Flight Maps and Charts

All Flights

Mission Operations Directorate
Operations Division

Generic, Rev F
September 25, 2003

NOTE
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| 482#: | MAPS-267 |

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The Maps and Charts document contains the following six items that are flown separately:

- Mercator and polar projection Star Charts (section 1)
- Mercator projection Earth Map with Earth observation areas and orbit overlay (section 2)
- Landing Site Videotape (section 2)
- Earth Observations Manual (section 2)
- World Atlas (section 2)
- Landing Site Charts (sections 3 and 4)

Page numbers assigned to sections 1 and 2 are for the convenience of ground users and do not appear in flight configuration.

The crew Landing Site Charts (sections 3 and 4) are organized as follows:

- General Information – Summary, Chart Legend, and World Map showing all sites
- Detailed Site Information – Runway and instrumentation data, area topographical map, aim point drawing, and aerial photo if available
- Postlanding Information

Originals for most maps and charts in this book were provided by the National Imagery and Mapping Agency (formerly Defense Mapping Agency).
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* – Previous name was Moses Lake
☐ – High inclination site
STAR CHARTS

1.1 The flight version of Star Charts is fabricated with polar projections (page 1-4) on the back of the rectangular projection (page 1-3). Flight charts are produced with white overprint on a black background. A photograph of Star Charts in flight configuration is shown on page 1-2.

1.2 The rectangular chart is a Mean of 1950 (M50) mercator projection with coverage extending from the equator to 65° north and 70° south declination. Each polar projection covers the entire hemisphere. Both right ascension and declination are expressed in degrees. The charts depict 1466 stars, ranging in magnitude from -1 to +4. The first 50 nav stars are circled, named, and numbered, and the second 50 nav stars are circled and numbered. The ecliptic plane is indicated on the charts, as are the Milky Way and the large and small Magellanic clouds.

1.3 The baseline rectangular Star Chart is annotated for each specific flight by the addition of the Sun and planets (Venus, Mars, Jupiter, and Saturn) in their launch date positions. Moon symbols that show the various phases (new, first quarter, full, last quarter) are added for each day of the mission. Moon symbols are identified by calendar day starting at GMT.
Figure 1-1.- Flight configuration Star Charts
Figure 1-2.- Typical Star Chart (reverse angle)
Figure 1-3.- Star Chart polar projections
2.1 A. The flight version Orbit Map is produced in color at a scale of 1:52 million. The flight map is mounted in a frame with a groundtrack overlay. The map shown on page 2-4 is a reduced copy. An Orbit Map with overlay (flight configuration) is shown on page 2-5.

B. The overlay shows the groundtrack for three consecutive orbits and can be set to any desired ascending node. The overlay has time ticks at 1-min intervals along the groundtrack, with elapsed time callouts every 10 min. Elapsed time is measured from the initial ascending node. The overlay includes a map update block for recording MET and longitude of node for any given orbit.

C. The flight Orbit Map shows station coverage of STDN sites and TDRSS for the primary orbital altitude of each mission. Also shown are 750-nmi radius crossrange circles for shuttle landing sites and the South Atlantic Anomaly at the primary orbital altitude of each mission.

D. The baseline Orbit Map is annotated for each mission by adding photo targets, visual observation sites, or other areas of scientific or technical interest. When applicable, these subjects are documented as tabular listings and included with the flight crew World Atlas.

EARTH OBSERVATIONS MANUAL

2.2 The Flight Science Support Office produces an Earth Observations Preflight Training Manual for each flight. It contains text, illustrations, and photos for information on mission overview, photographic techniques, Earth features, and sites of interest. The manual is used for flight-specific crew training and flown as mission weight and space constraints allow. An optional PGSC diskette containing the text of the manual is occasionally flown in place of the hard copy.
2.3 The Landing Site FD CD contains footage of approaches to various runways at several landing sites. The crew can view the CD on the orbiter PGSC as a visual reference tool in preparation for landing.

The Landing Site Mini DV also contains the same footage of approaches to various runways as the FDF CD. Mini DV consists of two cassettes; Volume I contains Kennedy Space Center landing sites. Volume II contains Edwards AFB and White Sands (Northrup) landing sites.

The following landing site video files are available to the crew.

**Directory ...\Landing Site Video**
- 78ksc33_.mpg 63,713,284 1/21/1998 5:21:00 PM
- 81ksc33_.mpg 55,799,812 1/21/1998 6:05:46 PM
- 86ksc15_.mpg 61,577,220 1/21/1998 7:03:38 PM
- 94ksc33_.mpg 57,972,740 1/21/1998 7:32:28 PM
- EDW04a_.mpg 14,491,652 1/26/1998 3:54:42 PM
- EDW15a_.mpg 19,644,420 1/26/1998 4:04:56 PM
- EDW22a_.mpg 25,899,012 1/26/1998 4:18:28 PM
- FDF.ICO 12,862 11/2/1998 5:36:58 PM
- index.htm 61,498 3/23/2001 6:50:06 PM
- ksc15a_.mpg 17,547,268 1/26/1998 4:36:38 PM
- ksc15b_.mpg 20,994,052 1/26/1998 4:47:36 PM
- ksc33a_.mpg 24,502,276 1/26/1998 4:59:56 PM
- nor35a_.mpg 13,279,236 1/27/1998 1:02:14 PM
- SHELEXEC.EXE 18,944 4/29/1999 6:04:00 AM

**Directory ...\Landing Site Video\Runway Data**
- Edwards-Map_g_e.pdf
- Kennedy-Maps_g_e.pdf
- Northrup-Maps_g_e.pdf
Links are provided to the individual videos through the following index:

**NASA Space Shuttle Orbiter Landing Site Refresher**

Runway Data: Kennedy Edwards Northrup

Video

Table 2-I.- Contents of file titled Index.htm

<table>
<thead>
<tr>
<th>Mission/Vehicle</th>
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Figure 2-1.- Flight configuration Orbit Map
Figure 2-2.- Orbit Map with overlay (flight configuration)
The flight version of the World Atlas (Space Shuttle Physiographic Atlas) is produced in color and provides worldwide coverage at a scale of 1:10 million. Its table of contents is shown on page 2-7.
## CONTENTS

<table>
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<th>PAGE</th>
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<td>Madagascar, Seychelles Islands, and Reunion Island</td>
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<td>Indian Ocean and Chagos Archipelago</td>
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<td>New Zealand, Tasmania, and South Pacific Islands</td>
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<td>Southern South America and Falkland Islands</td>
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<td>South Indian Ocean, Prince Edward and Crozet Islands</td>
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<td>South Pole and Antarctic Peninsula</td>
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<td>North Pole, Northern Russia, and Beaufort Sea</td>
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<td>North Pole, Greenland, Iceland, and Norway</td>
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<td>48</td>
<td>Major Ocean Currents</td>
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</tbody>
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2-7 MAPS/ALL/GEN F
LANDING SITE CHART SUMMARY

3.1 Landing Site Charts contain topographical information on designated shuttle landing sites. Flight versions are produced in color at the same size and scale as shown in this document.

