UVS Canada e-Newsletter
Q1-2009

Editor's Note: *I would like to take a moment to thank Dr. Paul Hubbard, Dr. Giovanni Fusina and Mr. Marc Roy for their contribution to this news letter as well as for the continuing contributions of Capt. Francois Allaire. A continuing goal of this newsletter is to include additional inputs, allowing different perspectives than may otherwise have been proferred. This newsletter is open to input from any and all UVS Canada members so I encourage anyone else who has a project or topic of interest to please submit it to the UVS Canada website with a subject line "Newsletter Contribution".*

Also of special note is that our Student Flying Competition will be held in May! Many individuals have volunteered a significant amount of time to make this event happen and a host of companies have stepped up to sponsor this very worthwhile endeavour- all in support of the next generation of UAS engineers! We thank all of the individuals and corporations for their involvement and will provide a recap of the fly-off in next quarter's news letter.

Finally, we are once again calling for applications to the Mark Cuss Memorial Schoalrship- ensure that your employees, interns and employees children are aware of this $2500 scholarship and apply by August.

Mike Meakin - Communications Director and Newsletter Editor

Contents

UVS Canada "UAS in Law Enforcement/ Emergency Services" Workshop

UVS Canada Helps Create a New Market for Unmanned Vehicle Systems

Article by Mr. Marc Roy

The workshop on UAS in Law Enforcement/Emergency Services was held as part of the UVS Canada annual conference at the Brookstreet Hotel in Kanata. The workshop was aimed at bringing together participant in the law enforcement/emergency services together to look on the use of UAS in their applicable field.

Figure 1: Const. Marc Sharpe Presents Law Enforcement Applications

Altogether, eight speakers presented their view ranging from unmanned vehicle system use in the police type operation (tactical, surveillance and forensic) to emergency situation created by HazMat/CBRN material. Speakers also

provided to the participants a view on the capability sensors need to have to be efficient to legal aspect and use of this sensor information.

The last part of the session was a round table discussing issues related to the following:

- Looking at the unified approach to UAS operations by Police and emergency services identifying key issues such has:
    - National Airspace access and Special Flight Operating Certificate – looking at standard approach with Transport Canada
    - System certification with approved operator training – Canadian Aviation Regulation test components for aircraft movement
    - Ideal system requirements to help in standardization (Altimeter limiter, fail safe feature, size/weight/payload, secure operational area)
    - Identifying limited/restricted operational areas (controlled airspace – prohibited/allowed for special ops, operation over civilians – prohibited/allowed over civilians with victim or suspect designation while still in secure emergency area.

Figure 2: DraganFly Innovations Micro Air Vehicle

- Review of the wants of emergency services versus the realistic mission goals within identified restriction that would allow Canadian wide operation for emergency ops
- Identifying interested stakeholders to develop action plan or Standard Operating Procedures (SOPs), standardization of operator training and network for available tart-up funding.

Overall, the workshop was very productive to all participants and provided them with a better understanding of the requirement to use a UAS it Law Enforcement/Emergency Services operations. This also allowed interested stakeholder to get together to start the elaboration of future plan to make UAS a reality for operations.

Mr. Marc Roy holds Bachelor in Mechanical Engineering from the Royal Military College in Kingston, Ontario as well as a Masters Degree in Aeronautical Engineering from the Air Force Institute of Technology in Wright Patterson AFB in Ohio. He served in the CFfrom 1982 to 2002 when he retired and took on the role of Manned and Unmanned Air Vehicle Systems in the Directorate of Science and Technology Air at Defence R&D Canada. In spring 2007 he was appointed the Explosives Portfolio Manager under the Chemical, biological, radiological-nuclear, and explosives Research Technology Initiative (CRTI) at the Centre for Security Services.
Marc Roy is the current Secretary of UVS Canada since June 2007.

***Editor's Note**: At the conclusion of the UVS Canada conference, it was announced by Peter van Blyenburgh of UVS International that he was working with OPP Constable Marc Sharpe of UVS Canada to establish an international symposium on the use of Unmanned Systems within Law Enforcement to be held in Europe in 2009. This is the first step in creating an awareness amongst law enforcement personnel of the capabilities and applicability of Unmanned Systems to their role and thereby establishing and expanding a new market for unmanned systems! Well done to Marc Sharpe for having spearheaded this movement through his initiative in using these systems as part of the OPP Forensics Unit (see **News Releases**)!*

An Update from "Police Head Quarters"…

Article by Const. Marc Sharpe, OPP

Since November, the Kenora Forensic Identification Unit have used the "Draganflyer X6" at two homicide scenes to date. The most recent was on March 21st 2009. This latest mission was another milestone as it took place within the City of Kenora. We believe that this represents the 1st operational mission within an Urban environment by a federally approved UAS by an emergency service.

