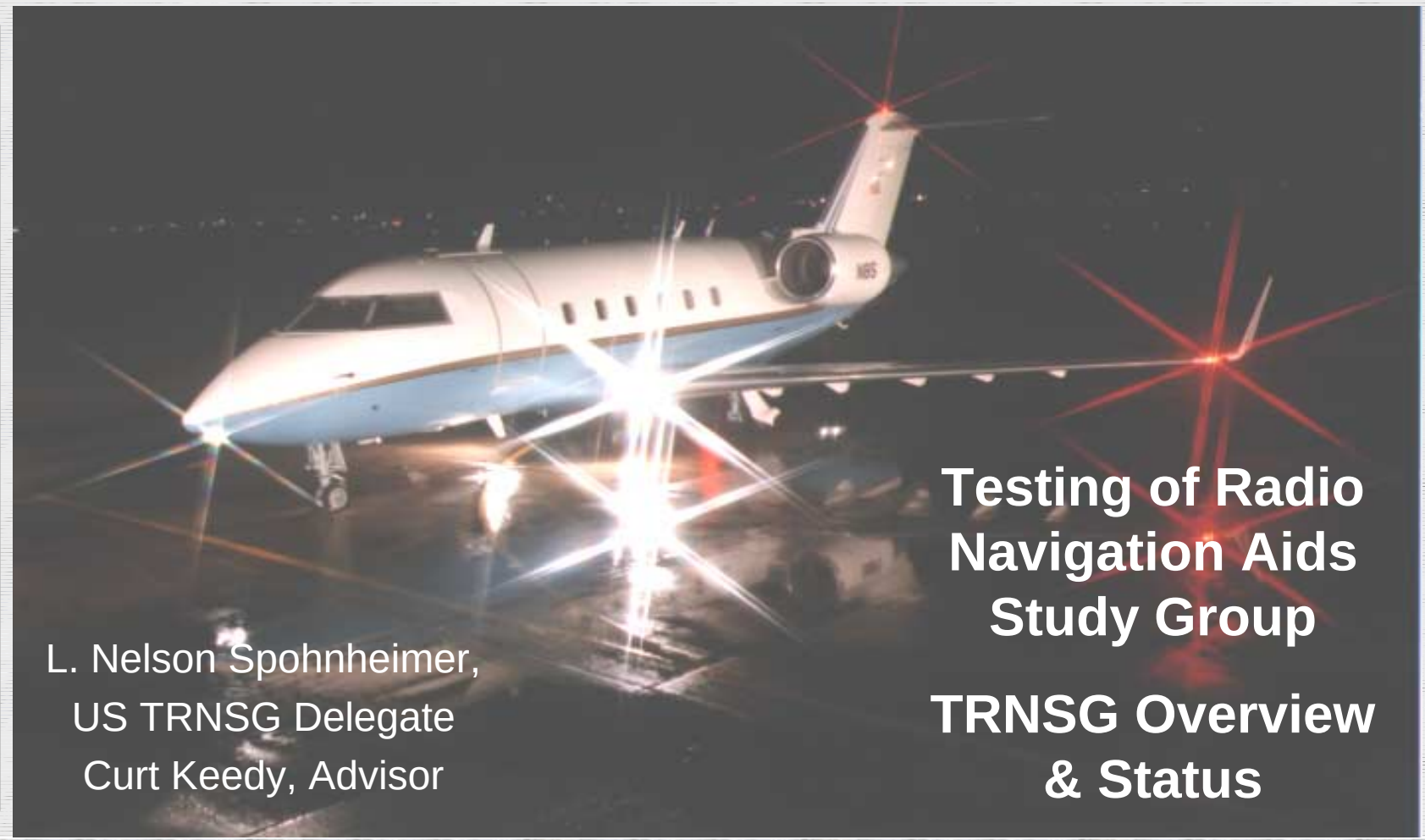
Radio Navigation Aids Flight Test Seminar



Testing of Radio Navigation Aids Study Group

TRNSG Overview & Status

L. Nelson Spohnheimer,
US TRNSG Delegate
Curt Keedy, Advisor

Membership

- **Usually 15-20 active participants**
  - Canada
  - UK
  - Norway
  - France
  - Germany US
  - Australia
  - Spain
  - Japan (Volume 2)
  - ICAO Secretary (V. Iatsouk)

Document 8071

- Defines ICAO-recommended Ground & Airborne Testing
  - Used as ground maintenance & flight inspection policy & procedures in many countries
- Volume 1 - Testing of Ground-Based Radio Navigation Systems
- Volume 2 - Testing of Global Navigation Satellite Systems (GNSS)
- Volume 3 - Testing of Surveillance Radar Systems
  - First Edition - 1998