There are two types of charts for each site:

- Area Chart - scale 1:2 million
- Runway Chart - scale 1:62,500

One set of charts is shown for each landing site, and a site data sheet is included with each chart set.

3.2 Each chart set contains the following information.

Data Sheet
- Site elevation
- Table identifier*
- Runway length, width, and overruns
- Channel number and identifier for PRI and SEC TACAN selections
- Cochannel interference for each TACAN. Values listed indicate orbiter approach directions and altitudes above which TACAN interference may be caused by nearby TACAN stations using the same channel as the orbiter
- MLS channel numbers for appropriate runways
- Runways equipped with PAPI lighting
- Runways equipped with Ball Bar lighting
- UHF availability

Area Chart
- Range circles at 100-nmi intervals with intermediate ticks at 50-nmi intervals. Range is 'yardstick' distance to center of site
- Magnetic heading lines at 30° intervals with intermediate ticks at 10° intervals
- TACAN stations carried in onboard software tables
  Note: No TACAN symbol used if station located at airfield
- All runways in the area at least 10,000 ft in length
- Airfield coordinates to nearest minute

Runway Chart
- Aim points
- Runway dimensions

3.3 To supplement the charts, oblique photographs are included where available. These photos approximate the view leaving the HAC on the steep glide slope

3.4 Section 4 contains crew procedures for postlanding at emergency airfields. A list of phone numbers is included only in flight books

*List of landing sites and TACAN data carried in software for use in contingency deorbits and landing
3.5 Runway information is presented as follows:

<table>
<thead>
<tr>
<th>#1</th>
<th>#</th>
<th>&gt;&gt;&lt;&gt;&lt;&gt;</th>
<th>width</th>
<th>&gt;&gt;&lt;&gt;&lt;&gt;</th>
<th>#2</th>
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<tbody>
<tr>
<td>aaaa</td>
<td>bbbb</td>
<td>aaa</td>
<td>bbbb</td>
<td>aaaa</td>
<td></td>
</tr>
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</table>

elev = eee  

Where

#1, #2 = Runway number  
axxx = Length of overrun  
bxxx = Length of shuttle artificially displaced threshold if reqd

**NOTE**

axxx+bxxx = 1000 ft at each end of rwy

cc = Distance of barrier from end of usable surface (overrun) if reqd  
eee = Runway elevation at each end  
xxxx = Length of each runway

**NOTE**

Length measured from shuttle threshold (actual or displaced) to end of rwy (with overrun to spare)

# = Shuttle barrier  
# = Shuttle displaced threshold
LANDING SITE CHARTS

AREA CHART
Scale 1:2,000,000

1. Magnetic Heading to Land Site
2. Distance to Landing Site (nautical miles)
3. NAVAIDS (Location symbols are omitted when the antenna is located at the landing site)
4. Airfields

RUNWAY CHART
Scale 1:62,5000

5. Highwind Aim Point
6. Nominal Aim Point
SPACE SHUTTLE PROGRAM APPROVED LANDING SITES
Tamanrasset, Algeria

<table>
<thead>
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<th>AAT</th>
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</thead>
<tbody>
<tr>
<td>Table</td>
<td></td>
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</tbody>
</table>

| 02 | 197 | 20 |
| 1000 | 1000 |

- Elev = 4467
- Elev = 4513
- Rwy 02: 10,870
- Rwy 20: 10,870

**TACAN:** TMS-72x (Pri-DME)

**I/F above:**
- N: clear
- E: clear
- S: 142k
- W: clear

**MLS:** none

**PAPI:** none

**Ball Bar:** none

**UHF:** none
Atlantic City International, Atlantic City, New Jersey

**Identifier**: ACY

**rwy 13**: 9,000

**rwy 31**: 9,000

**elev = 75**

**elev = 66**

**TACAN**: CYN-81x (Pri)

**I/F above**: N:110k E:clear

S:125k W:90k

**MLS**: none

**PAPI**: none

**Ball Bar**: none

**UHF**: yes (guard only)
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### Hoedspruit AFS, South Africa

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#### Table

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<td>18</td>
<td>161</td>
<td>839</td>
<td>274</td>
<td>744</td>
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</table>

- **elev = 1662**
- **elev = 1728**

#### TACAN:
- HSV-87x (Pri)

#### I/F above:
- N: clear
- E: clear
- S: clear
- W: clear

- **MLS:** none
- **PAPI:** none
- **Ball Bar:** none
- **UHF:** none

---

**NOTE**

Previous site identifier was HDS
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<th>Distance</th>
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<tr>
<td>33</td>
<td>85</td>
<td>10,000</td>
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**TACAN:** AMB-94x (Pri)

**I/F above:**
- N: clear
- E: clear
- S: clear
- W: clear

**MLS:** none

**PAPI:** none

**Ball Bar:** none

**UHF:** yes (guard only)
## Amilcar Cabral International, Republic of Cape Verde

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<tr>
<td>rwy 19</td>
<td>9,728</td>
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### Elevations
- elev = 177

### Runways
- rwy 01
- rwy 19

### TACAN
- CVS-100x (Pri-DME)

### I/F above
- N: clear  | E: clear
- S: clear  | W: clear

### MLS
- none

### PAPI
- none

### Ball Bar
- none

### UHF
- none

---

**WARNING**

Expect poor visibility and crosswinds from the east.

Rwy 01 preferred, but terrain on approach is more than 30 ft lower than rwy.

