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CARIBBEAN DEVELOPMENT BANK



**TECHNICAL ASSISTANCE – SUPPORT FOR CONDUCTING
AIR-BORNE LIGHT DETECTION AND RANGING SURVEYS AND TRAINING - REGIONAL**

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Considered at the Two Hundred and Eighty-First Meeting of
the Board of Directors on May 28, 2018

MAY 2018

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CARIBBEAN DEVELOPMENT BANK

TWO HUNDRED AND EIGHTY-FIRST MEETING OF THE BOARD OF DIRECTORS

TO BE HELD IN GRENADA

MAY 28, 2018

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**TECHNICAL ASSISTANCE – SUPPORT FOR CONDUCTING
AIR-BORNE LIGHT DETECTION AND RANGING SURVEYS AND TRAINING - REGIONAL**

1. APPLICATION

1.01 The Caribbean Community Climate Change Centre (the Centre) has requested a grant from the Caribbean Development Bank (CDB) to establish capacity to collect light detection and ranging (LiDAR) data and conduct LiDAR end-user training on behalf of its Borrowing Member Countries (BMCs). The proposed Technical Assistance (TA) is consistent with CDB's Strategic Objective of Supporting Inclusive and Sustainable Growth and Development.

1.02 It is also consistent with CDB's:

- (a) Corporate Priorities of Promoting Environmental Sustainability, Climate Change (CC) Resilience, Environmental Management and Disaster Risk Management (DRM).
- (b) Climate Resilience Strategy.

1.03 The TA is aligned with the Special Development Fund Ninth Cycle theme of Supporting Environmental Sustainability and Advancing the CC Agenda, by Strengthening the Capacities of Regional and National Institutions for Improved Environmental and Natural Resource Management.

1.04 The direct beneficiary of the TA, the Centre, will be responsible for coordinating and implementing the Project. The indirect beneficiaries of the Project are the BMCs of CDB who will have access to LiDAR data to improve their decision-making for natural hazards and climate risk management.

1.05 The estimated cost of the Project is two million, seven hundred and nineteen thousand, nine hundred and sixty-five United States dollars (USD2,719,965 mn). CDB's contribution will be a grant from the Special Funds Resources (SFR) of an amount not exceeding the equivalent of USD1,462,965. The Centre will provide counterpart support of an amount not exceeding the equivalent of USD724,500. Additional funds in the amount of USD300,000 and USD232,500 will be provided by the United States Agency for International Development (USAID) and the Government of Italy (Ministry of Environment, Land and Sea), respectively.

2. **BACKGROUND**

2.01 BMCs have a high probability of being adversely affected by CC due to the large concentrations of population, settlements and critical economic infrastructure in approximately 36,000 square kilometres (km²) of vulnerable low-lying coastal areas. Climate models project temperature increase of between one to three degrees Celsius (1.0 to 3.0 °C) by 2100 under different emission scenarios and increasing tendency towards dry spells, extreme rainfall events, and increased risks from drought and flooding. In the Northern Caribbean, sea level rise (SLR) could be 25 percent (%) higher than the global average, due to physical factors such as low land elevation. Projected SLR and severe storms are likely to increase the risk of storm surge events.¹

2.02 Development of CC adaptation policies and strategies requires information about the nature of risks posed to society. With a good knowledge base to assess these risks, more informed adaptation decisions can be made. However, according to the most recent Intergovernmental Panel on Climate Change Assessment Report (IPCC AR), small island developing states (SIDS) face many challenges in using CC projections for policy development and decision-making due largely to the general absence of credible regional socio-economic scenarios at the relevant spatial scale, and the scarcity of geo-spatial data and information. For many BMCs, their bathymetric and topographic maps are generally outdated or inaccessible, or are at scales that are impracticable for meaningful decision-making. The high costs for geo-spatial data acquisition and limited appreciation of range of potential uses has in part affected the priority given to funding for these purposes.

2.03 LiDAR-based mapping technology can assist BMCs in addressing some of the problems being experienced due to the absence of geo-spatial data² for decision-making. LiDAR is a remote sensing³ technology used to derive highly accurate elevation measurements of the earth's surface. It uses a pulsed laser light attached to an aircraft or on a motor vehicle at ground level, to scan the ground and generate precise three-dimensional (3D) information on surface shape and characteristics, such as physical features and buildings.

2.04 LiDAR technology:

- (a) is capable of simultaneously gathering both topographic and bathymetric data⁴;
- (b) offers economies of scale;
- (c) provides greater efficiency and precision in collecting spatial data;
- (d) maps large areas in a short time period; and
- (e) collects high-resolution data, which is useful for producing high quality maps and images.

¹ The most recent IPCC AR5 has projected global mean SLR between 0.5 metres (m) and 0.6m by the end of the century. Under a business as usual scenario, the cost of annual projected CC impacts range between 8% and 15% of Gross Domestic Product (GDP) by 2050 (between USD5.5 billion (bn) to USD9 bn annually at 2008 prices) with tourism and agriculture sectors projected to experience most of the adverse effects (Bynoe 2012).

² Geo-spatial is used to indicate that data has a geographic component to it. This means that the records in a dataset have locational information tied to them such as geographic data in the form of coordinates, address, city, or ZIP code. <https://www.gislounge.com/difference-gis-geospatial/>.

³ Remote sensing is the science of obtaining information about objects or areas from a distance, typically from aircraft or satellites. <https://oceanservice.noaa.gov/facts/remotesensing.html>.

⁴ Bathymetry - Bathymetry is the study of the "beds" or "floors" of water bodies, including the ocean, rivers, streams, and lakes. <https://oceanservice.noaa.gov/facts/bathymetry.html>.

2.05 Acquiring and processing LiDAR data is costly and BMCs have not financed mapping of even their most vulnerable areas.⁵ In 2017, in support of updating the national physical plan, LiDAR mapping was completed for the entire island of Barbados at a cost of USD1.2 mn or USD2,784 per km². Using this same unit cost, USD20.5 mn would be required to complete LiDAR bathymetric and topographic surveys of vulnerable coastal areas in BMCs. Given the high cost of using LiDAR, and the urgent need for high quality geospatial datasets to support decision-making especially for developments in the coastal zone, the Centre is seeking to establish capacity to use LiDAR to accelerate the mapping and disseminate LiDAR data and information to BMCs.

The Caribbean Community Climate Change Centre

2.06 The Centre was established in 2005 by the Caribbean Community (CARICOM) to coordinate the Region's response to CC. The Centre was established with the understanding that it would not receive budgetary support from Member States for its operations. It therefore relies on project management fees for its operations. Financial limitations aside, the Centre has achieved considerable success in delivering on its mandate of providing climate data and information, largely through the implementation of regional and national development projects⁶. With a staff complement of 45 (30 professional and technical and 15 support), at the end of 2017, the Centre was managing a portfolio of projects valued at approximately USD100 mn. The projects are financed by various multi-lateral and bi-lateral development institutions including, USAID, KfW Development Bank, (formerly KfW Bankengruppe) and the Green Climate Fund (GCF).

Strategic Developments

2.07 In 2007, the Centre and CARICOM's Council for Trade Environment and Development approved a regional strategy for CC – "Regional Framework for Achieving Development Resilience to CC". The Implementation Plan (IP) followed, identifying among its 12 priority actions, the building of knowledge and expertise to support CC decision-making. The IP recognises the need to treat climate data as a regional public good and that emphasis should be placed on providing: (a) scientifically sound and decision-oriented climate data and projections; and (b) building capacities to generate, interpret and apply climate data and information.

2.08 The Centre with the support of a grant from CDB, established an Information Clearinghouse which is now the largest repository of CC information for the Region. Through on-going collaboration with regional partners, the Caribbean Institute of Meteorology and Hydrology (CIMH), Instituto de Meteorología de Cuba (INSMET) Climate Studies Group of the University of the West Indies (Mona), the Centre has been downscaling⁷ the Global Climate Model 300 km resolution to 50 km and 25 km for the entire Region. Downscaled model outputs take into account local influences and allow for combining outputs with more local datasets, increasing their usefulness for sector-based vulnerability and impact assessments and sector adaptation strategies. These downscaled data outputs can be even more useful to

⁵ Although some global datasets are freely available, the horizontal and vertical resolution generally do not meet the requirements for hazard analysis and vulnerability assessments, and communicating such information to potential users.

⁶ These projects include: Mainstreaming Adaptation to CC (2004-2007), Special Programme on Adaptation to CC (2007-2011), Coastal Protection for CC Adaptation in SIDS in the Caribbean (2014-2018) and Regional Planning for Climate Compatible Development in the Caribbean.

⁷ Downscaling is the general name for a procedure to take information known at large scales to make predictions at local scales (<https://gisclimatechange.ucar.edu/question/63>).

BMCs if they were combined with high-resolution LiDAR data, thus enabling improved identification, classification and communication of risks and prioritisation of risk responses to affected populations and assets.

LiDAR Initiative

2.09 In 2016, the Centre received grant support project from USAID for the “Climate Change Adaptation Programme” (CCAP) 2016-2020. CCAP sought to consolidate the Centre’s previous initiatives in climate data production and dissemination by strengthening and integrating the use of climate data and information in decision-making, and building capacities of regional, national, and local partners to generate and apply climate data and information. In-keeping with the new US Administration’s scaling back of development assistance to Latin America and the Caribbean, the resources provided under CCAP was significantly reduced, which defunded some of the activities under the LiDAR programme.

2.10 The Centre had prioritised the collection of airborne LiDAR bathymetric and topographic data as an initiative under CCAP and developed a plan for a regional LiDAR Programme; to undertake surveys, archive and process LiDAR data; and develop data products. Work on its implementation had already begun and the Centre had procured an airborne LiDAR system at a cost of USD2.2 mn⁸, when funding for CCAP was reduced. (Information on the LiDAR system is provided at Appendix 1.)

