

**DOCKET NO.: SA-517
EXHIBIT NO. 2T**

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.**

**APPROACH PROCEDURE CHARTING
(20 Pages)**

*NTSB Hearing
Honolulu, Hawaii*



Jim Terpstra
Jeppesen
March 25, 1998

Instrument Approach Charts



- Sources of Information
- How Jeppesen Designs a Chart
- Validation of Sources

Airport & Users Establish the Need



Approach Procedure Design

- United States Standard for Terminal Instrument Approach Procedures (TERPs)
- U.S. Military and Civilian Same Standard
- Original Issue November 18, 1967
- TERPs Change 17 issued February 1998.
- International design according to ICAO PansOps Document 8168

JULY 1976



UNITED STATES STANDARD

FOR

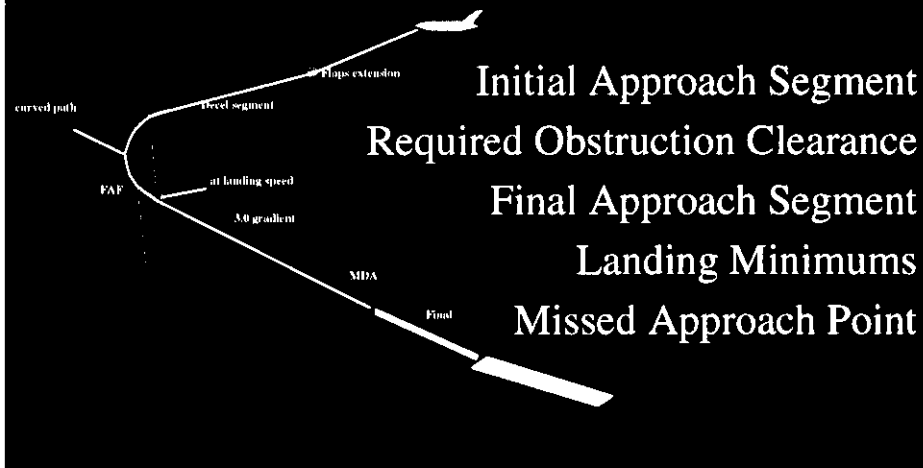
**TERMINAL
INSTRUMENT
PROCEDURES**

(TERPS)

(TERPS)

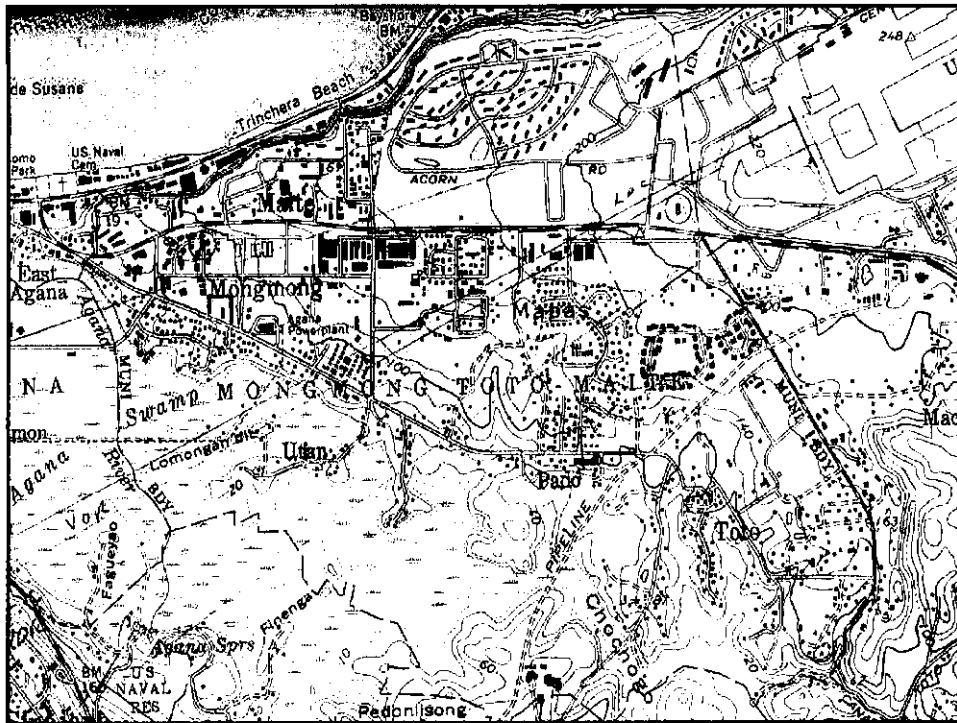
ARMY	TM 95-226
NAVY	OPNAV Inst. 3722.16C
AIR FORCE	AFM 55-9
COAST GUARD	CG 318
FAA Handbook	8260.38