Additionally, April 20-24th will be the 1st run of a test training program centered on the Draganfly and emergency service operations. We have partnered with CCUVS and the Canadian Police Research Centre to develop a course that includes a pre-course study package, flight theory, ground school component, radio operators licence and flight training. The course includes a theory exam along with practical testing on the UAS. If all goes well, the idea is to seek Transport Canada approval to issue SFOCs for agencies, instead of individuals with this course being the prerequisite for operators of the UAS system.

UVS Canada Workshop on UAV Modeling and Simulation

Article by Dr, Paul Hubbard and Dr. Giovanni Fusina of Defence Research & Development Canada (Ottawa)

The 2008 Workshop on UAV Modeling and Simulation was attended by a dozen researchers and engineers from academia, industry and government. The workshop began with an interactive session on the return on investment of the use of modeling and simulation in UAV applications. This session concluded with broad agreement that their was value in the early use of M&S in terms of design efficiency and risk mitigation, but that the learning curve associated with M&S tools sometimes discourages its use.

The second session in the morning was educational; Dr. Fusina gave an overview of the terminology, standards and tools associated with M&S and synthetic environments. Dr. Hubbard presented a case study based on the experiences at Defence R&D Canada in Ottawa exploring in simulation the use of UAVs in a large variety of military and non-military applications. In the afternoon session, the participants developed their own high-level plan for use of modeling and simulation in their own UAV programs. In particular, one group focused on the interesting topic of using UAVs for surveillance of Canada's Northern regions and came up with several uses of M&S to plan UAV missions and assess communications requirements in the arctic.

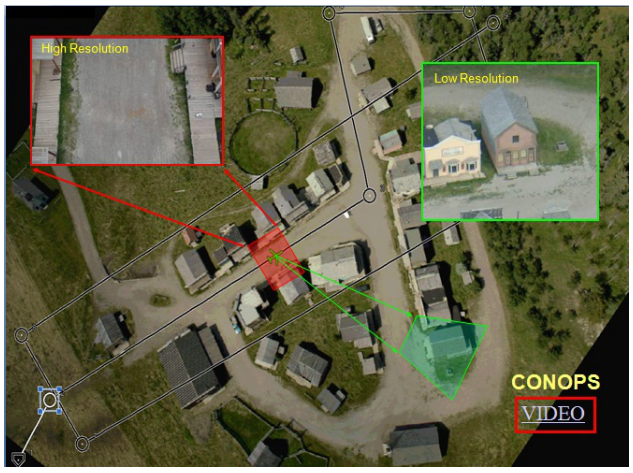


Figure 3: Simulated UAV Video

At UVS Canada 2009 in Victoria, the Workshop on UAV M&S will be significantly more hands-on. The educational component will be maintained, but participants will learn the practical side of building a UAV simulator from scratch and including the creation of the aerodynamic model, integration of a ground control station, autopilot, and external computer-generated forces, selection, integration and fine-tuning of an image generator. Following this, the participants will create a scenario and perform an external optimization to plan a multi-UAV maritime surveillance mission.

Dr. Giovanni Fusina obtained his doctoral degree from the University of Toronto Institute for Aerospace Studies (UTIAS) in 2003. He is now a Defence Scientist at the Capabilities for Asymmetric and Radiological Defence and Simulation (CARDS) Section at Defence R&D Canada (DRDC) in Ottawa. Some of his research interests lie in the field of UAV aerodynamics and UAV autonomy. He has also started investigating the application of the emerging field of complexity to defence applications.

Dr. Paul Hubbard is a currently defence scientist at Defence Research and Development Canada (DRDC) in Ottawa where he leads a group studying synthetic environment technologies and autonomous intelligent control of unmanned systems. He received a PhD in Electrical Engineering from McGill University, Montreal, and B.Sc. and M.Sc. degrees, both in Mathematics and Engineering, from Queen's University, Kingston. He has worked previously with Lockheed-Martin Canada on electronic counter-measures, with BBN Technologies on DARPA projects in command and control and at Carnegie Mellon University on the automatic generation of test inputs for V&V in the automotive industry.

