

Simplex Analysis

Monthly Exercise - September 2024

Goals: Relay, Cross-band

Prepared by VA3PRR Jasmine

Index

Index	2
Basic Summary	3
Detailed Overview - Sites	5
Detailed Overview - Terrain	6
Path Analysis	7
VA3PRR <=> VE3LON, VA3XLC	8
<=> VE3XCS, VE3PIK	9
<=> VA3TEW, VE3PRJ	10
VE3LON <=> VA3XLC, VE3XCS, VE3PIK	11
<=> VA3TEW, VE3PRJ	12
Coverage Analysis	13
Overall Summary and Recommendations	15
Recommended Control Station sites	16
Projected coverage of recommended sites	17
Final Thoughts	18

Basic Summary

Participants: 9
 Max power: 50W
 Min power: 5W
 Average power: ~34W
 Relays: 2
 Bands: 2
 2m frequency: 146.460
 70cm frequency: 446.025
 Grids: 6

Callsign	Name	Role	Grid
VA3PRR	JASMINE	2m NCS	EN92jw
VA3XLC	LEE	2m/70cm Remote	EN93ja
VE3XCS	CHRIS	2m/70cm Remote	EN93ja
VE3PIK	PAUL	2m/70cm Remote	EN93ia
VE3FLJ [VE3LON]	JOSHUA	2m/70cm Relay	EN93ka
VA3TEW	DAVE	2m Relay	EN92iw
VE3PRJ	CAM	2m Remote	EN92kv
VE3ZBG	BRETT	2m/70cm Remote	EN97dd
VE3ACW	MIKE	2m/70cm Remote	EN93kn

Basic Summary

NCS - Net Control Station

RCS - Relay Control Station

Voice

Despite laying out an elaborate plan via email over the course of the preceding month, I neglected to use almost all of it. With that said, I'm still quite happy to call this exercise a success, and the results are very interesting! I will clearly need to continue to refine and improve my own operations.

The first obstacle encountered when moving to simplex was establishing contact between NCS and the first designated RCS, VE3PIK. NCS is known to have a poor link to VE3PIK from this location due to obstacles, this should be taken into account for future iterations.

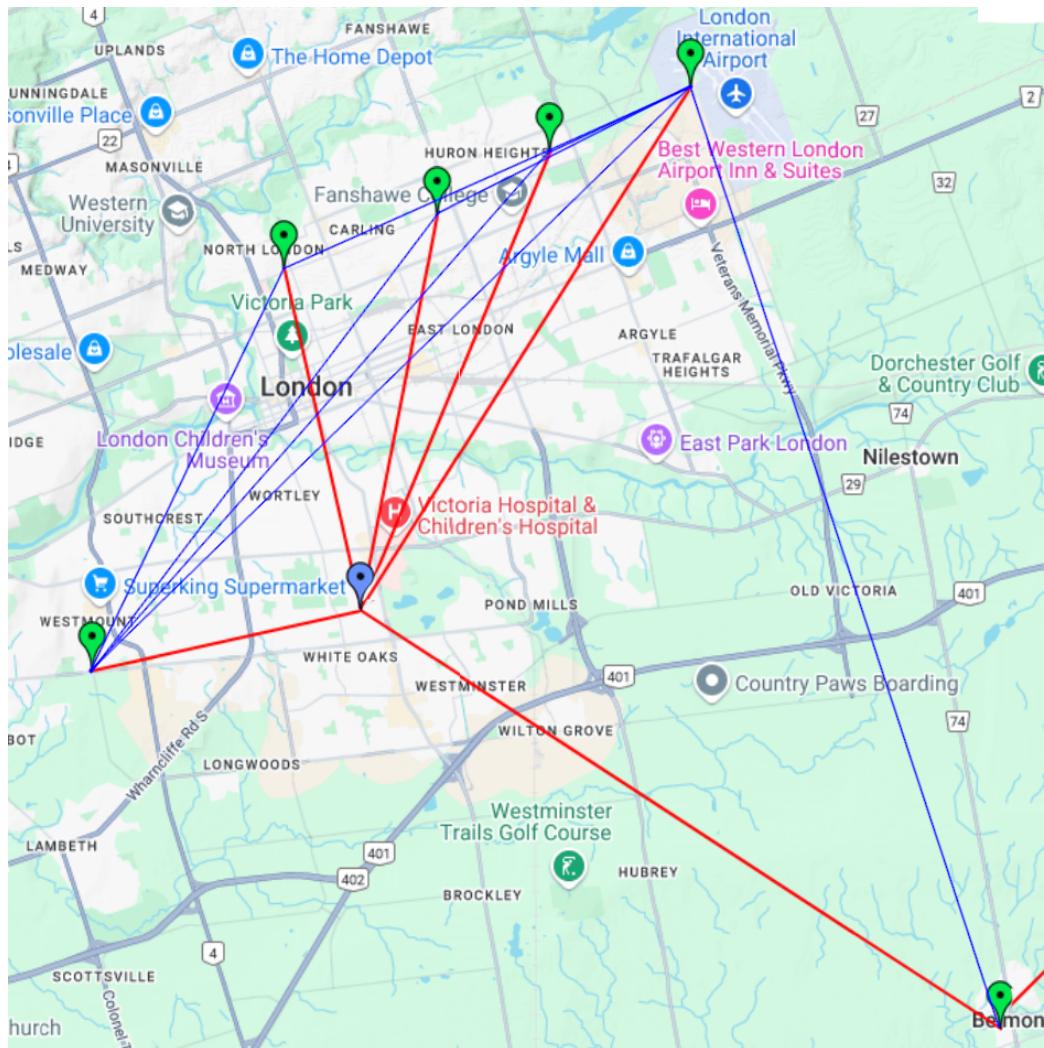
NCS chose the best known path - VA3TEW - as a replacement RCS. Previous experiments have suggested that VA3TEW generally has reasonable coverage of most of the participating stations, however he was only able to establish contact with VE3FLJ at the LARC station.

