



**GENERAL DYNAMICS**  
Information Technology

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## SUMMARY

### CRITICAL VULNERABILITIES

- Airports at Honolulu Int'l / Joint Base Hickam & MCAS-Kaneohe Bay
- Sand Island Port facilities & USCG base
- Barber's Point energy infrastructure

### CRITICAL UNCERTAINTIES

- Insurance company liabilities & response
- Inundation zones with shifting bathymetry
- Resilience of Oahu's freshwater lens

### RECOMMENDATIONS

- Investment in renewable energy and smart-grid technology
- Increase reserves of civilian food and energy stocks
- Maintain investment in environmental ISR
- Clarify rebuilding and retrofitting priorities to vulnerable infrastructure



# GLOBAL INT

## HAWAIIAN INFRASTRUCTURE SECURITY

### USAF Minerva Energy & Environmental Security Series US PACIFIC SCENARIO SUMMARY (UPDATE, NOVEMBER 2013)

#### BACKGROUND

In 2011, the USAF Air University Minerva team was tasked with undertaking comprehensive assessments of energy and environmental security risks to US forces and strategies in Asia-Pacific. The team established two tracks for assessment. One report would focus on Japan, China and India, and trace critical water/energy resources and their impacts on regional security and USAF strategy. The second track focused on scenario risk assessments for the US-associated Pacific Islands, beginning with disaster and logistic concerns on Hawaii. This summary concerns the latter track.

Using open-source networks of scientists, USAF Minerva first established environmental tipping points for potential, complex disasters. Scientists at the Hawaii Institute of Marine Biology provided emerging data on how marginal changes (~0.5C) in sea surface temperature can shift ocean

currents and tropical storm tracks to Hawaii, greatly increasing a hazard that has historically been low. Using these changes as a starting point, the Minerva team began a series



Barber's Point, Energy Port, Oahu, HI  
(photo, C.Briggs)

of scenario creation workshops, in cooperation with the University of Hawaii (CIMES), and later NCSE in Washington, DC. The USAF Minerva team developed scenario workshops that brought experts together to examine the cascading security impacts from variable factors, with tropical storms as a consistent driver. One scenario on Oahu proved to be the most compelling for illustrating energy and environmental security.

## SCENARIO STARTING POINTS

**TIMEFRAME:** 0 to 5 years

**DRIVERS:** Hawaiian tropical storm, cyber attack, deforestation, ocean acidification

**GEOGRAPHICAL SCOPE:** Limited to Hawaiian island of Oahu

One of the workshop teams focused their detailed scenario on the Hawaiian Islands, with particular attention to the island of Oahu and the potential impacts from a combination of natural events. Experts in the group included one flag officer and one environmental expert from PACOM, one cyber expert, a Chinese political scientist, a cetacean/fisheries expert, civil engineer, and a sociologist. Chad Briggs was facilitator. Recommendations were led by Tracy Walstrom Briggs.

This workshop team discussed the accelerating effects of flooding from deforestation on the islands, and increased risks of landslides after heavy rains. The acidification driver was considered a longer-term risk to both the freshwater lens on Oahu (which is protected by coral reefs) and storm surge protection of coastal areas (coral will disintegrate under highly acidic water). The cyber element was considered a wildcard in the risk matrix, with the military considered (e.g. Camp Smith) well prepared but civilian works highly vulnerable to sabotage of wastewater treatment, in particular.

The focus of the scenario

became not only the storm, but what combinations would provide a 'one-two' punch of overwhelming factors. These included closely consecutive tropical storms, a storm matched with a tsunami, or a disaster during deployment.

### CRITICAL NODES IN THE OAHU ENERGY & ENVIRONMENTAL SYSTEMS

**BARBER'S POINT:** This harbor is the only civilian import and refining facility for the island of Oahu, and has an open channel to the south, leaving it highly vulnerable to tropical storm tracks and storm surges. Significant damage to this facility would leave the island without any appreciable source of energy, as 95% of electricity on the island is provided by diesel generation. Though the military's energy reserves on the island are maintained independently and are significantly more secure, the vulnerability of civilian energy reserves is critical to security in the region.

Most civilian supplies on Oahu are maintained on a just-in-time delivery basis, meaning that electricity and transport fuels would run out before repairs could be made to the port and refineries without resupply after only three days. The work team suggested that increased investments in renewable fuel sources and microgrids may provide greater resilience in the face of such disasters. Such are actions already

underway on military installations.

