number":29,"name":"JCSAT-2B","date_utc":"2016-05-06T05:21:00. 000Z","date_unix":1462512060,"date_local":"2016-05-06T01:21:00-04:00","date_p recision":"hour","upcoming":false,"cores":[{"core":"5e9e28a2f35918077b3b263 f","flight":1,"gridfins":true,"legs":true,"reused":false,"landing_attempt":tr ue,"landing_success":true,"landing_type":"ASDS","landpad":"5e9e3032383ecb6bb2 34e7ca"}],"auto_update":true,"tbd":false,"launch_library_id":null,"id":"5eb87 cf5ffd86e000604b346"},{"fairings":{"reused":false,"recovery_attempt":false,"r ecovered":false,"ships":[]},"links":{"patch":{"small":"https://images2.imgbo x.com/fa/f2/iR1eKXrX_o.png","large":"https://images2.imgbox.com/84/dc/Qp0wk7j 1_o.png"},"reddit":{"campaign":"https://www.reddit.com/r/spacex/comments/4hjz 4k","launch":"https://www.reddit.com/r/spacex/comments/4l9uou","media":"http s://www.reddit.com/r/spacex/comments/4l4af1","recovery":"https://www.reddit.c om/r/spacex/comments/4lz2y6"},"flickr":{"small":[],"original":["https://farm 8.staticflickr.com/7420/26814484893_13059e4b39_o.jpg","https://farm8.staticfl ickr.com/7321/26812794884_bf91665325_o.jpg","https://farm8.staticflickr.com/7 337/26812792104_9323121f0b_o.jpg","https://farm8.staticflickr.com/7376/274214 61715_5640d2b87a_o.jpg","https://farm8.staticflickr.com/7717/26812758364_7456 9b4327_o.jpg","https://farm8.staticflickr.com/7742/27294263035_9b43bd141c_o.j pg","https://farm8.staticflickr.com/7252/27294262435_c534cc4351_o.jpg","http s://farm8.staticflickr.com/7698/27294261525_82c4b7e604_o.jpg","https://farm8. staticflickr.com/7045/27259828166_9e32061cc9_o.jpg","https://farm8.staticflic kr.com/7013/27259827316_c2f7507b3d_o.jpg","https://farm8.staticflickr.com/721 1/27182485331_ed2414a947_o.jpg","https://farm8.staticflickr.com/7740/27182481 921_0d7a759736_o.jpg","https://farm8.staticflickr.com/7315/26645036414_39736d b559_o.jpg"]},"presskit":"http://www.spacex.com/sites/spacex/files/spacex_tha icom_8_press_kit.pdf","webcast":"https://www.youtube.com/watch?v=zBYC4f79iX c","youtube_id":"zBYC4f79iXc","article":"https://spaceflightnow.com/2016/05/2 7/spacex-logs-successful-late-afternoon-launch-for-thaicom/","wikipedia":"htt ps://en.wikipedia.org/wiki/Thaicom_8"},"static_fire_date_utc":"2016-05-25T00: 00:00.000Z","static_fire_date_unix":1464134400,"net":false,"window":7200,"roc ket":"5e9d0d95eda69973a809d1ec","success":true,"failures":[],"details":"Manuf actured by Orbital ATK, the 3,100-kilogram (6,800 lb) Thaicom 8 communication s satellite will serve Thailand, India and Africa from the 78.5\xc2\xb0 East geostationary location. It is equipped with 24 active Ku-band transponder s.","crew":[],"ships":["5ea6ed2e080df4000697c906","5ea6ed2f080df4000697c90

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w.reddit.com/r/spacex/comments/4o5j6o","recovery":"https://www.reddit.com/r/s
pacex/comments/4on75l"},"flickr":{"small":[],"original":["https://farm8.stati
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m/watch?v=gLNmtUEvI5A","youtube_id":"gLNmtUEvI5A","article":"https://spacefli
ghtnow.com/2016/06/15/spacex-successfully-fires-satellites-into-orbit-but-los
es-booster-on-landing/","wikipedia":"https://en.wikipedia.org/wiki/ABS_(satel
lite_operator)"},"static_fire_date_utc":"2016-06-13T15:03:00.000Z","static_fi
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his technique on flight 16, Falcon again launched two Boeing 702SP gridded io
n thruster satellites in a dual-stack configuration, with the two customers s
haring the rocket and mission costs. First stage landing attempt on drone shi
p failed on landing due to low thrust on one of the three landing engine
s.","crew":[],"ships":["5ea6ed2e080df4000697c906","5ea6ed2f080df4000697c90
b","5ea6ed2f080df4000697c90c","5ea6ed30080df4000697c913"],"capsules":[],"payl
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l":"2016-06-15T10:29:00-04:00","date_precision":"hour","upcoming":false,"core
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cex/comments/4tayth","recovery":"https://www.reddit.com/r/spacex/comments/4zn
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g","https://farm8.staticflickr.com/7540/28291786662_5e2e874576_o.jpg"]},"pres
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8","article":"https://spaceflightnow.com/2016/07/18/spacex-sends-supplies-to-
space-station-lands-another-falcon-rocket/","wikipedia":"https://en.wikipedi
a.org/wiki/SpaceX_CRS-9"},"static_fire_date_utc":"2016-07-16T02:31:47.000
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o, an International Docking Adapter (IDA-2) was carried to the ISS. This miss
ion had a successful first-stage landing at Cape Canaveral.*Including the reu
sable Dragon Capsule, total payload to orbit was 6457 kg.","crew":[],"ships":
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e":"https://spaceflightnow.com/2016/08/14/falcon-9-rocket-launches-japanese-s
atellite-then-nails-bullseye-landing/","wikipedia":"https://en.wikipedia.org/
wiki/JCSAT-16"},"static_fire_date_utc":"2016-08-11T04:01:00.000Z","static_fir
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from a ballistic trajectory using a single-engine landing burn. All previous
landings from a ballistic trajectory had fired three engines on the landing-b
urn, which provided more braking force, but subjected the vehicle to greater
structural stresses. The single-engine landing burn takes more time and fuel,
but puts less stress on the vehicle.","crew":[],"ships":["5ea6ed2e080df400069
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ceflightnow.com/2016/09/01/spacex-rocket-and-israeli-satellite-destroyed-in-l
aunch-pad-explosion/","wikipedia":"https://en.wikipedia.org/wiki/Amos-6"},"st
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eral of the COPV tanks, causing perforations that allowed liquid and/or solid
oxygen to accumulate underneath the lining, which was ignited by frictio
n."}],"details":"The rocket and Amos-6 payload were lost in a launch pad expl
osion on September 1, 2016 during propellant fill prior to a static fire tes
t. The pad was clear of personnel and there were no injuries.","crew":[],"shi
ps":[],"capsules":[],"payloads":["5eb0e4c1b6c3bb0006eeb207"],"launchpad":"5e9
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4:00","date_precision":"hour","upcoming":false,"cores":[{"core":"5e9e28a2f359
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tube.com/watch?v=7WimRhydggo","youtube_id":"7WimRhydggo","article":"https://s
paceflightnow.com/2017/01/14/spacex-resumes-flights-with-on-target-launch-for
-iridium/","wikipedia":"https://en.wikipedia.org/wiki/Iridium_satellite_const
ellation#Next-generation_constellation"},"static_fire_date_utc":"2017-01-05T1
9:40:00.000Z","static_fire_date_unix":1483645200,"net":false,"window":0,"rock
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-to-flight mission after the loss of Amos-6 in September 2016. Iridium NEXT w
ill replace the original Iridium constellation, launched in the late 1990s. E

ach Falcon mission will carry 10 satellites, with a goal to complete deployme
nt of the 66 plus 9 spare satellite constellation by mid 2018. The first two
Iridium qualification units were supposed to ride a Dnepr rocket in April 201
6 but were delayed, so Iridium decided to qualify the first batch of 10 satel
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ess":true,"landing_type":"ASDS","landpad":"5e9e3033383ecbb9e534e7cc"}],"auto_
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s://spaceflightnow.com/2017/02/19/historic-launch-pad-back-in-service-with-th
undering-blastoff-by-spacex/","wikipedia":"https://en.wikipedia.org/wiki/Spac
eX_CRS-10"},"static_fire_date_utc":"2017-02-12T21:30:00.000Z","static_fire_da
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c","success":true,"failures":[],"details":"First Falcon 9 flight from the his
toric LC-39A launchpad at Kennedy Space Center, carrying supplies and materia
ls to support dozens of science and research investigations scheduled during
ISS Expeditions 50 and 51. The first stage returned to launch site and landed
at LZ-1.","crew":[],"ships":["5ea6ed30080df4000697c912"],"capsules":["5e9e2c5
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4:00","date_precision":"hour","upcoming":false,"cores":[{"core":"5e9e28a3f359
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3/","wikipedia":"https://en.wikipedia.org/wiki/EchoStar#Satellite_fleet"},"st
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oStar XXIII, based on a spare platform from the cancelled CMBStar 1 satellite
program, will provide direct-to-home television broadcast services over Brazi
l. There was no attempt at a first-stage recovery so this rocket did not have
landing legs or grid fins.","crew":[],"ships":[],"capsules":[],"payloads":["5
eb0e4c3b6c3bb0006eeb20a"],"launchpad":"5e9e4502f509094188566f88","flight_numb
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fficial_launch_discussion_updates/","media":"https://www.reddit.com/r/spacex/
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m/2017/03/31/spacex-flies-rocket-for-second-time-in-historic-test-of-cost-cut
ting-technology/","wikipedia":"https://en.wikipedia.org/wiki/SES-10"},"static
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1, previously launched with CRS-8, which also landed a second time. In what i
s also a first, the payload fairing remained intact after a successful splash
down achieved with thrusters and a steerable parachute.","crew":[],"ships":
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ully-launches-nrol-76-u-s-military-satellite/","wikipedia":"https://en.wikipe
dia.org/wiki/List_of_NRO_launches"},"static_fire_date_utc":"2017-04-25T19:02:
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aunch under SpaceX\'s certification for national security space missions, whi
ch allows SpaceX to contract launch services for classified payloads. Second-
stage speed and altitude telemetry were omitted from the launch webcast, whic
h displayed first-stage telemetry instead, with continuous tracking of the bo
oster from liftoff to landing for the first time.","crew":[],"ships":["5ea6ed
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alse,"recovery_attempt":false,"recovered":false,"ships":[]},"links":{"patch":
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x/comments/6b88hz/","media":"https://www.reddit.com/r/spacex/comments/6bcf8

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to GTO by a Falcon 9 rocket. The launch was originally scheduled for the Falc
on Heavy, but performance improvements allowed the mission to be carried out
by an expendable Falcon 9 instead.","crew":[],"ships":[],"capsules":[],"paylo
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spacex.com/sites/spacex/files/crs11presskit.pdf","webcast":"https://www.youtu
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ceflightnow.com/2017/06/03/reused-dragon-cargo-capsule-launched-on-journey-to
-space-station/","wikipedia":"https://en.wikipedia.org/wiki/SpaceX_CRS-1
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nterior Composition Explorer (NICER) to the ISS, along with the MUSES Earth i
maging platform and ROSA solar array. For the first time, this mission launch
ed a refurbished Dragon capsule, serial number C106 which first flew in Septe
mber 2014 on the CRS-4 mission. Originally scheduled to launch on June 1, but
was scrubbed due to inclement weather.","crew":[],"ships":["5ea6ed30080df4000
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garian-owned communications satellite and it will provide television broadcas
ts and other communications services over southeast Europe.","crew":[],"ship
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e.com/37304-liftoff-spacex-second-launch-three-days.html","wikipedia":"http

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eflightnow.com/2017/07/06/spacex-delivers-for-intelsat-on-heavyweight-falcon-
9-mission/","wikipedia":"https://en.wikipedia.org/wiki/Intelsat_35e"},"static
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now.com/2017/08/17/photos-falcon-9-rocket-soars-into-space-lands-back-at-cape
-canaveral/","wikipedia":"https://en.wikipedia.org/wiki/SpaceX_CRS-12"},"stat
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e Falcon 9 Block 4 upgrade. Last flight of a newly-built Dragon capsule; furt
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5/taiwanese-satellite-rides-spacex-rocket-into-orbit/","wikipedia":"https://e
n.wikipedia.org/wiki/Formosat-5"},"static_fire_date_utc":"2017-08-24T18:50:0
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s://spaceflightnow.com/2017/09/07/spacex-beats-hurricane-with-smooth-launch-o
f-militarys-x-37b-spaceplane/","wikipedia":"https://en.wikipedia.org/wiki/Boe
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spaceflightnow.com/2017/10/09/spacex-launch-adds-another-10-satellites-to-iri
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s://spaceflightnow.com/2017/10/12/video-falcon-9-rocket-lifts-off-with-joint-
satellite-for-ses-echostar/","wikipedia":"https://en.wikipedia.org/wiki/List_
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s://spaceflightnow.com/2017/10/30/spacex-launches-and-lands-third-rocket-in-t
hree-weeks/","wikipedia":"https://en.wikipedia.org/wiki/Koreasat_5A"},"static

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dia, Southeast Asia, the Philippines, Guam, Korea, and Japan. The satellite w
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services ranging from broadband internet to broadcasting services and maritim
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ghtnow.com/2017/12/23/spacex-launch-dazzles-delivering-10-more-satellites-for
-iridium/","wikipedia":"https://en.wikipedia.org/wiki/Iridium_satellite_const
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tps://spaceflightnow.com/2018/01/08/spacex-kicks-off-ambitious-2018-schedule-
with-launch-for-u-s-government/","wikipedia":"https://en.wikipedia.org/wiki/Z
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paceflightnow.com/2018/01/31/spacex-rocket-flies-on-60th-anniversary-of-first
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S_satellites#SES_Fleet"},"static_fire_date_utc":"2018-01-26T15:27:00.000Z","s
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M","youtube_id":"Kpfrp-GMKKM","article":"https://spaceflightnow.com/2018/03/0
6/hefty-hispasat-satellite-rides-spacex-rocket-into-orbit/","wikipedia":"http
s://en.wikipedia.org/wiki/Hispasat_30W-6"},"static_fire_date_utc":"2018-02-21
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s":"Launched with landing legs and titanium grid fins. Did not attempt a land
ing due to \'unfavorable weather conditions in the recovery area\'.","crew":
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ww.reddit.com/r/spacex/comments/82njj5/iridium_next_constellation_mission_5_l
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dium_next_5_official_launch_discussion/","media":"https://www.reddit.com/r/sp
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s://farm1.staticflickr.com/822/40227112875_ec3c5df585_o.jpg"]},"presskit":"ht
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t":"https://www.youtube.com/watch?v=mp0TW8vkCLg","youtube_id":"mp0TW8vkCL
g","article":"https://spaceflightnow.com/2018/03/30/iridium-messaging-network
-gets-another-boost-from-spacex/","wikipedia":"https://en.wikipedia.org/wiki/
Iridium_satellite_constellation#Next-generation_constellation"},"static_fire_
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t":false,"window":0,"rocket":"5e9d0d95eda69973a809d1ec","success":true,"failu
res":[],"details":"Fifth Iridium NEXT mission to deploy ten Iridium NEXT sate
llites. Reused booster from third Iridium flight, and although controlled des
cent was performed, the booster was expended into the ocean. SpaceX planned a
second recovery attempt of one half of the fairing using the specially modifi
ed boat Mr. Steven. However, the fairing\'s parafoil twisted during the recov
ery, which led to water impact at high speed","crew":[],"ships":["5ea6ed2e080
df4000697c908"],"capsules":[],"payloads":["5eb0e4c7b6c3bb0006eeb220"],"launch
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l":"2018-03-30T07:13:51-08:00","date_precision":"hour","upcoming":false,"core
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com/r/spacex/comments/82op7a/crs14_launch_campaign_thread/","launch":"http

