

## REQUEST FOR SOLE SOURCE

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STATE OF HAWAII  
REQUEST FOR SOLE SOURCESTATE PROCUREMENT OFFICE  
STATE OF HAWAII

TO: Chief Procurement Officer

FROM: Dept. of Business, Economic Development, and Tourism / Office of Planning / Coastal Zone Management  
(Department/Division/Agency)

Pursuant to §103D-306, HRS, and Subchapter 9, Chapter 3-122, HAR, the Department requests sole source approval to purchase the following:

## Description of goods, services, or construction:

The International Building Code (IBC) that will replace the code now used in Hawaii County introduces a new topographic factor and a wind directionality factor that in their current formulations will not give accurate results in Hawaii. This would lead to a high probability of incorrect design unless several customized map products are prepared for the building code in Hawaii County. Future implementation of the IBC in Hawaii requires an evaluation of the wind topographic and directionality factors. Significant improvements in wind hazard mitigation can be accomplished through the development of this particular methodology for wind speed-up mapping in local building codes and risk assessments. A *uniform* design standard of protection for hurricane hazard would then be defined in Hawaii County that will be consistent with the standards now being implemented by this sole source vendor in the building codes of the City & County of Honolulu and County of Kauai.

**Development of New Wind Speed Mapping for the County of Hawaii:**

- A. Numerical simulation of windflow and acceleration for the County of Hawaii using Computational Fluid Dynamics (CFD) to develop windspeed data.
1. The height and size of the shield volcanoes on Hawaii is the subject of this investigation to quantify their impact on wind speed-up using mesoscale computational fluid dynamic (CFD) numerical simulations. A CFD model to be run initially for the entire island for 16 directions in a "coarse" spatial resolution mode. The resulting output will be a set of velocities near the ground on a 5 km square grid. This will result in more than 500 locations over the island where mean wind speed, peak gust, and direction are predicted numerically. A byproduct will be vertical profiles of wind speed and direction at each of these grid locations for each of the 16 wind directions to establish the effect of large land masses on altering wind flow direction.
  2. CFD analysis will begin with the coarse solutions and focus down to a "fine" grid with about 0.5 km spacing horizontally, and finer vertical grid spacing near the surface, at selected locations to obtain the local influence of smaller terrain details.
- B. Wind Tunnel tests for validation of CFD results at selected locations using 2 scales of models for 16 wind directions with velocity point measurements and profile measurements.
- C. Applying any necessary modification to the existing method for wind speed-up prediction used for the City & County of Honolulu.
- D. Using spatial data analysis techniques and methodologies developed during a previous applied research sole source project undertaken for the City & County of Honolulu, prepare map products to enable adoption of the 2003 International Building Code and the 2003 International Residential Code by the County of Hawaii, including:
1. Risk-consistent basic design windspeed for the island.
  2. Probabilistic wind speed hazard contour mapping incorporating topographic effects appropriate for structural design specification.
  3. Incorporation of directionality weighting of probability of critical wind orientation appropriate for code adoption.
  4. Incorporation of Exposure Category wind profile adjustments related to terrain roughness / land use, to be validated by additional windspeed vertical profile measurements in the wind-tunnel.
  5. Development of an effective wind speed map for use within the prescriptive high-wind construction standards of the International Residential Code (IRC) for designating the wind speeds establishing prescriptive requirements.
- E. Final deliverables to consist of enabling code amendments and GIS-based design windspeed mapping products.

Name of Vendor:	Martin & Chock, Inc.	Cost:	\$265,000
Address:	1132 Bishop Street, Suite 1550 Honolulu, Hawaii 96813		

Term of Contract:	From:	To:	Prior Sole Source Reference No.
One year 4 months	December 1, 2005	March 30, 2007	

## REQUEST FOR SOLE SOURCE (Continued)

The goods, services, or construction has the following unique features, characteristics, or capabilities:

NASA-sponsored hurricane risk projects performed by Martin & Chock, Inc. produced new methodologies pertaining to modeling of hurricane wind speeds and topographic effects. To determine speedup factors for Oahu and Kauai, terrain models of portions of the island terrain were constructed and tested in the wind tunnel. Wind speedups or reductions were measured at several hundred locations. Then a unique phenomenological modeling technique was formulated to fit the measured data. The wind-tunnel data, analysis techniques, and numerical modeling were uniquely developed by Martin & Chock, Inc. and equivalent model output and mapping are not available elsewhere.