UAV Modeling and Simulation

Article by Capt. Francois Allaire, CD, MASc- Royal Military College of Canada

UVS Canada Conference's workshops have given to attendees a great opportunity to develop their understanding of important UAV issue such as the Modeling and Simulation required for gathering the proper data to validate the UVS technology. Dr. Paul Hubbard and Dr. Giovanni Fusina, from Capabilities for Asymmetric and Radiological Defence and Simulation (CARDS) section from DRDC Ottawa, reminded us that Modeling and Simulations are great in the followings:

- To reduce the risk associated with the implementation of new technologies;
- At the long run, to reduce the cost and to increase the flexibility in terms of training required to use the new technology; and
- To provide coherent development, when using real hardware within the simulation.

This is why Modeling and Simulations are great tools to perform the verification required to be done to ensure that functions, which are supposed to be executed by the new technology, are properly executed. Though, models need to be validated to ensure that they react as the real components.

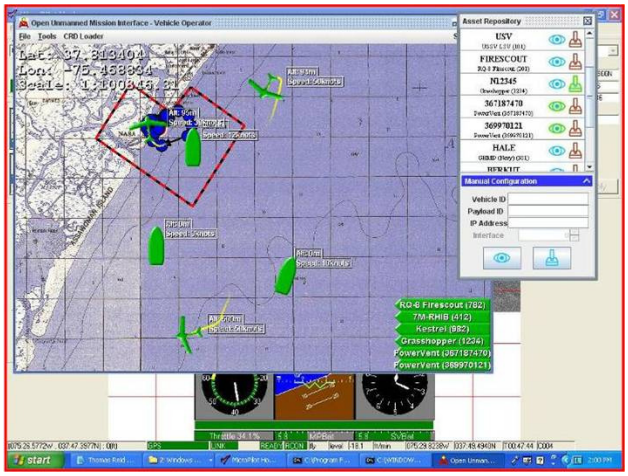


Figure 4: Simulated UAV Operations

Dr. Fusina and Dr. Hubbard not only taught us the fundamental elements of a good simulation, moreover they shared lots of lessons learned from their over 10 years of experience in small, medium and large simulation exercises. These lessons learned were one of the biggest highlight from that workshop. One thing, that is sure, is that these lessons learned will be further developed within their workshop next year, if that workshop takes place. We are therefore looking forward for that workshop.

Capitan François Allaire completed his Masters degree in Electrical Engineering (2005-2007) at the Royal Military College (RMC) of Canada. His thesis was on UAV Real-Time Path Planning. Now, he is teaching at RMC, while trying to light up the interest of his students towards the UVS world. Meanwhile, he is also starting a part time PhD at RMC to continue his research on UAV Real-Time Path Planning.

Book Now for This Year's "Across the Divide" Conference in Victoria, B.C.!

Go to http://www.uvscanada.org/content.php?doc=98&xwm=true for more info!

UVS Canada Student Competition Continues to Gain Ground- and Sponsors!

We have recently added 2 new sponsorships for the Flying Competition in May. **Thales Canada** and **J.D. Irving Ltd** are proudly joining our 2009 Student UAV Flying Competition sponsorship team. We thank them and all our Sponsors for their continued support of the competition! Without their important financial assistance the competition would not be possible.

The sponsors to date are:

Endowment SP
CDL Systems
Contributing SP
Bell Helicopter, A Textron Company
ING Engineering
Competition SP
MDA
Forest Protection Services
Pratt & Whitney Canada
NB Department Natural Resources
Canadian Interagency Forest Fire Centre
Thales Canada
J.D. Irving Ltd.
Supporting Sponsor
CFB Gagetown
PwM Consulting
Provincial Aerospace Ltd.
Crystal Public Relations

More information can be found at www.uvscanada.org under Student Competition.

Sense and Avoid in the National Airspace System

Article by Capt. Francois Allaire, CD, MASc- Royal Military College of Canada

Everyone knows that one of the major issues to deal with when talking about flying in a non-segregated airspace is the Sense and Avoid challenge. Good news for those who are working in this field- at the UVS Canada conference, Mr. Dennis Coulter's research brought a new way of looking at the goal of achieving a probability of Near Mid-Air Collision equal or smaller than 1×10^{-9}.