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cussion_updates/","media":"https://www.reddit.com/r/spacex/comments/88l52i/rs
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t":"https://www.youtube.com/watch?v=BPQHG-LevZM","youtube_id":"BPQHG-LevZ
M","article":"https://spaceflightnow.com/2018/04/02/spacex-supply-ship-depart
s-cape-canaveral-for-space-station/","wikipedia":"https://en.wikipedia.org/wi
ki/SpaceX_CRS-14"},"static_fire_date_utc":"2018-03-28T15:52:00.000Z","static_
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d booster (from CRS-12) for the 11th time, and a refurbished capsule (C110 fr
om CRS-8) for the third time. External payloads include a materials research
platform MISSE-FF phase 3 of the Robotic Refueling Mission TSIS, heliophysics
sensor several crystallization experiments, and the RemoveDebris spacecraft a
imed at space junk removal. The booster was expended in order to test a new l
anding profile.","crew":[],"ships":["5ea6ed30080df4000697c912"],"capsules":
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b_o.png"},"reddit":{"campaign":"https://www.reddit.com/r/spacex/comments/88l4
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mments/8cm61o/rspacex_tess_official_launch_discussion_updates/","media":"http
s://www.reddit.com/r/spacex/comments/8cmzop/rspacex_tess_media_thread_videos_
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final417.pdf","webcast":"https://www.youtube.com/watch?v=aY-0uBIYYKk","youtub
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surveyor-launched-from-cape-canaveral-on-the-hunt-for-exoplanets/","wikipedi
a":"https://en.wikipedia.org/wiki/Transiting_Exoplanet_Survey_Satellite"},"st
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1400,"net":false,"window":30,"rocket":"5e9d0d95eda69973a809d1ec","success":tr
ue,"failures":[],"details":"Part of the Explorers program, this space telesco
pe is intended for wide-field search of exoplanets transiting nearby stars. I
t is the first NASA high priority science mission launched by SpaceX. It was
the first time SpaceX launched a scientific satellite not primarily intended
for Earth observations. The second stage placed it into a high-Earth elliptic
al orbit, after which the satellite\'s own booster will perform complex maneu
vers including a lunar flyby, and over the course of two months, reach a stab
le, 2:1 resonant orbit with the Moon. In January 2018, SpaceX received NASA
\'s Launch Services Program Category 2 certification of its Falcon 9 \'Full T
hrust\', certification which is required for launching medium risk missions l
ike TESS. It was the last launch of a new Block 4 booster, and marked the 24t

h successful recovery of the booster. An experimental water landing was perfo
rmed in order to attempt fairing recovery.","crew":[],"ships":["5ea6ed2e080df
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com/r/spacex/comments/8624iq/bangabandhu1_launch_campaign_thread/","launc
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cial_launch_discussion","media":"https://www.reddit.com/r/spacex/comments/8ia
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c531950f_o.jpg","https://farm1.staticflickr.com/975/28197546158_880e466fb6_o.
jpg","https://farm1.staticflickr.com/823/27200014957_940f3720bb_o.jpg","http
s://farm1.staticflickr.com/945/42025498442_0b7b91d561_o.jpg","https://farm1.s
taticflickr.com/967/42025498972_8720104d8a_o.jpg","https://farm1.staticflick
r.com/954/42025499162_8a0ef7feaa_o.jpg","https://farm1.staticflickr.com/911/4
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x/files/bangabandhupresskit51118.pdf","webcast":"https://www.youtube.com/watc
h?v=rQEqKZ7CJlk","youtube_id":"rQEqKZ7CJlk","article":"https://spaceflightno
w.com/2018/05/11/spacex-debuts-an-improved-human-rated-model-of-the-falcon-9-
rocket/","wikipedia":"https://en.wikipedia.org/wiki/Bangabandhu-1"},"static_f
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1,"name":"Bangabandhu-1","date_utc":"2018-05-11T20:14:00.000Z","date_unix":15
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dit.com/r/spacex/comments/8kyk5a/rspacex_iridium_next_6_official_launch_discu
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e787538fc5_o.jpg"]},"presskit":"http://www.spacex.com/sites/spacex/files/irid
ium6presskit2018521.pdf","webcast":"https://www.youtube.com/watch?v=I_0GgKfwC
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22/rideshare-launch-by-spacex-serves-commercial-and-scientific-customers/","w
ikipedia":"https://en.wikipedia.org/wiki/Gravity_Recovery_and_Climate_Experim
ent"},"static_fire_date_utc":"2018-05-18T20:16:00.000Z","static_fire_date_uni
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cess":true,"failures":[],"details":"GFZ arranged a rideshare of GRACE-FO on a
Falcon 9 with Iridium following the cancellation of their Dnepr launch contra
ct in 2015. Iridium CEO Matt Desch disclosed in September 2017 that GRACE-FO
would be launched on the sixth Iridium NEXT mission. The booster reuse turnar
ound was a record 4.5 months between flights.","crew":[],"ships":["5ea6ed2e08
0df4000697c908"],"capsules":[],"payloads":["5eb0e4c7b6c3bb0006eeb224","5eb0e4
c8b6c3bb0006eeb225"],"launchpad":"5e9e4502f509092b78566f87","flight_number":6
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8.pdf","webcast":"https://www.youtube.com/watch?v=2hcM5hqQ45s","youtube_i
d":"2hcM5hqQ45s","article":"https://spaceflightnow.com/2018/06/04/multi-missi
on-telecom-craft-launched-by-spacex-for-ses/","wikipedia":"https://en.wikiped
ia.org/wiki/SES-12"},"static_fire_date_utc":"2018-05-25T01:48:00.000Z","stati
c_fire_date_unix":1527212880,"net":false,"window":7200,"rocket":"5e9d0d95eda6
9973a809d1ec","success":true,"failures":[],"details":"SES-12, the replacement
satellite for NSS-6, was successfully launched and deployed on June 4th, comp
leting SpaceX\'s eleventh flight of 2018. According to SES Luxembourg, The SE
S-12 satellite will expand SES\xe2\x80\x99s capabilities to provide direct-to
-home (DTH) broadcasting, VSAT, Mobility and High Throughput Satellite (HTS)
data connectivity services in the Middle East and the Asia-Pacific region, in
cluding rapidly growing markets such as India and Indonesia. [SES-12] will be
co-located with SES-8","crew":[],"ships":["5ea6ed2e080df4000697c90a"],"capsul
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34e7ca"}],"auto_update":true,"tbd":false,"launch_library_id":null,"id":"5eb87
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7_official_launch_discussion/","media":"https://www.reddit.com/r/spacex/comme
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ttps://farm1.staticflickr.com/928/28787338507_3be74590d2_o.jpg"]},"presski
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0","article":"https://spaceflightnow.com/2018/07/25/spacexs-second-launch-in-
three-days-lofts-10-more-iridium-satellites/","wikipedia":"https://en.wikiped
ia.org/wiki/Iridium_satellite_constellation#Next-generation_constellatio
n"},"static_fire_date_utc":"2018-07-20T21:08:00.000Z","static_fire_date_uni
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eventh of eight launches in a half-a-billion-dollar contract with Iridium. Wi
ll use a Block 5 first stage, to be recovered in the Pacific Ocean. Only one
mission will be left for Iridium, with 10 more satellites. First attempt to r
ecover a Fairing with the upgraded net. Fairing recovery was not successfu
l.","crew":[],"ships":["5ea6ed2f080df4000697c910","5ea6ed2e080df4000697c90
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ight_number":66,"name":"Iridium NEXT Mission 7","date_utc":"2018-07-25T11:39:
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rue,"landing_success":true,"landing_type":"ASDS","landpad":"5e9e3033383ecbb9e
534e7cc"}],"auto_update":true,"tbd":false,"launch_library_id":null,"id":"5eb8
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7/indonesian-communications-satellite-deployed-in-orbit-by-spacex/","wikipedi
a":"https://en.wikipedia.org/wiki/Telkom_Indonesia"},"static_fire_date_ut
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e,"window":7200,"rocket":"5e9d0d95eda69973a809d1ec","success":true,"failure
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(also known as Telkom-4) geostationary communications satellite for Telkom In
donesia. It marked the first reuse of any Block 5 first stage; the booster B1
046 had previously launched Bangabandhu-1. The stage was recovered and is exp
ected to become the first Falcon 9 booster to fly three missions.","crew":
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00.000Z","date_unix":1533619080,"date_local":"2018-08-07T01:18:00-04:00","dat
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56","flight":2,"gridfins":true,"legs":true,"reused":true,"landing_attempt":tr
ue,"landing_success":true,"landing_type":"ASDS","landpad":"5e9e3032383ecb6bb2
34e7ca"}],"auto_update":true,"tbd":false,"launch_library_id":null,"id":"5eb87
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m_o.png"},"reddit":{"campaign":"https://www.reddit.com/r/spacex/comments/95ct
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tube.com/watch?v=Apw3xqwsG1U","youtube_id":"Apw3xqwsG1U","article":"https://s
paceflightnow.com/2018/09/10/spacex-telesat-achieve-repeat-success-with-midni
ght-hour-launch/","wikipedia":"https://en.wikipedia.org/wiki/Telstar_18V"},"s
tatic_fire_date_utc":"2018-09-05T07:21:00.000Z","static_fire_date_unix":15361
32060,"net":false,"window":14400,"rocket":"5e9d0d95eda69973a809d1ec","succes
s":true,"failures":[],"details":"SpaceX\'s sixteenth flight of 2018 launched
the Telstar 18v GEO communication satellite for Telesat, the second launch fo
r the canadian company in a few months. The first stage was a new Falcon 9 V
1.2 Block 5 which was successfully recovered on OCISLY.","crew":[],"ships":
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00-04:00","date_precision":"hour","upcoming":false,"cores":[{"core":"5e9e28a5
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s://farm2.staticflickr.com/1951/30234801997_b5a65426ca_o.jpg","https://farm2.
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kr.com/1923/44451125454_8d26929d0b_o.jpg","https://farm2.staticflickr.com/191
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8/spacex-aces-first-rocket-landing-in-california-after-launching-argentine-sa
tellite/","wikipedia":"https://en.wikipedia.org/wiki/SAOCOM"},"static_fire_da
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alse,"window":0,"rocket":"5e9d0d95eda69973a809d1ec","success":true,"failure
s":[],"details":"SpaceX\'s seventeenth flight of 2018 was the first launch of
the Saocom Earth observation satellite constellation of the Argentine Space A
gency CONAE. The second launch of Saocom 1B will happen in 2019. This flight
marked the first RTLS launch out of Vandenberg, with a landing on the concret
e pad at SLC-4W, very close to the launch pad.","crew":[],"ships":[],"capsule
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w.spacex.com/sites/spacex/files/eshail-2_mission_press_kit_11_14_2018.pdf","w
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launches-qatars-eshail-2-communications-satellite/","wikipedia":"https://en.w
ikipedia.org/wiki/Es%27hailSat"},"static_fire_date_utc":"2018-11-12T18:13:00.
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t":"5e9d0d95eda69973a809d1ec","success":true,"failures":[],"details":"SpaceX
\'s eighteenth flight of 2018 was its first for Es\'hailSat. Es\'hail-2 is a
communications satellite delivering television and internet to Qatar and the
surrounding region. It was launched into a geostationary transfer orbit from
LC-39A at Kennedy Space Center. The booster landed on OCISLY.","crew":[],"shi
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yloads":["5eb0e4c9b6c3bb0006eeb22d"],"launchpad":"5e9e4502f509094188566f8
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0:46:00.000Z","date_unix":1542314760,"date_local":"2018-11-15T15:46:00-05:0
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eed3b2657","flight":2,"gridfins":true,"legs":true,"reused":true,"landing_atte
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nch_discussion_updates/","media":"https://old.reddit.com/r/spacex/comments/a0
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eddit.com/r/spacex/comments/a2tjoe/ssoa_recovery_thread/"},"flickr":{"small":
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f","webcast":"https://www.youtube.com/watch?v=Wq8kS6UoOrQ","youtube_id":"Wq8k
S6UoOrQ","article":"https://spaceflightnow.com/2018/12/03/spacex-launches-swa
rm-of-satellites-re-flies-rocket-for-third-time/","wikipedia":"https://en.wik
ipedia.org/wiki/Spaceflight_Industries"},"static_fire_date_utc":"2018-11-15T2
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ceX\'s nineteenth flight of 2018 will fly SSO-A: SmallSat Express out of Vand
enberg SLC-4E for Spaceflight. SSO-A is a rideshare to sun synchronus low ear
th orbit consisting of 64 individual microsatellites and cubesats. It is also
likely to be the third flight of core B1046 which previously flew Bangabandhu
-1 and Merah Putih. If this happens it will be the first time a Falcon 9 has
flown more than two missions. ","crew":[],"ships":["5ea6ed2f080df4000697c91
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tps://spaceflightnow.com/2018/12/05/spacex-falcon-9-boosts-dragon-cargo-ship-to-orbit-first-stage-misses-landing-target/","wikipedia":"https://en.wikipedia.org/wiki/SpaceX_CRS-16"},"static_fire_date_utc":"2018-11-30T19:57:00.000Z","static_fire_date_unix":1543607820,"net":false,"window":0,"rocket":"5e9d0d95eda69973a809d1ec","success":true,"failures":[],"details":"SpaceX\'s 16th Crew Resupply Mission on behalf of NASA, with a total of 20 contracted flights. This will bring essential supplies to the International Space Station using SpaceX\'s reusable Dragon spacecraft. The Falcon 9 will launch from SLC-40 at Cape Canaveral Air Force Station. During the landing of the first stage, a grid fin hydraulic pump stalled, causing the core to enter an uncontrolled roll, and resulting in a (succesful) water landing.","crew":[],"ships":["5ea6ed2f080df4000697c90b"],"capsules":["5e9e2c5cf359185d753b266f"],"payloads":["5eb0e4cab6c3bb0006eeb22f"],"launchpad":"5e9e4501f509094ba4566f84","flight_number":72,"name":"CRS-16","date_utc":"2018-12-05T18:16:00.000Z","date_unix":1544033760,"date_local":"2018-12-05T13:16:00-05:00","date_precision":"hour","upcoming":false,"cores":[{"core":"5e9e28a6f359185c603b265a","flight":1,"gridfins":true,"legs":true,"reused":false,"landing_attempt":true,"landing_success":false,"landing_type":"RTLS","landpad":"5e9e3032383ecb267a34e7c7"}],"auto_update":true,"tbd":false,"launch_library_id":null,"id":"5eb87d26ffd86e000604b371"},{"fairings":{"reused":false,"recovery_attempt":false,"recovered":false,"ships":[]},"links":{"patch":{"small":"https://images2.imgbox.com/3c/2f/tL7xDUD6_o.png","large":"https://images2.imgbox.com/f9/31/MGTnAfuR_o.png"},"reddit":{"campaign":"https://www.reddit.com/r/spacex/comments/a4516o/gps_iii2_launch_campaign_thread/","launch":"https://www.reddit.com/r/spacex/comments/a71wyn/rspacex_gps_iii2_official_launch_discussion/","media":"https://www.reddit.com/r/spacex/comments/a73kz5/rspacex_gps_iii2_media_thread_videos_images_gifs/","recovery":null},"flickr":{"small":[],"original":["https://farm5.staticflickr.com/4864/45715171884_f1dd88c058_o.jpg","https://farm8.staticflickr.com/7926/45525648155_32fdab17a5_o.jpg","https://farm8.staticflickr.com/7876/45525649035_ba60162fe0_o.jpg","https://farm8.staticflickr.com/7853/45525649825_e6d35415e1_o.jpg","https://farm5.staticflickr.com/4893/45525650685_02b408c385_o.jpg"]},"presskit":"https://www.spacex.com/sites/spacex/files/gps_iii_press_kit.pdf","webcast":"https://youtu.be/yRiLPoy_Mzc","youtube_id":"yRiLPoy_Mzc","article":"https://spaceflightnow.com/2018/12/23/spacex-closes-out-year-with-successful-gps-satellite-launch/","wikipedia":"https://en.wikipedia.org/wiki/GPS_Block_IIIA"},"static_fire_date_utc":"2018-12-13T21:24:00.000Z","static_fire_date_unix":1544736240,"net":false,"window":1560,"rocket":"5e9d0d95eda69973a809d1ec","success":true,"failures":[],"details":"SpaceX\'s twenty-first flight of 2018 launched the first of the new GPS III satellites (Block IIIA) for the United States Air Force and was SpaceX\'s first EELV mission. The spacecraft was delivered to a MEO transfer orbit from SLC-40 at Cape Canaveral Air Force Station. This mission was the first to fly with the redesigned COPV on the first stage (B1054) as well as the second. The booster was expended.","crew":[],"ships":[],"capsules":[],"payloads":["5eb0e4cab6c3bb0006eeb230"],"launchpad":"5e9e4501f509094ba4566f84","flight_number":73,"name":"GPS III SV01","date_utc":"2018-12-23T13:51:00.000Z","date_unix":1545573060,"date_local":"2018-12-23T08:51:00-05:00","date_precision":"hour","upcoming":false,"cores":[{"core":"5e9e28a6f35918513b3b265b","flight":1,"gridfins":false,"legs":false,"reused":false,"landing_attempt":false,"landing_success":null,"landing_type":null,"landpad":null}],"auto_update":true,"tbd":false,"launch_library_id":null,"id":"5eb87d27ffd86e000604b372"},{"fairings":{"reused":false,"recovery_attempt":false,"recovered":null,"ships":[]},"links":{"patch":{"small":"https://images2.imgbox.com/75/cb/DMVc5j8b_o.png","large":"https://images2.imgbox.com/d7/f9/861bfh4Q_o.png"},"reddit":{"campaign":"https://www.reddit.com/r/spacex/comments/a699fh/iridium_next_constellation_mission_8_launch/","launch":"https://www.reddit.com/r/spacex/comments/aemq2i/rspacex_iridium_next_8_official_launch

