University of Technology, Jamaica

Faculty of Science and Sport

4th International Scientific Conference

Science and Innovation in Response to Development Imperatives

Programme and Book of Abstracts

JULY 20 - 21, 2016

Venue: UTech, Jamaica Papine Campus - LT4

University of Technology, Jamaica

Faculty of Science and Sport

4th INTERNATIONAL SCIENTIFIC CONFERENCE

July 20 –21, 2016

"Science and Innovation in Response to Development Imperatives"

Conference Organising Committee:

Dr. Andrew Lamm, Director, Centre for Science-based Research, Entrepreneurship and Continuing Studies (CSRECS), Chair
Ms. Christine O'Sullivan, CSRECS (Abstracts Committee Chair)
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Welcome Message from the Ministry of Industry, Commerce, Agriculture and Fisheries

The Ministry of Industry, Commerce, Agriculture and Fisheries (MICAF) welcomes the staging of the **4th International Scientific Conference** by the University of Technology, Jamaica (UTech, Jamaica), under the appropriate theme: **"Science & Innovation in Response to Development Initiatives".**

We see this conference not only as a platform for local and international researchers, academicians, entrepreneurs, and policy makers to engage in meaningful discourse, but also as an opportunity for participants to showcase their research results, particularly in the context of the overall development goals of our country.

Equally important, this conference underpins the current focus of the government on promoting sustainable and inclusive development, whilst being cognizant of the fact that innovation performance is a crucial determinant of competitiveness, growth, and national progress.

Once again, we welcome this conference, and look forward to the successful outcomes.

Vivian Brown
Director General
Ministry of Industry, Commerce, Agriculture & Fisheries

Welcome Message from the Acting President

I am pleased to extend a warm UTech, Jamaica welcome to all delegates participating in the 4th annual International Scientific Conference organized by the Faculty of Science and Sport, particularly participants and presenters who have joined us from overseas.

The Faculty of Science and Sport has continued to blaze a trail with the staging of this annual conference which continues to be an important academic forum to bring national, regional and international focus on new knowledge and innovations related to bridging the gap between science, technology and our shared development imperatives.

Our country is relying heavily on this national university to provide breakthroughs in the application of science and technology to underpin economic advances and to impact improvements in health systems, in education, in infrastructure and in other areas of national life.

I am pleased that UTech, Jamaica is doing our part through research, partnerships and conferences like this one, in contributing to the advancement of public awareness and the applied knowledge of Science, Technology and Innovation in improving the human condition in Jamaica, the Caribbean region and beyond.

We look forward to your participation in an enriching exchange of ideas and to the forging of partnerships between academia and industry that will serve to influence the creation of new innovations and opportunities for economic development.

My best wishes for a successful conference.

Prof. Colin Gyles
Acting President
University of Technology, Jamaica

Message from the Dean

It is with a sense of pride and satisfaction that I welcome you to the **Faculty of Science and Sport's (FOSS) 4th International Scientific Conference**. This Scientific Conference is the continuation of a dream which was realised a few years ago with the staging of our first.

It is a direct product of the Faculty's vision which is: "To be an internationally renowned centre of excellence for the development of Science, Technology and Sport, incorporating teaching, research and service to the community". This year's theme, "Science and Innovation in Response to Development Imperatives", aims to highlight our vision and enhance our achievement of these goals.

The University of Technology, Jamaica (UTech, Jamaica) has been accepted as the "Home of World Class Athletes". I dare say we are and have been more than that. We are no doubt the "Home of World Class Minds". In fact, even before we acquired University status, our graduates demonstrated a competence which saw them embraced in first world countries. That was the strength of our system. We have built on that and have now graduated "World Ready" students in all our offerings.

Through this, our 4th International Scientific Conference, we intend to continue our journey of claiming our rightful place in the scientific world and in so doing aid in the development of our country, the region and the wider world.

Investment (monetary and academic) in science, technology and innovation acts as an engine for long-term development, and is an essential ingredient to achieving many developmental goals set by our country. The spending on science and technology research in universities must be escalated and top science graduates must be retained, encouraged and supported if Jamaica and the Caribbean are to become competitive in the global economy.

Indigenous knowledge needs to be harnessed and developed, with benefits accruing to the country's people through usage of the products, earnings for the people and savings. Our own Dr. Andrew Lamm is currently researching the medicinal properties of some of our indigenous plants and is supervising our graduate student O'Brien Brown along a similar path and already has unearthed properties which could lead to some very interesting and beneficial findings. Research Fellow Maurice McGlashan-Powell is doing cutting edge work in optics, photonics and computer technology. There is also Christine O'Sullivan who is making a name for herself in Marine Research as well as Dr. Aneisha Collins-Fairclough who has done research and published on the HIV Drug Resistance Surveillance among Jamaican men who have sex with men.

What the above speaks to is our emphasis on, and embracing of, research. New knowledge, we believe is one of the avenues that will see us do in the field of Science as we do in Sport and Entertainment, punch above our weight. With successive governments embracing our vision and focusing our educational path on STEM, (Science, Technology, Engineering and Mathematics), it is my view that positives will come.

Among the areas that we will be exploring are Energy Security with presentations by Denise Tulloch, Candice Edwards and Niconnor Reece who have done research into the economics of locally-grown castor oil and jatropha as agroenergy crops, and their conversion to biodiesel for use in the transport sector. Earle Wilson will explore the use of Hydrogen gas as fuel for cooking.

The exposure afforded to our staff members and the interaction and collaboration with our regional and international colleagues can only serve to enhance our efforts and elevate our standards/reputation as an institution and a country. We trust that you will open your minds and walk with us into the new dimension where 'world class' will be our definition.

Welcome and best wishes.

Kamilah Hylton, PhD
Associate Professor
Dean
Faculty of Science and Sport

Conference Overview

As Conference Chairman, it is my distinct pleasure to welcome you to the Faculty of Science and Sport's 4th International Scientific Conference (FOSSCON). Your presence truly makes this event that much more special. Our theme: "Science and Innovation in Response to Development Imperatives" was selected given the growing need for new technologies to drive regional and national development. Old traditional methods of labour intensive agriculture; perception dependent tourism; and unrestricted mining cannot be the methods used to drive developing economies.

Therefore, we must refocus our efforts into finding new science based approaches to solve our existing dilemmas and chart bold and innovative new solutions for the next hundred years. We are excited by the wide array of ideas that will be presented at this conference and look forward to the robust discussions to follow. More importantly, we encourage the active assessment and future implementation of some of these presentations. It is our hope that "FOSSCON 2016" will not only be a means of academic exchange but also a means of affecting policy

You will notice that we are making every effort to go paperless and we hope that you appreciate and use the thumb drives provided in your conference package. Please bring along your tablets and laptops as Internet access is provided over the two days of talks.

