

Navigation

Electronic Aids and Race Preparation

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Great Lakes Yacht Club

Peter Griffin

- 45+ years of sailing experience on boats 24' to 70'
- 35 Mackinac's and various ocean races
- 25+ years of navigation experience
- Class winner of last two Bermuda Races as navigator
- U.S. Sailing Senior Judge

Tim Metcalf

- 35 years racing and cruising on boats from 20' – 70'
- 14,500+ miles offshore racing & sailing
- USCG 50-Ton Masters License
- Commodore, Doublehanded Sailing Association
- Sails the 1984 C&C 41 “*Insatiable*”
- Owns TCM Marine Electronics Services, a small business that configures, sells & installs marine navigation electronics hardware & software



Navigator's Role

Ensures the boat is safely traveling in the correct direction to get to the mark as fast as possible taking full advantage of all the available tools – weather, electronics, sail angle, tides/currents, etc.



Race Preparation

- **Gather your gear: Laptop, tablet, waterproof mouse, waterproof thumb drive, hand held chart plotter GPS, USB GPS unit, binoculars, hand bearing compass, notepad, mechanical pencils/pens, sharpies, make sure there is a workable handheld VHF or bring your own.**
- **Make sure you have all the paper charts needed for the race - store in a waterproof tube.**
- **Update URL weather sites for quick access.**
- **Review race documents – NOR, SIs, safety regulations, inspection procedures, scratch sheet - time allowances.**

Race Preparation

- **Gather your gear: Laptop, tablet, waterproof mouse, waterproof thumb drive, hand held chart plotter GPS, USB GPS unit, binoculars, hand bearing compass, notepad, mechanical pencils/pens, sharpies, make sure there is a workable handheld VHF or bring your own.**
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- **Update URL weather sites for quick access.**
- **Review race documents – NOR, SIs, safety regulations, inspection procedures, scratch sheet - time allowances.**
- **Put together a notebook with all the documents - load electronic copies on your laptop/tablet.**

Race Preparation

- **Study the course – enter all coordinates in laptop/tablet and hand held - if multiple legs, write down the course, distance, mark rounding of each mark.**
- **If sailing in a new locale, make a color copy of race start area and put in your notebook for quick reference. Look up pictures of all marks you're going to round or lighthouse – print these out and put in your notebook.**
- **Don't forget to have a log sheet prepared to write down your position and other data at least once an hour – I know this is not done a lot anymore but it is important.**
- **Any tides or currents? If so, know them well and print out the tide/current tables for the days during the race and put in your notebook.**

Race Preparation

- **Review weather patterns a good ten days out and then every day.**
- **Know how to get GRIB files and what the update schedule is. Know how to get race updates during the race, if available.**
- **Start running optimized courses about a week out – may not have weather available for the race but run using current data to get head in the game.**
- **If race tracking is available, have it saved as a favorite and be able to isolate your class so you can track your competition. Expedition now has a menu option for Yellow Brick to download boatids and positions to plot – may not be available for all races.**
- **Are your boat's instruments calibrated? Compass/boat speed/wind.**
- **Know every boat in your class and calculate the time allowances you give/get from each boat. With the advent of TOT scoring need to run for various time periods. Post this somewhere on board so everyone knows what needs to be done to win the race.**

UNDERWAY

- **Get everything up and running early and confirm all instrument data is being received and GPS is receiving.**
- **Make sure you have the right polars loaded or if not using software, make sure the upwind/downwind targets are posted somewhere in the cockpit so the helmsperson and crew know what they are.**
- **Download latest Grib, review buoy data, review current forecast.**
- **Run an optimized course and review what it shows.**

UNDERWAY

- **Review latest weather and optimized course with onboard decision makers and update/formulate race strategy.**
- **Make sure any required class flags/bow stickers are in place.**
- **Know the starting procedure and review start line with helmsman and bowman. Determine if there is a pre-race check in.**
- **Monitor RC race channel for any nuggets of information - like postponements or other data. Make sure you know what starts are going off and monitor the radio for your start in case of over early.**