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ex-begins-2019-with-eighth-and-final-for-upgraded-iridium-network/","wikipedi
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2019 will be the eighth and final launch of its planned Iridium flights. Deli
vering 10 satellites to low earth orbit, this brings the total up to 75 and c
ompletes the Iridium NEXT constellation. This mission launches from SLC-4E at
Vandenberg AFB. The booster is expected to land on JRTI.","crew":[],"ships":
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es-ride-on-spacex-launch-with-indonesian-comsat/","wikipedia":"https://en.wik
ipedia.org/wiki/PT_Pasifik_Satelit_Nusantara"},"static_fire_date_utc":"2019-0
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920,"rocket":"5e9d0d95eda69973a809d1ec","success":true,"failures":[],"detail
s":"SpaceX will launch this rideshare to GTO for Space Systems Loral (SSL). T
he primary payload for this mission is Nusantara Satu, a communications satel
lite built by SSL for the private Indonesian company PT Pasifik Satelit Nusan
tara (PSN). Spaceflight Industries\' GTO-1 mission consists of two secondary
payloads. One of those is Beresheet, the lunar lander built by the Israeli no
n-profit organization, SpaceIL. Beresheet will make its own way to the moon f

rom GTO. The other secondary is Air Force Research Lab\'s (Space Situational Awareness) S5 mission, which hitches a ride to GEO aboard Nusantara Satu. This mission launches from SLC-40 at Cape Canaveral AFS. The booster is expected to land on OCISLY.","crew":[],"ships":["5ea6ed30080df4000697c913"],"capsules":[],"payloads":["5eb0e4cab6c3bb0006eeb232","5eb0e4cab6c3bb0006eeb233","5eb0e4cab6c3bb0006eeb234"],"launchpad":"5e9e4501f509094ba4566f84","flight_number":75,"name":"Nusantara Satu (PSN-6) / S5 / Beresheet","date_utc":"2019-02-22T01:45:00.000Z","date_unix":1550799900,"date_local":"2019-02-21T20:45:00-05:00","date_precision":"hour","upcoming":false,"cores":[{"core":"5e9e28a5f3591809c03b2658","flight":3,"gridfins":true,"legs":true,"reused":true,"landing_attempt":true,"landing_success":true,"landing_type":"ASDS","landpad":"5e9e3032383ecb6bb234e7ca"}],"auto_update":true,"tbd":false,"launch_library_id":null,"id":"5eb87d2affd86e000604b374"},{"fairings":{"reused":null,"recovery_attempt":null,"recovered":null,"ships":[]},"links":{"patch":{"small":"https://images2.imgbox.com/59/a8/q5IEqsOJ_o.png","large":"https://images2.imgbox.com/ee/a6/x4AyUIc3_o.png"},"reddit":{"campaign":"https://www.reddit.com/r/spacex/comments/a65clm/dm1_launch_campaign_thread/","launch":"https://www.reddit.com/r/spacex/comments/av1asz/rspacex_cctcap_demo_mission_1_official_launch/","media":"https://www.reddit.com/r/spacex/comments/aw6g7j/rspacex_cctcap_demo_mission_1_media_thread_videos/","recovery":"https://www.reddit.com/r/spacex/comments/awo5lf/cctcap_demo_mission_1_official_booster_recovery/"},"flickr":{"small":[],"original":["https://farm8.staticflickr.com/7899/39684491043_f0289164bd_o.jpg","https://farm8.staticflickr.com/7804/39684490433_70337aa4e5_o.jpg","https://farm8.staticflickr.com/7826/32774791628_e2234480db_o.jpg","https://farm5.staticflickr.com/4882/39684490143_7df3838d2c_o.jpg","https://farm8.staticflickr.com/7851/46535572784_7eb295968e_o.jpg","https://farm8.staticflickr.com/7826/46535572564_a022f9c43a_o.jpg","https://farm8.staticflickr.com/7889/40294395933_f429c12e83_o.jpg","https://farm8.staticflickr.com/7914/40294395873_0a328f2d87_o.jpg","https://farm8.staticflickr.com/7866/46535572294_22499c1223_o.jpg","https://farm8.staticflickr.com/7850/46535573034_03da10f899_o.jpg","https://farm8.staticflickr.com/7848/46535572664_316c466742_o.jpg"]},"presskit":"https://www.spacex.com/sites/spacex/files/crew_demo-1_press_kit.pdf","webcast":"https://youtu.be/2ZL0tbOZYhE","youtube_id":"2ZL0tbOZYhE","article":"https://spaceflightnow.com/2019/03/02/spacex-launches-first-crew-dragon-ferry-ship/","wikipedia":"https://en.wikipedia.org/wiki/SpX-DM1"},"static_fire_date_utc":"2019-01-24T19:03:00.000Z","static_fire_date_unix":1548356580,"net":false,"window":0,"rocket":"5e9d0d95eda69973a809d1ec","success":true,"failures":[],"details":"Demonstration Mission 1 (DM-1) will launch Dragon 2 as part of NASA\'s Commercial Crew Transportation Capability program. This mission will demonstrate Dragon 2, and Falcon 9 in its configuration for crewed missions. DM-1 will launch from LC-39A at Kennedy Space Center, likely carrying some cargo to the International Space Station. The booster is expected to land on OCISLY.","crew":[],"ships":["5ea6ed30080df4000697c913"],"capsules":["5e9e2c5df35918b1063b2671"],"payloads":["5eb0e4cbb6c3bb0006eeb235"],"launchpad":"5e9e4502f509094188566f88","flight_number":76,"name":"CCtCap Demo Mission 1","date_utc":"2019-03-02T07:45:00.000Z","date_unix":1551512700,"date_local":"2019-03-02T02:45:00-05:00","date_precision":"hour","upcoming":false,"cores":[{"core":"5e9e28a6f35918c0803b265c","flight":1,"gridfins":true,"legs":true,"reused":false,"landing_attempt":true,"landing_success":true,"landing_type":"ASDS","landpad":"5e9e3032383ecb6bb234e7ca"}],"auto_update":true,"tbd":false,"launch_library_id":null,"id":"5eb87d2bffd86e000604b375"},{"fairings":{"reused":false,"recovery_attempt":true,"recovered":true,"ships":["5ea6ed2f080df4000697c90c"]},"links":{"patch":{"small":"https://images2.imgbox.com/14/18/JxCyAHXk_o.png","large":"https://images2.imgbox.com/9f/c3/GvLfwIfg_o.png"},"reddit":{"campaign":"https://www.reddit.com/r/spacex/comments/b0kscl/arabsat6a_launch_campaign_thread/","launch":"https://www.reddit.com/r/spacex/comments/basm9y/rspacex_a

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ceX will launch Arabsat 6A to a geostationary transfer orbit from SLC-39A, KS
C. The satellite is a geostationary telecommunications satellite built by Loc
kheed Martin for the Saudi Arabian company Arabsat. This will be the first op
erational flight of Falcon Heavy, and also the first Block 5 Falcon Heavy. Al
l three cores will be new Block 5 cores. The side cores are expected to land
at LZ-1 and LZ-2, and the center core is expected to land on OCISLY.","crew":
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now.com/2019/05/04/spacex-launches-space-station-resupply-mission-lands-rocke
t-on-drone-ship/","wikipedia":"https://en.wikipedia.org/wiki/SpaceX_CRS-1

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cess":true,"failures":[],"details":"SpaceX\'s 17th Commercial Resupply Servic
es mission for NASA out of a total of 20 contracted flights, this mission bri
ngs essential supplies to the International Space Station using SpaceX\'s reu
sable Dragon 1 spacecraft. The external payloads for this mission include Orb
ital Carbon Observatory 3 and Space Test Program-Houston 6. The Falcon 9 laun
ches from SLC-40 at Cape Canaveral AFS. The booster was expected to land at L
Z-1, however, due to the ongoing investigation and clean-up following the Cre
w Dragon testing incident, it is likely to land on OCISLY instead.\\n   ","c
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I","article":"https://spaceflightnow.com/2019/05/24/spacexs-first-60-starlink
-broadband-satellites-deployed-in-orbit","wikipedia":"https://en.wikipedia.or
g/wiki/Starlink_(satellite_constellation)"},"static_fire_date_utc":"2019-05-1
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s":"SpaceX will launch dozens of Starlink demonstration satellites from SLC-4
0, Cape Canaveral AFS. Starlink is a low Earth orbit broadband internet const
ellation developed and owned by SpaceX which will eventually consist of nearl
y 12 000 satellites and will provide low latency internet service to ground t
erminals around the world. Two prototype satellites, Microsats 2a and 2b, wer
e launched from Vandenberg AFB in February 2018. The booster for this mission
will land on OCISLY.","crew":[],"ships":["5ea6ed30080df4000697c913","5ea6ed2f
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s://spaceflightnow.com/2019/06/12/three-canadian-radar-surveillance-satellite
s-ride-spacex-rocket-into-orbit/","wikipedia":"https://en.wikipedia.org/wiki/
RADARSAT_Constellation"},"static_fire_date_utc":"2019-06-08T08:39:00.000Z","s
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the three satellite RADARSAT Constellation Mission into Sun Synchronous orbit
from SLC-4E, VAFB. The RCM spacecraft are synthetic aperture radar (SAR) Eart
h observation satellites built by the Canadian space company, MDA, for the Ca
nadian Space Agency. This mission was delayed when the originally slated boos
ter failed to land after CRS-16. The booster is expected to return to LZ-
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s://spaceflightnow.com/2019/06/25/falcon-heavy-launches-on-military-led-rides
hare-mission-boat-catches-fairing","wikipedia":"https://en.wikipedia.org/wik
i/Space_Test_Program"},"static_fire_date_utc":"2019-06-19T21:52:00.000Z","sta
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is a rideshare managed by the U.S. Air Force Space and Missile Systems Center
(SMC), launching from LC-39A, KSC. Most of the spacecraft will be delivered i
nto low Earth orbit (LEO) in two deployment sequences separated by a second s
tage burn. These LEO payloads include the six Taiwan and United States owned

COSMIC–2 microsatellites, the Planetary Society\'s LightSail–B demonstrator c ubesat, and others. The third and final deployment will be the Air Force Rese arch Lab\'s DSX spacecraft, which will be delivered to a medium Earth orbit (MEO). This mission will reuse the side cores from Arabsat 6A, which will ret urn to LZ–1, and LZ–2. The new center core will boost back to land on OCISLY less than 40 km from the launch site.","crew":[],"ships":["5ea6ed30080df40006 97c913","5ea6ed2f080df4000697c90b","5ea6ed2e080df4000697c909","5ea6ed2e080df4 000697c908","5ea6ed2f080df4000697c90e"],"capsules":[],"payloads":["5eb0e4ccb6 c3bb0006eeb23a","5eb0e4ccb6c3bb0006eeb23b","5eb0e4ccb6c3bb0006eeb23c","5eb0e4 ccb6c3bb0006eeb23d","5eb0e4ccb6c3bb0006eeb23e","5eb0e4cdb6c3bb0006eeb23f","5e b0e4cdb6c3bb0006eeb240","5eb0e4cdb6c3bb0006eeb241","5eb0e4cdb6c3bb0006eeb24 2","5eb0e4cdb6c3bb0006eeb243","5eb0e4cdb6c3bb0006eeb244","5eb0e4cdb6c3bb0006e eb245","5eb0e4ceb6c3bb0006eeb246","5eb0e4ceb6c3bb0006eeb247","5eb0e4ceb6c3bb0 006eeb248","5eb0e4ceb6c3bb0006eeb249"],"launchpad":"5e9e4502f509094188566f8 8","flight_number":81,"name":"STP-2","date_utc":"2019-06-25T03:30:00.000Z","d ate_unix":1561433400,"date_local":"2019-06-24T23:30:00-04:00","date_precisio n":"hour","upcoming":false,"cores":[{"core":"5e9e28a7f3591878063b2661","fligh t":1,"gridfins":true,"legs":true,"reused":false,"landing_attempt":true,"landi ng_success":false,"landing_type":"ASDS","landpad":"5e9e3032383ecb6bb234e7c a"},{"core":"5e9e28a6f359183c413b265d","flight":2,"gridfins":true,"legs":tru e,"reused":true,"landing_attempt":true,"landing_success":true,"landing_typ e":"RTLS","landpad":"5e9e3032383ecb267a34e7c7"},{"core":"5e9e28a6f359188fd53b 265e","flight":2,"gridfins":true,"legs":true,"reused":true,"landing_attempt": true,"landing_success":true,"landing_type":"RTLS","landpad":"5e9e3032383ecb90 a834e7c8"}],"auto_update":true,"tbd":false,"launch_library_id":null,"id":"5eb 87d35ffd86e000604b37a"},{"fairings":null,"links":{"patch":{"small":"https://i mages2.imgbox.com/f1/70/USGBp3Dy_o.png","large":"https://images2.imgbox.com/7 9/a5/ZdV48VwO_o.png"},"reddit":{"campaign":"https://www.reddit.com/r/spacex/c omments/c8k6g5/crs18_launch_campaign_thread","launch":"https://www.reddit.co m/r/spacex/comments/ch2ml7/rspacex_crs18_official_launch_discussion_update s/","media":"https://www.reddit.com/r/spacex/comments/chbr8i/rspacex_crs18_me dia_thread_videos_images_gifs/","recovery":null},"flickr":{"small":[],"origin al":["https://live.staticflickr.com/65535/48380511527_190682b573_o.jpg","http s://live.staticflickr.com/65535/48380370691_7b0757a4d3_o.jpg","https://live.s taticflickr.com/65535/48380511492_51db1bf984_o.jpg","https://live.staticflick r.com/65535/48380370626_a5d264c637_o.jpg","https://live.staticflickr.com/6553 5/48380511427_97db52a9e3_o.jpg"]},"presskit":"https://www.spacex.com/sites/sp acex/files/crs-18_press_kit.pdf","webcast":"https://youtu.be/SlgrxVuP5jk","yo utube_id":"SlgrxVuP5jk","article":"https://spaceflightnow.com/2019/07/25/new- docking-port-spacesuit-and-supplies-en-route-to-space-station/","wikipedi a":"https://en.wikipedia.org/wiki/SpaceX_CRS-18"},"static_fire_date_utc":"201 9-07-19T15:31:00.000Z","static_fire_date_unix":1563550260,"net":false,"windo w":0,"rocket":"5e9d0d95eda69973a809d1ec","success":true,"failures":[],"detail s":"SpaceX\'s 18th Commercial Resupply Services mission out of a total of 20 such contracted flights for NASA, this launch will deliver essential supplies to the International Space Station using the reusable Dragon 1 cargo spacecra ft. The external payload for this mission is International Docking Adapter 3, replacing IDA-1 lost in SpaceX\'s CRS-7 launch failure. This mission will lau nch from SLC-40 at Cape Canaveral AFS on a Falcon 9, and the first-stage boos ter is expected to land back at CCAFS LZ-1.","crew":[],"ships":[],"capsules": ["5e9e2c5cf359188bfb3b266b"],"payloads":["5eb0e4ceb6c3bb0006eeb24a"],"launchp ad":"5e9e4501f509094ba4566f84","flight_number":82,"name":"CRS-18","date_ut c":"2019-07-25T22:01:00.000Z","date_unix":1564092060,"date_local":"2019-07-25 T18:01:00-04:00","date_precision":"hour","upcoming":false,"cores":[{"core":"5 e9e28a7f3591809313b2660","flight":2,"gridfins":true,"legs":true,"reused":tru e,"landing_attempt":true,"landing_success":true,"landing_type":"RTLS","landpa