Becoming the new RCS, VE3FLJ then established contact with all other stations to exchange a signal report. On 146.46, it appears that most remote stations were functionally readable with minimal difficulty from this RCS location. On 446.025, it appears that most stations were functionally readable with some difficulty from this RCS location. 223.505 was not tested due to lack of available stations. Location data given by or relayed for VE3ZBG and VE3ACW appeared to be incorrect, and wasn't included in detailed analyses.

Data

The data portion was not completed due to lack of available stations.

Detailed Overview



Red Line: Path to NCS

Blue Line: Path to RCS

Blue Marker: VA3PRR [NCS]

Green Markers (top to bottom):

VE3FLJ [RCS]

VA3XLC

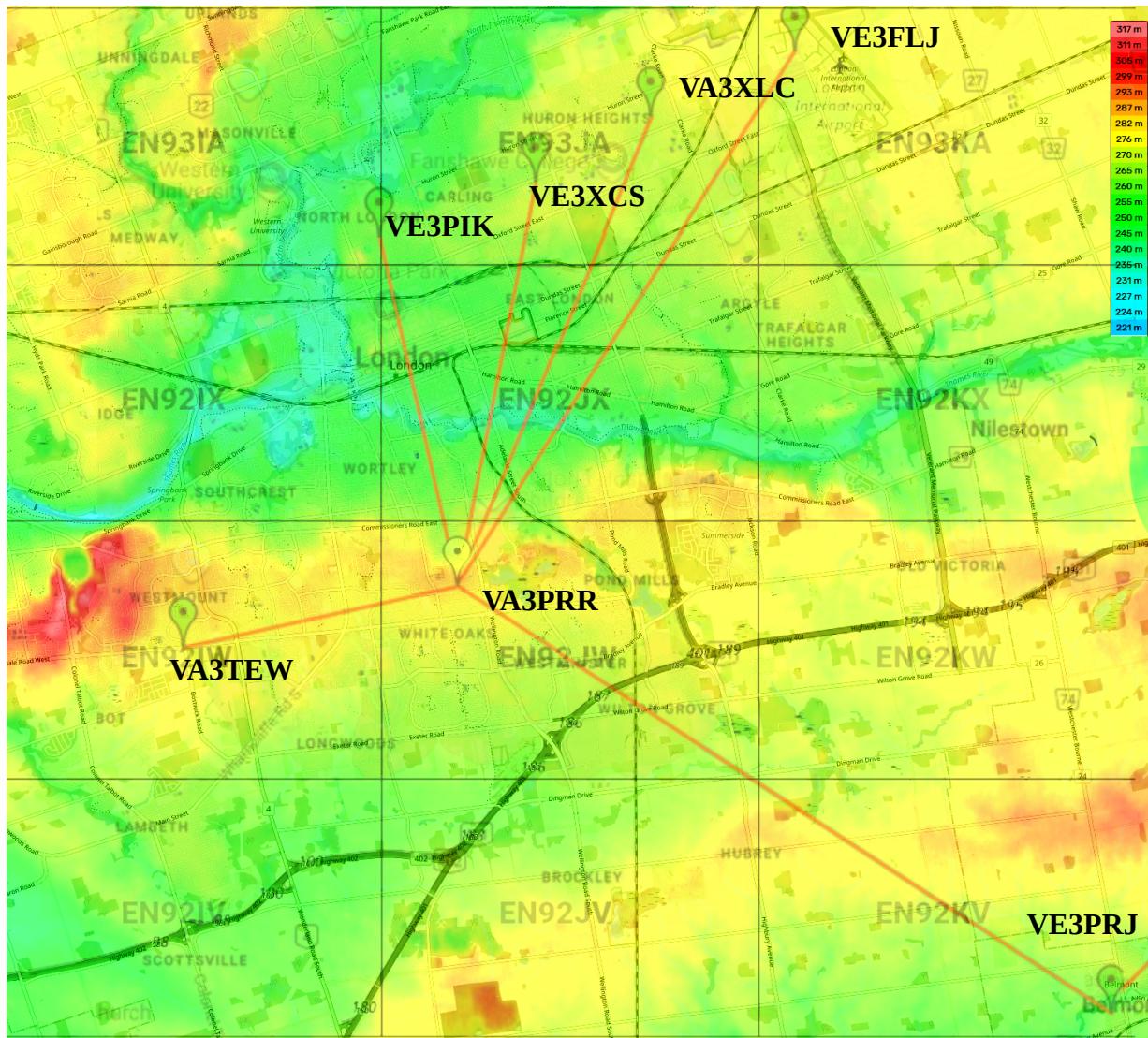
VE3XCS

VE3PIK

VA3TEW [RCS]

VE3PRJ

Detailed Overview



This image composites three layers: the previous image showing station locations, a grid map, and the topography.

The terrain suggests that VE3PIK, VE3XCS, VA3XLC, and the VE3LON station should all have a **very usable link** to each other. VE3LON is also slightly higher in elevation than those stations in the northeast quadrant, making it a **suitable choice for NCS/RCS**.

Note the ridge north of VA3PRR, which, in combination with building clutter, deafens NCS to stations further north from that location.

Finally, note the series of terrain ridges between VE3PRJ and VE3LON, which should have largely prevented this link.