---

**NOTE**

Language is Portuguese

Total pavement width is 240 ft
Bermuda International, St. David’s Island, Bermuda

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<th></th>
<th>12</th>
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<td>&lt;&lt;&lt;&lt;&lt;&lt;</td>
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**TACAN:** BDA-86x (Pri-DME)
**I/F above:** N: clear  E: clear
S: clear  W: clear

**MLS:** none
**PAPI:** none
**Ball Bar:** none
**UHF:** yes (guard only)
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### Table Identifier: BEJ

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#### Beja, Portugal

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<td>100</td>
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<tr>
<td>Elev 624</td>
<td>100</td>
<td>900</td>
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- **TACAN:** MOJ-37x (Pri) BEJ-105x (Sec)
- **I/F above:**
  - N: clear, E: clear, N: <<80k, E: <<80k
  - S: clear, W: clear, S: <<80k, W: <<80k
- **MLS:** none
- **PAPI:** none
- **Ball Bar:** none
- **UHF:** yes

---

Runway 01L: 11,219 ft. Runway 19R: 11,219 ft.
BEJA INSTRUMENT CHART

MINIMUM VECTORING ALTITUDE 38°04′44″N 007°55′57″W

BEJA
(LPBJ)

BEJA APP
130.10 362.30
358.85

BEJA RADAR
123.30 315.50
344.00

BEJA FINAL
130.10 370.75
385.40

WGS DATUM
ELEV 636

4000FT
3000FT
2100FT
2NM
15NM
30NM
60NM

EVORA
REGOS

GAIOS 1640′
1070′

1224′
2955′
1240′
1673′

ROI 38°07′N

BEJA INSTRUMENT CHART

MAP 4-9-1-1
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Ben Guerir, Morocco

**TACAN:**  
BEN-108x (Pri)  
MAK-80x (Sec-DME)

**I/F above:**  
N: 135k  E: clear  
S: clear  W: clear  
N: 115k  E: clear  
S: clear  W: clear

**MLS:**  
(36-Sr) ch 6

**PAPI:**  
18, 36

**Ball Bar:**  
18, 36

**UHF:**  
none (UHF available only when NASA convoy present)

---

**NOTE**

Distance remaining markers count down to rwy threshold  
(i.e., Rwy 18: 0 marker is at beginning of concrete overrun;  
Rwy 36: 0 marker is at beginning of dirt overrun)

BEN-108x available only when NASA convoy present
Banjul International, Gambia

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<tr>
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---

**TACAN:** BYD-121x (Pri) BJ-76x (Sec-DME)

**I/F above:**
- N: clear
- E: clear
- S: clear
- W: clear

**MLS:** (32-2 Jr’s) ch 6

**PAPI:** 32

**Ball Bar:** 32

**UHF:** none (UHF available only when NASA convoy present)

---

**WARNING**
40-ft palm trees 3200 ft from rwy 32

---

**NOTE**
No MLS data available during rollout

Visual landing aids for rwy 14, including PAPI lights shown on BYD-A, no longer exist

BYD-121x available only when NASA convoy present
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## Dover AFB, Delaware

<table>
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<th>Length</th>
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<td>DOV</td>
<td>9,600</td>
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<td>32</td>
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<td>12,052</td>
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### TACAN
- **SIE-95x (Pri)**
- **DQQ-87x (Sec)**

### I/F above
- **N:100k**
- **E:105k**
- **N:90k**
- **E:clear**
- **S:clear**
- **W:100k**
- **S:clear**
- **W:85k**

### MLS
- **none**

### PAPI
- **none**

### Ball Bar
- **none**

### UHF
- **yes (guard only)**
Dyess AFB, Texas

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<thead>
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<th></th>
<th>16</th>
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Table Identifier: DYS

16: 13,500
34: 13,500

elev = 1787
elev = 1785

TACAN: ABI-84x (Pri)
TACAN: MQP-124x (Sec)

I/F above:
N:85k E:clear
N:100k E:125k
S:115k W:140k S:clear W:clear

MLS: none
PAPI: none
Ball Bar: none
UHF: yes (guard only)
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Elmendorf AFB, Anchorage, Alaska

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<th>23</th>
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<th>200</th>
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<td>1000</td>
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</table>

ev = 202

rwy 23 10,000
rwy 05 10,000

ev = 175

TACAN: EDF-81x (Pri)

I/F above:
N: clear   E: clear
S: clear   W: clear

MLS: none
PAPI: none
Ball Bar: none
UHF: yes (guard only)
Edwards AFB, California

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<tr>
<th>Identifier</th>
<th>EDW</th>
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### Table

<table>
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<th>Distance</th>
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<td>04</td>
<td>13,995</td>
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<tr>
<td>22</td>
<td>14,995</td>
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</tbody>
</table>

**TACAN:**
- EDW-111x (Pri)
- LHS-21x (Sec)

**I/F above:**
- N:140k E:125k
- N:80k E:95k
- S:clear W:clear
- S:clear W:90k

**MLS:**
- (22-Sr) ch 8; 4 Jrs, ch 6*
- Ch 6 used for all lakebed rwy.

**PAPI:**
- 22, all others**

**Ball Bar:**
- 22, all others**

**UHF:** yes

**NOTE**
- All rwy have painted aim points at 6500 ft and 7500 ft except rwy 05R, which has only 6500-ft aim point
- Rwy 35R not in onboard software but can be uplinked in OPS 3
- Rwy 22 has no usable overrun

* Four trailer-mounted MLS-Jrs available for installation on rwy 04, 15, 17, 22, and 23.
  Ch 6 used for all lakebed rwy. If installed on rwy 22, ch 8 used

** With 24-hr notice, PAPI and Ball Bar lights can be moved and configured to meet mission requirements
Mataveri International, Easter Island (Chile)