Some Elements of TERPs



Many Tools for TERPs Experts

- Trained by FAA in Oklahoma City
- Use local topographical charts
- Use obstacles from NOS obstacle file
- Use obstacles known locally
- Use FAA-designed Instrument Approach Procedure Automation software
- Coordinated with Air Traffic Control



Flight checked by FAA
 Entered onto FAA Form 8260-3 or -5
 Submitted to Oklahoma City for review
 Coordinated with designer for corrections
 Sent to Industry for Review
 Sent to FAA National Flight Data Center
 (NFDC) for official distribution
 Submitted to Federal Register

U.S. Department of Transportation
Federal Aviation Administration

ILS - STANDARD INSTRUMENT APPROACH PROCEDURE FAR PART 97.29

Headings, bearings, courses, and altitudes are magnetic. Distances and altitudes are in feet, MSL, except HAT, MAA, TCA, and PA. Altitudes are minimum altitudes unless otherwise indicated. Courses are to be flown above airport elevations. Obstructions are in circular miles unless otherwise indicated, except obstructions which are in square miles or in feet MSL.

TERMINAL ROUTES				ISSUED APPROACH	
FROM	TO	COURSE AND DISTANCE	ALTITUDE	LS: AT THE DR:	LOC: 4.35 MILES AFTER
HAMALANUZ 7.00 DME CCW (AP)	1-GRN 242.95/UNZ 7.00 DME (XPT)	7.00 DME ARC (UNZ LR-020)	3000	GRUQZY OMALNZ 1.00	OR AT UNZ 2.00 DME FIX.
ZEBEKANUZ 7.00 DME CW (AP)	1-GRN 242.95/UNZ 7.00 DME (XPT)	7.00 DME ARC (UNZ LR-020)	3000	CLEAN TO 3000, THEN TURN RIGHT VIA UNZ R-042 TO PLAKSARUZ 7.00 DME AND HOLD.	
1-GRN 242.95/UNZ 7.00 DME	GRUQZY OMALNZ 1.00 DME	082.0645.24	3000		

**FAA Form 8260-3
FAR Part 97.29**

ADDITIONAL FLIGHT DATA:
HOLD SW, RT, 082 INBOUND
FAS OBST: 086 TERUARN 1228441444702
794 ANT 1227481444259
CHART: UNZ 2.00 DME AT 082

1. FT MSL SIDE OF COURSE OUTBOUND _____ FT WITHIN _____ MILES OF _____ (AP)
2. PROFILE SKIMMS AT 1-GRN 242.95/UNZ 7.00 DME ←
3. FAC: 082LS FAS: GRUQZY 082 DIST FAF TO MAP: 4.35 THLD: 4.00
4. MIN ALT: 1-GRN 242.95/UNZ 7.00 DME 3000; GRUQZY ON 2000; 082 VORTAC 1450 # LOC ONLY
5. DIST TO THLD FROM OM: 4.35 MSL: 25 MSL: 180 HAT: 100 HAT: 082 ANT: 082
6. MIN GS INOPT: 3000 GS ALT AT: _____ DME 1004 MSL: 082 MSL: _____
7. GS ANGLE: 3.00 TCH: 80
8. MSA FROM: 082 VORTAC 080-070 2000, 070-080 2000

Chart localizer mmms require simultaneous reception of I. Gurn and UNZ VORTAC.

TAKEOFF:	STANDARD	X	SEE FAA FORM 8080-15 FOR THIS AIRPORT	ALTERNATE: M/A	LS: STANDARD	LOC: STANDARD						
CATEGORY	A		B		C		D		E			
	DAV MDA	VIS	HAT/MAA	DAV MDA	VIS	HAT/MAA	DAV MDA	VIS	HAT/MAA	DAV MDA	VIS	HAT/MAA
B - ILS	082	1/2	200	400	1/2	200	400	1/2	200			
B - LOC	082	1/2	200	400	1/2	200	400	1/2	200			
CIRCLING	700	1	400	700	1	400	700	1 1/2	400	600	2	900

NOTES: CIRCLING MSL BE OF RWY 08-24L ←
DME FROM 082 VORTAC ← THIS IS A CORRECTED COPY OF A PROCEDURE PUBLISHED IN TL 96-15.