Path Analysis

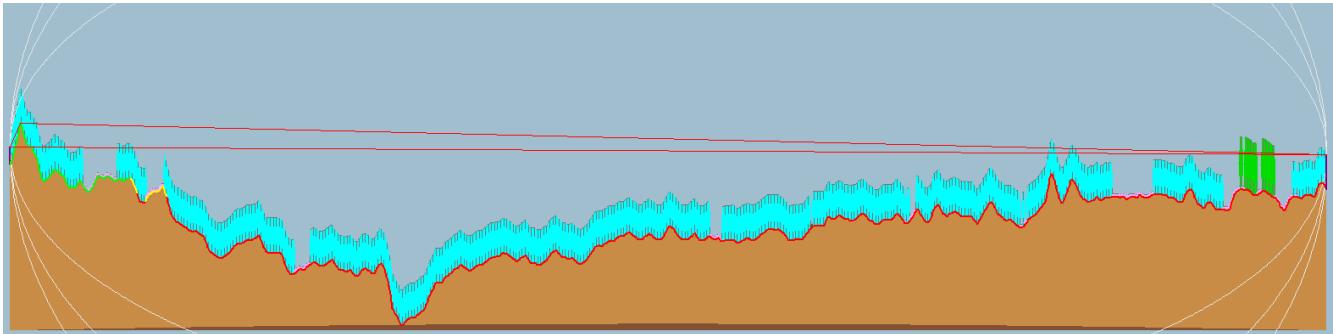
I've done a detailed analysis for all paths between my NCS location and all remote stations, as well as between RCS at VE3LON and all remote stations. Information about the tool used for these analyses will be included at the end. For the most part, I have made some very broad assumptions about antennas and transmission lines - in general, this doesn't tend to amount to much difference for line-of-sight, however it does affect estimates of a station's coverage.

The images provided show:

- brown to indicate terrain
- blue to indicate structures
- green to indicate vegetation
- NCS or RCS on the left, remote station on the right

The first set describes the path between my current location at EN92jw27 and all other stations, and the second set describes the path between VE3FLJ's location at VE3LON and all other stations (except mine).

1) VA3PRR <=> VE3FLJ [VE3LON] EN93ka



Due to the high ridge at the far left (PRR) side of the image, there is no direct line of sight between stations. Despite this, NCS reports a very usable 57 for this link overall.

Link distance: 11.255 km

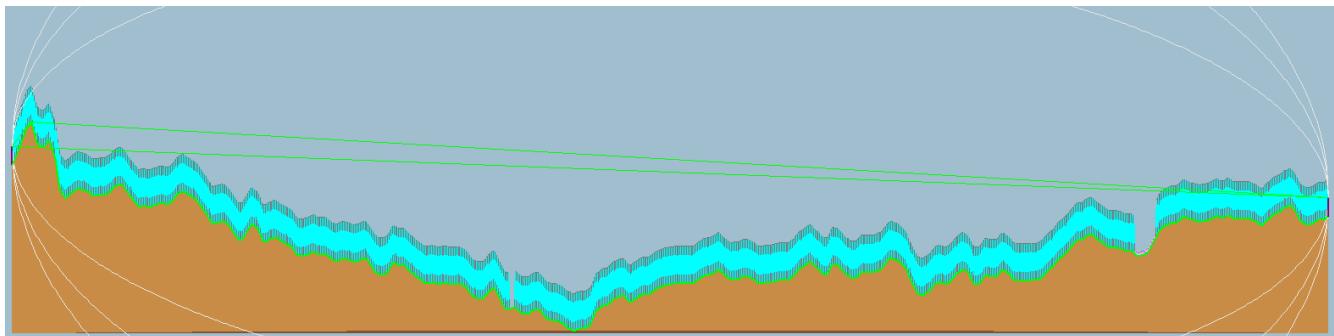
2) VA3PRR <=> VA3XLC EN93ja



Since XLC is fairly close to VE3LON, the path between PRR and XLC is fairly similar. The ridge on the PRR side interferes with the link, but additionally, the path disappears into a few layers of structures. XLC may have heard NCS at full power, however NCS barely heard that XLC was transmitting over the noise floor. Link not reliable.

Link distance: 9.041 km

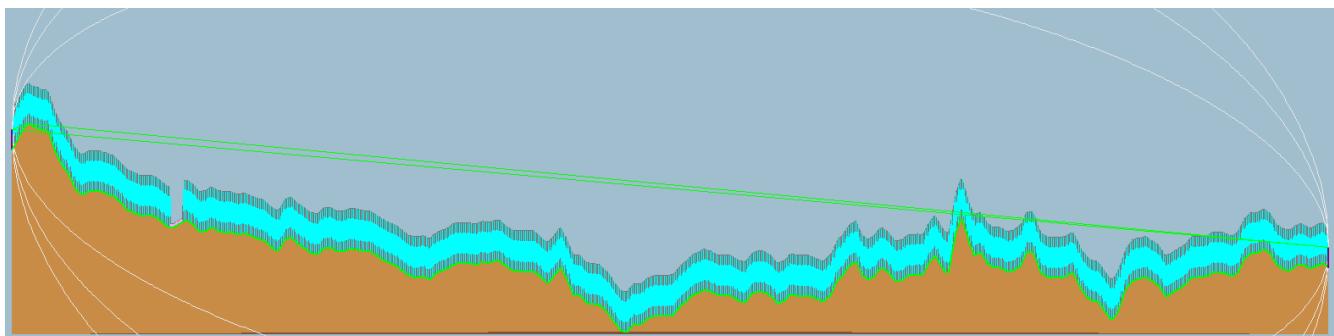
3) VA3PRR <=> VE3XCS EN93ja



Position estimated. XCS is marginally closer than XLC, however, as they are both in the same 6-grid, they lie along roughly similar paths to NCS. XCS reports he could not hear NCS, link not reliable.