For the island of Hawaii, the existing topographic wind speed-up techniques used for Oahu and Kauai may not fully capture the wind flow over the terrain of the island of Hawaii due to the slopes and larger-scale (mesoscale) impact of Mauna Kea and Mauna Loa. The height of the terrain is sufficient and the area of the island is large enough that the effects of atmospheric Coriolis acceleration and thermal stability effects may have a significant impact on the wind flow over and around this high terrain. Consequently, the phenomenological modeling used by Martin & Chock may need to be extended for application in this type of island terrain. The height and size of the shield volcanoes on the island of Hawaii require additional investigation to quantify their impact on wind speed-up using state-of-the-art mesoscale computational fluid dynamic (CFD) numerical simulations, wind-tunnel tests, and then applying any necessary modification to the existing empirical method. This study will also include windfield vectoring to establish the effect of large land masses on altering wind flow direction. Future implementation of the IBC by Hawaii County requires an evaluation of the wind topographic and directionality factors. This work will also establish the investigative methodology of similar effects on Maui.

The project will produce several needed technical data products so that the state-of-the-art research data results captured in the project can be used in design applications, in a way that completely addresses the requirements of the International Building Code. The wind design parameters for the Hawaii Building Code will be determined through probabilistic analysis to provide a level of safety consistent with wind load exceedence probabilities of the national ASCE-7 standard. The necessary maps will be utilized with a customized design procedure in conjunction with the latest analysis of hurricane probabilities to furnish wind speed design criteria with a uniform ultimate return period throughout the County of Hawaii.

How the unique features, characteristics, or capabilities are essential for agency to accomplish its work:

The Chock Wind Speed-up methodology has been used to formulate the building code wind standards for Honolulu and will be used under a separately-funded project for Kauai, taking into account all the relevant factors of hurricane probabilities, terrain, and topographic features using wind-tunnel testing to develop a comprehensive database of wind effects. Because hurricanes are typically multi-county disasters, it is essential that all counties approach the risk through mapping and building regulations that are implemented with a common technical basis and procedure. State and county emergency planning and operations and building design professionals need to have a product line with a common technical framework, mapping convention, and building regulation basis in order to consistently plan and respond to the hurricane risk from island to island. The Chock methodology is the only one that can provide this consistency since Oahu and Kauai have already committed to and are implementing that methodology.

The building code now used in the County of Hawaii does not include any design requirements for amplified winds caused by topography. The IBC that will replace the current building code introduces a new topographic factor and a wind directionality factor. The current formulations will not give accurate results in the topography of Hawaii. This would lead to a high probability of incorrect design unless several customized map products are prepared for the building code in Hawaii. The new wind code would then achieve a uniform level of protection for hurricane hazard in structural design that will be consistent with the standards developed by this vendor for Oahu and Kauai. Benefits include explicit quantification of wind-hazard and its mitigation through the identification of severe-wind environments for planners and building designers that will significantly improve building performance. Determination of the wind hazard in topographically-affected critical facility sites is essential for pre-disaster planning and emergency operations planning. Criteria for critical facility use and any necessary mitigation can then be objectively established and evaluated for priority, thereby optimizing the effectiveness of any retrofits.