CITY AND STATE: Agaña, GU
ELEVATION: 111
AIRPORT NAME: GUAM INTERNATIONAL
FACILITY IDENTIFIER: MSLM
PROCEDURE NO. / AMDT NO. / EFFECTIVE DATE: 15 AUG 96
ILS RWY 08, 082P 1
SUP: NONE
DATED:

FAA FORM 8260-3 (February 1995) (continuous submission)

U.S. Department of Transportation
Federal Aviation Administration

ILS - STANDARD INSTRUMENT APPROACH PROCEDURE FAR PART 97.29

Headings, bearings, courses, and altitudes are magnetic. Distances and altitudes are in feet, MSL, except HAT, MAA, TCA, and PA. Altitudes are minimum altitudes unless otherwise indicated. Courses are to be flown above airport elevations. Obstructions are in circular miles unless otherwise indicated, except obstructions which are in square miles or in feet MSL.

TERMINAL ROUTES				ISSUED APPROACH	
FROM	TO	COURSE AND DISTANCE	ALTITUDE	LS: AT THE DR:	LOC: 4.35 MILES AFTER
HAMALANUZ 7.00 DME CCW (AP)	1-GRN 242.95/UNZ 7.00 DME (XPT)	7.00 DME ARC (UNZ LR-020)	3000	GRUQZY OMALNZ 1.00	OR AT UNZ 2.00 DME FIX.
ZEBEKANUZ 7.00 DME CW (AP)	1-GRN 242.95/UNZ 7.00 DME (XPT)	7.00 DME ARC (UNZ LR-020)	3000	CLEAN TO 3000, THEN TURN RIGHT VIA UNZ R-042 TO PLAKSARUZ 7.00 DME AND HOLD.	
1-GRN 242.95/UNZ 7.00 DME	GRUQZY OMALNZ 1.00 DME	082.0645.24	3000		

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5. DIST TO THLD FROM OM: 4.35 MSL: 25 MSL: 180 HAT: 100 HAT: 082 ANT: 082
6. MIN GS INOPT: 3000 GS ALT AT: _____ DME 1004 MSL: 082 MSL: _____
7. GS ANGLE: 3.00 TCH: 80
8. MSA FROM: 082 VORTAC 080-070 2000, 070-080 2000

Minimums

TAKEOFF:	STANDARD	X	SEE FAA FORM 8080-15 FOR THIS AIRPORT			
CATEGORY	A		B			
	DAV MDA	VIS	HAT/MAA	DAV MDA	VIS	HAT/MAA
B - ILS	082	1/2	200	400	1/2	200
B - LOC	082	1/2	200	400	1/2	200
CIRCLING	700	1	400	700	1	400

ADDITIONAL FLIGHT DATA:
HOLD SW, RT, 082 INBOUND
FAS OBST: 086 TERUARN 1228441444702
794 ANT 1227481444259
CHART: UNZ 2.00 DME AT 082

Profile View

Additional Flight Data

A DISTINCTION

- There is now an official instrument approach procedure.
- There is NO instrument approach chart - yet.
- An approach *procedure* is NOT the same as an approach *chart*.
- The FAA creates approach *procedures*.
- Jeppesen and NOS produces approach *charts*.

Approach Chart Sources

Intersections & Formations
NFDC Fix List

Components
Out Minimums
TERPs Criteria

Jeppesen Speed & Descent Rate Calculations

Special Use Airspace
Holding Patterns
Approach Lights

FAA Form 8260-3 & -5
Communications
Obstacles
Terrain

JEPPESEN		2 AUG 96	(11-1)	111.1° Avg	AGANA, GUAM
ATIS 119.0		GUAM Approach (R) 119.8			GUAM INTL
AGANA Tower 118.1		Ground 121.9			ILS Rwy 6L
Trans level: FL 180		Trans alt: 18000' (17744')			LOC 110.3 IGUM
Alt Set: INCHES					Apt. Elev 297'
DME REQUIRED. DME from UNZ VOR.					796'
					(IAF) HAMAL

Intersection Formations - NFDC

NATIONAL FLIGHT DATA DIGEST



Air Traffic Airspace Management Program
National Flight Data Center

Thursday
Part Two of Three

NO. 144

07/25/96

AIRSPACE

SUPPLEMENT TO NFDD # 144

AIRSPACE FIXES

SUPPLEMENT TO NFDD # 144

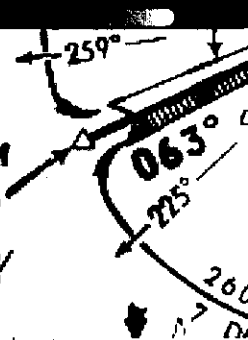
ALL AZIMUTHS ARE MAGNETIC AND FROM THE FACILITY.
ALL DISTANCES ARE IN NAUTICAL MILES.

EFFECTIVE 10/10/96 THE FOLLOWING AIRSPACE FIXES
ARE ESTABLISHED MODIFIED OR CANCELLED AS INDICATED.