Link distance: 7.341 km

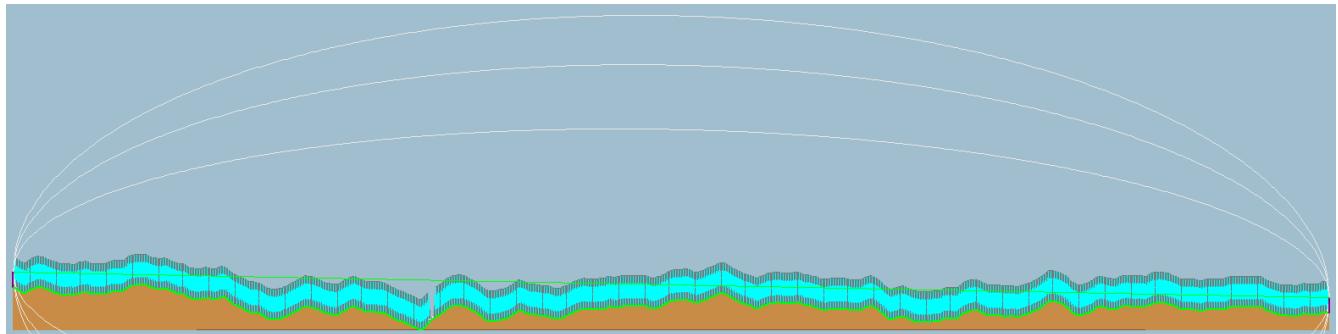
4) VA3PRR <=> VE3PIK EN93ia



This is known to be a non-link using an omni-vertical. There is a cluster of apartment buildings on the NCS side which prevent a direct link, however NCS has had success using a tape measure yagi for foxhunting to reliably send and receive.

Link distance: 6.357 km

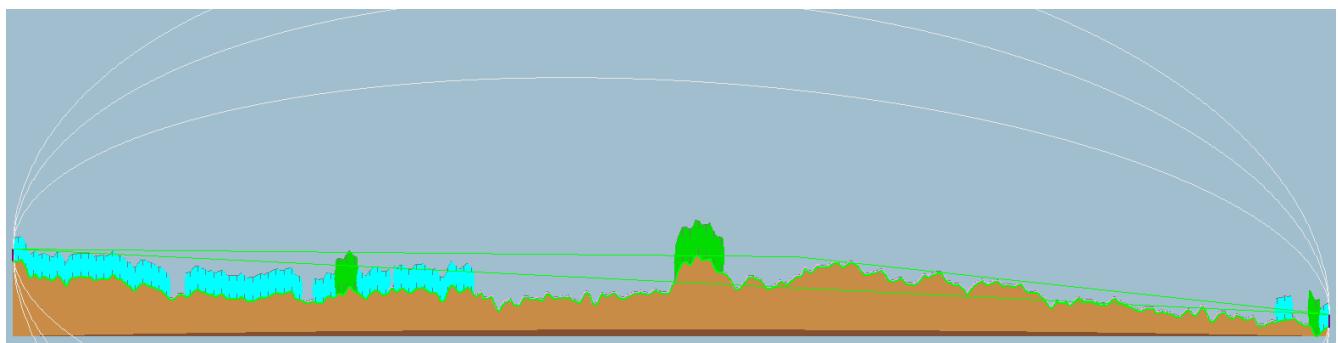
5) VA3PRR <=> VA3TEW EN92iw



Position estimated. Experimentation has shown this to be a reliable link, and the comparatively flat terrain illustrates this.

Link distance: 5.000 km

6) VA3PRR <=> VE3PRJ EN92kv

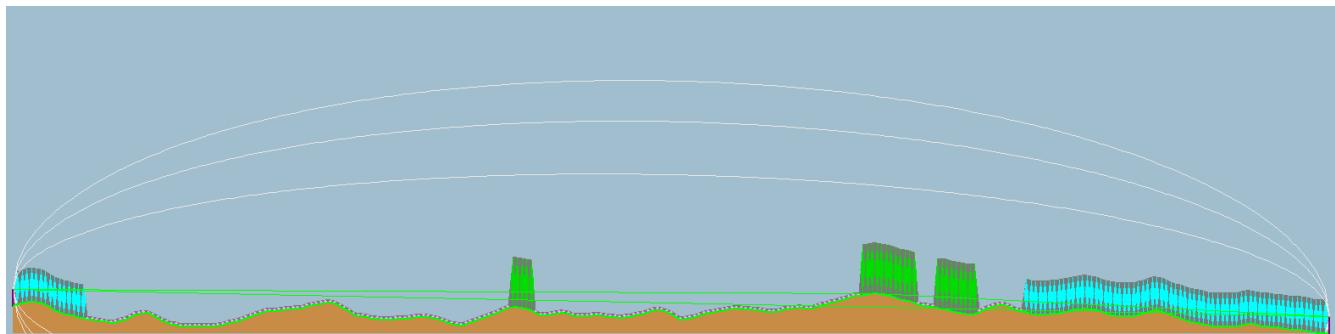


PRJ was an excellent candidate for this exercise due to his distance from all other stations, as well as the complicated terrain. NCS could not hear PRJ on simplex at any time, no direct link exists.

Link distance: 13.857 km

Overall NCS Observations: VA3PRR's current location is not conducive to wide area coverage, and would require at least one relay to operate effectively. Experiment with repositioning.

