

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 formatting.

- 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 from an AP
import requests
# Pandas is a software library written for the Python programming language for data
import pandas as pd
# NumPy is a library for the Python programming language, adding support for large,
import numpy as np
# Datetime is a library that allows us to represent dates
import datetime

# Setting this option will print all columns 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 the data
def getBoosterVersion(data):
    for x in data['rocket']:
        if x:
            response = requests.get("https://api.spacexdata.com/v4/rockets/"+str(x)).json()
            BoosterVersion.append(response['name'])
```

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

```
In [3]: # Takes the dataset and uses the launchpad column to call the API and append the data
def getLaunchSite(data):
    for x in data['launchpad']:
        if x:
            response = requests.get("https://api.spacexdata.com/v4/launchpads/"+str(x)).json()
            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 the data
def getPayloadData(data):
    for load in data['payloads']:
        if load:
            response = requests.get("https://api.spacexdata.com/v4/payloads/"+load).json()
            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, whether the core is reused, whether legs were used, the landing pad used, the block of the core which is a number used to separate 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 data
def getCoreData(data):
    for core in data['cores']:
        if core['core'] != None:
            response = requests.get("https://api.spacexdata.com/v4/cores/"+core['core']).json()
            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['landing_type']))
        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)
```

```
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```

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1 Falcon 9 v1.0 launch vehicle", "crew": [], "ships": ["5ea6ed2d080df4000697c902"], "capsules": ["5e9e2c5bf359189ef23b2667"], "payloads": ["5eb0e4bbb6c3bb0006eeb1ed"], "launchpad": "5e9e4501f509094ba4566f84", "flight_number": 10, "name": "CRS-2", "date_utc": "2013-03-01T19:10:00.000Z", "date_unix": 1362165000, "date_local": "2013-03-01T15:10:00-04:00", "date_precision": "hour", "upcoming": false, "cores": [{"core": "5e9e289ff3591884e03b262c", "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": "5eb87ce1ffd86e000604b333"}, {"fairings": {"reused": false, "recovery_attempt": false, "recovered": false, "ships": []}, "links": {"patch": {"small": "https://images2.imgbox.com/f8/27/XwZPEhTJ_o.png", "large": "https://images2.imgbox.com/ae/62/D6SZleUG_o.png"}, "reddit": {"campaign": null, "launch": "http://www.reddit.com/r/spacex/comments/1ndlay", "media": null, "recovery": null}, "flickr": {"small": [], "original": []}, "presskit": "https://spaceflightnow.com/falcon9/006/UpgradedF9DemoMission_PressKit.pdf", "webcast": "https://www.youtube.com/watch?v=uFefasS6bhc", "youtube_id": "uFefasS6bhc", "article": "http://www.parabolicarc.com/2013/09/29/falcon-9-launch-payloads-orbit-vandenberg/", "wikipedia": "https://en.wikipedia.org/wiki/CASSIOP E"}, "static_fire_date_utc": "2013-09-19T00:00:00.000Z", "static_fire_date_unix": 1379548800, "net": false, "window": 0, "rocket": "5e9d0d95eda69973a809d1ec", "success": true, "failures": [], "details": "Commercial mission and first Falcon 9 v1.1 flight, with improved 13-tonne to LEO capacity. Following second-stage separation from 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 experiment-its primary objective-but as the booster neared the ocean, aerodynamic forces caused an uncontrollable roll. The center engine, depleted of fuel by centrifugal force, shut down resulting in the impact and destruction of the vehicle."}, {"crew": [], "ships": ["5ea6ed2d080df4000697c903"], "capsules": [], "payloads": ["5eb0e4bbb6c3bb0006eeb1ee"], "launchpad": "5e9e4502f509092b78566f87", "flight_number": 11, "name": "CASSIOPE", "date_utc": "2013-09-29T16:00:00.000Z", "date_unix": 1380470400, "date_local": "2013-09-29T09:00:00-07:00", "date_precision": "hour", "upcoming": false, "cores": [{"core": "5e9e289ff359180ae23b262d", "flight": 1, "gridfins": false, "legs": false, "reused": false, "landing_attempt": true, "landing_success": false, "landing_type": "Ocean", "landpad": null}], "auto_update": true, "tbd": false, "launch_library_id": null, "id": "5eb87ce1ffd86e000604b334"}, {"fairings": {"reused": false, "recovery_attempt": false, "recovered": false, "ships": []}, "links": {"patch": {"small": "https://images2.imgbox.com/4e/f8/rqu7XWMF_o.png", "large": "https://images2.imgbox.com/41/b7/H6vprzuB_o.png"}, "reddit": {"campaign": null, "launch": "http://www.reddit.com/r/spacex/comments/1ryy1n", "media": null, "recovery": null}, "flickr": {"small": [], "original": []}, "presskit": "http://www.spacex.com/sites/spacex/files/spacex_ses-8launch_presskit.pdf", "webcast": "https://www.youtube.com/watch?v=aAj5xapImEs", "youtube_id": "aAj5xapImEs", "article": "https://www.nasaspaceflight.com/2013/12/spacex-falcon-9-v1-1-milestone-ses-8-launch/", "wikipedia": "https://en.wikipedia.org/wiki/SES-8"}, "static_fire_date_utc": "2013-11-22T06:26:00.000Z", "static_fire_date_unix": 1385101560, "net": false, "window": 0, "rocket": "5e9d0d95eda69973a809d1ec", "success": true, "failures": [], "details": "First GTO launch for Falcon 9"}, {"crew": [], "ships": [], "capsules": [], "payloads": ["5eb0e4bbb6c3bb0006eeb1ef"], "launchpad": "5e9e4501f509094ba4566f84", "flight_number": 12, "name": "SES-8", "date_utc": "2013-12-03T22:41:00.000Z", "date_unix": 1386110460, "date_local": "2013-12-03T18:41:00-04:00", "date_precision": "hour", "upcoming": false, "cores": [{"core": "5e9e289ff35918862c3b262e", "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": "5eb87ce2ffd86e000604b335"}, {"fairings": {"reused": false, "recovery_attempt": false, "recovered": false, "ships": []}, "links": {"patch": {"small": "https://images2.imgbox.com/5c/20/AsqTXJDC_o.png", "large": "https://images2.imgbox.com/f5/fa/JvLWfNZz_o.png"}, "reddit": {"campaign": null, "launch": "http://www.reddit.com/r/spacex/comments/1ujoc0", "media": null, "recovery": null}, "flickr": {"small": [], "original": ["https://farm9.staticflickr.com/8617/16789019815_f99a165dc5_o.jpg", "https://farm8.staticflickr.com/7619/16763151866_35a0a4d8e1_o.jpg", "https://farm9.staticflickr.com/8569/16169086873_4d8829832e_o.png"]}, "pre

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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 hypersonic 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": [{"id": "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-satellites-for-asiasat/", "wikipedia": "https://en.wikipedia.org/wiki/AsiaSat_8"}, "static_fire_date_utc": "2014-07-31T23:35:15.000Z", "static_fire_date_unix": 1406849715, "net": false, "window": 0, "rocket": "5e9d0d95eda69973a809d1ec", "success": true, "failures": [], "details": null, "crew": [], "ships": [], "capsules": [], "payloads": [{"id": "5eb0e4bcb6c3bb0006eeb1f3", "launchpad": "5e9e4501f509094ba4566f84", "flight_number": 16, "name": "AsiaSat 8", "date_utc": "2014-08-05T08:00:00.000Z", "date_unix": 1407225600, "date_local": "2014-08-05T04:00:00-04:00", "date_precision": "hour", "upcoming": false, "cores": [{"core": "5e9e28a0f359186e2e3b2632", "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": "5eb87ce5ffd86e000604b339"}, {"fairings": {"reused": false, "recovery_attempt": false, "recovered": false, "ships": []}, "links": {"patch": {"small": "https://images2.imgbox.com/d4/ea/jdJqr6He_o.png", "large": "https://images2.imgbox.com/5a/f0/b3TgnmVr_o.png"}, "reddit": {"campaign": null, "launch": "http://www.reddit.com/r/spacex/comments/2fenrv", "media": null, "recovery": null}, "flickr": {"small": [], "original": ["https://farm8.staticflickr.com/7604/16169087563_0e3559ab5b_o.jpg", "https://farm9.staticflickr.com/8742/16233828644_96738200b2_o.jpg", "https://farm8.staticflickr.com/7645/16601443698_e70315d1ed_o.jpg", "https://farm9.staticflickr.com/8730/16830335046_5f017c17be_o.jpg", "https://farm9.staticflickr.com/8637/16855040322_57671ab8eb_o.jpg"]}, "presskit": "https://www.spaceflightnow.com/falcon9/012/presskit.pdf", "webcast": "https://www.youtube.com/watch?v=39ninsyTRk8", "youtube_id": "39ninsyTRk8", "article": "https://www.space.com/27052-spacex-launches-asiasat6-satellite.html", "wikipedia": "https://en.wikipedia.org/wiki/AsiaSat_6"}, "static_fire_date_utc": "2014-08-22T23:51:18.000Z", "static_fire_date_unix": 1408751478, "net": false, "window": 7200, "rocket": "5e9d0d95eda69973a809d1ec", "success": true, "failures": [], "details": null, "crew": [], "ships": [], "capsules": [], "payloads": [{"id": "5eb0e4bcb6c3bb0006eeb1f4", "launchpad": "5e9e4501f509094ba4566f84", "flight_number": 17, "name": "AsiaSat 6", "date_utc": "2014-09-07T05:00:00.000Z", "date_unix": 1410066000, "date_local": "2014-09-07T01:00:00-04:00", "date_precision": "hour", "upcoming": false, "cores": [{"core": "5e9e28a0f3"}]

