



Satellite Industry Initiatives in Uplink Earth Station Quality

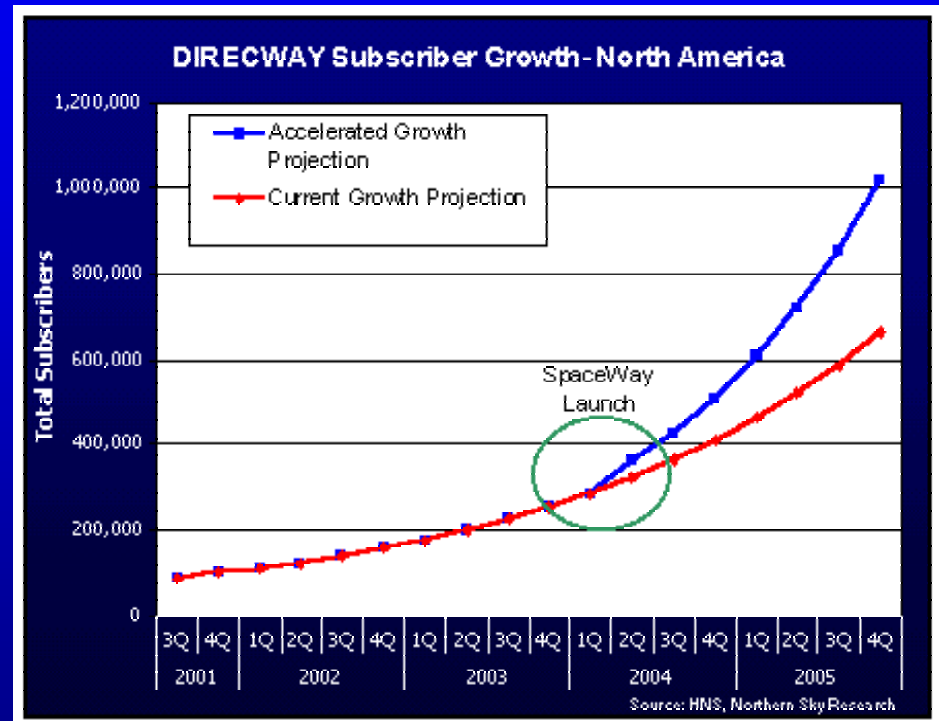
Ralph Brooker

***Director, Satellite Network Engineering, Andrew Corporation
Chair, Mutual Recognition Arrangement Working Group, GVF***

Tel: 703-548-6777
Fax: 703-548-6808
ralph.brooker@andrew.com

This is an important time for the satellite industry

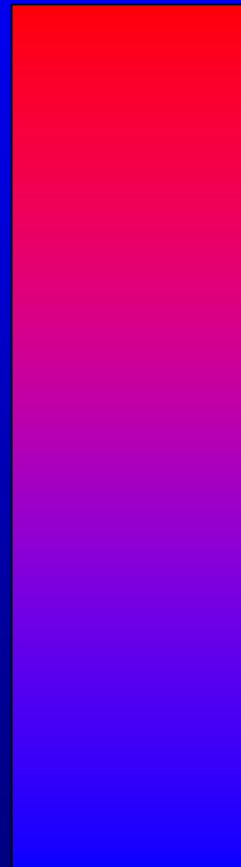
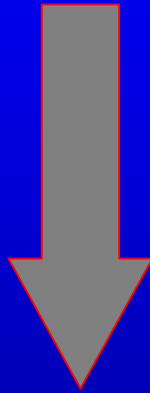
- VSAT terminal deployments are accelerating
- Consumer uplink terminals may exceed 5-10 million by 2008
- Even one terminal can cause major interference



Source: Northern Sky Research

Earth station installation skill scale

*As deployments rise,
cost pressure
increases to employ
technicians with
reduced (or no)
training*



Earth station field technician

VSAT installer

DTH installer

TV installer, computer technician

“DIY” consumer

Non-technical consumer



Earth station quality affects interference

- Antenna patterns (sidelobes)
 - 2-degree spacing
 - Shared services (terrestrial) interference
- Cross-pol performance
- Installation
 - Pointing
 - Aligning polarization
 - Setting the correct EIRP
- Electronics
 - Automatic power control
 - RF stability
 - Out-of-lock oscillators
 - Spurious emissions



What is the role of the Global VSAT Forum?