The concept that Mr Coulter explained was that we need to break four layers of security to get into a collision:

1. The first layer is the Procedural layer: if every aircrafts fallow the rules and procedures in flight, everyone will be flying in a safety distance to each others.
2. If that first layer is violated, than there is a second layer to go through, which is the Air Traffic Controllers layer: directives/commands from the ATC should prevent the air vehicles from colliding.
3. If this second layer is violated, than there is a third layer, which is the Separation Assurance System: this should allow the detection of the danger with sufficient time to allow separation measures to take place.
4. If and only if that third layer fails, than we get to the last layer where we need to have a good collision avoidance system.

By modularising the problem, we can spread the risk of collision among the four systems/layers. Therefore, the probability of Near Mid-Air Collision could now been seen as the following product:

$$P_{\text{Near Mid Air Collision}} = P_{\text{Procedural failure}} * P_{\text{ATC failure}} * P_{\text{Separation Assurance System failure}} * P_{\text{Sense \& Avoid System failure}}$$

The challenge is still present but better put into perspective. For those interested by Mr. Coulter's research, you may have a look at the UVS Canada conference CD, which contains the details of that great presentation.

Insect Flight & MAVs

Article by Mr. Mike Meakin, B.Sc., PMP

Potentially putting a completely different- and very literal- twist on the concept of "Sense and Avoid" was Dr. Jeff Dawson from Carleton University. Dr. Dawson presented a fascinating talk on the applicability of the study of insect flight to the development of micro air vehicles (MAVs).

Dr. Dawson started from some known facts:

1. Insects are specialized for flight at a size range where conventional wings perform very badly;
2. Flapping wings provide 2-3 times more lift in this size range than conventional wings; and
3. *Only* a flapping design can exploit the high lift/ high drag aerodynamics utilized by insects.

From there Dr. Dawson then asked the question- "do we actually know how insects fly?" Very surprisingly the answer appears to be "probably not"! There are 32 Orders of insects encompassing more than 1,000,000 species yet only **three** insects have been studied in any detail by aerodynamicists! These three are bumble bees, flies and hawk moths. When we consider that the scale of insects ranges from the Goliath beetle at 110 mm wingspan and 80 g weight to the Thrips with a 1 mm wing span, it seems clear that the

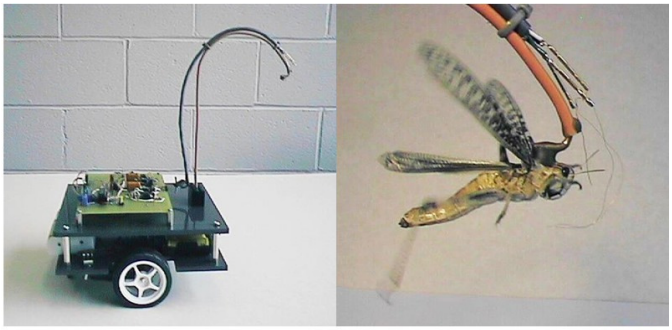
Figure 5: Locust

aerodynamic principles explaining the flight of insects likely varies a great deal. In addition, the three insects for which reasonable studies have been undertaken are three of the most derived/ evolved insects so other insects likely utilize different (earlier) aerodynamic principles to fly. Finally, the most damning evidence that there is much left to learn is that bees, flies and hawk moths all utilize two wing flight while many other insects utilize four wings so wing-wing interaction is not yet understood to any great degree at all (note that the bee does indeed have four wings, however the back wings are not connected to the front two wings and are used only for sensors and stabilizers, not lift).

Figure 6: Beetles

Following on the work published by C. P. Ellington on the application of insect flight to MAVs, Dr. Dawson notes that the study of damsel/ dragon flies, locusts/ grasshoppers and beetles are likely to reveal new and potentially useful adaptations for use in MAV development. Beetles, for instance, have hard shell forewings that are stationary in flight with the rear wings doing the work; this kind of "flying armour" and wing stowage system could be of particular use in protecting a small but valuable asset being flown remotely. Likewise, many insects use their wings for thermoregulation- not only important for MAV systems but potentially also capable of being adapted for power regeneration.

