

Access to Space for All and Artificial Intelligence

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UNITED NATIONS
Office for Outer Space Affairs



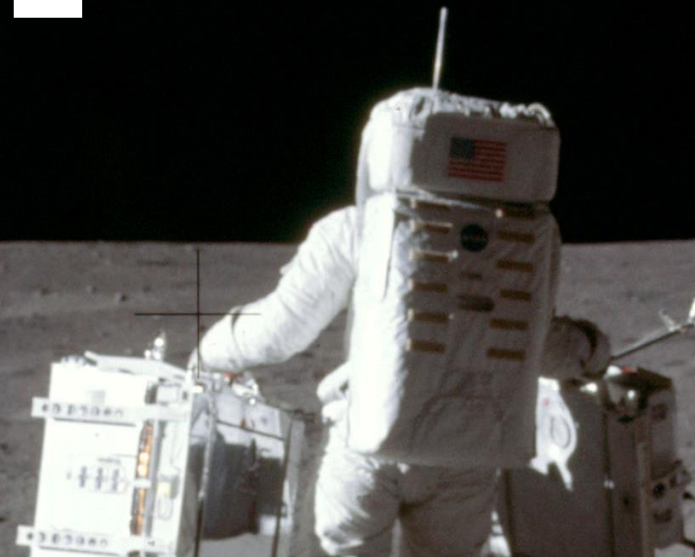
IBM's HISTORY AS

A PIONEER IN SPACE

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Without IBM and the systems they provided,
we would not have landed on the Moon.

- **Gene Kranz**, NASA Flight Director



**50 years ago, IBM created a mainframe that
was critical in sending humans to the Moon**

More than 4,000 IBMers worked tirelessly to help NASA put the first humans on the Moon
(still regarded as one of the great engineering feats in history)