I must express my sincere appreciation to the conference organising committee for their continued support and hard work. Without them, this event could not be a reality. I continue to feel blessed to have the opportunity to work with such a great team. I sincerely thank our partners for their support financially and in-kind especially during these difficult economic times. Last but not least, we thank our presenters, session chairs, staff, students, colleagues and friends for participating in this event.

Andrew Lamm, PhD
Senior Lecturer and Principal Investigator, Natural Products Research Laboratory, UTech
Director, Centre for Science-based Research, Entrepreneurship and Continuing Studies (CSRECS)
Chair, Organising Committee

Acknowledgments

The organising committee wishes to thank the following organisations for their support:

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National Development Plan

Keynote Speaker
Dr. Cliff Riley
Executive Director
Scientific Research Council

Dr. Riley holds a PhD in Biotechnology (Pharmaceutical), a M.A in Teaching-Science Education, and a Bachelor of Science Degree in Chemistry and Biochemistry from the University of the West Indies, Mona. He is currently the Executive Director of the Scientific Research Council, Jamaica. Dr. Riley has served in several capacities including, Associate Professor and Associate Dean, Graduate Studies and Research in the College of Health Sciences, University of Technology, Associate Director of Research and Grants at Northern Caribbean University and Research Scientist at the Scientific Research Council. He has done extensive research and published over 90 scientific papers in diabetes management and prevention, nutrition, food technology, pharmaceutics, polymer chemistry, natural products and science education. Additionally, he has served the scientific community both locally and internationally and is an active member of several professional organizations including the Biochemical Society, UK, the Society for Scientific Advancement, and the Caribbean Academy of Science. Additionally, he served as Chairman of the Board of Directors of the Jamaica National Agency for Accreditation (JNAAC) from 2012 – 2015 and is currently a Board Member of the Diabetes Association of Jamaica and a Director for the Carnegie Foundation for Cancer Research, Trustee to the Environmental Health Foundation, Commissioner of the National Commission on Science and Technology, Member of the Board of Graduate Studies, UTech among others. In 2006 Dr. Riley was awarded the JPS/SRC Young Scientist of the Year, in 2007 the Northern Caribbean University President Award for Research and the Taylor Hall-Attica Fraternity Award for Outstanding Contribution to Society, in 2009, the UWI Mona Principal Award for Best Publication and in 2010, the UTech, Jamaica President Award for Research. Dr. Riley is married and enjoys fishing and hiking in his spare time.

Conference Programme
4th International Scientific Conference
Venue: Lecture Theatre 4, Faculty of the Built Environment
University of Technology, Jamaica

DAY 1: WEDNESDAY, JULY 20 VENUE: LECTURE THEATRE 4	
8:00 am – 9:00 am	Registration
9:00 am – 10:45 am	**Opening Ceremony** **Chair: Nodley Wright, Executive Assistant to the Dean, Faculty of Science and Sport** **National Anthem** **Welcome** Professor Colin Gyles, Acting President, University of Technology, Jamaica **Overview of Conference** Dr. Andrew Lamm, Director, Centre for Science-based Research, Entrepreneurship and Continuing Studies, Conference Chair **Greetings** Associate Professor Kamilah Hylton, Dean, Faculty of Science and Sport Mr. Vivian Brown, Director General, Ministry of Industry, Commerce, Agriculture and Fisheries **Introduction of the Keynote Speaker** Dr. Aneisha Collins-Fairclough, Head of Division, Research and Graduate Studies, Centre for Science-based Research, Entrepreneurship and Continuing Studies **Keynote Address – Dr. Cliff Riley, Executive Director, Scientific Research Council** ***"Bridging the Scientific Divide: Research Supporting Innovation"***
10:45 am – 11:00 am	Coffee Break
11:00 am – 12:00 pm	***Session 1: Energy Security*** ***Chair: Dr. Ruth Potopsingh, UTech, Ja.*** **Denise Tulloch**, Candice Edwards, Niconor Reece – Research into the economics of locally grown castor and jatropha as agroenergy crops, and their conversion to biodiesel for use in the transport sector. **Earle Wilson** – Hydrogen gas as a fuel for cooking: The safe practical solutions.
12:00 – 12:30	***Partner Presentation – Petrojam*** **Rochelle Bramwell –** Saving energy 1 kWh at a time.

12:30 pm – 1:30 pm	Lunch Lillian's Restaurant, UTech, Ja. & Room 4A-3
1:30 pm – 2:45 pm	***Session 2: Health and Medicine I*** ***Chair: Dr. Andrew Lamm, UTech, Ja.*** **Rasheed Perry**, Judy Thomas, Andrew Lamm, Marcia Williams, Donald Land – Jamaica's green gold profile: An analytical approach. **Aisha Jones** – Jamaica's national nutraceuticals industry: A review of prospects, players and progress. **O'Brien Brown**, Debbie-Ann Gordon-Smith, Andrew Lamm – The phytochemical analysis of *Verbesina karsticola Proctor*.
2:45 pm – 2:50 pm	Break
2:50 pm – 4:05 pm	***Session 3: Health and Medicine II*** ***Chair: Dr. Cecelia Waugh-Hall, UTech, Ja.*** **Cressana Williams-Massey**, Roy Porter – Jamaican pimento oil and its antioxidant and antimicrobial activity. **Marco-Dean Brown** – The molecular epidemiology of *Angiostrongylus cantonensis* in Jamaica. **Nicole Cameron** – Risk, trust and information: Jamaicans' risk perceptions, trust levels and key information sources for information on infectious diseases.
4:05 pm – 4:15 pm	Coffee Break
4:15 pm – 4:50 pm	***Session 4: Agriculture and Food Security*** ***Chair: Mr. Damian Nesbeth, UTech, Ja.*** **Raymond Martin** – Organic production as a response to the impact of climate change on food security in Jamaica.
5:30 pm – 7:00 pm	Welcome Reception Lillian's Restaurant, UTech Ja.