### *SAND ISLAND & PARKWAY:*

The port facilities of Oahu (including the USCG base) exist on a sandy, low-level island south of Honolulu, connected by only one bridge between the island and the city. This container port is highly vulnerable to flooding, and in particular, food imports could be disrupted if the island and/or parkway were damaged. Oahu maintains only a three day reserve of food on the island, and any disruption to the port facilities would create an immediate food insecurity situation.

The Sand Island port facility is connected to the mainland of Oahu by a single parkway bridge and it is from this point that all civilian shipping imports for the island (excluding military supplies via Pearl Harbor) are received.

This vulnerability to storms/tsunamis carries the potential of causing significant disruptions over the short-term as emergency services are re-established and in the long-term repairing and improving damaged infrastructure.

The group identified acute risks to combined disaster hazards, particularly two tropical storms in one month or a combination of storm and tsunami.

### *HICKAM & KANEOHE BAY:*

The airbases at JB Hickam and MCAS Kaneohe Bay lie at sea level, and a loss of protective, corral reefs (due to

ocean acidification) would mean higher vulnerability to wave surges. The PACOM experts were particularly concerned at the risks of a tsunami following a hurricane, owing to the debris scattered on the airfields and the weeks of time it would take to clear the fields for general operation (hurricane-related storm surges would presumably be easier to clear and repair).

Damage to these airfields would pose two primary difficulties to the security community: one, that disruption of operations might impede military ops elsewhere in the Pacific, and two, such fields would not be available for disaster relief operations for the island itself.

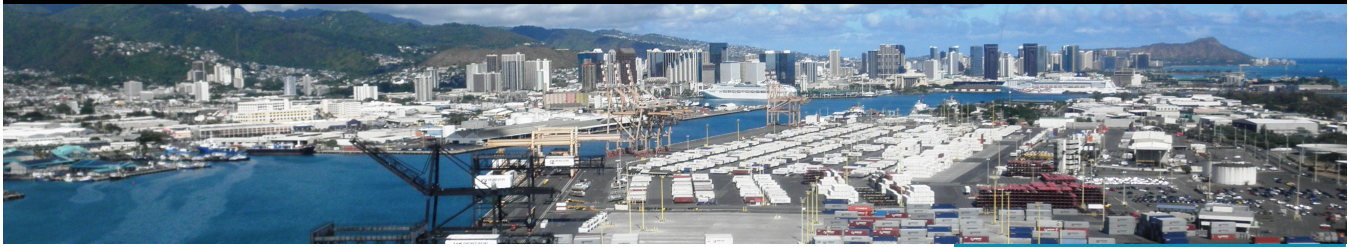
**WAIKIKI:** The tourist area of Waikiki (including Fort DeRussy) lies on reclaimed land and is highly vulnerable to flooding. Given the shallow waters off the beach and existence of extensive coral reefs, a scenario of flooding coupled with reef damage would result in complete inundation of the area and shutdown of Oahu's tourist industry.

Workgroup members could not determine how long the area could economically survive without hotels being open, and raised questions about the role of insurance companies. Several hotels in Kauai remain closed 20 years after Hurricane Iniki, because of the insurance companies' refusal to reinsure vulnerable locations.

### OUTLINE OF SCENARIO EVENTS

- Rising ocean temperatures shift Hawaiian trade wind patterns, and a hurricane hits the island of Oahu. Significant damage occurs in some coastal and inland areas, but overall the island is able to withstand the storm and recover economic activity. DOD air and naval operations are only disrupted for a matter of days, as ships are put to sea and aircraft are diverted to other bases.
- Due to the storm, and a combination of ocean acidification, coral bleaching and urban runoff, Hawaiian coral reefs are significantly damaged following the initial hurricane. This may affect some tourism, but the primary concern remains increased reef vulnerability to wave inundation to Oahu.
- Another event within one year then occurs. This trigger can be either another tropical storm/hurricane or a tsunami (< 3m), whose impact is then disproportionate to previous events or previous 'worst case' projections. The Barber's Point harbor and refining facility is flooded and damaged beyond use, Sand Island is flooded and container facilities are rendered inoperable, Sand Island Parkway is rendered inoperable for cargo vehicles, and airfields at Hickam/HNL and Kaneohe Bay are out of operation for at least one week. The island's resilience in the face of more frequent and intense storm activity raises serious security implications.
- Island transport networks are damaged by erosion and flooding of coastal roads, hampering relief efforts.
- Food and energy security becomes a primary concern, as civilian reserves on the island are insufficient and port facilities cannot be used. Relief operations by air are initially limited to C-130 and C-17 flights into Wheeler Field. Adequate energy supplies for civilian use cannot be restored for at least several weeks.
- Fresh water supplies for the island may also be threatened. Oahu's groundwater supplies are protected by undersea coral formations that are deteriorating from recent intensification of storm activity and long-term ocean acidification. These and other pressures threaten to cause irreparable damage from saltwater intrusion into the freshwater supplies of the island.
- Hotels around Waikiki are evacuated, and may fail to reopen due to lack of insurance coverage for areas now deemed high risk flood zones. The economic impacts on the island are severe, with downward cascading effects on the state's economy. Significant migration to the US mainland follows.