Edge Computing in Space

International Space Station

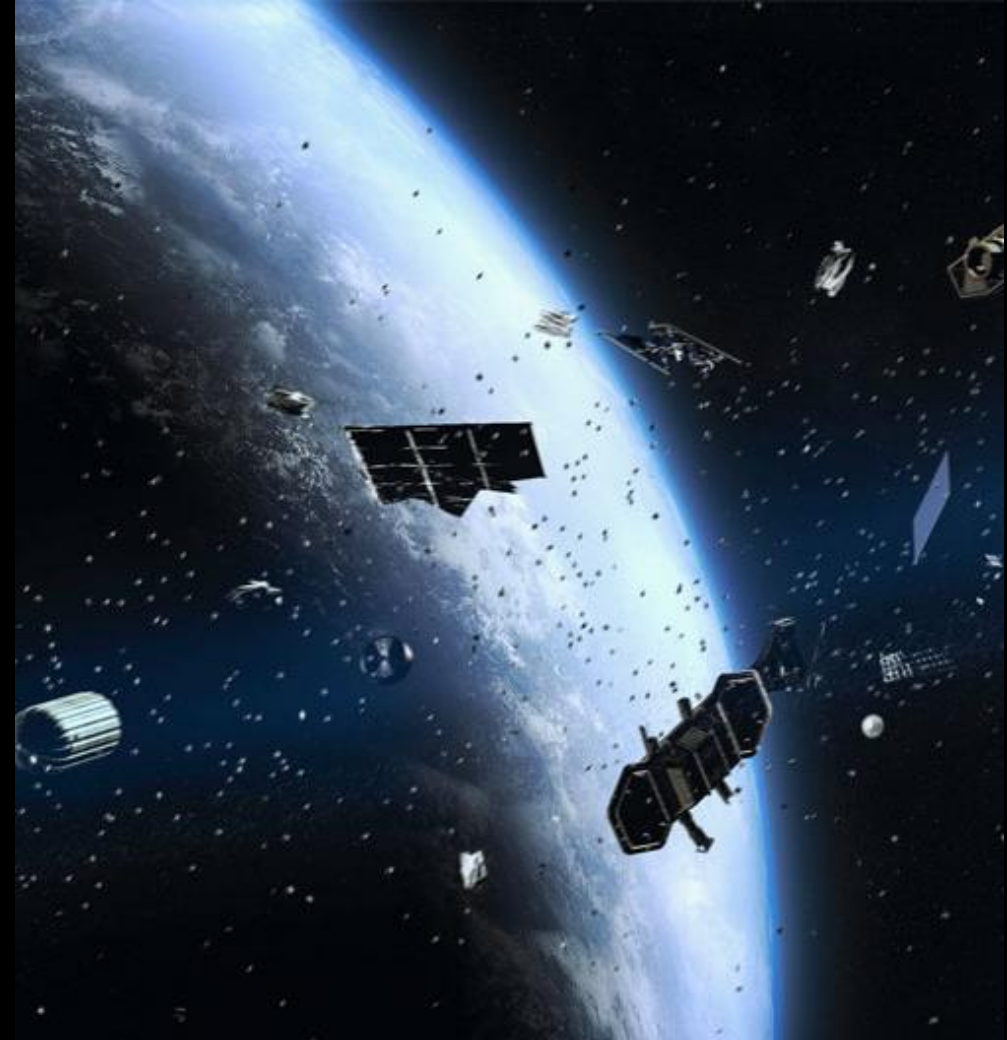
DNA sequencing with the **MinION device** is allowing for the identification of microbes onboard the International Space Station (ISS). This type of molecular diagnostic for both the environment and crew health will be critical for future exploration missions. While DNA sequencing has become common onboard the ISS, data processing still requires the downlink of the data to Earth delaying the time to results. For this capability to fully enable human exploration, data analysis needs to be automated to occur in near real-time.