DAY 2

DAY 2: THURSDAY, JULY 21 VENUE: LECTURE THEATRE 4	
8:30 am – 9:00 am	Registration and Morning Coffee
9:00 am – 10:15 am	***Session 5: Entrepreneurship and Innovation*** ***Chair: Dr. Kadamawe Knife, UWI, Mona*** **Kadamawe Knife**, Kethania Griffiths – An examination of entrepreneurial thinking and practice among private sector companies in developing countries; the case of Jamaica. **Paul Ivey** – Valorising innovative research results: A paradigm shift at Jamaica's national university. **Maurice McGlashan-Powell** – Magneto acoustic emission and recent advances in magneto-optics and photonics.
10:15 am – 10:20 pm	Coffee Break
10:20 am – 11:55	***Session 6: Advancing STEM Education*** ***Chair: Dr. Leonie Clarke, UTech, Ja.*** **Shermaine Barrett,** Hope Mayne – Science, technology, engineering and mathematics (STEM) methodology in action. **Eddia Solas**, Kenesha Wilson – Using sketches for formative assessment in general education science classrooms. **Susan Muir** – Are Jamaican universities fulfilling their responsibility to protect research participants? A review of research ethics capacity in Jamaica. **Andrea Barrett**, Silburn Clarke – The development of a creative class – An innovation imperative.
11:55 pm – 12:55 pm	Lunch Lillian's Restaurant, UTech, Ja.& Room 4A-3

DAY 2: THURSDAY, JULY 21 VENUE: LECTURE THEATRE 4	
12:55 am –2:10 pm	***Session 7: Environmental Conservation, Threats and Mitigation I*** ***Chair: Dr. Kamilah Hylton, UTech, Ja.*** **Damian Whyte**, Uta Berger, Luna Soledad, Eric Garraway – A population viability analyses using the Vortex software to examine the main parameters that will influence the survival of the Jamaican Iguana (*Cyclura collei*) in the next 50 years. **Myrna Ellis** – An investigation of the extent to which cruise tourism and its activities have threatened the physical-ecological tourism carrying capacity level in the marine environment. A pilot study of St. Lucia. **Donovan Hay** – Towards adaptive management of hunting of columbid gamebirds in Jamaica.
2:10 pm – 2:25 pm	Break
2:25 pm – 3:40 pm	***Session 8:Environmental Conservation, Threats and Mitigation II*** ***Chair: Dr. Debbie Devonish, UTech, Ja.*** **Christine O'Sullivan**, Ricardo Antunes – Depredation of Antillean fish traps by bottlenose dolphins (*Tursiops truncatus*) in Jamaica. **Donovan Hay**, Ann Haynes-Sutton – A preliminary assessment of the status of the breeding seabird population of the cays in the Portland Bight Protected Area, Jamaica. **Ruth Potopsingh**, Omar Alcock, Roberto Ellis – Global fuels efficiency initiative: Jamaica's progress.
3:40 pm – 4:10 pm	Closing Ceremony

ABSTRACT – Keynote Address

Dr. Cliff Riley
Executive Director
Scientific Research Council

"Bridging the Scientific Divide: Research Supporting Innovation"

Advancing the Research and Innovation agenda for any institution and, by extension a country, cannot be disjointed or individualistic. These discussions have, and continue to find, place in the public space especially amongst policy makers. This holds true in today's society as scientists are charged not only to uncover or discover new knowledge but also, and even more importantly, to translate this knowledge into a useable and understandable form. The solutions-driven approach is gaining more and more traction, evidenced by the constant debates on basic or applied research as well as the role of universities in innovation and technology transfer. However, traversing the unpredictable and at times troubling waters is never easy or attractive enough for our local scientists to risk. This therefore leads to the question, "how do we bridge this scientific divide?" or better yet, "how do we translate our knowledge to support innovation?"

It is a known fact that the challenges faced by policy makers globally revolve around translation of scientific knowledge into understandable and usable forms with the desired result of creating solutions. The dynamics of knowledge transfer while maintaining the integrity and meaning of such knowledge to the public and policy makers continues to challenge governments and scientists in general. This will require partnership; buy-in from public and private interest groups as well as strategic planning, vision and financing. It has been shown globally that cross-institutional collaborative approaches result in far more successes than individualistic approaches.

Knowledge is in fact power. However, the use and packaging of such knowledge is even more important than the knowledge itself. As such, the presentation will focus on strategies and scientific approaches that have been shown to build trust and support national development through synergistic partnerships between researchers, manufacturers, policy makers and members of the public.

ABSTRACTS – Oral Presentations

Session 1: Energy Security

Research into the Economics of Locally Grown Castor and Jatropha as Agroenergy Crops, and their Conversion to Biodiesel for use in the Transport Sector

Denise Tulloch, Candice Edwards and Niconor Reece
Petroleum Corporation of Jamaica

Castor and Jatropha plants produce seeds with oil contents ranging from 40 – 55%. The fatty acids contained in these seeds can be converted to biodiesel using the transesterification reaction process. The Castor bean plant, *Ricinus communis*, belongs to the Euphorbiaceous family and grows wild in Jamaica. Several varieties of castor oilseeds from Jamaica, Brazil, China and India were cultivated in local trials on marginal and mined out bauxite lands to compare their productivity and oil content and to research the economics of growing these oilseeds. Additionally, Jatropha oilseeds from India were cultivated.

Over the past four years, the Petroleum Corporation of Jamaica (PCJ), an implementing arm of the Ministry of Science, Energy and Technology (MSET), in collaboration with the Ministry of Industry, Commerce, Agriculture and Fisheries (MICAF) and the Caribbean Agriculture Research and Development Institute (CARDI) have demonstrated the relative yields of various plant varieties and assessed the economics of cultivating and harvesting these plants on 6.5 hectares of marginal and mined out bauxite lands.

Researchers have identified the challenges that farmers may face in cultivating these crops and extracting and converting the castor and jatropha oils into biodiesel. The biodiesel was tested in keeping with the requirements of the local standard, which is the American Society of Testing and Materials (ASTM) 6751, gazetted by MSET in June 2013.

Hydrogen Gas as a Fuel for Cooking: The Safe Practical Solutions

Earle Wilson
University of Technology, Jamaica

Jamaica imports over 90% of its energy, and with the fluctuating price of oil, its energy security is unstable. The country spends in excess of US$30M per year on LPG which is predominantly used as cooking gas. In light of this instability in energy security, the Government of Jamaica seeks to diversify its energy mix, to include 20% renewables by 2030.

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Hydrogen has approximately two and a half times the energy content of liquefied petroleum gas (LPG). It is renewable, sustainable, abundant, and can be produced by electrolyzing water using photovoltaics (conversion of solar energy, sunlight, into direct current electricity). Hydrogen is therefore an exciting prospect for Jamaica and other oil importing countries with abundant sunlight and water as natural resources.

However, before hydrogen gas can be used as a fuel for cooking on a "regular" gas stove and cylinder system, there are technical issues to be addressed; this paper confronts these issues and outlines safe and practical solutions to resolve them.

