Caribbean Community
Climate Change Centre

Office of the Executive Director
Caribbean Community Climate Change Centre
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8 November, 2018

Dr. Francesco La Camera
Director General
Department for Sustainable
Development, Environmental
Damage, European Union and
International Affairs
Ministry for Environmental, Land and Sea
Via Cristoforo Colombo, 44
00147 – Rome, Italy

Dear Director General,

Subject: Funding for the 5Cs Airborne LiDAR Project

I am writing to seek the financial support of your Ministry to the 5Cs Airborne LiDAR Project. The project (see annex1 for details) is supported by all fifteen (15) CARICOM Members[1] and five (5) Associate Members[2]. These countries are referred to as CMs and ACMs.

The project is a regional public good initiative to assist in assessing the Climate Change (CC) and Sea Level Rise (SLR) impacts. Data collected under the project would provide a good knowledge base to assess these impacts and better informed decisions about adaptation that can be made. The Fifth IPCC Report indicated that the countries have a high probability of being adversely affected by CC and SLR due to large concentrations of population, settlements and critical economic infrastructure in vulnerable low-lying coastal areas. More recently the IPCC released a Special Report on 8 October, 2018 on the impacts that would result from a rise in atmospheric global temperature in excess of 1.5 degree Celsius. The Special Report informed the 1.5 degree Celsius would be reached by the 2040's and the region would face devastating and unprecedented risks should the warming reach 2 or 2.5 degrees. It also indicated that on the present track, global temperatures will rise by about 3.0 degrees or more by the end of the current century. Other studies have shown that the rate of SLR is accelerating and could reach 66 cm by 2100. Addressing these issues will require the development of appropriate adaptation policies and strategies.

Development of CC and SLR 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 decisions about

[1] CARIOM Members: Antigua and Barbuda, Bahamas, Barbados, Belize, Dominica, Grenada, Guyana, Haiti, Jamaica, Montserrat, St. Kitts and Nevis, Saint Lucia, Suriname, St. Vincent and the Grenadines and Trinidad and Tobago.
[2] CARICOM Associate Members: Anguilla, Bermuda, British Virgin Islands, Cayman Islands, Turks and Caicos.

adaptation can be made. However, according to the most recent IPCC AR5, 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 relevant at the spatial scale, and the scarcity of geo-spatial data and information. This includes lack of reliable bathymetric and near shore topographic data, to inform decision-making. Bathymetric and topographic maps in the CMs and ACMs are generally outdated or inaccessible, and are often at small scales that are impracticable for meaningful decision-making. The high costs for geo-spatial data and in some instances, inadequate knowledge of the range of potential uses, further add to the problem. Integrating of high-resolution topographic and bathymetric data into policies and decision-making can assist in, among other things: identifying areas most vulnerable to the impacts of CC; identifying vulnerable land uses and infrastructure in vulnerable coastal zones; and improve infrastructure planning and design.

LiDAR-based mapping technology can assist in addressing some of the problems being experienced due to the absence of geo-spatial data for decision-making. LiDAR is a remote sensing 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.

LiDAR is capable of simultaneously gathering both topographic and bathymetric data, offers economies of scale, greater efficiency and precision in collecting spatial data, maps large areas in a short time period, and collects high-resolution data, making it useful for producing high quality maps and images.
Acquiring and processing LiDAR is costly and so far the CMCs and ACMCs have generally not been able to find sufficient funds to map even their most vulnerable areas. In 2017, LiDAR mapping was completed for the entire island of Barbados at a cost of USD1 million or USD2,353 per km^2. Using this same unit cost, USD20.5 million would be required to complete LiDAR bathymetric and topographic surveys of vulnerable coastal areas in the CMs and ACMs. With the high cost of using LiDAR, the Centre in collaboration with its partners are seeking to develop a mechanism for advancing the production and dissemination of LiDAR data and information at a more affordable cost.

Cognizant of the urgent need for airborne LIDAR bathymetric/topographic surveys in the CMs and ACMs, and the high cost for conducting these surveys, the 5Cs explored ways of conducting the surveys at an affordable cost to the CMs and ACMs.

In 2016, the Centre received grant support from USAID to develop the capacity to conduct the necessary surveys. The grant support provided:

i. The acquisition of a state-of-the-art LiDAR system
ii. Training of personnel
iii. Data storage and processing and archiving hardware and software systems
iv. Formulation of a program within the context of the Regional Framework that 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. Also in the building of capacities of regional, national, and local partners to generate and apply climate data and information.