Intersection Formations - NFDC

GUAM	NFDD
FIBEE M	
NAV-FAC-AZIMUTH/DSTC	UNZ VORTA
LATITUDE	13-34-49.
LONGITUDE	144-57-51
CHARTING	IAP
CHARTING CHANGES	IAP

(IAP)
063° IGUM
ILS/D7.0
UNZ VOR
● FLAKE
UNZ VOR R-242/
D7.0 UNZ VOR



GUAM	NFDD 144- 120.	07/25/96
FLAKE		
NAV-FAC-AZIMUTH/DSTC	UNZ VORTAC 241.84/7.00	MODIFIED
LATITUDE	13-24-10.34N	
LONGITUDE	144-37-33.13E	
CHARTING	IAP	

JEPPESEN 2 AUG 96 (11-1)

ATIS 119.0
GUAM Approach (R) 119.8
AGANA Tower 118.1
Ground 121.9
Alt Ser: INCHES
Trans level: FL 180
Trans alt: 18000 (17744')

Communications

JEPPESEN 25 OCT 96 (10-9)

ATIS 119.0	GUAM Departure (R) 119.8
AGANA Ramp 121.6	
Ground 121.9	
Tower 118.1	

AGANA, GUAM. Guam Intl Apt PGUM/IFR PG FSS HNL Honolulu long distance call to FSS dial (area code) 836 8054. (NFDD 028-96) ICB 024-96 02/09/96 APT/PAC

AGANA, GUAM. Agana NAS Apt. PGUM/IFR PG Nimitz VORTAC. UNZ N13 27.16.4, W144 43-59.9, modified (per NOS field survey). Elev 680, modified. NFDD 246/95 ICB 002-96 01/04/96 NAV/PAC

AGANA, GUAM. Guam Intl Apt PGUM/IFR PG Ry 6R/24L 8001'. (NFDD 214-95) ICB 190-95 11/07/95 APT/PAC

AGANA, GUAM. Guam Intl Apt. PGUM/IFR PG ATCT. GND/P freq 119.0 chgd to 121.9. CD/P freq 121.9, added. ATIS freq 119.0, added. (NFDD 145/95) ICB 130-95 07/28/95 COM/PAC

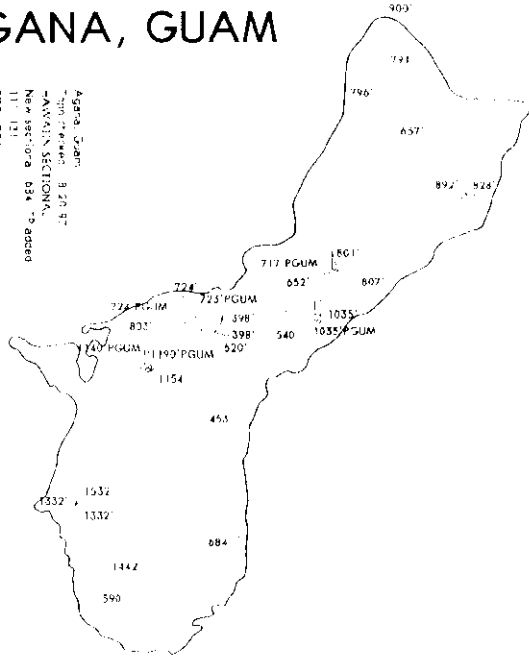
Component-out Minimums

- Stated in Sections 3 and 4 of TERPs
- Glide slope availability
- Approach light availability
- Runway alignment light availability
- Form 8260-3

STRAIGHT-IN LANDING RWY 6L				
ILS DA/H: 456' (200')		LOC (GS out) MDA/H: 560' (304')		
	FULL	RAIL or ALS out	RAIL out	ALS out
A				
B	1/2	3/4	1/2	3/4
C				1
D			3/4	1

AGANA, GUAM

AGANA, GUAM
 Title of chart
 Date of issue
 Edition
 New sectional, 684' TP added
 111 131
 11
 131
 FACTOR:
 1:50,000



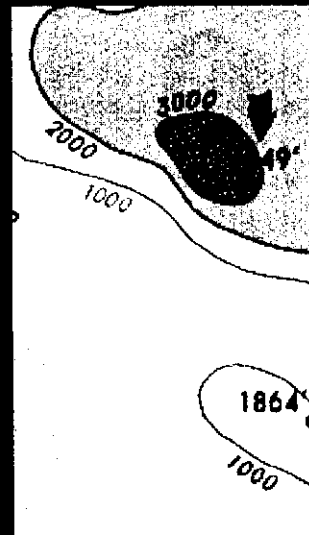
Obstacles

- ONCs
- TPCs
- Sectionals
- 8260s
- WACs
- AIPs

Agana, Guam
 Topo checked 8-20-97
 HAWAII SECTIONAL
 New sectional, 684' TP added
 111 131
 FOR4.DPJ

