From: Ken McDonald [redacted]
Sent: Tuesday, 18 October 2016 11:06 PM
To: 'senator.nash@aph.gov.au'
Cc: [redacted]
Subject: Norfolk Island - Important Need for Connection to Hawaiki Cable

Senator Hon. Fiona Nash,

I am an Australian Engineering consultant and run an engineering systems company in Australia with a worldwide customer base. While based in Mornington Victoria I also have a home and office on Norfolk Island and have been associated with the Island for more than 20 years.

My expertise is in the design of high speed real time software based control systems for a variety of heavy industries and the telecommunications industry. I have been involved in a number of projects delivering enhanced telephone and data services to outback and rural Australia and more recently have been involved in the design and development of advanced mathematical models for rolling steel or Aluminium. From Mornington or Norfolk Island I manage several teams of engineers worldwide and provide remote support to customer sites in Europe, India, Bangladesh, China and North America. My business relies on good stable low latency internet connectivity to service these needs.

I cannot stress how importantly I view a connection to a fibre optic cable as being essential for Norfolk Island in the medium to long term. There is an important opportunity now to connect to the new Hawaiki cable and in my view all possible efforts should be explored with a view to ensuring that this connection can be made.

I refer you firstly to the submission made recently to you by XXXXXXXXXXXXXXXXXXXXXXX. His submission outlines many of the advantages a cable connection would provide and provides some insight into the deficiencies of the NBN rollout to Norfolk Island using the Sky Muster satellites that have recently been launched and being brought into operation. His submission provides insightful documentation of the background, current situation and recommendations for Norfolk Island's telecommunications future.

Secondly I refer you to your recent article that appeared in this week's issue (Vol 51, number 33) of the Norfolk Island newspaper titled "Partnerships are the way to take NI forward".

Your desire to partner with the local council to co-invest in projects as you say is a great way to move things forward. We all want to see Norfolk Island prosper and flourish and funding the connection to the new Hawaiki cable plus carrying out other much needed work like the 2G to 4G upgrade would help to ensure that Norfolk Island's communications needs can be met for the next generation.

I refer you to your comments made concerning broadband internet delivery to the island.

"We're also delivering broadband internet to the island through the NBN SkyMuster satellite. Sky Muster delivers up to 25 Megabits per second – more than enough for high definition teleconferencing, or video streaming through services like Netflix."

SkyMuster cannot deliver on the promise of video streaming, nor can it deliver the low latency network connectivity required for interactive and business use. I respectfully state that you have been

misinformed if you believe that a GEO stationary satellite can adequately deliver the types of services that Norfolk Island needs.

I want to address each of these points one by one. A few technical points need to be raised but I will try to keep these as brief as possible.

- **SkyMuster service speed** is inadequate to meet the needs of Norfolk Island in the medium to long term.
- **SkyMuster service latency** has a negative effect on the overall user experience for interactive and business use.

Please consider the technical points that I make below concerning service speed and latency. I urge you to consider this once in a generation opportunity to connect to the Hawaiki cable and make all efforts to ensure that this can be done.

SkyMuster Service Speed

NBN services are sold and advertised on the basis of the Peak Information Rate (PIR) that can be achieved by the technology. For SkyMuster the PIR is 25 Megabits per second from the satellite to subscriber and 5 Megabits per second from subscriber to the satellite. There is also a 12/1 option, but for simplicity I am only looking at the higher performance option. For a shared resource like a satellite the PIR sounds good but it is much higher than the typical design rates that can be achieved. The SkyMuster system and rollout is designed on the basis of a design Committed Information Rate (CIR). This is the rate that can be committed to in a typical system fully loaded with subscribers. For the NBN SkyMuster the CIR is 0.3 Megabits per second from satellite to subscriber and 0.03 Megabits per second from subscriber to satellite. This is 83 times slower than the advertised PIR down rate and 166 times slower than the advertised PIR up rate.

The average capacity of a typical beam from SkyMuster, such as the beam directed at Norfolk Island is 115.8 Megabits per second. Since ultimately there will be two satellites, hence two beams this can be doubled to 231.6 Megabits per second. The average up rate is about one fifth of this number. Hence the asymmetric nature of the service, advertised as 25/5. Since the down rate of 231.6 Megabits per second is shared between all users it is easy to see how the performance will degrade during peak periods of use.

In order to stop people hogging the satellite, fair use policy is put in place to limit the total quota of subscriber "anytime" downloads to 60 Gigabytes in a 4 week rolling period. There is an additional 90 Gigabytes off peak quota, but that does not typically come at a time of day that is useable for streaming large quantities of data. If any subscriber exceeds the fair use policy in a rolling 4 week period, the data rate is automatically restricted to 0.128/0.128 Megabits per second. For the bigger data plans, cost also rises steeply to discourage use.