To address the gaps in geo-spatial data, the Centre has prioritised the collection of airborne LiDAR bathymetric and topographic data in two phases. Phase 1 includes the calibration and initial baseline surveys to be conducted under a range of marine and terrestrial scenarios at the Centre. Phase 2 will include surveys at various sites in each member state.

The funds being sought are to cover Phase 1 of the program. Phase 2 of the program is being funded by the Caribbean development Bank (CDB). The successful implementation of both

phases of the program, which if successfully implemented, would position the 5Cs as the primary institution with the capacity to undertake surveys, archive and process LiDAR data and develop data products for use by various users.

The project contributes to the achievement of the objectives established under the IMELS/CARICOM MOU. The relevant activities are described under the sub-programme for Disaster Risk Reduction of Annex II (Climate Change Adaptation) of the MOU.

The project is also complementary to the early warning system (EWS) being provided by IMELS to the Government of Saint Lucia and designed to provide:

- Early Warning Alerting, that combines information and data derived from multiple ground and satellite sources in order to deliver a unified picture
- Local meteorological information, by radar with 120 Km of radius on medium high intensity phenomena
- Hydraulic information through hydro models, exploiting the already existing hydrometric networks in St. Lucia
- Flood mapping capability, for post event damage assessment, based on the analysis of both SAR and optical satellite images, freshly acquired during the peak of the event and immediately after.

The effectiveness of the early warning alerting will be dependent on available inputs to be provided by the 5Cs airborne LiDAR system and hydrometeorological/hydrological data from automatic weather stations (AWS) currently being installed by the 5Cs under the USAID CCAP project.

In order to proceed with the implementation of the project, I kindly request provision of the first tranche of funds. The invoice for the first disbursement and banking information are attached.

Yours respectfully,

KRleslie

Kenrick R. Leslie PhD, CBE
Executive Director

Caribbean Community Climate Change Centre

Invoice

Date	Invoice #
11/8/2018	41

Bill To
Dr. Francesco La Camera Director General Ministry for the Environment, Land & Sea Via C. Colombo, 44 00147 Rome - Italy

Description	Amount
Project: Completing the Operationalization of the Caribbean Community Climate Change Centre Airborne LIDAR System – Request for first disbursement	150,000.00
	Total $150,000.00

CARIBBEAN COMMUNITY
CLIMATE CHANGE CENTRE

Caribbean Community Climate Change Centre (CCCCC)

CCCCC Banking Instructions

Remit to:

JP Morgan Chase Bank, N.A.
153 West 51st Street
4th Floor,
New York, New York 10019

Swift Bic: CHASUS33
Chips ABA: 0002
Fed Wire ABA: 021000021

To Credit:

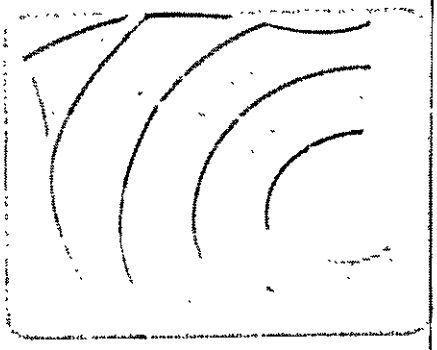
Scotiabank (Belize) Ltd
Account Number: 001058527
Swift Code: NOSCBZBS

For further Credit to:
(Beneficiary)

Caribbean Community Climate Change Centre
P.O. Box 563
2nd Floor Lawrence Nicholas Bldg.
Belmopan City
BELIZE

Branch: Belmopan

Account No.: 914-1468
Transit # 19075



Caribbean Community Climate Change Centre

A PROPOSAL FOR CONSIDERATION AS A REGIONAL PUBLIC GOOD

The Operationalization of the Caribbean Community Climate Change Centre Airborne LIDAR System

Submitted by

Kenrick R. Leslie

Executive Director

Project Title:	The Operationalization of the Caribbean Community Climate Change Centre Airborne LIDAR System
Total Project Cost:	US$2.8 Million
Available Funding:	US$2.2 Million
Funding short fall:	US$0.6 Million
Available Funding Sources:	
CCCCC contribution	US$200 Thousand:
Purpose of Funds:	Development of an Airborne LIDAR Specifications and Program for use in bathymetric/topographic surveys in the Caribbean