Table Identifier

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</table>
```

** elev = 124**

** elev = 215**

- **TACAN:** IPA-118x (Pri-DME)
- **I/F above:**
  - N: clear
  - E: clear
  - S: clear
  - W: clear
- **MLS:** none
- **PAPI:** none
- **Ball Bar:** none
- **UHF:** none
Esenboga, Turkey

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<tr>
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<td>197</td>
<td>21L</td>
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<td>1000</td>
<td></td>
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elev = 3100   elev = 3123

- **TACAN:** ETI-113x (Pri)  BAG-78 (Sec-DME)
- **I/F above:** N:<80k   E:<80k   N:clear   E:clear
  S:<80k   W:<80k   S:130k   W:clear
- **MLS:** none
- **PAPI:** none
- **Ball Bar:** none
- **UHF:** yes (guard only)
Fairford RAF, England

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<th>27</th>
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- TACAN: BZN-56x (Pri)
- I/F above: N:clear E:clear S:clear W:clear
- MLS: none
- PAPI: none
- Ball Bar: none
- UHF: yes (guard only)
### Otis ANGB, Massachusetts

<table>
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<p>| | | |</p>
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</table>
```

**TACAN:**
- BOS-74x (Pri)
- FMH-105x (Sec)

**I/F above:**
- N: 158k E: clear
- N: <<80k E: <<80k
- S: clear W: 100k
- S: <<80k W: <<80k

**MLS:** none

**PAPI:** none

**Ball Bar:** none

**UHF:** yes (guard only)
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Le Tube, Istres, France

<table>
<thead>
<tr>
<th>Identifier</th>
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<th>197</th>
<th>15</th>
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<td>elev = 63</td>
<td>1345</td>
<td>1000</td>
<td>&lt;&lt;&lt;&lt;&lt; 3963</td>
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</table>

rwy 33 11,303
rwy 15 12,303

TACAN: NIM-53x (Pri) ITR-104x (Sec)

I/F above:
N: clear E: 127k N: 85k E: 105k
S: 150k W: clear S: clear W: clear

MLS: none
PAPI: none
Ball Bar: none
UHF: yes (guard only)

NOTE
Underrun for FMI 33 unusable
Underrun for FMI 15 unlit
Previous site identifier was ITR

Le Tube, Istres, France
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Francis S. Gabreski, Westhampton Beach, New York

Table Identifier: FOK

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<th>24</th>
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<td>150</td>
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<td>1000</td>
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</tr>
</tbody>
</table>

elev = 49          elev = 67

---

rwy 06  9,000          rwy 24  9,000

TACAN: HTO-83x (Pri)   TMU-45y (Sec-DME)
I/F above: N:clear   E:clear
            N:clear   E:clear
            S:80k      W:90k
            S:clear    W:clear

MLS: none
PAPI: none
Ball Bar: none
UHF: yes (guard only)
FRANCIS S. GABRESKI AIRPORT DIAGRAM

SUFFOLK COUNTY TOWER
125.3 236.8
GND COM
121.8 223.4

JANUARY 1995
ANNUAL RATE OF CHANGE
0.0 W

FIELD ELEV
61

ELEV 49

ELEV 49

ELEV 49

ELEV 49

ELEV 49

ELEV 49

ELEV 49

ELEV 49

ELEV 49

ELEV 49

CAUTION: BE ALERT TO RUNWAY CROSSING CLEARANCES.
PREADBACK OF ALL RUNWAY HOLDING INSTRUCTIONS IS REQUIRED.

AIRPORT DIAGRAM
WESTHAMPTON BEACH, NEW YORK

WESTHAMPTON BEACH, THE FRANCIS S GABRESKI (FOK)

72°38'W

72°37'W

FOK-3 MAPS/ALL/GEN F
Las Palmas, Grand Canary Isle (Spain)

<table>
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<th>Table Identifier</th>
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<tr>
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<th>rwy 21R</th>
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</tr>
<tr>
<td>elevation</td>
<td>76</td>
</tr>
<tr>
<td>orientation</td>
<td>N:clear E:clear S:clear W:clear</td>
</tr>
</tbody>
</table>

**WARNING**
Expect headwinds gusting 20 to 30 kt. Expect wind shear at 5000 ft where wind changes from northwesterly to 030

Terrain off end of rwys 03 L/R is hazardous

**NOTE**
Both rwys suitable. Plan on 03R because it has runway remaining markers and less traffic. Both rwys have 25-ft shoulders
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### Souda, Crete (Greece)

<table>
<thead>
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<th>Rwy 11</th>
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<tr>
<td>GSA</td>
<td>148</td>
<td>795</td>
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<tr>
<td>11</td>
<td>395</td>
<td>395</td>
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<td>elev = 492</td>
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<td>rwy 29</td>
<td>11,786</td>
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<tr>
<td>rwy 11</td>
<td>10,991</td>
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**TACAN:** RKL-20x (Pri)  
SUD-28x (Sec)

**I/F above:**
- N: clear
- E: clear
- S: clear
- W: clear

**MLS:** none

**PAPI:** none

**Ball Bar:** none

**UHF:** yes (guard only)

---

**NOTE**

Previous site identifier was SUD

This site usable only with 6 months prior notice
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Andersen AFB, Guam

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<td>1002</td>
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<tr>
<td>24R</td>
<td>1049</td>
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</table>

elev = 540

elev = 627

**TACAN:**
- UAM-54x (Pri)
- UNZ-100x (Sec)

**I/F above:**
- N: clear E: clear
- S: clear W: clear

**MLS:** none

**PAPI:** none

**Ball Bar:** none

**UHF:** yes (guard only)
Hao Atoll, Tuamotu, French Polynesia

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**TACAN:** HAO-85x (Pri-DME)

**I/F above:**
- N: clear
- E: clear
- S: clear
- W: clear

**MLS:** none

**PAPI:** none

**Ball Bar:** none

**UHF:** none
Ascension Aux AF, Ascension Island

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<th>32</th>
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<td>500</td>
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<tr>
<td>elev</td>
<td>255</td>
<td>212</td>
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</table>

TACAN: ASI-59x (Pri)
I/F above: N:clear E:clear
S:clear W:clear

MLS: none
PAPI: none
Ball Bar: none
UHF: yes (guard only)
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This Page Intentionally Blank
ASCENSION RWY HAW 14
### Honolulu International, Hawaii

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<th>200</th>
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<td>1000</td>
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</tbody>
</table>

**TACAN:** HNL-95x (Pri)  
CKH-86x (Sec)

**I/F above:**
- N: clear  
- E: clear  
- S: clear  
- W: clear

**MLS:** none

**PAPI:** none

**Ball Bar:** none

**UHF:** yes (guard only)
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Wilmington International, Wilmington, North Carolina

TACAN: ILM-117x (Pri)  NJM-67x (SEC)
I/F above: N:90k  E:clear  N:clear  E:clear
S:clear  W:85k  S:clear  W:clear