UNDERWAY

- **On distance races with multiple legs, I like to make up a small table in Excel that shows the course of the first leg and corresponding bearing. I then laminate this and tape in the cockpit and down below so everyone knows what we will be sailing. It also keeps everyone from asking what the next leg is numerous times.**
- **Constantly update weather during the race as best as you can and review with onboard decision makers.**
- **Update your log sheets on an hourly basis.**
- **Log onto tracking, if available, and plot/update your competition.**

UNDERWAY

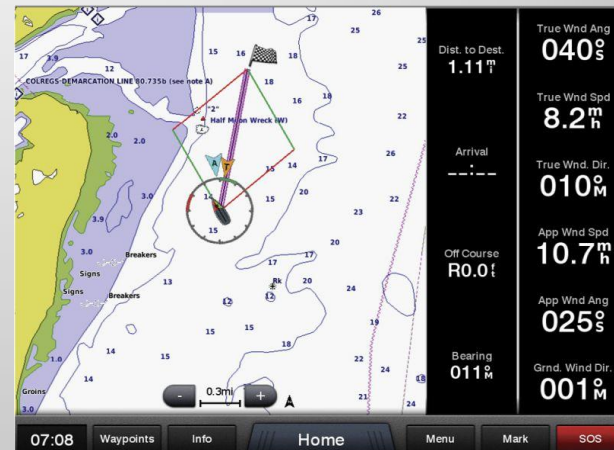
- **Know if there are any communications required with the RC during the race – if so, make a schedule and post this in the nav area and make whatever scheduled check-ins are required.**
- **Prepare for the finish of the race. RC call in, reflective sail number display, etc. Know your finish line – make sure you know if you need to make a significant course change after the finish line to avoid running aground.**
- **If there is any post-race check-in, which there typically is for most distance races, know what these are and make sure they are complied with within the stipulated time period.**

Garmin Chartplotter Features

Sail Race Support

Recent GPSMap Plotters

- 741xs, 840xs, 1040xs
- 7000 series
- 8000 series



- Wind speed & angle (true/app)
- Wind rose
- Magnetic wind direction
- Layline guidance

Garmin Chartplotter Features

Start Line Guidance

- New in Jan-2015 software update
- Identify start line
- Set “sailing assumptions”
- Pick a “time to the line”
- Start the Race Timer
- Stay in the “box”



PC Based Navigation Software Overview

- Most run on MS Windows
- Connection to navigation electronics required
 - NMEA 0183
 - NMEA 2000
- Charts can be raster or vector
- Some use free charts available from NOAA
- 12V power supply is most efficient

PC-Based Navigation Software

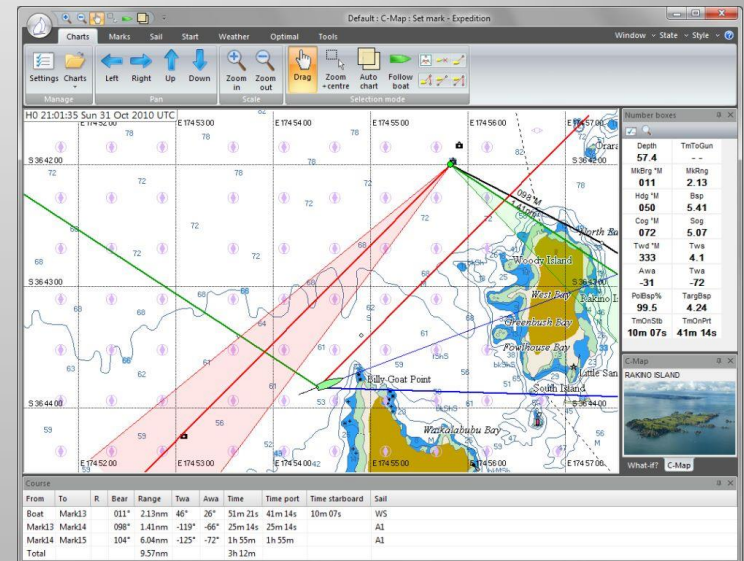
Nobeltec TimeZero Family

- Connection to navigation electronics
 - NMEA 0183 or 2000
 - Furuno NavNet
- TimeZero chart engine & user interface
- Integrates with Nobeltec & Furuno radars
- Waypoints, routes, boundaries
- AIS, DSC, MARPA
- Active Captain integration
- Weather forecasts (GRIBs) for free from Nobeltec
- Sailing “Plus Pack” adds useful sailing features such as laylines, routing, etc.