Dr. Dawson noted that insects- being considerably simpler than larger animals- use only a limited number of motorneurons ("wires") controlling a small number of muscles ("servos") for flight. The locust uses only about 80 motorneurons controlling about 40 muscles for all flight dynamics. This then is a system that is relatively easily understood by researchers and scientists have conducted experiments in which these muscle signals have been "tapped" for the purposes of study. One example of this was when a locust had sensors attached to it's muscles that allowed it to steer a car to which it was attached! This is obviously an unmanned vehicle though a debate may be had as to whether or not it is "uninhabited"!



M.E.L – MyoElectric Locust Car

Figure 7: Locust Driven Car

Research thus far indicates that flexible wings greatly outperform fixed wings at the scales being examined so the future of MAVs may very well depend on how well we improve our understanding of how insects fly.

Mike Meakin graduated the University of Toronto in 1991 with a Specialist degree in Physics. He then spent 8 ½ years as a Combat Systems Engineering Officer before entering the world of unmanned systems with CDL Systems. While there, he led the development of control station software for the winning Shadow-200 Tactical UAV team now utilized by the US Army with over 350,000 combat hours. He integrated three other vehicles, three other autoland systems and a multitude of sensor systems before leaving to join General Dynamics Canada on the Maritime Helicopter Program. At GD he served in a variety of roles, finishing as the Integration and Test Manager for the Integrated Mission System. In 2007, Mike founded InnUVative Systems, Inc. with two other colleagues to develop software for the unmanned vehicle market.
Mike has served on the UVS Canada board as Membership Coordinator since Sep 2006.

Call for Applications for Mark Cuss Memorial Scholarship 2009

In keeping with the commitment of UVS Canada to serve the interests of the UV community within Canada, a post-secondary scholarship program was established in 2007 for all members, employees of corporate members and their children.

This scholarship was established in memory of Mark Cuss, a young unmanned vehicles engineer who passed away in Dec 2006 at the age of 27 from cancer. It encourages and develops interest in and involvement with UV systems within our post-secondary students. At the same time, it relieves some of the financial burden associated with post-secondary education by awarding $2,500 each year to the winning applicant to put toward their post-secondary education.

Applications for 2009 need to be submitted by 31 August 2009; the winner will be informed by 30 September 2009 with awarding of the scholarship occurring during the UVS Canada "Across the Divide" conference in Victoria, B.C., 2-5 November 2009.

Applicants need to demonstrate a combination of good scholastic performance, good understanding of UV technology and applications and good professional performance, if employed within the UV industry (for further details, please see http://www.uvscanada.org/markcuss.html).

For those individuals and corporations not yet enrolled, the membership application forms are available on-line at www.uvscanada.org as is the scholarship application form.

We most *especially encourage our corporate members to enroll as members of UVS Canada* as this will allow them to extend eligibility for this scholarship as ***a benefit to their employees and their employees' children***.

The winning applicant for 2008 was Ryan Gariepy, a Mechatronics student at Waterloo University doing an internship with Aeryon Labs. By demonstrating strong academic marks, excellent professional performance within the unmanned vehicle industry and submitting an original paper demonstrating the depth of his understanding of unmanned vehicle technology, Ryan received $2,500 towards his post-secondary education.

Figure 8: 2009 winner Mark Cuss Memorial Scholarship- Ryan Gariepy

News Releases

Draganflyer X6 Unmanned Aerial Vehicle Takes Flight in OPP Police Applications

The Draganflyer X6 UAV helicopter, designed by Draganfly Innovations Inc. for aerial photography and videography, was used by the Forensic Identification Unit of the Ontario Provincial Police (OPP) on February 21, 2009 to collect evidence in a homicide investigation in a remote area outside of Kenora, Ontario, Canada. This represented the first operational mission of a federally approved, commercially produced Unmanned Aerial Vehicle by an emergency service in North America.

Saskatoon, Saskatchewan (PRWEB) March 26, 2009 — From the pages of Popular Science Magazine's "Top 100 Innovations of the Year", Draganfly Innovations' Draganflyer X6 Unmanned Aerial Vehicle (UAV) has made the significant leap to commercial utilization.