REQUEST FOR SOLE SOURCE (Continued)

The following other possible sources for the goods, services, or construction were investigated but do not meet our needs because:

The nature of the work is of specialized research involving a unique combined knowledge of structural engineering, wind engineering, and probability and statistical techniques used in risk analysis. The State of Hawaii Multi-Hazard Science Advisory Committee to the State Civil Defense Hazard Mitigation Forum has found that the Federal Emergency Management Agency (FEMA) HAZUS MH (Hazards U.S. Multi-Hazard) software does not produce the necessary mapping for this application, based on a technical review and correspondence with the FEMA and National Institute of Building Sciences (NIBS) HAZUS Project Managers. Hawaii County made a similar conclusion and did not use HAZUS MH in their Hazard Mitigation Plan, which then calls for development of the new wind speed maps with high priority. Both the Hawaii County Civil Defense Agency and State Civil Defense request exclusive use of the products available through the sole-source vendor to have a unified system. Hawaii County will not accept any other methodology. See attached letters, Exhibits A & B, respectively, herein. Therefore, it is necessary that this study be performed in Hawaii by the originator of the customized wind database, numerical terrain analysis, and predictive modeling techniques.

The Hawaii Geographic Information Coordinating Council I-Plan (July 29, 2003), which reflects the collaboration of federal, state, county and local agencies, academia, the private and not-for-profit sector GIS subject matter experts, identified a high priority natural hazard data need as "Completion of the High Wind modeling for Maui and Hawaii and refinement of the model for Kauai, using the Chock Speed-up Methodology." The data analysis techniques and numerical modeling were uniquely developed by the sole source vendor, and the work has been peer-reviewed and accepted for publication in a major scientific journal (Journal of Wind Engineering and Industrial Aerodynamics). Numerous federal, state, and county agencies have been periodically briefed on this methodology since 2000, including the National Weather Service Central Pacific Hurricane Center and State Civil Defense, and professional societies such as the Structural Engineers Association of Hawaii, the American Society of Civil Engineers, the American Meteorological Society, and the American Institute of Architects.

Direct questions to: Ann Ogata-Deal

Phone: 587-2804

I certify that the information provided above is to the best of my knowledge, true, correct and that the goods, services, or construction are available through only one source.

[Handwritten Signature]

OCT 27 2005

Department Head or Designee

Date

Title (If other than Department Head)

Chief Procurement Officer's comments:

This approval is based on the County of Hawaii's representation that they will only accept this contractor's methodology in the development of their wind mapping system and endorsements of this system by the DBEDT and DOD- State Civil Defense.

Please ensure adherence to applicable administrative and statutory requirements.

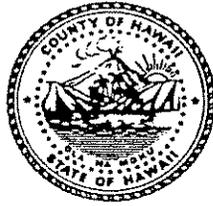
Expenditure may be processed through a purchase order: Yes  No  In no, a contract must be executed and funds certified.

APPROVED  DISAPPROVED

[Handwritten Signature: Adam S. Fyfe]  
Chief Procurement Officer

11/21/05  
Date

Harry Kim  
Mayor



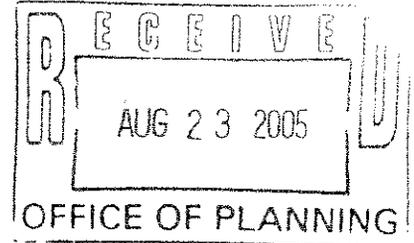
Troy M. Kindred  
Administrator

Lanny T. Nakano  
Assistant Administrator

## County of Hawaii

### CIVIL DEFENSE AGENCY

920 Ululani Street • Hilo, Hawaii'i 96720-3958  
(808) 935-0031 • Fax (808) 935-6460



August 18, 2005

Ms Laura H. Thielen, Director  
Office of Planning  
Department of Business, Economic Development and Tourism  
P. O. Box 2359  
Honolulu, Hawaii'i 96804

Dear Ms. Thielen,

The County of Hawaii'i Civil Defense Agency strongly supports the development of New Wind Speed Maps for the County of Hawaii'i project. It has been identified as a high priority project in the County of Hawaii'i Multi-hazard Mitigation Strategy, the State of Hawaii'i Multi-Hazard Mitigation Plan, and the Hawaii'i I-Plan for Spatial Data (sponsored by the Hawaii'i Geographic Information Coordinating Council).

Damaging windstorms and hurricanes will generally affect several counties concurrently during a single storm event. Accordingly, wind (hurricane) simulation and loss estimation systems and building design provisions that are nearly uniform throughout the State of Hawaii'i are of great benefit to the public health, safety, and welfare. This will facilitate emergency operations planning and response by civil defense agencies at the county and state levels, and generally enable risk-consistent planning exercises.