USAID contribution:	US$ 2 Million
Purpose of Funds:	To procure LIDAR System with supporting software analytical tools.
IMELS contribution:	US$600 Thousand
Purpose of Funds:	To enable the 5Cs to complete the operationalization of its Airborne LIDAR.
IMELS Funding period:	December 2018 – Sep 2019

Proposed Disbursement of Funds by IMELS:

Tranche	Amount (US$)	Disbursement Trigger
1	150,000	On approval of project
2	200,000	80% verifiable expenditure of 1st Tranche
3	200,000	80% verifiable expenditure of 2nd Tranche
4	50,000	80% verifiable expenditure of 3rd Tranche
Total	600,000	

1.0 Purpose of the Grant

The coastal areas (marine and terrestrial) of the CARICOM Member Countries contribute the most to their livelihood and economy. Climate Change and other human factors are posing a serious threat to the sustainability of this critical region. The CCCCC is preparing a Proposal for submission to the Green Climate Fund (GCF) under the Simplified Adaptation Process to address this sustainability issue. The project is entitled: *"Climate Change Information Systems for supporting Ridge to Reef Adaptation and Disaster Risk Reduction in the Caribbean (CCIS-RtR)".*

The goal of the CCIS-RtR proposal is to maintain and enhance CARICOM SIDS and Low Lying Coastal States ecosystem goods and services (provisioning, regulating, supporting and cultural) through integrated approaches to land, water, forest, biodiversity and coastal resource management that contribute to poverty reduction, sustainable livelihoods and climate resilience. Although most ecosystem elements will be considered under the project, the project will concentrate its efforts to the key contributing ecosystem to the economy and livelihood, coastal ecosystem which includes the coral reef coastal zone. The structure and functioning of coral reef coastal zones are currently coping with an increasing variety of threats, thereby altering the coastal spatial patterns at an accelerated pace.

A critical input to the development of models to address the sustainability of coastal ecosystem is bathymetric/topographic data. The Centre has been developing its capacity to be able it to conduct the requisite airborne LIDAR bathymetric/topographic surveys at reasonable and affordable cost.

The purpose of the grant is to assist the Centre in completing the development of its airborne LIDAR capacity in a timely manner for initial use in the CCIS-RtR project.

2.0 The use of Airborne LIDAR bathymetric/topographic data in understanding and predicting threats in the coastal zone ecosystem

Understanding and predicting the evolution of the threat to highly valuable coastal ecosystems require reliable and frequent mapping and monitoring of both inhabited terrestrial and marine areas at the individual tree and coral colony spatial scale. The very high spatial resolution (VHR) mapping by an airborne LIDAR system will provide the data set necessary for the development of tools for use in vulnerability and capacity assessments and early warning systems, and tangible adaptation and disaster risk reduction initiatives.

3.0 The Socio-Economic importance of the project

In the Caribbean SIDS the socio-economic importance of activities in the coastal zone (marine and terrestrial) cannot be overemphasized. The livelihood of the majority of their people is dependent on activities in coastal area, hence the importance of the CCIS-RtR and the supporting LIDAR sub-projects.

The two primary economic activities in the coastal zone are:

i. Fishing
ii. Tourism

The socio-economic importance of these two industries is highlighted below.

3.01 Fishing activities, and livelihood

It is estimated that more than 200,000 people in the region are directly employed, either fulltime or part-time, as fishers. In addition, some 100,000 work in processing and marketing of fish, with additional job opportunities in net-making, boat-building, and other associated industries. With their dependencies this number increases to at least 1.5 million that rely for their livelihood on commercial fishing. The activity also brings in approximately U.S. $1.2 billion annually in export earnings. However the true importance of fishing is not fully reflected in these figures. In a region where most of the population has access to the Sea, fish provide a vital resource for poor communities in ways which do not always appear on the national accounts. It is estimated, for example, that fish products account for on average 7% of the protein consumed by people in the Caribbean region. Anything which damages the productivity of the marine food chain is therefore a significant threat both to the health and to the wealth of these societies.

Between 2000 and 2015 it is estimated that gross revenue decreased by 30 to 45 percent. This decrease resulted from primarily reef degradation. Preservation of the natural environment supporting these industries is, therefore, essential for maintaining their sustainability.

For this to happen it is, therefore, imperative that the state of the current coastal bathymetric and topographic environment be properly documented so that proper sustainability polices can be developed and implemented.

3.02 Tourism

In most of the Caribbean SIDS and Low Lying Coastal States their population is highly dependent on income from tourism. Over two million people are employed either directly or indirectly in travel and tourism. The industry contributes some US$ 28 billion to the Region's GDP.