PC-Based Navigation Software Expedition

- Widely recognized as the best tactical and navigation software available
- Has been in development since 1995
- Developed by veteran VOR and Whitbread navigator Nick White
- Supports a wide variety of sensors and manufacturers
- Weather data and GRIBs from a number of sources



iPad Navigation Overview

- Some apps are free
- Charts may be “in app” purchases, typically \$30-\$60 per region
- Some more suited to coastal cruising as opposed to full offshore
- Some source of GPS data required
 - Cellular iPad
 - WiFi from navigation electronics
 - Bluetooth GPS
 - Dual XGPS150A
 - Garmin GLO
 - Delorme inReach



iPad Navigation

Garmin BlueChart Mobile

- App is free
- Charts are “in app” purchase
- Inland & coastal
- Vector charts
- Waypoints, routes & tracks
- ActiveCaptain
- Navigation aid information
- Garmin Network integration
- Garmin Quatix support
- Radar and satellite weather imagery can be purchased



iPad Navigation

Nobeltec TZ App

- App is free
- Charts are “in app” purchase
- Raster charts
- Tides & currents
- Waypoints, routes & tracks
- Weather if WiFi connected
- Will support radar overlay from certain Furuno radars in 2015



iPad Navigation

iNavX

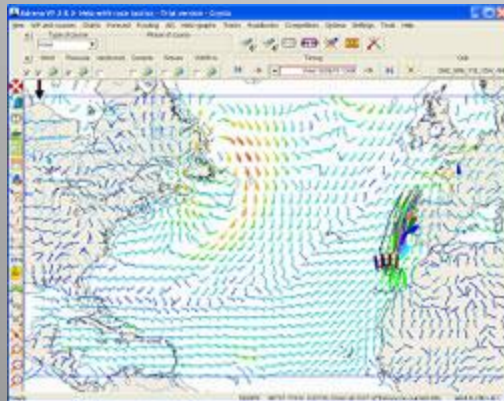
- App costs \$49.99
- NOAA US charts are free
- Additional charts are available from X-Traverse
- Navigation electronics integration over WiFi
- Waypoints, routes & tracks
- Tides using AyeTides app
- Weather overlay using GRIBS from X-Traverse



iPad Navigation

Weather

- Baron (Free)
- BuoyData (\$1.99)
- NOAARadarPro (\$1.99)
- PredictWind (Free - \$499/yr)



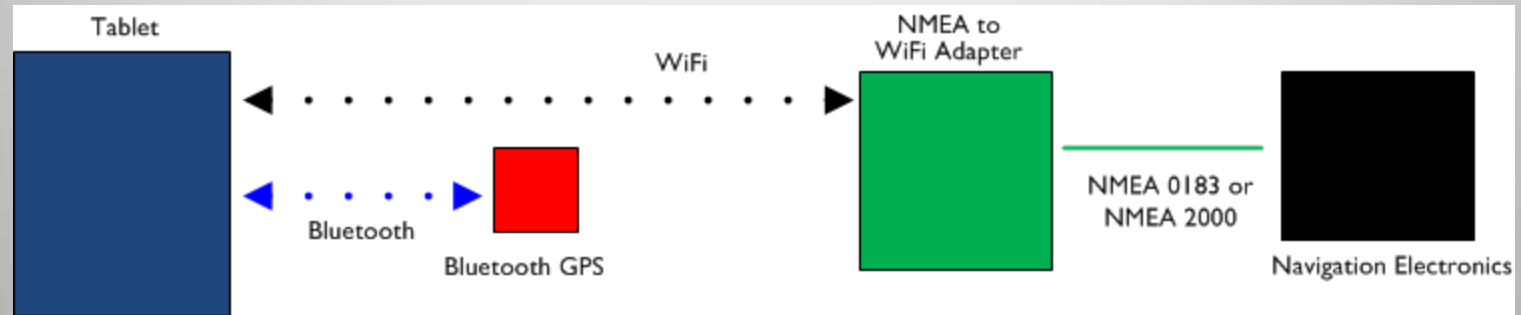
iPad Navigation

Other Useful Apps

- US Sailing's Racing Rules of Sailing (\$4.99)
- RaceStarter (\$5.99)
 - Similar to Garmin start guidance
 - No graphics
- ChartSymbol (\$1.99)
 - NOAA Chart I
- Garmin Helm
- B&G GoFree Controller



iPad as Chartplotter



- Tablet running navigation software
- External GPS source (if necessary)
- NMEA to WiFi adapter connected to navigation electronics

iPad as Chartplotter

Hardware Options

Bluetooth GPS

- Dual XGPS150A
 - Amazon (\$85)
- Garmin GLO
 - TCM Marine (\$100)
 - West Marine (\$100)
- DeLorme inReach
 - West Marine (\$300)



