Aviation & climate change

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OFTEN WE THINK of Aviation as a contributor to emissions that have adverse climate impacts. Along with the IPCC predictions of likely sea level rise of up to a metre in the next 100 years comes predictions of more intense storms having stronger winds, and much larger ocean waves. Storms may occur during various phases of the tide, but erosion and inundation effects are most damaging at the highest of tides (Spring tides) when onshore winds create both large waves and a general additional raising of the sea level known as storm surge. When these effects combine, sea levels can rise several metres above normal high tide levels. Lower-lying coastal areas with soft substrates such as sand and clay are particularly vulnerable; and the Office of Environment and Heritage of the NSW Government has identified a number of climate change 'hot spots' along the NSW coast where erosion risks are significant. This is the case in all states of Australia, and most nations having coastal oceans.

Potential costs of climate change to the community are immense, and the impacts on government, business and personal resources yet to be fully understood, as important infrastructure is impacted.

Aviation has the potential to play a major role in documenting changes, and in providing support for those researchers seeking to understand, model and predict impacts of weather variability and climate change. This role involves airborne observation, in which large areas are able to be surveyed quickly and repeatedly in short times.

At UNSW the Flying Operations Unit at Bankstown Airport delivers in-house flying training for students enrolled in the Bachelor of Aviation (Flying) and the Graduate Diploma in Flying. But having substantial flying infrastructure also puts UNSW in a unique position with regard to facilitating airborne research.

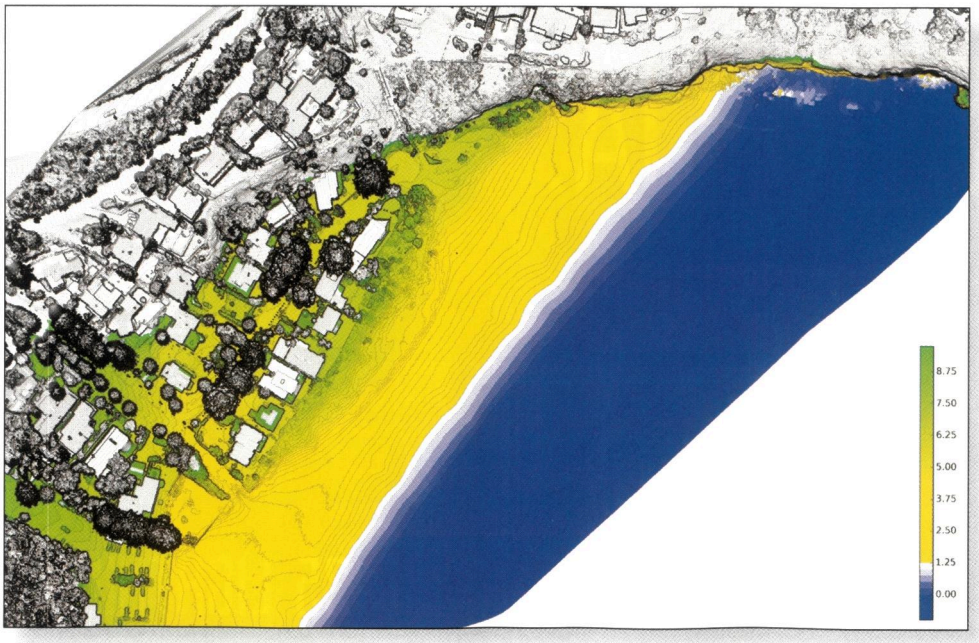
> "Aviation has the potential to play a major role..."

UNSW has a number of researchers who have need for airborne observations; and in conjunction with researchers at UNSW from the Science and Engineering faculties, the School of Aviation is gradually building an airborne research facility, providing remote observations of the earth's surface using an airborne platform (a Piper PA 44 Seminole) fitted with an approved observation port. On board the aeroplane, a Riegl VQ480i scanning lidar used in conjunction with a Novatel GPS/IMU unit is able to provide high vertical accuracy (+/- 3 cm) data of earth surface topography, as well as vegetation depths. Importantly, with a swath width of 100m or so (from 1000 ft altitude), and travelling at 50 m/s, the system is capable of acquiring surface topography data at the rate of 5000 sq m/s, with a data density of between 10 and 20 point per square metre.

Presently a team from the School of Aviation, led by of Jason Middleton, is working in conjunction with the coastal engineering team of Ian Turner (Civil and Environmental Engineering) and David Hanslow (Office of Environment and Heritage) on improving data acquisition during beach erosion events, as well as observing beach rebuilding. With storm events often eroding beach surfaces by more than 1 m in depth and tens of metres across, thousands of tons of sand are often moved in erosion events. Predicting these is ultimately important to coastal planning, to ensure that risks of building and infrastaructure loss are can be accurately estimated.

Airborne lidar observations of Narrabeen-Collaroy beach in Sydney's northern beaches in 2010 documented an erosion event and subsequent beach replenishment. However, unlike laboratory-based science, field-based science observations remain at the mercy of nature's gifts, and the group continues to observe ongoing beach erosion and replenishment events as they occur, to build data bases for comparison with mathematical models.

An image of the northern end of Bilgola Beach taken at low tide on 14th July, 2014 shows topographic beach contours at 0.25m height intervals, as well as clearly depicting some vegetation, and local buildings. The color bar depicts height above mean sea level (msl), in this case up to 9m. In Sydney, high tides can be up to approximately 2m higher than low tides. With some areas behind the foredune as little at 3 to 4 m above msl at Bilgola, it doesn't take too much imagination or expertise to envisage significant damage if a major storm event occurred during a high tide. This work is ongoing and is extended to a number of other 'hot spot' beaches. The ability to understand and predict such events does not make money, but the contributions of aviation have a significant utility for improving understanding, more effective planning and mitigating losses.



False colour image of the topography of the Bilgola beach area, Sydney, constructed from airborne lidar data acquired on 14th July, 2014. Cameron Cooke (UNSW Aviation) constructed the image.