Petroleum and Water Trace Locator (PAWTL)

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Petroleum and Water Trace Locator (PAWTL)
The Challenge

Spectrum of Operations

Domestic Support
- Disaster Relief
- Civil Support

Peace Operations
- Peace Building/Making
- Military to Military Contacts
- Arms Control
- Nation Assistance
- Peace Keeping
- Security Assistance

Limited Conflict
- Counter Terrorism
- Raids
- Strikes
- Insurgency & Counterinsurgency

Environmental Operations

Humanitarian Assistance

Show of Force

NEO

Counter Drug

Regional Conventional Conflict

Peace Enforcement

Sanctions Enforcement

Nuclear War
- Strategic Weapons
- Tactical Weapons

With a full spectrum mission potential, how do you size lean, efficient, tailored logistical lines of communication?
Commercial And Military Supply Chains – A Comparison

**Commercial Supply Chain**
- Fixed stable infrastructure; stable operational processes

**Military Supply Chain**
- Fixed stable infrastructure; stable operational processes
- Limited infrastructure; potential terrain / weather impacts; constrained operational processes
- No infrastructure; terrain, weather and enemy impacts; highly constrained operational processes

**PAWTL Operations**

**CONUS**
- Wholesale manufacturers
- Commercial distribution
- Special carriers (FedEx, UPS)
- Distribution warehouses

**OCONUS**
- Intermodal cargo terminal
- Carrier transfer center
- Company distributor center
- Retail points

**TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.**
**GOAL:** A PC-BASED DECISION SUPPORT TOOL TO OPTIMIZE SITE SELECTION, LAYOUT, AND OPERATION OF LOGISTICAL SITES AND SUSTAINMENT ROUTES.

FROM THIS...

...TO THIS

FROM PAPER AND PENCIL TO COMPUTER AIDED PLANNING AND OPERATIONS

**Planning Cycles Of Hours Instead Of Days**

Planning On-Site Or En-Route

"SIMCITY" Approach
The Challenge:

- Terrain, weather, insurgent risk and other factors can significantly affect military logistics operations and equipment.
- Impacts are complex to calculate and to apply consistently to planning processes:
  - The various commodities, operations and equipments are affected differently.
  - The relative importance may vary with ROE and other situational factors.
  - Planning processes are often manpower intensive and _ad hoc_.

The Solution:

- "Owning the Terrain" – Proactive use of the battlespace environment:
  - Mitigate the impact of operationally detrimental effects.
  - Make use of operationally advantageous effects.
- Enabled by decision support tools:
  - Geospatial / Map-Based.
  - Includes battlespace effects in the planning process.
  - Rapid Planning / Re-Planning: Pre-Deployment, Post-Deployment and En Route.
  - Constrained object model paradigm using terrain-related rule sets.
  - Incorporates end-user business practices.
• Ability to plan the supply chain from the ground up in austere hostile theater environments

• The supply chain (storage sites, routes, equipment, and the commodities themselves):
  – Viewed as a series of constrained objects
  – Optimized for performance based on the terrain and terrain-related constraint rules used

• Constraints can be characterized by sets of rules that determine suitability (terrain, risk, etc.):
  – Terrain Elevation
  – Terrain Slope
  – Proximity to roads, built-up areas or other infrastructure
  – Probability Of Insurgent Attack (Based On Historical Incidents, Local Terrain And Socio-Cultural Factors)
  – Areas prone to flooding or ponding (Based on Local Terrain And Precipitation Forecasts)

• Suitability analytics for constraint factors are represented as color-coded map overlays

• Analytics for multiple factors can be viewed independently or aggregated

• Advantages:
  – Sustainment planners can quickly develop and compare multiple courses of action
  – Incorporates warfighter business practices into the planning process
  – Provides rapid visualization for better situational awareness
  – Combines all the relevant planning information, allowing planners to use their subject matter expertise to select the best solutions based on battlespace conditions
Class III Tank Farm: Site Suitability

Unsuitable Areas:
- Excessive Slope
- Too Far From APOD
- Runways/Taxiways

Potential Tank Farm Sites

Possible Rule Set:
- Minimal Terrain Slope
- Physically Near APOD
Site Layout: Optimized To Minimize Terrain Footprint

Ammunition Storage:
• Pack PES Sites As Close As Possible
• Meet QD Safety Requirements
• Meet Terrain Restrictions

PES – Potential Explosive Site
QD – Quantity Distance
Notional CONOPs For Convoy Security Planning

Insurgent Activity
- Unlikely
- Seldom
- Occasional
- Likely
- Frequent

Original Convoy Route

Smart Convoy Assembly

Smart Alternate Route

Fuel Point Layout

TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.
## 1. SAMPLE MyWIDA RULES

<table>
<thead>
<tr>
<th>System/Operation</th>
<th>Meteorological Parameter(s)</th>
<th>Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>350 GPM Flammable Liquid Bulk Transfer Pumping Assembly [Fuel Use Only]</td>
<td>Temperature &lt; 10° F</td>
<td>AMBER (Very Cold)</td>
</tr>
<tr>
<td>350 GPM Flammable Liquid Bulk Transfer Pumping Assembly [Fuel Use Only]</td>
<td>Altitude &gt; 3280 Ft (MSL) and Temperature &gt; 68° F</td>
<td>AMBER (Altitude and Temperature)</td>
</tr>
<tr>
<td>Assault Hoseline System (AHS)</td>
<td>Temperature &gt; 130° F</td>
<td>RED (Extreme Heat)</td>
</tr>
<tr>
<td>Assault Hoseline System (AHS)</td>
<td>Temperature &lt; -28° F</td>
<td>RED (Extreme Cold)</td>
</tr>
<tr>
<td>Assault Hoseline System (AHS)</td>
<td>Any Occurrence of Thunder/Lightening Within 3 Miles</td>
<td>RED (Electrical Storms)</td>
</tr>
</tbody>
</table>

2. FOR ANY PARTICULAR SYSTEM (E.G., 350 GPM PUMP), A POLYGON OF THE APPROPRIATE IMPACT (AMBER OR RED) IS CREATED WHENEVER A WEATHER CONDITION IN THE CENTER COLUMN ABOVE IS TRUE. EACH POLYGON IS ALSO ATTRIBUTED WITH THE REASON CODE (Very Cold, FOR EXAMPLE).