Session 2: Health and Medicine I

Jamaica's Green Gold Profile: An Analytical Approach

Rasheed Perry[1], Judy Thomas[1], Andrew Lamm[1], Marcia Williams[1] and Donald Land[2]
[1]*University of Technology, Jamaica*
[2]*SteepHill Labs, USA*

Cannabinoids such as THC and CBD are known to have varying medicinal benefits including analgesic, anti-inflammatory and immunosuppressive properties. Our study therefore looked at over 50 cannabis plants, which were voluntarily submitted for analysis. Samples tested utilized the raw plant material and plant extracts. Analysis was conducted using the QuantaCann 2 instrument from SteepHill Labs and a Waters HPLC instrument. From our sample set, the analytical findings indicated that Jamaica has chemotypes I, II and III. According to Aizpurua-Olaizola et al (2015), cannabis spp that are classified as drug-type are classified based on the ratio of cannabinoids present; THCA: CBDA. Those classified as chemotype I had a THCA: CBDA ratio >>1.0, chemotype II 0.5 – 2.0 and chemotype III <<1.0. The initial testing of the raw plant material was conducted with the QuantaCann 2, which revealed an average THCA content of 11.45 percent and CBDA of 6.55 percent. Of the samples analyzed, Forty-four (44) were found to be chemotype I, Seven (7) samples chemotype 2 and three (3) samples were to be chemotype III. The highest THCA content was recorded at 19.8% with less than 2% CBDA while the highest CBDA content recorded was 10.3% with less than 2% THCA. It was concluded that the primary chemotype available within the Jamaican landscape is that of chemotype I. This indicates that the main constituent of the plants are THC, from a drug development perspective, this indicates that the plants have good analgesic properties and thus are good pain modulators.

Jamaica's National Nutraceuticals Industry: A Review of Prospects, Players and Progress

Aisha Jones
National Commission on Science and Technology, Jamaica

Entrenched in Jamaica's heritage is the use of locally found plants to prevent and treat diseases and maintain well-being. This folk tradition has the potential to revolutionize the local and international health sector by providing alternative nutraceutical products and services. 'A nutraceutical is a food or parts of food that offer medical-health benefits, including prevention and/or treatment of disease.' Today, the global nutraceuticals industry is valued at US$207 billion. With Jamaica's unique biodiversity, tropical climate and rich ethno-botanical heritage, tremendous prospects to carve our share of this massive market exist. However there are limited and uncoordinated regulations and standards for fledgling enterprises and this puts public health, intellectual property and the natural environment at risk. As such the National Nutraceuticals Industry (NNI); led by a multi-sectoral committee, was launched in 2015 to formalize all players in the industry. This paper will detail the recent developments in the NNI, a historical analysis on the local industry and the diversity of the natural resources with proven and potential health benefits. A critical analysis of the role of the public, private and academic communities in the advancement of the NNI will also be presented.

The Phytochemical Analysis of *Verbesina karsticola Proctor*

O'Brien Brown[1], Debbie-Ann Gordon-Smith[2] and Andrew Lamm[1]
[1]*University of Technology, Jamaica*
[2]*University of the West Indies, Mona Campus*

Natural products have been, are and will continue to be a major source of new drugs and commercially viable products because they offer great structural diversity. There are many undiscovered bioactive compounds within endemic species in Jamaica. This study sought to investigate the phytochemical constituents of *Verbesina karsticola* to search for new compounds and properties which demonstrate value added, medicinal or agricultural potential and also to add informative scientific data on traditional plants in Jamaica.

Verbesina karsticola Proctor is a species from the family Asteraceae. It is an endemic Jamaican shrub that is found in the Cockpit Country. The antimicrobial efficacy of the plant extract was investigated against four pathogenic bacteria, namely: *Pseudomonas aeruginosa*; *Escherichia coli*; *Staphyloccocus aureus* and *Bacillus subtilis*. Plant extracts were obtained via solvent percolation and *en vacuo* concentration. Crude extracts were subjected to Disc Diffusion Assay using a modified Kirby-Bauer method. The results indicated that growth of *Bacillus subtilis* was inhibited by the plant extract, with an 11 mm zone of inhibition. Additional phytochemical analysis revealed the presence of saponins, quinones, steroids and coumarins in the extract. Bioautography analysis guided the isolation and structure elucidation of two known compounds, bornyl caffeate and dehydroxy bornyl caffeate. A Unique HPLC method was developed to successfully separate compounds by gradient elution on a reverse phase C18 semi prep column with silica column guard. These structures were elucidated based on spectroscopic analysis using 1D and 2D Nuclear Magnetic Resonance (NMR) Spectroscopic techniques.

Session 3: Health and Medicine II

Jamaican Pimento Oil and its Antioxidant and Antimicrobial Activity

Cressana Williams-Massey, Roy Porter
University of the West Indies, Mona Campus

Pimenta dioica commonly called Pimento, English Spice, Jamaica pepper and a host of other names, is a known medicinal plant in different areas of the world. The aqueous extract of the *Pimenta* berries and leaves, is commonly consumed as a tea to treat gastrointestinal discomforts such as: nausea, flatulence and diarrhoea. Health benefits are not only to be found in the aqueous extracts, but also in the plant oils, which have been proven to exhibit: antimicrobial, acaricidal, antioxidant and anaesthetic properties. Additionally, *Pimenta* oil is used as a muscle relaxant, and is also used in aromatherapy to help treat depression, stress and nervous tension.

To better understand the properties of foliar *Pimenta* oil, an investigation was carried out on seven *P. dioica* plants- six from the parish of Westmoreland and one from the parish of Manchester. The oils were extracted by means of hydrodistillation using the Clevenger apparatus. They were then analysed by Gas Chromatography and the different components were identified by means of their calculated Kovat's retention index values. Two bioassays were carried out on the extracted oils to determine their antimicrobial activity and their antioxidant capacity. The essential oils have shown varying levels of antimicrobial activity when tested by means of paper-disk agar diffusion method, against select bacteria and fungi, and have proven to be very potent in their radical scavenging activities against the DPPH radical, even at concentrations below 10µg/ml.

The Molecular Epidemiology of *Angiostrongylus cantonensis* in Jamaica

Marco-Dean Brown
University of West Indies, Mona Campus

Angiostrongylus cantonensis is an emerging cause of human eosinophilic meningitis in Jamaica. It has been associated with mild self-limiting infections, severe disease and deaths. *A. cantonensis* which is known as the rat lungworm is a common parasite of rats in Jamaica and is transmitted between rats and molluscs in nature. Humans become infected by accidental ingestion of infective larvae on vegetable material.

This study highlights the prevalence and intensities of the parasite in the local definitive hosts, *Rattus rattus* and *R. norvegicus,* as observed by Lindo et al. (2002) and Waugh et al. (2005). Additionally, the study highlights the previously identified intermediate hosts of the parasite and the reported cases of eosinophilic miningitis & *Angiostrongylus cantonensis* infections in Jamaica.

Improvements in the molecular methods used for detection of the parasite in snail tissue allows for rapid and accurate identification of infected snails and slugs. Furthermore, quantitative polymerase chain reaction (QPCR) allows workers to estimate how heavily infected snails are and therefore their likelihood to be involved in transmission to humans. The importance of a particular mollusc in the transmission of *A. cantonensis* in Jamaica will be determined by the proportion of molluscs infected with *A. cantonensis* (prevalence), the larval burden (intensity) in the infected molluscs, and abundance of infected molluscs in the ecosystem and the geographical proximity of infected molluscs to human communities with confirmed cases of infection.