Martin & Chock has recently completed a wind hazard mapping and county building code update project for the City and County of Honolulu, and it is anticipated that the County of Kauai will soon receive FEMA funds awarded for a similar project to utilize the same method of analysis. Those two counties have utilized the Martin & Chock methodology, which is proprietary and state-of -the-art, as recognized and recommended in the Hawaii I-Plan. In order to achieve a uniform system for wind hazard estimation statewide, the counties of Hawaii'i and Maui would also use the Martin & Chock methodology.

Exhibit No.   A  



Ms. Laura H. Thielen

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August 18, 2005

Thus, the only methodology that the County of Hawai'i will accept for this project is the Martin & Chock methodology. We request that this project be carried out using the Martin & Chock methodology.

Sincerely,



Lanny T. Nakano  
Acting Administrator

cc: Harry Kim, Mayor  
Christopher J. Yuen, Planning Director, County of Hawai'i  
Edward T. Teixeira, Vice Director, State Civil Defense  
Ann Ogata-Deal, Planning & Policy Analyst,  
Hawaii Coastal Zone Management Program

LINDA LINGLE  
GOVERNOR

MAJOR GENERAL ROBERT G. F. LEE  
DIRECTOR OF CIVIL DEFENSE

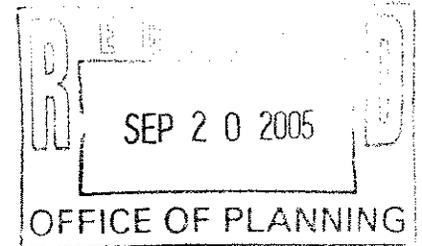
EDWARD T. TEIXEIRA  
VICE DIRECTOR OF CIVIL DEFENSE



PHONE (808) 733-4300  
FAX (808) 733-4287

**STATE OF HAWAII**  
DEPARTMENT OF DEFENSE  
OFFICE OF THE DIRECTOR OF CIVIL DEFENSE  
3949 DIAMOND HEAD ROAD  
HONOLULU, HAWAII 96816-4495

September 19, 2005



Ms. Laura H. Thielen, Director  
Office of Planning  
Department of Business, Economic  
Development and Tourism  
P.O. Box 2359  
Honolulu, Hawaii 96804

Dear Ms. Thielen:

Hawaii County Wind Speed Up Project

Wind speed mapping has been identified as a high priority project in the County of Hawaii Multi-Hazard Mitigation Strategy, the State of Hawaii Multi-Hazard Mitigation Plan, and the Hawaii I-Plan for Spatial Data (sponsored by the Hawaii Geographic Information Coordinating Council). That said, we strongly support this important initiative for Hawaii County.

During a large, single-storm event, damaging winds are likely to affect several counties concurrently. Consistent wind (hurricane) simulation and loss estimation systems, as well as consistent building design provisions, will prove to be of great benefit to public health, safety, and welfare. Consistently acquired data will enable uniformity in statewide emergency operations planning and response, and will enable risk-consistent, statewide planning exercises.

Martin & Chock has recently completed a wind hazard mapping project for the City & County of Honolulu in an initiative to update the County's building code. The County of Kauai is expected to soon initiate a similar project that will map those areas not covered by previous wind mapping activities which utilized the Martin & Chock methodology. In order to achieve a consistent system for wind hazard estimation statewide, the Counties of Hawaii and Maui are being encouraged to utilize the Martin & Chock methodology, which is proprietary.

Exhibit No. B

Ms. Laura Thielen  
September 19, 2005  
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We recommend that the Martin & Chock methodology be utilized for upcoming and future wind speed mapping.

If you have any questions please contact Ms. Faye Chambers, State Hazard Mitigation Officer at 733-4300.

Sincerely,

  
EDWARD T. TEIXEIRA  
Vice Director of Civil Defense

c: Ann Ogata-Deal, Coastal Zone Management, DBEDT

