Concept Note: Feasibility Study for a Dedicated Humanitarian Satellite Mission

INTRODUCTION

This concept note proposes a feasibility study to evaluate a dedicated humanitarian satellite mission to bridge this critical gap and take advantage of market trends. The final report will contain a humanitarian user assessment including detailed needs and associated mission requirements, satellite costs and business models, risks and possible mitigation plans, potential impacts, synthesis and viable pathways.

Satellite imagery has proven invaluable in addressing humanitarian challenges; however, there is a persistent gap in access to tasking high-resolution satellites. Without access to these satellites, humanitarian needs go unmet and the potential for our space-based assets to impact humanity goes unrealized. A poignant example is the 2015 investigation by the Associated Press into illegal fishing and human trafficking near Papua New Guinea. A satellite image captured two fishing trawlers likely involved in the illegal transshipment of slave-caught fish. This image, coupled with on-ground accounts, led to the liberation of 2,000 slaves and brought perpetrators to justice.[1] Such successes are rare due to limited access to high-resolution satellites for humanitarian purposes.

244 Earth Observation (EO) satellites have military users. There are 589 commercial satellites, 327 government EO satellites, and 32 for civil users[2]. Governments control most satellite assets with the majority of use cases dedicated to military purposes. Companies operate the 589 other EO satellites for commercial endeavors (including selling back to the government, largely for defense and intelligence purposes). There are currently no satellites dedicated to humanitarian missions, even as the need continues to grow.

Study Justification: Why Explore a Satellite Mission Now?

There are strong arguments to be made for a dedicated humanitarian satellite mission, including (a) economic feasibility through lower costs, technology advancements, and pooling of shared resources, (b) the market readiness in terms of increasing demand and ability to leverage a deluge of data, and (c) the potential impact to address a wide array of humanitarian data gaps from a dedicated satellite.

There are two major considerations in terms of improved recent **economic feasibility** - the decreasing costs to launch and build satellites making these missions more affordable than ever coupled with funder interest in leveraging these technologies for societal impact and spending on satellite imagery already exceeding expected mission costs.

- Decreasing Costs with Technological Advancements: The small satellite revolution has democratized space technology. High-resolution imaging satellites can now be built and launched at a fraction of past costs. Satellite launch costs are also significantly reduced.

[1] Associated Press. https://www.ap.org/media-center/press-releases/2016/ap-wins-pulitzer-prize-for-seafood-from-slaves-investigation/

[2] Union of Concerned Scientists. https://www.ucsusa.org/resources/satellite-database

For example, SpaceX's SmallSat Rideshare Program offers launches starting at $275,000 for payloads up to 50 kg.[3] Satellite manufacturers like Maxar, Planet, and Satellogic are poised to build affordable satellites without major technical sacrifices. Building smaller satellites can save tens of millions of dollars compared to the traditional, larger satellites, and today's average costs for a small satellite can range between $1 and $10 million.[4]

- Donor Investments in Satellite Data: In recent years, donors have signaled an increasing willingness to fund data investments, including satellite data investments for societal impact. Many donors, like the Norwegians (NICFI), Gates Foundation, NASA, and others have shown a willingness to buy access to commercial satellite data for their grantees and partners. The cost of building and operating a dedicated satellite is comparable to existing expenditures on limited commercial imagery access. For instance, NICFI's *initial* $43 million investment, which unlocked high-resolution data for monitoring rainforests, could have funded a dedicated satellite mission. By pooling resources behind a shared mission, they would spend less, receive much more data, and all the data would be accessible.[5] In conversations with their leadership, Environmental Defense Fund also shared that the fundraising for MethaneSat attracted new tech-oriented funders to their satellite mission. In addition to the donor community, the public is also willing to invest in these technologies for societal benefit. The Ukrainian government's successful crowdfunding of $55 million for satellite access demonstrates public willingness to support such initiatives as well.[6]

In parallel with market trends, **humanitarian organizations are increasingly ready** to use these data streams for impactful applications. They are aware of how to use the data and need improved data accessibility to create fit-for-purpose tools. Open data from a dedicated humanitarian mission could see rapid adoption and usage across humanitarian organizations, especially as tools like machine learning help analyze all this data and process it efficiently and governance and ethics frameworks are adopted.