3. RESULTING IMPACTS ARE AVAILABLE FOR OVERLAY ON PAWTL MAP

MyWIDA – My Weather Impacts Decision Aid
Petroleum and Water Trace Locator (PAWTL)
PAWTL Purpose – Rapid planning / re-planning of fuel and water pipelines / hoselines by automating hydraulic calculations and component placement. For selected trace parameters, software ensures:

- Static and dynamic pressures do not exceed pipeline / hoseline maximum operating pressure.
- Dynamic pressure does not fall below pump minimum suction pressure.

### PAWTL WORKFLOW (SUMMARY)

- **Open Plan** – Open an existing plan or create a new one (plans can be saved and edited).
- **Draw AOI** – Draw an Area Of Interest (AOI) rectangle on the map. The hoseline trace will be placed inside this rectangle.
- **Draw Trace** – Draw a hoseline trace on the map (or, route along a road).
- **Edit Trace** – Adjust the trace as desired/required.
- **Select Trace Parameters** – Select the hoseline parameters (e.g., flow rate, etc.).
- **Analyze Hydraulics** – Combine selected parameters with underlying elevation to place trace components.
- **View Report** – View the trace elevation profile and summary of components in preparation for trace implementation and/or route reconnaissance.
1. DRAW AREA OF INTEREST (AOI)
2. DRAW TRACE
3. SELECT DESIGN PARAMETERS
4. SOLVE HYDRAULICS
5. RECON ROUTE And / Or IMPLEMENT TRACE
1. **Open Plan** – Or create a new one.
2. **Draw AOI** – By placing an Area of Interest rectangle on the map.
3. **Analyze Terrain** – And display unsuitable areas on the map.
4. **Draw Trace** – For the hoseline on the map, or
   - **Route Trace** – For the hoseline along the road network
5. **Fixed Pumps** – Place on the map or along the trace.
6. **Edit Trace** – For the hoseline as desired.
7. **Select Trace Parameters** – To specify flow rate, working pressure, etc.
8. **Analyze Hydraulics** – To place hoseline components.
    - **Dynamic Re-Planning** – Allows traces to be extended or re-designed.
9. **View Reports** – To aid route reconnaissance and hoseline implementation.
PAWTL NGA Terrain Import Process

Imports a Range of NGA Terrain Data Products from DLA-Ordered CDs and DVDs
**Map Style Thumbnails**

- **Green** – Good Choice at The Current PAWTL Map Scale
- **Red** – Poor Choice at The Current PAWTL Map Scale
- **Amber** – Marginal Choice at The Current PAWTL Map Scale

*Mouse Over Thumbnail To Identify*
PAWTL Trace Routing Along Road Network

1. Identify Network
2. Place Endpoints
3. Solve Route
4. Accept Route
PAWTL Hoseline Design Parameters
AFTER HYDRAULIC ANALYSIS, DETAILED TRACE ELEVATION AND PRESSURE PROFILES CAN BE REVIEWED.
Hoseline Layout
Workflow Example

1. Perform Route Reconnaissance

2. Re-Analyze Hydraulics as Needed

3. Drive to 1st Pump Location, and Place Pump

4. Lay Down Hoseline, Navigating from Component to Component

5. Re-Analyze Hydraulics as Needed
PAWTL Insurgent Attack Risk

Insurgent Threat Predictions
Provided by the University of Virginia’s Asymmetric Threat Tracker (ATT)

High Threat Areas
Additional PAWTL Features

**PAWTL Routing Obstructions**

- Point Barrier
- VMAP1 Roads
- Route
- Line Barriers
- Polygon Barrier

**PAWTL 3D Viewer**

- AOI
- Trace

TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.
• **PAWTL Provides Significant New Capabilities For Petroleum and Water Warfighters:**

  - Automates Hydraulic Calculations For Fast Planning, Allowing: 1) Multiple COAs To Be Considered Quickly, 2) Rapid Response To Battlespace Changes, And 3) Planning Pre-Deployment, Post-Deployment Or Even En Route.

  - Uses NGA Digital Terrain Elevation, Removing The Need To Manually Estimate Trace Elevation Profiles, And Providing Better Profile Accuracy And Consistency.

  - Increases Situational Awareness By Including Terrain And Other Battlespace Factors In The Plan. Provides Instant Feedback About The Impact Of Design Choices / Parameters On The Trace.

  - Import Wizard Makes It Easy To Ingest The Required NGA Terrain Data Products.

• **PAWTL Will Support a Variety of Hoseline and Pipeline Systems:**

  - Initial 2nd Quarter FY2013 Release Will Support Army AHS And TWDS.

  - Army IPDS Support Will Be Added In A Later Release.

  - The Possibility Of Supporting USMC Systems is Being Considered.
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• Mr. Keith Gemeinhart, TSC’s PAWTL software architect and co-author of this presentation.

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