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g","https://live.staticflickr.com/65535/48478120031_5aae1f6131_o.jpg","http
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ecom-satellite/","wikipedia":"https://en.wikipedia.org/wiki/Spacecom"},"stati
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e,"failures":[],"details":"SpaceX will launch Boeing built Amos-17, a geostat
ionary communications satellite for Israeli company Spacecom. The satellite w
ill be delivered to GTO from KSC LC-39A or possibly CCAFS SLC-40, and will re
place the defunct Amos-5 at 17\xc2\xb0 E. Amos-17 carries multi-band high thr
oughput and regional beams servicing Africa, Europe and the Middle East. The
cost of this launch is covered for Spacecom by SpaceX credit following the Am
os-6 incident. A recovery of the booster for this mission is not expecte
d.","crew":[],"ships":["5ea6ed2e080df4000697c908","5ea6ed2e080df4000697c90
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XQ","youtube_id":"pIDuv0Ta0XQ","article":"https://spaceflightnow.com/2019/11/
11/successful-launch-continues-deployment-of-spacexs-starlink-network","wikip
edia":"https://en.wikipedia.org/wiki/Starlink_(satellite_constellation)"},"st
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e,"failures":[],"details":"This mission will launch the first batch of Starli
nk version 1.0 satellites, from SLC-40, Cape Canaveral AFS. They are expected
to contribute to the 550 km x 53\xc2\xb0 shell. It is the second Starlink lau
nch overall. Starlink is a low Earth orbit broadband internet constellation d
eveloped and owned by SpaceX which will eventually consist of nearly 12 000 s
atellites and will provide low latency internet service to ground terminals a
round the world. The booster for this mission is expected to land on OCISL
Y.","crew":[],"ships":["5ea6ed2e080df4000697c908","5ea6ed30080df4000697c91
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2/05/dragon-soars-on-research-and-resupply-flight-to-international-space-stat
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h a total of 20 contracted flights, this mission brings essential supplies to
the International Space Station using SpaceX\'s reusable Dragon spacecraft. T
he external payloads for this mission include the Hyperspectral Imager Suite
and a lithium-ion battery. Falcon 9 and Dragon will launch from SLC-40, Cape
Canaveral AFS. The mission will be complete with return and recovery of the D
ragon capsule and down cargo.","crew":[],"ships":["5ea6ed2f080df4000697c90
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s://youtu.be/sbXgZg9JmkI","youtube_id":"sbXgZg9JmkI","article":"https://space
flightnow.com/2019/12/17/startup-launches-broadband-satellite-on-spacex-rocke
t-to-connect-pacific-islands","wikipedia":"https://en.wikipedia.org/wiki/JSAT
_(satellite_constellation)"},"static_fire_date_utc":"2019-12-13T12:34:00.000
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unch the Boeing built dual payload satellite to geostationary transfer orbit
from XXXX. JCSat 18 is a mobile broadband communications payload built for Sk
y Perfect JSAT Corporation of Japan and will service Asia Pacific. Kacific 1
is a high throughput broadband internet payload built for Kacific Broadband S
atellites and will service certain high demand areas of Southeast Asia and th
e Pacific. Both payloads share a single chassis. The booster for this mission
is expected to land on OCISLY.","crew":[],"ships":["5ea6ed2e080df4000697c90
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w.com/2020/01/07/spacex-launches-more-starlink-satellites-tests-design-change
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ite_constellation)"},"static_fire_date_utc":"2020-01-04T11:45:00.000Z","stati
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he second batch of Starlink version 1.0 satellites, from SLC-40, Cape Canaver
al AFS. They are expected to contribute to the 550 km x 53\xc2\xb0 shell. It
is the third Starlink launch overall. Starlink is a low Earth orbit broadband
internet constellation developed and owned by SpaceX which will eventually co
nsist of nearly 12 000 satellites and will provide low latency internet servi
ce to ground terminals around the world. The booster for this mission is expe
cted to land on OCISLY.","crew":[],"ships":["5ea6ed2e080df4000697c908","5ea6e

d30080df4000697c913","5ea6ed2e080df4000697c909","5ea6ed2f080df4000697c90b","5ea6ed2f080df4000697c90d"],"capsules":[],"payloads":["5eb0e4cfb6c3bb0006eeb24f"],"launchpad":"5e9e4501f509094ba4566f84","flight_number":87,"name":"Starlink-2","date_utc":"2020-01-07T02:19:00.000Z","date_unix":1578363540,"date_local":"2020-01-06T21:19:00-05:00","date_precision":"hour","upcoming":false,"cores":[{"core":"5e9e28a5f3591833b13b2659","flight":4,"gridfins":true,"legs":true,"reused":true,"landing_attempt":true,"landing_success":true,"landing_type":"ASDS","landpad":"5e9e3032383ecb6bb234e7ca"}],"auto_update":true,"tbd":false,"launch_library_id":null,"id":"5eb87d3cffd86e000604b380"},{"fairings":{"reused":null,"recovery_attempt":null,"recovered":null,"ships":[]},"links":{"patch":{"small":"https://images2.imgbox.com/c0/9d/SJYvC4hT_o.png","large":"https://images2.imgbox.com/19/df/IH0nVnSr_o.png"},"reddit":{"campaign":"https://www.reddit.com/r/spacex/comments/ek7eny/in_flight_abort_test_launch_campaign_thread","launch":"https://www.reddit.com/r/spacex/comments/eq24ap/rspacex_inflight_abort_test_official_launch","media":"https://www.reddit.com/r/spacex/comments/eq7pg4/rspacex_inflight_abort_test_media_thread_videos/","recovery":null},"flickr":{"small":[],"original":["https://live.staticflickr.com/65535/49421605028_b7ba890f0e_o.jpg","https://live.staticflickr.com/65535/49422067976_cda2b8f021_o.jpg","https://live.staticflickr.com/65535/49422067876_13ed519fe6_o.jpg","https://live.staticflickr.com/65535/49421604803_0093a5d2cb_o.jpg","https://live.staticflickr.com/65535/49422294602_0d5e7d8e82_o.jpg","https://live.staticflickr.com/65535/49422068111_2ed613b19b_o.jpg"]},"presskit":"https://www.spacex.com/sites/spacex/files/in-flight_abort_test_press_kit.pdf","webcast":"https://youtu.be/mhrkdHshb3E","youtube_id":"mhrkdHshb3E","article":"https://spaceflightnow.com/2020/01/19/spacex-aces-final-major-test-before-first-crew-mission","wikipedia":"https://en.wikipedia.org/wiki/Commercial_Crew_Development"},"static_fire_date_utc":"2020-01-11T09:42:00.000Z","static_fire_date_unix":1578735720,"net":false,"window":14400,"rocket":"5e9d0d95eda69973a809d1ec","success":true,"failures":[],"details":"SpaceX will launch a Crew Dragon capsule from LC-39A, KSC on a fully fueled Falcon 9 rocket and then trigger the launch escape system during the period of maximum dynamic pressure. As part of NASA\'a Commercial Crew Integrated Capability program (CCiCap) this test will contribute valuable data to help validate Crew Dragon and its launch abort system. The Crew Dragon will be recovered by GO Searcher after splashdown in the Atlantic Ocean. This flight does not go to orbit. The booster and upper stage are expected to break up following capsule separation and there will be no landing attempt.","crew":[],"ships":["5ea6ed2f080df4000697c90c"],"capsules":["5e9e2c5df359184c9a3b2672"],"payloads":["5eb0e4d0b6c3bb0006eeb250"],"launchpad":"5e9e4502f509094188566f88","flight_number":88,"name":"Crew Dragon In Flight Abort Test","date_utc":"2020-01-19T14:00:00.000Z","date_unix":1579442400,"date_local":"2020-01-19T09:00:00-05:00","date_precision":"hour","upcoming":false,"cores":[{"core":"5e9e28a5f359182b023b2656","flight":4,"gridfins":false,"legs":false,"reused":true,"landing_attempt":false,"landing_success":null,"landing_type":null,"landpad":null}],"auto_update":true,"tbd":false,"launch_library_id":null,"id":"5eb87d3dffd86e000604b381"},{"fairings":{"reused":false,"recovery_attempt":true,"recovered":true,"ships":["5ea6ed2e080df4000697c908"]},"links":{"patch":{"small":"https://images2.imgbox.com/3a/c6/ueu9Acdh_o.png","large":"https://images2.imgbox.com/1c/55/xNcIOR8Z_o.png"},"reddit":{"campaign":"https://www.reddit.com/r/spacex/comments/eof5pr/starlink3_launch_campaign_thread/","launch":"https://www.reddit.com/r/spacex/comments/eudve3/rspacex_starlink_3_official_launch_discussion/","media":"https://www.reddit.com/r/spacex/comments/evjdws/rspacex_starlink3_media_thread_videos_images_gifs/","recovery":"https://www.reddit.com/r/spacex/comments/evnyij/rspacex_starlink3_recovery_discussion_updates/"},"flickr":{"small":[],"original":["https://live.staticflickr.com/65535/49461673512_f4e01c8b27_o.jpg","https://live.staticflickr.com/65535/49461673792_b1804c2a2b_o.jpg","https://live.staticflickr.com/655

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9/spacex-boosts-60-more-starlink-satellites-into-orbit-after-weather-delay
s/","wikipedia":"https://en.wikipedia.org/wiki/SpaceX_Starlink"},"static_fire
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on 1.0 satellites, from SLC-40, Cape Canaveral AFS. It is the fourth Starlink
launch overall. The satellites will be delivered to low Earth orbit and will
spend a few weeks maneuvering to their operational altitude of 550 km. The bo
oster for this mission is expected to land on OCISLY.","crew":[],"ships":["5e
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le":"https://spaceflightnow.com/2020/02/17/spacex-delivers-more-starlink-sate
llites-to-orbit-booster-misses-drone-ship-landing/","wikipedia":"https://en.w
ikipedia.org/wiki/SpaceX_Starlink"},"static_fire_date_utc":"2020-02-14T08:31:
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ssion will launch the fourth batch of Starlink version 1.0 satellites, from S
LC-40, Cape Canaveral AFS. It is the fifth Starlink launch overall. The satel
lites will be delivered to low Earth orbit and will spend a few weeks maneuve
ring to their operational altitude of 550 km. The booster for this mission is
expected to land on OCISLY.","crew":[],"ships":["5ea6ed2e080df4000697c908","5
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3","5ea6ed2f080df4000697c90d"],"capsules":[],"payloads":["5eb0e4d0b6c3bb0006e
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le":"https://spaceflightnow.com/2020/03/07/late-night-launch-of-spacex-cargo-
ship-marks-end-of-an-era/","wikipedia":"https://en.wikipedia.org/wiki/SpaceX_
CRS-20"},"static_fire_date_utc":"2020-03-01T10:20:00.000Z","static_fire_date_
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c","success":true,"failures":[],"details":"SpaceX\'s 20th and final Crew Resu
pply Mission under the original NASA CRS contract, this mission brings essent
ial supplies to the International Space Station using SpaceX\'s reusable Drag
on spacecraft. It is the last scheduled flight of a Dragon 1 capsule. (CRS-21
and up under the new Commercial Resupply Services 2 contract will use Dragon
2.) The external payload for this mission is the Bartolomeo ISS external payl
oad hosting platform. Falcon 9 and Dragon will launch from SLC-40, Cape Canav
eral Air Force Station and the booster will land at LZ-1. The mission will be
complete with return and recovery of the Dragon capsule and down cargo.","cre
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om/2020/03/18/falcon-9-rocket-overcomes-engine-failure-to-deploy-starlink-sat
ellites/","wikipedia":"https://en.wikipedia.org/wiki/Starlink"},"static_fire_
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t":false,"window":0,"rocket":"5e9d0d95eda69973a809d1ec","success":true,"failu
res":[],"details":"The sixth Starlink launch overall and the fifth operationa
l batch of Starlink satellites will launch into orbit aboard a Falcon 9 rocke
t. This mission is expected to deploy all sixty satellites into an elliptical
orbit about fifteen minutes into flight. In the weeks following launch the sa
tellites are expected to utilize their onboard ion thrusters to raise their o

rbits to 550 km in three groups of 20, making use of precession rates to sepa
rate themselves into three planes. The booster will land on a drone ship appr
oximately 628 km downrange.","crew":[],"ships":["5ea6ed30080df4000697c913","5
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omments/fxkc7k/starlink6_launch_campaign_thread/","launch":"https://www.reddi
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s://youtu.be/wSge0I7pwFI","youtube_id":"wSge0I7pwFI","article":"https://space
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k-after-successful-launch/","wikipedia":"https://en.wikipedia.org/wiki/Starli
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of operational Starlink satellites, which are expected to be version 1.0, fro
m SLC-40, Cape Canaveral AFS. It is the seventh Starlink launch overall. The
satellites will be delivered to low Earth orbit and will spend a few weeks ma
neuvering to their operational altitude of 550 km. The booster for this missi
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ttps://live.staticflickr.com/65535/49934168858_cacb00d790_o.jpg","https://live.staticflickr.com/65535/49934682271_fd6a31becc_o.jpg","https://live.staticflickr.com/65535/49956109906_f88d815772_o.jpg","https://live.staticflickr.com/65535/49956109706_cffa847208_o.jpg","https://live.staticflickr.com/65535/49956109671_859b323ede_o.jpg","https://live.staticflickr.com/65535/49955609618_4cca01d581_o.jpg","https://live.staticflickr.com/65535/49956396622_975c116b71_o.jpg","https://live.staticflickr.com/65535/49955609378_9b77e5c771_o.jpg","https://live.staticflickr.com/65535/49956396262_ef41c1d9b0_o.jpg"]},"presskit":"https://www.nasa.gov/sites/default/files/atoms/files/commercialcrew_press_kit.pdf","webcast":"https://youtu.be/xY96v0OIcK4","youtube_id":"xY96v0OIcK4","article":"https://spaceflightnow.com/2020/05/30/nasa-astronauts-launch-from-us-soil-for-first-time-in-nine-years/","wikipedia":"https://en.wikipedia.org/wiki/Crew_Dragon_Demo-2"},"static_fire_date_utc":"2020-05-22T17:39:00.000Z","static_fire_date_unix":1590169140,"net":false,"window":0,"rocket":"5e9d0d95eda69973a809d1ec","success":true,"failures":[],"details":"SpaceX will launch the second demonstration mission of its Crew Dragon vehicle as part of NASA\'s Commercial Crew Transportation Capability Program (CCtCap), carrying two NASA astronauts to the International Space Station. Barring unexpected developments, this mission will be the first crewed flight to launch from the United States since the end of the Space Shuttle program in 2011. DM-2 demonstrates the Falcon 9 and Crew Dragon\'s ability to safely transport crew to the space station and back to Earth and it is the last major milestone for certification of Crew Dragon. Initially the mission duration was planned to be no longer than two weeks, however NASA has been considering an extension to as much as six weeks or three months. The astronauts have been undergoing additional training for the possible longer mission.","crew":["5ebf1a6e23a9a60006e03a7a","5ebf1b7323a9a60006e03a7b"],"ships":["5ea6ed30080df4000697c913","5ea6ed2f080df4000697c90b","5ea6ed2f080df4000697c90c","5ea6ed2e080df4000697c909","5ea6ed2f080df4000697c90d"],"capsules":["5e9e2c5df359188aba3b2676"],"payloads":["5eb0e4d1b6c3bb0006eeb257"],"launchpad":"5e9e4502f509094188566f88","flight_number":94,"name":"CCtCap Demo Mission 2","date_utc":"2020-05-30T19:22:00.000Z","date_unix":1590866520,"date_local":"2020-05-30T15:22:00-04:00","date_precision":"hour","upcoming":false,"cores":[{"core":"5e9e28a7f3591817f23b2663","flight":1,"gridfins":true,"legs":true,"reused":false,"landing_attempt":true,"landing_success":true,"landing_type":"ASDS","landpad":"5e9e3032383ecb6bb234e7ca"}],"auto_update":true,"tbd":false,"launch_library_id":null,"id":"5eb87d46ffd86e000604b388"},{"fairings":{"reused":false,"recovery_attempt":true,"recovered":null,"ships":["5ea6ed2e080df4000697c908","5ea6ed2e080df4000697c907"]},"links":{"patch":{"small":"https://images2.imgbox.com/14/8a/x2EqeeM4_o.png","large":"https://images2.imgbox.com/f4/9a/sUj3vEI3_o.png"},"reddit":{"campaign":"https://www.reddit.com/r/spacex/comments/gamcbr/starlink7_launch_campaign_thread/","launch":"https://www.reddit.com/r/spacex/comments/gkfe30/rspacex_starlink_7_official_launch_discussion/","media":null,"recovery":null},"flickr":{"small":[],"original":["https://live.staticflickr.com/65535/49971196871_a0462d0084_o.jpg","https://live.staticflickr.com/65535/49970682603_e6333945ee_o.jpg"]},"presskit":"https://spacextimemachine.com/assets/press_kits/185.pdf","webcast":"https://youtu.be/y4xBFHjkUvw","youtube_id":"y4xBFHjkUvw","article":"https://spaceflightnow.com/2020/06/04/spacex-sets-new-mark-in-rocket-reuse-10-years-after-first-falcon-9-launch/","wikipedia":"https://en.wikipedia.org/wiki/Starlink"},"static_fire_date_utc":"2020-05-13T11:11:00.000Z","static_fire_date_unix":1589368260,"net":false,"window":0,"rocket":"5e9d0d95eda69973a809d1ec","success":true,"failures":[],"details":"This mission will launch the seventh batch of operational Starlink satellites, which are expected to be version 1.0, from SLC-40, Cape Canaveral AFS. It is the eighth Starlink launch overall. The satellites will be delivered to low Earth orbit and will spend a few weeks maneuvering to their operational altitude of 550 km. The booster for thi

