Data Mining/Threat Assessment:

... GPS Issues

…the use of GPS as a primary reference mode for collected data (ILI, field, survey, as-built, etc.).

We're looking for a discussion of current technology and practices, limitations, and opportunities for improvement that might warrant R&D.

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GPS Starter Topics …

1. Remote GPS Issues
2. Related to ICDA
3. Depth of Cover
4. Related to ECDA
5. Related to ICDA
6. Metadata Standards
7. Elevation Accuracy
8. Satellite Geometry
9. Using Historical Data

Remote GPS Issues …

1. Resolving reproducibility issues of GPS readings in some remote locations, taken at the same time (with survey quality equipment)
2. Collecting GPS values remotely. For example, if a long hill is the point of interest, I would rather site the two points from the bottom of the hill and let the equipment take into account distance and angle (i.e., like a surveyor) without having to hike the hill to capture the data points. This would really speed up site selection for dig sheet planning purposes. A potential military tool like this may already exist

   (a) some use a Range Finder for collecting GPS points remotely. It is a device that will give distance, bearing and inclination and integrates with Trimble GPS data collectors.

ike™

Key to effectively delivering disaster aid is Terrain Knowledge.

Fundamentally, that constitutes an understanding of the precise location of features on the landscape and their geospatial relationship to each other. Given a disaster has occurred these features are more than likely altered or obstructed.

Current approaches to disaster mapping involve numerous different steps and technologies that have not been seamlessly integrated.

That "seamless integration" can be provided by **ike**. From a "safe" stand off position the mobile operator can now capture a remote point of interest.

As **ike** takes a photo it records geospatial information about the target point, linking and locking the data into a single record. The captured point is identified by Surveylabs patented crosshair feature.

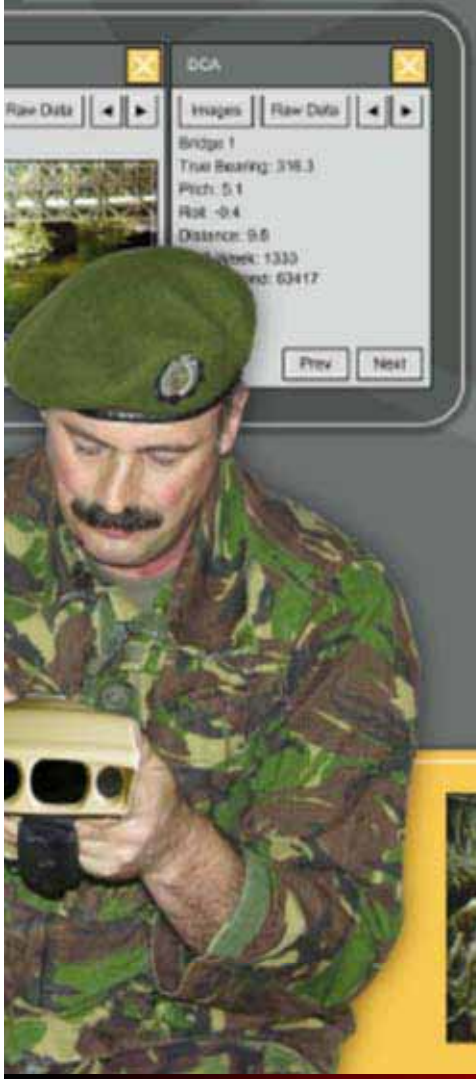
As **ike** takes a photo it also records the following information about the target point in the photo:

- The direction from where you are standing (bearing)
- The difference in height from where you are standing (pitch)
- The distance from where you are standing (up to 1,000 metres)
- The local latitude, longitude and altitude.

From all this **ike** calculates the latitude, longitude and altitude of the target point in the photo. A crosshair on the picture confirms the mapped point.

The captured point or polygon is then mapped into popular mobile mapping products such as ESRI's ArcPad™ using **ike** application extensions.

ikeSync allows data to be simply checked in and out of enterprise GIS systems.



Related to ICDA …

1. Need a method for determining installed angle of directional drills (i.e., better DOC measurement equipment at deeper depths)
2. Improving the integration of pipeline depth (collected by GPS but not necessarily exactly over the spatial centerline) with DEM surface pipeline profiles (i.e., improving inclination calculation accuracy)
3. ICDA Data Interchange Exchange (IDX)
   - Similar to ECDA IDX (NACE TG357 ballot) to allow operator/vendors to easily exchange elevation/inclination & other ICDA info