2.11 The Government of Italy (Ministry of Environment, Land and Sea), has provided USD600,000 to support the calibration and baselining activities,⁹ since this phase is critical for the success of producing quality mapping products. A local Belizean company was engaged to carry out bathymetric and topographic surveys for areas specified by the Centre (details of the Aviation Services Agreement are shown at Appendix 2), for the calibration and baselining phase which began in March 2018. A suitable airborne platform is required to operate the LiDAR system and residual resources from CCAP were used to customise the LiDAR platform on the aircraft used for the surveys. The Centre intends to continue this arrangement, to conduct all the LiDAR survey flights under the Programme. Technical support through collaborative work programmes, which began under CCAP, will continue with key US universities and research institutions such as, US Geological Survey (USGS), the National Oceanic and Atmospheric Administration (NOAA), Atmospheric and Oceanic Marine Laboratory (AOML), and the National Oceanic Systems, and the Department of the Interior.

2.12 The Centre has also taken steps to strengthen the capacity of its Information Clearinghouse to process, manage, disseminate and archive the increased data volumes from the surveys. This includes:

- (a) Acquiring additional analytical capacity, including a software suite to produce high-resolution 3D data and imagery of beach and shallow water seafloor¹⁰.

⁸ This includes equipment (USD1.6 mn; USD300,000 for maintenance; and USD300,000 for calibrating the LiDAR system).

⁹ These funds were obtained under the “CC Information Systems for Supporting Ridge to Reef Adaptation and Disaster Risk Reduction in the Caribbean Project” a component of which supports spatial data acquisition.

¹⁰ This includes coastal topography; benthic classification and water column characterisation; and performs well in shallow, turbid waters.

- (b) Training of three staff members in LiDAR systems, data analysis (including quality control and assurance); data formatting for end-users; and the use of the Hydro Fusion software¹¹.
- (c) Expanding its hardware and software capacity to facilitate increased data storage and raw data processing with partial funding through a CDB financed independent consultancy, which assessed the Centre's capacity to archive and process LiDAR data as envisaged under the Project.

2.13 The Centre sought the formal endorsement by its Member Countries of the LiDAR initiative, since its success depends on Member Countries' willingness to have the Centre play the dual role as service provider and data archiver on their behalf. Appendix 3 provides a copy of a sample endorsement letter received ¹².

3. THE PROPOSAL

3.01 The Centre is requesting CDB's support for financing flight-mapping services to collect LiDAR data for approximately 9,900 km² of vulnerable areas across all BMCs; train 38 BMC end-users in 19 BMCs in the application of topographic and bathymetric data; and prepare an Intellectual Property Policy (IPP); and product development and marketing strategy. CDB's proposed support will build on activities commenced under the USAID's CCAP to promote the use of climate data and information in adaptation decision-making. The link between CCAP and CDB's support for this Project is outlined in Appendix 4.

Proposal Description

3.02 It is proposed that CDB provide a grant to the Centre in an amount not exceeding the equivalent of one million, four hundred and sixty two thousand, nine hundred and sixty-five United States dollars (USD1,462,965) from its SFR to assist in financing TA for implementation of the following:

(a) Component 1: Flight Services for Completion of High Resolution LiDAR Surveys

This will include financial support for flight services to conduct coastal bathymetric and topographic mapping for a flight area of approximately 9,900 km². The surveys will be collected over specified areas agreed between the Centre and BMCs. Mapping activities will take place in three or more phases. BMCs have indicated that the priority areas for mapping are generally within 2 km on-shore and 2 km off-shore of the coastline. However, the precise areas for mapping will be fine-tuned with individual countries prior to the surveys.

(b) Component 2: LiDAR End-User Training

Training of 38 BMC LiDAR data and information end-users in the use and application of bathymetric and topographic LiDAR data. The Project will support a Consultancy to provide the training to end-users. The draft Terms of Reference (TOR) for this Consultancy is presented at Appendix 5A.

¹¹ This software is capable of producing high-resolution 3D data and environmental image products.

¹² The survey areas will be based on a multi-criteria model including: population; location of ports and harbours; coastal zones subject to storm surge flooding; areas subject to flash flooding producing coastal watersheds; coral reefs; benthic habitats; sea grass beds; mangroves; changes in habitats for benthic (bottom-dwelling) organisms and marine ecosystems; coastal bathymetry; and coastal topography.

(c) Component 3: Consulting Services to Strengthen Capacity for Data Management Services

(i) *Intellectual Property Policy*

Consultancy services to prepare an IPP to establish the legal and professional parameters for managing the LiDAR data. The TOR for this Consultancy is presented at Appendix 5B.

(ii) *Product Development and Marketing Strategy*

Consultancy services to support the Centre to determine high potential LiDAR products which can be marketed in order to enhance the Centre's financial sustainability. The TOR for this Consultancy is presented at Appendix 5C.

4. OUTCOME

4.01 The expected outcome of the Project is improved capacity of BMCs to make decisions for more effective management of natural hazard and climate risks. The Project will help to establish the capacity of the Centre to manage geo-spatial data; and develop LiDAR products and enhance skills of BMCs' end-users to use LiDAR data sets and products in decision-making. The Results Framework is presented at Appendix 6.

5. PROJECT JUSTIFICATION AND BENEFITS

5.01 The generation of quality scientific data and information products, data sharing, ease of data access and transfer are all-important for building resilience to CC impacts, since this supports learning and improved understanding of climate risks, impacts and potential responses. CDB's experience has shown that BMCs' efforts to design new climate resilient investments and retrofit existing infrastructure, support coastal zone management, identify natural hazards and formulate DRM strategies, are constrained by an absence of high quality geo-spatial datasets. Where the data exists, it is often project specific, inaccessible and with limited meaningful data documentation methodology. In addition, the cost of acquiring high quality data is expensive which constrains routine updating.

5.02 The increasing frequency of tropical storms, hurricanes, coastal erosion and SLR has altered nearshore geomorphology and bathymetry and increased the exposure and vulnerability of coastal infrastructure, including critical public assets (e.g. ports, airports, sea defences, roads and drainage), as well as coastal settlements where a majority of the population live. There is now an urgent need for updated robust geo-spatial datasets and data products, and accompanying technical support services.

5.03 The Project presents an opportunity to BMCs to accelerate the acquisition of LiDAR high resolution coastal and bathymetry datasets, at significantly reduced costs compared to commercial sources. For example, commercial LiDAR costs per km² range between USD800 – USD1,000 depending on the size of the area being mapped. At USD150 per/km², the Centre's LiDAR initiative would be approximately six times less than the commercial LiDAR. The financial implications of LiDAR mapping for BMCs was evident in a recent CDB-funded road project in Belize, where the cost for mapping a small area to facilitate construction of an 8 km stretch of road amounted to USD52,000 (Figure 1 provides comparative costs of LiDAR).

5.04 The project provides significant benefits to all BMCs seeking to advance policies for building resilience to CC and protect vulnerable populations from its potential adverse impacts, including:

- (a) Improving access to high-resolution LiDAR base-maps for a 2 km width (on-shore and offshore) along the length of coastline specified for each BMC as detailed at Figure 1. Shoreline and bathymetric data needed as inputs for sea defence and port development projects can be readily accessed and updated to support vulnerability assessments and designs for assets, such as roads, bridges, culverts and ports.
- (b) Providing the opportunity for BMCs to benefit from value added LiDAR data products including digital elevation models, digital surface models, digital terrain models, contour maps, storm surge mapping, and the provision of critical information for hazard vulnerability and DRM.
- (c) Improving project design and implementation efficiency by significantly reducing the time and costs needed for the preparation and design of infrastructure projects.
- (d) Providing data/information for multiple stakeholders (e.g. tourism, fishing and emergency planners) for management of development activities in the coastal zone.

5.05 The proposed programme will allow the Centre to develop a dedicated LiDAR facility to:

- (a) undertake cost-effective LiDAR surveys for BMCs;
- (b) provide on-demand access to datasets;
- (c) facilitate access to customised data processing for specific users;
- (d) allow rapid post-disaster data collection in affected areas; and
- (e) facilitate ease in routine updating of datasets.

6. GENDER MARKER AND PERFORMANCE ASSESSMENT

6.01 The Project is assessed as Marginally Mainstreamed (MM) based on CDB’s Gender Marker, having limited potential to contribute to gender equality scoring 1.75 out of 4.00 points. The Gender Marker is summarised in Table 1 (see Appendix 7 for the Gender Marker Analysis). The Project primarily focuses on the development of tools to strengthen geo-spatial data management for adaptation in BMCs. The Project will provide data and information that may affect gender relations and decision-making that could contribute to improved gender mainstreaming. The performance assessment score is 3.5 (see Appendix 8).

TABLE 1: GENDER MARKER SUMMARY

Gender Marker	Analysis	Design	Implementation	Monitoring and Evaluation	Score	Code
	0.25	1	0.5	0	1.75	MM

7. EXECUTION

7.01 The Project will be executed by the Centre over a 35-month period. The Project Implementation Schedule is presented at Appendix 9. The Centre has an established Project Management Team (PMT)

within its Project Development and Management Unit for the LiDAR initiative. A Project Coordinator (PC) currently the Assistant Executive Director, will have responsibility for all administrative aspects of the Project (see Appendix 10 for organogram of PMT). The duties of the PC are presented at Appendix 11. The technical team will comprise the following:

- (a) Software Developer/Data Analytics and Management, providing support for data analysis.
- (b) Instruments Officer/Systems Operator, providing support for data acquisition, storage and dissemination.
- (c) Data Management and Archiving Officer, providing support for data archiving.