The six-rotor, one kilogram, electric, VTOL, UAV helicopter designed for aerial photography and videography was used by the Forensic Identification Unit of the Ontario Provincial Police (OPP) on February 21, 2009 to collect evidence in a homicide investigation in a remote area outside of Kenora, Ontario, Canada. This represented the first operational mission of a federally approved, commercially produced Unmanned Aerial Vehicle by an emergency service in North America. Then, in March, 2009, the Saskatoon Police Service announced that it will follow suit, becoming the first urban police service in North America to utilize the Draganflyer X6 Police UAV for aerial forensic purposes within city limits.

Figure 9: Constable Marc Sharpe, OPP with Draganflyer X6

Unmanned Aerial Vehicles such as Draganfly's Draganflyer X6 helicopter are subject to Transport Canada aviation regulations. Prior to the Saskatoon Police Service being able to test the Draganflyer X6, Transport Canada officials were in Saskatoon for a flight demonstration, to undertake their standard risk assessment testing, and discuss technical issues with Draganfly Innovations.

Under the Special Flight Operations Certificate granted by Transport Canada, Draganfly Innovations personnel will operate the Draganflyer X6 Police UAV Helicopter while Saskatoon Police Service personnel will operate the cameras used for forensic support.

Figure 10: The Ontario Provincial Police's Draganflyer X6 UAV helicopter captures high resolution aerial photographs of major case scenes. The Draganflyer X6's onboard camera has remote controlled zoom, tilt and shutter. Typically, one police officer controls the UAV and another operates the camera controls.

The use of UAVs goes back to the 1950's with the military, but only recently has it evolved into police applications. One of the innovators was Identification Constable Marc Sharpe of the Kenora Identification Services unit of the Ontario Provincial Police.

"Having used a fixed wing UAV since 2007, I could see the potential for great benefits to our forensic support operations. It gave us the ability to collect aerial evidence quickly and at minimum cost," states Sharpe. "However, it also became apparent that in order to improve and expand operational effectiveness, an optimal UAV would need certain attributes. It would need to be small and light, have Vertical Take Off and Landing VTOL capabilities, have a GPS hold system while hovering, be constructed of exceptionally strong materials and be completely transportable."

The Draganflyer X6 met all Sharpe's requirements for a Police VTOL UAV. Sharpe continued, "The Draganflyer X6 enables us to economically obtain high quality aerial photos of major case scenes in a timely fashion."

About Draganfly Innovations Inc.

Draganfly Innovations Inc. has been manufacturing Unmanned Aerial Vehicles including radio controlled helicopters, airplanes, and airships for the past eleven years. From toys to industrial tools for police and military, Draganfly Innovations Inc. strives for optimum performance and ease of use. Draganfly's innovative products have been featured on CNN Headline News, MSNBC, Discovery Channel, and in magazines and newspapers such as Popular Science, Popular Mechanics, Gizmodo.com, WIRED, GQ, Stuff, Maxim, The New York Times, and The London Times. All Draganflyer helicopters, including the new Draganflyer X6 are exclusively available from Draganfly Innovations Inc.

ING Engineering Wins Contract to Support SUAV in Afghanistan

Saving Lives One Mission At A Time

ING Engineering is very pleased to announce that we will continue to support Canadian Army operations in Afghanistan and in Canada under the recently announced SUAV Contract.

http://news.gc.ca/web/article-eng.do?crtr.sj1D=&mthd=advSrch&crtr.mnthndVl=12&nid=441429

Figure 11: Scan Eagle on display at New Canada House in Kandahar, Afghanistan.

With a truly integrated military-civilian team, soldiers from 4 Air Defence Regiment RCA and civilian UAV Operator/Maintainers from ING Engineering and Insitu/Boeing have delivered over 3,500 hours of persistent, covert airborne ISR to Canadian ground forces since late last summer with the ScanEagle UAV system. The new contract will allow the SUAV Troop to expand their role with more hours of coverage for operations while employing the latest technological innovations from Insitu. To meet the increased demand, ING Engineering's UAV Services group will more than double in size in the coming months.

The SUAV Troops' adopted motto is "Saving Lives One Mission at a Time". All of us at ING Engineering are honoured and humbled by the opportunity to play such a key support role in providing the very best airborne surveillance capability to our fellow Canadians in their dangerous work in service to their country.

Classifieds:

Advertise your company's positions directly to the unmanned vehicle community using the UVS Canada e-Newsletter!! Send your classifieds to newsletter@uvscanada.org to have them included in our next edition!