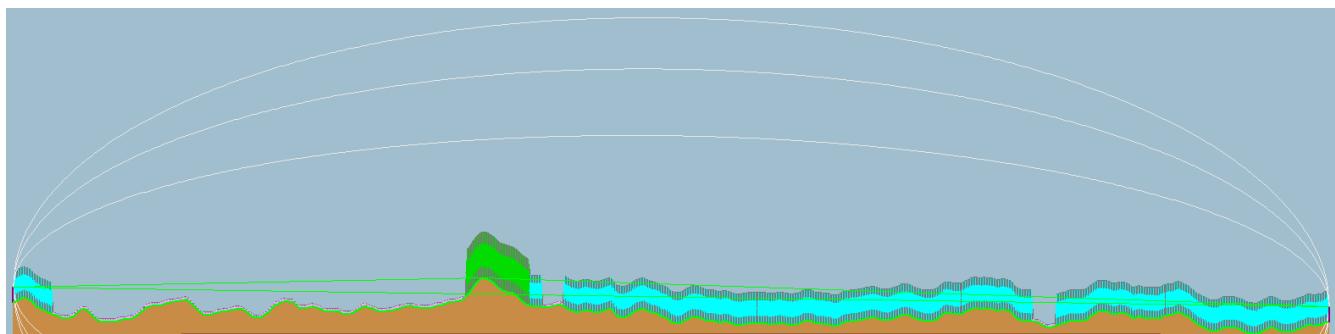
1) VE3LON <=> VA3XLC EN93ja



Despite appearing to be an obstructed path, RCS reported this to be a usable link.

Link distance: 2.814 km [Shortest Path]

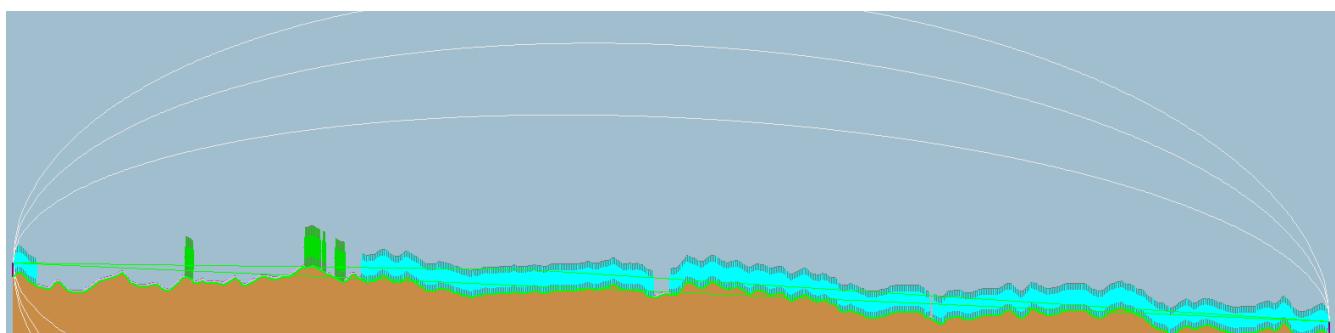
2) VE3LON <=> VE3XCS EN93ja



RCS reported this to be a somewhat weak but readable link.

Link distance: 5.156 km

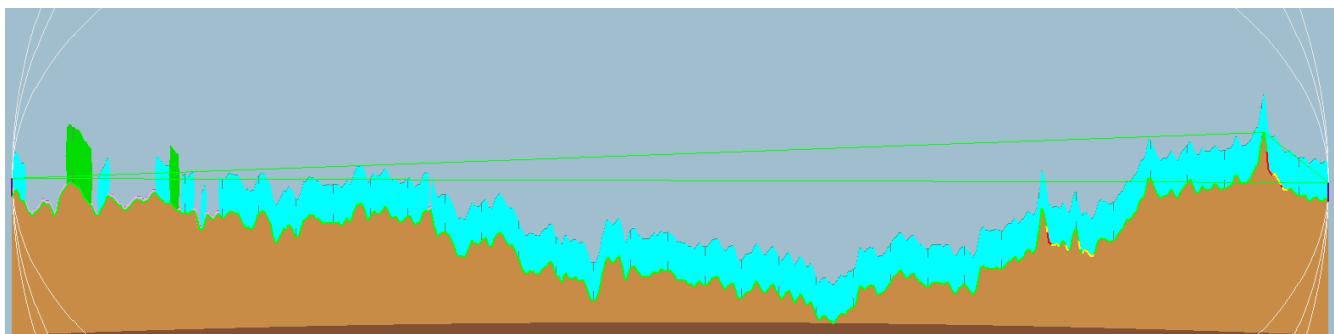
3) VE3LON <=> VE3PIK EN93ia



RCS reported this to be a weak but somewhat usable link.

Link distance: 8.147 km

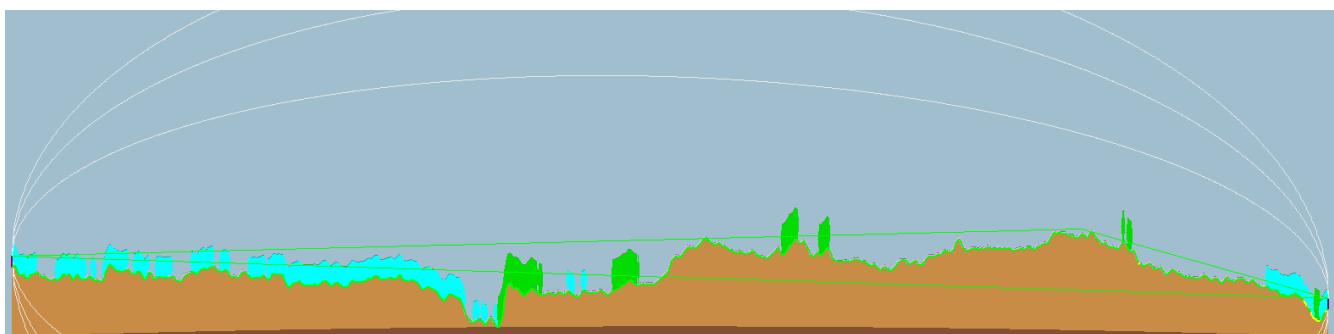
4) VE3LON <=> VA3TEW EN92iw



VA3TEW acted as secondary RCS, and was able to hand off to VE3FLJ via this link without difficulty.