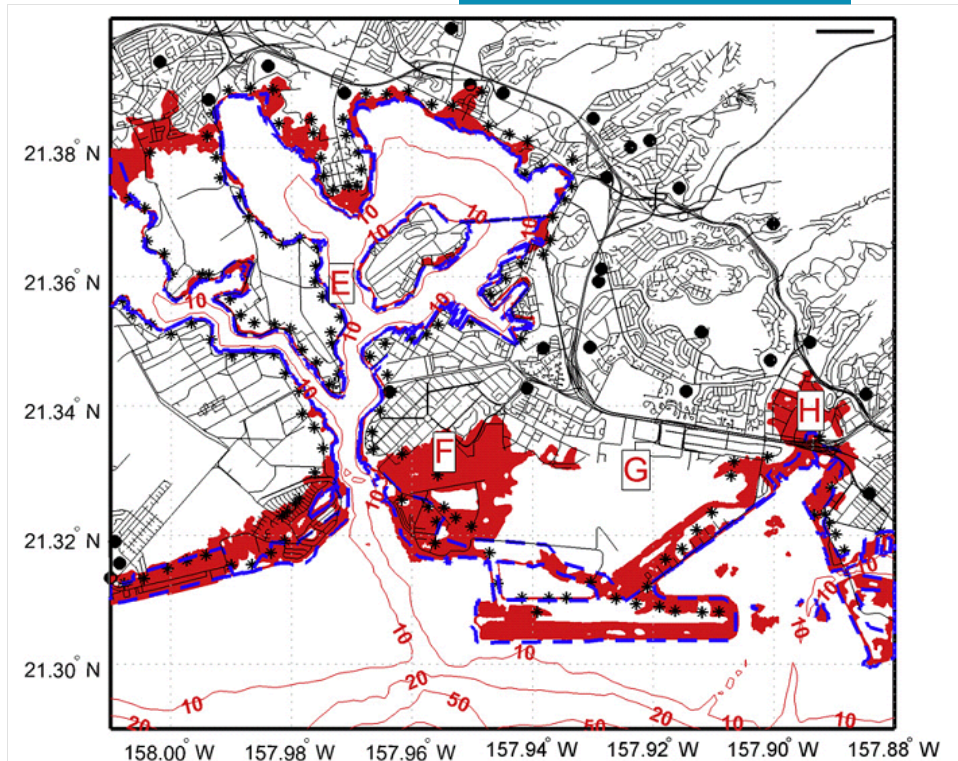




Sand Island Port facility, Oahu  
(photo C. Briggs)

Emergency risk management plans and significant federal, state and DOD resources are in place to mitigate the damage caused by a single storm event, ensuring short-term, basic capabilities are resumed as quickly as possible. It was concluded, however, that the vulnerabilities exposed by shifting storm patterns within the Hawaiian Islands would be amplified with each subsequent event. The existing energy infrastructure in Hawaii (specifically focusing on Oahu due to its military, economic, demographic significance) is entirely dependent upon importing energy with relatively short energy reserves.

In the short-term, PACOM could shift ships, aircraft, necessary equipment and personnel to other forwarding operating bases in the Pacific (e.g. Japan, S. Korea, Australia) or to the US mainland if necessary to protect its assets. In the long-term, if variable and unpredictable storm patterns become more prevalent and severe, Pacific force capabilities may be affected, and frequent disaster response missions may degrade readiness and budget planning. Working groups concluded that impacts on Oahu could be mirrored, with even greater impacts, on other islands of Asia-Pacific (including Okinawa, Diego Garcia, Philippines, etc).



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Inundation zone map of Hickam and Pearl Harbor: drawn from: Andrew Kennedy et al, 2012, 'Tropical cyclone inundation potential on the Hawaiian Islands of Oahu and Kauai,' Ocean Modeling 52-53: 54-68.