Low Cost UAV Runways

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DISTRIBUTION STATEMENT A: Distribution approved for public release; distribution is unlimited.
Why UAV Runways?

1. Launch & Land in Restricted Airspace (no FAA COA required)
2. Population or Building over-flight issues
3. Separating Manned & Unmanned Aircraft
4. Expeditionary Runways for Theater
5. Hazardous Testing at Remote Sites

NSWC Dahlgren Base Runway outside the Restricted Airspace!
Runway Siting

- Away from People and Property
- Within Restricted Airspace
- Minimal Terrain
- Minimal Obstructions
- Minimal Manned Air Traffic
- Align with Prevailing Winds
- Consider UAV Traffic Pattern
- Consider Environmental Factors
- Consider Required Approvals
UAV Runway Surface Types

- Concrete
- Asphalt
- Expeditionary Mats and Grids
- Dirt
- Chip Seal
- Geotextile ?
Geotextile Runways

- $\frac{1}{4}$ the cost of Asphalt
- Can be expanded / re-configured
- Semi-Permanent
- 3-7 year life
- Permeable / Environmentally Friendly
- Can be paved later

Distribution Statement A
## Runway Type Comparison

<table>
<thead>
<tr>
<th>Type</th>
<th>Approx. Life (Years)</th>
<th>Approx. Max Wheel Load</th>
<th>Approx. Cost (UAV Application)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concrete International Airport</td>
<td>20-30</td>
<td>&gt;45,000 lb</td>
<td>$38 /SY (4”)</td>
</tr>
<tr>
<td>Asphalt National Airport</td>
<td>15-20</td>
<td>&lt; 35,000 lb</td>
<td>$18 /SY (2”)</td>
</tr>
<tr>
<td>GFI Mats Military</td>
<td>15</td>
<td>&lt;30,000 lb</td>
<td>$100/SY</td>
</tr>
<tr>
<td>Dirt Private Airport</td>
<td>1</td>
<td>0-30,000 lb weather dependent</td>
<td>$2.75 /SY</td>
</tr>
<tr>
<td>Chip Seal NZ Light Duty Field</td>
<td>3-5</td>
<td>&lt; 5,000 lb</td>
<td>$6.25/SY</td>
</tr>
<tr>
<td>Geotextile RC and UAV field</td>
<td>3-7</td>
<td>150 lb</td>
<td>$4.6 /SY Tested (higher likely)</td>
</tr>
</tbody>
</table>

Distribution Statement A
**Geotextile Runway Life**

1. **Fabric on Soil**
   - 2-3 Year Life
   - Expeditionary

2. **Fabric on Rock**
   - 4-7 Year Life
   - Semi-Permanent

3. **Asphalt over Fabric**
   - 15-20 Year Life
   - Permanent

*Distribution Statement A*

Construction can be Phased
Cost Example 1350 ft x 60 ft

- Clear, Grub and Roll:
  - 3 men, Dozer, Loader, Truck and Roller; 1 week = $25,000
- Fabric Cost:
  - 10,350SY x $1.85 = $19,000
  - 5 men 1 week = $22,000
- Paint and Misc = $8,000

Construction Cost: $75,000

Asphalt

- Clear, Grub and Roll: $25,000
- Separator Fabric: $5,400 + $5,300 labor
- 6” Crushed Rock: $55,000 + $25,000 labor
- 2” Asphalt: $160,000
- Paint, Drainage and Misc: $20,000

Construction Cost: $295,000

Distribution Statement A
Planning CONUS

- Site selection
- Approvals
  - Base / Municipality
  - FAA
  - Environmental Permits
  - Other: Explosive
- Topographic Survey
- Geotechnical Report
- Design
  - Size
  - Orientation
  - Cut & Fill
  - Drainage (crown 1-2%)
  - Pavement Section
  - Striping
  - Plans, Specs Estimates
- Contracts and Bids

Planning Time: 1-3 years

Planning Expeditionary

- Site selection
- Approvals
  - Base / FOB
  - Local Authorities
- Design
  - Size
  - Orientation
  - Striping
  - Drainage
- Organize Work Party

Planning Time: 1 month

Distribution Statement A
Construction Steps
Construction Equipment

- Bulldozer
- Surveying Level
- Grader
- Roller
- Dump Trucks

Must have at minimum**
Construction Survey

• Transfers the design onto the ground
• Stake centerline
• Elevation stakes
• Survey Contract or simple $300 level
Excavate and Compact

- Remove Organics
- Remove obstructions
- Prepare and compact sub-grade
- Herbicide to prevent growth
- Pipes (if required)
Build up UAV Runway Section
Expeditionary

Fabric on Soil

Staked US 230
Geotextile Surface

Graded & Compacted
Native soil

Distribution Statement A
Build up UAV Runway Section
Semi-Permanent

Fabric on Rock

US 230 Geotextile Surface
(not shown)

6” Crushed Gravel

US 200 Geotextile

Fill

Native soil

Distribution Statement A
Placing Geotextile Surface

- Check for tears at Roll ends and remove
- Keep Rolls running straight
- Apply Tar on seams 6” min, 12” max overlap
- Anchor runway edges under rock if available
Staking Geotextile Surface

- Use landscape stakes or nails with washers on 1-2ft centers
- Fold horizontal seams and nail
- Do not pull fabric too tight. Leave some minor wrinkles
- Sun will heat and stretch surface ‘drum tight’
Striping the Surface

- Use Temporary X’s
- Follow FAA Standards for Airport Markings
  
  AC NO.150/5340-1

- **Do Not** use Runway number markings. Use ‘UAV’ instead

- Use large 60’ x 60’ **Yellow** Xs every 1000’ per AC 150/5340-1

- Standard Latex Road paint

- Paint ‘Rotor Wing Prohibited’ in 20’ letters on center of runway

Distribution Statement A
Final Touches

- Prevent Vehicles from driving on runway
- Remove Flight Obstructions
- Place Wind Sock
- Tar over Nails
- Seeding
- Access Ramps
- Electrical hook-up
Upkeep

- Walk Runway before every flight
- Remove debris and weeds
- Sweep if required
- Repair rips and tears with tar and patches
- Check for protruding Nails / Stakes