s mission is expected to land on JRTI on its first mission since arriving at Port Canaveral.","crew":[],"ships":["5ea6ed2e080df4000697c908","5ea6ed2e080df4000697c907","5ee68c683c228f36bd5809b5"],"capsules":[],"payloads":["5eb0e4d1b6c3bb0006eeb256"],"launchpad":"5e9e4501f509094ba4566f84","flight_number":95,"name":"Starlink-7","date_utc":"2020-06-04T01:25:00.000Z","date_unix":1591233900,"date_local":"2020-06-03T21:25:00-04:00","date_precision":"hour","upcoming":false,"cores":[{"core":"5e9e28a5f3591833b13b2659","flight":5,"gridfins":true,"legs":true,"reused":true,"landing_attempt":true,"landing_success":true,"landing_type":"ASDS","landpad":"5e9e3033383ecbb9e534e7cc"}],"auto_update":true,"tbd":false,"launch_library_id":null,"id":"5eb87d45ffd86e000604b387"},{"fairings":{"reused":true,"recovery_attempt":true,"recovered":null,"ships":["5ea6ed2e080df4000697c908","5ea6ed2e080df4000697c907"]},"links":{"patch":{"small":"https://images2.imgbox.com/f2/ab/jxHngBd5_o.png","large":"https://images2.imgbox.com/ba/aa/6rusTkQw_o.png"},"reddit":{"campaign":"https://www.reddit.com/r/spacex/comments/gwbr4t/starlink8_launch_campaign_thread/","launch":"https://www.reddit.com/r/spacex/comments/h7gqlc/rspacex_starlink_8_official_launch_discussion/","media":"https://www.reddit.com/r/spacex/comments/h842qk/rspacex_starlink8_media_thread_photographer/","recovery":"https://www.reddit.com/r/spacex/comments/h8sx6q/starlink8_recovery_thread/"},"flickr":{"small":[],"original":["https://live.staticflickr.com/65535/50009748327_93e52a451f_o.jpg"]},"presskit":null,"webcast":"https://youtu.be/8riKQXChPGg","youtube_id":"8riKQXChPGg","article":"https://spaceflightnow.com/2020/06/13/starlink-satellite-deployments-continue-with-successful-falcon-9-launch/","wikipedia":"https://en.wikipedia.org/wiki/Starlink"},"static_fire_date_utc":null,"static_fire_date_unix":null,"net":false,"window":0,"rocket":"5e9d0d95eda69973a809d1ec","success":true,"failures":[],"details":"This mission will launch the eighth batch of operational Starlink satellites, which are expected to be version 1.0, from SLC-40, Cape Canaveral AFS. It is the ninth Starlink launch overall. The satellites will be delivered to low Earth orbit and will spend a few weeks maneuvering to their operational altitude of 550 km. This mission is includes rideshare payloads, SkySats 16-18, on top of the Starlink stack. The booster for this mission is expected to land an ASDS.","crew":[],"ships":["5ea6ed2e080df4000697c908","5ea6ed2e080df4000697c907","5ea6ed2f080df4000697c90b"],"capsules":[],"payloads":["5eb0e4d1b6c3bb0006eeb258"],"launchpad":"5e9e4501f509094ba4566f84","flight_number":96,"name":"Starlink-8 & SkySat 16-18","date_utc":"2020-06-13T09:21:00.000Z","date_unix":1592040060,"date_local":"2020-06-13T05:21:00-04:00","date_precision":"hour","upcoming":false,"cores":[{"core":"5e9e28a7f359187afd3b2662","flight":3,"gridfins":true,"legs":true,"reused":true,"landing_attempt":true,"landing_success":true,"landing_type":"ASDS","landpad":"5e9e3032383ecb6bb234e7ca"}],"auto_update":true,"tbd":false,"launch_library_id":null,"id":"5eb87d46ffd86e000604b389"},{"fairings":{"reused":null,"recovery_attempt":true,"recovered":true,"ships":[]},"links":{"patch":{"small":"https://images2.imgbox.com/1f/83/TEXnegNL_o.png","large":"https://images2.imgbox.com/14/95/yd34FANN_o.png"},"reddit":{"campaign":"https://www.reddit.com/r/spacex/comments/gzeshn/gps_iii_sv03_launch_campaign_thread/","launch":"https://www.reddit.com/r/spacex/comments/hi5hit/rspacex_gps_iii_sv03_columbus_official_launch/","media":"https://www.reddit.com/r/spacex/comments/hiq0vd/rspacex_gps_iii_sv03_media_thread_photographer/","recovery":"https://www.reddit.com/r/spacex/comments/hjendd/gps_iii_svo3_recovery_thread/"},"flickr":{"small":[],"original":["https://live.staticflickr.com/65535/50065947228_804efe6117_o.jpg","https://live.staticflickr.com/65535/50065947263_e1a6ea1e22_o.jpg","https://live.staticflickr.com/65535/50065947218_88ef29951a_o.jpg","https://live.staticflickr.com/65535/50066762457_8c92090037_o.jpg","https://live.staticflickr.com/65535/50085443052_9f6b843a02_o.jpg","https://live.staticflickr.com/65535/50085211776_588bed76f0_o.jpg","https://live.staticflickr.com/65535/50084627433_89d8915596_o.jpg"]},"presskit":null,"webcast":"https://youtu.b

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om/2020/06/30/spacex-launches-its-first-mission-for-u-s-space-force/","wikipe
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ls":"SpaceX will launch GPS Block III Space Vehicle 03 from SLC-40, Cape Cana
veral AFS aboard a Falcon 9. GPS III is owned and operated by the US Air Forc
e and produced by Lockheed Martin. This is the third GPS III satellite and th
e second launched by SpaceX. The satellite will be delivered into a MEO trans
fer orbit. The booster for this mission is expected to land on an ASDS.","cre
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w.com/2020/07/20/spacex-delivers-south-koreas-first-military-satellite-into-o
n-target-orbit/","wikipedia":null},"static_fire_date_utc":"2020-07-11T17:58:0
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te from LC-39A, Kennedy Space Center. It will be South Korea\'s first dedicat
ed military communications satellite. Falcon 9 will deliver the satellite to
a geostationary transfer orbit. The booster is expected to land downrange on
an ASDS.","crew":[],"ships":["5ea6ed2e080df4000697c908","5ea6ed2e080df4000697
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ek-with-launch-of-more-starlink-satellites/","wikipedia":"https://en.wikipedi
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ic_fire_date_unix":1593022680,"net":false,"window":0,"rocket":"5e9d0d95eda699
73a809d1ec","success":true,"failures":[],"details":"This mission will launch
the ninth batch of operational Starlink satellites, which are expected to be
version 1.0, from LC-39A, Kennedy Space Center. It is the tenth Starlink laun
ch overall. The satellites will be delivered to low Earth orbit and will spen
d a few weeks maneuvering to their operational altitude of 550 km. This missi
on is includes a rideshare of two BlackSky satellites on top of the Starlink
stack. The booster for this mission is expected to land an ASDS.","crew":
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h the tenth batch of operational Starlink satellites, which are expected to b
e version 1.0, from LC-39A, Kennedy Space Center. It is the eleventh Starlink
launch overall. The satellites will be delivered to low Earth orbit and will
spend a few weeks maneuvering to their operational altitude of 550 km. This m
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stack. The booster for this mission is expected to land on an ASDS.","crew":
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first-polar-orbit-mission-from-florida-in-decades/","wikipedia":"https://en.w
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the two satellite SAOCOM 1 satellites into a sun-synchronous polar orbit from
SLC-40, Cape Canaveral AFS. SAOCOM 1B is a synthetic aperture radar Earth obs
ervation satellite to support disaster management. The SAOCOM spacecraft are
operated by CONAE, the Argentinian National Space Activities Commission, and
are built by INVAP. This mission is also expected to include rideshare payloa
ds Sequoia, and GNOMES-1. This will be the first polar launch from the Space
Coast in 60 years. The launch azimuth will be southward and the booster will
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s the twelfth Starlink launch overall. The satellites will be delivered to lo
w Earth orbit and will spend a few weeks maneuvering to their operational alt

itude of 550 km. The booster for this mission is expected to land on an ASD
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eral Air Force Station. It is the thirteenth Starlink launch overall. The sat
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titude of 550 km. The booster for this mission is expected to land on an ASD
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SLC-40, Cape Canaveral AFS aboard a Falcon 9. GPS III is owned and operated b
y the US Air Force and produced by Lockheed Martin. This will be the fourth G
PS III satellite launched and the third launched by SpaceX. The satellite wil
l be delivered into a MEO transfer orbit. The booster for this mission will l
and on an ASDS.","crew":[],"ships":["5ea6ed30080df4000697c913","5ee68c683c228
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acex/comments/ju7fxv/rspacex_crew1_official_launch_coast_docking/","media":"h
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ational mission of its Crew Dragon vehicle as part of NASA\'s Commercial Crew
Transportation Capability Program (CCtCap), carrying 3 NASA astronauts and 1
JAXA astronaut to the International Space Station. This mission will be the s
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90c","5ea6ed2e080df4000697c909","5ea6ed2f080df4000697c90b"],"capsules":["5f6f99fddcfdf403df379709"],"payloads":["5eb0e4d2b6c3bb0006eeb25f"],"launchpad":"5e9e4502f509094188566f88","flight_number":107,"name":"Crew-1","date_utc":"2020-11-16T00:27:00.000Z","date_unix":1605486420,"date_local":"2020-11-15T19:27:00-05:00","date_precision":"hour","upcoming":false,"cores":[{"core":"5f57c53d0622a6330279009f","flight":1,"gridfins":true,"legs":true,"reused":false,"landing_attempt":true,"landing_success":true,"landing_type":"ASDS","landpad":"5e9e3033383ecbb9e534e7cc"}],"auto_update":true,"tbd":false,"launch_library_id":null,"id":"5eb87d4dffd86e000604b38e"},{"fairings":{"reused":null,"recovery_attempt":null,"recovered":null,"ships":[]},"links":{"patch":{"small":"https://images2.imgbox.com/96/40/667HXq7w_o.png","large":"https://images2.imgbox.com/26/73/pypHBlGD_o.png"},"reddit":{"campaign":"https://www.reddit.com/r/spacex/comments/jkk93v/sentinel6_michael_freilich_launch_campaign_thread/","launch":"https://www.reddit.com/r/spacex/comments/jxsche/rspacex_sentinel6_official_launch_discussion/","media":"https://www.reddit.com/r/spacex/comments/jyd67q/rspacex_sentinel6_media_thread_photographer/","recovery":null},"flickr":{"small":[],"original":["https://live.staticflickr.com/65535/50630802488_8cc373728e_o.jpg","https://live.staticflickr.com/65535/50631642722_3af8131c6f_o.jpg","https://live.staticflickr.com/65535/50631544171_66bd43eaa9_o.jpg","https://live.staticflickr.com/65535/50631543966_e8035d5cca_o.jpg","https://live.staticflickr.com/65535/50631643257_c214ceee7b_o.jpg","https://live.staticflickr.com/65535/50631643917_cb7db291d0_o.jpg"]},"presskit":null,"webcast":"https://youtu.be/aVFPzTDCihQ","youtube_id":"aVFPzTDCihQ","article":"https://spaceflightnow.com/2020/11/21/international-satellite-launches-to-extend-measurements-of-sea-level-rise/","wikipedia":"https://en.wikipedia.org/wiki/Copernicus_Sentinel-6"},"static_fire_date_utc":"2020-11-17T13:17:00.000Z","static_fire_date_unix":1605619020,"net":false,"window":null,"rocket":"5e9d0d95eda69973a809d1ec","success":true,"failures":[],"details":"SpaceX will launch Sentinel-6 Michael Freilich into low Earth orbit for NASA, NOAA, ESA, and the European Organization for the Exploitation of Meteorological Satellites aboard a Falcon 9 from SLC-4E, Vandenberg Air Force Station. Sentinel-6(A) is an ocean observation satellite providing radar ocean surface altimetry data and also atmospheric temperature profiles as a secondary mission. The booster for this mission is will land at LZ-4.","crew":[],"ships":[],"capsules":[],"payloads":["5ed9867c1f30554030d45c40"],"launchpad":"5e9e4502f509092b78566f87","flight_number":108,"name":"Sentinel-6 Michael Freilich","date_utc":"2020-11-21T17:17:00.000Z","date_unix":1605979020,"date_local":"2020-11-21T09:17:00-08:00","date_precision":"hour","upcoming":false,"cores":[{"core":"5f57c54a0622a633027900a1","flight":1,"gridfins":true,"legs":true,"reused":false,"landing_attempt":true,"landing_success":true,"landing_type":"RTLS","landpad":"5e9e3032383ecb554034e7c9"}],"auto_update":true,"tbd":false,"launch_library_id":null,"id":"5ed983aa1f30554030d45c31"},{"fairings":{"reused":true,"recovery_attempt":true,"recovered":null,"ships":["5ea6ed2e080df4000697c907"]},"links":{"patch":{"small":"https://images2.imgbox.com/54/00/2OgoVFlS_o.png","large":"https://images2.imgbox.com/4a/e7/h403ivFa_o.png"},"reddit":{"campaign":"https://www.reddit.com/r/spacex/comments/jhu37i/starlink_general_discussion_and_deployment_thread/","launch":"https://www.reddit.com/r/spacex/comments/jxyodz/rspacex_starlink15_official_launch_discussion/","media":"https://www.reddit.com/r/spacex/comments/k0mom0/starlink15_media_thread_photographer_contest/","recovery":null},"flickr":{"small":[],"original":["https://live.staticflickr.com/65535/50644831893_bb40b60827_o.jpg","https://live.staticflickr.com/65535/50645580736_44af27257f_o.jpg"]},"presskit":null,"webcast":"https://youtu.be/J442-ti-Dhg","youtube_id":"J442-ti-Dhg","article":"https://spaceflightnow.com/2020/11/25/spacex-launches-60-more-starlink-satellites-on-100th-falcon-9-flight/","wikipedia":"https://en.wikipedia.org/wiki/Starlink"},"static_fire_date_utc":"2020-11-21T16:31:00.000Z","static_fire_date_unix":1605976260,"net":false,"window":null,"rock

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ission will launch the fifteenth batch of operational Starlink satellites, wh
ich are version 1.0, from SLC-40, Cape Canaveral Air Force Station. It will b
e the sixteenth Starlink launch overall. The satellites will be delivered to
low Earth orbit and will spend a few weeks maneuvering to their operational a
ltitude of 550 km. The booster for this mission is expected to land on an ASD
S.","crew":[],"ships":["5ea6ed30080df4000697c913","5ea6ed2f080df4000697c90
c","5ea6ed2f080df4000697c90b","5ea6ed2f080df4000697c90d","5ea6ed2e080df400069
7c907"],"capsules":[],"payloads":["5fb95c263a88ae63c9546044"],"launchpad":"5e
9e4501f509094ba4566f84","flight_number":109,"name":"Starlink-15 (v1.0)","date
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-24T21:13:00-05:00","date_precision":"hour","upcoming":false,"cores":[{"cor
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S","landpad":"5e9e3032383ecb6bb234e7ca"}],"auto_update":true,"tbd":false,"lau
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view_high_res.pdf","webcast":"https://youtu.be/4xJAGFR_N-c","youtube_id":"4xJ
AGFR_N-c","article":"https://spaceflightnow.com/2020/12/06/spacex-launches-fi
rst-in-new-line-of-upgraded-space-station-cargo-ships/","wikipedia":"https://
en.wikipedia.org/wiki/SpaceX_CRS-21"},"static_fire_date_utc":"2020-12-03T13:4
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et":"5e9d0d95eda69973a809d1ec","success":true,"failures":[],"details":"SpaceX
\'s 21st ISS resupply mission on behalf of NASA and the first under the CRS-2
contract, this mission brings essential supplies to the International Space S
tation using the cargo variant of SpaceX\'s Dragon 2 spacecraft. The external
payload for this mission is the Nanoracks Bishop Airlock. Falcon 9 and Dragon
launch from LC-39A, Kennedy Space Center and the booster is expected to land
on an ASDS. The mission will be complete with return and recovery of the Drag
on capsule and down cargo.","crew":[],"ships":["5ea6ed30080df4000697c913","5e
a6ed2f080df4000697c90b","5ea6ed2f080df4000697c90d"],"capsules":["5fbb0f8fec55
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509094188566f88","flight_number":110,"name":"CRS-21","date_utc":"2020-12-06T1
6:17:00.000Z","date_unix":1607271420,"date_local":"2020-12-06T11:17:00-05:0
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a":"https://www.reddit.com/r/spacex/comments/kcev8p/sxm7_media_thread_photogr