IBM developed the “**Edge Computing in Space**” solution. Eliminating the need to move the massive data being produced on the ISS by the DNA Sequencing project, by presenting containerized analytical code right where the data is being produced by leveraging the local compute to be available on ISS, reducing the time to less than a week to get results. IBM's solution utilizes **Redhat CodeReady Containers, a single-node OpenShift cluster**. This solution connects back on the ground with **IBM Cloud** where researchers will develop, test, and make their code ready to be pushed to ISS.



Blockchain

Satellite Manufacturing, Space Cargo, Space Traffic Management





KubeSat

Cognitive Autonomous Framework

KubeSat is an open source, cognitive autonomous, software-defined framework for satellite swarm applications. KubeSat framework allows for the simulation and optimization of multi-satellite communications. Startups and research groups that intend to use swarm of satellite as a modular, low-cost alternative to a more traditional larger satellite need underlying technology that can create and control the swarm, as well as support additional software for their specific goals.

KubeSat is a set of microservices implemented in Python that allow you to create personalized configurations of satellites, ground stations, and IoT sensors while optimizing their communications via reinforcement learning.

Open Source



GitHub

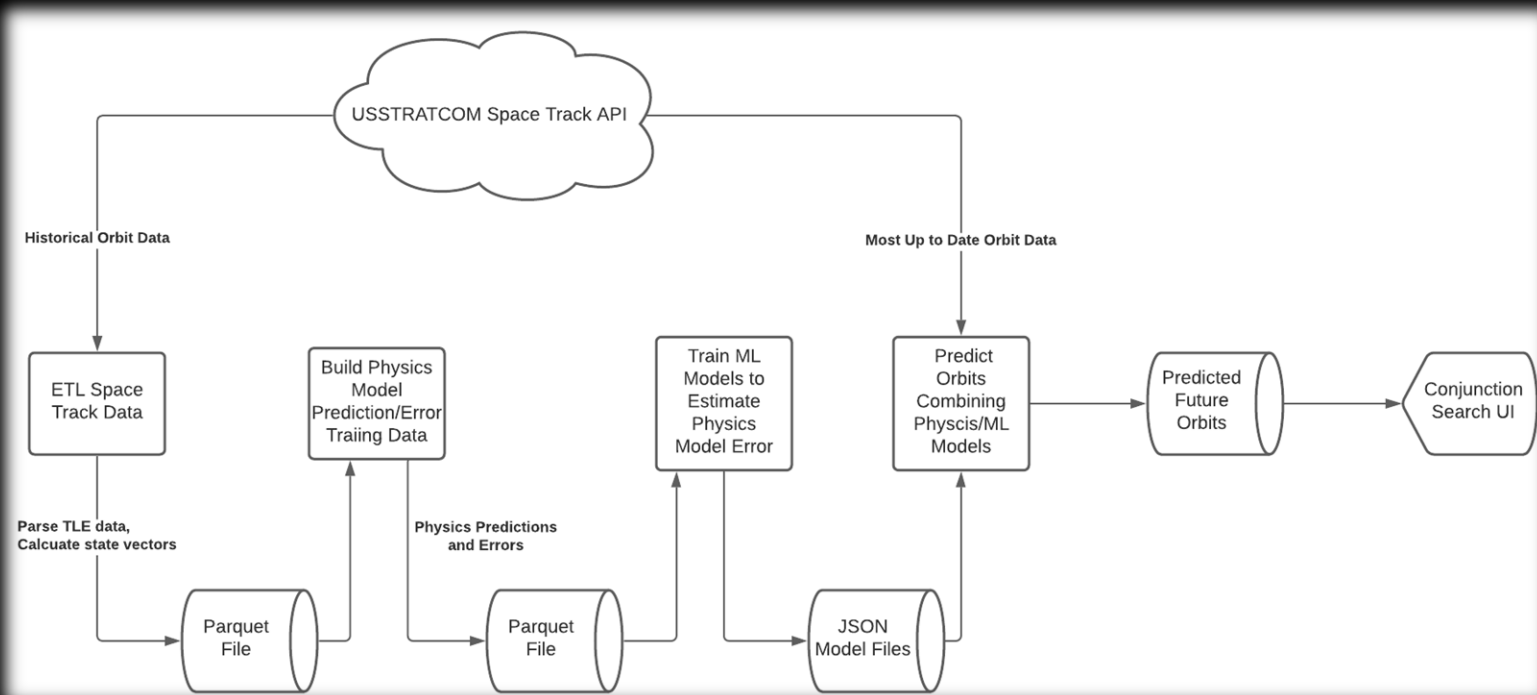
<https://github.com/IBM/spacetech-kubesat>

<http://kubesat.space/>

Space Situational Awareness

Space is becoming cluttered with objects launched by a growing number of commercial companies. Within the next few years, U.S. companies (Starlink, Kuiper, Telesat) alone are planning to send more than 30,000+ satellites into space. We need better identification, tracking and sharing of information

- **Orbit Prediction:** The orbital prediction component combines physics and machine learning models to predict the future path of Resident Space Objects
- **Conjunction Search:** The conjunction search component combs through future orbit predictions to determine when and where two RSOs may come close to each other based on user provided search parameters