7.02 The PMT has received extensive training, including in-house training in laser systems; training in the use of the LiDAR and mission planning by the LiDAR supplier in Orlando, Florida; and practical experience in LiDAR flight missions by NOAA. The Executive Director of the Centre is a LiDAR Scientist and will provide technical oversight for the Project. The composition and experience of the team are acceptable to CDB.

Project Implementation

7.03 To ensure efficient and effective implementation of the Project, the Centre will benefit from continued association with key collaborating partners in the United States of America, through various Memoranda of Understanding. These institutions include NOAA; AOML; National Aeronautics Space Administration; and the USGS LiDAR facility in Saint Petersburg, Florida. These institutions will provide support to the Centre, as required, including best practice in data management, quality and control, storage, processing, analysis and formatting. Technical support from these partners has so far been estimated at 5 man days, with a further 25 days of support estimated for the implementation period.

7.04 Participating BMCs will be required to sign a LiDAR Programme Participation Agreement (LPPA), with the Centre, which will define the terms and conditions and the roles and responsibilities of the Parties under the Programme. The LPPA covers issues relating to data acquisition; data processing; analysis and formatting; data archiving; data ownership; data dissemination; and use of data by third parties. A proposed draft agreement for LPPA is provided at Appendix 12.

8. RISK ASSESSMENT AND MITIGATION

8.01 Table 2 identifies the risk for the Project.

TABLE 2: SUMMARY OF RISKS AND MITIGATION MEASURES

Risk Type	Description	Mitigation
Implementation	Delay or rescheduling of the planned LiDAR surveys due to seasonal and or immediate weather conditions.	The surveys will be carried out during the dry season, which will provide optimal survey conditions.

9. COST AND FINANCING

9.01 The total cost of the Project is estimated at USD2,719,965 of which USD1,462,965 represents a Grant from CDB's SFR with USD724,500 representing in-kind counterpart contributions from the Centre. The budget is provided at Appendix 13 and the summary of the Financing Plan (Table 3) is shown below.

TABLE 3: FINANCING PLAN

Contributors	USD	%
CDB – SFR	1,462,965	53
USAID	300,000	11
Italy	232,500	9
The Centre	724,500	27
Total	2,719,965	100

10. FUNDING SOURCE

10.01 CDB's contribution, the equivalent of USD1,462,965 is eligible for funding from its SFR. Funds are available within existing resources.

11. PROCUREMENT

11.01 The procurement of goods and non-consulting services financed by CDB shall be undertaken in accordance with CDB's Guidelines for Procurement (January 2006), and the procurement of consulting services shall be undertaken in accordance with CDB's Guidelines for the Selection and Engagement of Consultants by Recipients of CDB Financing (October 2011). In accordance with paragraph 3.07 of the aforementioned Guidelines for Procurement, the Centre has contracted an aviation service provider to undertake the LiDAR surveys, using the direct contracting procurement method. This is a natural extension of the Centre's existing contract with the services provider for LiDAR services, which has been awarded in accordance with procedures acceptable to CDB. Under the existing contract the aircraft had to be altered to do the surveys and recertified as safe by Aviation Authorities. The Procurement Plan is set out at Appendix 14.

12. RECOMMENDATION

12.01 It is recommended that the Board of Directors approve a grant on CDB's standard terms and conditions and on the following terms and conditions:

No	Subject	Terms and Conditions of the Grant
1	Parties	<u>Bank</u> : Caribbean Development Bank <u>Beneficiary</u> : Caribbean Community Climate Change Centre
2	Amount of Grant	The Bank agrees to make available to the Beneficiary by way of grant an amount not exceeding the equivalent of one million, four hundred and sixty-two thousand, nine hundred and sixty-five United States dollars (USD1,462,965) (the Grant) comprising:

No	Subject	Terms and Conditions of the Grant
		<p><u>Special Funds Resources (SFR):</u> USD1,462,965</p>
3	Purpose	<p>The purpose for which the Grant is being made is to assist the Beneficiary in financing:</p> <p>the collection of LiDAR data, training of BMC end-users and capacity building for data management services (the Project).</p>
4	Payment of Grant	<p>Except as the Bank may otherwise agree, payment of the Grant shall be made as follows:</p> <ul style="list-style-type: none">(i) an amount not exceeding the equivalent of fifteen thousand United States dollars (USD15,000) shall be paid to the Beneficiary as an Advance (the Advance) on account of expenditures in respect of the Project following receipt by the Bank of:<ul style="list-style-type: none">(aa) a request in writing from the Beneficiary for such funds; and(bb) evidence acceptable to the Bank that the condition precedent to first disbursement of the Grant set out below has been satisfied; and(ii) the balance of the Grant shall be paid to the Beneficiary periodically after receipt by the Bank of an account and documentation satisfactory to the Bank, in support of expenditures incurred by the Beneficiary with respect to the Project, provided however, that the Bank shall not be under any obligation to make:<ul style="list-style-type: none">(aa) the first such payment under this sub-paragraph (b) until the Bank shall have received an account and documentation satisfactory to the Bank in support of expenditures incurred by the Beneficiary with respect to the Advance;(bb) any payment under this sub-paragraph (b) until the Bank shall have received an account and documentation satisfactory to the Bank in support of expenditures financed by the Beneficiary from the immediately preceding payment, and the requisite number of copies of the reports or other deliverables, in form and substance acceptable to the Bank, to be furnished for the time being by the PC in accordance with Appendix 11; and

No	Subject	Terms and Conditions of the Grant
		<p>(cc) payments exceeding one million three hundred and sixteen thousand six hundred and seventy United States dollars, (USD1,316,670) representing ninety percent (90%) of the amount of the Grant, until the Bank shall have received:</p> <p>(aa) the requisite number of copies of the Project Completion Report or other deliverables, in form and substance acceptable to the Bank, to be furnished by the PC in accordance with Appendix 11; and</p> <p>(bb) a certified statement of the expenditures incurred by the Beneficiary in respect of and in connection with the Project.</p>
5	Disbursement	The first payment of the Grant shall be made by August 1, 2018 and the Grant shall be fully disbursed by April 30, 2021 or such later dates as the Bank may specify in writing.
6	Procurement	<p>Procurement of goods and services to be financed from the Grant shall be in accordance with the following procedures or such other procedures as the Bank may from time to time specify in writing:</p> <p>The Bank’s Guidelines for Procurement (January 2006).</p> <p>The Bank’s Guidelines for the Selection and Engagement of Consultants by Recipients of CDB Financing (October 2011).</p> <p>The Beneficiary shall comply with the procurement requirements set out in the Procurement Plan. Any revisions to the Procurement Plan shall require the Bank’s prior approval in writing.</p>
7	Condition(s) Precedent to First Disbursement	<p>The Beneficiary shall, by the 60th day after the date of the Grant Agreement, or such later date as the Bank may agree, provide the Bank with evidence acceptable to the Bank, that the following condition/s has/have been satisfied:</p> <p>Detailed work implementation schedule setting out the dates for survey scheduling for each of the BMCs.</p>
8	Condition(s) Precedent to Disbursement with respect to Flight Services in each BMC	Executed copy of a LiDAR Programme Participation Agreement between the Beneficiary and that BMC.

No	Subject	Terms and Conditions of the Grant
9	Project Execution	Except as the Bank may otherwise agree, the Beneficiary shall execute the Project.
10	Project Management	<p>The Beneficiary shall, for the duration of the Project, assign the Assistant Executive Director of the Beneficiary as PC, who shall be responsible for all administrative aspects of the Project, including the duties and responsibilities set out in Appendix 11. The qualifications and experience of any person subsequently assigned to the position of PC shall be acceptable to the Bank.</p> <p>The Beneficiary shall, for the duration of the Project, maintain the existing PMT within its Project Development and Management Unit to oversee and advise the PC on the Project. The PMT will comprise a technical team as follows:</p> <ul style="list-style-type: none"> (a) Software Developer/Data Analytics and Management, providing support for data analysis. (b) Instruments Officer/Systems Operator, providing support for data acquisition, storage and dissemination. (c) Data Management and Archiving Officer, providing support for data archiving.
11	Engagement of Consultants	<p>The Beneficiary shall, in accordance with the procurement procedures applicable to the Grant, select and engage consultant(s) to provide the following consultancy services and shall, within a timeframe acceptable to the Bank, implement such recommendations arising out of the following consultancy/ies, as may be acceptable to the Bank:</p> <ul style="list-style-type: none"> (a) consultant to carry out the services set out in the TOR at Appendix 5A; (b) by August 1, 2018, consultant to carry out the services set out in the TOR at Appendix 5B; and (c) by August 1, 2018, consultant to carry out the services set out in the TOR at Appendix 5C
12	Reports and Information	Except as the Bank may otherwise agree, the Beneficiary shall furnish or cause to be furnished to the Bank the reports and other information set out in the Reporting Requirements in the form specified therein, or in such form or forms as the Bank may require, not later than the times specified therein for so doing.