Take for example "Netflix". Streaming standard definition TV via Netflix requires about 3 Megabits per second, HD TV requires about 9 Megabits per second, UHD TV requires about 20 Megabits per second. To exhaust the Norfolk Island capacity of SkyMuster using HD TV would take just 25 simultaneous users. Assuming the average family of 5, parents and kids watch different shows, this bottleneck would be reached very quickly, with a take-up and usage during peak times by less than 13 families on the Island. If we look at UHD TV the numbers get much worse. For UHD TV the SkyMuster

has the capacity to stream data for only 9 simultaneous users to Norfolk Island at the expense of all other data.

Reality is even worse, as the capacity is used for many services other than streaming video, for example web browsing, computer software downloads, skype, emails, business use etc. My own measurements on the Island using standard internet speed testing software show a typical download rate of 22 Megabits per second in quiet periods, like 5:00AM in the morning and as low as 3 Megabits per second during peak periods, such as early evening. Rollout across the Island is underway, but not completed so the peak period performance will continue to drop as more subscribers get connected to SkyMuster.

For example the Netflix site itself suggests that for 10 hours of Netflix TV per week, monthly usage would be 40 Gigabytes for standard definition, 120 Gigabytes for HD and 280 Gigabytes for Ultra HD TV. Netflix suggests plans of 100 Gigabytes, 200 Gigabytes and 500 Gigabytes+ plans to service these usages. Clearly these usages are far beyond what the SkyMuster service can deliver.

Having a connection to the Hawaiki cable would remove bandwidth limitations. This would allow Norfolk Island to grow its communications as ever more and more online and cloud based services are added. Longlining of Australian telecommunications services would also be feasible. The upgrade of the existing 2G mobile network would be practical. Existing infrastructure along with 4G services can distribute services across the Island. Relying on SkyMuster will put a restrictive limit on Norfolk Island's ability to grow its telecommunications network. Capacity will likely be exhausted even during the initial rollout of services and not allow for future growth.

SkyMuster Service Latency

The SkyMuster satellite being a geostationary satellite adds a significant latency or delay to any internet traffic. The SkyMuster system is effectively designed as a "bent pipe", that is the satellite simply acts as a conduit for the data, relaying data from a ground station to a customer unit and vice versa with no intelligent processing within the satellite itself. You can effectively think of it as a conduit 72,000km long reaching up to the satellite positioned 36,000km above the earth and then bending down to Norfolk island. The ground station that services Norfolk island is based in Waroona Western Australia. The inherent design of the system results in long time delays from an action by a user and a response from a service. For example the average NBN SkyMuster round trip delay from Norfolk Island to Houston Texas and back is about 851 milliseconds. In contrast the latency using the O3B satellite service provided by Norfolk Telecom is only 268 milliseconds. For interactive business work, this makes the difference between having a useable connection and not. For a fibre connection the latency will reduce even further, an estimated round trip time using the Hawaiki cable would be about 200 milliseconds to Houston and less than 100 milliseconds to Australia and New Zealand.

(Note: Norfolk Telecom's O3B satellite service is also designed as a "bent pipe" service, although the pipe in this case is only 16,000km long, rather than 72,000km. The minimum round trip distance for NBN SkyMuster is 144,000km, whereas for O3B is 32,000km. O3B connects into optical fibre in Hawaii and this results in the very good latency numbers achieved by O3B.)

For my own business use on the Island I have an NBN connection and a Norfolk Telecom O3B connection. Having both services available has meant that I have been in a good position to trial the services together and The NBN connection under test has proved unsuitable for interactive use, whereas with the O3B connection, interactive performance is similar to what I get in Mornington

Victoria. Having a low latency fibre connection would improve this further, enhancing interactive user experiences.

NBN SkyMuster attempts to mitigate the effects of this latency by using advanced software within the ground stations and customer terminal units to learn the web browsing habits of subscribers and automatically fetch content. This software is called a "Performance Enhancing Proxy" or PEP. This software can work for web browsing, but it does not work when encrypted links or what we call "Virtual private Networks" (VPNs) are used. The ineffectiveness of the PEP, combined with the high latency of the NBN SkyMuster means that VPN business links do not work well via SkyMuster. For businesses like mine that rely on worldwide VPN connections, this equates to poor performance.

If a connection is made to the Hawaiki cable and the local infrastructure is used to distribute the services, more conventional Proxy servers can be used. This reduces the off Island traffic for commonly accessed web pages or software downloads, such as Microsoft Windows updates. The first time anyone downloads such software it can be cached locally on Island and then is available to anyone who needs it. A distributed system like NBN SkyMuster does not allows for these types of commonly used traffic optimisations to be done.

Once again I would ask that you carefully consider the points made above along with the other submissions that have been made. It is my belief that it is not too late to secure emergency funding to allow for provision of a connection to the Hawaiki cable. Even if the full cost of funding cannot be provided now, at least the cost of the undersea tap should be considered.

Yours Sincerely,

Ken

Kenneth McDonald
Managing Director
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