Tourism is the lifeblood of many CARICOM countries, contributing more than 30 percent of GDP in 10 countries or territories within the community. One Caribbean worker in six is employed directly in tourism. In 2000, international tourism receipts in the Caribbean region (excluding the United States) totaled US$25.5 billion. Including supporting and related services, tourism contributes a total of about US$105 billion annually to the Caribbean economy. It is estimated that US$625 million in direct expenditures is associated with diving on natural reefs in the year 2000. This further highlights the importance of the reefs in the Caribbean.

4.0 The cost of conducting airborne LIDAR bathymetric/topographic surveys

Although the urgent need for the acquisition of airborne LIDAR bathymetric/topographic surveys has been recognized its high cost has been inhibitor. On an average the commercial cost of bathymetric surveys is US$1000/km^2. As a result of the high survey cost the surveys when conducted are limited in scope and site specific. More importantly the high cost prohibits, even though required, repeat periodic surveys. Repeat surveys are required especially after the passage of hurricanes and other extreme weather events. The repeat surveys are required to monitor induced changes resulting from these events. This allows for timely adaptation intervention. The types of induce changes that can occur include:

- changes in the characteristics of the seabed
- effects of climate change on the benthic environment
- coastal erosion, and
- sea level rise and beach erosion

5.0 The Rationale for the development of the 5Cs airborne LIDAR capacity

Noting:

i. The urgent need for airborne LIDAR bathymetric/topographic surveys, and
ii. The high cost for conducting these surveys

The 5Cs as the CARICOM Regional Institution **mandated to** coordinate CARICOM'S response to Climate Change and its efforts to manage and adapt to its projected impacts felt that it was necessary to explore

ways for conducting the surveys at affordable cost. The Airborne LIDAR capacity developed by the 5Cs meet both requirements.

6.0 The acquisition and operationalization of the Centre's LIDAR

The Centre has, with the support of USAID, acquired a state of the art LIDAR system. Key operational personnel have been trained. To complete the operationalization of the LIDAR requires the funding being requested under this project.

The requested funds will support the following activities:

i. Lease/rental of the airborne platform
ii. System calibration and ground reference verification
iii. Baseline reference surveys

6.01 Lease/Rental of the airborne platform

The MAYA ISLAND AIR, a domestic airline in Belize, has agreed to make available one of its aircraft to the Centre on an as needed basis. An Agreement between the 5Cs and Maya Island has been provisionally agreed upon. The Centre will have the use of the aircraft, as needed, at a significantly and affordable reduced rate. It is the Airline's corporate contribution to the Region's Climate Change initiative.

6.02 System calibration and ground reference verification

Calibration and ground reference verification will be conducted during the months of December, 2018. These activities are a prerequisite to the start of the baseline surveys.

6:03 Baseline reference surveys

The baseline reference surveys will be conducted in Belize for the following reasons:

i. Belize has the only barrier reef structure in the Caribbean (second longest in the world).
ii. In addition it has the different types of reef structures found in the rest of the Caribbean
iii. It has three of the four atolls in the Caribbean
iv. It is a mainland country with similar coastal and inland topography as Guyana and Suriname

7.0 Beyond the operationalization of the LIDAR

Once the operationalization is complete the comprehensive bathymetric/topographic surveys in all CARICOM Member countries will begin. Funding for the comprehensive surveys is being provided by:

- The Caribbean Development Bank (CDB)

- The Inter-American Development Bank (IDB) under the Climate Investment Fund project: *Pilot Program for Climate Resilience (PPCR)*
- The GCF funded[1] *CCIS-RtR* project

A number of private enterprises have expressed interest in the use of the 5Cs airborne LIDAR for use in:

- topographical mapping for agricultural irrigation design
- Precision mapping of Transmission lines
- Drainage design in road design

8.0 The 5Cs LIDAR System

The 5Cs LIDAR System is similar to the NASA and NOAA systems used to conduct bathymetric and topographic surveys in the United States. The system is capable of:

(a) collecting highly accurate details of terrain and surface features;
(b) conducting critical and important bathymetric and topographic surveys;
(c) processing spatial data and information for archiving, retrieval and distribution to Member States;
(d) generating high resolution data in three dimensional formats; and
(e) supporting the development of tools for providing public access to the data and information

9.0 Applications of the survey data

The potential applications of the surveys are summarised below:

(a) ***Bathymetric data*** will provide information about the depths and shapes of underwater terrain that has a range of uses:

(i) The development and/or updating of highly accurate nautical charts required for safe and efficient maritime transportation.