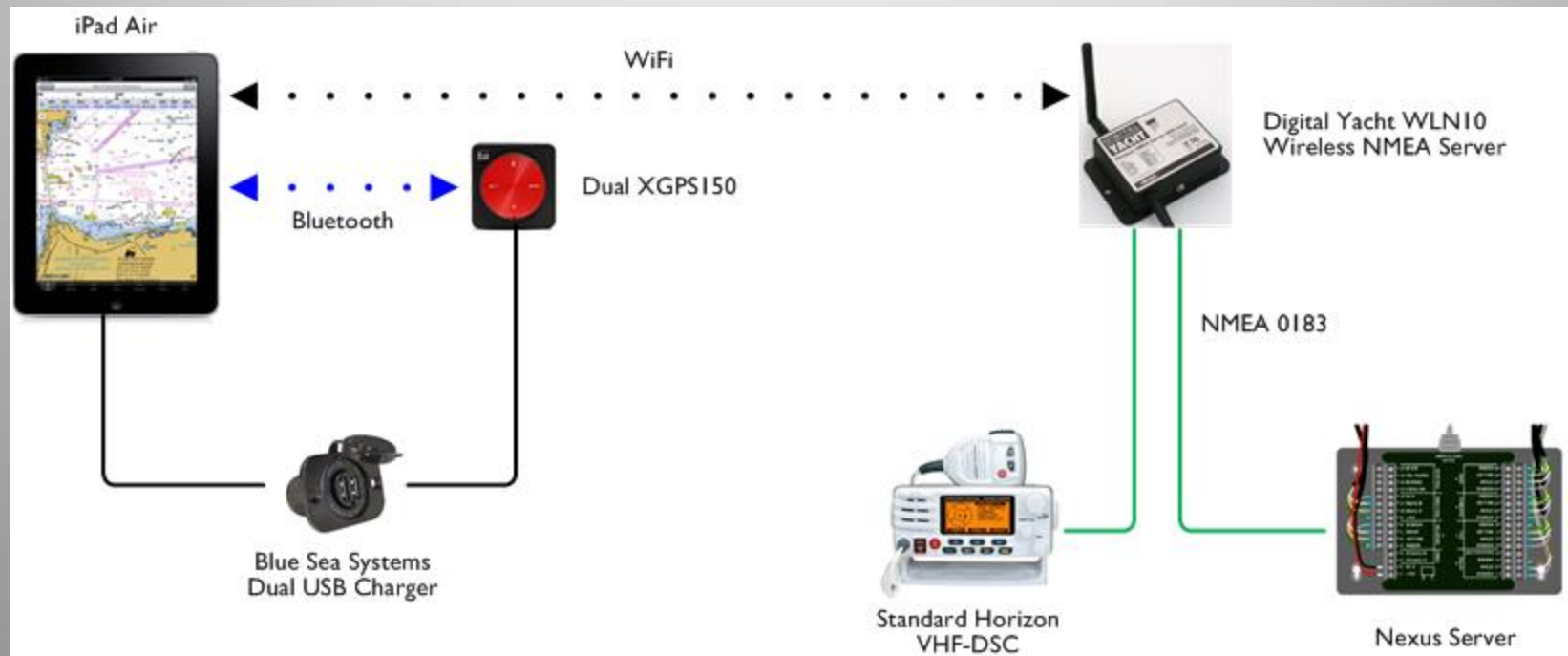
NMEA to WiFi Adapter

- Digital Yacht
 - www.digitalyachtamerica.com
 - WLN10 (NMEA 0183, \$300)
 - WLN2NET (NMEA 2000, \$550)
- Brookhouse
 - www.brookhouseonline.com
 - iMux (NMEA 0183)