No	Subject	Terms and Conditions of the Grant
13	Beneficiary's Contribution to the Project	<p>Except as the Bank may otherwise agree, the Beneficiary shall meet or cause to be met:</p> <ul style="list-style-type: none">(i) the cost of the items designated for financing by the Beneficiary in the Financing Plan;(ii) any amount by which the cost of the components of the Project to be financed from the Grant exceeds the amount set out in the Financing Plan; and(iii) the cost of any other items needed for the purpose of, or in connection with, the components of the Project to be financed from the Grant. <p>Except as the Bank may otherwise agree, the Beneficiary shall provide or cause to be provided, all other inputs required for the punctual and efficient carrying out of the Project not being financed by the Bank.</p>
14	Suspension, Cancellation and Refund	<p>The Beneficiary may not cancel any amount of the Grant in respect of which the Bank shall have entered into a special commitment pursuant to Section 3.02 of the General Provisions.</p> <p>The Bank shall be entitled to suspend, cancel or require a refund of the Grant, or any part thereof, if the contribution from USAID or the Government of Italy, or any part thereof is suspended, cancelled, or called in, except that the Beneficiary shall not be required to refund any amount of the Grant already expended on the components of the Project to be financed from the Grant and not recoverable by the Beneficiary.</p>

SUPPORTING DOCUMENTATION

Appendix 1	Information on Airborne LiDAR System
Appendix 2	Aviation Services Agreement
Appendix 3	Link between CDB's LiDAR Project and CCAP
Appendix 4	Sample Endorsement Letter
Appendix 5A	Draft Terms of Reference LiDAR Training Specialist
Appendix 5B	Draft Terms of Reference Intellectual Policy Specialist
Appendix 5C	Draft Terms of Reference Product Development and Marketing Strategy
Appendix 6	Results Framework
Appendix 7	Gender Marker Analysis
Appendix 8	Performance Assessment Score
Appendix 9	Project Implementation Schedule
Appendix 10	Project Management Unit and Institutional Arrangements for LiDAR
Appendix 11	Duties of the Project Coordinator
Appendix 12	Draft LPPA
Appendix 13	Budget
Appendix 14	Procurement Plan

INFORMATION ON AIRBORNE LiDAR SYSTEM
TELEDYNE OPTECH LIDAR SYSTEM

1. OPTECH CZMIL NOVA

1.01 Optech Coastal Zone Mapping and Imaging LiDAR (CZMIL) Nova is not only the most capable airborne bathymetric mapping system available today; it is also the most efficient. With a powerful yet more efficient laser, it maps deeper while flying higher, reaching depths of 80 m in clear waters. The enhanced design and automated processing tools produce simultaneous high-resolution 3D data and imagery of the beach and shallow water seafloor, including coastal topography, bathymetry, benthic classification and water column characterisation. CZMIL has been proven to outperform other bathymetric sensors in shallow, turbid waters, and CZMIL Nova improves on this with greater ease of use, smaller size, and less power consumption. Its bathymetric LiDAR is integrated with a hyperspectral imaging system and digital metric camera. Optech HydroFusion, a powerful end-to-end software suite, handles data from all three sensors - from mission planning to post-processing, delivering fused LiDAR and imagery datasets, bottom classifications, and even submerged object detection. Enhancements including CZMIL HydroFusion won a Geospatial Products and Services Excellence Award for Technology Innovation.

2. CZMIL NOVA ADVANTAGES

2.01 The advantages of CZMIL NOVA are:

- (a) 30% smaller and 25% lighter, with >15% less power required.
- (b) Simpler to install, easier to service, and less likely to need service.
- (c) More compact and efficient laser with precise pulse parameter control.
- (d) CZMIL series is validated and in use by multiple government agencies.
- (e) Best seamless, simultaneous high-resolution topographic/bathymetric imaging.
- (f) Depth penetration of $2.5 \times$ Secchi depth, up to 80 m.
- (g) Highest performance in shallow or turbid water.
- (h) Detects objects as small as 1m^3 in water up to 25m deep.
- (i) Green and Infrared frequencies available in a single system.
- (j) Superior land/water discrimination and depth resolution.
- (k) Optimised coverage, spatial density and survey rate.
- (l) Best operational productivity with all-in-one HydroFusion software workflow.

3. APPLICATIONS

- (a) Coastal and Marine.
- (b) Coastal and Shoreline.
- (c) Disaster Management.
- (d) Shallow, Turbid and Muddy Water.
- (e) Submerged Object Detection.
- (f) Defense and Security.
- (g) Natural Resources.
- (h) Environmental.

Further information on CZMIL can be obtained from the address:
<http://www.teledyneoptech.com/index.php/product/czmil/>.

AVIATION SERVICES AGREEMENT

THE SERVICE AGREEMENT IS MADE BETWEEN:

CARIBBEAN COMMUNITY CLIMATE CHANGE CENTER (“5Cs”), a Caribbean regional entity established by Members States of the Caribbean Community with principal offices at the Lawrence Nicholas Building, Ring Road, Belmopan, Belize.

AND

a limited liability company incorporated under the Companies Act of Belize and having its registered office at the Belize Municipal Airport, Belize City, Belize.

WHEREAS:

- (a) The Centre was established by the Caribbean Community as a regional legal entity for the coordination of the Caribbean region’s response to climate change, working on effective solutions and projects to combat environmental impacts and global warming;
- (b) In support of the objectives of the CC thrust the Centre, among other things, has recognised the use of Airborne LiDAR bathymetric/topographic data in understanding and predicting threats in the coastal zone ecosystem;
- (c) The Centre is in the process of finalising the operational capacity of its airborne Light Imaging, Detection and Ranging (LiDAR) system. A critical component in this development is the temporary use of a suitable airborne platform from which the LiDAR would operate during the calibration and baseline phases;
- (d) The calibration and baseline activities will be conducted in Belize. For this reason, support was sought from the commercial airlines in Belize;
- (e) In support of its airborne LiDAR program the Centre has sought the use of a local airline to provide an airborne platform for its LiDAR system from which to conduct regional bathymetric and topographic surveys;
- (f) -----, one of the local commercial airlines in Belize, expressed a willingness to provide as part of its corporate social responsibility, a reduced cost for providing the services of one of its aircraft;
- (g) ----- is in the business of providing commercial airline services;
- (h) ----- has indicated its interest in providing one of its planes to serve as a platform from which to operate the Centre LiDAR.

IT IS HEREBY AGREED:

1. Definition of the Service Contract Proposal and Service Parameters

- 1.1 The objectives of the Centre’s initiative and the required Services to be provided by an aviation services provider are:

- (a) To conduct the calibration of its LiDAR system on a CESSNA 206 aircraft provided by -----.
- (b) To conduct baseline bathymetric and topographic surveys over areas of Belize to be specified by the Centre.

2. Project Costs and Funding

- 2.1 Subject to Clause 1.3, ----- confirms that the cost represents the total cost of the operation of the aircraft inclusive of all deliverables and components required for completion and implementation of the calibration and baseline surveys.

3. Conditions Precedent

- 3.1 This Agreement is subject to satisfaction by the Centre of the following:
 - (a) air worthiness of the aircraft to be used as the airborne platform based on relevant certificate and any other relevant document to be provided by -----.
 - (b) the pilots assigned for the operations of the aircraft are suitably certified to perform the required services.

4. Liability and Indemnity

- 4.1 ----- shall indemnify the Centre and its governors, employees, contractors and subcontractors from and against all penalties, fines, damages, losses, costs or liabilities arising out of:
 - (a) the services provided or equipment operated by ----- of any injury, damage or loss sustained to any person or property unless such injury, damage or loss is due to the negligent or intentional act or omission of any employee or agent of the Centre.
 - (b) the failure to secure any permits, clearances or authorisations of any government agency or authority.

5. General Provisions

- 5.1 This Agreement shall be effective from the date on which it has been executed by both parties and unless terminated earlier in accordance with the terms hereof shall continue in force until the completion of the Centre's Airborne LiDAR survey programme.
- 5.2 This Agreement binds all heirs, assigns, trustees in bankruptcy, executors, administrators and successors-in-title in any form whatsoever of the parties hereto.

The address for service of any notice or document hereunder shall be as follows:

[Aviation Services Provider]

Address:

BELIZE

E-mail:

Attn: [NAME]

Caribbean Community Climate Change Center

The Lawrence Nicholas Building

Ring Road

Belmopan

Belize

E-mail:

PROVIDED that any party may from time to time by written notice, change its address for service hereunder. Save and except for any court process and where specifically stated otherwise service of notices and documents hereunder may be effected by hand delivery, registered mail, or e-mail.

5.3 The validity, construction and performance of this Agreement shall be governed exclusively by the laws of Belize.

5.5 Each party shall assume its own costs and expenses associated with the negotiation, approval and execution of this Agreement.

5.6 This Agreement, along with any exhibits, addenda, schedules, and amendments hereto, encompasses the entire agreement of the parties, and supersedes all previous understandings and agreements between the parties, whether oral or written.

AVIATION SERVICES PROVIDER

By: _____

Name:

Title:

In the presence of

This day of 2018

CARIBBEAN COMMUNITY CLIMATE CHANGE CENTER

By: _____

Name:

Title:

In the presence of

This day of 2018

SAMPLE ENDORSEMENT LETTER

Minister of State
Ministry of Finance and
Corporate Governance
Government Complex
St. John's, Antigua



Tel: 268-462-4302
Fax: 268-462-1622
Email: lennoxlow10@yahoo.com

GOVERNMENT OF ANTIGUA AND BARBUDA

February 12, 2018

Dr. Kenrick Leslic
Executive Director
Caribbean Community Climate Change Centre
The Lawrence Nicholas Building
Ring Road, Belmopan
Belize

Dear Dr. Leslie,

RE: Letter of Endorsement for 5Cs Airborne Lidar System Project

I am writing with regards to the 5Cs endorsement request for a Caribbean Development Bank (CDB) grant supporting the use of the Airborne Lidar System to conduct coastal bathymetric and topographic surveys for its Borrowing Member Countries (BMCs).

The Government of Antigua and Barbuda views the bathymetric and topographic surveys as an investment that can provide substantial benefits for both the immediate and long-term future of the region's coastal environment. It views these surveys as important and necessary inputs in addressing sustainable development-related issues.