NACE INTERNATIONAL

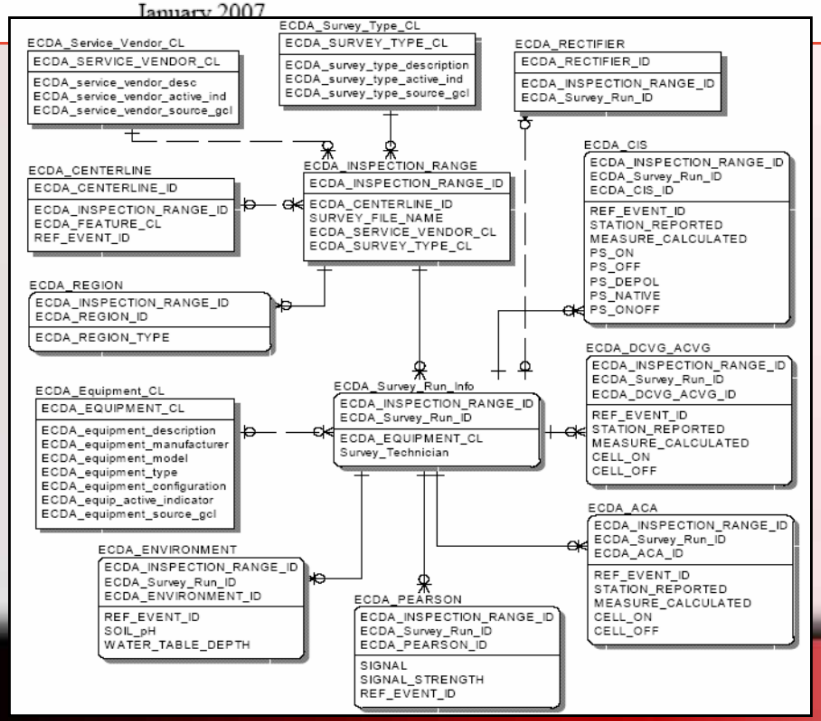
Date Prepared: 2007-01-08
TG 357

NOT APPROVED: This draft of a proposed NACE/PODS standard is for committee u
duplicated i
or any use ot

PROPOSED NACE/PODS STANDARD PRACTICE

"External Corrosion Direct Assessment (ECDA) Integrity Data Exchange (IDX) I

Draft #1: Draft Prepared by the Task Group, Edited and Processed by Headquarters, and STG 35, 05, and 07 List and TCC for Ballot and to the TCC RPC for Edito January 2007



205	Pipeline identifier	**LINE_ID**	Number (16)
206	Beginning station series	**BEGIN_SERIES**	Number (16)
207	Ending station series	**END_SERIES**	Number (16)
208	Beginning station	**BEGIN_STATION**	Number (16,3)
209	Ending station	**END_STATION**	Number (16,3)
210	Route identifier	ROUTE_ID	Number (16)
211	Begin cumulative station	**BEGIN_MEASURE**	Number (16,3)
212	End cumulative station	**END_MEASURE**	Number (16,3)
213	Beginning coordinate latitude or northing	BEGIN_LATITUDE	Number(10,8)
214	Beginning coordinate longitude or easting	BEGIN_LONGITUDE	Number(11,8)
215	Beginning elevation	BEGIN_ELEVATION	Number(11,6)
216	Ending coordinate latitude	END_ LATITUDE	Number(10,8)
217	Ending coordinate longitude	END_ LONGITUDE	Number(11,8)
218	Ending elevation	END_ELEVATION	Number(11,6)
219	Begin northing	BEGIN_COORD_X	Number(16,6)
220	Begin easting	BEGIN_COORD_Y	Number(16,6)
221	End northing	END_COORD_X	Number(16,6)
222	End easting	END_COORD_Y	Number(16,6)

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Depth of Cover …

The lack of an accurate Depth of Cover instrument is frustrating. In 2002 we did a study of electronic depth verses prod depth. We compared 884 prods verses electronic depth at the same location. The sample contained a 4 inch, 10 inch, 16 inch and 22 inch pipeline. Attached are some graphs from that report. This line sums up the report well. "The average electronic derived error (normal) was 5.8 inches per prod."

Hart Smalley, Mears

Related to ECDA …

I would like a GPS meter that was designed to integrate with CIS, DCVG, Soil Resistivity, Depth of Cover and ACVG. All this equipment is separate and does not integrate. I have seen CIS meters collect GPS, but not post process sub-meter/sub-centimeter GPS. Since the actual location is in my opinion the most important feature, the GPS equipment should be the center piece to the data acquisition process.

Hart Smalley, Mears

Related to ILI …

- When developing GPS from ILI … We capture our centerlines using the DGPS Trimble Units (typically the ProXRS with the TSCe Ranger Units).
- We also capture the Above Ground References (Valves, Aerial Marker,etc) to sub-meter accuracy
- We are installing Marker Plates every mile along our pipelines and capturing to sub-meter accuracy
- We run the MFL tool and correlate the results (anomalies) back to our engineering station locations using the AGR's and Marker Plates as sub-meter control points to align the tool run log distance against our PODS Stationing to interpolate the location of the anomalies.
- We can then create a waypoint file with the lat/longs for each anomaly
- The field will then plug the waypoint file into their Trimble units and navigate to the anomaly. We have had tremendous success so far with this process

Moore Resources

Could there be an easier way?

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Metadata standards …

- One of the biggest headaches I have with GPS data from surveyors is they never include any meta data with the delivery.
- I've dealt with several so called expert surveyors that claim they have been doing GPS surveying for years and yet it never occurs to them that they need to tell the client what their codes mean or what coordinate system they used for the survey.

Kinder Morgan

Elevation Accuracy …

- **One thing that I think could be a benefit would be if there was a way to tighten up the elevation accuracy of GPS. My understanding is that there is a usually a 3 to 1 accuracy ratio on the Z component of an X,Y,Z coordinate, so even using sub meter, or even sub foot accuracy does not lend itself to using GPS to determine slope. I haven't been involved in the in-line applications but it would seem to me having a way to determine slope would provide a wealth of information not currently available.**

American Innovations

Satellite Geometry

- Every since I have been doing GIS survey I have always had a problem with satellite geometry, this might be a great topic of discussion. If there is a way, which i am sure there is, improving precision would benefit us in so many ways. You know there have been times where we spend a week doing what could have been a two day survey all because of poor satellite geometry.

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Using Historical data …

- **Lower cost Tools (possible calculators or software) for translating positional data into GPS coordinates based on routing information.**


Other Wish
List items…
Questions?