- At least one elevation 4,000' above airport in at least one plan view --or--
- One elevation 2,000' above airport within six miles
- Special customer request
- Multiple sources for terrain
 - Digital terrain
 - Sectional charts
 - Topographical charts

Terrain



Special Use Airspace

11/07/97

- Federal Register
- FAR Part 73

WARNING
W-517

W-517 Guam, GU

Boundaries. Beginning at lat. 12°50'00"N., long. 144°30'00"E.; to lat. 13°10'00"N., long. 144°30'00"E.; to lat. 13°10'00"N., long. 144°42'00"E.; to lat. 12°50'00"N., long. 144°45'00"E.; to lat. 11°00'00"N., long. 144°45'00"E.; to lat. 11°00'00"N., long. 143°00'00"E.; to lat. 11°45'00"N., long. 143°00'00"E.; to the point of beginning.

Altitudes. Surface to unlimited.

Times of use. By NOTAM.

Controlling agency. FAA, Guam CERAP

Using agency. Commander, Naval Forces, Marianas Naval Station, Guam

7400 9E

09/10/97

AWP GU D Guam Island, Agana NAS, GU
Guam Island, Agana NAS, GU

(lat. 13°25'54"N, long. 144°47'36"E)

That airspace extending upward from the surface to and including 2,600 feet MSL within a 1.3-mile radius of Guam Island, Agana NAS

AWP GU D Guam Island, GU

Guam Island Andersen AFB, GU

(lat. 13°44'52"N, long. 141°55'28"E)

That airspace extending upward from the surface to and including 2,600 feet MSL within a 1.3-mile radius of Andersen AFB

JEPPESEN 25 OCT 96 (10-9A) **AGANA, GUAM**
GUAM INTL

GENERAL

ADDITIONAL RUNWAY INFORMATION

RWY	SURF	LANDING BEYOND	USABLE LENGTHS		TAKE-OFF	WIDTH
			Threshold	Glide Slope		
06R	24L	MIRL				150'
06L	24R	MALS, VASI (3 bar)	grooved	9169'		150'

① Upwind angle 3.00°, downwind angle 2.65°

Airport Lighting

GUAM
S **GUAM INTL** (GUM) (PGUM) 3 NE UTC+10 N13°29'01" E144°47'76" HAWAIIAN-MARIANA 1-A-B IAP

29/ B S2 FUEL 100LL, JET A1 OX 1, 2, 3 TPA-1597(1300) LRA ARFF Index D

RWY 06L-24R: H10015X150 (ASPH-CONC-GRVD) S-135, 0-235, DT 390, DDT 780 MIRL

RWY 06L: MALS, VASI(V4L) GA 3.0° TCH 51'. Tower, 0.5% up.

RWY 24R: VASI(V6L)-- Upper GA 3.0° TCH 68'. Lower GA 2.65° TCH 36'. Trees, Rgt t/c 0.7% down.

RWY 06R 24L: H8001X150 (ASPH-CONC) S-85, D 160, DT 330, DDT 660 MIRL

RWY 06R: Tower, 0.8% up. **RWY 24L:** Trees, Rgt t/c, 0.5% down.

AIRPORT REMARKS: Attended continuously. Rwy 06R 24L not avbl for B747 ops. Rwy 06R 24L E 1000' CLOSED to fighter acft. Lighted tower 785' 1.7 NM ENE of Rwy 24L thld. Dep acft maintain rwy heading until past end of rwy and reaching 1000'. Departing aircraft maintain runway heading until past departure end of rwy and reaching 1000'. Rgt pattern 24L/R do not exceed 1300' in t/c pattern. Rising terrain 75' from thld Rwy 24L and 140' from centerline extended is +4'. For parking info etc freq 121.6 after entering ramp. Customs available 24 hours daily. Landing fee. Consult special notice section of International NOTAMS.

Jeppesen Conversion Table

- Time, Distance, and Speed Values
- Glide Slope Descent Rate
- Missed Approach Point location and distance to MAP

A	Grnd speed-Kts	70	90	100	120	140	160
B	Gs	3.00°	377	484	538	646	753
C	MAP at D2 B LONE VOR or						
D	FAF to MAP	4.4	3:46	2:56	2:38	2:12	1:53

CHANGES: Location name, procedure

Revisions to Procedures

- Revisions result from various reasons
 - NFDC
 - 8260
 - Communications
 - Notes

NFDC/CARF/INTL NTMS 021924

FDC :FDC 8/0748 GUM FI/P GUAM INTL, AGANA, GUAM

FEB - 3 1998


ILS RWY 6L, ORIG...