Meetings

- **Informal working format**
- **Schedule**
  - **10/95, Montreal, TRNSG/1**
  - **04/98, Montreal, TRNSG/2**
  - **01/99, Montreal, Volume 1 Final editing by small group**
  - **03/00, Montreal, TRNSG/3, Volume 2 begins**
  - **06/00, Chile, (informal meeting during IFIS-11)**
  - **02/01, Florida, TRNSG/4**
  - **03/02, Montreal, TRNSG/5 (scheduled)**

TRNSG

Informal Meetings

Volume 1- Previous Edition

- Published in early 1970's
- Largely based on
  - tube-type equipment
  - pre-AFIS airborne equipment (RTT referencing)

Volume 1 - Current Edition

- 8 Chapters….
  - Chapter 1, Introduction
  - Chapter 2, VOR
  - Chapter 3, DME
  - Chapter 4, ILS
  - Chapter 5, NDB
  - Chapter 6, Markers
  - Chapter 7, PAR
  - Chapter 8, Procedures
- ICAO English editing complete approximately end of 1999, Being translated
- Unofficial Word and/or .pdf version available

Volume 1 Chapters

- **Standardized Format**
  - Paragraph x.1 - Introduction, System Description, and Testing Requirements of Equipment (Ground and Air)
  - Paragraph x.2 - Ground Testing, Procedures, Test Equipment
  - Paragraph x.3 - Airborne Testing, Procedures, Test Equipment, Calibration, Positioning Requirements
- **Standardized Tables**
  - Table x-1 -- Summary of Testing Requirements
  - Table x-2 -- Summary of Ground Testing Requirements
  - Table x-3 -- Summary of Airborne Testing Requirements

Example of Testing Summary

Parameter	Annex 10 Reference	Testing
Identification keying (if used)	3.6.1.2.4	F, G
Coverage	3.6.1.2.5	F
Standby equipment (if installed)		F,G
Carrier frequency	3.6.1.1	G
Coverage (RF output power)		G
Modulation depth	3.6.1.2.1	G
Modulation frequency	3.6.1.2.2	G
Harmonic content of modulation tone	3.6.1.2.1	G
Monitor system (where provided) a) Carrier power b) Modulation Depth c) Keying (when used)	3.6.1.3	G

Note: ***G –*** ***Ground test***
F – ***Flight test/inspection***

Example of Ground Testing Summary

Parameter, Annex 10 Reference, Doc 8071 Reference

Parameter	Annex 10 Reference	Doc 8071 Reference	Measurand	Tolerance	Uncertainty	Periodicity
Carrier frequency	3.6.1.1	6.2.3.1	Frequency	± 0.005%	0.001%	12 months
Coverage (RF output power)	3.6.1.2.5	6.2.3.2	Power	± 15% of value set at commissioning.	5%	6 months
Carrier Modulation	3.6.1.2.1	6.2.3.3	Modulation Depth	95 - 100%	2%	6 months
Carrier Modulation Frequency	3.6.1.2.2	6.2.3.4	Frequency of tone	± 75 Hz	0.01%	6 months
Harmonic content of modulation tone	3.6.1.2.1	6.2.3.5	Modulation Depth	Total less than 15%	1%	12 months
Keying (if used)	3.6.1.2.4	6.2.3.6	Keying	Proper, clearly audible		6 months
Monitor System (where provided)	3.6.1.3	6.2.3.7		Alarm at:		6 months
a) Carrier power			Power	-3 dB	1 dB	
b) Modulation depth			Percent	70%	2%	
c) Keying (when used)			Presence	Loss		

Measurand, Tolerance, Uncertainty, Periodicity

Example of Airborne Testing Summary

Parameter, Annex 10 Reference, Doc 8071 Reference

Parameter	Annex 10 Reference	Doc 8071 Reference	Measurand	Tolerance	Uncertainty	Inspection Type
Identification (if used)	3.6.1.2.4	6.3.3.1	Keying	Clearly audible, proper keying, correct coding and frequency.		C, P
Coverage	3.6.1.2.5, 3.6.1.2.6	6.3.3.2	Field Strength	Proper indication given to aircraft of the particular location on the airway. The coverage pattern should be centered over the beacon (or other defined point). **Commissioning**: Nominal (as determined by operational requirements), ± 25% **Periodic:** Nominal (as determined by operational requirements), ± 50%	1 second or 10 µVolts	 C P
Standby equipment (if installed)		6.3.3.3		Same checks and tolerances as main equipment.		C

Measurand, Tolerance, Uncertainty, Periodicity

Volume 2

- Began work with draft SARPs
- Approximately 50% complete
- Covers
  - Airborne Augmentation Systems (ABAS)
  - Satellite-Based Augmentation Systems (SBAS)
  - Ground-Based Augmentation Systems (GBAS)
- Same format as Volume 1

Current Work

- GBAS emphasis for short-term
- SBAS to follow shortly
- Recently, tasks include informal responsibility for Annex 10, pre-GNSS navigation aids
- Next meeting March 2002, Montreal
  - Taking input from anyone

END

- **Q&A?**
- **Thank you!**