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com/r/spacex/comments/3b27hk", "media": "https://www.reddit.com/r/spacex/comments/3berj3", "recovery": null}, "flickr": {"small": [], "original": ["https://farm1.staticflickr.com/344/19045370790_f20f29cd8d_o.jpg", "https://farm1.staticflickr.com/287/18999110808_6e153fed64_o.jpg"]}, "presskit": "https://www.nasa.gov/sites/default/files/atoms/files/spacex_nasa_crs-7_presskit.pdf", "webcast": "https://www.youtube.com/watch?v=PuNymhcTtSQ", "youtube_id": "PuNymhcTtSQ", "article": "https://spaceflightnow.com/2015/06/28/falcon-9-rocket-destroyed-in-launch-mishap/", "wikipedia": "https://en.wikipedia.org/wiki/SpaceX_CRS-7", "static_fire_date_utc": "2015-06-26T05:00:00.000Z", "static_fire_date_unix": 1435294800, "net": false, "window": 0, "rocket": "5e9d0d95eda69973a809d1ec", "success": false, "failures": [{"time": 139, "altitude": 40, "reason": "helium tank overpressure led to the second stage LOX tank explosion"}], "details": "Launch performance was nominal until an overpressure incident in the second-stage LOX tank, leading to vehicle breakup at T+150 seconds. The Dragon capsule survived the explosion but was lost upon splashdown because its software did not contain provisions for parachute deployment on launch vehicle failure.", "crew": [], "ships": ["5ea6ed2e080df4000697c906", "5ea6ed2f080df4000697c90b", "5ea6ed2f080df4000697c90c"], "capsules": ["5e9e2c5cf35918407d3b266c"], "payloads": ["5eb0e4beb6c3bb0006eeb1fc"], "launchpad": "5e9e4501f509094ba4566f84", "flight_number": 24, "name": "CRS-7", "date_utc": "2015-06-28T14:21:00.000Z", "date_unix": 1435501260, "date_local": "2015-06-28T10:21:00-04:00", "date_precision": "hour", "upcoming": false, "cores": [{"core": "5e9e28a1f35918683c3b263a", "flight": 1, "gridfins": true, "legs": true, "reused": false, "landing_attempt": true, "landing_success": null, "landing_type": "ASDS", "landpad": "5e9e3032383ecb6bb234e7ca"}], "auto_update": true, "tbd": false, "launch_library_id": null, "id": "5eb87cefffd86e000604b341"}, {"fairings": {"reused": false, "recovery_attempt": false, "recovered": false, "ships": []}, "links": {"patch": {"small": "https://images2.imgbox.com/6a/7e/J7IQfBqg_o.png", "large": "https://images2.imgbox.com/99/d4/0aIlpFpw_o.png"}, "reddit": {"campaign": null, "launch": "https://www.reddit.com/r/spacex/comments/3xgxh5", "media": "https://www.reddit.com/r/spacex/comments/3xm83h/", "recovery": null}, "flickr": {"small": [], "original": ["https://farm2.staticflickr.com/1648/23827554109_837b21739e_o.jpg", "https://farm1.staticflickr.com/597/23802553412_d41e4dcc64_o.jpg", "https://farm6.staticflickr.com/5806/23802550622_9ff8c90098_o.jpg", "https://farm1.staticflickr.com/571/23604164970_2a1a2366e4_o.jpg", "https://farm6.staticflickr.com/5773/23271687254_5e64d726ba_o.jpg", "https://farm6.staticflickr.com/5766/23526044959_5bfe74bc88_o.jpg", "https://farm6.staticflickr.com/5723/23785609832_83038751d1_o.jpg", "https://farm1.staticflickr.com/715/23833499336_d3fde6a25a_o.jpg"]}, "presskit": "http://www.spacex.com/sites/spacex/files/spacex_orbcomm_press_kit_final2.pdf", "webcast": "https://www.youtube.com/watch?v=05bTbVbe4e4", "youtube_id": "05bTbVbe4e4", "article": "https://spaceflightnow.com/2015/12/22/round-trip-rocket-flight-gives-spacex-a-trifecta-of-successes/", "wikipedia": "https://en.wikipedia.org/wiki/Falcon_9_flight_20", "static_fire_date_utc": "2015-12-19T00:09:00.000Z", "static_fire_date_unix": 1450483740, "net": false, "window": 0, "rocket": "5e9d0d95eda69973a809d1ec", "success": true, "failures": [], "details": "Total payload mass was 2,034 kg (4,484 lb) : 11 satellites weighing 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 percent power increase. Orbcomm had originally agreed to be the third flight of the enhanced-thrust rocket, but the change to the maiden flight position was announced in October 2015. SpaceX received a permit from the FAA to land the booster on solid ground at Cape Canaveral, and succeeded.", "crew": [], "ships": [], "capsules": [], "payloads": ["5eb0e4beb6c3bb0006eeb1fd"], "launchpad": "5e9e4501f509094ba4566f84", "flight_number": 25, "name": "OG-2 Mission 2", "date_utc": "2015-12-22T01:29:00.000Z", "date_unix": 1450747740, "date_local": "2015-12-22T21:29:00-04:00", "date_precision": "hour", "upcoming": false, "cores": [{"core": "5e9e28a1f3591867753b263b", "flight": 1, "gridfins": true, "legs": true, "reused": false, "landing_attempt": true, "landing_success": true, "landing_type": "RTL S", "landpad": "5e9e3032383ecb267a34e7c7"}], "auto_update": true, "tbd": false, "launch_library_id": null, "id": "5eb87cefffd86e000604b342"}, {"fairings": {"reused": false, "recovery_attempt": false, "recovered": false, "ships": []}, "links": {"patch": {"small": "https://images2.imgbox.com/8a/44/PSksEBjd_o.png", "large": "https://images2.imgbox.com/d9/c9/57io

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In what is also a first, the payload fairing remained intact after a successful splashdown achieved with thrusters and a steerable parachute.","crew":[],"ships":["5ea6ed2e080df4000697c906","5ea6ed2f080df4000697c90b","5ea6ed2f080df4000697c90c","5ea6ed30080df4000697c913"],"capsules":[],"payloads":["5eb0e4c3b6c3bb0006eeb20b"],"launchpad":"5e9e4502f509094188566f88","flight_number":38,"name":"SES-10","date_utc":"2017-03-30T22:27:00.000Z","date_unix":1490912820,"date_local":"2017-03-30T18:27:00-04:00","date_precision":"hour","upcoming":false,"cores":[{"core":"5e9e28a2f359182d0b3b263e","flight":2,"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":"5eb87d00ffd86e000604b34f"},"fairings":{"reused":false,"recovery_attempt":false,"recovered":false,"ships":[]},"links":{"patch":{"small":"https://images2.imgbox.com/e5/2d/IZB4g6Ra_o.png","large":"https://images2.imgbox.com/9d/76/kMetaHqz_o.png"},"reddit":{"campaign":"https://www.reddit.com/r/spacex/comments/601yxk","launch":"https://www.reddit.com/r/spacex/comments/68bn8y","media":"https://www.reddit.com/r/spacex/comments/68bp1i","recovery":null},"flickr":{"small":[],"original":["https://farm3.staticflickr.com/2922/33578359423_4169ac8f98_o.jpg","https://farm3.staticflickr.com/2900/33578357343_85c247ebce_o.jpg","https://farm5.staticflickr.com/4166/34006001860_8c45f28e69_o.jpg","https://farm5.staticflickr.com/4166/34005999880_77684dba4b_o.jpg","https://farm3.staticflickr.com/2934/34005998140_c77076b6fb_o.jpg","https://farm5.staticflickr.com/4191/34005996220_fe9e4342d3_o.jpg","https://farm3.staticflickr.com/2883/33575654563_699c544776_o.jpg","https://farm3.staticflickr.com/2902/33575652913_0dece34db4_o.jpg","https://farm5.staticflickr.com/4163/33575651063_24e05826c5_o.jpg","https://farm3.staticflickr.com/2876/33994851620_fabd14770f_o.jpg","https://farm3.staticflickr.com/2832/33973172140_b370b79c51_o.jpg","https://farm3.staticflickr.com/2874/34357262105_11b417bea2_o.jpg","https://farm5.staticflickr.com/4158/34357260545_16870a94ba_o.jpg"]},"presskit":"http://www.spacex.com/sites/spacex/files/nrol76presskit.pdf","webcast":"https://www.youtube.com/watch?v=EzQpkQ1etdA","youtube_id":"EzQpkQ1etdA","article":"https://techcrunch.com/2017/05/01/spacex-successfully-launches-nrol-76-u-s-military-satellite/","wikipedia":"https://en.wikipedia.org/wiki/List_of_NRO_launches"},"static_fire_date_utc":"2017-04-25T19:02:00.000Z","static_fire_date_unix":1493089200,"net":false,"window":900,"rocket":"5e9d0d95eda69973a809d1ec","success":true,"failures":[],"details":"First payload to fly on a reused first stage, B1021, previously launched with CRS-8, which also landed a second time. In what is also a first, the payload fairing remained intact after a successful splashdown achieved with thrusters and a steerable parachute."}]}

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(also known as Telkom-4) geostationary communications satellite for Telkom Indonesia. It marked the first reuse of any Block 5 first stage; the booster B1046 had previously launched Bangabandhu-1. The stage was recovered and is expected to become the first Falcon 9 booster to fly three missions.

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s-first-rocket-landing-in-california-after-launching-argentine-satellite/", "wikipedia": "https://en.wikipedia.org/wiki/SAOCOM", "static_fire_date_utc": "2018-10-02T21:00:00.000Z", "static_fire_date_unix": 1538514000, "net": false, "window": 0, "rocket": "5e9d0d95eda69973a809d1ec", "success": true, "failures": [], "details": "SpaceX's seventeenth flight of 2018 was the first launch of the Saocom Earth observation satellite constellation of the Argentine Space Agency 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 concrete pad at SLC-4W, very close to the launch pad.", "crew": [], "ships": [], "capsules": [], "payloads": ["5eb0e4c9b6c3bb006eeb22c"], "launchpad": "5e9e4502f509092b78566f87", "flight_number": 69, "name": "SAOCOM 1A", "date_utc": "2018-10-08T02:22:00.000Z", "date_unix": 1538965320, "date_local": "2018-10-07T19:22:00-07:00", "date_precision": "hour", "upcoming": false, "cores": [{"core": "5e9e28a5f3591809c03b2658", "flight": 2, "gridfins": true, "legs": true, "reused": true, "landing_attempt": true, "landing_success": true, "landing_type": "RTLS", "landpad": "5e9e3032383ecb554034e7c9"}, {"fairings": {"reused": false, "recovery_attempt": false, "recovered": false, "ships": []}, "links": {"patch": {"small": "https://images2.imgbox.com/ad/40/cTcFYf1_o.png", "large": "https://images2.imgbox.com/7c/8a/j6Hu3TqR_o.png"}, "reddit": {"campaign": "https://www.reddit.com/r/spacex/comments/9p82jt/eshail_2_launch_campaign_thread/", "launch": "https://www.reddit.com/r/spacex/comments/9x9w9v/rspacex_eshail_2_official_launch_discussion/", "media": "https://www.reddit.com/r/spacex/comments/9xaa76/rspacex_eshail_2_media_thread_videos_images_gifs/", "recovery": "https://www.reddit.com/r/spacex/comments/9xmpa7/eshail_2_recovery_thread/"}, "flickr": {"small": [], "original": ["https://farm5.staticflickr.com/4834/32040174268_b71d703417_o.jpg", "https://farm5.staticflickr.com/4810/32040174058_a65fa64e85_o.jpg", "https://farm5.staticflickr.com/4814/32040173268_0ab571e7bc_o.jpg", "https://farm5.staticflickr.com/4899/32040173568_bb5c991565_o.jpg", "https://farm5.staticflickr.com/4875/32040173278_b5578ba6be_o.jpg", "https://farm5.staticflickr.com/4862/32040173928_afdfb09939_o.jpg", "https://farm5.staticflickr.com/4888/32040173048_b2b29c020f_o.jpg", "https://farm5.staticflickr.com/4808/32248947038_dd1cf9e8c3_o.jpg", "https://farm5.staticflickr.com/4887/31180979107_da6a935c20_o.jpg"]}], "presskit": "https://www.spacex.com/sites/spacex/files/eshail-2_mission_press_kit_11_14_2018.pdf", "webcast": "https://www.youtube.com/watch?v=PhTbzc-BqKs&feature=youtu.be", "youtube_id": "PhTbzc-BqKs", "article": "https://spaceflightnow.com/2018/11/15/spacex-launches-qatars-eshail-2-communications-satellite/", "wikipedia": "https://en.wikipedia.org/wiki/Es%27hailSat"}, {"static_fire_date_utc": "2018-11-12T18:13:00.000Z", "static_fire_date_unix": 1542046380, "net": false, "window": 6180, "rocket": "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 OCISL Y.", "crew": [], "ships": ["5ea6ed2f080df4000697c90d", "5ea6ed30080df4000697c913"], "capsules": [], "payloads": ["5eb0e4c9b6c3bb006eeb22d"], "launchpad": "5e9e4502f509094188566f88", "flight_number": 70, "name": "Es'hail 2", "date_utc": "2018-11-15T20:46:00.000Z", "date_unix": 1542314760, "date_local": "2018-11-15T15:46:00-05:00", "date_precision": "hour", "upcoming": false, "cores": [{"core": "5e9e28a5f359181eed3b2657", "flight": 2, "gridfins": true, "legs": true, "reused": true, "landing_attempt": true, "landing_success": true, "landing_type": "ASDS", "landpad": "5e9e3032383ecb6bb234e7ca"}, {"fairings": {"reused": false, "recovery_attempt": true, "recovered": false, "ships": ["5ea6ed2e080df4000697c908"]}], "links": {"patch": {"small": "https://images2.imgbox.com/48/3b/Lg1Qc4uX_o.png", "large": "https://images2.imgbox.com/3e/87/xYszAJQc_o.png"}, "reddit": {"campaign": "https://www.reddit.com/r/spacex/comments/9raysi/ssoa_launch_campaign_thread", "launch": "https://www.reddit.com/r/spacex/comments/a0vjff/rspacex_ssoa_official_launch_discussion_updates/", "media": "https://old.reddit.com/r/spacex/comments/a0wylf/rspacex_ssoa_media_thread_videos_images_gifs/", "recovery": "https://www.reddit.com/r/spacex/comments/a2tjoe/ssoa_recovery_thread/"}, "flickr": {"small": [], "original": ["https://