The Government, therefore, endorses its inclusion on the agenda of the March 2018 CDB Board Meeting.

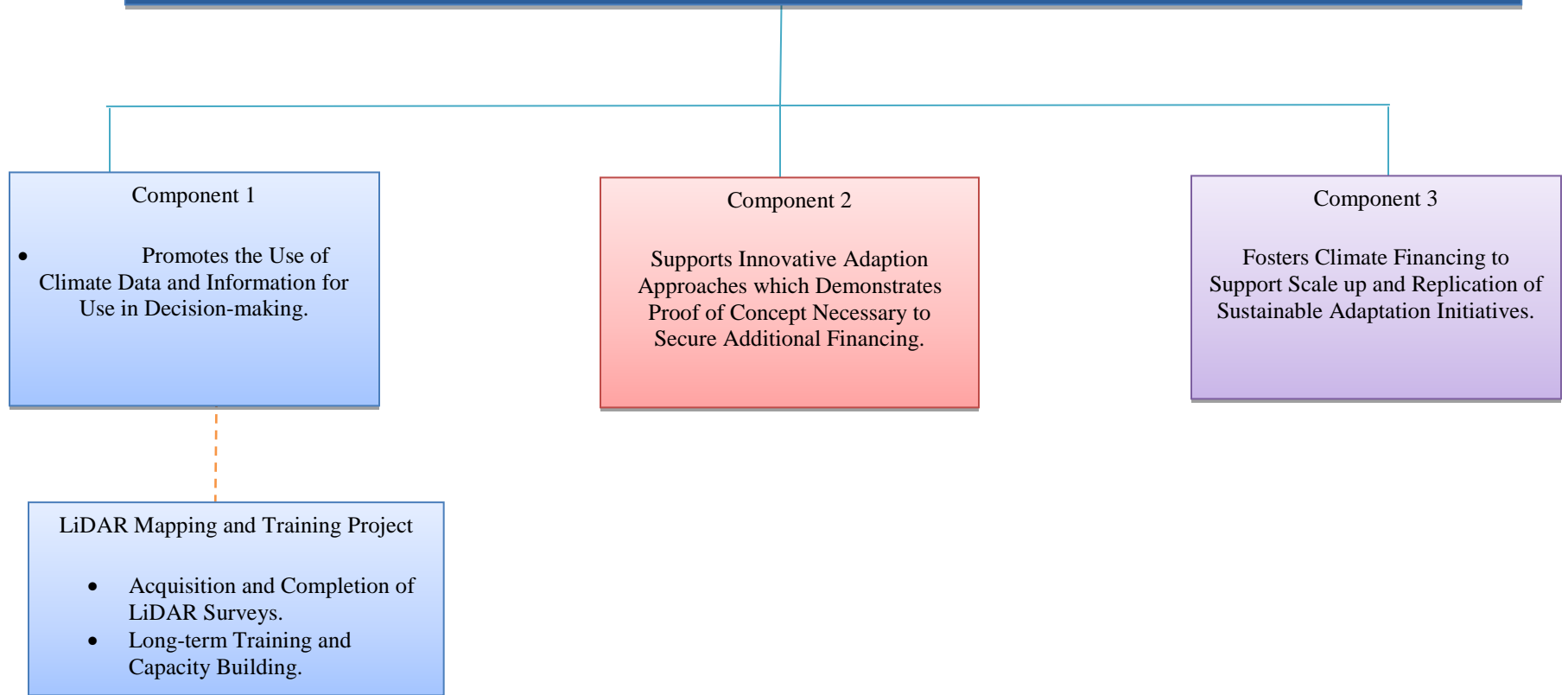
Yours respectfully,

A handwritten signature in blue ink that reads "Lennox Weston".

Senator the Hon. Lennox Weston
Minister of State, Ministry of Finance & Corporate Governance



LINK BETWEEN CDB'S LIDAR PROJECT AND CCAP: 2016-2020



DRAFT TERMS OF REFERENCE
LiDAR TRAINING SPECIALIST

1. BACKGROUND

1.01 The Borrowing Member Countries (BMCs) of the Caribbean Development Bank are likely to face considerable challenges due to the adverse effects of climate change (CC). Climate models project temperature increase to be within one to three degrees Celsius (1.0 to 3.0 °C) by 2100 under the different emission scenarios and an increasing tendency towards dry spells, extreme rainfall events, and increased risks from drought and flooding. In the Northern Caribbean, sea level rise (SLR) could be 25 percent higher than the global average, due to physical factors such as low land elevation. Projected SLR and severe storms are likely to increase the risk of storm surge events. The most recent Intergovernmental Panel on Climate Change Assessment Report has projected global mean sea level to rise between 0.5 metres (m) and 0.6m by the end of the century.

1.02 Adapting to CC is critical to supporting the process of resilience building and needs to be integrated in planning and designing of investments. This entails taking the right measures to reduce the effects of CC. The lack of reliable spatial data (bathymetric and near shore topographic data and consistent procedures) to inform decision-making is presenting a major challenge in managing natural hazards and climate risks, in particular assessing and mapping hazards, their vulnerability, establishing sea-level baselines, storm surge analyses, and integrating CC considerations into infrastructure planning and design. In many countries, bathymetric and topographic maps are outdated or inaccessible and are often at scales that make them impracticable for meaningful adaptation decision-making. Data on coastal and nearshore resources need to be collected urgently particularly given the increasing exposure of coastal areas to rising sea levels and the potential for loss and degradation of coastal and marine ecosystems. Light detection and ranging (LiDAR)-based mapping technology has considerable promise for overcoming drawbacks of traditional geo-spatial data collection methods.

1.03 The Centre has procured an airborne LiDAR system capable of conducting bathymetric and topographic surveys more frequently and at a significantly reduced and more affordable cost to BMCs. Many of the outputs of the LiDAR system will be technical in nature, and thus require technical knowledge for interpretation and use. The Centre intends to provide training in the interpretation and use of the outputs of the LiDAR surveys to allow selected target audiences to take advantage of the available data.

Profile of Caribbean Community Climate Change Centre

1.04 The Caribbean Community Climate Change Centre (the Centre) was established in 2005 by the Caribbean Community to coordinate the Region's response to CC. The Centre is the key mode for information on CC issues and on the Region's response to CC management and adaptation. With a staff complement of 45 (30 professional and technical and 15 support), the Centre is the official repository and clearinghouse for regional CC data for BMCs.

1.05 The Centre was established without budgetary support from Member States for its operations. It therefore relies on project management fees for its operations, in addition to support from collaborating partners.¹ Achieving financial sustainability is therefore a long-term goal of the Centre.

¹ These include Agreement with the National Oceanic and Atmospheric Administration, Atmospheric and Oceanic Laboratory, National Oceanic Systems and Department of the Interior. Agreements with regional institutions include the University of the West Indies, University of Guyana and University of Belize.

1.06 In spite of its financial limitations, the Centre has achieved considerable success in delivering on its mandate to provide climate data and information. Much of this has been achieved through the implementation of regional and national development projects including: Mainstreaming Adaptation to CC (2004-2007), Special Programme on Adaptation to CC (2007-2011), Coastal Protection for CC Adaptation in small island developing states (SIDS) in the Caribbean (2014-2018); and Regional Planning for Climate Compatible Development in the Caribbean. At the end of 2017 the value of projects being managed by the Centre was approximately one million United States dollars (USD1 mn), financed by various development institutions and governments including: KfW Development Bank, the Green Climate Fund (GCF), and the Government of Italy.

1.07 In 2015, the Centre was accredited as a regional implementing entity for grants by the Board of the GCF, a key multilateral climate financing mechanism for Developing Countries. This enabled the Centre to become the interface and conduit for GCF funding to Caribbean SIDS¹. In 2017, two projects valued at USD45.2 mn and USD9 mn were approved by the GCF, for execution by the Centre.

2. OBJECTIVE

2.01 The objective of the assignment is to deliver a hands-on LiDAR end-user training programme which reflects the needs of users and end users of the LiDAR data.

3. SCOPE OF WORK

3.01 The tasks to be undertaken by the Consultant will be done in close collaboration with the Centre, and key national stakeholders as necessary, and include, but are not limited to, the following:

- (a) Develop the programme aims, intended learning outcomes, methods of delivery, and comprehensive outline of the core training subjects.
- (b) Develop an indicative resources/materials/equipment for the core subject areas.
- (c) Deliver training in workshops.

4. DELIVERABLES

4.01 The LiDAR Trainer shall provide:

- (a) Detailed course outline and annotated course agenda to be submitted two weeks prior to the commencement of the assignment. This should include but not limited to: aims and objectives, learning outcomes, modes of delivery, and an outline of the core topics to be covered in the course.
- (b) Successful delivery of LiDAR User Training:
- (c) Evaluation/Assessment of training effectiveness, to be submitted within five days following each LiDAR User Training workshop.

¹ The Centre has gained the recognition of the United Nations Framework Convention on Climate Change, United Nations Environment Programme and other international agencies as the focal point for CC issues in the Caribbean, the United Nations Institute for Training and Research as a centre of excellence.

5. QUALIFICATION

5.01 The proposed Training Specialist should possess the following:

- (a) A recognised degree or higher in Geographical Information Systems or a similar related field from a tertiary institution; and qualifications in Marketing.
- (b) Previous experience in LiDAR training or equivalent experience to undertake the assignment.
- (c) A high level of knowledge of LiDAR data analysis and applications.
- (d) Fluent in written and spoken English.
- (e) Excellent interpersonal skills and demonstrated ability to communicate with project stakeholders is essential.

6. REPORTING REQUIREMENTS

6.01 The Consultant is expected to work closely with the LiDAR Project Management Unit counterpart and will report directly to the Executive Director, the Centre or his designate during the assignment.