Link distance: 15.185 km

5) VE3LON <=> VE3PRJ EN92kv



Especially given PRJ's description of his antenna configuration, this link is very surprising. RCS reported this as quite weak but readable.

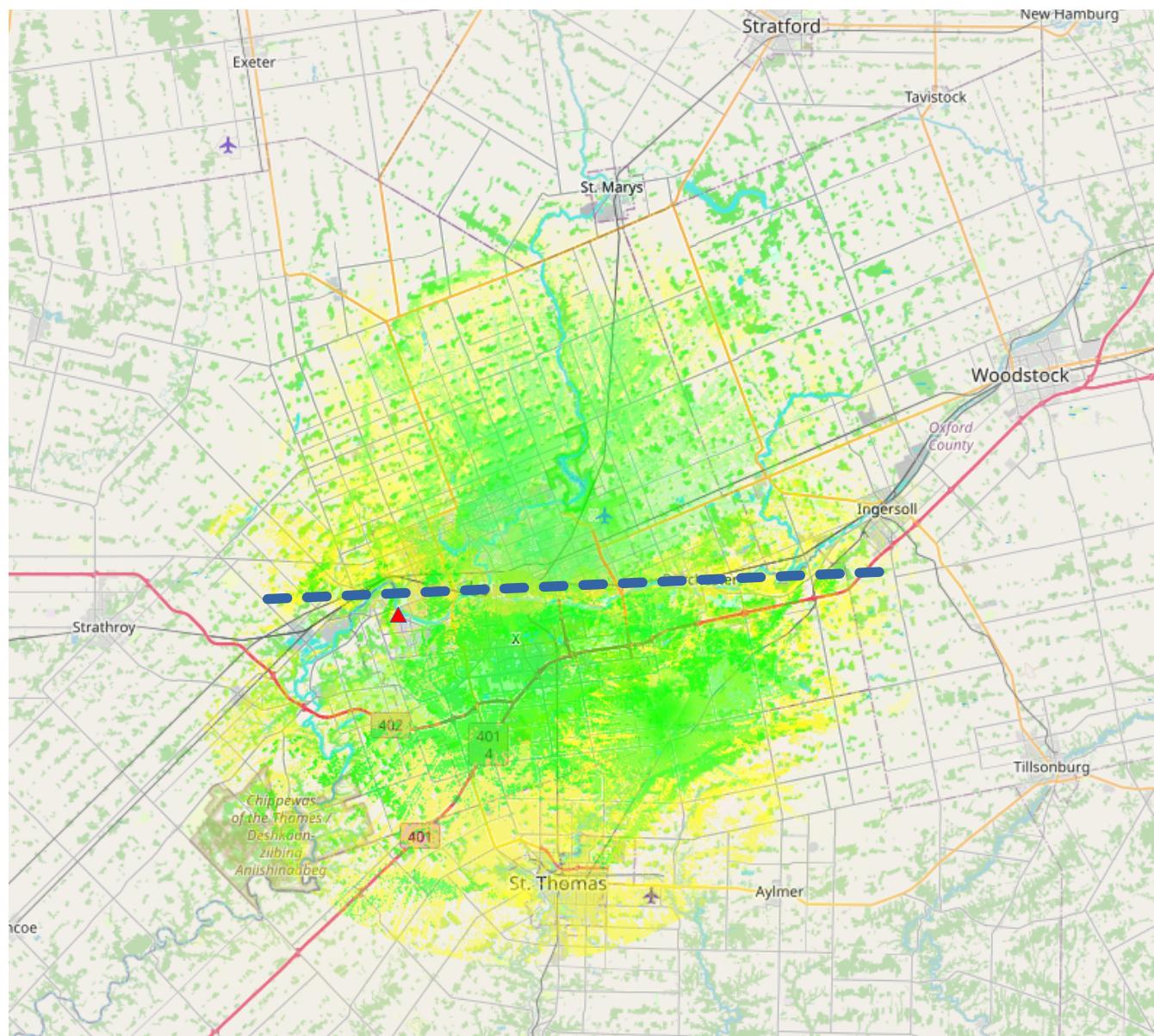
Link distance: 17.984 km [Longest Path]

Overall RCS Observations: Having demonstrated the ability to reach the majority of participating stations, the VE3LON site appears to constitute a viable net or relay control location. No data exists for coverage of central and northwest regions.

Coverage Analysis

We covered a total of 6 grid squares at the 6-digit level, which constitutes roughly 30% of the goal coverage area by grid. We have demonstrated that this is **largely feasible using the 2 metre band**. VE3PRJ's participation has also allowed us to demonstrate that our coverage can potentially include communities up to almost 20km away from the VE3LON station. Preliminary experiments suggest that 70cm is also mostly feasible from this location, however more testing is needed. We were unable to test a 70cm link to VE3PRJ.

The total (calculated) coverage area on 146.460 is shown below.



Coverage Analysis

- 1) Coverage of the **Emergency Operations Centre** (approximate location of red triangle)

Coverage of this location by participating stations appears to be marginal due to terrain, and this was demonstrated during the City of London's 2024 **MARCONI BRAUN** interoperability exercise. This was not a stated goal of the monthly simplex exercises, but it's very useful to keep in mind. If needed, establishing a link to the EOC would require at least one relay station. The closest participating station to the EOC was **VA3TEW**, however path study indicates that this link may be marginal.