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74,"name":"Iridium NEXT Mission 8","date_utc":"2019-01-11T15:31:00.000Z","date_unix":1547220660,"date_local":"2019-01-11T07:31:00-08:00","date_precision":"hour","upcoming":false,"cores":[{"core":"5e9e28a5f3591833b13b2659","flight":2,"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":"5eb87d28ffd86e000604b373"},{"fairings":{"reused":false,"recovery_attempt":false,"recovered":false,"ships":[]},"links":{"patch":{"small":"https://images2.imgbox.com/06/bc/5KvLN0mH_o.png","large":"https://images2.imgbox.com/4d/63/oBLNSPKL_o.png"},"reddit":{"campaign":"https://www.reddit.com/r/spacex/comments/afxyrd/nusantara_satu_launch_campaign_thread/","launch":"https://www.reddit.com/r/spacex/comments/assxjz/rspacex_psnvi_official_launch_discussion_updates/","media":"https://www.reddit.com/r/spacex/comments/at5mu8/rspacex_psn6_media_thread_videos_images_gifs/","recovery":"https://www.reddit.com/r/spacex/comments/atbnp3/psnvi_recovery_discussion_updates_thread/"},"flickr":{"small":[],"original":["https://farm8.staticflickr.com/7800/47173936271_b8ddb5bc5b_o.jpg","https://farm8.staticflickr.com/7821/47121969172_37428a280e_o.jpg","https://farm8.staticflickr.com/7923/47173936181_c0bf7a22a6_o.jpg","https://farm8.staticflickr.com/7829/46259779115_8982c2c8c2_o.jpg","https://farm8.staticflickr.com/7889/46259778995_68130be69d_o.jpg","https://farm8.staticflickr.com/7895/47130341432_3772641a68_o.jpg"]},"presskit":"https://www.spacex.com/sites/spacex/files/nusantara_satu_press_kit.pdf","webcast":"https://www.youtube.com/watch?v=XS0E35aYJcU","youtube_id":"XS0E35aYJcU","article":"https://spaceflightnow.com/2019/02/22/israeli-moon-lander-hitches-ride-on-spacex-launch-with-indonesian-comsat/","wikipedia":"https://en.wikipedia.org/wiki/PT_Pasifik_Satelit_Nusantara"},"static_fire_date_utc":"2019-02-18T17:03:00.000Z","static_fire_date_unix":1550509380,"net":false,"window":1920,"rocket":"5e9d0d95eda69973a809d1ec","success":true,"failures":[],"details":"SpaceX will launch this rideshare to GTO for Space Systems Loral (SSL). The primary payload for this mission is Nusantara Satu, a communications satellite built by SSL for the private Indonesian company PT Pasifik Satelit Nusantara (PSN). Spaceflight Industries' GTO-1 mission consists of two secondary payloads. One of those is Beresheet, the lunar lander built by the Israeli non-profit organization, SpaceIL. Beresheet will make its own way to the moon from 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://farm

8.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": "5e9e4502f509094188566f88", "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_arabsat6a_official_launch_discussion/", "media": "https://www.reddit.com/r/spacex/comments/bbh9a/rspacex_arabsat6a_media_thread_videos_images_gifs/", "recovery": "https://www.reddit.com/r/spacex/comments/bcecao/fh_arabsat_6a_center_core_recovery_thread/"}, "flickr": {"small": [], "original": ["https://live.staticflickr.com/7911/32652060737_4be1171d4a_o.jpg", "https://live.staticflickr.com/7807/40628442293_9643eaf670_o.jpg", "https://live.staticflickr.com/7804/40628440983_4da5d76cc7_o.jpg", "https://live.staticflickr.com/7856/40628439793_27927d11de_o.jpg", "https://live.staticflickr.com/7919/40628438523_c597eabff1_o.jpg", "https://live.staticflickr.com/7834/40628437283_84088aca75_o.jpg", "https://live.staticflickr.com/7856/40628435833_a1bcde59db_o.jpg", "https://live.staticflickr.com/7809/40628435153_17c05d3b5e_o.jpg", "https://live.staticflickr.com/7885/40628434483_3545598b82_o.jpg"]}, "presskit": "https://www.spacex.com/sites/spacex/files/arabsat-6a_press_kit.pdf", "webcast": "https://youtu.be/TXMGU2d8c8g", "youtube_id": "TXMGU2d8c8g", "article": "https://spaceflightnow.com/2019/04/11/spacexs-falcon-heavy-successful-in-commercial-debut/", "wikipedia": "https://en.wikipedia.org/wiki/Arabsat-6A", "static_fire_date_utc": "2019-04-05T09:57:00.000Z", "static_fire_date_unix": 1554458220, "net": false, "window": 7020, "rocket": "5e9d0d95eda69974db09d1ed", "success": true, "failures": [], "details": "SpaceX will launch Arabsat 6A to a geostationary transfer orbit from SLC-39A, KSC. The satellite is a geostationary telecommunications satellite built by Lockheed Martin for the Saudi Arabian company Arabsat. This will be the first operational flight of Falcon Heavy, and also the first Block 5 Falcon Heavy. All 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": [], "ships": ["5ea6ed2f080df4000697c90e", "5ea6ed30080df4000697c913", "5ea6ed2f080df4000697c90b", "5ea6ed2e080df4000697c909", "5ea6ed2f080df4000697c90c"], "capsules": [], "payloads": ["5eb0e4cbb6c3bb0006eeb236"], "launchpad": "5e9e4502f509094188566f88", "flight_number": 77, "name": "ArabSat 6A", "date_utc": "2019-04-11T22:35:00.000Z", "date_unix": 1555022100, "date_local": "2019-04-11T18:35:00-04:00", "date_precision": "hour", "upcoming": false, "cores": [{"core": "5e9e28a6f3591897453b265f", "flight": 1, "gridfins": true, "legs": true, "reused": false, "landing_attempt": true, "landing_success": true, "landing_type": "ASDS", "landpad": "5e9e3032383ecb6bb234e7ca"}, {"core": "5e9e28a6f359183c41

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77960,"net":false,"window":9000,"rocket":"5e9d0d95eda69973a809d1ec","success":true,"failures":[],"details":"SpaceX will launch dozens of Starlink demonstration satellites from SLC-40, Cape Canaveral AFS. Starlink is a low Earth orbit broadband internet constellation developed and owned by SpaceX which will eventually consist of nearly 12 000 satellites and will provide low latency internet service to ground terminals around the world. Two prototype satellites, Microsats 2a and 2b, were launched from Vandenberg AFB in February 2018. The booster for this mission will land on OCISLY.", "crew":[],"ships":["5ea6ed30080df4000697c913","5ea6ed2f080df4000697c90c","5ea6ed2f080df4000697c90e","5ea6ed2f080df4000697c90b","5ea6ed2e080df4000697c909"],"capsules":[],"payloads":["5eb0e4cbb6c3bb0006eeb238"],"launchpad":"5e9e4501f509094ba4566f84","flight_number":79,"name":"Starlink v0.9","date_utc":"2019-05-24T02:30:00.000Z","date_unix":1558665000,"date_local":"2019-05-23T22:30:00-04:00","date_precision":"hour","upcoming":false,"cores":[{"core":"5e9e28a5f3591833b13b2659","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":"5eb87d30ffd86e000604b378"}, {"fairings":{"reused":false,"recovery_attempt":false,"recovered":null,"ships":[],"links":{"patch":{"small":"https://images2.imgbox.com/39/af/ygmjLYhv_o.png","large":"https://images2.imgbox.com/03/18/xlkSHLy1_o.png"},"reddit":{"campaign":"https://www.reddit.com/r/spacex/comments/buq487/radarsat_constellation_launch_campaign_thread","launch":"https://www.reddit.com/r/spacex/comments/byp69f/rspacex_radarsat_constellation_official_launch","media":null,"recovery":null},"flickr":{"small":[],"original":["https://live.staticflickr.com/65535/48052269657_71764b0fb3_o.jpg","https://live.staticflickr.com/65535/48052269617_34447619f0_o.jpg","https://live.staticflickr.com/65535/48052224858_20ea2a411e_o.jpg","https://live.staticflickr.com/65535/48052269562_325c117b81_o.jpg","https://live.staticflickr.com/65535/48052182461_a419db6b84_o.jpg","https://live.staticflickr.com/65535/48052224733_f89f1dd046_o.jpg"]},"presskit":"https://www.spacex.com/sites/spacex/files/radarsat_constellation_mission_press_kit.pdf","webcast":"https://youtu.be/8A2nJd9Urk8","youtube_id":"8A2nJd9Urk8","article":"https://spaceflightnow.com/2019/06/12/three-canadian-radar-surveillance-satellites-ride-spacex-rocket-into-orbit/","wikipedia":"https://en.wikipedia.org/wiki/RADARSAT_Constellation"},"static_fire_date_utc":"2019-06-08T08:39:00.000Z","static_fire_date_unix":1559983140,"net":false,"window":780,"rocket":"5e9d0d95eda69973a809d1ec","success":true,"failures":[],"details":"SpaceX is launching the three satellite RADARSAT Constellation Mission into Sun Synchronous orbit from SLC-4E, VAFB. The RCM spacecraft are synthetic aperture radar (SAR) Earth observation satellites built by the Canadian space company, MDA, for the Canadian Space Agency. This mission was delayed when the originally slated booster failed to land after CRS-16. The booster is expected to return to LZ-4.", "crew":[],"ships":[],"capsules":[],"payloads":["5eb0e4ccb6c3bb0006eeb239"],"launchpad":"5e9e4502f509092b78566f87","flight_number":80,"name":"RADARSAT Constellation","date_utc":"2019-06-12T14:17:00.000Z","date_unix":1560349020,"date_local":"2019-06-12T07:17:00-07:00","date_precision":"hour","upcoming":false,"cores":[{"core":"5e9e28a6f35918c0803b265c","flight":2,"gridfins":true,"legs":true,"reused":true,"landing_attempt":true,"landing_success":true,"landing_type":"RTLS","landpad":"5e9e3032383ecb554034e7c9"}],"auto_update":true,"tbd":false,"launch_library_id":null,"id":"5eb87d31ffd86e000604b379"}, {"fairings":{"reused":false,"recovery_attempt":true,"recovered":true,"ships":["5ea6ed2e080df4000697c908"],"links":{"patch":{"small":"https://images2.imgbox.com/b0/90/fA4QaCAi_o.png","large":"https://images2.imgbox.com/81/9e/p6AaiJwj_o.png"},"reddit":{"campaign":"https://www.reddit.com/r/spacex/comments/bw6aa8/stp2_launch_campaign_thread/","launch":"https://www.reddit.com/r/spacex/comments/c40a29/rspacex_stp2_official_launch_discussion_updates","media":"https://www.reddit.com/r/spacex/comments/c4ng3a/rspacex_stp2_media_thread_videos_images_gifs","recovery":null},"flickr":{"small":[],"original":["https://live.staticflickr.com/65535/48129211778_83c1769305_o.jpg","https://live.staticflickr.com/65535/48129211908_8390c775b0_o.jpg","https://live.staticflickr.com/65535/48129182836_fd53e5646b_o.jpg","https://live.staticflickr.com/65535/48129269897_22d854be5c_o.jpg","https://live.staticflickr.com/