Angiostrongylus cantonensis infections present several challenges in epidemiology, public health and clinical management. Therefore ascertaining information on the presence of the parasite and the mode of transmission will aid in better management and reduction of human infections.

Risk, Trust and Information: Jamaicans' Risk Perceptions, Trust Levels and Key Information Sources for Information on Infectious Diseases

Nicole Cameron
Washington State University
University of Technology, Jamaica

Between 2015 to 2016, both the Jamaican government and the citizens of Jamaica had to grapple with the realities of the Zika virus and the H1N1 disease popularly known as swine flu. In the face of any infectious diseases it is important that citizens of any nation understand the risks involve and take the necessary precautions to protect themselves. At the heart of decision-making in instances like these are the information sources that feed public knowledge and simultaneously individual trust levels in the public actors that are charged with educating the public on the spread of diseases and how to safe guard their heath, that of their families and the wider nation. The current study reports the results of a survey fielded in April 2016 on Jamaicans' perceptions of risk, trust in different social actors and information sources in regards to the Zika virus and the H1N1 virus. Results indicate that risk perceptions for both diseases are relatively low in Jamaica. In addition, older Jamaicans are more likely to trust the government than younger Jamaicans but overall, Jamaicans do not exhibit high levels of trust in the government in regards to information and competence in dealing with the Zika virus and the H1N1 virus. Additionally, television news, radio news and social media dominate as the main information sources. The implications of these and other findings for the communication of health risk, risk perceptions and trust are discussed.

Session 4: Agriculture and Food Security

Organic Production as a Response to the Impact of Climate Change on Food Security in Jamaica

Raymond Martin
University of Technology, Jamaica
Jamaica Organic Agricultural Movement

There are increasing concerns about the effects of climate change on food security. The Food and Agriculture Organisation (FAO) estimates that losses to the agricultural sector due to major climate events between 1994 and 2010 amounted to J$14.4 billion. Climate events implicated in these losses include hurricanes, floods, landslides, droughts and heavy winds. Other impacts on the sector include saline intrusion due to rising sea levels, increasing pest pressure and heat stress. Organic agriculture is standards based and prescribes practices which make farms more climate resilient. Certified organic producers must implement soil and water management practices and maintain biodiversity. Incorporation of organic matter is a practice commonly used by organic producers. According to the French Agriculture Ministry a 0.4% annual growth rate in soil carbon content would stop the increase in global carbon dioxide levels and limit global temperature increase to between 1.5°C and 2°C. Reducing this temperature increase would decrease the likelihood of climate disaster, as predicted by the Intergovernmental Panel on Climate Change (IPCC). This paper explores some of the climate challenges being faced by the Jamaican agricultural sector and puts forward the case for organic agriculture as a solution.

Session 5: Entrepreneurship and Innovation

An Examination of Entrepreneurial Thinking and Practice among Private Sector Companies in Developing Countries: The Case of Jamaica

Kadamawe Knife, Kethania Griffiths
University of the West Indies, Mona Campus

The Jamaican economy has been underperforming for the past five decades, reflecting almost negative growth. Despite several World Bank and International Monetary Fund programmes the country continues to underperform. It is argued that there is little innovation within traditional mature sectors (sugar, bauxite, tourism), and a dormant dependent private sector, suggesting an absence of creativity and innovation. Creativity and innovation are the foundations for entrepreneurial thinking and practice and is what drives companies and sectors growth trajectory over their life cycle. The government is still has the view that these companies and sectors will be the engine of growth for Jamaica. It is thus imperative to assess if these companies and/or sectors do encourage entrepreneurial thinking and practice; which would justify the government's decision.

The paper examines and presents the findings from over 150 entrepreneurship audits and marketing inventions carried out by Master of Business Administration students at the Mona School of Business Management/University of the West Indies, Mona. Audits were done on companies across various sectors, in which the students worked, most being middle managers. They assessed if the company encouraged, facilitated and embraced innovation. Additionally it presents what they recommended as marketing inventions/innovations that the organisations could adopt to propel growth. The findings will add to the sparse body of literature on supporting entrepreneurship innovation, within developing countries; to inform policy that promotes and incentivises innovation; and provide direct guidance to the companies examined, on how to generate meaningful innovation in the company.

Valorising Innovative Research Results: A Paradigm Shift at Jamaica's National University

Paul Ivey
University of Technology, Jamaica

Caribbean higher education institutions (HEIs) are faced with declining public funding support from regional governments. Because of this vulnerability, they must seek alternative funding streams such as commercialization of their research results. In this paper, reflection and the scholarship of integration are used to highlight, using a recent example of an internally-funded research project, how the University of Technology, Jamaica (UTech, Jamaica) is facilitating a paradigm shift by capturing for commercial exploitation the value that inheres in research results. The role of the university's research management office as a helpful intermediary, the lessons learnt, and the "pathway to impact"- where evidence of the translation of research into impacts is usually manifested - of the cited example are also discussed. It is concluded that taking the results of this research project from "lab to market" holds extremely important lessons for other researchers at UTech, Jamaica, students of the university, and other Caribbean higher education institutions (HEIs) in that the actions described herein represent a "live" demonstration of the process of converting science into tangible value that has income-earning potential (i.e., "capitalization of science").

Magneto Acoustic Emission and Recent Advances in Magneto-Optics and Photonics

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Recent advances in the areas of Magneto Acoustic Emission (MAE) (the generation of ultra sonic waves using magnetic fields), magneto-optics, and photonics will be presented. The technological implication of the research and development in these areas will be discussed in the context of technological and economic development. The developments of technologies based on the ongoing research in optical interconnect and optical computing will be presented. Also presented is the possible application of MAE in the areas of acoustic microscopy, ultra sound imaging, phononic computing (computers based on sound or phonons) and ultra sonic levitation. Finally methods and possibilities of incorporating these cutting edge and innovative technologies into entrepreneurial and business opportunities will be discussed.

Session 6: Advancing Science, Technology, Engineering and Mathematics (STEM) Education

Science, Technology, Engineering and Mathematics (STEM) Methodology in Action

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This exploratory research project sought to develop an understanding of the STEM methodology in practice. The study grew out of the Ministry of Education's decision to employ the STEM methodology as the main approach to the delivery of its newly developed National Standard Curriculum. The main purpose was to advance our understanding as teacher educators of the problem/project-based methodology which undergirds STEM teaching and learning. The study engaged a team of teacher educators and 'teachers in training' who sought to connect theory to practice. The conceptual framework of the study was framed on the idea of ***'learning in action'***. Data were collected via observation, reflection, and focus group. A thematic analysis was used to analyze data. Preliminary findings revealed both strengths and challenges in using the methodology. Some indicators from the teacher trainees were that the methodology was exciting, excellent, fascinating and a life method. On the other hand it was time consuming; required in-depth research knowledge and intense preparation. The significance of this study lies in its contribution to the practice of teacher preparation for STEM teaching and learning. It also has the potential to inform the professional development of in-service teachers within the context of the new National Standards Curriculum in Jamaica.