(ii) The development of bathymetric maps that is important for marine scientists to learn more about the effects of Climate Change and Sea Level Rise on the environment.

(iii) The Bathymetric surveys will serve to alert scientists to ongoing and potential beach erosion, SLR, and subsidence (land sinking).

(iv) Provide scientists with bathymetric data needed to create hydrodynamic models for use in hurricane storm surge forecasting and marine engineering designs.

(v) Support the work of scientist working in biological oceanography. The depth and characteristics of the seabed define the habitat for benthic (bottom-dwelling)

[1] Project currently going through the GCF approval process

organisms, and are fundamental parameters of marine ecosystems. Scientists use high-resolution bathymetry to help determine where fish and other sea life will feed, live, and breed.

(b) ***Topographic data***, have multiple uses in the present day, including:

(i) Development of flood and landslide risk maps;
(ii) Land use planning;
(iii) Mining and related activities; and
(iv) Civil engineering and physical planning and urban design.

(c) *Inputs for Socio-economic Analysis*

The data from the surveys will provide critical input in the development of appropriate adaptive strategies in support of the agriculture, tourism and through the establishment of baselines on the status of the coastal, terrestrial and maritime environment to:

(a) determine revenue derived from the various environmental and eco-system assets;

(b) project decreases in revenue due to changes in environmental and eco-system assets (beach erosion, salt water intrusion in costal habitats, acidification, etc.) resulting from the impacts of Climate Change (CC) and Sea Level Rise (SLR).

(c) develop adaptation strategies to minimise or mitigate the impacts of CC and SLR, acidification and extreme weather events; and

(d) conducting cost benefit analysis for the implementation of the adaptive measures.

10.0 Other Benefits

10.01 Establishment of critical baselines

The surveys conducted by the Centre will enable the establishment of critical baselines as well as for repeated surveys, as needed, to update the data sets after a significant event such as a hurricane. As indicated earlier the surveys will be conducted at significantly lower cost than is available commercially.

The Centre as a regional hub will have the ability to store and standardise the data across CARICOM member states. This allows for ease of reporting, monitoring and comparison across countries.

10.02 Country ownership of processed and un-processed data

All data will be owned by the Countries. This is not the case when the surveys are conducted by a commercial institution on behalf of a country.

11.0 Project budget and Duration

11.01 Budget (Italy contribution): US$600,000

Item	Activity Description	Unit Cost (US$)	Units	Cost (US$)
1	Installation of LIDAR on aircraft	500/hr	8	4,000
2	Alignment and ground truth calibration	2000/hr	25	50,000
3	Baseline reference surveys	2000/hr	225	450,000
5	Data down loading and processing	20/hr	500	10,000
6	Project Management	250/hr	120	30,000
7	Contingency[2] @ 10%			54,400
Estimated Total				**598,400**

11.02. Duration of the Project: Ten (10) months

WP/ Task	Activities	Month									
		Dec 2018	Jan 2018)	Feb 2018	Mar 2018	Apr 2018	May 2018	Jun 2018	Jul 2019	Aug 2019	Sep 2019
Task 1	Installation of LIDAR on aircraft										
Task 2	Alignment and ground truth calibration										
Task 3a	Baseline reference surveys during dry season										
Task 3b	Baseline reference surveys during dry season										
Task 4	Data down loading and processing										

[2] The contingency reserve is to cover inadvertent activities such as:

1. The need to repeat a set of measurements due unexpected change in atmospheric/weather condition.
2. System failure during a survey mission

Sapienza Samantha

Da: Kenrick R Leslie <k.leslie@sbcglobal.net>
Inviato: venerdì 9 novembre 2018 02:44
A: La Camera Francesco
Cc: Sapienza Samantha; Vignola Emanuela; Kenrick R Leslie
Oggetto: Funding for 5Cs LiDAR
Allegati: Letter to La Camera_8Nov18 lidar project.pdf; Italian Invoice _41.pdf; 5Cs LIDAR Project_Final.docx

Dear Director General,
Attached please find the following revised documents on the captioned subject:
1. Request for funding letter
2. Invoice for the first tranche
3. Project document

Once again accept our sincere thanks for the support provided to the 5Cs and the CARICOM Countries in adaptation and mitigation efforts to the impacts of Climate change.

With kind regards,

Kenrick

KRLeslie
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Executive Director
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