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C-40 at Cape Canaveral AFS on a Falcon 9, and the first-stage booster is expected to land back at CCAFS LZ-1.", "crew": [], "ships": [], "capsules": ["5e9e2c5cf359188bfb3b266b"], "payloads": ["5eb0e4ceb6c3bb0006eeb24a"], "launchpad": "5e9e4501f509094ba4566f84", "flight_number": 82, "name": "CRS-18", "date_utc": "2019-07-25T22:01:00.000Z", "date_unix": 1564092060, "date_local": "2019-07-25T18:01:00-04:00", "date_precision": "hour", "upcoming": false, "cores": [{"core": "5e9e28a7f3591809313b2660", "flight": 2, "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": null, "id": "5eb87d36ffd86e000604b37b"}, {"fairings": {"reused": false, "recovery_attempt": true, "recovered": true, "ships": ["5ea6ed2e080df4000697c908"]}, "links": {"patch": {"small": "https://images2.imgbox.com/65/c2/MMGkhdcA_o.png", "large": "https://images2.imgbox.com/9e/6f/oaYZfAoF_o.png"}, "reddit": {"campaign": "https://www.reddit.com/r/spacex/comments/cjaawx/amos17_launch_campaign_thread", "launch": "https://www.reddit.com/r/spacex/comments/cmmedgn/rspacex_amos17_official_launch_discussion_updates", "media": "https://www.reddit.com/r/spacex/comments/cmppne/rspacex_amos17_media_thread_videos_images_gifs", "recovery": null}, "flickr": {"small": [], "original": ["https://live.staticflickr.com/65535/48478269312_58dd3dc446_o.jpg", "https://live.staticflickr.com/65535/48478269747_353dcb2e62_o.jpg", "https://live.staticflickr.com/65535/48478119901_2de0441026_o.jpg", "https://live.staticflickr.com/65535/48478120646_ab72c2c6c3_o.jpg", "https://live.staticflickr.com/65535/48478120031_5aaelf6131_o.jpg", "https://live.staticflickr.com/65535/48478269442_08479bed36_o.jpg"]}, "presskit": "https://www.spacex.com/sites/spacex/files/amos-17_mission_press_kit_8_6_2019.pdf", "webcast": "https://youtu.be/fZh82-WcCuo", "youtube_id": "fZh82-WcCuo", "article": "https://spaceflightnow.com/2019/08/07/spacex-launches-israeli-owned-telecom-satellite/", "wikipedia": "https://en.wikipedia.org/wiki/Spacecom"}, "static_fire_date_utc": "2019-08-01T00:00:00.000Z", "static_fire_date_unix": 1564617600, "net": false, "window": 5280, "rocket": "5e9d0d95eda69973a809d1ec", "success": true, "failures": [], "details": "SpaceX will launch Boeing built Amos-17, a geostationary communications satellite for Israeli company Spacecom. The satellite will be delivered to GTO from KSC LC-39A or possibly CCAFS SLC-40, and will replace the defunct Amos-5 at 17\\xc2\\xb0 E. Amos-17 carries multi-band high throughput and regional beams servicing Africa, Europe and the Middle East. The cost of this launch is covered for Spacecom by SpaceX credit following the Amos-6 incident. A recovery of the booster for this mission is not expected.", "crew": [], "ships": ["5ea6ed2e080df4000697c908", "5ea6ed2e080df4000697c909"], "capsules": [], "payloads": ["5eb0e4cfb6c3bb0006eeb24b"], "launchpad": "5e9e4501f509094ba4566f84", "flight_number": 83, "name": "Amos-17", "date_utc": "2019-08-06T22:52:00.000Z", "date_unix": 1565131920, "date_local": "2019-08-06T18:52:00-04:00", "date_precision": "hour", "upcoming": false, "cores": [{"core": "5e9e28a5f359181eed3b2657", "flight": 3, "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": "5eb87d37ffd86e000604b37c"}, {"fairings": {"reused": true, "recovery_attempt": false, "recovered": false, "ships": []}, "links": {"patch": {"small": "https://images2.imgbox.com/61/a6/1MnnbXIF_o.png", "large": "https://images2.imgbox.com/3a/d1/R1MaGiiV_o.png"}, "reddit": {"campaign": "https://www.reddit.com/r/spacex/comments/dgqcb6/2nd_starlink_mission_launch_campaign_thread", "launch": "https://www.reddit.com/r/spacex/comments/du07rt/rspacex_starlink1_official_launch_discussion", "media": "https://www.reddit.com/r/spacex/comments/durx53/rspacex_starlink_1_media_thread_videos_images", "recovery": "https://www.reddit.com/r/spacex/comments/du1duu/starlink1_booster_and_fairing_recovery_discussion"}, "flickr": {"small": [], "original": ["https://live.staticflickr.com/65535/49051988851_0b422e1603_o.jpg", "https://live.staticflickr.com/65535/49051988746_1a97e38ca8_o.jpg", "https://live.staticflickr.com/65535/49052201452_c3b01e37f0_o.jpg", "https://live.staticflickr.com/65535/49051477088_d86104481d_o.jpg"]}, "presskit": "https://www.spacex.com/sites/spacex/files/starlink_press_kit_nov2019.pdf", "webcast": "https://youtu.be/pIDuv0Ta0XQ", "youtube_id": "pIDuv0Ta0XQ", "article": "https://spaceflightnow.com/2019/11/11/successful-launch-continues-deployment-of-spacexs-starlink-network", "wikipedia": "https://

en.wikipedia.org/wiki/Starlink_(satellite_constellation)},"static_fire_date_utc":"2019-11-11T12:08:00.000Z","static_fire_date_unix":1573474080,"net":false,"window":0,"rocket":"5e9d0d95eda69973a809d1ec","success":true,"failures":[],"details":"This mission will launch the first batch of Starlink version 1.0 satellites, from SLC-40, Cape Canaveral AFS. They are expected to contribute to the 550 km x 53° shell. It is the second Starlink launch overall. Starlink is a low Earth orbit broadband internet constellation developed and owned by SpaceX which will eventually consist of nearly 12 000 satellites and will provide low latency internet service to ground terminals around the world. The booster for this mission is expected to land on OCISLY.", "crew":[],"ships":["5ea6ed2e080df4000697c908","5ea6ed30080df4000697c913","5ea6ed2e080df4000697c909","5ea6ed2f080df4000697c90d"],"capsules":[],"payloads":["5eb0e4cfb6c3bb0006eeb24c"],"launchpad":"5e9e4501f509094ba4566f84","flight_number":84,"name":"Starlink-1","date_utc":"2019-11-11T14:56:00.000Z","date_unix":1573484160,"date_local":"2019-11-11T09:56:00-05:00","date_precision":"hour","upcoming":false,"cores":[{"core":"5e9e28a5f3591809c03b2658","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":"5eb87d39ffd86e000604b37d"}, {"fairings":{"patch":{"small":"https://images2.imgbox.com/5d/26/ZP75I1lj_o.png","large":"https://images2.imgbox.com/6e/76/jVcSQg0K_o.png"},"reddit":{"campaign":"https://www.reddit.com/r/spacex/comments/e0upb3/crs19_launch_campaign_thread/","launch":"https://www.reddit.com/r/spacex/comments/e5r8hj/rspacex_crs19_official_launch_discussion_updates","media":"https://www.reddit.com/r/spacex/comments/e6ln0m/rspacex_crs19_media_thread_videos_images_gifs","recovery":"https://www.reddit.com/r/spacex/comments/e6lbzy/rspacex_crs19_booster_recovery_discussion_updates"},"flickr":{"small":[],"original":["https://live.staticflickr.com/65535/49178460143_e3ae2bd506_o.jpg","https://live.staticflickr.com/65535/49178954221_8544835325_o.jpg","https://live.staticflickr.com/65535/49179161792_9f1801a963_o.jpg","https://live.staticflickr.com/65535/49178460368_62eb945db8_o.jpg","https://live.staticflickr.com/65535/49184948561_ce20b38bc6_o.jpg","https://live.staticflickr.com/65535/49185149122_00a7fa573d_o.jpg"]},"presskit":"https://www.spacex.com/sites/spacex/files/crs-19_mission_press_kit.pdf","webcast":"https://youtu.be/-aoAGdYXp_4","youtube_id":"-aoAGdYXp_4","article":"https://spaceflightnow.com/2019/12/05/dragon-soars-on-research-and-resupply-flight-to-international-space-station","wikipedia":"https://en.wikipedia.org/wiki/SpaceX_CRS-19"},"static_fire_date_utc":"2019-11-26T17:04:00.000Z","static_fire_date_unix":1574787840,"net":false,"window":0,"rocket":"5e9d0d95eda69973a809d1ec","success":true,"failures":[],"details":"SpaceX's 19th Crew Resupply Mission on behalf of NASA with a total of 20 contracted flights, this mission brings essential supplies to the International Space Station using SpaceX's reusable Dragon spacecraft. The external payloads for this mission include the Hyper Spectral 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 Dragon capsule and down cargo.", "crew":[],"ships":["5ea6ed2f080df4000697c90d"],"capsules":["5e9e2c5bf3591880643b2669"],"payloads":["5eb0e4cfb6c3bb0006eeb24d"],"launchpad":"5e9e4501f509094ba4566f84","flight_number":85,"name":"CRS-19","date_utc":"2019-12-05T17:29:23.000Z","date_unix":1575566963,"date_local":"2019-12-05T12:29:23-05:00","date_precision":"hour","upcoming":false,"cores":[{"core":"5e9e28a7f359187afd3b2662","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":"5eb87d39ffd86e000604b37e"}, {"fairings":{"reused":false,"recovery_attempt":true,"recovered":false,"ships":["5ea6ed2e080df4000697c908"]},"links":{"patch":{"small":"https://images2.imgbox.com/2c/03/fMLdgNQ4_o.png","large":"https://images2.imgbox.com/73/e2/4I30s6n7_o.png"},"reddit":{"campaign":"https://www.reddit.com/r/spacex/comments/e5w6i8/jcsat18kacifc1_launch_campaign_thread","launch":"https://www.reddit.com/r/spacex/comments/ebfr9t/rspacex_jcsat18kacifc1_official_launch","media":"https://www.reddit.com/r/spacex/comments/ebn4g5/rspacex_jcsat18kacifc1_media_thread_videos","recovery":"http