[**VE3LFD** station @ EOC on left, **VA3TEW** station on right]

- 2) Coverage of grid squares on the EN92_x line appears to be present but suboptimal. (Blue horizontal line)

The same terrain that complicates a direct link with the EOC results in an area of reduced coverage on a roughly east-west line following the southern branch of the Thames River (Askunessippi), just south of the downtown area. More concrete information will require testing, but I estimate that we should have a usable - if somewhat weak - link to these areas.

Overall Summary

and Recommendations

First, take another look at the coverage map on page 13. While this is estimated based on some assumed (and somewhat pessimistic) values, experimentation seems to indicate that at least some parts of it may be reasonably accurate. To get a more accurate understanding of our simplex coverage on 2m VHF, we would need more stations at more locations. That said, the coverage map seems to suggest that 9 hams are able to reliably connect the majority of London, Komoka, Mt. Brydges, Dorchester and Arva. It also suggests that those same 9 hams can almost provide a tenuous connection to Sheddron, St. Thomas, Ingersoll, St. Mary's, Lucan, and Strathroy. With the addition of 6 strategically located hams, these communities and others could be included as well.

Analysis of coverage and terrain suggests that positioning operators near the following locations would improve city-wide coverage;

Alfa - Wonderland Road at Teeple Terrace

Direct link to **EOC**, **VE3LON**, and **Charlie**.

Potentially marginal link to **Bravo**.

Bravo - Commissioners Road west of Hamilton Road

Direct link to **VE3LON**

Potentially usable link to **Alfa** and **Charlie**.

No link to **EOC**.

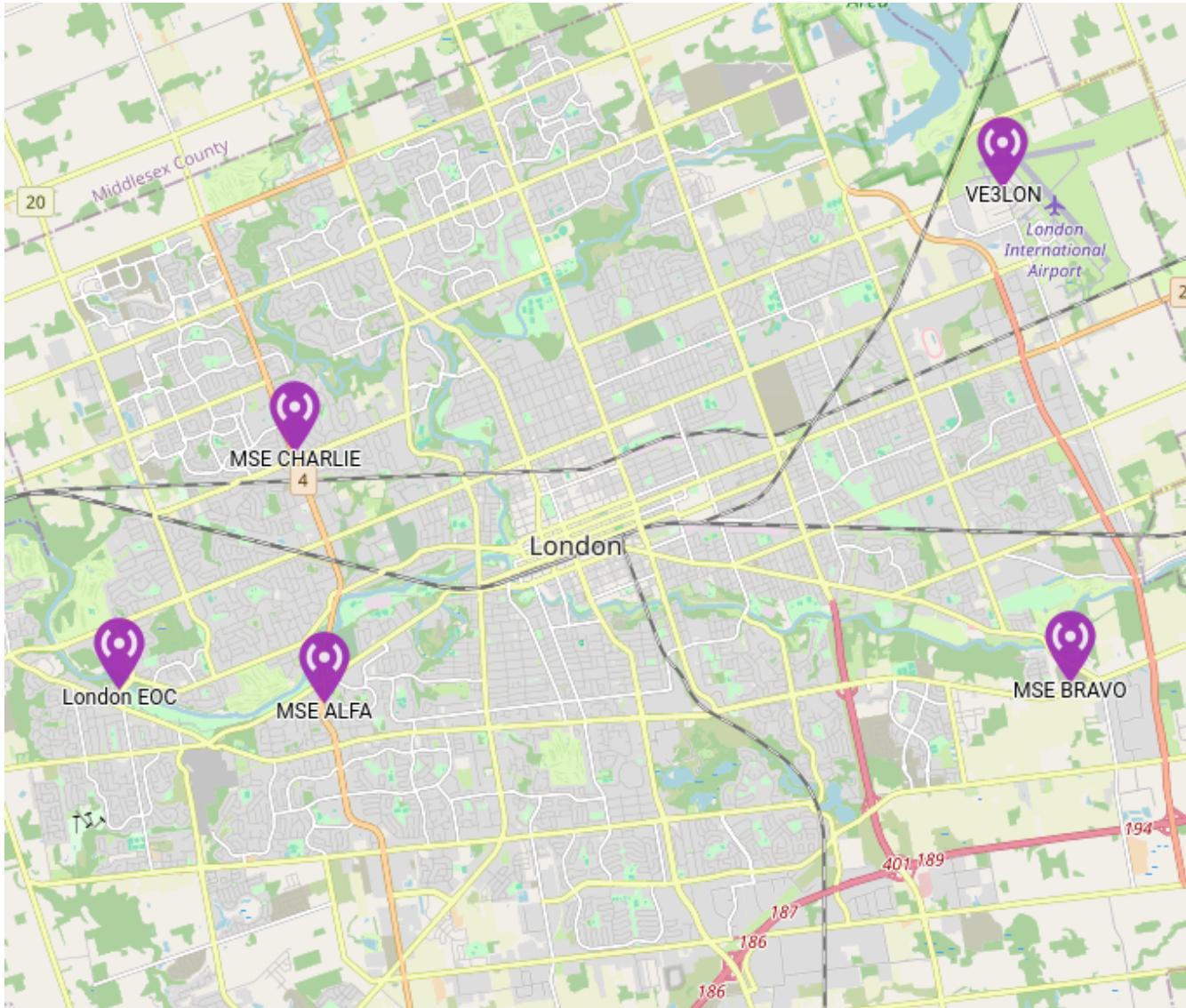
Charlie - Wonderland Road at Sarnia Road

Direct link to **VE3LON**, **Alfa** and **Bravo**.

No direct link to **EOC**, but a marginal indirect link may exist.