Open Source



<https://github.com/IBM/spacetechn-ssa>

<https://spaceorbits.net/>

Orbital Conjunction Search

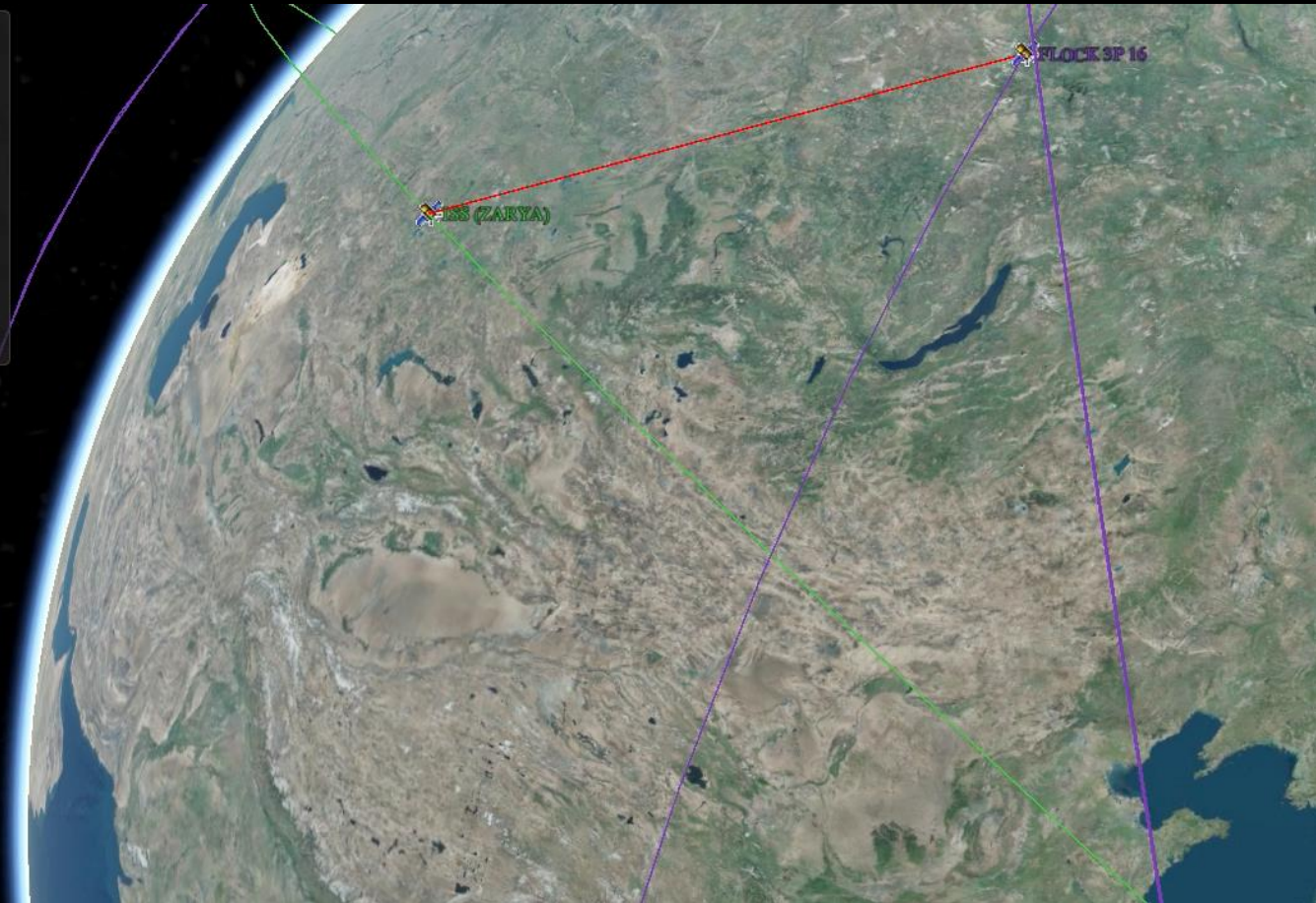
Conjunction Search

Resident Space Object
ISS (ZARYA)

Search Type
 Number of Nearest RSOs
 Radius

Number of Nearest RSOs
3

Submit



A wide-angle photograph of Earth from space. The Earth's horizon is visible, with a thin blue atmosphere and a bright yellow sun rising or setting behind it. The International Space Station (ISS) is visible in the lower-left foreground, showing its complex structure and large solar panel arrays. The background is a deep black space filled with stars and the Milky Way galaxy, which appears as a dense band of white and blue light stretching across the upper half of the frame.

Thank You