MLS: none
PAPI: none
Ball Bar: none
UHF: yes (guard only)
Shannon, Ireland

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<td>960</td>
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elev = 44
elev = 17

rwy 06
rwy 24

9,539
9,699

---

**TACAN:**
- SHA-80x (Pri-DME)
- CRN-37x (Sec-DME)

**I/F above:**
- N: clear  E: 105k
- N: clear  E: 135k
- S: 140k    W: clear
- S: clear   W: clear

**MLS:**
- none

**PAPI:**
- none

**Ball Bar:**
- none

**UHF:**
- none
### Diego Garcia NSF, Chagos Archipelago

#### Table Identifier

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<td>950</td>
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<td>950</td>
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</table>

* Elev = 9*

---

**TACAN:** NKW-57x (Pri)

**I/F above:**
- N: clear
- E: clear
- S: clear
- W: clear

**MLS:** none

**PAPI:** none

**Ball Bar:** none

**UHF:** yes (guard only)
Yokota AB, Tokyo, Honshu Island, Japan

Table Identifier: JTY

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<table>
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<th>11,000</th>
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TACAN: YOK-85x (Pri)
I/F above: N:clear   E:clear
S:125k    W:110k

MLS: none
PAPI: none
Ball Bar: none
UHF: yes (guard only)
YOKOTA RWY JTY 36
View 1
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<table>
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<td>32R</td>
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**Koln/Bonn, Germany**

**Identifier**: KBO

**TACAN**: NOR-109x (Pri) KBO-58y (Sec-DME)

**I/F above**: N:<80k E:<80k N:<80k E:<80k
S:<80k W:<80k S:<80k W:<80k

**MLS**: none

**PAPI**: none

**Ball Bar**: none

**UHF**: yes (guard only)
KOLN/BONN RWY KBO 14L
Kinshasa/N'Djili International, Zaire

| Identifier | KIN |

TACAN: BZ-78x (Pri-DME)  
I/F above: N:clear  E:clear  S:clear  W:clear  
MLS: none  
PAPI: none  
Ball Bar: none  
UHF: none

---

**WARNING**

Expect thundershowers from October through May. From June through September, expect visibility to be 3 nmi or less below 10,000 ft due to smoke and haze. This site not recommended for landing due to political concerns.
King Khalid International, Riyadh, Saudi Arabia

<table>
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<th>197</th>
<th>33L (rwy 33L)</th>
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<tr>
<td>elev</td>
<td>2048</td>
<td></td>
<td>2034</td>
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</table>

TACAN: RIY-92x (Pri)  KIA-80x (Sec)
I/F above: N::<80k   E::<80k   N:100k   E:140k
S:clear   W:80k       S:105k   W:110k

MLS: none
PAPI: none
Ball Bar: none
UHF: yes (guard only)
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Kennedy Space Center, Florida

### Table Identifier: KSC

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<th>15</th>
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<tr>
<td>elev = 9</td>
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<td>elev = 9</td>
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---

**TACAN:** TTS-59y (Pri)  
OMN-73x (Sec)

**I/F above:**  
N: clear  E: clear  
S: clear  W: clear  
N: 120k  E: clear  
S: 140k  W: 115k

**RTLS I/F:**  
N: clear  E: clear  
S: clear  W: clear  
N: 135k  E: clear  
S: clear  W: 115k

**MLS:** (15-Sr) ch 8; (33-Sr) ch 6

**PAPI:** 15, 33

**Ball Bar:** 15, 33

**UHF:** yes

---

rwy 15 15,000  
rwy 33 15,000
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Lajes AB, Azores

TACAN: LAJ-45x (Pri) TRM-109x (Sec)*
I/F above: N:clear E:clear N:clear E:clear
           S:clear W:clear S:clear W:clear
MLS: none
PAPI: none
Ball Bar: none
UHF: yes

*TRM-109x is mobile TACAN operational 24 hr/day
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**Lincoln Municipal, Nebraska**

### Table Identifier

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elev = 1193  
elev = 1181

- **TACAN:** LNK-108x (Pri)  
  OFF-54x (Sec)

- **I/F above:**
  - N:135k  
  - E:125k  
  - S:125k  
  - W:135k  

- **MLS:** none

- **PAPI:** none

- **Ball Bar:** none

- **UHF:** yes (guard only)
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Monrovia/Roberts International, Liberia

<table>
<thead>
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<th>LRB</th>
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| rwy 04 | 04 | 1000 | 150 | <<< |
| rwy 22 | 22 | 1200 | 167 |  |

elev = 29
elev = 25

TACAN: ROB-85x (Pri-DME)
I/F above: N:clear E:clear S:clear W:clear
MLS: none
PAPI: none
Ball Bar: none
UHF: none

WARNING

Do not use rwy 22
No overruns
Expect thunderstorms, low clouds, and low visibility from May through November. Expect scattered low clouds other times
Braking action poor
This site not recommended for landing due to political concerns

NOTE

25-ft shoulders
Airport officials may be unaware of your purpose
Language is English
Previous site identifier was ROB
## Orlando International, Florida

### Table Identifier

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- **elev = 92**
- **elev = 91**

---

### TACAN:

- TTS-59y (Pri)
- ORL-59x (Sec)

### I/F above:

- N: clear  E: clear  N: 85k  E: 85k
- S: clear  W: clear  S: 85k  W: 95k

### MLS:

- none

### PAPI:

- none

### Ball Bar:

- none

### UHF:

- yes (guard only)
Moron AB, Spain

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<table>
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<th>11,729</th>
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<tr>
<td>rwy 20</td>
<td>11,729</td>
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</tbody>
</table>

**TACAN:** MRN-100x (Pri)
AOG-23x (Sec)

**I/F above:**
N:<80k E:90k
N:clear E:clear
S:clear W:clear S:clear W:clear

**MLS:** (20-Sr) ch 6

**PAPI:** 20

**Ball Bar:** 20

**UHF:** yes (guard only after L/O)

---

**CAUTION**
Terrain on approach from either direction is 10 to 20 ft lower than rwy

Trees on approach are not tall but can result in ground rush

---

**NOTE**
Center 150 ft of 200-ft wide rwy resurfaced.
50-ft shoulders give visual impression of a 300-ft wide rwy
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This Page Intentionally Blank
<table>
<thead>
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elev = 2985
rwy 12 13,500
rwy 30 13,500
elev = 3002