Using sketches for formative assessment in general education science classrooms

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According to Black and Wiliam (2009), conventional formative assessments may be grouped into areas of questioning, providing criteria for assessment – as in the case of rubrics, written feedback through comments, peer- and self-assessment and summative assessment. While each of these methods undoubtedly have their strengths, they can be time-consuming and exhausting for instructors and not prompt enough for students. In the UAE environment, where the majority of students in higher education federal institutions are taught in English, and the mother tongue is Arabic, it is imperative that students are supplied with clear instantaneous formative assessment, for learning to take place inside classrooms. The literature shows a paucity of detailed, prompt formative assessment techniques that are both student and instructor friendly.

This study describes the use of student-generated concept sketches to formatively assess students inside general education science classrooms. One hundred and fifty female students participated in the study. Sketches were collected over two semesters and were done both individually and in small groups. The results show that the technique is effective as a formative assessment tool in its promptness, clarity of instructor feedback, ease of execution and active engagement of students. Students' understandings, misconceptions, alternative conceptions and gaps in knowledge were easily identified and assessed.

Are Jamaican Universities Fulfilling their Responsibility to Protect Research Participants? A Review of Research Ethics Capacity in Jamaica

Susan Muir
University of Technology, Jamaica

Research is an essential part of academia, and it is imperative that human subject research proposals should be reviewed independently within universities. It is as important to assess scientific quality as it is to ensure that research participants are protected from harm. To this end, it is critical that a Research Ethics Committee (REC) consider pertinent questions, including: "Does a proposed study satisfy ethical principles of beneficence, autonomy and justice?" and "Is a proposed study design likely to provide a valid answer to the research question(s)?" This presentation will present an overview of the research ethics (RE) capacity at two leading Jamaican universities. In this case, research ethics capacity includes the level of RE training; the quality of RE legislation, regulation and policy; as well as institutional resources to support RE review, monitoring and enforcement. Currently, while the level of RE training is increasing among Jamaican REC members, it is typically inadequate among Jamaican researchers. Similarly, while research ethics policy formulation at two leading Jamaican universities can be deemed sound, there are notable challenges in policy implementation and monitoring. Finally, it is clear that limited institutional resources adversely affect Jamaican RECs. Practical suggestions to address the gaps in research ethics capacity will be outlined, including the role of policy entrepreneurs to respond to opportunities for marked improvements in policy formulation, implementation and monitoring. Lessons presented could be utilized to improve the protection of the rights and safety of human subjects in research projects across the Caribbean and other developing countries.

The Development of a Creative Class – An Innovation Imperative

Andrea Barrett[1], Silburn Clarke[2]
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[2]*Labour Market Reform Commission, Jamaica*

As developing economies struggle to be more efficient and effective; developing a national innovation agenda has become an important national development imperative. The presentation intends to review and present supporting literature on the emergence of the creative class from a knowledge-based society as critical to the development of an innovative culture within a nation. The role of the creative class in the development of an entrepreneurial society and sustained socio-economic development of a country is examined and presented.

The presentation intends to highlight the importance of educational reform across all cohorts in the education trajectory, the creation of a national research and development (R&D) culture, the development of a robust infrastructure supporting the formation of a distinctive creative class. It also examines the role of public policy in managing the 'creative class'.

The authors propose that for this oral presentation, we shall present the criteria required in the establishment of the creative class of a nation. The research shall apply the use of secondary data in a review of the variables present within Jamaica ecosystem as a national imperative in the development of its creative class.

The presentation shall outline a call for action for the involvement of major stakeholders as the creative class develops to place the country on a sustainable development path. A *creative class* is regarded as one major factor in Jamaica being regarded as developing the ***competitive edge*** within the Caribbean region.

Session 7: Environmental Conservation, Threats and Mitigation I

A Population Viability Analyses Using the Vortex Software to Examine the Main Parameters that will Influence the Survival of the Jamaican Iguana (*Cyclura collei*) over the Next 50 Years

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[2]*Technische Universitat Dresden (Dresden University of Technology), Germany*

Over the past 20 years, the Jamaican Iguana Recovery Programme was very successful in increasing the population in the wild; however the success of the programme has not resulted in a change in the conservation status of the Jamaican Iguana, *Cyclura collei*, from critically endangered. In addition, there are several factors that still threaten the long term survival such as funding for the recovery programme, high predation of eggs and juveniles, risk of the lack of genetic variability and habitat loss.

This study presents a Population Viability Analysis using the Vortex software to model parameters that will impact the survival of the Jamaican Iguana population over the next 50 years. This would be used to inform recommendations for the improvement of the Jamaican Iguana Recovery Programme.

The model suggested that within the next 50 years, juvenile mortality and hurricanes will have a negative impact on the survival of the Jamaican Iguana under the current management programme; while, inbreeding, which was expected to decrease both genetic variability and population growth, would not have a negative impact. The "Head start" programme has also been shown to be very effective in reducing the risks of extinction in the worst case scenario (a combination of high juvenile mortality, inbreeding and hurricanes) over the short term.

An Investigation of the Extent to which Cruise Tourism and its Activities have Threatened the Physical-Ecological Tourism Carrying Capacity Level in the Marine Environment. A Pilot Study of St. Lucia

Myrna Ellis
University of the West Indies, St. Augustine Campus

Globally, cruising is growing at a rate of 7.5% annually. In St. Lucia, approximately 640,000 cruise passengers and 386 cruise ships arrived on the island during the 2014/2015 cruise season. Consequently, St. Lucia has expanded its berths to accommodate up to 6 large cruise ships. This level of growth results in frequent and severe impacts to the fragile ecosystems of Caribbean islands. According to Wilkinson (2006), the tourism carrying capacity (TCC) of islands for this specific activity should be determined.

This research used indicators (Coccossis and Mexa 2004) to signal changes observed in the marine environment and the consequent threat posed to the physical-ecological TCC and also examined management strategies (Ormans 1999) for minimizing these threats. The methodology employed concurrent triangulation mixed method (Creswell 2009) in which both quantitative (284 questionnaires) and qualitative (2 focus groups and 8 interviews) data were collected concurrently and compared.