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w.com/2020/12/13/siriusxm-satellite-rides-spacex-rocket-into-orbit/","wikiped
ia":"https://en.wikipedia.org/wiki/Sirius_XM#Satellites"},"static_fire_date_u
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s":[],"details":"SpaceX will launch the first of two next generation high pow
er S-band broadcast satellites for SiriusXM. The spacecraft will be delivered
into a geostationary transfer orbit and the booster will be recovered downran
ge. The spacecraft is built by Space Systems Loral (SSL) on the SSL 1300 plat
form and includes two solar arrays producing 20kW, and an unfurlable antenna
dish. SXM-7 will replace XM-3 in geostationary orbit.","crew":[],"ships":["5e
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s://spaceflightnow.com/2020/12/19/spacex-closes-out-record-year-of-launches-f
rom-floridas-space-coast/","wikipedia":"https://en.wikipedia.org/wiki/Nationa
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s":true,"failures":[],"details":"SpaceX will launch NROL-108 for the National
Reconnaissance Office aboard a Falcon 9 from SLC-40, Cape Canaveral Air Force
Station. The booster for this mission is expected to land at LZ-1.","crew":
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deploys-turkish-satellite-in-first-launch-of-2021/","wikipedia":"https://en.w
ikipedia.org/wiki/T%C3%BCrksat_5A"},"static_fire_date_utc":null,"static_fire_
date_unix":null,"net":false,"window":17820,"rocket":"5e9d0d95eda69973a809d1e
c","success":true,"failures":[],"details":"SpaceX will launch the first of tw
o next generation satellites on contract for T\xc3\xbcrksat. T\xc3\xbcrksat 5
A is a Ku-band broadcast satellite built by Airbus Defense and Space and base
d on the Electric Orbit Raising version of the Eurostar E3000 platform. This
spacecraft will be delivered into a transfer orbit and will then raise itself
to its operational 31\xc2\xb0 East geostationary orbit to serve Turkey, the M
iddle East, Europe, North Africa and South Africa. The booster for this missi
on will be recovered downrange via ASDS.","crew":[],"ships":["5ea6ed2f080df40
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ds-with-successful-starlink-launch/","wikipedia":"https://en.wikipedia.org/wi
ki/Starlink"},"static_fire_date_utc":null,"static_fire_date_unix":null,"net":
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res":[],"details":"This mission launches the sixteenth batch of operational S
tarlink satellites, which are version 1.0, from SLC-40 or LC-39A. It is the s
eventeenth Starlink launch overall. The satellites will be delivered to low E
arth orbit and will spend a few weeks maneuvering to their operational altitu

de. The booster is expected to land on an ASDS.","crew":[],"ships":["5ea6ed2e
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umber":114,"name":"Starlink-16 (v1.0)","date_utc":"2021-01-20T13:02:00.000
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ision":"hour","upcoming":false,"cores":[{"core":"5e9e28a6f35918c0803b265c","f
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x_transporter1_official_launch_discussion/","media":null,"recovery":"https://
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ad/"},"flickr":{"small":[],"original":["https://live.staticflickr.com/65535/5
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tting-rideshare-mission-with-143-small-satellites/","wikipedia":null},"static
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s":"SpaceX will launch a dedicated rideshare mission from SLC-40 or LC-39A. T
he spacecraft will be delivered into a sun-synchronous orbit. The booster for
this mission is expected to land on an ASDS.","crew":[],"ships":["5ea6ed30080
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nding-after-launching-60-more-starlink-satellites/","wikipedia":"https://en.w
ikipedia.org/wiki/Starlink"},"static_fire_date_utc":"2021-02-24T12:25:00.000
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aunches the sixteenth batch of operational Starlink satellites, which are ver
sion 1.0, from LC-39A. It is the eighteenth Starlink launch overall. The sate
llites will be delivered to low Earth orbit and will spend a few weeks maneuv
ering to their operational altitude. The booster is expected to land on an AS
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-more-satellites-to-starlink-internet-fleet/","wikipedia":"https://en.wikiped
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m LC-39A or SLC-40. It is the 21st Starlink launch overall. The satellites wi
ll be delivered to low Earth orbit and will spend a few weeks maneuvering to
their operational altitude. The booster is expected to land on an ASDS.","cre
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overall. The satellites will be delivered to low Earth orbit and will spend a
few weeks maneuvering to their operational altitude. The booster is expected
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4/spacex-launches-25th-mission-to-build-out-starlink-internet-network/","wiki
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the 22nd batch of operational Starlink satellites, which are version 1.0, fro
m or SLC-40. It is the 23rd Starlink launch overall. The satellites will be d
elivered to low Earth orbit and will spend a few weeks maneuvering to their o
perational altitude. The booster is expected to land on an ASDS.","crew":
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the 24th Starlink launch overall. The satellites will be delivered to low Ear
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nauts Shane Kimbrough, Megan McArthur, Thomas Pesquet, and Akihiko Hoshide to
the International Space Station. The Falcon 9 and Crew Dragon lift off from L
C-39A, Kennedy Space Center. Both the booster and the capsule have flown prev
iously, each a first for a commercial crew flight. The booster for this missi
on is expected to land on an ASDS. The mission will be complete with the safe

return of the astronauts to Earth.","crew":["5fe3ba5fb3467846b3242188","5fe3b
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aunches the 24th batch of operational Starlink satellites, which are version
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lites will be delivered to low Earth orbit and will spend a few weeks maneuve
ring to their operational altitude. The booster is expected to land on an ASD
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satellites, which are version 1.0, from LC-39A. It is the 26th Starlink launc

h overall. The satellites will be delivered to low Earth orbit and will spend a few weeks maneuvering to their operational altitude. The booster is expected to land on OCISLY.","crew":[],"ships":["608c1a06cf7f3d6152666ad4","5ea6ed30 080df4000697c913","6059166413f40e27e8af34b6"],"capsules":[],"payloads":["605b 4befaa5433645e37d047"],"launchpad":"5e9e4502f509094188566f88","flight_numbe r":125,"name":"Starlink-25 (v1.0)","date_utc":"2021-05-04T19:01:00.000Z","dat e_unix":1620154860,"date_local":"2021-05-04T15:01:00-04:00","date_precisio n":"hour","upcoming":false,"cores":[{"core":"5e9e28a5f3591833b13b2659","fligh t":9,"gridfins":true,"legs":true,"reused":true,"landing_attempt":true,"landin g_success":true,"landing_type":"ASDS","landpad":"5e9e3032383ecb6bb234e7c a"}],"auto_update":true,"tbd":false,"launch_library_id":"1ecc82c0-c5c8-41f0-a a58-b50a3b839ae0","id":"605b4b7daa5433645e37d040"},{"fairings":{"reused":tru e,"recovery_attempt":true,"recovered":true,"ships":["6059166413f40e27e8af34b 6"]},"links":{"patch":{"small":"https://images2.imgbox.com/ad/eb/pq1vQuoW_o.p ng","large":"https://images2.imgbox.com/97/83/Y1Qj9iUC_o.png"},"reddit":{"cam paign":"https://www.reddit.com/r/spacex/comments/jhu37i/starlink_general_disc ussion_and_deployment_thread/","launch":"https://www.reddit.com/r/spacex/comm ents/n7ju15/rspacex_starlink27_launch_discussion_updates/","media":null,"reco very":"https://www.reddit.com/r/spacex/comments/k2ts1q/rspacex_fleet_updates_ discussion_thread/"},"flickr":{"small":[],"original":[]},"presskit":null,"web cast":"https://youtu.be/J71s2KmkSrc","youtube_id":"J71s2KmkSrc","article":nul l,"wikipedia":"https://en.wikipedia.org/wiki/Starlink"},"static_fire_date_ut c":null,"static_fire_date_unix":null,"net":false,"window":null,"rocket":"5e9d 0d95eda69973a809d1ec","success":true,"failures":[],"details":"This mission la unches the 26th batch of operational Starlink satellites, which are version 1.0, from SLC-40. It is the 27th Starlink launch overall. The satellites will be delivered to low Earth orbit and will spend a few weeks maneuvering to the ir operational altitude. The booster is expected to land on an ASDS.","crew": [],"ships":["5ea6ed30080df4000697c913","5ee68c683c228f36bd5809b5","6059166413 f40e27e8af34b6"],"capsules":[],"payloads":["6079bd5e9a06446e8c61bf7c"],"launc hpad":"5e9e4501f509094ba4566f84","flight_number":126,"name":"Starlink-27 (v1. 0)","date_utc":"2021-05-09T06:42:00.000Z","date_unix":1620542520,"date_loca l":"2021-05-09T02:42:00-04:00","date_precision":"hour","upcoming":false,"core s":[{"core":"5e9e28a6f35918c0803b265c","flight":10,"gridfins":true,"legs":tru e,"reused":true,"landing_attempt":true,"landing_success":true,"landing_typ e":"ASDS","landpad":"5e9e3032383ecb6bb234e7ca"}],"auto_update":true,"tbd":fal se,"launch_library_id":"e5085f22-208b-4b28-b66c-fd4bd9df90e7","id":"6079bd1c9 a06446e8c61bf76"},{"fairings":{"reused":true,"recovery_attempt":true,"recover ed":null,"ships":["6059166413f40e27e8af34b6"]},"links":{"patch":{"small":"htt ps://images2.imgbox.com/b5/8a/KeiGEz4f_o.png","large":"https://images2.imgbo x.com/f6/28/amlU5JWP_o.png"},"reddit":{"campaign":"https://www.reddit.com/r/s pacex/comments/jhu37i/starlink_general_discussion_and_deployment_thread/","la unch":"https://www.reddit.com/r/spacex/comments/ncfexu/rspacex_starlink26_lau nch_discussion_updates/","media":null,"recovery":"https://www.reddit.com/r/sp acex/comments/k2ts1q/rspacex_fleet_updates_discussion_thread/"},"flickr":{"sm all":[],"original":["https://live.staticflickr.com/65535/51171344450_6a3f0e08 b9_o.jpg","https://live.staticflickr.com/65535/51170251791_9b36fba5b7_o.jp g","https://live.staticflickr.com/65535/51185653708_86840b1672_o.jpg","http s://live.staticflickr.com/65535/51185653723_7bd9ecab87_o.jpg","https://live.s taticflickr.com/65535/51186506630_1a47a43787_o.jpg"]},"presskit":null,"webcas t":"https://youtu.be/tdgg_qwj-hI","youtube_id":"tdgg_qwj-hI","article":nul l,"wikipedia":"https://en.wikipedia.org/wiki/Starlink"},"static_fire_date_ut c":null,"static_fire_date_unix":null,"net":false,"window":0,"rocket":"5e9d0d9 5eda69973a809d1ec","success":true,"failures":[],"details":"This mission launc hes the 27th batch of operational Starlink satellites, which are version 1.0, from LC-39A or SLC-40. It is the 28th Starlink launch overall. The satellites

will be delivered to low Earth orbit and will spend a few weeks maneuvering t
o their operational altitude. The booster is expected to land on an ASDS.","c
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launch overall. The satellites plan to be delivered to low Earth orbit and wi
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ip-launches-on-mission-to-begin-upgrading-space-station-electrical-grid/","wi
kipedia":"https://en.wikipedia.org/wiki/SpaceX_CRS-22"},"static_fire_date_ut
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resupply mission on behalf of NASA, this mission sends essential supplies to
the International Space Station using the cargo variant of SpaceX\'s Dragon 2
spacecraft. The external payload for this mission is the first pair of ISS Ro
ll Out Solar Arrays. Falcon 9 and Dragon launch from LC-39A, Kennedy Space Ce
nter and the booster is expected to land on an ASDS. The mission will be comp
lete with splashdown and recovery of the capsule and down cargo.","crew":
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for SiriusXM from SLC-40, Cape Canaveral Space Force Station. The spacecraft
will be delivered into a sub-synchronous geostationary transfer orbit and wil
l replace XM-4 in geostationary orbit. The booster for this mission will land
on an ASDS.","crew":[],"ships":["5ee68c683c228f36bd5809b5","5ea6ed2f080df4000
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a809d1ec","success":true,"failures":[],"details":"SpaceX\'s fourth GPS III la
unch will use the first stage from the previous GPS mission. This will be the
first time a National Security Space Launch has flown on a flight proven boos
ter. Falcon 9 will launch from SLC-40, Cape Canaveral and the booster will la
nd downrange on a drone ship. GPS III is the third generation of the U.S. Spa
ce Force\'s NAVSTAR Global Positioning System satellites, developed by Lockhe
ed Martin. The GPS III constellation will feature a cross-linked command and
control architecture, allowing the entire GPS constellation to be updated sim
ultaneously from a single ground station. A new spot beam capability for enha
nced military coverage and increased resistance to hostile jamming will be in
corporated.","crew":[],"ships":["60c8c7a45d4819007ea69871","5ee68c683c228f36b
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e,"window":0,"rocket":"5e9d0d95eda69973a809d1ec","success":true,"failures":
[],"details":"Falcon 9 launches to sun-synchronous polar orbit from Florida a
s part of SpaceX\'s Rideshare program dedicated to smallsat customers. The mi
ssion lifts off from SLC-40, Cape Canaveral on a southward azimuth and perfor
ms a dogleg maneuver. The booster for this mission is expected to return to L
Z-1 based on FCC communications filings. This rideshare takes approximately 9
0 satellites and hosted payloads into orbit on a variety of deployers includi

ng three free-flying spacecraft which dispense their customers\' satellites after separation from the SpaceX stack.","crew":[],"ships":["60c8c7a45d4819007ea69871"],"capsules":[],"payloads":["608ac397eb3e50044e3630e7"],"launchpad":"5e9e4501f509094ba4566f84","flight_number":132,"name":"Transporter-2","date_utc":"2021-06-30T19:31:00.000Z","date_unix":1625081460,"date_local":"2021-06-30T15:31:00-04:00","date_precision":"hour","upcoming":false,"cores":[{"core":"5ef670f10059c33cee4a826c","flight":8,"gridfins":true,"legs":true,"reused":true,"landing_attempt":true,"landing_success":true,"landing_type":"RTLS","landpad":"5e9e3032383ecb267a34e7c7"}],"auto_update":true,"tbd":false,"launch_library_id":"5d248abe-17ef-43ce-9c04-aef33af40520","id":"600f9b6d8f798e2a4d5f979f"},{"fairings":null,"links":{"patch":{"small":"https://images2.imgbox.com/23/8a/eyj3lHJk_o.png","large":"https://images2.imgbox.com/fd/60/g7jacgTb_o.png"},"reddit":{"campaign":"https://www.reddit.com/r/spacex/comments/p67i27/crs23_launch_campaign_thread/","launch":"https://www.reddit.com/r/spacex/comments/pcj0ao/rspacex_crs23_launch_docking_discussion_updates/","media":null,"recovery":null},"flickr":{"small":[],"original":["https://live.staticflickr.com/65535/51411435986_82d7088b61_o.jpg","https://live.staticflickr.com/65535/51411702583_fe67991413_o.jpg","https://live.staticflickr.com/65535/51411702573_de10cdbc06_o.jpg","https://live.staticflickr.com/65535/51411435116_ac7b3cc3d1_o.jpg"]},"presskit":null,"webcast":"https://youtu.be/x-KiDqxAMU0","youtube_id":"x-KiDqxAMU0","article":null,"wikipedia":"https://en.wikipedia.org/wiki/SpaceX_CRS-23"},"static_fire_date_utc":"2021-08-26T02:49:00.000Z","static_fire_date_unix":1629946140,"net":false,"window":0,"rocket":"5e9d0d95eda69973a809d1ec","success":true,"failures":[],"details":"SpaceX\'s 23rd ISS resupply mission on behalf of NASA, this mission brings essential supplies to the International Space Station using the cargo variant of SpaceX\'s Dragon 2 spacecraft. Cargo includes several science experiments. The booster for this mission is expected to land on an ASDS. The mission will be complete with return and recovery of the Dragon capsule and down cargo.","crew":[],"ships":["5ea6ed2d080df4000697c904"],"capsules":[],"payloads":["5fe3c4f2b3467846b3242193"],"launchpad":"5e9e4502f509094188566f88","flight_number":133,"name":"CRS-23","date_utc":"2021-08-29T07:14:00.000Z","date_unix":1630221240,"date_local":"2021-08-29T03:14:00-04:00","date_precision":"hour","upcoming":false,"cores":[{"core":"5f57c53d0622a6330279009f","flight":4,"gridfins":true,"legs":true,"reused":true,"landing_attempt":true,"landing_success":true,"landing_type":"ASDS","landpad":"5e9e3033383ecb075134e7cd"}],"auto_update":true,"tbd":false,"launch_library_id":"13386512-85bb-4c93-a9b0-f5eac05fbe4f","id":"5fe3b11eb3467846b324216c"},{"fairings":{"reused":true,"recovery_attempt":null,"recovered":null,"ships":[]},"links":{"patch":{"small":"https://images2.imgbox.com/cb/ef/u7GOlbj4_o.png","large":"https://images2.imgbox.com/a3/55/7K6zEOT2_o.png"},"reddit":{"campaign":"https://www.reddit.com/r/spacex/comments/jhu37i/starlink_general_discussion_and_deployment_thread/","launch":"https://www.reddit.com/r/spacex/comments/pmn0xm/rspacex_starlink21_launch_discussion_and_updates/","media":null,"recovery":"https://www.reddit.com/r/spacex/comments/k2ts1q/rspacex_fleet_updates_discussion_thread/"},"flickr":{"small":[],"original":["https://live.staticflickr.com/65535/51474853666_be4615e186_o.jpg","https://live.staticflickr.com/65535/51475097383_dcf9002e9c_o.jpg"]},"presskit":null,"webcast":"https://youtu.be/4372QYiPZB4","youtube_id":"4372QYiPZB4","article":"https://spaceflightnow.com/2021/09/14/spacex-launches-first-full-batch-of-laser-equipped-starlink-satellites/","wikipedia":"https://en.wikipedia.org/wiki/Starlink"},"static_fire_date_utc":"2021-09-02T17:29:00.000Z","static_fire_date_unix":1630603740,"net":false,"window":0,"rocket":"5e9d0d95eda69973a809d1ec","success":true,"failures":[],"details":null,"crew":[],"ships":["5ea6ed30080df4000697c913"],"capsules":[],"payloads":["60e3bf3373359e1e20335c3c"],"launchpad":"5e9e4502f509092b78566f87","flight_number":134,"name":"Starlink 2-1 (v1.5)","date_utc":"2021-09-14T03:55:00.000Z","date_unix":1631591700,"date_loca