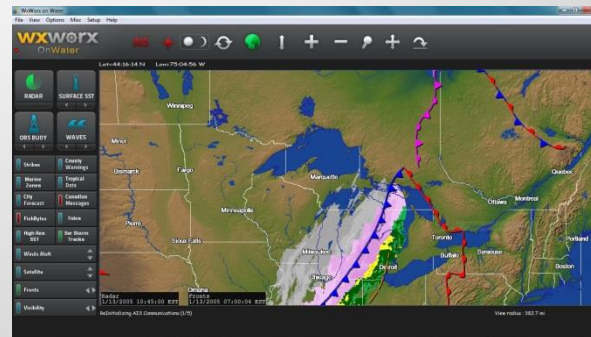


iPad as Chartplotter

(Courtesy of “Ben Jammin”)



Satellite Weather Options



SiriusXM Weather

- Used by chartplotter mfrs
- Requires hardware & antenna
- 3 offerings, \$12.99 - \$54.99/month
- www.siriusxm.com/sxmmarine

XM WX Weather

- Requires hardware & antenna
- Displays on a PC
- 4 offerings, \$9.95 - \$49.99/month
- Better view of weather than SiriusXM
- www.xmwxweather/marine

Satellite Weather Offerings

SiriusXM

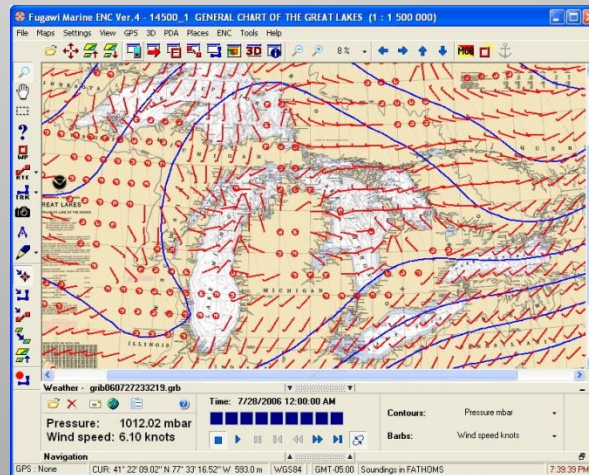
SiriusXM Marine ¹				
Package Name	Marine Inland ²	Marine Coastal	Marine Offshore	
Monthly Subscription Rate	\$12.99	\$29.99	\$54.99	
See Offer Details below				
PACKAGE CONTENT ³				
NEXRAD Storm Cell Attributes	✓	✓	✓	
RADAR - Base Reflectivity	✓	✓	✓	
Cloud to Cloud and Cloud to Ground Lightning Strikes	✓	✓	✓	
Tropical Storm Tracks with Windfields Observed	✓	✓	✓	
Alerts Service	✓	✓	✓	
Weather Watch Boxes	✓	✓	✓	
Local 5 Day Weather Forecasts	✓	✓	✓	
Roadside Fuel Prices	✓	✓	✓	
Sport Scores	✓	✓	✓	
150+ Channels of Sirius XM Satellite Radio Programming ⁴	Optional	Optional	Optional	
Offshore Surface Wind Forecasts	0 Hr	0-3 Hr	0-48 Hr	
High Resolution Coastal & Inland Surface Wind Forecasts	0 Hr	0-3 Hr	0-24 Hr	
Weather Map with Surface Features & Isobars	✓	0-24 Hr	0-72 Hr	
Offshore Forecast Wave Height, Period & Direction		0-3 Hr	0-48 Hr	
High Resolution Coastal Wave Heights		0-3 Hr	0-24 Hr	
Great Lakes Forecast Wave Height, Period & Direction		0-3 Hr	0-24 Hr	
Marine Warnings		✓	✓	
Marine Zone Forecasts		✓	✓	
Tropical Weather Statements		✓	✓	
METARs		✓	✓	
Marine Observations (buoys)		✓	✓	
Cloud Top Images		✓	✓	
Wind Shear		✓	✓	
Vertically Integrated Liquid		✓	✓	
Maximum Radar Return (dbZ)		✓	✓	
Maximum Hail Size		✓	✓	
High Resolution Coastal Sea Surface Temperatures		✓	✓	
Offshore Sea Surface Temps			✓	

