ADvantis Legal Applications:
Offender Tracking Example

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What is Electronic Monitoring of Offenders?

○ ADvantis is a system developed for road tolling and associated applications
○ Alternative applications for the technology were explored, specifically
  ● Electronic monitoring of offenders (offender tracking)

○ Offender tracking systems are tools used by the Probation and Policing Services
○ When are they used?
  ● During community Sentences (alternative to prison)
  ● As a condition of bail (pre-trial/sentences)
  ● As a condition of parole (early release)
Devices comprise

- GPS device, incorporating high-sensitivity GPS
  - SirfStar II/III, Sony, Fujitsu, uBlox, Nemerix, Trimble
- Communication system
- Monitoring centre
  - Monitor inclusion and exclusion zones, curfews, etc
There are 3 categories of electronic monitoring device:

- Active tracking is real-time tracking and reporting
- Passive tracking device collects the locations in memory which is sent to monitoring officers later
- Home monitoring/curfew devices monitor the proximity of the offender
In 2004, 12 month pilot studies ran in the UK

Offender target groups
- Prolific offenders
- Domestic violence perpetrators
- Sex offenders

Pilot studies received bad press ...
Daily Mirror,
10 August 2005

£3 MILLION PAEDOPHILE SPY FARCE
(By Bob Roberts Deputy Political Editor)
Sex offender tracker system doesn't work near tall buildings, trees or when it's cloudy. A SPY-in-the-sky system to track sex offenders is a disastrous failure, leaked documents reveal today.
Offender Tracking identified as an alternative application for the ADvantis solution

Positioning accuracy and integrity is critical due to:
- Safety of society
- Reducing Probation and Police call-out costs
- Civil rights of the offender
- Evidential purposes

Trials took place using COTS equipment and the ADvantis OBU in typical environments representing
- Urban,
- Semi-urban, and
- Rural areas
 Trials conducted in September ‘05 and January ‘06.
  ● Nottingham, UK
 COTS equipment was used to replicate the GPS performance of offender tracking systems
  ● SirfStar III (latest generation) GPS and data-logger
 Equipment was either carried, or driven in a car
- OBU in car
- Driven in Residential area ("Victorian")
- Narrow streets, 3-storey houses
- Significant satellite masking (up to 60°)
Urban, Example Environment
NB. The COTS OBU does not compute an integrity value irrespective of the number of satellites used in the position solution.
So Why do we need an Advanced Integrity Solution?

- The performance of the SirfStar III within a car, within an urban canyon is EXCELLENT.
- Positions were always on the road even in very high satellite masking areas.
- Estimated accuracy of less than 5m.
- Surely we can just use GPS chipsets currently available!
- The following slides show results using the same receiver, same time of day, but different days ...
Semi-urban, COTS OBU, Sample Results
THE GOOD
- Accuracy approx 5m
- Max error = 20m

THE BAD
- Accuracy approx 50m
- Max error = 500m
Rural, COTS OBU, Sample Results
Rural, Performance Analysis

THE GOOD
- Accuracy approx 5m
- Max error = 10m

THE BAD
- Accuracy approx 20m
- Max error = 11,000m
In other words, What are you Getting?

Same SirfStar III based receiver, similar user information, different days
The ADvantis “Guaranteed” Solution
Current tracking units use High-Sensitivity GPS with no/limited quality indicators.

These often give very good results, even in areas of limited/restricted GPS signal reception.

However, as the examples demonstrate, the results can be poor.

The user is oblivious to the performance.

In the examples shown, the degraded performance was due to increased atmospheric (ionospheric) activity.

- Particularly affected high sensitivity GPS
Recommendations

- Care should be taken with GPS receiver selection
  - Cost, Time-to-first-fix, power consumption, etc, are important BUT should not be highest priority
- Only GPS receivers that use “direct line of sight” observations should be considered
  - Or better understanding of HS GPS observations is required
- Advanced integrity algorithms are required to indicate performance to the user(s)
  - ADvantis uses multiple advanced procedures
  - Availability will be improved with Galileo
  - EGNOS provides better accuracy and integrity
- Monitoring of GPS performance is required for current technology
  - Different GPS receivers behave differently