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SAIL AND POWER BOATING

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1 February, 2012

Dear Ms. Susan Tomczuk:

Enclosed in this package are the documents to close out Grant 1102.02, *Reducing Recreational Boating Accidents through Advanced Risk Analysis – Fast Track*. The United States Power Squadrons is pleased to have conducted and concluded this portion of the grant project successfully.

The documents contained in this close-out package are listed below:

- Abstract
- Executive Summary
- SF 425

Sincerely,

Mary Catherine Berube
Executive Director

Reducing Boating Accidents through Advanced Risk Analysis Reducing

Fast Track Grant Closeout Report

Project Abstract

Recreational boating accidents are a primary cause of injury in water-based transportation. Each year more than 6,000 recreational boating accidents are reported, ranking this form of transportation as the second leading cause of transportation accidents and fatalities within the United States. Contemporary research has shown that transportation accidents result from multiple causes as part of a chain leading to questions about the interrelationships between environmental, human, and technological factors. However, such accidents are primarily attributed to human error or less frequently, technological factors. This proposal offers a different perspective by exploring the nature of recreational boating accidents from an environmental and more specifically geographical perspective, e.g., where and when do recreational boating accidents occur and why do they occur in those locations.

The primary objective of Reducing Boating Accidents through Advanced Risk Analysis is to better understand how largely ignored environmental factors combine with previously examined human and technological factors to better understand recreational boating accidents. This understanding will emerge from an examination of key influences including but not limited to: traffic congestion, the relationship between traffic patterns and associated boat speed variation, subsurface navigation channel characteristics, boating accident frequency, the influence of weather-sea state, boat and boat operator characteristics, available navigation tools, life jacket wear, and the differences between peak and off-peak boating periods. With this deeper understanding, officials charged with waterway management will be better equipped to mitigate those influences that are responsible for recreational boating accidents.

Intellectual Merit

This research project derives intellectual merit from the use of accident theory to specify a model that statistically explains the space-time qualities of recreational boating accidents. This synthesis will be achieved by developing a new methodology using advanced data fusion techniques to represent the spatial distribution of recreational boat accidents and their relationship to environmental factors. This approach permits varied forms of analyses such as the examination of recreational boating accident “hot spots” or life-cycles. It further allows the relationships between key influencing variables to be modeled using advanced regression approaches (multi-level logistic analysis) that control for spatial autocorrelation and heterogeneity while permitting an investigation of potential multi-level interactive effects. Within this novel and highly integrative approach, all outcomes (recreational boating accidents) and all causal factors will be sampled and rendered explicitly in terms of space and time. Collectively, the proposed approach will lead to the development of a model that avoids the overwhelming specification errors that plague previous research.

Broader Impact

The recent availability and use of high resolution commercial optical satellite imagery and a state–federal agency collaborative provide the necessary data foundation to fully assess recreational boat accidents. In the case of coastal waterways and harbors, remote sensing technology can provide a wealth of information pertaining to on-the-water boat density, traffic patterns, traffic congestion, boat speeds, directionalities, the physical characteristics associated with navigable coastal waterways, and the like. This approach offers improved measurement techniques that can quantify recreational boating patterns to build upon previous research. The data, integrative models, and quantitative methods will constitute “proof of concept” for the future development of decision support tools that will assist governmental authorities charged with coastal management and waterway oversight. Additionally, this investigation will illustrate the synergistic value of building a multiagency state–federal collaborative to create effective communication pathways that offer enhanced support to the recreational boating community. The project collaborators who have committed to this investigation include the United States Coast Guard - Division of Boating Safety, National Association of State Boating Law Administrators (NASBLA), the Florida Fish and Wildlife Conservation Commission (FWC), and the Ohio Division of Natural Resources (ODNR).

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Executive Summary: The Reducing Boating Accidents through Advanced Risk Analysis (ARA) Fast Track Grant began on 1 May 2011 through an award from the Sport Fish Restoration and Boating Trust Fund, administered by the U.S. Coast Guard in the amount of \$18,369.52. This funding was used to procure the initial (two) electronic data collection units used during phase one of the ARA project and enable the development of an electronic version (software programming) of the paper-based recreational boat operator survey form used to capture on-water boating activity. The collection of recreational boating non-accident-based data continues to be critical to the analytical phase of the ARA project as it will be used to normalize the recreational Boating Accident Report Database (BARD) data collected in conjunction with this study. In addition, these electronic data collection units permitted a better understanding of (on-water) paper-based vs. electronic data collection techniques.