The results indicated that significant changes in the marine environment (depletion of fish populations, coral damage, pollution of the Castries harbor, oil slicks on the water surface near reefs and an increase in solid waste on beaches and at the reef) have been observed over time and pose a threat to the physical-ecological TCC. The main driver for these changes may be the unregulated increase in activity in the marine environment by vessels including cruise ships. Enforcement of existing regulations and environmental education were identified as the most effective mitigation strategies.

Towards Adaptive Managemement of Hunting of Columbid Gamebirds in Jamaica

Donovan B. Hay
Caribbean Coastal Area Management Foundation
Jamaica

Sport hunting of columbid gamebirds (White-crowned Pigeon *Patagioenas leucocephala*, White-winged Dove *Columba asiatica*, Mourning Dove *Columba macroura* and Zenaida Dove *Zenaida aurita*) has a long cultural tradition in Jamaica and is economically important in many rural areas. Thus it is important that the longterm sustainability of the harvest is ensured. In many countries, such as Puerto Rico, this is done through adaptive management.

In Jamaica, hunting is managed under the Wild Life Protection Act. Season dates, species that can be hunted and bag limits for each species are fixed annually by the Minister on the advice of the Gamebird Committee and the Natural Resources Conservation Authority. However the government is yet to adopt an adaptive management approach to setting limits to hunting and gamebird management. This means that there is a risk that populations may decline as a result of a combination of over-hunting and external factors (such as habitat loss, hurricanes or drought).

Currently the information available to decision-makers includes the returns from the hunters from the previous year (which are unreliable for several reasons) and data from a few standard field surveys. If hunting is to be sustainable in the long term it is necessary to persuade the decision-makers to adopt a science-based decision-making process, based on adaptive management.

To do this we need more research into the ecology of Jamaica's gamebird populations and the habitat they require. Identification of their primary breeding areas, assessment of the effect of rainfall breeding success and the effect of the scale and impacts inter-island migration.

Session 8: Environmental Conservation, Threats and Mitigation II

Depredation of Antillean Fish Traps by Bottlenose Dolphins (*Tursiops truncatus*) in Jamaica

Christine O'Sullivan[1], Ricardo Antunes[2]
[1]*University of Technology, Jamaica*
[2] *Wildlife Conservation Society, New York*

Depredation from artisanal Z-shaped Antillean fish traps by dolphins has been reported by fishers in Jamaica since at least 2000, but no instances of this occurring had been described. High definition video cameras were deployed daily at sites in Montego Bay, St. James (May 2015) and Bluefields, Westmoreland (May and December 2015) adjacent to fish traps to record any potential depredation events. Video was recorded at 30 frames per second, with either 1920x720 or 1920x1080 pixel resolution on 128 Gb card for a period of 24 hours. While no instances of interference were recorded in Montego Bay, eleven separate events where bottlenose dolphins (*Tursiops truncatus*) interacted, extracted and ate fish caught within the traps were recorded in Bluefields. Based on observations made while reviewing the recordings, as well as discussions held with fishers, potential mitigation measures were determined. With fishers continuing to complain about these depredation events and threatening to retaliate, further studies are needed to determine the most effective mitigation strategies in order to reduce the effects of depredation on artisanal fisheries and protect bottlenose dolphin populations in Jamaica.

A Preliminary Assessment of the Status of the Breeding Seabird Population of the Cays in the Portland Bight Protected Area, Jamaica

Donovan Hay[1], Ann Haynes-Sutton[2]
[1]*Caribbean Coastal Area Management Foundation, Jamaica*
[2]*Marshall's Pen Great House, Jamaica*

Seabirds are of outstanding ecological importance to marine ecosystems. They contribute to marine productivity and guide fishers to concentrations of fish. They are indicators of the broad impacts of climate change.

There are two major groups of seabird breeding colonies close to mainland Jamaica and two offshore. The largest inshore colonies are in the Portland Bight Protected Area. The Caribbean Coastal Area Management (C-CAM) Foundation has been monitoring the breeding colonies of seabirds on the coral Cays since 1997 and has documented a continuing decline in these important populations. Five species of seabirds have been observed breeding during this study; Magnificent Frigatebirds, Brown Noddy, Bridled Tern, Roseate Tern and Least Tern.

These colonies have shown declines in population due in part to a loss of habitat. Half Moon Cays have been severely damaged by hurricanes and seasonal erosion. The Two Bush Cays which are twin mangrove islets standing on a shallow reef was the exclusive nesting area for Frigatebirds. They have been so severely damaged such that the northern islet, which was the larger nesting area, has been completely destroyed and the remaining birds must nest on the smaller southern islet. Climate change is expected to exacerbate this loss and it is evident that unless urgent interventions are made more colonies may soon be extirpated. This paper will examine the reasons behind the declining bird populations on the cays and propose conservation measures to protect these populations in the face of climate change.

Global Fuels Efficiency Initiative: Jamaica's Progress

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[1]*University of Technology, Jamaica*
[2]*Ministry of Science, Energy and Technology, Jamaica*

The use of fossil fuel and the negative environmental impacts such as CO_2 emissions is well studied. Mitigation policies that reduce carbon emissions would not only offset that expected pollution increase but also further reduce pollution below current levels. (Larr & Neidell, 2016) The shift towards more sustainable practices has gained traction locally with various actions taken to stabilize and reduce carbon dioxide emissions. Half the world's oil is used in transport and about 95% of transport fuel is petroleum based. We face a near tripling of the number of cars on the planet by 2050, the vast bulk in emerging economies. Small Island Developing States (SIDS) like Jamaica are at high risk of abnormal weather conditions and increased sea level rise resulting from climate change. There are also health risks as noted by Narain (2016), the changes in physical and biological conditions, and ecosystems associated with climate change create an environment conducive for transmission of diseases. With that in mind, the country has joined several others such as Costa Rica and Chile in participating in a Global Environment Facility (GEF) Project: *Stabilizing Greenhouse Gas (GHG) Emissions from Road Transport through Doubling of Global Vehicle Fuel Economy: Regional Implementation of the Global Fuel Economy Initiative (GFEI)*. This paper will examine the creation of a Jamaican database. The establishment of the database is critical for determining carbon emissions and for assessing improvements in fuel economy based on the motor vehicle population. The data will be further used to initiate long term planning in the transportation sector by predicting and analyzing possible reactions to policy changes using various scenarios.