- Increasing Demand: Programs like NICFI and Copernicus Sentinel have thousands of registered users, indicating a substantial and growing humanitarian user base. Over the past decade, LandSat user numbers have continued to grow, according to the US Geological Survey (USGS). In 2023, there were 200,000 LandSat users.[7] Beyond users working directly with the raster data, there are many further downstream users on crowdsourcing platforms and Google Earth Engine, to name just a couple, that also interact with satellite imagery for humanitarian purposes.
- Data Accessibility: A dedicated satellite would simplify data acquisition and processing, fostering greater adoption and innovation within the humanitarian sector. Open data policies and standards (e.g., STAC, COGs) facilitate easy access and sharing, enhancing collaboration among humanitarian actors. The proliferation of AI/ML pipelines

[3] SpaceX: https://www.spacex.com/rideshare/
[4] Reznik et al. https://www.researchgate.net/publication/347276446_Comparison_of_geostationary_and_low-orbit_round_dance_satellite_communication_systems#pf7
[5] Norway's International Climate and Forest Initiative. https://www.nicfi.no/2023/03/22/public-access-to-high-resolution-satellite-images-protects-the-rainforest/
[6] Reuters. https://www.reuters.com/world/europe/ukrainian-celebrity-crowdfunds-radar-satellite-armed-forces-2022-08-18 /
[7] USGS: https://www.usgs.gov/landsat-missions/landsat-project-statistics

enhances the ability to process vast amounts of satellite data, making derived information more accessible.
- Ethics & Governance Frameworks: Existing efforts like the Locus Charter and Signal Code offer helpful resources for geospatial frameworks as do humanitarian principles and accountability. These frameworks are already in place and ready to be applied in the context of a dedicated satellite mission.

The **potential humanitarian impacts** of improved accessibility to high-resolution, timely satellite data are too immense to ignore. From helping to end modern human slavery to transparent, uncensored crisis coverage to keeping our frontline workers safe, to name just a few use cases, a humanitarian mission means the most vulnerable are recognized and humanitarians are better equipped to support them.

- Address Persistent Data Gaps. Owning the satellite would allow humanitarians to prioritize tasking over low-commercial value areas critical to their missions. Reliance on commercial providers often results in inconsistent support due to shifting terms and priorities. A dedicated mission ensures reliable access when needed.
- Immense Societal Benefit. These data gaps really represent the places where the most vulnerable people are currently suffering the most. In some cases, there's no news coverage. In some cases, there's no commercial interest to spur coverage. In some cases, access to data can't even be purchased. In some cases, competing priorities take precedence. And as a result, many get left behind and underutilize a very valuable asset. High-resolution satellite data can directly benefit a wide range of humanitarian use cases and directly impact humanitarian operations.

STUDY OBJECTIVES

Primary Objective: Assess the feasibility of a dedicated humanitarian satellite mission.

- Aggregate humanitarian requirements to develop satellite mission requirements.
- Evaluate the range of costs associated with building and launching a satellite to meet those requirements as well as the potential impacts of the mission.
- Explore viable pathways to operationalizing such a mission, including licensing, governance, fundraising, data access, and other considerations.

APPROACH

A transparent and robust feasibility study would help the community jointly assess this opportunity and have an evidence base for further action. Completed in just under a year, the study will include primary research like stakeholder interviews, focus groups, a market assessment of available providers, an extensive literature review, an in-depth case study, and expert analysis and review.

The final report will include:

- Executive Summary highlighting main findings and recommendations
- Introduction outlining the background and objectives of the study

- Methodology section detailing the approach and processes used
- Demand Assessment of humanitarian needs and mission requirements
- Technical Assessment of satellite specifications, technological options, and trade-offs
- Economic Assessment providing cost estimates, funding models, and ability to fundraise
- Case Study on Environmental Defense Fund's recently launched MethaneSat, as one of the few satellite missions independently owned and operated by an NGO
- Impact Assessment would cover a wide range of impacts and include a forecast for potential adoption and usage as well as humanitarian outcomes
- Viable Pathways discussing implementation strategies, risks, mitigation plans, data infrastructure, and more;
- Conclusion and Recommendations section offering actionable guidance and next steps
- Annexes containing supporting materials such as detailed data, interview summaries, and additional analyses