ADD NOTE: LOCALIZER MNMS REQUIRE SIMULTANEOUS RECEPTION OF I-GUM AND UNZ VORTAC.

THIS IS ILS RWY 6L, AMDT 1.

Where Information Comes From
- Over 190 Countries -

Aeronautical
Information
Publication
(AIP)



How Jeppesen Designs a Chart

- History since 1934
- Flight Information Design Department
 - Pilots and flight instructors
 - Controllers
 - Chart experts and cartographers
- “Jeppesen Listens” Comment Cards
- Chart Seminars
- Airline Seminars

How Jeppesen Designs a Chart

- From the smallest detail -
- Identifier **215** versus 215
- Number **3** versus 3

RANTOUL, ILL	215
RANTOUL NATIONAL AVIATION CENTER	
N40 17.6 W088 08.3 268.2°/26.9 From DNV 111.0	
Elev 737' Var 01°W	

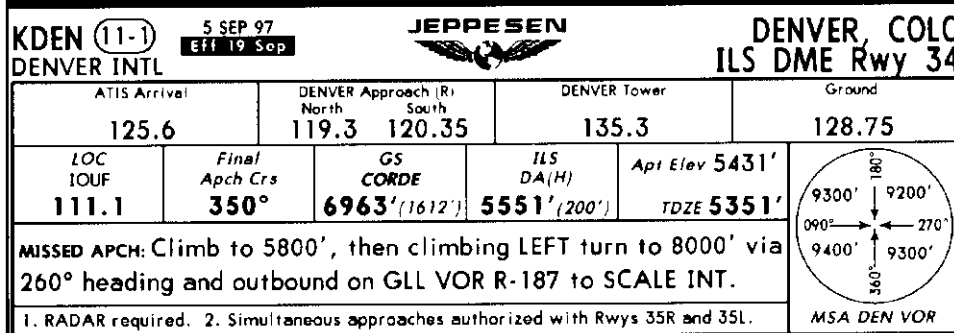
- To the highest overview - The design of the Jeppesen charts are based on the intended use which is by experienced instrument rated pilots.

How Jeppesen Designs a Chart

- Human Factors
 - Volpe National Transportation System Center
 - FAA Sponsored Program conducted by Dr. Bill Connor & Joe Cox
 - Flight and simulator tests
 - Boeing Sponsored Study of Pilot's eye movements on approach charts
 - ATA Charting & Data Display Task Force
 - ATA Charts, Database, and Avionics Task Force

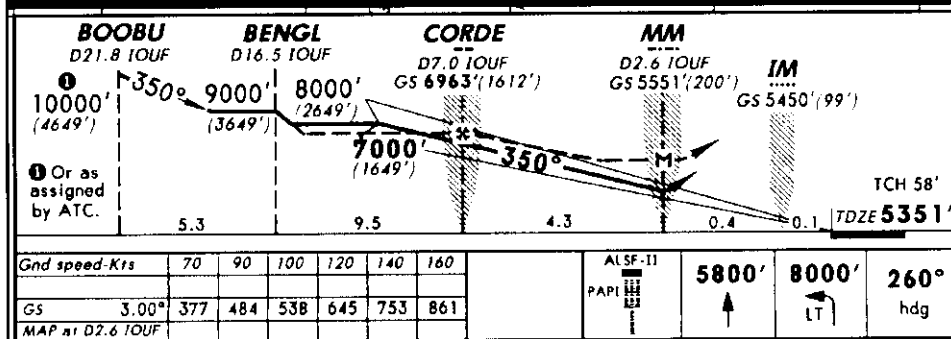
How Jeppesen Designs a Chart

- Briefing Strip
- In prototype use for two years
- More than 4,000 pilot surveys completed