- (a) An Inception Report describing the methodology for the assignment.
- (b) A Training Programme Outline.
- (c) A Draft Final Report.
- (d) Final Report.

7. DURATION

7.01 It is expected that the consultancy will be conducted for 20 days over a period of three months.

DRAFT TERMS OF REFERENCE
INTELLECTUAL POLICY SPECIALIST

1. OBJECTIVE

1.01 The primary objective of this assignment is to develop an Intellectual Policy (IP)/Code of Practice (COP) for management of Light detection and ranging (LiDAR) data and derivative products.

2. SCOPE OF WORK

- (a) Review existing IPs, laws, and regulations and data arrangements regarding data and knowledge sharing;
- (b) Develop an IP/COP for management of LiDAR data and derivative products. This should include but not limited to:
 - (i) Ownership and use of IP resulting from work involving the use of the data.
 - (ii) Ownership of IPs relating to secondary inputs.
 - (iii) Archiving of the un-processed and processed data.
 - (iv) Ownership of the un-processed and processed data.
 - (v) Access and use of un-processed and processed data by third parties.
 - (vi) Revenue sharing from commercial exploitation of the data, infringement of IP rights.
 - (vii) Sharing of data with government entities such as, defense and coast guard.

3. REPORTING REQUIREMENTS

3.01 The Consultant will report to the Executive Director, the Centre.

3.02 The Consultant will be required to submit the following reports to the Centre and the Caribbean Development Bank (CDB), within the time periods indicated:

- (a) An Inception Report and Work Plan within the first two weeks of the assignment, which provides a brief overview of the background research conducted to date, with an implementation plan including timelines for the assignment.
- (b) A Draft IP/COP for management of LiDAR data within three weeks of receipt of comments on the Inception Report.
- (c) A Final Report including the validated IP/COP, within three weeks of receipt of comments on the Preliminary IP.

3.03 All reports should be submitted to the Centre and CDB both in hard copy (one copy each) and in Electronic format. Reports should be submitted in Microsoft Word and/or Microsoft Excel formats as

appropriate. All data collected or produced during the consultancy shall be submitted to the Centre with the Draft Final Report.

4. QUALIFICATIONS AND EXPERIENCE

4.01 The minimum qualifications of the members of the consulting team shall include Masters Degrees in the relevant disciplines and a minimum of 10 years' relevant experience, or Bachelor's Degrees in the disciplines identified and a minimum of 15 years' relevant experience. The team should also possess experience in the areas of surveying, Geographical Information Systems, disaster risk management, engineering and physical planning. Professional qualifications in the relevant areas such as surveying, engineering, etc. will be a distinct advantage.

5. DURATION

5.01 It is estimated that the services will be 25 days elapsed over three months.

DRAFT TERMS OF REFERENCE
CONSULTANCY FOR THE DEVELOPMENT OF A
PRODUCT DEVELOPMENT AND MARKETING STRATEGY

1. OBJECTIVE

1.01 The objective of the assignment is to prepare a Product Development Strategy for the Centre.

2. SCOPE OF WORK

2.01 The tasks to be undertaken by the Consultant will be done in close collaboration with the Centre, and relevant stakeholders as necessary, and include, but are not limited to, the following:

- (a) Conduct a rapid market scan of relevant Borrowing Member Countries' stakeholder needs, industry gaps, and factors influencing market growth (opportunities, threats and industry-specific challenges) for light detection and ranging (LiDAR) derived products ensuring that they are accurately identified and described.
- (b) Describe the potential market for LiDAR products, among Government and the private sector. The end-user market segments of interest should include, but not limited to Coastal Zone Managers, Disaster Managers, Land Survey Departments, Cartography, Marine and Civil Engineering, Transport Forestry, and Agriculture.
- (c) Make comprehensive recommendations for development and marketing of LiDAR derivative products in response to market needs.

3. QUALIFICATIONS AND EXPERIENCE

3.01 The Product Development Consultant should possess the following:

- (a) A Masters Degrees in Geographical Information Systems/Environmental Management and a minimum of ten years' relevant experience.
- (b) Fluent in written and spoken English.
- (c) Excellent interpersonal skills and demonstrated ability to communicate with project stakeholders is essential.

4. REPORTING REQUIREMENTS

4.01 The Consultant will deliver:

- (a) An Inception Report describing the methodology for the assignment.
- (b) A report containing comprehensive recommendations for development and marketing LiDAR derivative products in response to market needs.
- (c) A Draft Final Report.
- (d) Final Report.

4.02 The Consultant is expected to work closely with the LiDAR Project Management Unit counterpart and will report directly to the Executive Director, the Centre or his designate during the assignment.

5. DURATION

5.01 It is expected that the consultancy will be 25 man days over three months.

RESULTS FRAMEWORK

Project Impact: Increased resilience of terrestrial coastal and marine areas to the impacts of CC.					
Outcome	Indicator	Baseline	Target	Data Sources, Mechanisms and Frequency	Reporting Report
1. Capacity of the Centre to develop LiDAR products.	1.1 Five LiDAR-related products generated by the Centre.	0	5 December 31, 2019	CCCCC Annual Reports. Monitoring and Evaluation Reports/Participant Evaluation Reports. Reports from collaborating institutions.	
2 Improved capacity of BMCs to make decisions for climate resilience planning.	2.1 Number of strategies, plans and projects that used LiDAR data products increase by 30%. Number of vulnerable areas/land uses identified increase by 20%. Number of storm surge and flood models increased by 30%.	0 0 0	30% December 31, 2021 20% December 31, 2020. December 31, 2020.	CCCCC Annual Reports. Monitoring and Evaluation Reports/Participant Evaluation Reports. Reports from collaborating institutions.	

Output	Indicator	Baseline	Target	Data Sources, Reporting and Freq.
1. High resolution LiDAR topographic and bathymetric data produced and available for selected coastal sites.	1. High resolution LiDAR topographic and bathymetric maps and geo-spatial database for areas mapped in 19 BMCs.	0	19 June 30, 2020.	PC Project Reports.
2. Technical skills BMC end-users in the interpretation and application of topographic and bathymetric data analysis.	2. At least 38 end-users in targeted BMCs trained in the interpretation and application of topographic and bathymetric LiDAR for flood risk mapping, storm surge modelling and hazard vulnerability assessments.	0	38 May 31, 2020.	Survey of participants conducted at the end of the workshop. Training Workshop reports. PC Project Reports.
3. Product development strategy for the Centre.	Product development strategy completed.	0	December 31, 2018.	
4. IPP for the Centre.	IPP completed.	0	December 31, 2018.	
<u>Assumptions for achieving Outcomes</u>			Assumptions for achieving Outputs	
(a) Requisite technical expertise resident in the BMCs to apply training.			BMC Personnel will be released to attend the training.	

GENDER MARKER ANALYSIS

Project Cycle Stage	Criteria	Score
Analysis: Introduction/Background/ Preparation	Consultations with women/girls/men/boys and relevant gender-related or sector-related public or private organisations have taken place.	0
	Social analysis identifies gender issues and priorities.	0.25
	Macroeconomic analysis identifies gender issues and priorities.	0
Design: Project Proposal/Definition Objective	To address the needs of women/girls and men/boys concrete interventions to reduce existing gender disparities have been designed. Effect on project outcome is direct.	0
	Project objective/outcome includes gender equality.	0.5
Implementation: Execution	Implementation arrangements (gender mainstreaming capacity building or gender expertise in implementing agency) to enhance the gender capacity of the implementing agency. Effect on project outcome is indirect.	0.5
	TOR of Project Coordinating Unit/PMT include responsibilities of gender mainstreaming, especially at the levels of the project coordinator/director and the Monitoring and Evaluation (M&E) Officer.	0.5
M&E: Results Framework (RF)	Sex-disaggregated data included in the baselines, indicators and targets of the RF.	0.0
	At least one gender-specific indicator at the outcome and/or output level in the RF.	0.0
Maximum Score:		1.75

Marginally Mainstreamed: The Project has limited potential to contribute to gender equality.

Marginal Gender Mainstreaming: Limited potential to contribute to gender equality mainstreaming

The total score in the Gender Marker means the following:

Score: over 4 - Gender Mainstreamed: The Project has potential to contribute significantly to gender equality.

Score: 3 to 4 - Gender Specific: The Project's principal purpose is to advance gender equality.

Score: 1.5 to 2.5 - Marginal Gender Mainstreaming: Limited potential to contribute to gender equality.

Score: 0 to 1 - No contribution to Gender Equality (NO): reference only.