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ceX\'s 20th and final Crew Resupply Mission under the original NASA CRS contract, this mission brings essential supplies to the International Space Station using SpaceX\'s reusable Dragon 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 payload hosting platform. Falcon 9 and Dragon will launch from SLC-40, Cape Canaveral 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.", "crew": [], "ships": [], "capsules": ["5e9e2c5cf359185d753b266f"], "payloads": ["5eb0e4d0b6c3bb0006eeb253"], "launchpad": "5e9e4501f509094ba4566f84", "flight_number": 91, "name": "CRS-20", "date_utc": "2020-03-07T04:50:31.000Z", "date_unix": 1583556631, "date_local": "2020-03-06T23:50:31-05:00", "date_precision": "hour", "upcoming": false, "cores": [{"core": "5e9e28a7f359187afd3b2662", "flight": 2, "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": null, "id": "5eb87d42ffd86e000604b384"}, {"fairings": {"reused": true, "recovery_attempt": true, "recovered": false, "ships": ["5ea6ed2e080df4000697c908"]}, "links": {"patch": {"small": "https://images2.imgbox.com/dc/14/DLlaYbmF_o.png", "large": "https://images2.imgbox.com/e4/fd/2NPlCwzs_o.png"}, "reddit": {"campaign": "https://www.reddit.com/r/spacex/comments/f8awv0/starlink5_launch_campaign_thread/", "launch": "https://www.reddit.com/r/spacex/comments/fhymy3/rspacex_starlink5_official_launch_discussion/", "media": "https://www.reddit.com/r/spacex/comments/fizrn1/rspacex_starlink5_media_thread_videos_images_gifs/", "recovery": null}, "flickr": {"small": [], "original": ["https://live.staticflickr.com/65535/49673373182_93a517e140_o.jpg", "https://live.staticflickr.com/65535/49672551378_fabc17ef6f_o.jpg", "https://live.staticflickr.com/65535/49672551303_564ce21658_o.jpg"]}, "presskit": "https://www.spacex.com/sites/spacex/files/sixth_starlink_press_kit.pdf", "webcast": "https://youtu.be/I4sMhHbHYXM", "youtube_id": "I4sMhHbHYXM", "article": "https://spaceflightnow.com/2020/03/18/falcon-9-rocket-overcomes-engine-failure-to-deploy-starlink-satellites/", "wikipedia": "https://en.wikipedia.org/wiki/Starlink"}, "static_fire_date_utc": "2020-03-13T18:37:00.000Z", "static_fire_date_unix": 1584124620, "net": false, "window": 0, "rocket": "5e9d0d95eda69973a809d1ec", "success": true, "failures": [], "details": "The sixth Starlink launch overall and the fifth operational batch of Starlink satellites will launch into orbit aboard a Falcon 9 rocket. This mission is expected to deploy all sixty satellites into an elliptical orbit about fifteen minutes into flight. In the weeks following launch the satellites are expected to utilize their onboard ion thrusters to raise their orbits to 550 km in three groups of 20, making use of precession rates to separate themselves into three planes. The booster will land on a drone ship approximately 628 km downrange.", "crew": [], "ships": ["5ea6ed30080df4000697c913", "5ea6ed2f080df4000697c90d"], "capsules": [], "payloads": ["5eb0e4d0b6c3bb0006eeb254"], "launchpad": "5e9e4502f509094188566f88", "flight_number": 92, "name": "Starlink-5", "date_utc": "2020-03-18T12:16:00.000Z", "date_unix": 1584533760, "date_local": "2020-03-18T08:16:00-04:00", "date_precision": "hour", "upcoming": false, "cores": [{"core": "5e9e28a5f3591809c03b2658", "flight": 5, "gridfins": true, "legs": true, "reused": true, "landing_attempt": true, "landing_success": false, "landing_type": "ASDS", "landpad": "5e9e3032383ecb6bb234e7ca"}], "auto_update": true, "tbd": false, "launch_library_id": null, "id": "5eb87d43ffd86e000604b385"}, {"fairings": {"reused": true, "recovery_attempt": false, "recovered": null, "ships": ["5ea6ed2e080df4000697c908", "5ea6ed2f080df4000697c90d"]}, "links": {"patch": {"small": "https://images2.imgbox.com/ef/36/h10Ds3kT_o.png", "large": "https://images2.imgbox.com/ab/12/2cQPNTCZ_o.png"}, "reddit": {"campaign": "https://www.reddit.com/r/spacex/comments/fxkc7k/starlink6_launch_campaign_thread/", "launch": "https://www.reddit.com/r/spacex/comments/g5jmx0/rspacex_starlink6_official_launch_discussion/", "media": "https://www.reddit.com/r/spacex/comments/g5fqka/rspacex_starlink6_media_thread_photographer/", "recovery": "https://www.reddit.com/r/spacex/comments/g6kztd/rspacex_starlink_v1_l6_recovery_discussion/"}, "flickr": {"small": [], "original": ["https://live.staticflickr.com/65535/49673373182_93a517e140_o.jpg", "https://live.staticflickr.com/65535/49672551378_fabc17ef6f_o.jpg", "https://live.staticflickr.com/65535/49672551303_564ce2"]

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The booster for this mission is expected to land on JRTI.", "crew": [], "ships": ["5ea6ed2f080df4000697c911", "5ea6ed2f080df4000697c90b", "5ea6ed2e080df4000697c907", "5ea6ed2e080df4000697c908"], "capsules": [], "payloads": ["5ef6a4ea0059c33cee4a82a2"], "launchpad": "5e9e4501f509094ba4566f84", "flight_number": 106, "name": "Starlink-15 (v1.0)", "date_utc": "2020-11-05T12:00:00.000Z", "date_unix": 1604582400, "date_local": "2020-11-05T08:00:00-04:00", "date_precision": "hour", "upcoming": false, "cores": [{"core": "5ef670f10059c33cee4a826c", "flight": 4, "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": "5ef6a2e70059c33cee4a8294"}, {"fairings": {"reused": null, "recovery_attempt": true, "recovered": null, "ships": ["5ea6ed2e080df4000697c907"]}, "links": {"patch": {"small": "https://images2.imgbox.com/5e/b7/Kn4Vn6nM_o.png", "large": "https://images2.imgbox.com/c8/f5/tRqtdHD6_o.png"}, "reddit": {"campaign": "https://www.reddit.com/r/spacex/comments/jobxn2/rspacex_gps_iii_sv04_sacagawea_official_launch/", "launch": "https://www.reddit.com/r/spacex/comments/jobxn2/rspacex_gps_iii_sv04_sacagawea_official_launch/", "media": null, "recovery": null}, "flickr": {"small": [], "original": ["https://live.staticflickr.com/65535/50611865511_2299e11860_o.jpg", "https://live.staticflickr.com/65535/50611118958_448d239fe1_o.jpg", "https://live.staticflickr.com/65535/50611979827_48811d2ea6_o.jpg"]}, "presskit": null, "webcast": "https://youtu.be/wufXF5YKR1M", "youtube_id": "wufXF5YKR1M", "article": "https://spaceflightnow.com/2020/11/06/spacex-launches-gps-navigation-satellite-from-cape-canaveral/", "wikipedia": "https://en.wikipedia.org/wiki/GPS_Block_III"}, {"static_fire_date_utc": "2020-11-05T12:00:00.000Z", "static_fire_date_unix": 1604582400, "net": false, "window": null, "rocket": "5e9d0d95eda69973a809d1ec", "success": true, "failures": [], "details": "This mission will launch the fifteenth batch of operational Starlink satellites, which are expected to be version 1.0, from SLC-40, Kennedy Space Center. 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The booster for this mission is expected to land on JRTI.", "crew": [], "ships": ["5ea6ed2f080df4000697c911", "5ea6ed2f080df4000697c90b", "5ea6ed2e080df4000697c907", "5ea6ed2e080df4000697c908"], "capsules": [], "payloads": ["5ef6a4ea0059c33cee4a82a2"], "launchpad": "5e9e4501f509094ba4566f84", "flight_number": 106, "name": "Starlink-15 (v1.0)", "date_utc": "2020-11-05T12:00:00.000Z", "date_unix": 1604582400, "date_local": "2020-11-05T08:00:00-04:00", "date_precision": "hour", "upcoming": false, "cores": [{"core": "5ef670f10059c33cee4a826c", "flight": 4, "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": "5ef6a2e70059c33cee4a8294"}, {"fairings": {"reused": null, "recovery_attempt": true, "recovered": null, "ships": ["5ea6ed2e080df4000697c907"]}, "links": {"patch": {"small": "https://images2.imgbox.com/5e/b7/Kn4Vn6nM_o.png", "large": "https://images2.imgbox.com/c8/f5/tRqtdHD6_o.png"}, "reddit": {"campaign": "https://www.reddit.com/r/spacex/comments/jobxn2/rspacex_gps_iii_sv04_sacagawea_official_launch/", "launch": "https://www.reddit.com/r/spacex/comments/jobxn2/rspacex_gps_iii_sv04_sacagawea_official_launch/", "media": null, "recovery": null}, "flickr": {"small": [], "original": ["https://live.staticflickr.com/65535/50611865511_2299e11860_o.jpg", "https://live.staticflickr.com/65535/50611118958_448d239fe1_o.jpg", "https://live.staticflickr.com/65535/50611979827_48811d2ea6_o.jpg"]}, "presskit": null, "webcast": "https://youtu.be/wufXF5YKR1M", "youtube_id": "wufXF5YKR1M", "article": "https://spaceflightnow.com/2020/11/06/spacex-launches-gps-navigation-satellite-from-cape-canaveral
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frica and South Africa. The booster for this mission will be recovered downrange via ASDS.", "crew": [], "ships": ["5ea6ed2f080df4000697c90d", "5ea6ed2f080df4000697c910", "5ea6ed2e080df4000697c907", "5ea6ed2e080df4000697c908"], "capsules": [], "payloads": ["5eb0e4d3b6c3bb0006eeb264"], "launchpad": "5e9e4501f509094ba4566f84", "flight_number": 113, "name": "Turksat 5A", "date_utc": "2021-01-08T02:15:00.000Z", "date_unix": 1610072100, "date_local": "2021-01-07T21:15:00-05:00", "date_precision": "hour", "upcoming": false, "cores": [{"core": "5ef670f10059c33cee4a826c", "flight": 4, "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": "5eb87d4fffd86e000604b393", {"fairings": {"reused": true, "recovery_attempt": true, "recovered": null, "ships": ["5ea6ed2e080df4000697c907", "5ea6ed2e080df4000697c908"]}, "links": {"patch": {"small": "https://images2.imgbox.com/a6/d3/bPczm8gQ_o.png", "large": "https://images2.imgbox.com/2b/28/fZnNbGqX_o.png"}, "reddit": {"campaign": "https://www.reddit.com/r/spacex/comments/jhu37i/starlink_general_discussion_and_deployement_thread/", "launch": "https://www.reddit.com/r/spacex/comments/kz969o/rspacex_starlink16_official_launch_discussion/", "media": "https://www.reddit.com/r/spacex/comments/l1b5q8/starlink16_media_thread_photographer_contest/", "recovery": "https://www.reddit.com/r/spacex/comments/k2ts1q/rspacex_fleet_updates_discussion_thread/"}, "flickr": {"small": [], "original": ["https://live.staticflickr.com/65535/50855737853_4d290519b4_o.jpg", "https://live.staticflickr.com/65535/50856457401_5fd05cddd1_o.jpg", "https://live.staticflickr.com/65535/50855737933_bcc65bdf8b_o.jpg", "https://live.staticflickr.com/65535/50856551642_5190c59ec1_o.jpg"]}, "presskit": null, "webcast": "https://youtu.be/84Nct_Q9Lqw", "youtube_id": "84Nct_Q9Lqw", "article": "https://spaceflightnow.com/2021/01/20/spacex-sets-new-rocket-reuse-records-with-successful-starlink-launch/", "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": "This mission launches the sixteenth batch of operational Starlink satellites, which are version 1.0, from SLC-40 or LC-39A. It is the seventeenth Starlink launch 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 an ASDS.", "crew": [], "ships": ["5ea6ed2e080df4000697c907", "5ea6ed2e080df4000697c908", "5ea6ed2f080df4000697c910", "5ea6ed2f080df4000697c90d", "5ea6ed2f080df4000697c90b"], "capsules": [], "payloads": ["5fbfedba54ceb10a5664c813"], "launchpad": "5e9e4502f509094188566f88", "flight_number": 114, "name": "Starlink-16 (v1.0)", "date_utc": "2021-01-20T13:02:00.000Z", "date_unix": 1611147720, "date_local": "2021-01-20T08:02:00-05:00", "date_precision": "hour", "upcoming": false, "cores": [{"core": "5e9e28a6f35918c0803b265c", "flight": 8, "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": "5fbfecce54ceb10a5664c80a", {"fairings": {"reused": false, "recovery_attempt": true, "recovered": true, "ships": ["5ea6ed2e080df4000697c908", "5ea6ed2e080df4000697c907"]}, "links": {"patch": {"small": "https://images2.imgbox.com/58/70/eapAog9v_o.png", "large": "https://images2.imgbox.com/82/9a/fzsUstOu_o.png"}, "reddit": {"campaign": "https://www.reddit.com/r/spacex/comments/kt5gds/transporter1_launch_campaign_thread/", "launch": "https://www.reddit.com/r/spacex/comments/l210i3/rspacex_transporter1_official_launch_discussion/", "media": null, "recovery": "https://www.reddit.com/r/spacex/comments/k2ts1q/rspacex_fleet_updates_discussion_thread/"}, "flickr": {"small": [], "original": ["https://live.staticflickr.com/65535/50870343533_e815eb30c4_o.jpg", "https://live.staticflickr.com/65535/50871151292_af114a3f9e_o.jpg", "https://live.staticflickr.com/65535/50871053741_59a1dbb6cc_o.jpg", "https://live.staticflickr.com/65535/50871053696_cd01a7e092_o.jpg", "https://live.staticflickr.com/65535/50870343763_1b1ac55eae_o.jpg"]}, "presskit": null, "webcast": "https://youtu.be/SchI1cbkUv4", "youtube_id": "SchI1cbkUv4", "article": "https://spaceflightnow.com/2021/01/24/spacex-launches-record-setting-rideshare-mission-with-143-small-satellites/", "wikipedia": null}, "static_fire_date_utc": null, "static_fire_date_unix": null, "net": false, "window": 2520, "rocket": "5e9d0d95eda69973a809d1ec", "success": true, "failures": [], "details": "SpaceX will launch a dedica