In connection with these objectives, the two electronic data collection units (Trimble Nomad 800L) were delivered in mid-April 2011, one each, to the Florida Fish and Wildlife Conservation Commission (FWC) and the Ohio Department of Natural Resources (ODNR). Following deployment, these units served as test units enabling participating officers to become more familiar with electronic data collection techniques and to create a platform for transitioning from paper-based to electronic data collection via an approved Human Subjects Review Board (HSRB) recreational boater survey. An itemized list of the project components procured using Fast Track grant funding is detailed as follows:

Fast Track Funding Budget				May - June 2011					
		FL	OH	Proj.Maint.	Item Description	Mo	%	Cost	Ext.Cost
Equipment	APS001792 20	1	1		Marine State ReportBeam System			\$ 449.00	\$ 898.00
	VS001881	1	1		ReportBeam Server included Online Training			\$ 1,500.00	\$ 3,000.00
	APS001345	1	1		Trimble TDS Recon 400X 64/256 Yellow BT			\$ 1,195.00	\$ 2,390.00
	APS001290			65	VS ProgrammingServices, RBS Survey Form			\$ 175.00	\$ 11,375.00
					USPS Personnel (Grants/Materials Mgmt)				\$ 706.52
Grand Total Start-up									\$ 18,369.52

Collectively, the electronic data collection instruments acquired during the Fast Track grant period (1 May 2011 – 30 June 2011) enabled the ARA project to capture critical data that will help describe the recreational boating environment within the research sites occurring during the 2011 peak boating season. No significant issues related to water survey data collection were reported by participating officers during the Fast Track grant period at either research site. However, the software data collection form required several rounds of programming updates before it was declared as “stable” by participating officers. This factor coupled with other project startup challenges detailed in the first quarter project report dated August 2011 contributed to data collection rate reductions that have since been aggressively addressed by the project steering committee.

During the Fast Track Grant period both paper-based and Trimble Nomad 800L (electronic) based surveys collected at the Florida and Ohio research sites were entered into Trimble’s ReportBeam system then aggregated into separate databases for subsequent analysis, i.e., one for Florida data and one for Ohio data. ReportBeam is a secured, enterprise server maintained (and backed-up daily) by Trimble ensuring high data reliability. The mechanism for this transfer can be summarized as: 1) officer facilitated point of contact collection, 2) data upload from Trimble Nomad 800L to a local ReportBeam client in the participating officers’ work area, 3) data transfer (following appropriate administrative review and approval) between the ReportBeam client and Trimble’s secured database via the Internet, and 4) data review and evaluation using ReportBeam tools, or in this case, exported in a Microsoft Excel file format to the project Principal Investigator (PI) for use in connection with analytical and geospatial tools, e.g., SAS, ERDAS IMAGINE, and ESRI ArcGIS.

As noted earlier, an examination of the data collected during the Fast Track Grant period was observed as falling slightly short of projections (optimally based on an average collection of three on-water boat operator surveys/day) as of 1 August 2011 (208 surveys collected at the Tampa Bay and 221 surveys collected at the Sandusky Bay). The reasons attributed to the data collection shortfall are characterized as project startup challenges that include: 1) delays in participating officer familiarization with the paper-based on-water survey form; 2) delayed establishment of the on-water survey as a routine procedure and integrated with officers’ time on the water (note that other participating officer tasks including office time, time in court, and sick/vacation leave

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limit participating officer engagement in project related data collection); and 3) logistical complications associated with the paper-based data collection process, the initially limited number of electronic data collection devices available to participating officers, the transition from paper-based recording to an electronic recording format, and the number of inclement weather days when the decision was made to not send officers out on an on-water patrol for safety reasons.