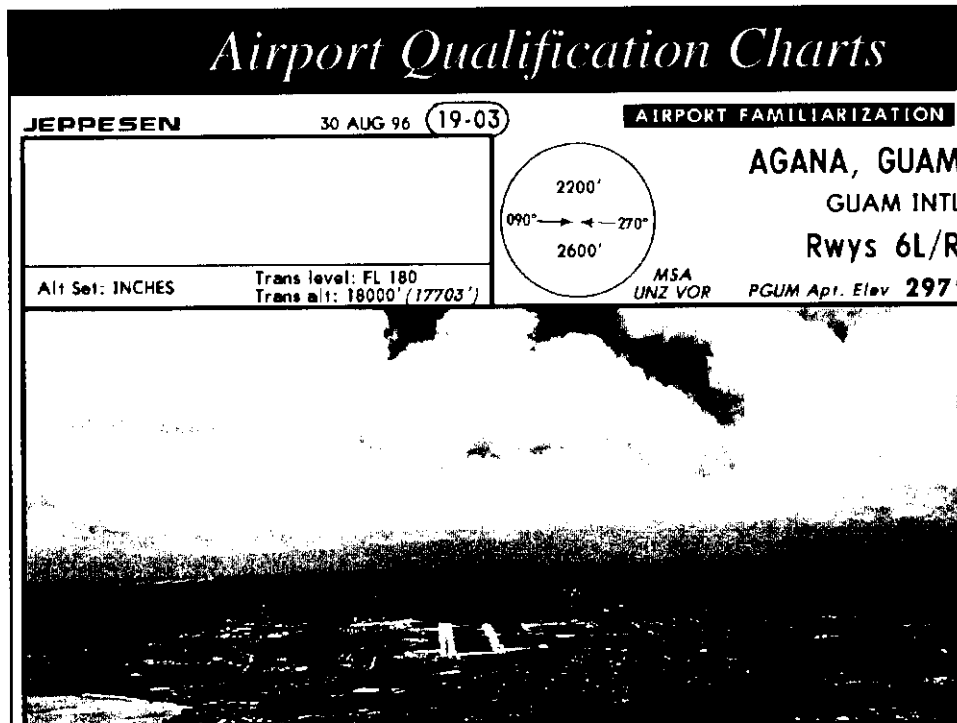


How Jeppesen Designs a Chart

- Missed approach icons - and approach lights
- Intersection names, FAF altitude, and final approach course in bold



Airport Qualification Charts



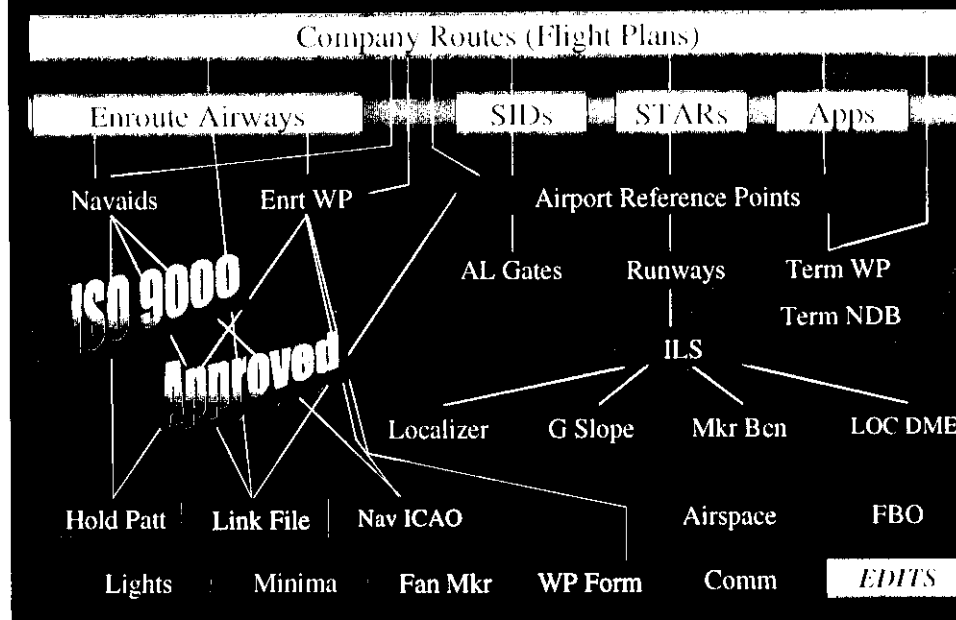
Validation of Source

- Every FAA approach procedure is FAR Part 97 and illegal for Jeppesen to change.
- Every international approach procedure included in State's sovereign domain.