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The satellites will be delivered to low Earth orbit and will spend a few weeks maneuvering to their operational altitude. 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It is the 21st Starlink launch 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 an ASDS.", "crew": [], "ships": ["5ea6ed2f080df4000697c90d", "5ea6ed30080df4000697c913"], "capsules": [], "payloads": ["5fbfedc654ceb10a5664c814"], "launchpad": "5e9e4502f509094188566f88", "flight_number": 120, "name": "Starlink-21 (v1.0)", "date_utc": "2021-03-10T00:00:00.000Z", "date_unix": 1615330800, "date_local": "2021-03-09T19:00:00-05:00", "date_precision": "hour", "upcoming": false, "cores": [{"core": "5e9e28a5f3591833b13b2659", "flight": 10, "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": "dfd4f0e0-0ab4-494d-bd88-1b93b934b269", "id": "5fbfecfe54ceb10a5664c80b"}, {"fairings": {"reused": true, "recovery_attempt": true, "recovered": true, "ships": ["5ea6ed2e080df4000697c909", "5ea6ed2f080df4000697c90c"]}, "links": {"patch": {"small": "https://images2.imgbox.com/df/ea/lre39tFr_o.png", "large": "https://images2.imgbox.com/38/db/moPRrpCB_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/m0yww5/rspacex_starlink20_official_launch_discussion/", "media": null, "recovery": "https://www.reddit.com/r/spacex/comments/k2ts1q/rspacex_fleet_updates_discussion_thread/"}, "flickr": {"small": [], "original": ["https://live.staticflickr.com/65535/51027544097_799f5bacc_o.jpg", "https://live.staticflickr.com/65535/51027443336_3e7486be6f_o.jpg", "https://live.staticflickr.com/65535/51027443321_9a59458d39_o.jpg"]}, "presskit": null, "webcast": "https://youtu.be/U4sWbTfrzj8", "youtube_id": "U4sWbTfrzj8", "article": "https://spaceflightnow.com/2021/03/11/spacex-adds-more-satellites-to-starlink-internet-fleet/", "wikipedia": "https://en.wikipedia.org/wiki/Starlink"}, {"static_fire_date_utc": "2021-03-09T23:00:00.000Z", "static_fire_date_unix": 1615330800, "net": false, "window": null, "rocket": "5e9d0d95eda69973a809d1ec", "success": true, "failures": [], "details": "This mission launches the 20th batch of operational Starlink satellites, which are version 1.0, from LC-39A or SLC-40. It is the 21st Starlink launch 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 an ASDS.", "crew": [], "ships": ["5ea
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c","success":true,"failures":[],"details":"SpaceX launches the second operational mission of its Crew Dragon vehicle as part of NASA's Commercial Crew Program, carrying NASA astronauts Shane Kimbrough, Megan McArthur, Thomas Pesquet, and Akihiko Hoshide to the International Space Station. The Falcon 9 and Crew Dragon lift off from LC-39A, Kennedy Space Center. Both the booster and the capsule have flown previously, each a first for a commercial crew flight. The booster for this mission is expected to land on an ASDS. The mission will be complete with the safe return of the astronauts to Earth.", "crew":["5fe3ba5fb3467846b3242188","5fe3bb01b3467846b3242189","5fe3bc3db3467846b324218b","5fe3bc8ab3467846b324218c"],"ships":["5ea6ed2e080df4000697c909","5ea6ed30080df4000697c913"],"capsules":["5e9e2c5df359188aba3b2676"],"payloads":["5fe3b3adb3467846b3242173"],"launchpad":"5e9e4502f509094188566f88","flight_number":123,"name":"Crew-2","date_utc":"2021-04-23T09:49:00.000Z","date_unix":1619171340,"date_local":"2021-04-23T05:49:00-04:00","date_precision":"hour","upcoming":false,"cores":[{"core":"5f57c53d0622a6330279009f","flight":2,"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":"32dcb5ad-7609-4fc0-8094-768ee5c2ebe0","id":"5fe3af58b3467846b324215f"}, {"fairings":{"reused":false,"recovery_attempt":true,"recovered":true,"ships":["6059166413f40e27e8af34b6"]},"links":{"patch":{"small":"https://images2.imgbox.com/cd/30/UyfjAmuT_o.png","large":"https://images2.imgbox.com/2e/a8/bvzKciwf_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/mz0l0k/rspacex_starlink24_launch_discussion_updates/","media":null,"recovery":"https://www.reddit.com/r/spacex/comments/k2ts1q/rspacex_fleet_updates_discussion_thread/"},"flickr":{"small":[],"original":["https://live.staticflickr.com/65535/51146838376_4667d78231_o.jpg","https://live.staticflickr.com/65535/51147622479_d027e09727_o.jpg","https://live.staticflickr.com/65535/51147949685_975bd6b4ee_o.jpg"]},"presskit":null,"webcast":"https://youtu.be/RBxkRKZ34yo","youtube_id":"RBxkRKZ34yo","article":"https://spaceflightnow.com/2021/04/29/spacex-launches-60-more-starlink-spacecraft-fcc-clears-spacex-to-fly-satellites-at-lower-altitudes/","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":"This mission launches the 24th batch of operational Starlink satellites, which are version 1.0, from LC-39A or SLC-40. It is the 25th Starlink launch 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 an ASDS.", "crew":[],"ships":["5ea6ed2f080df4000697c910","5ea6ed2f080df4000697c90d","5ee68c683c228f36bd5809b5","6059166413f40e27e8af34b6"],"capsules":[],"payloads":["605b4be3aa5433645e37d046"],"launchpad":"5e9e4501f509094ba4566f84","flight_number":124,"name":"Starlink-24 (v1.0)","date_utc":"2021-04-29T03:44:00.000Z","date_unix":1619667840,"date_local":"2021-04-28T23:44:00-04:00","date_precision":"hour","upcoming":false,"cores":[{"core":"5ef670f10059c33cee4a826c","flight":7,"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":"fbd23c86-89d0-4d3f-b5fb-5d7165d05cca","id":"605b4b6aaa5433645e37d03f"}, {"fairings":{"reused":true,"recovery_attempt":true,"recovered":true,"ships":["6059166413f40e27e8af34b6"]},"links":{"patch":{"small":"https://images2.imgbox.com/33/03/aHKx9cu1_o.png","large":"https://images2.imgbox.com/8e/e0/w0t6ZecV_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/n3z0aa/rspacex_starlink25_launch_discussion_updates/","media":null,"recovery":"https://www.reddit.com/r/spacex/comments/k2ts1q/rspacex_fleet_updates_discussion_thread/"},"flickr":{"small":[],"original":[]},"presskit":null,"webcast":"https://youtu.be/xpl_JnG7rcg","youtube_id":"xpl_JnG7rcg","article":null,"wikipedia":"https://en.wikipedia.org/wiki/Starlink"},"static_fire_date_utc":"2021-05-03T05:00:00.000Z","static_fire_date_unix":1620018000,"net":false,"window":0,"rocket":"5e9d0d95eda69973a809d1ec","success":true,"fail

ures":[],"details":"This mission launches the 25th batch of operational Starlink satellites, which are version 1.0, from LC-39A. It is the 26th Starlink launch 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","5ea6ed30080df4000697c913","6059166413f40e27e8af34b6"], "capsules":[], "payloads":["605b4befaa5433645e37d047"], "launchpad":"5e9e4502f509094188566f88", "flight_number":125, "name":"Starlink-25 (v1.0)", "date_utc":"2021-05-04T19:01:00.000Z", "date_unix":1620154860, "date_local":"2021-05-04T15:01:00-04:00", "date_precision":"hour", "upcoming":false, "cores":[{"core":"5e9e28a5f3591833b13b2659"}, {"flight":9, "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":"1ecc82c0-c5c8-41f0-aa58-b50a3b839ae0", "id":"605b4b7daa5433645e37d040"}, {"fairings":{"reused":true, "recovery_attempt":true, "recovered":true, "ships":["6059166413f40e27e8af34b6"]}, "links":{"patch":{"small":"https://images2.imgbox.com/ad/eb/pq1vQuoW_o.png", "large":"https://images2.imgbox.com/97/83/Y1Qj9iUC_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/n7ju15/rspace_starlink27_launch_discussion_updates/", "media":null, "recovery":"https://www.reddit.com/r/spacex/comments/k2ts1q/rspace_fleet_updates_discussion_thread/"}, "flickr":{"small":[], "original":[]}, "presskit":null, "webcast":"https://youtu.be/J71s2KmkSrc", "youtube_id":"J71s2KmkSrc", "article":null, "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":"This mission launches 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 their operational altitude. The booster is expected to land on an ASDS.", "crew":[], "ships":["5ea6ed30080df4000697c913","5ee68c683c228f36bd5809b5","6059166413f40e27e8af34b6"], "capsules":[], "payloads":["6079bd5e9a06446e8c61bf7c"], "launchpad":"5e9e4501f509094ba4566f84", "flight_number":126, "name":"Starlink-27 (v1.0)", "date_utc":"2021-05-09T06:42:00.000Z", "date_unix":1620542520, "date_local":"2021-05-09T02:42:00-04:00", "date_precision":"hour", "upcoming":false, "cores":[{"core":"5e9e28a6f35918c0803b265c"}, {"flight":10, "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":"e5085f22-208b-4b28-b66c-fd4bd9df90e7", "id":"6079bd1c9a06446e8c61bf76"}, {"fairings":{"reused":true, "recovery_attempt":true, "recovered":null, "ships":["6059166413f40e27e8af34b6"]}, "links":{"patch":{"small":"https://images2.imgbox.com/b5/8a/KeiGEz4f_o.png", "large":"https://images2.imgbox.com/f6/28/am1U5JWP_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/ncfexu/rspace_starlink26_launch_discussion_updates/", "media":null, "recovery":"https://www.reddit.com/r/spacex/comments/k2ts1q/rspace_fleet_updates_discussion_thread/"}, "flickr":{"small":[], "original":["https://live.staticflickr.com/65535/51171344450_6a3f0e08b9_o.jpg", "https://live.staticflickr.com/65535/51170251791_9b36fba5b7_o.jpg", "https://live.staticflickr.com/65535/51185653708_86840b1672_o.jpg", "https://live.staticflickr.com/65535/51185653723_7bd9ecab87_o.jpg", "https://live.staticflickr.com/65535/51186506630_1a47a43787_o.jpg"]}, "presskit":null, "webcast":"https://youtu.be/tdgg_qwj-hI", "youtube_id":"tdgg_qwj-hI", "article":null, "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 launches 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 to their operational altitude. The booster is expected to land on an ASDS.", "crew":[], "ships":["5ea6ed30080df4000697c913","6059166413f40e27e8af34b6","608c1a06cf7f3d"]