Overall Summary

Recommended Control Station sites

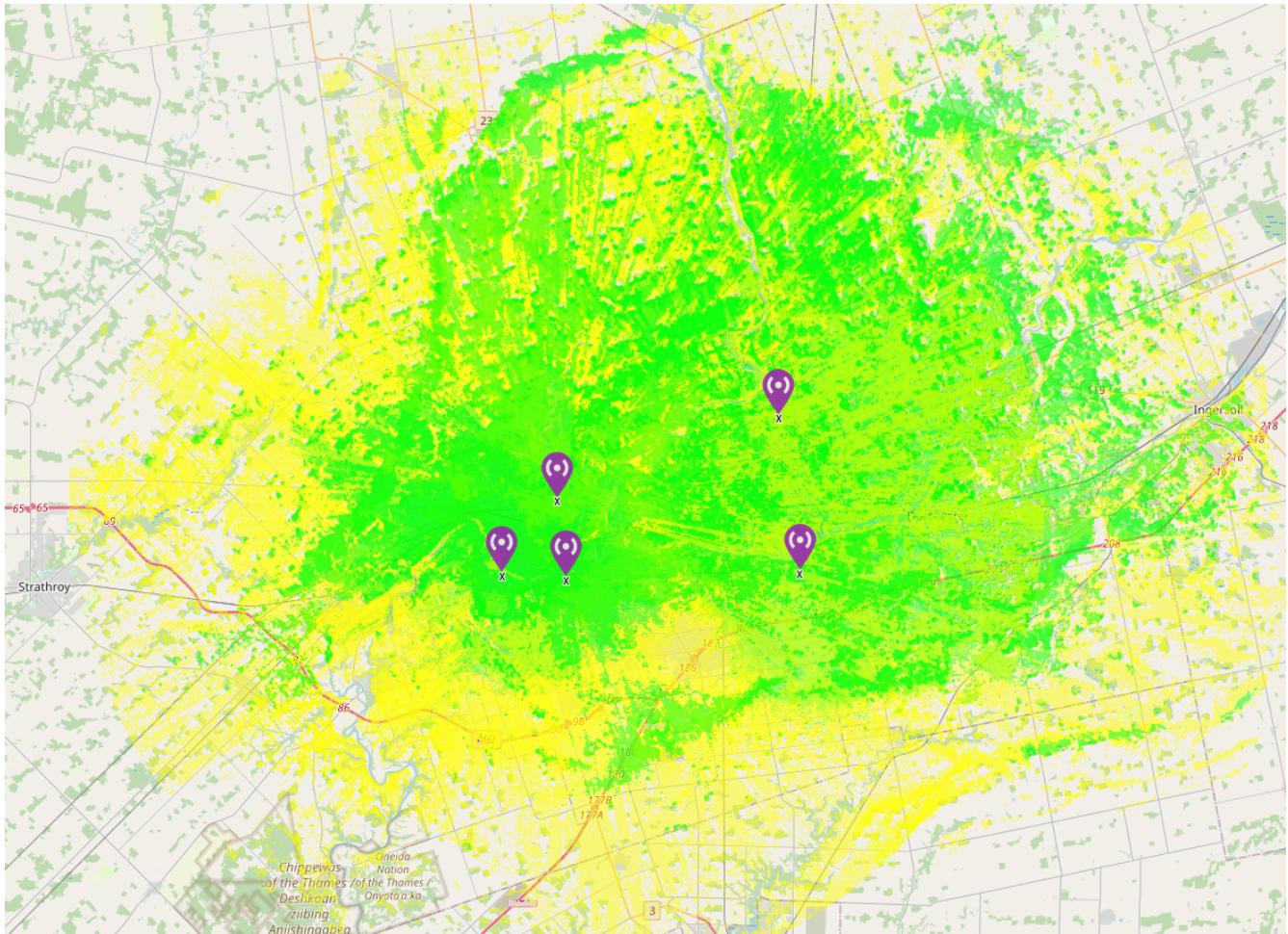


VE3LON and the London EOC [VE3LFD] provide rather capable permanent 2m stations, however, access to both locations would need to be secured ahead of time for exercises.

Locations **Alfa**, **Bravo**, and **Charlie** should be located as close to the suggested positions as possible for optimal links, and will need to be prepared to operate in close proximity to the public.

Overall Summary

Projected coverage of recommended Control Station sites



Positioning an operator at each of the suggested locations would overlap much of the previously established coverage area, taking advantage of terrain, and ensuring a direct link between critical nodes. These five sites appear to provide a viable two-way link across the city.

A fair degree of inaccuracy should be expected in this model, due to pessimistic estimates of antenna and feedline values, as well as imperfections in the method used to overlay the imagery of each coverage region.

Final Thoughts

Preparing this analysis has been truly fascinating, and the data encourages me to think outside the box for future iterations. Despite the fact that I need to get my scripts straight and stick to them, I hope that everyone who participated enjoyed the exercise as much as I did.

Since starting these exercises in July 2024, I've run things very much by ear, with very loose goals. Common feedback is to outline a set of goals ahead of time, to allow adequate time and information to prepare - I'll take that feedback into account going forward, and ask

all participants to consider contributing feedback, ideas, and scenarios. I enjoy developing these exercises, but your help can make them much better.

Also, please consider filling out my equipment survey to give me an idea of what types of exercise would be feasible. Participation is optional, but every piece of data helps.

<https://forms.gle/MZKXiia4avoM1Rm97>

At the time of writing this, the date and details for the next exercise are undetermined; please submit your scenario and goal ideas to me by email at va3prr@gmail.com

I hope to release more concrete information at least two weeks beforehand, but tentative dates are October 19 or 26 - depending on everyone's availability, we could talk about pushing this into November.

The tool used for these analyses is Radio Mobile Online, by VE2DBE Roger Coudé. Please find that tool at

https://www.ve2dbe.com/rmonline_s.asp