Plans for the GPS Distribution System at Homestake

Since there are levels that cannot be accessed from both Ross and Yates, we need to have two GPS distribution systems, one coming through Yates and the other through Ross.

1) Ross Leg
    a. GPS antenna installed on the roof of Ross building, clear of obstructions (but lower than lightning ground).
    b. Within ~25 feet of the GPS antenna, we will have the first seismometer-digitizer pair. The seismic signal will be contaminated here, but may be of use for data quality studies later (eg monitoring when the shaft is running). The digitizer will operate in the master mode. A transmitter will also be installed near the digitizer, to convert the digital GPS signal into optical.
    c. The optical signal is sent into the Ross shaft via a single optical fiber (could use the one that is already used for GPS).
    d. Install GPS repeaters at the 300ft, 800ft, 2000ft, and potentially 4100ft gates. The repeaters produce multiple output signals, one of which goes further down the shaft and the others go via dedicated fibers to each of the stations on the given level.
        i. At 300ft Ross gate, the repeater produces 2 outputs, one of which goes via fiber to the single station at the 300ft level and the other continues down the shaft toward the 800ft level.
        ii. At 800ft Ross gate, the repeater produces 2 outputs, one of which goes via fiber to the single station at the 800ft level and the other continues down the shaft toward the 2000ft level.
        iii. At 2000ft Ross gate, the repeater produces 2 outputs, both of which go via two fibers to the two stations at the 2000ft level.
    e. At each station, there will be a GPS receiver which will convert the optical signal to digital, and supply it to the local digitizer operating in slave mode. Each station will also operate a seismometer.

2) Yates Leg
    a. GPS antenna installed on the roof of Yates building, clear of obstructions (but lower than lightning ground).
    b. Within ~25 feet of the GPS antenna, we will have the first seismometer-digitizer pair. The seismic signal will be contaminated here, but may be of use for data quality studies later (eg monitoring when the shaft is running). The digitizer will operate in the master mode. A transmitter will also be installed near the digitizer, to convert the digital GPS signal into optical.
    c. The optical signal is sent into the Yates shaft via a single optical fiber.
    d. Install GPS repeaters at the 1700ft, 4100ft, and 4850ft gates. The repeaters produce multiple output signals, one of which goes further down the shaft and the others go via dedicated fibers to each of the stations on the given level.

i. At 1700ft Yates gate, the repeater produces 5 outputs, four of which go via four fibers to the four stations at the 1700ft level and the last continues down the shaft toward the 4100ft level.
ii. At 4100ft Yates gate, the repeater produces 5 outputs, four of which go via four fibers to the four stations at the 4100ft level and the last continues down the shaft toward the 4850ft level.
iii. At 4850ft Yates gate, the repeater produces 4 outputs, all of which go via four fibers to the four stations at the 4850ft level.
iv. Note: if it is more convenient, the 4100 stations could be supplied through the Ross shaft.

e. At each station, there will be a GPS received which will convert the optical signal to digital, and supply it to the local digitizer operating in slave mode. Each station will also operate a seismometer.

Plans for Power Supply at Homestake

a) AC power supply already exists at the following stations: 300ft, 800ft, 2000ft (2), and 4100ft (2).
b) AC power supply will be provided at the following new stations: 4100 ft (2)
    a. 4100ft (1 or 2): the existing power lines are either close or pass by the new locations (to be checked).
    b. 4850ft (2 or 3): the existing power lines are either close or pass by the 3 stations near Ross and Yates (to be checked).
c) Battery power supply (12 V) will be required for the following stations:
    a. All stations at 1700ft.
    b. Possibly one station at 4100ft.
    c. One or possibly 2 stations at 4850ft.
d) Note that power will also be needed for the GPS repeaters located near the shafts. This will be AC at 300ft (Ross), 800ft (Ross), 2000ft (Ross), 4100ft (Yates), 4850ft (Yates). At 1700ft the power supply will be based on 12V batteries.

Plans for Ethernet Access at Homestake

a) At each station, we would like to have three Ethernet connections: one for the digitizer, one for the baler, and one spare.
b) At AC-powered stations, we will use a network switch so that only one fiber is needed for the network access from that station (hence minimizing used fiber counts). The digitizer, baler, and the spare will be then connecting to the network switch.
c) At the battery-powered stations, in order to minimize the power requirements we will not use a network switch. Rather, the three Ethernet connections will be provided by three fibers, connecting directly to the shaft.
    a. At 1700ft, each station will require total of 4 fibers (3 for network, 1 for GPS), totaling 16 fibers. The fiber strand should have 24 fibers.

b. Other levels that would be affected by this: 4100ft (adding two stations, one of which may be battery powered) and 4850ft (adding four stations, 1 or 2 of which will be battery powered).

d)