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\x99s first all-civilian mission to space. The mission will be commanded by J
ared Isaacman, the 37-year-old founder and Chief Executive Officer of Shift4
Payments and an accomplished pilot and adventurer. Inspiration4 will leave Ea
rth from Kennedy Space Center\xe2\x80\x99s historic Launch Complex 39A, the e
mbarkation point for Apollo and Space Shuttle missions, and travel across a l
ow earth orbit on a multi-day journey that will continually eclipse more than
90% of the earth\xe2\x80\x99s population. Named in recognition of the four-pe
rson crew that will raise awareness and funds for St. Jude Children\xe2\x80\x
99s Research Hospital, this milestone represents a new era for human spacefli
ght and exploration.","crew":["607a3a5f5a906a44023e0870","607a3ab45a906a44023
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n-launch-to-the-international-space-station/","wikipedia":"https://en.wikiped
ia.org/wiki/SpaceX_Crew-3"},"static_fire_date_utc":"2021-10-28T05:46:00.000
Z","static_fire_date_unix":1635399960,"net":false,"window":0,"rocket":"5e9d0d
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h the third operational mission of its Crew Dragon vehicle as part of NASA\'s

Commercial Crew Program, carrying four astronauts to the International Space Station, including 1 international partner This mission will fly on a new capsule and a once used booster. The booster will land downrange on a drone ship. The Crew-2 mission returns from the space station in November.","crew":["5fe3c587b3467846b3242198","5fe3c5beb3467846b3242199","5fe3c5f6b3467846b324219a","60c4b5ad4e041c0b356db393"],"ships":["5ea6ed2d080df4000697c904","5ee68c683c228f36bd5809b5","614251b711a64135defb3654","5ea6ed2f080df4000697c90c","5ea6ed2e080df4000697c909"],"capsules":["617c05591bad2c661a6e2909"],"payloads":["5fe3b3bab3467846b3242174"],"launchpad":"5e9e4502f509094188566f88","flight_number":136,"name":"Crew-3","date_utc":"2021-11-11T02:03:00.000Z","date_unix":1636596180,"date_local":"2021-11-10T21:03:00-05:00","date_precision":"hour","upcoming":false,"cores":[{"core":"60b800111f83cc1e59f16438","flight":2,"gridfins":true,"legs":true,"reused":true,"landing_attempt":true,"landing_success":true,"landing_type":"ASDS","landpad":"5e9e3033383ecb075134e7cd"}],"auto_update":true,"tbd":false,"launch_library_id":"0d779392-1a36-4c1e-b0b8-ec11e3031ee6","id":"5fe3b15eb3467846b324216d"},{"fairings":{"reused":null,"recovery_attempt":true,"recovered":true,"ships":["618fad7e563d69573ed8caa9"]},"links":{"patch":{"small":"https://images2.imgbox.com/f1/38/HYBzPrio_o.png","large":"https://images2.imgbox.com/c9/b7/R0e1MkGD_o.png"},"reddit":{"campaign":"https://www.reddit.com/r/spacex/comments/jhu37i/starlink_general_discussion_and_deployment_thread/","launch":"https://www.reddit.com/r/spacex/comments/qro60o/rspacex_starlink_41_launch_discussion_and_updates/","media":null,"recovery":"https://www.reddit.com/r/spacex/comments/k2ts1q/rspacex_fleet_updates_discussion_thread/"},"flickr":{"small":[],"original":["https://live.staticflickr.com/65535/51676939646_1a12780e54_o.jpg","https://live.staticflickr.com/65535/51677186188_e03e87ae8e_o.jpg","https://live.staticflickr.com/65535/51676136297_0bbb893f44_o.jpg","https://live.staticflickr.com/65535/51677822295_87c2ee94b1_o.jpg","https://live.staticflickr.com/65535/51677186098_12c8f54593_o.jpg","https://live.staticflickr.com/65535/51676136282_5118fa42ef_o.jpg"]},"presskit":null,"webcast":"https://youtu.be/AtmtP4vouSY","youtube_id":"AtmtP4vouSY","article":"https://spaceflightnow.com/2021/11/13/spacex-launch-starts-deployment-of-new-starlink-orbital-shell/","wikipedia":"https://en.wikipedia.org/wiki/Starlink"},"static_fire_date_utc":null,"static_fire_date_unix":null,"net":false,"window":null,"rocket":"5e9d0d95eda69973a809d1ec","success":true,"failures":[],"details":null,"crew":[],"ships":["5ea6ed2f080df4000697c910","618fad7e563d69573ed8caa9"],"capsules":[],"payloads":["618fabf0563d69573ed8caa6"],"launchpad":"5e9e4501f509094ba4566f84","flight_number":137,"name":"Starlink 4-1 (v1.5)","date_utc":"2021-11-13T12:40:00.000Z","date_unix":1636807200,"date_local":"2021-11-13T07:40:00-05:00","date_precision":"hour","upcoming":false,"cores":[{"core":"5e9e28a7f3591817f23b2663","flight":9,"gridfins":true,"legs":true,"reused":true,"landing_attempt":true,"landing_success":true,"landing_type":"ASDS","landpad":"5e9e3033383ecbb9e534e7cc"}],"auto_update":true,"tbd":false,"launch_library_id":null,"id":"618faad2563d69573ed8ca9d"},{"fairings":{"reused":null,"recovery_attempt":true,"recovered":null,"ships":["5ea6ed30080df4000697c912"]},"links":{"patch":{"small":"https://images2.imgbox.com/5a/fa/fhZj1ebN_o.png","large":"https://images2.imgbox.com/57/b8/7pGrT5cb_o.png"},"reddit":{"campaign":"https://www.reddit.com/r/spacex/comments/qu8s5a/dart_launch_campaign_thread/","launch":"https://www.reddit.com/r/spacex/comments/r0dn3a/rspacex_dart_launch_discussion_and_updates_thread/","media":null,"recovery":null},"flickr":{"small":[],"original":["https://live.staticflickr.com/65535/51702654584_13a4b39655_o.jpg","https://live.staticflickr.com/65535/51702261963_ec86519bce_o.jpg","https://live.staticflickr.com/65535/51702654544_c4b0a727c3_o.jpg","https://live.staticflickr.com/65535/51702654514_c379940fa3_o.jpg","https://live.staticflickr.com/65535/51702654339_7c40563d73_o.jpg"]},"presskit":null,"webcast":"https://youtu.be/XKRf6-NcMqI","youtube_id":"XKRf6-NcMqI","article":null,"wikipedia":"https://en.wikipedia.org/wiki/Double_Asteroid_Redirec

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te_unix":1637353200,"net":false,"window":null,"rocket":"5e9d0d95eda69973a809d
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Test (DART) will demonstrate the use of a kinetic impactor to alter an astero
id\'s trajectory, an intervention that could be used in the future to prevent
devastating Earth impacts. The target system consists of Didymos, 780 meters
in diameter, and its moonlet Dimorphos, 160 meters. The DART spacecraft will
intercept the double asteroid, using autonomous guidance to crash into the sm
aller one. Moving at about 6 km/s, the transferred momentum should alter Dimo
rphos\'s 12 hour orbital period around its companion by several minutes. The
mission tests several technologies, including the Small-body Maneuvering Auto
nomous Real-Time Navigation (SMART Nav) used to differentiate and steer towar
d the target body and Roll-Out Solar Arrays (ROSA) with Transformational Sola
r Array concentrators. NASA\xe2\x80\x99s Evolutionary Xenon Thruster \xe2\x80
\x94 Commercial (NEXT\xe2\x80\x93C) ion engine will also be demonstrated, alt
hough the spacecraft\'s primary propulsion is hydrazine thrusters. DART shoul
d arrive at Didymos in late September 2022, when it is about 11 million kilom
eters from Earth. Ten days before impact, the Italian Space Agency\'s cubesat
LICIACube will be deployed to observe the collision and ejecta with its two c
ameras. Earth-based telescopes will be used to measure the altered orbit.","c
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at Airbus Defense and Space\'s facilities in Toulouse, France, will soon be s
ent to the Cape Canaveral Space Launch Station located in Florida, United Sta
tes. The satellite will be launched into space onboard the Falcon 9 rocket fo
llowing pre-launch preparations. With an estimated in-orbit lifetime of 30 ye
ars and the aim of securing Turkey\xe2\x80\x99s orbital and frequency rights,
T\xc3\xbcrksat 5B will be launched into an orbital slot at 42 degrees East. W
ith 12 kW power, T\xc3\xbcrksat 5B will provide TV broadcasting and data comm
unication services over a wide coverage area that reaches the entire Middle E
ast, the Persian Gulf, the Red Sea, the Mediterranean, North Africa, East Afr
ica, South Africa and Nigeria. Apart from that, the satellite will also provi
de customized services for airlines and commercial ship operators around the
world thanks to the fact that it operates in Ka-Band.","crew":[],"ships":["61
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half of NASA, this mission brings essential supplies to the International Spa
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cludes several science experiments. The booster for this mission is expected
to land on an ASDS. The mission will be complete with return and recovery of
the Dragon capsule and down cargo.","crew":[],"ships":["5ea6ed2f080df4000697c
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s":true,"failures":[],"details":null,"crew":[],"ships":[],"capsules":[],"payl
oads":["63161699ffc78f3b85670719"],"launchpad":"5e9e4501f509094ba4566f84","fl
ight_number":185,"name":"Starlink 4-34 (v1.5)","date_utc":"2022-09-17T01:05:0
0.000Z","date_unix":1663376700,"date_local":"2022-09-16T21:05:00-04:00","date
_precision":"hour","upcoming":false,"cores":[{"core":"60b800111f83cc1e59f1643
8","flight":6,"gridfins":true,"legs":true,"reused":true,"landing_attempt":tru
e,"landing_success":true,"landing_type":"ASDS","landpad":"5e9e3033383ecbb9e53
4e7cc"}],"auto_update":true,"tbd":false,"launch_library_id":"9ba04064-c329-40
bf-b477-ff468d7d8058","id":"63161329ffc78f3b8567070b"},{"fairings":{"reused":
null,"recovery_attempt":null,"recovered":null,"ships":[]},"links":{"patch":
{"small":"https://images2.imgbox.com/a9/9a/NXVkTZCE_o.png","large":"https://i
mages2.imgbox.com/e3/cc/hN96PmST_o.png"},"reddit":{"campaign":"https://www.re
ddit.com/r/spacex/comments/jhu37i/starlink_general_discussion_and_deployment_
thread/","launch":"https://www.reddit.com/r/spacex/comments/xn028t/rspacex_st
arlink_435_launch_discussion_and/","media":null,"recovery":"https://www.reddi
t.com/r/spacex/comments/k2ts1q/rspacex_fleet_updates_discussion_thread/"},"fl
ickr":{"small":[],"original":[]},"presskit":null,"webcast":"https://youtu.be/
VVu2bSJJhgI","youtube_id":"VVu2bSJJhgI","article":null,"wikipedia":null},"sta
tic_fire_date_utc":null,"static_fire_date_unix":null,"net":false,"window":nul
l,"rocket":"5e9d0d95eda69973a809d1ec","success":true,"failures":[],"details":
null,"crew":[],"ships":[],"capsules":[],"payloads":["631616a7ffc78f3b85670671
a"],"launchpad":"5e9e4501f509094ba4566f84","flight_number":186,"name":"Starli
nk 4-35 (v1.5)","date_utc":"2022-09-24T23:30:00.000Z","date_unix":166406220
0,"date_local":"2022-09-24T19:30:00-04:00","date_precision":"hour","upcomin
g":false,"cores":[{"core":"627843d657b51b752c5c5a53","flight":4,"gridfins":tr
ue,"legs":true,"reused":true,"landing_attempt":true,"landing_success":true,"l
anding_type":"ASDS","landpad":"5e9e3033383ecbb9e534e7cc"}],"auto_update":tru
e,"tbd":false,"launch_library_id":"1c903b65-6667-4fd5-944d-296c5f13e01f","i
d":"63161339ffc78f3b8567070c"},{"fairings":null,"links":{"patch":{"small":"ht
tps://images2.imgbox.com/eb/d8/D1Yywp0w_o.png","large":"https://images2.imgbo
x.com/33/2e/k6VE4iYl_o.png"},"reddit":{"campaign":null,"launch":"https://www.
reddit.com/r/spacex/comments/xvm76j/rspacex_crew5_launchcoast_docking_discuss
ion_and/","media":null,"recovery":null},"flickr":{"small":[],"original":
[]},"presskit":null,"webcast":"https://youtu.be/5EwW8ZkArL4","youtube_id":"5E
wW8ZkArL4","article":null,"wikipedia":"https://en.wikipedia.org/wiki/SpaceX_C
rew-5"},"static_fire_date_utc":null,"static_fire_date_unix":null,"net":fals

e,"window":null,"rocket":"5e9d0d95eda69973a809d1ec","success":true,"failure
s":[],"details":null,"crew":["62dd7196202306255024d13c","62dd71c9202306255024
d13d","62dd7210202306255024d13e","62dd7253202306255024d13f"],"ships":[],"caps
ules":["617c05591bad2c661a6e2909"],"payloads":["62dd73ed202306255024d145"],"l
aunchpad":"5e9e4502f509094188566f88","flight_number":187,"name":"Crew-5","dat
e_utc":"2022-10-05T16:00:00.000Z","date_unix":1664985600,"date_local":"2022-1
0-05T12:00:00-04:00","date_precision":"hour","upcoming":false,"cores":[{"cor
e":"633d9da635a71d1d9c66797b","flight":1,"gridfins":true,"legs":true,"reuse
d":false,"landing_attempt":true,"landing_success":true,"landing_type":"ASD
S","landpad":"5e9e3033383ecbb9e534e7cc"}],"auto_update":true,"tbd":false,"lau
nch_library_id":"f33d5ece-e825-4cd8-809f-1d4c72a2e0d3","id":"62dd70d520230625
5024d139"}]'

You should see the response contains massive information about SpaceX launches.

Next, let's try to discover some more relevant information for this project.