**TACAN:** MUO-87x (Pri)  BOI-80x (Sec)
**I/F above:** N:80k  E:clear  N:clear  E:145k  S:100k  W:80k  S:95k  W:110k
**MLS:** none
**PAPI:** none
**Ball Bar:** none
**UHF:** yes (guard only)
Grant County International, Washington*

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<tr>
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<table>
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<tbody>
<tr>
<td>rwy 32R</td>
<td>13,501</td>
</tr>
</tbody>
</table>

- Elevations: 1163, 1180

**TACAN:**
- EPH-73x (Pri)
- MWH-97x (Sec-DME)

**I/F above:**
- N: clear, E: 80k, S: 80k, W: clear
- N: clear, E: 135k, S: clear, W: clear

**MLS:**
- None

**PAPI:**
- None

**Ball Bar:**
- None

**UHF:**
- Yes (guard only)

*Previous name was Moses Lake*
Myrtle Beach International, South Carolina

<table>
<thead>
<tr>
<th>RWY</th>
<th>Identifier</th>
<th>TACAN</th>
<th>I/F above</th>
<th>MLS</th>
<th>PAPI</th>
<th>Ball Bar</th>
<th>UHF</th>
</tr>
</thead>
<tbody>
<tr>
<td>17</td>
<td>MYR</td>
<td>FLO-99x (Pri)</td>
<td>N:80k E:90k N:80k E:clear</td>
<td>none</td>
<td>none</td>
<td>none</td>
<td>yes (guard only)</td>
</tr>
<tr>
<td>35</td>
<td>MYR</td>
<td>ILM-117x (Sec)</td>
<td>S:85k W:95k S:clear W:85k</td>
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Table Identifier: MYR

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<th>Dist</th>
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<td>1000</td>
<td>24</td>
<td>1000</td>
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<td>35</td>
<td>16</td>
<td>1000</td>
<td>24</td>
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rwy 17: 9,502
rwy 35: 9,502
MYRTLE BEACH RWY MYR 17
Cherry Point MCAS, North Carolina

<table>
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<tr>
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<th>Table</th>
<th>NKT</th>
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</table>

**14L**
- dirt >>>>> 200
- elev = 19

**32L**
- dirt <<<<< 1000
- elev = 17

**05R**
- dirt >>>>> 200
- elev = 18

**23R**
- dirt <<<<< 1600
- elev = 27

**TACAN:**
- NKT-75x (Pri)
- EWN-83x (Sec-DME)

**I/F above:**
- N: <<80k E: <<80k N: 90k E: 95K
- S: <<80k W: <<80k S: clear W: 110k

**MLS:**
- none

**PAPI:**
- none

**Ball Bar:**
- none

**UHF:**
- yes (guard only)
TACAN: SNG-121y (Pri) HMN-92x (Sec)  
I/F above: N:clear E:clear N:<80k E:<80k  
S:clear W:clear S:<80k W:120k  
MLS: (17-JR) (23-JR) ch 6  
PAPI: 17, 23, 35*  
Ball Bar: 17, 23, 35  
UHF: yes  

NOTE  
TAL training rwy 02/20 located in NW quadrant between rwys 05 and 17

*7500-ft aim point only
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**Oceana NAS, Virginia**

<table>
<thead>
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</table>

**TACAN:**
- NGU-48x (Pri)
- NTU-113x (Sec)

**I/F above:**
- N: 95k E: clear
- S: clear W: clear
- N: <<80k E: <<80k
- S: <<80k W: <<80k

**MLS:** none

**PAPI:** none

**Ball Bar:** none

**UHF:** yes (guard only)
Leopold Sedar Senghor International, Dakar, Senegal

Table Identifier: OOY

<table>
<thead>
<tr>
<th>18</th>
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<th>148</th>
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<td>197</td>
<td>803</td>
<td>803</td>
<td>197</td>
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</table>

elev = 78

---

NOTE

Sharp dropoff on approach end of rwy 18

Hill on approach end of rwy 36

Previous site identifier was YOF

No current agreement for use of this site

**TACAN**:
- BYD-121x (Pri)*
- YF-78x (Sec-DME)

**I/F above**:
- N: clear
- E: clear
- S: clear
- W: clear

**MLS**: none

**PAPI**: none

**Ball Bar**: none

**UHF**: none

---

---

* TACAN BYD-121x available only during ascent
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Pease International Tradeport, Portsmouth, New Hampshire

**Table Identifier**

<table>
<thead>
<tr>
<th>Rwy</th>
<th>Elev</th>
<th>MLS</th>
<th>PAPI</th>
<th>Ball Bar</th>
<th>UHF</th>
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<tbody>
<tr>
<td>34</td>
<td>&gt;85</td>
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<td>none</td>
<td>none</td>
<td>yes (guard only)</td>
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<tr>
<td>16</td>
<td>&gt;90</td>
<td>none</td>
<td>none</td>
<td>none</td>
<td>none</td>
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</tbody>
</table>

- **TACAN:**
  - ENE-118x (Pri)
  - PSM-112x (Sec)

- **I/F above:**
  - N:clear  E:clear
  - S:clear  W:clear

  - N:<80k  E:<80k
  - S:<80k  W:<80k

- **UHF:** yes (guard only)
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**Tindal RAAF, Australia**

<table>
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<th>14</th>
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<p>| | | |</p>
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<tbody>
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<td>elev</td>
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<td></td>
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<tr>
<td>elev</td>
<td>442</td>
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- **TACAN:** TDL-70x (Pri)
- **I/F above:** N:clear  E:clear  S:clear  W:clear
- **MLS:** none
- **PAPI:** none
- **Ball Bar:** none
- **UHF:** yes (guard only)
Ellsworth AFB, South Dakota

Table Identifier: RCA

<p>| | | |</p>
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rwy 13  13,497  rwy 31  13,497

elev = 3270  elev = 3176

TACAN: RCA-25x (Pri)  RAP-70x (Sec)
I/F above: N:<80k  E:<80k  N:140k  E:120k
S:<80k  W:<80k  S:90k  W:110k