PERFORMANCE ASSESSMENT SCORE

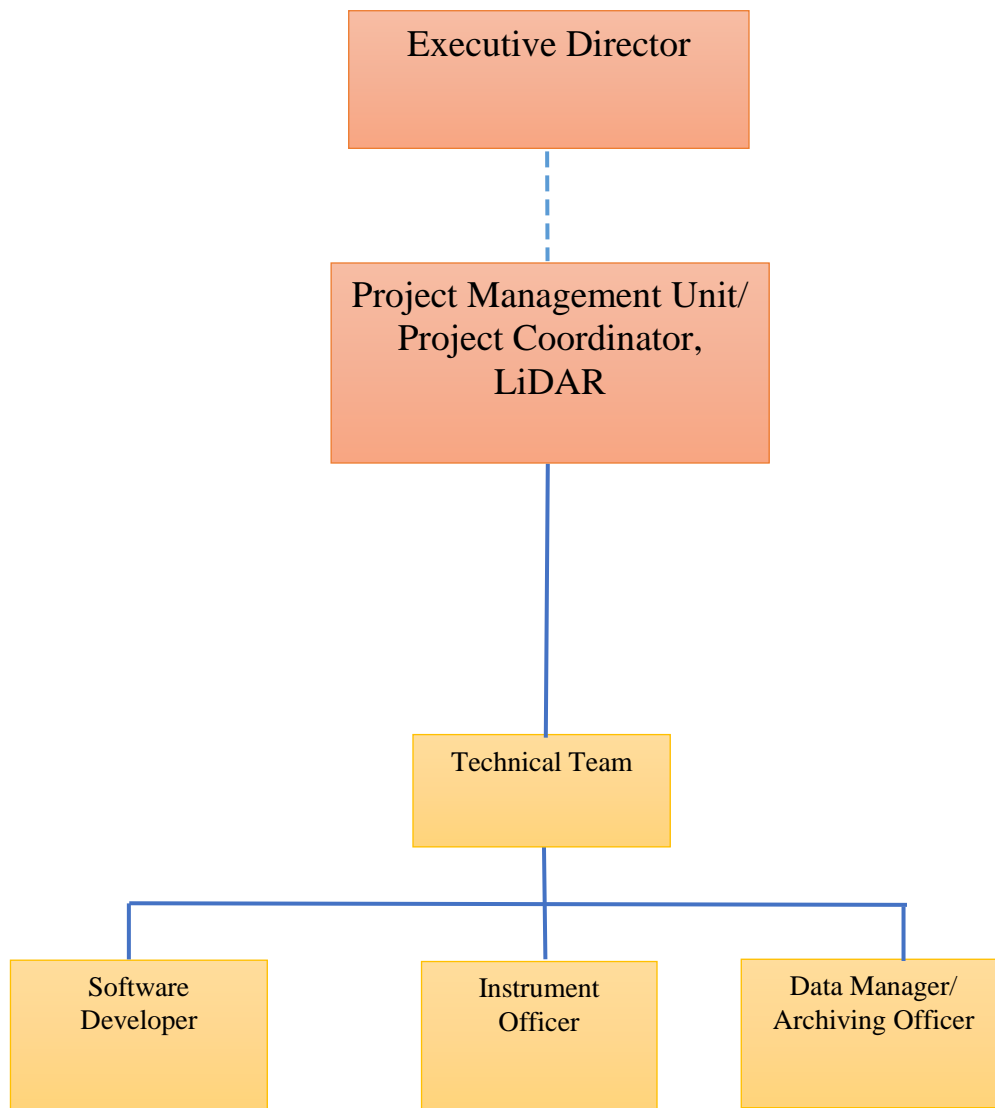
Criteria	Score	Justification
Relevance	4	The TA will help improve BMCs' access to high-resolution data to make evidenced-based decisions for responding to challenges being experienced with natural hazards, CC and environmental management. This TA is accorded high priority by BMCs as it supports the Region's goal of developing resilience to the effects of CC. It is also consistent with CDB's Strategic Objective of supporting inclusive and sustainable growth and development, and regional cooperation and integration. It has also been identified as a major pillar in CDB's Environmental Policy and Strategy.
Effectiveness	3	The project effectiveness will be assured by: selection of the priority sites for conducting LiDAR surveys based on the development of an objective criteria.
Efficiency	3	Utilisation of the existing clearinghouse mechanism will eliminate the need to develop a new information-sharing mechanism for LiDAR data and information, reducing the required effort, time and expense. Additionally, the project takes advantage of the relationship between CDB, the Centre and BMCs to facilitate project implementation. The economic benefits from acquiring enhanced spatial data in BMCs will translate in improved planning for natural hazards and climate risks far outweighs the economic costs of procuring LiDAR surveys and developing derivative planning tools.
Sustainability	3	The project has been designed to ensure long-term financial, physical, environmental and social sustainability of future CC resilience investments. It will also address the potential risks that might threaten the sustainability of the project and introduce necessary mitigation measures. Important features of the proposed project that will contribute to enhanced long-term financial sustainability include: development of product development strategy for the Centre to guide the development and marketing of LiDAR derived products, to improve its income generation and an IPP to establish the parameters for use of the data.
Overall Score	3.25	Satisfactory

PROJECT IMPLEMENTATION SCHEDULE

ID	Task Name	2017				2018				2019				2020				2021	
		Qtr 1	Qtr 2	Qtr 3	Qtr 4	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Qtr 1	Qtr 2
1	Prepare aircraft for LiDar	[Task Bar]																	
2	Initial training of the Centre's personnel on operation and maintenance of LiDAR	[Task Bar]																	
3	Calibration and baselining of the LiDAR system in Belize					[Task Bar]													
4	Technical support provided by collaborating partners - USGS, National Aeronautics and Space Administration, etc.	[Task Bar]																	
5	Initial field-testing of the airborne LiDAR in Belize.					[Task Bar]													
6	Bathymetric and topographic survey									[Task Bar]				[Task Bar]					
7	Data acquisition and processing									[Task Bar]				[Task Bar]					
8	Training of end-users													[Task Bar]					
9	Preparation of Product Development Strategy					[Task Bar]													
10	Preparation of IPP					[Task Bar]													

Project: WIP_ CCCCC Date: Fri 5/11/18	Task	[Blue Bar]	Inactive Task	[White Bar]	Manual Summary Rollup	[Thick Blue Bar]	External Milestone	[Diamond]
	Split	[Dotted Bar]	Inactive Milestone	[Diamond]	Manual Summary	[Thick Black Bar]	Deadline	[Green Arrow]
	Milestone	[Diamond]	Inactive Summary	[White Bar]	Start-only	[L Bracket]	Progress	[Blue Bar]
	Summary	[Thick Black Bar]	Manual Task	[Thick Blue Bar]	Finish-only	[R Bracket]	Manual Progress	[Thick Blue Bar]
	Project Summary	[White Bar]	Duration-only	[Light Blue Bar]	External Tasks	[Grey Bar]		

PROJECT MANAGEMENT UNIT ARRANGEMENTS FOR LiDAR PROGRAMME



DUTIES OF THE PROJECT COORDINATOR

1. The PC will report to the Executive Director, the Centre. The PC will be responsible for coordinating and monitoring all aspects of the implementation of the Project. The PC will be supported by technical and administrative staff of the Centre.
2. The specific functions of the PC, include but are not limited to:
 - (a) Project monitoring, specifically:
 - (i) reviewing the design and monitoring framework, to ensure familiarity and ensure arrangements are established for the collection of baseline data; such as:
 - (aa) developing a detailed results monitoring plan which clearly outlines the methods, sources, responsibilities and timelines for data collection;
 - (ii) collecting, analysing and reporting the results data as required by the monitoring framework.
 - (b) ensuring that training, stakeholder participation and all aspects of the Project are conducted in a gender-sensitive and gender-responsive manner, and that data is collected to reflect this dimension of project implementation;
 - (c) updating the Procurement Plan for the Project and seeking CDB's "no objection" for any proposed changes;
 - (d) cost control;
 - (e) expediting the submission of claims to CDB for disbursement/reimbursement;
 - (f) liaising with CDB on all technical and administrative aspects of the Project;
 - (g) preparing and submitting to CDB a quarterly report on the investment cost of the Project in a form acceptable to CDB, within two weeks after the end of each quarter (ending March 31, June 30, September 30, December 31);
 - (h) keeping separate accounts for project-related expenditures and disbursement activities;
 - (i) submitting to CDB, within two weeks after the end of a two-month period, progress reports on the implementation of the Project;
 - (j) submitting to CDB, immediately upon receipt, copies of reports furnished by the Consultants and providers of non-consulting services; and
 - (k) preparing and submitting to CDB a Project Completion Report, within two months after practical completion of the works. This Report will focus on the Project's performance and on desired results as outlined in the results monitoring framework and lessons learned.

DRAFT
LIDAR PROGRAMME PARTICIPATION AGREEMENT

FOR THE ACQUISITION, PROCESSING, INTERPRETATION AND DISSEMINATION OF
AIRBORNE LIDAR BATHYMETRIC AND TOPOGRAPHIC DATA IN THE COASTAL AREAS
OF (insert country)

BETWEEN

CARIBBEAN COMMUNITY CLIMATE CHANGE CENTRE (the Centre)

AND

GOVERNMENT OF (insert country)

This AGREEMENT is made and entered into on the ____day of _____ 2017 by and between the Centre currently located in the Lawrence Nicholas Building, 2nd Floor, Belmopan, Belize and the Government of (insert country).

WHEREAS:

The Centre, a CARICOM Institution with a mandate to coordinate CARICOM'S response to Climate Change and its efforts to manage and adapt to its projected impacts, declare and guarantees that it possesses the technical knowledge, suitable professional skills, appropriate organisation and personnel to perform its obligations under this AGREEMENT and further undertakes to and shall be obligated to perform a coastal marine airborne bathymetric and topographic survey including data acquisition and data processing as per the terms and conditions described in this agreement and schedule thereof.

NOW THIS AGREEMENT WITNESSETH AS HEREUNDER:

A. Data Acquisition

- (i) Coastal bathymetric and topographic data will be acquired using an airborne LIDAR system.
- (ii) The data will be acquired through aerial surveys over specified areas agreed upon between the Centre and the competent authority of the Government of (insert country).
- (iii) The Government of (insert country) will ensure that all permits required for the conduct of the surveys will be provided by the competent authorities.

B. Data Processing, Analysis and Formatting

- (i) The processing and analysis of the data will be conducted at the Centre's facilities in Belmopan, Belize.
- (ii) The processed data will be formatted to meet the prescribed needs of the country.

C. Archiving of the Unprocessed and Processed Data

(i) All data will be archived at the Centre and at any other site designated by the Government of (insert country).

(ii) The Centre will also have a secured off-site storage site as a back-up.