List of Presenters

1. Andrea Barrett: andrea.barrett@utech.edu.jm
   The development of a creative class – An innovation imperative

2. Shermaine Barrett: shbarrett@utech.edu.jm
   Science, technology, engineering and mathematics (STEM) methodology in action

3. Marco-Dean Brown: marcomogul@gmail.com
   The molecular epidemiology of *Angiostrongylus cantonensis* in Jamaica

4. O'Brien Brown: o'brien.brown@utech.edu.jm
   The phytochemical analysis of *Verbesina karsticola Proctor*

5. Nicole Cameron: nicole.cameron@wsu.edu
   Risk, trust and information: Jamaicans' risk perceptions, trust levels and key information sources for information on infectious diseases

6. Myrna Ellis: myrnad4ellis@gmail.com
   An investigation of the extent to which cruise tourism and its activities have threatened the physical ecological tourism carrying capacity level in the marine environment. A pilot study of St. Lucia

7. Donovan Hay: brandonhay@cwjamaica.com
   Towards adaptive management of hunting of columbid gamebirds in Jamaica
   A preliminary assessment of the status of the breeding seabird population of the cays in the Portland Bight Protected Area, Jamaica

8. Paul Ivey: paul.ivey@utech.edu.jm
   Valorising innovative research results: A paradigm shift at Jamaica's national university

9. Aisha Jones: ajones_ncst@mstem.gov.jm
   Jamaica's national nutraceuticals industry: A review of prospects, players and progress

10. Kadamawe Knife: kahnknife@gmail.com
    An examination of entrepreneurial thinking and practice among private sector companies in developing countries; the case of Jamaica

11. Raymond Martin: rmartin@utech.edu.jm
    Organic production as a response to the impact of climate change on food security in Jamaica

12. Maurice McGlashan-Powell: mmcglashan@utech.edu.jm
    Magneto acoustic emission and recent advances in magneto-optics and photonics

13. Susan Muir: smuir@utech.edu.jm
    Are Jamaican universities fulfilling their responsibility to protect research participants? A review of research ethics capacity in Jamaica.

14. Christine O'Sullivan: christine.o'sullivan@utech.edu.jm
    Depredation of Antillean fish traps by bottlenose dolphins (*Tursiops truncatus*) in Jamaica

15. Rasheed Perry: rasheed.perry@utech.edu.jm
    Jamaica's green gold profile: An analytical approach

16. Ruth Potopsingh: ruth.potopsingh@utech.edu.jm
    Global fuels efficiency initiative: Jamaica's progress

17. Cliff Riley: cliffr@src-jamaica.org
    Bridging the scientific divide: Research supporting innovation

18. Eddia Solas: ecopelnd@yahoo.co.uk
    Using sketches for formative assessment in general education science classrooms

19. Denise Tulloch: denise.tulloch@pcj.com
    Research into the economics of locally grown castor and jatropha as agroenergy crops and their conversion to biodiesel for use in the transport sector

20. Damian Whyte: dl_whyte@yahoo.com
    A population viability analyses using the Vortex software to examine the main parameters that will influence the survival of the Jamaican Iguana (*Cyclura collei*)

21. Cressana Williams-Massey: cressanalwilliams@hotmail.com
    Jamaican pimento oil and its antioxidant and antimicrobial activity

22. Earle Wilson: ewilson@utech.edu.jm
    Hydrogen gas as a fuel for cooking: The safe practical solutions

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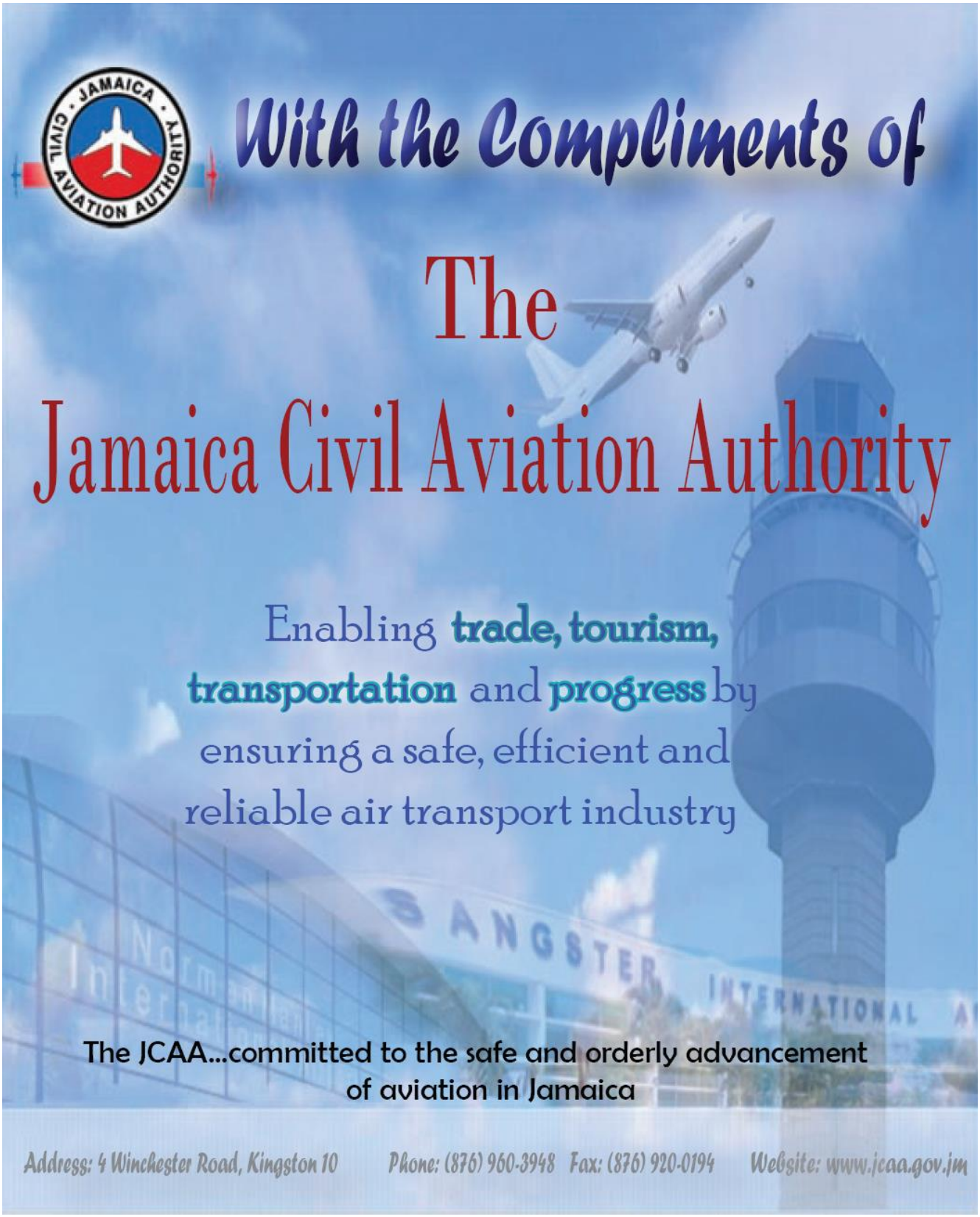
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