XMWX

Home > Marine > Data Service Pricing				
Overview Hardware Data Service Pricing				
	SkyWatch**	Fisherman	Sailor	Master Mariner
	\$9.95* /mo.	\$29.99* /mo.	\$29.99* /mo.	\$49.99* /mo.
Weather Warnings	U.S.	U.S.	U.S.	U.S. and Canada
City Forecasts	U.S.	U.S.	U.S.	U.S.
Surface Observations	U.S.	U.S.	U.S.	U.S. and Canada
Radar Coverage	U.S.	U.S.	U.S.	U.S. and Canada
Radar Summary	U.S.	Not Available	Not Available	Not Available
High Resolution NEXRAD Radar	Not Available	U.S.	U.S.	U.S.
High Resolution Radar	Not Available	Not Available	Not Available	Canada
Precipitation Type (at surface)	Not Available	U.S.	U.S.	U.S.
Surface Analysis Weather Maps	Not Available	U.S. and Canada	U.S. and Canada	U.S. and Canada
Marine Zone Forecasts	Not Available	U.S.	U.S.	U.S. and Canada
Sea Surface Temperature	Not Available	U.S. and Canada	U.S. and Canada	U.S. and Canada
Wave Height	Not Available	U.S. and Canada	U.S. and Canada	U.S. and Canada
Buoy Data	Not Available	U.S. and Canada	U.S. and Canada	U.S. and Canada
Surface Pressure	Not Available	U.S. and Canada	U.S. and Canada	U.S. and Canada
Wave Period	Not Available	U.S. and Canada	U.S. and Canada	U.S. and Canada
Wave Direction	Not Available	U.S. and Canada	U.S. and Canada	U.S. and Canada
Surface Wind Speed/Direction	Not Available	U.S. and Canada	U.S. and Canada	U.S. and Canada
Satellite Mosaic	Not Available	Not Available	Not Available	U.S. and Canada
Surface Pressure Forecast: 12, 24, 36	Not Available	Not Available	Not Available	U.S. and Canada
Wave Direction Forecast: 12,	Not Available	Not Available	Not Available	U.S. and Canada

GRIB Files (GRIdded Binary)

- **Via Nobeltec/Expedition Software**
- **Grib U.S. – free download of viewer and files**
- **Expedition LT – GRIB Viewer**
- **SailFlow**
- **Saildocs**
- **PredictWind**



Internet Access Afloat

WiFi Adapters

Improve WiFi signal reception by moving the WiFi antenna out of the boat



~\$170

RadioLabs Wave RV-Marine

- Self contained WiFi adapter
- USB connection to PC
- Maximum range ~ 1 mile
- www.radiolabs.com



~\$350

BitStorm Bad Boy

- WiFi antenna & router
- Ethernet connection to PC
- 12V Power over Ethernet (PoE)
- Maximum range ~ 5 miles
- www.bitstorm.com

Internet Access Afloat Cell Phone Boosters

Amplifies and re-broadcasts weak cell phone signals



~\$450



~\$500

Wilson Marine 4G Signal Booster

- Phone needs to be within 6 feet of re-broadcast antenna
- Requires a marine antenna
- www.wilsonelectronics.com

SureCall FlexPro 3G Booster

- Directional (Yagi) antenna
- Panel interior antenna
- www.surecall.com

Internet Access Afloat

Satellite Broadband

Serious data for serious money!



~\$5,800
+ Airtime

Sailor 150 FleetBroadband

- Full duplex, single or multi-user
- Up to 150 kbps
- Airtime: \$220/mo includes 10MB; \$25 per additional MB
- www.satpro.tv



~\$16,200
+ Airtime

Sailor 500 FleetBroadband

- Full duplex, single or multi-user
- Up to 256 kbps
- Airtime: \$49/mo includes 50MB; \$1.99 per additional MB
- www.satpro.tv

Internet Access Afloat

Satellite Broadband

Alternatives



FleetBroadband 150 Rental

- 150 kbps
- \$450 per month
- \$15.99 per MB
- www.satphonestore.com

LinkWav

- Turn service on or off at will
- \$50 activation fee
- \$14 per month
- \$10 per MB
- www.linkwav.com