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ion 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 Roll Out Solar Arrays. 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 splashdown and recovery of the capsule and down cargo.", "crew": [], "ships": ["5ea6ed2f080df4000697c90b", "608c1a06cf7f3d6152666ad4", "5ea6ed30080df4000697c913"], "capsules": ["60b803421f83cc1e59f1644d"], "payloads": ["5fe3b642b3467846b324217b"], "launchpad": "5e9e4502f509094188566f88", "flight_number": 129, "name": "CRS-22 & IROSA", "date_utc": "2021-06-03T17:29:00.000Z", "date_unix": 1622741340, "date_local": "2021-06-03T13:29:00-04:00", "date_precision": "hour", "upcoming": false, "cores": [{"core": "60b800111f83cc1e59f16438", "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": "89a150ea-6e4b-489f-853c-3603ae684611", "id": "5fe3af84b3467846b3242161"}, {"fairings": {"reused": false, "recovery_attempt": true, "recovered": true, "ships": ["5ea6ed2f080df4000697c90b", "5ea6ed2e080df4000697c909"]}, "links": {"patch": {"small": "https://images2.imgbox.com/9a/f0/UV16cZ6e_o.png", "large": "https://images2.imgbox.com/98/c3/8McdwgVu_o.png"}, "reddit": {"campaign": "https://www.reddit.com/r/spacex/comments/n9llxw/sxm8_launch_campaign_thread/", "launch": "https://www.reddit.com/r/spacex/comments/nss9br/rspacex_sxm8_launch_discussion_and_updates_thread/", "media": null, "recovery": null}, "flickr": {"small": [], "original": []}, "presskit": null, "webcast": "https://youtu.be/bgtDRR2F2wA", "youtube_id": "bgtDRR2F2wA", "article": null, "wikipedia": "https://en.wikipedia.org/wiki/Sirius_XM#Satellites"}, "static_fire_date_utc": "2021-06-03T06:32:00.000Z", "static_fire_date_unix": 1622701920, "net": false, "window": 5940, "rocket": "5e9d0d95eda69973a809d1ec", "success": true, "failures": [], "details": "SpaceX launches the second of two next generation satellites for SiriusXM from SLC-40, Cape Canaveral Space Force Station. The spacecraft will be delivered into a sub-synchronous geostationary transfer orbit and will replace XM-4 in geostationary orbit. The booster for this mission will land on an ASDS.", "crew": [], "ships": ["5ee68c683c228f36bd5809b5", "5ea6ed2f080df4000697c910", "5ea6ed2f080df4000697c90b", "5ea6ed2e080df4000697c909"], "capsules": [], "payloads": ["5fe3b57db3467846b324217a"], "launchpad": "5e9e4501f509094ba4566f84", "flight_number": 130, "name": "SXM-8", "date_utc": "2021-06-06T04:26:00.000Z", "date_unix": 1622953560, "date_local": "2021-06-06T00:26:00-04:00", "date_precision": "hour", "upcoming": false, "cores": [{"core": "5f57c53d0622a6330279009f", "flight": 3, "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": "edaf9a8d-d67c-4e0e-8452-a37b111581d5", "id": "5fe3af6db3467846b3242160"}, {"fairings": {"reused": false, "recovery_attempt": true, "recovered": true, "ships": ["60c8c7a45d4819007ea69871"]}, "links": {"patch": {"small": "https://images2.imgbox.com/d0/66/bCRsHNSZ_o.png", "large": "https://images2.imgbox.com/2f/6f/ebFS9FDJ_o.png"}, "reddit": {"campaign": "https://www.reddit.com/r/spacex/comments/nuud0l/gps_iii_sv05_launch_campaign_thread/", "launch": "https://www.reddit.com/r/spacex/comments/o0gcnq/rspacex_gps_iii_sv05_launch_discussion_and/", "media": null, "recovery": null}, "flickr": {"small": [], "original": ["https://live.staticflickr.com/65535/51254829184_e6e1d0d79c_o.jpg", "https://live.staticflickr.com/65535/51253353892_de82b01e23_o.jpg", "https://live.staticflickr.com/65535/51254285968_288383ce6e_o.jpg", "https://live.staticflickr.com/65535/51254829154_3c5980c086_o.jpg", "https://live.staticflickr.com/65535/51253353882_e59ea4df4f_o.jpg", "https://live.staticflickr.com/65535/51254829139_ca68c19689_o.jpg", "https://live.staticflickr.com/65535/51262926489_9fbce20e9c_o.jpg", "https://live.staticflickr.com/65535/51262926469_974292477d_o.jpg", "https://live.staticflickr.com/65535/51262179176_e4302db116_o.jpg", "https://live.staticflickr.com/65535/51263224735_3210fb7499_o.jpg"]}, "presskit": null, "webcast": "https://youtu.be/QJXxVtp3KqI", "youtube_id": "QJXxVtp3KqI", "article": null, "wikipedia": "https://en.wikipedia.org/wiki/GPS_Block_III"}, "static_fire_date_utc": "2021-06-13T19:30:00.000Z", "static_fire_date_unix": 1623612600, "net": false, "window": 900, "rocket": "5e9d0d95eda69973a809d1ec", "success": true, "failures": [], "details": "SpaceX's fourth GPS III launch 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 booster. Falcon 9 will launch from SLC-40, Cape Canaveral and the booster will land downrange on a drone ship. GPS III is the third generation of the U.S. Space Force's NAVSTAR Global Positioning System satellites, developed by Lockheed Martin. The GPS III constellation will feature a cross-linked command and control architecture, allowing the entire GPS constellation to be updated simultaneously from a single ground station. A new spot beam capability for enhanced military coverage and increased resistance to hostile jamming will be incorporated.

,"crew":[],"ships":["60c8c7a45d4819007ea69871","5ee68c683c228f36bd5809b5","5ea6ed2f080df4000697c910"],"capsules":[],"payloads":["5eb0e4d2b6c3bb0006eeb261"],"launchpad":"5e9e4501f509094ba4566f84","flight_number":131,"name":"GPS III SV05","date_utc":"2021-06-17T16:09:00.000Z","date_unix":1623946140,"date_local":"2021-06-17T12:09:00-04:00","date_precision":"hour","upcoming":false,"cores":[{"core":"5f57c5440622a633027900a0","flight":2,"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":"110c808a-a091-47ab-8532-4fa058c1de7a","id":"5eb87d4effd86e000604b390"},{"fairings":{"reused":true,"recovery_attempt":true,"recovered":true,"ships":["60c8c7a45d4819007ea69871"]},"links":{"patch":{"small":"https://images2.imgbox.com/a9/3e/L2EqHzn0_o.png","large":"https://images2.imgbox.com/96/8c/4H0qLFoZ_o.png"},"reddit":{"campaign":"https://www.reddit.com/r/spacex/comments/nz7rai/transporter2_launch_campaign_thread/","launch":"https://www.reddit.com/r/spacex/comments/o9ki7u/rspacex_transporter2_launch_discussion_and/","media":null,"recovery":"https://www.reddit.com/r/spacex/comments/k2ts1q/rspacex_fleet_updates_discussion_thread/"},"flickr":{"small":[],"original":["https://live.staticflickr.com/65535/51283430951_a9e5a41141_o.jpg","https://live.staticflickr.com/65535/51283430936_3852120bbe_o.jpg","https://live.staticflickr.com/65535/51283604493_d1a088b7c9_o.jpg","https://live.staticflickr.com/65535/51284454795_591717faee_o.jpg","https://live.staticflickr.com/65535/51284454810_9fdd0e8db4_o.jpg","https://live.staticflickr.com/65535/51283604443_6d92fe1231_o.jpg","https://live.staticflickr.com/65535/51283604428_b24ebf1b5f_o.jpg","https://live.staticflickr.com/65535/51283604438_7202e2a388_o.jpg"]},"presskit":null,"webcast":"https://youtu.be/sSiuW1HcGjA","youtube_id":"sSiuW1HcGjA","article":null,"wikipedia":null},"static_fire_date_utc":"2021-06-22T15:24:00.000Z","static_fire_date_unix":1624375440,"net":false,"window":0,"rocket":"5e9d0d95eda69973a809d1ec","success":true,"failures":[],"details":"Falcon 9 launches to sun-synchronous polar orbit from Florida as part of SpaceX's Rideshare program dedicated to smallsat customers. The mission lifts off from SLC-40, Cape Canaveral on a southward azimuth and performs a dogleg maneuver. The booster for this mission is expected to return to LZ-1 based on FCC communications filings. This rideshare takes approximately 90 satellites and hosted payloads into orbit on a variety of deployers including 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-f5eac05f4e4f", "id": "5fe3b11eb3467846b324216c"}, {"fairings": {"reused": true, "recovery_attempt": null, "recovered": null, "ships": []}, "links": {"patch": {"small": "https://images2.imgbox.com/cb/ef/u7G0l1bj4_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_deployement_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_local": "2021-09-13T20:55:00-07:00", "date_precision": "hour", "upcoming": false, "cores": [{"core": "5e9e28a5f3591833b13b2659", "flight": 10, "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": "6b9f9fe6-7f94-498b-a664-7c9e42dbe76d", "id": "60e3bf0d73359e1e20335c37"}, {"fairings": null, "links": {"patch": {"small": "https://images2.imgbox.com/bb/2f/jMnSSQHM_o.png", "large": "https://images2.imgbox.com/eb/36/ZJnCO6hc_o.png"}, "reddit": {"campaign": "https://www.reddit.com/r/spacex/comments/pc1fq7/inspiration4_launch_campaign_thread/", "launch": "https://www.reddit.com/r/spacex/comments/po651k/rspacex_inspiration4_launch_discussion_updates/", "media": null, "recovery": null}, "flickr": {"small": [], "original": []}, "presskit": null, "webcast": "https://youtu.be/3pv01sSq44w", "youtube_id": "3pv01sSq44w", "article": null, "wikipedia": "https://en.wikipedia.org/wiki/Inspiration4"}, "static_fire_date_utc": "2021-09-13T07:07:00.000Z", "static_fire_date_unix": 1631516820, "net": false, "window": 18000, "rocket": "5e9d0d95eda69973a809d1ec", "success": true, "failures": [], "details": "Inspiration4 is the world's first all-civilian mission to space. The mission will be commanded by Jared Isaacman, the 37-year-old founder and Chief Executive Officer of Shift4 Payments and an accomplished pilot and adventurer. Inspiration4 will leave Earth from Kennedy Space Center's historic Launch Complex 39A, the embarkation point for Apollo and Space Shuttle missions, and travel across a low earth orbit on a multi-day journey that will continually eclipse more than 90% of the earth's population. Named in recognition of the four-person crew that will raise awareness and funds for St. Jude Children's"}]