- Goal: Advance the competitiveness of satellite communications solutions
- 167 member organizations: satellite operators, equipment manufacturers, VSAT network integrators
- Working groups:
 - *Regulatory* (international licensing)
 - *Mutual Recognition Arrangement* (type approvals)
 - *Training and Education* (installation quality)
 - *Broadband Multimedia*
 - *Promotions*

Conventional quality control procedures are too expensive

- On-site verification testing
- Measure patterns over the satellite after the dish is installed
- Measure EIRP & frequency stability over 24 hrs
- Requires
 - Extended technician presence
 - Fully motorized mount
 - Interactive support from satellite operator



GVF MRA procedure for Operator Type Approvals

- Type approval concept:
 - Build in the quality, eliminate non-value-added tests
 - Qualification test for design AND the mfg. process
 - Allows satellite operator to waive on-site testing
- MRA procedure (GVF-101) extends this:
 - “Test once, approve anywhere”
 - Factory test & audit witnessed by impartial expert
 - Covers antenna, & optionally, RF electronics & modem
 - Comprises a thorough design and quality audit
 - Results are accepted by all (GVF) satellite operators

MRA Test List

4.3.1 Antenna Model Tests

- 4.3.1.1 Transmit And Receive Band Antenna Gain Measurement
- 4.3.1.2 Sidelobe Pattern Test
- 4.3.1.3 Axial Ratio OR Polarization Discrimination Test
- 4.3.1.4 Cross-Polarization Isolation or Discrimination Contours
- 4.3.1.5 Feed Measurements
- 4.3.1.6 Antenna Temperature Profiles
- 4.3.1.7 Antenna Pointing/Tracking Accuracy and Beam Steerability Test

4.3.2 Earth Station Model

- 4.3.2.1 Receiving System: Figure of Merit (G/T) Test
- 4.3.2.2 Transmit e.i.r.p./power and frequency Stability Tests
- 4.3.2.3 Spurious oscillation tests
- 4.3.2.4 Amplitude Response
- 4.3.2.5 Spectrum Purity
- 4.3.2.6 Electromagnetic Compatibility Tests

4.3.3 VSAT Terminal Tests

- 4.3.3.1 Allocated Bandwidth
- 4.3.3.2 Spurious Emissions - Sidebands
- 4.3.3.3 Spurious Emissions - General
- 4.3.3.4 Remote Shutdown
- 4.3.3.5 Immunity to adjacent channel signals
- 4.3.3.6 BER vs. Eb/No
- 4.3.3.7 Transmit e.i.r.p./power and frequency stability Tests
- 4.3.3.8 Spurious oscillation tests

Authorized Test Entities (ATEs)

- The ATE:
 - Is contracted by the Primary Satellite Operator, not the manufacturer
 - Represents the Primary Operator and all potential future operators who may be applied to
 - Witnesses and assures **complete** and **accurate** tests
 - Assures design and quality control are fully reviewed
 - Does NOT address specific performance Pass/Fail criteria
- Each ATE has been elected by unanimous ballot of satellite-operator members of the GVF.
 - Cetecom; Comsat Labs; Eutelsat; Systar; D. Belanger; Memco; Intelsat



GVF Training and Education Initiative

- “The quality of satellite signals has been significantly degraded due to earth stations that are improperly installed and commissioned.” - *Dick Tauber, CNN & ISOG*
- “Many areas of the world do not have any authority offering guidance for installers to regulate the quality of VSAT installations in an effort to minimize/eliminate signal interference.” – *Asiasat (at GVF board meeting)*
- GVF has initiated a new Working Group to develop a training program for VSAT installers worldwide:
 - “Through proper Training and Education, we intend to reduce the effects of installation errors that cause interference problems in many parts of the world.”
 - *George Jusaites, Chair, GVF T & E Working Group*



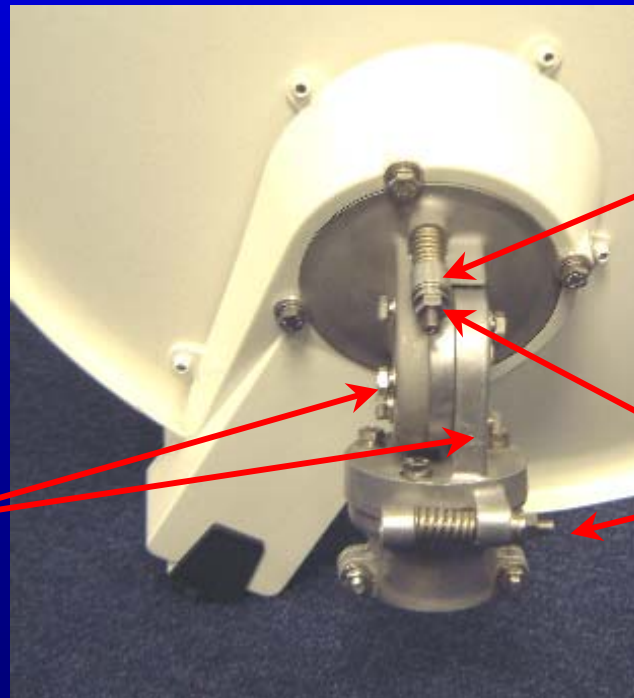
GVF Training and Education Working Group Objectives