WORKPLAN

Phase	**Weeks**	**Activities**	**Acceptance Criteria**
Phase 1	1-4	Kick-off meeting with stakeholders, project planning, initial research and literature review, stakeholder mapping, interview questions defined, final report contents outlined	The project plan and timeline are agreed upon with stakeholders, a kick-off meeting is held, and the project plan is finalized.
Phase 2	5-12	Conduct interviews, implement online surveys to gather additional feedback, document findings, and assess demand and information asymmetries addressed.	Interview recordings, transcripts, and summaries are shared. Preliminary findings and presentation delivered.
Phase 3	13-20	Technical scoping, focus groups with humanitarians, assessment of existing business models, surveying providers on nonprofit/humanitarian partnerships, cost analysis, risk assessment	Preliminary findings defining basic requirements against aggregated needs. Presentation delivered.
Phase 4	21- 27	Economic assessment, focus groups with potential funders, case study on EDF's MethaneSat, identify possible pathways to fundraise and timelines	Preliminary findings. Presentation delivered.

Phase 5	27-31	Report writing, development of visuals, review, and publication preparation	Feedback summarized. Final Report delivered for review before publication.
Phase 6	31-36	Finalize publication including design, conduct final review meeting, determine communication campaign	The publication is shared and delivered to the public. Promotion of the publication on social media, and at speaking events. The report for the next steps based on the findings of the publication is delivered.
Phase 7	36-44	Promote and share findings	Webinar delivered. Speaking and presenting results via various events and outlets.

Kickoff: Kickoff meeting to gather feedback on our approach, and integrate that feedback into the final work plan and next steps. The draft work plan will be shared ahead of the kickoff meeting so stakeholders can share written or verbal feedback before work commences. In this meeting, the team will set the cadence for ongoing check-ins and future review meetings, including draft deadlines for various report sections.

Demand Assessment: this will be the cornerstone of the study and guide our research thereafter as mission requirements will dictate available options and costs. This section of the report will provide in-depth answers to questions like: what do humanitarians really need from an EO satellite? What difference will it make to their missions?

To best ascertain demand, the team will conduct a thorough literature review, including sources like *Beyond Borders* that have cataloged over 500 existing humanitarian applications of satellite data. To validate and complement these findings, our team will interview between 50 and 100 humanitarians to gain a detailed understanding of their needs and priorities and what trade-offs are acceptable. In parallel to these interviews, there will be a public survey to capture additional input and a series of humanitarian focus groups to confirm requirements findings, their workflows, and potential impact for their work. The team will host up to ten focus group discussions to allow for in-depth conversations on what this mission could mean for issues like human trafficking, human rights investigations, damage mapping, displacement monitoring, and more.

Technical Assessment: based on the mission requirements from humanitarians, the technical assessment will evaluate available options from satellite providers and related partners. This section of the report will provide in-depth answers to questions like: what satellites would meet humanitarian needs? What are detailed profiles (e.g., specifications, business models, partnership programs, maturity and track record) for relevant satellite offerings?

After narrowing market options by humanitarian mission needs, the team will conduct a literature review of all publicly available information on the satellite offerings. Products will be mapped against the satellite value chain from launch to payload and ongoing infrastructure (e.g., ground segment, data hosting). This will be important to assessing the full financial resources needed. Given the plethora of new entrants to the satellite industry, the team will capture history and track record of satellites and companies as well as key requirements like resolution, revisit, latency, communications, capacity, and spectrum. It will also be important to profile any new products on the horizon given how quickly new providers are emerging and launching satellites. Using our industry networks, the team will conduct follow-up interviews with providers to provide more details on how they would meet the humanitarian mission requirements.

Interoperability considerations and data accessibility will be paramount. These will also be profiled alongside the expected data volumes from the mission. Ensuring integration with existing humanitarian workflows and where users are already leveraging similar data and tools. As part of the technical assessment, there will be sections to define open data policies, licensing, and user authentication mechanisms.

Economic Assessment: building on the findings of the previous two sections, this section will answer key questions like: what is the expected cost range for a humanitarian satellite mission? What are alternative approaches and their costs compared to this approach?

This will include a breakdown of expected costs associated with mission requirements based on available market offerings. Costs will be segmented across the satellite value chain including satellite build, integration, testing, launch, operations, sensors, and data access. Adapting evaluation practices from established organizations like NASA can enhance the rigor and credibility of the assessment, ultimately leading to a well-informed decision that balances cost, impact, and strategic alignment.