MLS: none
PAPI: none
Ball Bar: none
UHF: yes (guard only)
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ELLSWORTH RWY RCA 13
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Wake Island AAF, Wake Island

Table
Identifier
WAK

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<th>10</th>
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elev = 12

rwy 28 8,859
rwy 10 8,859

TACAN: AWK-82x (Pri)
I/F above: N:clear E:clear
S:clear W:clear

MLS: none
PAPI: none
Ball Bar: none
UHF: yes (guard only)
WAKE ISLAND RWY WAK 28
WAKE ISLAND RWYS WAK 10 AND WAK 28
Wallop Flight Facility, Wallops Island, Virginia

Table Identifier: WAL

28  200  10

elev = 35  elev = 19

rwy 28  8,005  rwy 10  8,005

TACAN:  SBY-49x (Pri)
I/F above:  N:<80k  E:<80k  S:<80k  W:<80k
MLS:  none
PAPI:  none
Ball Bar:  none
UHF:  yes (guard only)
TACAN: UAW-38x (Pri) YHZ-98x (Sec-DME)
I/F above: N:clear E:clear N:clear E:clear
S:clear W:clear S:clear W:90k
MLS: none
PAPI: none
Ball Bar: none
UHF: yes (guard only)
Stephenville, Newfoundland, Canada

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**TACAN:**
- YJT-78x (Pri)
- YDF-80x (Sec-DME)

**I/F above:**
- N: clear
- E: clear
- S: clear
- W: clear
- S: 95k
- W: 90k

**MLS:** none

**PAPI:** none

**Ball Bar:** none

**UHF:** none (UHF available only through Gander Center)
Nassau International, New Providence Island, Bahamas

<table>
<thead>
<tr>
<th>Identifier</th>
<th>YNN</th>
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</table>

| rwy 14 | 14 | 150 | 293 |
| rwy 32 | 32 | 230 | 707 |

| Elev | 8 |

**TACAN:** YNN-74x (Pri-DME)

**I/F above:**
- N: 100k, E: clear
- S: clear, W: 115k

**MLS:** none

**PAPI:** none

**Ball Bar:** none

**UHF:** none

---

**NOTE**

- 25-ft shoulders
- Plan on rwy 14
- Previous site identifier was ZQA
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Gander International, Newfoundland, Canada

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</table>

TACAN: YQX-74x (Pri)  
I/F above: N:clear E:clear S:clear W:150k

 MLS: none  
PAPI: none  
Ball Bar: none  
UHF: yes

Gander International, Newfoundland, Canada

Table Identifier YQX

rwy 22 9,500
rwy 04 9,500

elev = 449
elev = 428
Goose Bay, Newfoundland, Canada

<table>
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<th>MLS</th>
<th>PAPI</th>
<th>TACAN</th>
<th>UHF</th>
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<tr>
<td>08</td>
<td>152</td>
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<td>none</td>
<td>UYR-40x (Pri)</td>
<td>yes</td>
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<td>26</td>
<td>142</td>
<td>none</td>
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I/F above:
- N: 150k, E: clear
- S: clear, W: 120k

Ball Bar: none
GOOSE BAY RWYS YYR 08 AND YYR 26
View 1
<table>
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**St. John’s International, Newfoundland, Canada**

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<th>Length</th>
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<td>8,500</td>
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<td>8,500</td>
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</tbody>
</table>

**TACAN:**
- UYT-23x (Pri)
- YYT-82 (Sec-DME)

**I/F above:**
- N:clear  E:clear
- S:clear  W:clear

**MLS:**
- none

**PAPI:**
- none

**Ball Bar:**
- none

**UHF:**
- yes
NOTE: White Rotating Hazard Beacons off thresholds of Rwy 11, 16 and 34.
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Zaragoza AB, Spain

Table Identifier ZZA

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elev = 834

rwy 12R 12,197
rwy 30L 12,197

elev = 862

TACAN: ZZA-64x (Pri) ZZA-77x (Sec-DME)
I/F above: N:clear E:clear N:<<80k E:<<80k
S:clear W:clear S:<<80k W:<<80k

MLS: (30L-Sr)* ch 6
PAPI: 30L*
Ball Bar: 30L*
UHF: yes

RWY 30L

WARNING
Do not line up on 30R - it may be seen first in reduced visibility
PAPIs are offset 170 ft to right of centerline at standard distance to threshold
Dip in rwy approx 4000 ft from threshold shows up dark in night TAL but is illuminated
Rwy slopes down slightly. rollout end approx 30 ft lower than approach end

NOTE
Prominent triangular field adjacent to and left of PAPIs. Apex points to rwy 30L

RWY 12R

CAUTION
Do not fly high on IGS to avoid VOR bldg on final
No visual landing aids

*Available only for ascent
This Page Intentionally Blank
ZARAGOZA RWY ZZA 30L
View 2
POSTLANDING PROCEDURES
FOR EMERGENCY AIRFIELD LANDING
1. **OVERSEAS AUGMENTED LANDING SITES**

Augmented indicates that landing aids and NASA personnel are in place at prime and backup TAL sites.

- a. Evacuate to a distance of 1250 ft.

- b. The Commander will turn over responsibility for the orbiter to the senior NASA representative present.

- c. One hour after landing, a teleconferenced debriefing will be held to report the condition of the orbiter and record a press statement. The flight crew will then speak with their families.

- d. The flight crew will not meet with media representatives.

- e. The flight crew will brief local NASA representatives on orbiter status.

- f. The DOD will be responsible for treatment and transportation of injured flight crew. Uninjured flight crew may be evacuated by the DOD to the nearest U.S. military base (Rota, Spain). The local FCOD representative may go with the flight crew.

- g. NASA personnel should aid the flight crew in retrieving early return items to be transported with the flight crew.

- h. The flight crew will brief the Rapid Response Team and Mishap Investigation Team via telecon.

- i. The flight crew will return to JSC on the JSC KC-135 aircraft.