Task 1: Request and parse the SpaceX launch data using the GET request

To make the requested JSON results more consistent, we will use the following static response object for this project:

```
In [9]:  static_json_url='https://cf-courses-data.s3.us.cloud-object-storage.appdomai
```

We should see that the request was successfull with the 200 status response code

```
In [10]:  response=requests.get(static_json_url)
```

```
In [11]:  response.status_code
```

```
Out[11]:  200
```

Now we decode the response content as a Json using `.json()` and turn it into a Pandas dataframe using `.json_normalize()`

```
In [12]:  # Use json_normalize meethod to convert the json result into a dataframe
          data_json = response.json()
          data = pd.json_normalize(data_json)
```

Using the dataframe `data` print the first 5 rows

```
In [13]:  # Get the head of the dataframe
          print(data.head())
```

```
         static_fire_date_utc  static_fire_date_unix    tbd    net  window  \
0  2006-03-17T00:00:00.000Z           1.142554e+09  False  False     0.0
1                       None                    NaN  False  False     0.0
2                       None                    NaN  False  False     0.0
3  2008-09-20T00:00:00.000Z           1.221869e+09  False  False     0.0
4                       None                    NaN  False  False     0.0

                       rocket  success  \
0  5e9d0d95eda69955f709d1eb    False
1  5e9d0d95eda69955f709d1eb    False
2  5e9d0d95eda69955f709d1eb    False
3  5e9d0d95eda69955f709d1eb     True
4  5e9d0d95eda69955f709d1eb     True


details  \
0
Engine failure at 33 seconds and loss of vehicle
1  Successful first stage burn and transition to second stage, maximum altitu
de 289 km, Premature engine shutdown at T+7 min 30 s, Failed to reach orbit,
Failed to recover first stage
2
Residual stage 1 thrust led to collision between stage 1 and stage 2
3                      Ratsat was carried to orbit on the first successful
orbital launch of any privately funded and developed, liquid-propelled carrie
r rocket, the SpaceX Falcon 1
4
None

  crew ships capsules                                               payloads
\
0   []    []       []                               [5eb0e4b5b6c3bb0006eeb1e1]
1   []    []       []                               [5eb0e4b6b6c3bb0006eeb1e2]
2   []    []       []  [5eb0e4b6b6c3bb0006eeb1e3, 5eb0e4b6b6c3bb0006eeb1e4]
3   []    []       []                               [5eb0e4b7b6c3bb0006eeb1e5]
4   []    []       []                               [5eb0e4b7b6c3bb0006eeb1e6]

                  launchpad  auto_update  \
0  5e9e4502f5090995de566f86         True
1  5e9e4502f5090995de566f86         True
2  5e9e4502f5090995de566f86         True
3  5e9e4502f5090995de566f86         True
4  5e9e4502f5090995de566f86         True


failures  \
0                                           [{'time': 33, 'altitude': No
ne, 'reason': 'merlin engine failure'}]
1           [{'time': 301, 'altitude': 289, 'reason': 'harmonic oscillation
leading to premature engine shutdown'}]
2  [{'time': 140, 'altitude': 35, 'reason': 'residual stage-1 thrust led to c
ollision between stage 1 and stage 2'}]
3
[]
4
[]
```

```
     flight_number            name                    date_utc    date_unix  \
0                1        FalconSat  2006-03-24T22:30:00.000Z  1143239400
1                2          DemoSat  2007-03-21T01:10:00.000Z  1174439400
2                3       Trailblazer  2008-08-03T03:34:00.000Z  1217734440
3                4           RatSat  2008-09-28T23:15:00.000Z  1222643700
4                5         RazakSat  2009-07-13T03:35:00.000Z  1247456100

                   date_local date_precision   upcoming  \
0  2006-03-25T10:30:00+12:00           hour      False
1  2007-03-21T13:10:00+12:00           hour      False
2  2008-08-03T15:34:00+12:00           hour      False
3  2008-09-28T11:15:00+12:00           hour      False
4  2009-07-13T15:35:00+12:00           hour      False


cores  \
0  [{'core': '5e9e289df35918033d3b2623', 'flight': 1, 'gridfins': False, 'leg
s': False, 'reused': False, 'landing_attempt': False, 'landing_success': Non
e, 'landing_type': None, 'landpad': None}]
1  [{'core': '5e9e289ef35918416a3b2624', 'flight': 1, 'gridfins': False, 'leg
s': False, 'reused': False, 'landing_attempt': False, 'landing_success': Non
e, 'landing_type': None, 'landpad': None}]
2  [{'core': '5e9e289ef3591814873b2625', 'flight': 1, 'gridfins': False, 'leg
s': False, 'reused': False, 'landing_attempt': False, 'landing_success': Non
e, 'landing_type': None, 'landpad': None}]
3  [{'core': '5e9e289ef3591855dc3b2626', 'flight': 1, 'gridfins': False, 'leg
s': False, 'reused': False, 'landing_attempt': False, 'landing_success': Non
e, 'landing_type': None, 'landpad': None}]
4  [{'core': '5e9e289ef359184f103b2627', 'flight': 1, 'gridfins': False, 'leg
s': False, 'reused': False, 'landing_attempt': False, 'landing_success': Non
e, 'landing_type': None, 'landpad': None}]

                          id fairings.reused fairings.recovery_attempt  \
0  5eb87cd9ffd86e000604b32a           False                      False
1  5eb87cdaffd86e000604b32b           False                      False
2  5eb87cdbffd86e000604b32c           False                      False
3  5eb87cdbffd86e000604b32d           False                      False
4  5eb87cdcffd86e000604b32e           False                      False

   fairings.recovered fairings.ships  \
0               False             []
1               False             []
2               False             []
3               False             []
4               False             []

                          links.patch.small  \
0  https://images2.imgbox.com/3c/0e/T8iJcSN3_o.png
1  https://images2.imgbox.com/4f/e3/I0lkuJ2e_o.png
2  https://images2.imgbox.com/3d/86/cnu0pan8_o.png
3  https://images2.imgbox.com/e9/c9/T8CfiSYb_o.png
4  https://images2.imgbox.com/a7/ba/NBZSw3Ho_o.png

                          links.patch.large links.reddit.campaign  \
0  https://images2.imgbox.com/40/e3/GypSkayF_o.png                   None
```

```
1  https://images2.imgbox.com/be/e7/iNqsqVYM_o.png                          None
2  https://images2.imgbox.com/4b/bd/d8UxLh4q_o.png                          None
3  https://images2.imgbox.com/e0/a7/FNjvKlXW_o.png                          None
4  https://images2.imgbox.com/8d/fc/0qdZMWWx_o.png                          None

   links.reddit.launch links.reddit.media links.reddit.recovery  \
0                 None                None                  None
1                 None                None                  None
2                 None                None                  None
3                 None                None                  None
4                 None                None                  None

   links.flickr.small links.flickr.original  \
0                  []                    []
1                  []                    []
2                  []                    []
3                  []                    []
4                  []                    []


links.presskit  \
0
None
1
None
2
None
3
None
4  http://www.spacex.com/press/2012/12/19/spacexs-falcon-1-successfully-deliv
ers-razaksat-satellite-orbit

                              links.webcast links.youtube_id  \
0  https://www.youtube.com/watch?v=0a_00nJ_Y88      0a_00nJ_Y88
1  https://www.youtube.com/watch?v=Lk4zQ2wP-Nc      Lk4zQ2wP-Nc
2  https://www.youtube.com/watch?v=v0w9p3U8860      v0w9p3U8860
3  https://www.youtube.com/watch?v=dLQ2tZEH6G0      dLQ2tZEH6G0
4  https://www.youtube.com/watch?v=yTaIDooc8Og      yTaIDooc8Og

                                                              links.artic
le  \
0  https://www.space.com/2196-spacex-inaugural-falcon-1-rocket-lost-launch.ht
ml
1      https://www.space.com/3590-spacex-falcon-1-rocket-fails-reach-orbit.ht
ml
2       http://www.spacex.com/news/2013/02/11/falcon-1-flight-3-mission-summa
ry
3                                           https://en.wikipedia.org/wiki/Rats
at
4                   http://www.spacex.com/news/2013/02/12/falcon-1-flight
-5

                                  links.wikipedia  fairings
0                 https://en.wikipedia.org/wiki/DemoSat       NaN
1                 https://en.wikipedia.org/wiki/DemoSat       NaN
2  https://en.wikipedia.org/wiki/Trailblazer_(satellite)       NaN
```

```
3            https://en.wikipedia.org/wiki/Ratsat       NaN
4            https://en.wikipedia.org/wiki/RazakSAT     NaN
```

You will notice that a lot of the data are IDs. For example the rocket column has no information about the rocket just an identification number.

We will now use the API again to get information about the launches using the IDs given for each launch. Specifically we will be using columns `rocket`, `payloads`, `launchpad`, and `cores`.

```
In [14]:  # Lets take a subset of our dataframe keeping only the features we want and
          data = data[['rocket', 'payloads', 'launchpad', 'cores', 'flight_number', 'd

          # We will remove rows with multiple cores because those are falcon rockets w
          data = data[data['cores'].map(len)==1]
          data = data[data['payloads'].map(len)==1]

          # Since payloads and cores are lists of size 1 we will also extract the sing
          data['cores'] = data['cores'].map(lambda x : x[0])
          data['payloads'] = data['payloads'].map(lambda x : x[0])

          # We also want to convert the date_utc to a datetime datatype and then extra
          data['date'] = pd.to_datetime(data['date_utc']).dt.date

          # Using the date we will restrict the dates of the launches
          data = data[data['date'] <= datetime.date(2020, 11, 13)]
```

- From the `rocket` we would like to learn the booster name

- From the `payload` we would like to learn the mass of the payload and the orbit that it is going to

- From the `launchpad` we would like to know the name of the launch site being used, the longitude, and the latitude.

- **From `cores` we would like to learn the outcome of the landing, the type of the landing, number of flights with that core, whether gridfins were used, whether the core is reused, whether legs were used, the landing pad used, the block of the core which is a number used to seperate version of cores, the number of times this specific core has been reused, and the serial of the core.**

The data from these requests will be stored in lists and will be used to create a new dataframe.

```
In [15]:  #Global variables
          BoosterVersion = []
          PayloadMass = []
          Orbit = []
          LaunchSite = []
          Outcome = []
```

3/3/25, 2:40 PM

```
Flights = []
GridFins = []
Reused = []
Legs = []
LandingPad = []
Block = []
ReusedCount = []
Serial = []
Longitude = []
Latitude = []
```

These functions will apply the outputs globally to the above variables. Let's take a looks at `BoosterVersion` variable. Before we apply `getBoosterVersion` the list is empty:

In [16]: `BoosterVersion`

Out[16]: `[]`

Now, let's apply `getBoosterVersion` function method to get the booster version

In [17]: ```
# Call getBoosterVersion
getBoosterVersion(data)
```

the list has now been update

In [18]: `BoosterVersion[0:5]`

Out[18]: `['Falcon 1', 'Falcon 1', 'Falcon 1', 'Falcon 1', 'Falcon 9']`

we can apply the rest of the functions here:

In [19]: ```
# Call getLaunchSite
getLaunchSite(data)
```

In [20]: ```
# Call getPayloadData
getPayloadData(data)
```

In [21]: ```
# Call getCoreData
getCoreData(data)
```

Finally lets construct our dataset using the data we have obtained. We we combine the columns into a dictionary.

In [22]: ```
launch_dict = {'FlightNumber': list(data['flight_number']),
'Date': list(data['date']),
'BoosterVersion':BoosterVersion,
'PayloadMass':PayloadMass,
'Orbit':Orbit,
'LaunchSite':LaunchSite,
'Outcome':Outcome,
```

```
'Flights':Flights,
'GridFins':GridFins,
'Reused':Reused,
'Legs':Legs,
'LandingPad':LandingPad,
'Block':Block,
'ReusedCount':ReusedCount,
'Serial':Serial,
'Longitude': Longitude,
'Latitude': Latitude}
```

Then, we need to create a Pandas data frame from the dictionary launch_dict.

In [23]:
```
# Create a data from launch_dict
launch_df = pd.DataFrame(launch_dict)
```

Show the summary of the dataframe

In [24]:
```
# Show the head of the dataframe
launch_df.head()
```

Out[24]:

	FlightNumber	Date	BoosterVersion	PayloadMass	Orbit	LaunchSite	Outcome	
0	1	2006-03-24	Falcon 1	20.0	LEO	Kwajalein Atoll	None None	
1	2	2007-03-21	Falcon 1	NaN	LEO	Kwajalein Atoll	None None	
2	4	2008-09-28	Falcon 1	165.0	LEO	Kwajalein Atoll	None None	
3	5	2009-07-13	Falcon 1	200.0	LEO	Kwajalein Atoll	None None	
4	6	2010-06-04	Falcon 9	NaN	LEO	CCSFS SLC 40	None None	

Task 2: Filter the dataframe to only include `Falcon 9` launches

Finally we will remove the Falcon 1 launches keeping only the Falcon 9 launches. Filter the data dataframe using the `BoosterVersion` column to only keep the Falcon 9 launches. Save the filtered data to a new dataframe called `data_falcon9`.

In [25]:
```
# Hint data['BoosterVersion']!='Falcon 1'
data_falcon9 = launch_df[launch_df['BoosterVersion'] != 'Falcon 1']
```

Now that we have removed some values we should reset the FlgihtNumber column

In [26]:
```
data_falcon9.loc[:,'FlightNumber'] = list(range(1, data_falcon9.shape[0]+1))
data_falcon9
```

/home/jupyterlab/conda/envs/python/lib/python3.7/site-packages/pandas/core/in
dexing.py:1773: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/s
table/user_guide/indexing.html#returning-a-view-versus-a-copy
  self._setitem_single_column(ilocs[0], value, pi)

Out[26]:

	FlightNumber	Date	BoosterVersion	PayloadMass	Orbit	LaunchSite	Outcome
4	1	2010-06-04	Falcon 9	NaN	LEO	CCSFS SLC 40	None None
5	2	2012-05-22	Falcon 9	525.0	LEO	CCSFS SLC 40	None None
6	3	2013-03-01	Falcon 9	677.0	ISS	CCSFS SLC 40	None None
7	4	2013-09-29	Falcon 9	500.0	PO	VAFB SLC 4E	False Ocean
8	5	2013-12-03	Falcon 9	3170.0	GTO	CCSFS SLC 40	None None
...	...	...	...	...	...	...	...
89	86	2020-09-03	Falcon 9	15600.0	VLEO	KSC LC 39A	True ASDS
90	87	2020-10-06	Falcon 9	15600.0	VLEO	KSC LC 39A	True ASDS
91	88	2020-10-18	Falcon 9	15600.0	VLEO	KSC LC 39A	True ASDS
92	89	2020-10-24	Falcon 9	15600.0	VLEO	CCSFS SLC 40	True ASDS
93	90	2020-11-05	Falcon 9	3681.0	MEO	CCSFS SLC 40	True ASDS

90 rows × 17 columns

Data Wrangling

We can see below that some of the rows are missing values in our dataset.

In [27]:
```
data_falcon9.isnull().sum()
```

```
Out[27]:  FlightNumber       0
          Date               0
          BoosterVersion     0
          PayloadMass        5
          Orbit              0
          LaunchSite         0
          Outcome            0
          Flights            0
          GridFins           0
          Reused             0
          Legs               0
          LandingPad        26
          Block              0
          ReusedCount        0
          Serial             0
          Longitude          0
          Latitude           0
          dtype: int64
```

Before we can continue we must deal with these missing values. The `LandingPad` column will retain None values to represent when landing pads were not used.

Task 3: Dealing with Missing Values

Calculate below the mean for the `PayloadMass` using the `.mean()`. Then use the mean and the `.replace()` function to replace `np.nan` values in the data with the mean you calculated.

```
In [30]:  # Calculate the mean value of PayloadMass column
          pm_mean = data_falcon9['PayloadMass'].mean()
          print(pm_mean)
          data_falcon9['PayloadMass'].replace(np.nan, pm_mean, inplace=True)
          # Replace the np.nan values with its mean value
```

```
6123.547647058824
/home/jupyterlab/conda/envs/python/lib/python3.7/site-packages/pandas/core/ge
neric.py:6619: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/s
table/user_guide/indexing.html#returning-a-view-versus-a-copy
  return self._update_inplace(result)
```

```
In [31]:  data_falcon9.isnull().sum()
```

```
Out[31]:  FlightNumber        0
          Date                0
          BoosterVersion      0
          PayloadMass         0
          Orbit               0
          LaunchSite          0
          Outcome             0
          Flights             0
          GridFins            0
          Reused              0
          Legs                0
          LandingPad         26
          Block               0
          ReusedCount         0
          Serial              0
          Longitude           0
          Latitude            0
          dtype: int64
```

You should see the number of missing values of the `PayLoadMass` change to zero.

Now we should have no missing values in our dataset except for in `LandingPad`.

We can now export it to a **CSV** for the next section,but to make the answers consistent, in the next lab we will provide data in a pre-selected date range.

```
data_falcon9.to_csv('dataset_part_1.csv', index=False)
```

Authors

[Joseph Santarcangelo](#) has a PhD in Electrical Engineering, his research focused on using machine learning, signal processing, and computer vision to determine how videos impact human cognition. Joseph has been working for IBM since he completed his PhD.