To consider alternatives to building a satellite, the team will also evaluate current spending on satellite data and the costs of procuring imagery (unit costs but also the transaction costs and restrictions on usage). The team will compare unit costs of imagery when purchased from providers or resellers against the cost of owning and operating a dedicated mission.

In addition to the cost analysis, the team will conduct a focus group with potential funders to get their feedback on the working assessment. The team will also provide two relevant case studies - one study of the NICFI imagery acquisition given its spend and broad access, and another on the EDF MethaneSat mission costs and fundraising. NICFI's purchasing of satellite imagery for rainforest mapping and monitoring can provide insights to inform future investments - whether buying a satellite or data. EDF's experience could inform any future satellite missions that are spearheaded by a non-profit organization or consortia outside the commercial sector or government.

Impact Assessment: this section will answer key questions like: what is expected adoption and usage of the satellite data by humanitarians? With that usage, what are expected impacts on humanitarian action and community?

The team will forecast expected user adoption and usage over time. This analysis will consider other satellite imagery adoption trends like Landsat when it adopted an open license and what similarities exist with this effort. The assessment will segment and estimate likely users across the humanitarian stakeholder ecosystem (e.g., tech-savvy humanitarians, their partners at universities and research institutes, and volunteer mappers). In addition to identifying these user segments, the team will profile expected impacts based on stakeholder interview data and research. By stakeholders, impacts like what humanitarian decisions will be affected and what that means for vulnerable communities will be assessed.

Revisiting the types of humanitarian applications supported will be key to modeling long-term impacts benefiting the most vulnerable. With those applications in mind, the team can forecast expected coverage and which humanitarian crises and hotspots would have data, and which communities would be served in that coverage area. For example, imaging all the forced labor sites (e.g., IUU fishing vessels and ports, brick kilns) would cover nearly 25 million people globally; or support over a billion people who live in slums and informal settlements worldwide living in safe and resilient communities.

Ethics & Regulations: this section would elaborate on the regulatory process and key considerations in building and launching a new satellite. It will evaluate expected timelines for the humanitarian mission to gain necessary approvals.

It would also consider ethical questions like who should have access to the data and what are most reasonable licensing options? What is the potential for this satellite mission to harm vulnerable communities, and do the benefits outweigh those risks? Who should govern the tasking of the satellite? Who should host the data?

Viable Pathways: This section synthesizes the information on needs and satellite possibilities, considers enabling environments like current policies and regulations, to present several pathways to building and launching a humanitarian satellite mission. A few options to explore include following a similar path to EDF and fundraising among donors to have an NGO own and operate a mission-based satellite; partnering with existing operators - commercial or space agencies - to launch a joint mission; or the future of the status quo which is continuing with ad hoc data purchases.

Risks & Mitigation Strategies: this section enumerates the various risks throughout the process of designing, funding, building, launching, operating, and decommissioning a satellite mission. The list of risks will be comprehensive, covering everything from technical risks (e.g., launch failure, satellite malfunction) to financial risks (e.g., cost overruns, funding shortfalls) to ethical risks (e.g., who governs tasking, who can access data) to the regulatory environment (e.g., timeframe, approval processes). The team will prioritize the greatest risks for further consideration and identification of mitigation strategies.

Conclusions and Recommendations: this section will offer a synthesis and key takeaways from previous sections, focusing on lessons learned and emerging opportunities. Our team will offer expert-validated recommendations in light of these findings, sharing the community census

where it exists and highlighting further areas for research. The recommendations will also include potential next steps beyond the feasibility study to advance this potential mission.

Expert Analysis and Review: In addition to our team's analysis, our networks and expert reviewers will also contribute to making the report a robust and accurate study. Below is a list of potential reviewers for the study - these are experts from the humanitarian and satellite sectors who can weigh in across the many factors being considered. They would read the draft and provide written comments. They would also provide feedback on recommendations and what they would suggest as paths forward. These potential reviewers have expertise in humanitarian assistance, satellite systems, geospatial technologies, open data, United Nations systems, humanitarian applications of satellite data, human rights, global health, philanthropy, data licensing, data accessibility, regulations, food security, disasters, displacement, artificial intelligence/machine learning approaches, crowdsourcing, cloud infrastructure, ground segments, Earth science, journalism, monitoring and evaluation, ethics, policymaking, science communications, fundraising, research.