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2:x80\x99s Research Hospital, this milestone represents a new era for human spaceflight and exploration.", "crew": ["607a3a5f5a906a44023e0870", "607a3ab45a906a44023e0872", "607b48375a906a44023e08b8", "607b48da5a906a44023e08b9"], "ships": ["5ea6ed2f080df4000697c910", "5ee68c683c228f36bd5809b5", "614251b711a64135defb3654"], "capsules": ["5f6f99fddcfd403df379709"], "payloads": ["607a382f5a906a44023e0867"], "launchpad": "5e9e4502f509094188566f88", "flight_number": 135, "name": "Inspiration4", "date_utc": "2021-09-16T00:02:00.000Z", "date_unix": 1631750520, "date_local": "2021-09-15T20:02:00-04:00", "date_precision": "hour", "upcoming": false, "cores": [{"core": "5f57c5440622a633027900a0", "flight": 3, "gridfins": true, "legs": true, "reused": true, "landing_attempt": true, "landing_success": true, "landing_type": "ASDS", "landpad": "5e9e3033383ecb9e534e7cc"}], "auto_update": true, "tbd": false, "launch_library_id": "621d64e6-0513-45dc-8ffa-c9fd56518398", "id": "607a37565a906a44023e0866"}, {"fairings": null, "links": {"patch": {"small": "https://images2.imgbox.com/5a/2f/w3woVyro_o.png", "large": "https://images2.imgbox.com/80/34/J7ROsgsi_o.png"}, "reddit": {"campaign": "https://www.reddit.com/r/spacex/comments/q8r52a/crew3_launch_campaign_thread/", "launch": "https://www.reddit.com/r/spacex/comments/qij6f4/rspacex_crew3_launch_discussion_updates_thread/", "media": null, "recovery": null}, "flickr": {"small": [], "original": ["https://live.staticflickr.com/65535/51673353699_e3da266245_o.jpg", "https://live.staticflickr.com/65535/51673548360_64354b760f_o.jpg", "https://live.staticflickr.com/65535/51672676881_3b88410a96_o.jpg", "https://live.staticflickr.com/65535/51673548330_7acc53d2fb_o.jpg", "https://live.staticflickr.com/65535/51671874407_4f56a87855_o.jpg", "https://live.staticflickr.com/65535/51672676961_36371a6a76_o.jpg", "https://live.staticflickr.com/65535/51672915563_7f5b373701_o.jpg", "https://live.staticflickr.com/65535/51672915633_947e35cabc_o.jpg"]}, "presskit": null, "webcast": "https://youtu.be/WZvtrnFItNs", "youtube_id": "WZvtrnFItNs", "article": "https://spaceflightnow.com/2021/11/11/spacex-debuts-new-dragon-capsule-in-launch-to-the-international-space-station/", "wikipedia": "https://en.wikipedia.org/wiki/SpaceX_Crew-3"}, {"static_fire_date_utc": "2021-10-28T05:46:00.000Z", "static_fire_date_unix": 1635399960, "net": false, "window": 0, "rocket": "5e9d0d95eda69973a809d1ec", "success": true, "failures": [], "details": "SpaceX will launch 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/qro600/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/0333333333", "youtube_id": "0333333333", "article": "https://spaceflightnow.com/2021/11/11/spacex-debuts-new-dragon-capsule-in-launch-to-the-international-space-station/", "wikipedia": "https://en.wikipedia.org/wiki/SpaceX_Crew-3"}, {"static_fire_date_utc": "2021-10-28T05:46:00.000Z", "static_fire_date_unix": 1635399960, "net": false, "window": 0, "rocket": "5e9d0d95eda69973a809d1ec", "success": true, "failures": [], "details": "SpaceX will launch 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. 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This is unusual as the mission is launching from Vandenberg as these missions usually launch from the East Coast.", "crew": [], "ships": ["5ea6ed30080df4000697c913", "5ea6ed30080df4000697c912", "5ea6ed2f080df4000697c90b"], "capsules": [], "payloads": ["61bbac16437241381bf70632"], "launchpad": "5e9e4501f509094ba4566f84", "flight_number": 141, "name": "Starlink 4-4 (v1.5)", "date_utc": "2021-12-17T08:31:00.000Z", "date_unix": 1639729860, "date_local": "2021-12-17T03:31:00-05:00", "date_precision": "hour", "upcoming": false, "cores": [{"core": "5f57c53d0622a6330279009f", "flight": 6, "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": "dfb2cc3b-8cd8-41b6-a83a-22b2a742ba4b", "id": "6161c88d6db1a92bfba85349"}]

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this mission is expected to return to LZ-1 based on FCC communications filings","cre
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000Z","date_unix":1662858600,"date_local":"2022-09-10T21:10:00-04:00","date_precision":null,"net":false,"window":null,"rocket":"5e9d0d95eda69973a809d1ec","success":true,"failures":[],"details":null,"crew":[],"ships":[],"capsules":[],"payloads":["63161610ffc78f3b8567071 8","63161872ffc78f3b8567071e"],"launchpad":"5e9e4502f509094188566f88","flight_numbe r":184,"name":"Starlink 4-2 (v1.5) & Blue Walker 3","date_utc":"2022-09-11T01:10:00. 000Z","date_unix":1662858600,"date_local":"2022-09-10T21:10:00-04:00","date_precision":null,"net":false,"window":null,"rocket":"5e9d0d95eda69973a809d1ec","success":true,"failures":[],"details":null,"crew":[],"ships":[],"capsules":[],"payloads":["63161610ffc78f3b8567071 8","63161872ffc78f3b8567071e"],"launchpad":"5e9e4502f509094188566f88","flight_numbe r":184,"name":"Starlink 4-2 (v1.5) & Blue Walker 3","date_utc":"2022-09-11T01:10:00. 000Z","date_unix":1662858600,"date_local":"2022-09-10T21:10:00-04:00","date_precision":null,"net":false,"window":null,"rocket":"5e9d0d95eda69973a809d1ec","success":true,"failures":[],"details":null,"crew":[],"ships":[],"capsules":[],"payloads":["63161610ffc78f3b8567071 8","63161872ffc78f3b8567071e"],"launchpad":"5e9e4502f509094188566f88","flight_numbe r":184,"name":"Starlink 4-2 (v1.5) & Blue Walker 3","date_utc":"2022-09-11T01:10:00. 000Z","date_unix":1662858600,"date_local":"2022-09-10T21:10:00-04:00","date_precision":null,"net":false,"window":null,"rocket":"5e9d0d95eda69973a809d1ec","success":true,"failures":[],"details":null,"crew":[],"ships":[],"capsules":[],"payloads":["63161610ffc78f3b8567071 8","63161872ffc78f3b8567071e"],"launchpad":"5e9e4502f509094188566f88","flight_numbe r":184,"name":"Starlink 4-2 (v1.5) & Blue Walker 3","date_utc":"2022-09-11T01:10:00. 000Z","date_unix":1662858600,"date_local":"2022-09-10T21:10:00-04:00","date_precision":null,"net":false,"window":null,"rocket":"5e9d0d95eda69973a809d1ec","success":true,"failures":[],"details":null,"crew":[],"ships":[],"capsules":[],"payloads":["63161610ffc78f3b8567071 8","63161872ffc78f3b8567071e"],"launchpad":"5e9e4502f509094188566f88","flight_numbe r":184,"name":"Starlink 4-2 (v1.5) & Blue Walker 3","date_utc":"2022-09-11T01:10:00. 000Z","date_unix":1662858600,"date_local":"2022-09-10T21:10:00-04:00","date_precision":null,"net":false,"window":null,"rocket":"5e9d0d95eda69973a809d1ec","success":true,"failures":[],"details":null,"crew":[],"ships":[],"capsules":[],"payloads":["63161610ffc78f3b8567071 8","63161872ffc78f3b8567071e"],"launchpad":"5e9e4502f509094188566f88","flight_numbe r":184,"name":"Starlink 4-2 (v1.5) & Blue Walker 3","date_utc":"2022-09-11T01:10:00. 000Z","date_unix":1662858600,"date_local":"2022-09-10T21:10:00-04:00","date_precision":null,"net":false,"window":null,"rocket":"5e9d0d95eda69973a809d1ec","success":true,"failures":[],"details":null,"crew":[],"ships":[],"capsules":[],"payloads":["63161610ffc78f3b8567071 8","63161872ffc78f3b8567071e"],"launchpad":"5e9e4502f509094188566f88","flight_numbe r":184,"name":"Starlink 4-2 (v1.5) & Blue Walker 3","date_utc":"2022-09-11T01:10:00. 000Z","date_unix":1662858600,"date_local":"2022-09-10T21:10:00-04:00","date_precision":null,"net":false,"window":null,"rocket":"5e9d0d95eda69973a809d1ec","success":true,"failures":[],"details":null,"crew":[],"ships":[],"capsules":[],"payloads":["63161610ffc78f3b8567071 8","63161872ffc78f3b8567071e"],"launchpad":"5e9e4502f509094188566f88","flight_numbe r":184,"name":"Starlink 4-2 (v1.5) & Blue Walker 3","date_utc":"2022-09-11T01:10:00. 000Z","date_unix":1662858600,"date_local":"2022-09-10T21:10:00-04:00","date_precision":null,"net":false,"window":null,"rocket":"5e9d0d95eda69973a809d1ec","success":true,"failures":[],"details":null,"crew":[],"ships":[],"capsules":[],"payloads":["63161610ffc78f3b8567071 8","63161872ffc78f3b8567071e"],"launchpad":"5e9e4502f509094188566f88","flight_numbe r":18
```



```
e":true,"tbd":false,"launch_library_id":"f33d5ece-e825-4cd8-809f-1d4c72a2e0d3","id":"62dd70d5202306255024d139"}]]'
```

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.appdomain.cloud'
```

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

```
In [10]: response.status_code
```

```
Out[10]: 200
```

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

```
In [11]: # Use json_normalize meethod to convert the json result into a datafr
import pandas as pd
data=pd.json_normalize(response.json())
```

Using the dataframe `data` print the first 5 rows

```
In [12]: # Get the head of the dataframe
data.head()
```

Out[12]:

	static_fire_date_utc	static_fire_date_unix	net	window	rocket	success
--	----------------------	-----------------------	-----	--------	--------	---------

0	2006-03-17T00:00:00.000Z	1.142554e+09	False	0.0	5e9d0d95eda69955f709d1eb	False
---	--------------------------	--------------	-------	-----	--------------------------	-------

1	None	NaN	False	0.0	5e9d0d95eda69955f709d1eb	False
---	------	-----	-------	-----	--------------------------	-------

2	None	NaN	False	0.0	5e9d0d95eda69955f709d1eb	False
---	------	-----	-------	-----	--------------------------	-------

3	2008-09-20T00:00:00.000Z	1.221869e+09	False	0.0	5e9d0d95eda69955f709d1eb	False
---	--------------------------	--------------	-------	-----	--------------------------	-------

	static_fire_date_utc	static_fire_date_unix	net	window	rocket	success
4	None	NaN	False	0.0	5e9d0d95eda69955f709d1eb	-

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 [13]: # Lets take a subset of our dataframe keeping only the features we want and the flight number
data = data[['rocket', 'payloads', 'launchpad', 'cores', 'flight_number', 'date_utc']]

# We will remove rows with multiple cores because those are falcon rockets with 2 cores
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 single values
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 extracting the date only
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 separate 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 [14]: #Global variables
BoosterVersion = []
PayloadMass = []
Orbit = []
LaunchSite = []
Outcome = []
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 look at `BoosterVersion` variable. Before we apply `getBoosterVersion` the list is empty:

```
In [15]: BoosterVersion
```

```
Out[15]: []
```

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

```
In [16]: # Call getBoosterVersion
getBoosterVersion(data)
```

the list has now been update

```
In [17]: BoosterVersion[0:5]
```

```
Out[17]: ['Falcon 1', 'Falcon 1', 'Falcon 1', 'Falcon 1', 'Falcon 9']
```

we can apply the rest of the functions here:

```
In [18]: # Call getLaunchSite
getLaunchSite(data)
```

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

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

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

```
In [21]: 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 [22]: # Create a data from Launch_dict
launch_data=pd.DataFrame(launch_dict)
```

Show the summary of the dataframe

```
In [23]: # Show the head of the dataframe
launch_data.head()
```

```
Out[23]:
```

	FlightNumber	Date	BoosterVersion	PayloadMass	Orbit	LaunchSite	Outcome	Flight
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 [24]: # Hint data['BoosterVersion']!='Falcon 1'
data_falcon9=launch_data[launch_data['BoosterVersion']!='Falcon 1']
```

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

```
In [25]: 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/indexing.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/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
self._setitem_single_column(ilocs[0], value, pi)
```

Out[25]:

	FlightNumber	Date	BoosterVersion	PayloadMass	Orbit	LaunchSite	Outcome	Fligh
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 [26]: data_falcon9.isnull().sum()
```

```
Out[26]: 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 [28]: # Calculate the mean value of PayloadMass column
         mean=data_falcon9['PayloadMass'].mean()
         # Replace the np.nan values with its mean value
         data_falcon9['PayloadMass'].replace(np.nan, mean, inplace=True)
         data_falcon9.isnull().sum()
```

```
Out[28]: 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.

Change Log

Date (YYYY-MM-DD)	Version	Changed By	Change Description
2020-09-20	1.1	Joseph	get result each time you run
2020-09-20	1.1	Azim	Created Part 1 Lab using SpaceX API
2020-09-20	1.0	Joseph	Modified Multiple Areas

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