- j. For further information, see the Nonaugmented Non-U.S. Military Base guidelines.
2. U.S. MILITARY BASES

These guidelines are only deltas to instructions for Non-U.S. Military Bases, Nonaugmented landing sites. Please refer to them for full instructions.

a. Evacuate the orbiter and turn it over to the senior military official responsible for the orbiter until arrival of the Rapid Response Team. The Commander will designate a crewmember to assist the DOD senior official in safing and guarding the orbiter.

b. The flight crew will be escorted to the Command Post to contact MCC. They will make a recorded press statement and speak to their families through the DOD Support Operations Center.

c. The flight crew will be escorted to appropriate facilities to await arrival of the Rapid Response Team. Meals should be available.

d. The U.S. military will assume responsibility for treatment of flight crew injuries.

e. The flight crew will not meet with media representatives.

f. DOD has arranged to contact, train, and provide orbiter documentation to emergency and rescue forces who will therefore have preliminary knowledge of orbiter hazards and precautions.

g. The JSC KC-135 aircraft will be dispatched to pick up the flight crew. Estimated arrival time is 14 hr.
3. NON-U.S. MILITARY BASES – NONAUGMENTED

a. Evacuate to a distance of 1250 ft. Beware of toxic fumes and burning tires. Notify the tower that only firefighting and medical personnel should approach the orbiter.

b. The Commander will retain responsibility for the flight crew and orbiter until either (1) the DOD evacuation team arrives to evacuate the flight crew, or (2) the Rapid Response Team arrives.

c. A DOD Medivac aircraft and medical team will be dispatched to the landing site as soon as possible.

d. The Commander or his representative will meet with local airfield officials and give them prepared onboard orbiter emergency guidelines (4. U.S. EMBASSY, p. 4-7). He will briefly advise them on vehicle hazards and safety requirements and inform them that towing should not be attempted. The State Department will inform local officials that the U.S. Government will reimburse all reasonable expenses.

e. The Commander will have local officials contact the nearest U.S. Embassy so that a representative can immediately come to the landing site.

f. The Commander will arrange with local officials to provide 24-hr security for the flight crew and orbiter. If a U.S. Embassy is nearby, these security forces would include at least one U.S. citizen each. The controlled access area should be a 2000-ft radius around the orbiter. The Commander will designate a crewmember to remain with the orbiter until a U.S. citizen with a secret clearance arrives.

g. The Commander should designate a crewmember to maintain a log and enter local landing time and any pertinent observations of the orbiter and events leading up to the landing.

h. The flight crew will establish communications with MCC as soon as possible. The MCC will record a press statement made by the flight crew and release it from JSC. The flight crew will not meet with media representatives.

i. The Commander will contact MCC CAPCOM.

j. After initial contact with MCC, each crewmember will be allowed to speak to family members on a NASA comm line.

k. If there is a local U.S. Embassy, the flight crew may be escorted there to await transportation to the nearest U.S. military base.

l. The Rapid Response Team will arrive in approximately 24 hr. Personnel will include, but are not limited to:

   KSC Ground Operations Manager
   KSC Convoy Commander
   KSC Tow Team
   KSC Logistics Team
   JSC FCOD representative
   Mishap Investigation Team
   Payload representative
   DDMS representative
m. The JSC KC-135 will be deployed to pick up the flight crew. Estimated time of arrival is landing plus 14 hr. Flight crew passports will be carried onboard by the FCOD representative. Personnel on the KC-135 will include, but are not limited to:

   JSC FCOD Director or representative(s)
   Flight Surgeon
   PAO representative
   Security representative

n. The MCC may advise the Commander that the flight crew can approach the orbiter. This may include authorization to close the side hatch. The flight crew may then enter the orbiter and retrieve clean clothes or other needed articles including “Return to Houston” items.

o. The flight crew will brief the Rapid Response Team and Mishap Investigation Team via telecon as reqd from the accident site and the evacuation site.

p. The flight crew shall brief an FCOD or Rapid Response Team representative on location of early return items to be removed from the orbiter for return to JSC if they are unable to retrieve them before evacuation.

q. If a DOD mission, security requires a U.S. citizen with a secret clearance to remain with the orbiter at all times and have the side hatch closed as soon as possible.
4. U.S. EMBASSY

a. If medical attention is reqd for the flight crew, please have a U.S. citizen stay in contact with injured flight crew. Arrangements will be made with DOD to evacuate both injured and uninjured flight crew to the nearest U.S. military base.

b. The flight crew will be retrieved by the Johnson Space Center KC-135 aircraft from their evacuation location.

c. Due to the nature of hazards present, you should not approach the orbiter within 1250 ft. Stay upwind and avoid the forward and aft sections. Approaches can be safely made only from the 10, 2, 4, or 8 o’clock position, whichever direction is most upwind. The vehicle is considered hazardous for 24 hr. All smoking is prohibited.

d. Contact NASA Kennedy Space Center, Mission Control Center, Landing and Recovery Director for questions concerning the orbiter.

e. Contact NASA Johnson Space Center, Mission Control Center, CAPCOM for questions concerning flight crew.

f. Provide U.S. citizen(s) with a secret clearance for 24-hr security of the orbiter and flight crew.

g. Provide interpreters.

h. Provide escorts, transportation, lodging, and meals as necessary for the flight crew until evacuation.

i. The Rapid Response Team will arrive in approximately 24 hr. Personnel will include NASA management, orbiter tow team, Mishap Investigation Team, DOD and flight crew representatives.

j. The flight crew will not meet with media representatives. The flight crew statement will be released from Johnson Space Center.

k. Please contract a photographer to take photos of the orbiter, any debris, and anything unusual (e.g., fire, smoke, fumes).

l. If any damage to the orbiter, please have debris left in its place with documentary photographs and location descriptions taken. Debris could be contaminated with hazardous substances. Handle with protective clothing and avoid debris having a fishy-ammonia, pungent-sweet, or ammonia-like smell. Seek immediate medical attention for irritation to the nose, throat, or eyes, or any coughing or difficulty breathing.

m. Please record any pertinent observations, with time noted.

n. Please arrange to have witnesses contacted. Obtain their names, addresses, and telephone numbers.

o. Discourage towing of the orbiter until the RRT arrives. It cannot be towed or moved without special equipment. Contact Kennedy Space Center for further information if airfield officials insist.

p. The U.S. Government will repay any reasonable expenses incurred.
q. The Commander is responsible for the orbiter and flight crew. It will be necessary for him to stay in contact with the Mission Control Center in Houston, Texas. Please assist him in any way possible.

r. Requests for public information should be referred to the National Aeronautics and Space Administration.
PROPRIETARY INFORMATION