As a part of the project evaluation, refinement, and improvement process, the project steering committee actively communicated during the Fast Track Grant period to proactively address these project deficiencies. Areas of focus were reaching the designated data capture milestones, meeting project expectations, and ensuring that participating officer suggestions/requests continue to be met in a timely fashion. An outcome of these discussions was a commitment by steering committee members to meet end of project data collection commitments through more aggressive data collection efforts in 2012. The provision of the additional electronic data collection units, via the follow-up Boating Safety Grant enabled participating officers (at both research sites) to be assigned an individual Trimble Nomad 800L electronic data collection unit as opposed to necessitating coordination of a shared unit. Additionally, as the number of available electronic data collection units exceeded the number of initially participating officers, both Mr. Moore (Florida) and Ms. Terry (Ohio) have continuously investigated the potential of additional participating officer teams, i.e., two participating officer teams rather than one operating at each respective research sites.

In addition to the collection of recreational boat operator survey data, the PI (Marshburn) has also collected environmental factors data such as weather conditions from the NOAA National Ocean Service (NOS) National Data Buoy Center (NDBC) and National Climatic Data Center (NCDC) during the Fast Track Grant period. Specifically, data was captured from the NDBC buoys: Station SBIO1 - South Bass Island, OH, Station MRHO1 - 9063079 - Marblehead, OH, Station EGKF1 - EGK - Egmont Key, FL, and Station CUF1, St. Petersburg, FL. On an as needed basis, NOAA has also permitted the PI to access NDBC buoy data from their archives. NCDC weather data with specific interest in the issuance of "small craft warnings" is collected from KTPW (Tampa Bay, FL) and from KCLE (Cleveland, OH). At a later state of analytical evaluation, this information will be informative in evaluating potential correlation between such warnings and the accident records within the study research sites.

Collection of satellite imagery representing the Tampa Bay and Sandusky Bay research sites took place on June 5 and 13 for Tampa Bay and June 3 and 11 for Sandusky Bay during the Fast Track Grant period. GeoEye, a company that provides color geospatial satellite imaging, is committed to providing data for to this project and is re-tasking their satellite constellation as needed to ensure that project related imagery requirements are met. Note that table 1 also identifies those dates that satellite imagery has been collected subsequent to the Fast Track Grant period. Given that MSS satellite data is composed of optical imagery, it is subject to occlusion by cloud cover. This was the case during the planned Sept-Oct imaging scheduled for both Tampa Bay and Sandusky Bay. In consultation with the ARA steering committee and Trimble, the revised plan is to reschedule (re-task the GeoEye I satellite) to image the three missed Sept-Oct research site data captures during the April-May 2012 period for inclusion and data aggregation with other off-peak satellite image data capture.

Table 1: MSS Satellite Sampling Distribution

	Data Collection Timeline		1		2		# Images	Total Images
			TB	SB	TB	SB		
Peak	Jun	2011	6-Jun	3-Jun	13-Jun	11-Jun	4	8
	Jul	2011	13-Jul	22-Jul	24-Jul	30-Jul	4	
Non-Peak	Sep	2011	9-Sep	1-Sep	23-Sep	---	4	8
	Oct	2011	9-Oct	7-Oct	---	---	4	
Non-Peak	Mar	2012		F		Sa	4	8
	Apr	2012		W		Su	4	
Peak	Jun	2012		F		Sa	4	8
	Jul	2012		W		Su	4	
--- indicates satellite image not available							Grand Total	32

Project Budget: All equipment budgeted for the Fast Track Grant (Grant No. 1102.02, \$18,369.52) has been expensed during the reporting period. These expenses included the procurement of two ReportBeam operating systems (\$898.00), ReportBeam server training for both the Tampa Bay and Ohio data acquisition teams (\$3,000.00), two Trimble TDS Recon 400X data acquisition units (\$2,390.00), programming of the Trimble TDS Recon 400X data acquisition units with the RBS Survey form (\$11,375.00), and direct expenses associated with United States Power Squadrons personnel involved with the management of this grant. As a result, all funds associated with the Fast Track Grant have been appropriately expended and accounted for and the project has transitioned into phase two as outlined in the Boating Safety Grant (Grant No. 1102.26, \$125,000).