D. Ownership of the Unprocessed and Processed Data

(i) All data shall remain the ownership of the Government of (insert country).

E. Dissemination of Unprocessed and Processed Data

(i) Dissemination of the data will be conducted only with the authorisation of the Government of (insert country).

F. The Access and Use of Unprocessed and Processed Data by Third Parties.

(i) The access and use of data archived at the Centre by Third Parties must be approved by the Government of (insert country).

(ii) The confidentiality of data will be protected as follows:

(aa) The data recipient will not release data to a third party without prior approval from the Centre and the Government of (insert country).

(bb) The data recipient will not share, publish, or otherwise release any findings or conclusions derived from analysis of data obtained from the data provider without prior approval from the Centre and the Government of (insert country).

IN WITNESS WHEREOF, both the Centre, through its duly authorised representative, and The Government of (insert country), through its duly authorised representative, have hereunto executed this Data Acquisition and Sharing Agreement as of the last date below written.

Executive Director
Caribbean Community Climate Change Centre

Date:

BUDGET
(USD)

ITEM	CDB	CCCCC	USAID	ITALY	TOTAL
Calibration and Baselineing of LiDAR System			300,000	112,500	412,500
Training- BMC End-User Training Workshop (interpretation and application of topographic and bathymetric LiDAR) -five days	162,400				162,400
LiDAR Flight Mapping Services	1,162,500			120,000	1,282,500
Data Acquisition and Processing		288,000			288,000
Preparation of Product Development and Marketing Strategy	39,200				39,200
Preparation of Intellectual Property Policy	29,200				29,200
LiDAR Upkeep and Maintenance		50,000			50,000
Project Management		352,000			352,000
SUB TOTAL	1,393,300	690,000	300,000	232,500	2,615,800
Contingency (5%) ¹	69,665	34,500			104,165
TOTAL	1,462,965	724,500	300,000	232,500	2,719,965
Percentage	53	27	11	9	100

Notes to the Budget:

LiDAR Upkeep and Maintenance: This activity includes the on-going maintenance and upkeep (replacement or repair) of LiDAR components. A five-year contract has been signed with a supplier to provide extended warranty for replacement or repair of LiDAR component parts.

¹ Include transfer charges for dispatching funds to grantee.

PROCUREMENT PLAN

I. General

1. Project Information:

Country: Regional
Beneficiary: Caribbean Community Climate Change Centre

Project Name: Technical Assistance – Support for Conducting Air-Borne Light Detection and Ranging (LIDAR) Surveys and Training

Project Implementing Agency: Caribbean Community Climate Change Centre

2. Bank’s Approval Date of the Procurement Plan: May 2018

3. Period Covered By This Procurement Plan: August 1, 2018 – April 30, 2021

4. Date of General Procurement Notice: August 1, 2018

II. Goods and Works and Non-Consulting Services

(a) **Prior Review Threshold:** Procurement decision subject to prior review by the Bank as stated in Appendix 2 to the CDB Guidelines for Procurement (January 2006):

	Procurement Method	Prior Review Threshold	Comments
1.	Direct Contracting	All	
2.			

(b) **Reference to (if any) Project Operational/Procurement Manual:** CDB Guidelines for Procurement (January 2006).

(c) **Any Other Special Procurement Arrangements:** None

(d) **Procurement Packages with Methods and Time Schedule:**

1	2	3	4	5	6	7	8
Ref No.	Contract (Description)	Estimated Cost (USD)	Procurement Method	Prequalification (Yes/No)	Review by Bank (Prior/Post)	Expected Bid-Opening Date	Comments
1.	LiDAR Flight Services for LiDAR Mapping	■	DC	N	Prior		Competitive pricing and long established relationship with Maya Airways

This information is withheld in accordance with one or more of the exceptions to disclosure under the Bank’s Information Disclosure Policy.

III Consulting Services

1. **Prior Review Threshold:** Procurement decision subject to prior review by the Bank as stated in Appendix 1 to the CDB Guidelines for the Selection and Engagement of Consultants (October 2011):

	Selection Method	Prior Review Threshold	Comments
1.	CQS	[REDACTED]	
2.			

2. **Reference to (if any) Project Operational/Procurement Manual:** CDB Guidelines for Selection and Engagement of Consultants (October 2011).
3. **Any Other Special Procurement Arrangements:** None
4. **Procurement Packages with Selection Methods and Time Schedule:**

1	2	3	4	5	6	7
Ref No.	Assignment (Description)	Estimated Cost (USD)	Selection Method	Bank Review Prior/Post	Expected Proposal Submission Date	Comments
	LiDAR End-user Training	[REDACTED]	ICS			
C1.	Consultancy Services to prepare Product Development and Marketing Strategy	[REDACTED]	CQS			
C2.	Consultancy Services to prepare IPP	[REDACTED]	CQS	Prior		

III. Implementing Agency Capacity Building Activities with Time Schedule

No.	Expected Outcome/ Activity Description	Estimated Cost	Estimated Duration	Start Date	Comments
1.	Virtual Launch	N/A	0.5 days	August 2018	
2.					

This information is withheld in accordance with one or more of the exceptions to disclosure under the Bank's Information Disclosure Policy.

IV. Summary of Proposed Procurement Arrangement

Project Component	CDB (USD'000)			NBF (USD'000)	Total Cost (USD'000)
	ICS	CQS	DC		
Component 1: End-User Training.	█				█
Component 2: High-resolution LiDAR surveys (Bathymetric and Topographic).			█		█
Component 3a. Consultancy Services to prepare Product Development and Marketing Strategy.		█			█
Component 3b. Consultancy Services to prepare IPP.		█			█
Total Project Costs					█
Contingency					█
Base Total					█

This information is withheld in accordance with one or more of the exceptions to disclosure under the Bank's Information Disclosure Policy.

COMPARATIVE COST OF LiDAR PER SQUARE KILOMETRE

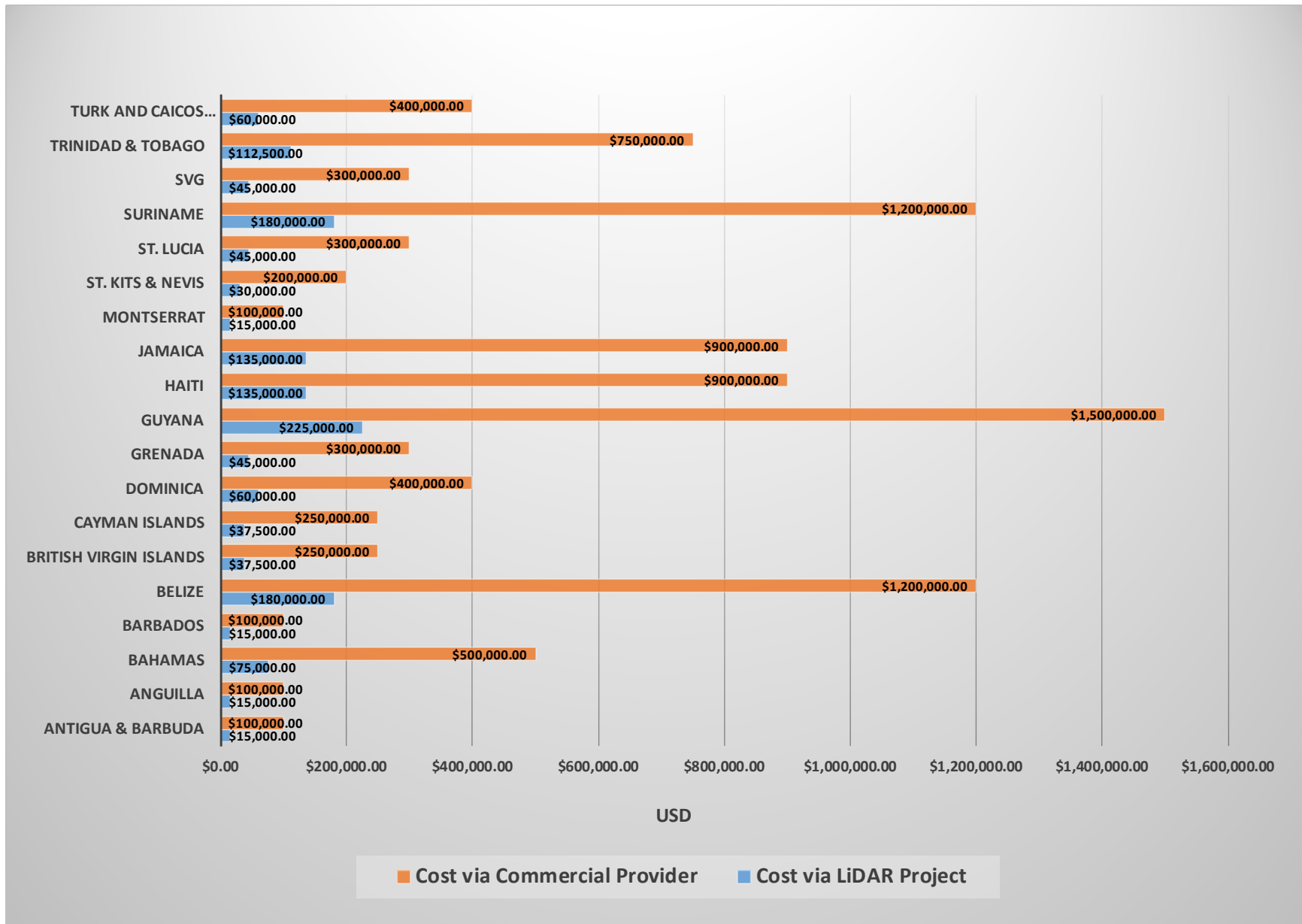


FIGURE 1