Validation of Source

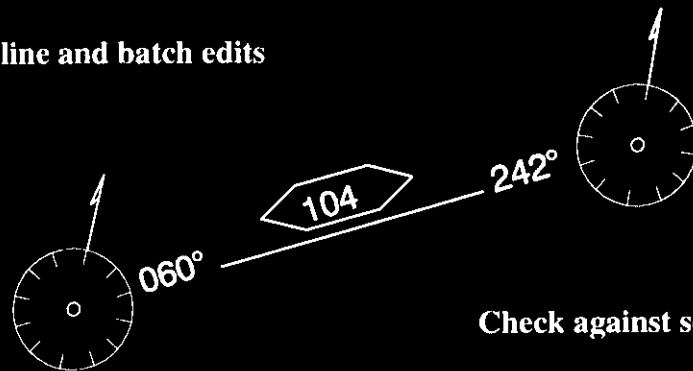
- Obvious errors - Jeppesen seeks clarification from authorities on any element that appears questionable as a result of routinely processing the procedures for publication in graphic form.
- Jeppesen makes no attempt to determine that procedures prescribed by governing authorities are in compliance with their own criteria.
- Entering procedures into NavData

Navigation Database Structure



Bearing and Distance Edits

On line and batch edits



Check against source

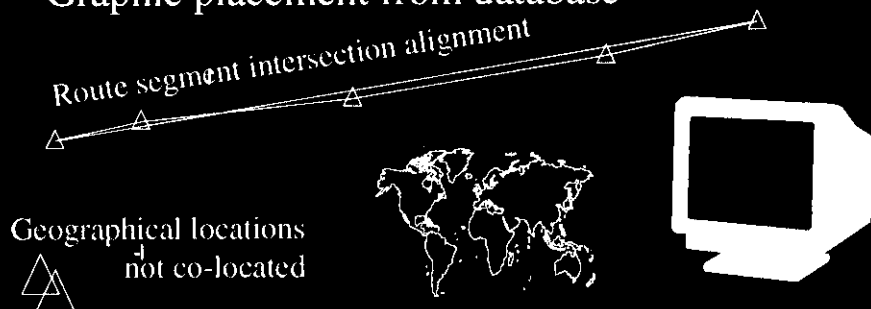
+/- .5° and +/- .5 NM on final approach

Bearing and Distance Edits

- Outbound course
- Segment distance
- Origin fix latitude and longitude
- Destination fix latitude and longitude
- Route identifier
- Sequence number
- Navaid or fix identifier
- Magnetic variation
- Station declination

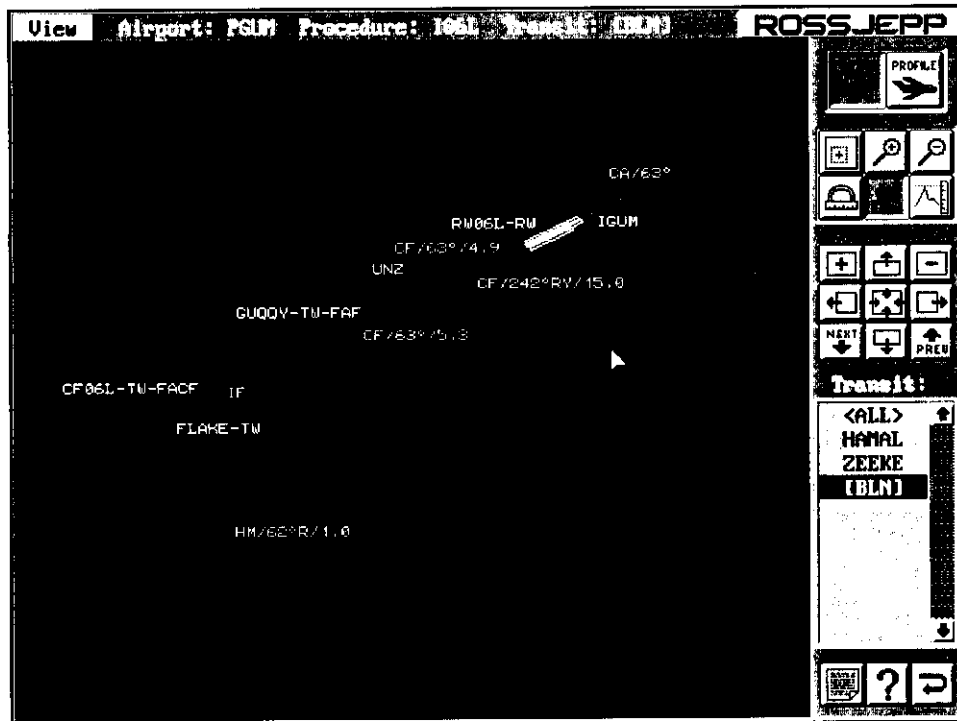
Computer Graphic Visual Edits

- Other edits beyond those mentioned
- Jeppesen database used for chart production
- Graphic placement from database



Graphic Editing Tool

- Visually edits NavData content
- Checks lateral paths
- Checks vertical paths
- Does not check obstacles
- Does not check procedure validity
- Does not check MDAs or segment altitudes against obstacles or terrain
- Does not check compliance with TERPs or PansOps



Thank You

Jim Terpstra