- Develop uniform installation training materials
 - Initial materials now being published
- Develop installation training program
- Enlist instructors and develop Web-based services to train and test installers on a global basis

Equipment evolution: VSAT antenna mounts

- No “lock-off”
 - Pointing shift after final tightening
 - Often not corrected by installer)
- Easy to peak by splitting the main lobe
 - More accurate than only looking for maximum signal

Separate coarse and fine lockdown bolts eliminate “lock off”

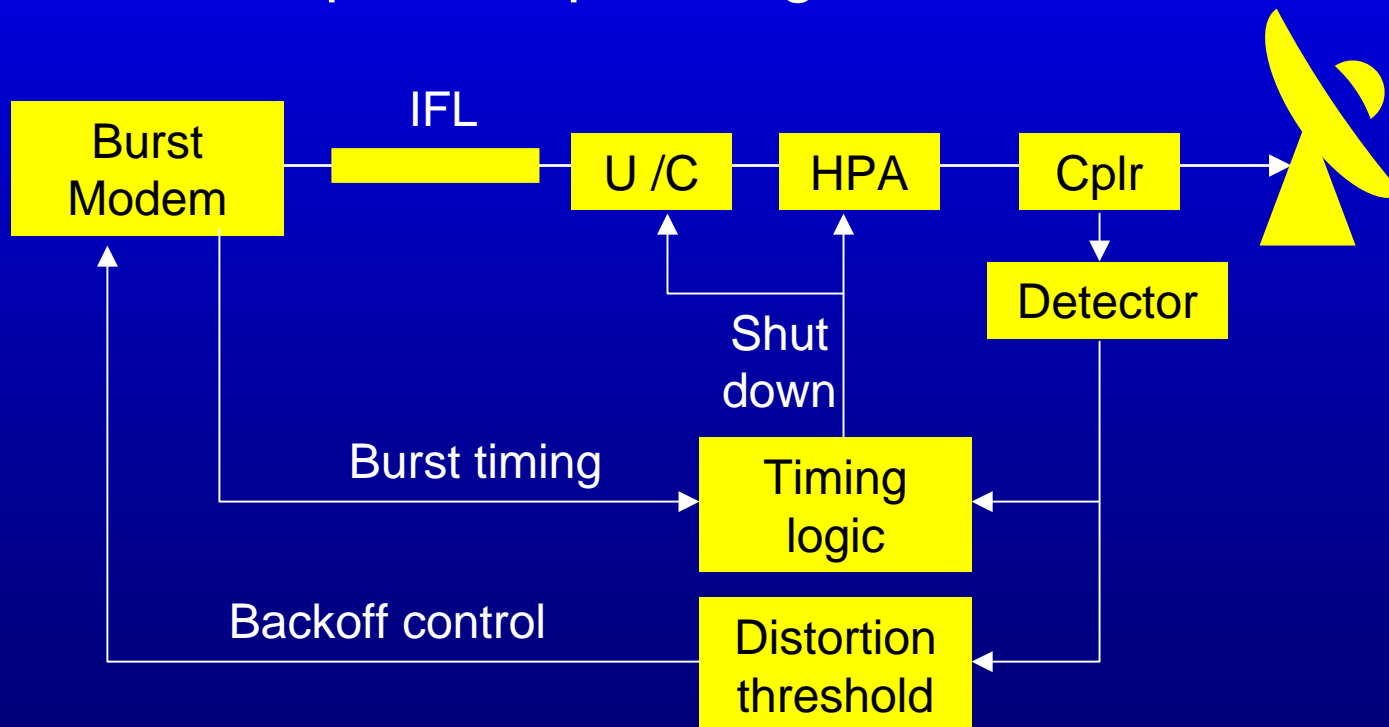


Fiducial mark for repeatable plus/minus delta allows for accurate peaking by equalizing the main lobe edges

Zero-backlash fine az & el adjustments

Equipment evolution: Self detection of erroneous transmission

- Example: Spaceway 3.5m Ka-band terminal
- Automatic shutdown if RF electronics become unstable
- Prevent spectral spreading from HPA overdrive



What does the future hold?

- Extremely low cost equipment (\$300 terminal)
 - But more rigorous equipment qualifications
 - High-precision, low-cost Ka-band antennas
- Demand for reduced installer skill & training
- Easy-to-install antennas
- Advanced installation tools
- Self-pointing earth stations



GVF contacts

- David Hartshorn, Global VSAT Forum
 - General Secretary, GVF
 - david.hartshorn@gvf.org, tel +44 (1727) 884-739
- Ralph Brooker, Andrew Corp.
 - Chair, Mutual Recognition Arrangement Working Group
 - ralph.brooker@andrew.com, tel +1-703-548-6777
- George Jusaites, Channel Master
 - Chair, Training and Education Working Group
 - gjusaites@cmnc.com, tel (919) 989-2286
- www.gvf.org