Design & Final Report: To make the report findings accessible and help promote results, the team will also produce key tables, charts, and graphics to accompany each section. These visuals will be presented in a polished, accessible design available in PDF format. They will also be included as part of the webinar slides.

Sharing Study Results: The report will be shared through multiple channels like direct outreach (personalized emails, meetings), professional networks, conferences, and online platforms will maximize reach and impact. The team will also host a learning webinar to share results; the team will create a set of slides summarizing study objectives, methods, key findings, and soliciting community feedback.

OUTPUTS

As a result of this effort, a feasibility report will be produced. The report will have components in various formats—including executive summaries, detailed reports, infographics, presentation decks, and video summaries—to cater to different preferences. The report will also have a summary tailored to each of our respective audiences (e.g., humanitarian leaders, donors, space agencies, etc.)

- **Final report delivered in pdf format**
- **50-100 humanitarian interviews complete with recording and transcripts**
- **5 focus group discussions complete with recording and transcripts**
- **Presentation slides of study objectives, methods, key findings**
- **Webinar sharing report results**

RESOURCES REQUIRED

The estimated budget to produce a comprehensive and actionable feasibility report is $300,000 for an eleven-month effort. The report scope would include extensive stakeholder interviews and group discussions, literature and market research, technical assessments of satellite offerings, cost-benefit analyses, risk evaluations, expert analysis, peer review, and accessible publication.

This budget estimate accounts for professional fees over eleven months (two full-time consultants, a designer, plus stipends for other contributors and reviewers), as well as expenses such as travel (e.g., reporting meetings, stakeholder interviews at events, event promotion) and administrative support.

THE TEAM

The study would be led by Rhiannan Price and Bill Greer, two industry-leading experts with decades of experience working with satellite data for societal benefit. They have worked throughout their careers to democratize access to geospatial technology.

Rhiannan has an extensive background in leveraging satellite data for social impact, having led initiatives that apply Earth observations to address humanitarian and sustainable development challenges. She currently leads NASA Lifelines, a community-building initiative bringing together scientists and humanitarians to use more satellite data for humanitarian action. She also serves as an advisor to NASA through their Applied Sciences Advisory Committee and is a former advisor to the International Criminal Court's Office of the Prosecutor. Previously, she led the global sustainable development and humanitarian portfolio at Maxar Technologies and founded their Open Data Program to benefit humanitarian missions with high-resolution, openly licensed commercial imagery. Rhiannan is a co-author of Beyond Borders, a research report providing a consolidated view of the current use of satellite applications in humanitarian settings. Her expertise lies in bridging the gap between complex satellite data and practical applications that benefit communities in need.

Bill brings a wealth of experience in satellite mission planning and technical implementation. As a veteran of Esri, Albedo, and Maxar, his knowledge of satellite systems will be instrumental as the study evaluates technical requirements and available products. Bill has worked at the most pioneering dual-use startups as well as the industry giants while advocating for using spatial tools and data to improve the real world. He has seen the value of open data, open methodologies, analytics, and data-driven decisions in the field to make life-saving interventions. Bill was deployed to the front lines in Kurdistan during the Yazidi genocide in 2015 and deployed to Bamako, Mali in 2018 for counter-trafficking efforts using drones, and satellite imagery to help humanitarians on the ground.

CONCLUSION & PATH FORWARD

A study to evaluate a dedicated humanitarian satellite mission is both feasible and timely. The decreasing costs of satellite technology, coupled with the urgent need for reliable, high-resolution imagery, seem to make a compelling case – at least one worth evaluating, especially if such a mission could empower humanitarian organizations with autonomy over data critical to saving lives and reducing suffering.

The standalone value of the report itself also justifies this investment, as it would contribute to the community's shared knowledge on many fronts. Humanitarians would have an evidence base pointing to needs and priorities. They would also benefit from a tailored technical assessment of which satellites offer data that will meet those needs. This could inform future data purchases just as much as the evaluation of potential satellite investments. For the satellite

industry, this report also offers an important resource to consult in designing their missions, especially dual-use missions where societal goods are considered.

We would welcome the opportunity to discuss this study and collaborate together.

CONTACTS

Rhiannan Price
+1.314.448.0446 (mobile)
rhiannan.price@dev.global

Bill Greer
+1.607.342.2106 (mobile)
billfgreer@gmail.com