



# Satellite Industry Initiatives in Uplink Earth Station Quality

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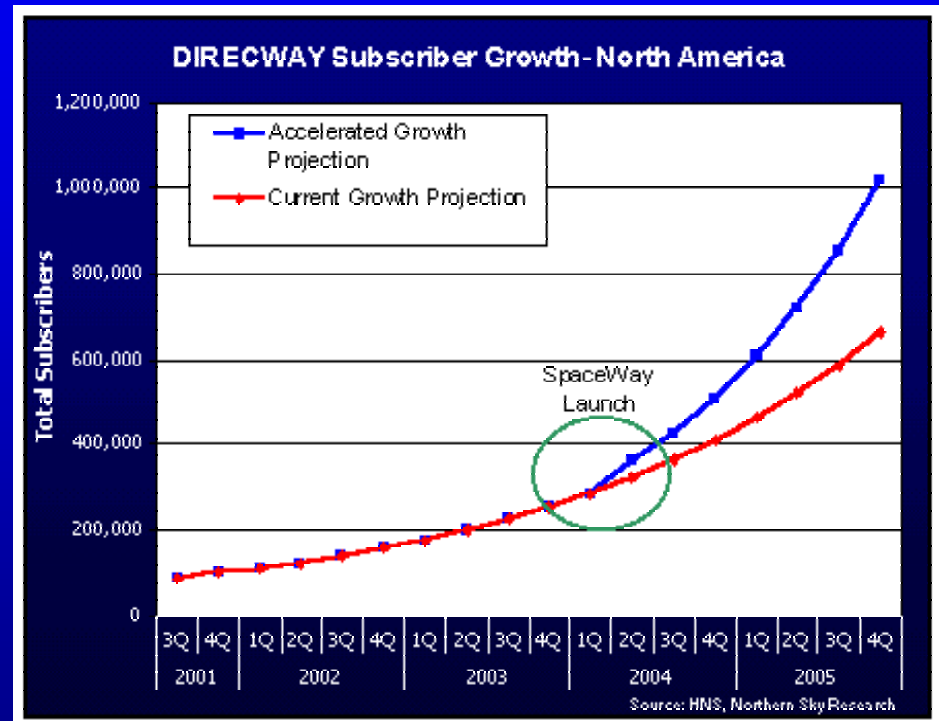
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# This is an important time for the satellite industry

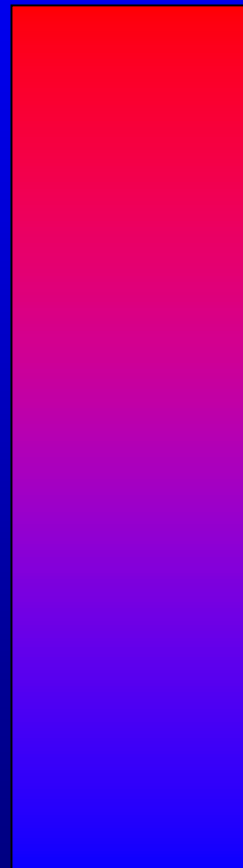
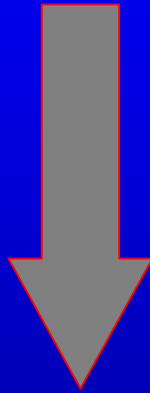
- VSAT terminal deployments are accelerating
- Consumer uplink terminals may exceed 5-10 million by 2008
- Even one terminal can cause major interference



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

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- 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?

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- 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

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- 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

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- 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

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## 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)

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- 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

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- “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

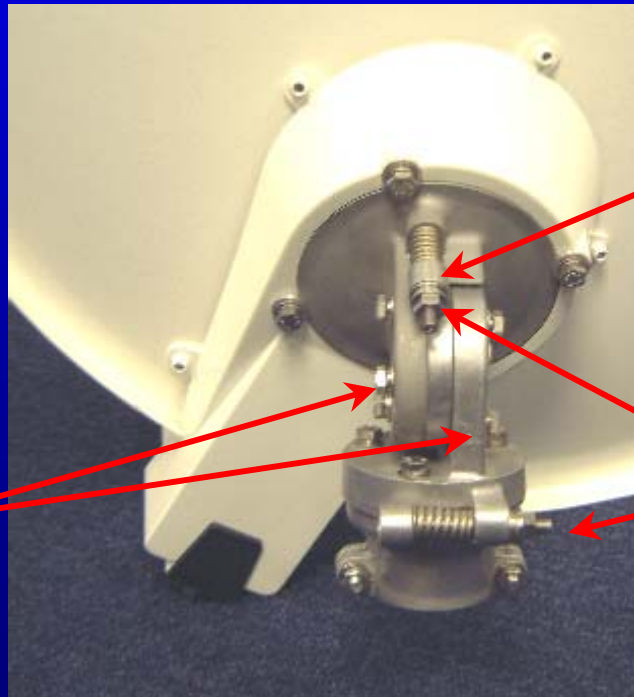
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- Develop uniform installation training materials
  - Initial materials now being published
- Develop installation training program
- Enlist instructors and develop Web-based services to train and test installers on a global basis

# 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”

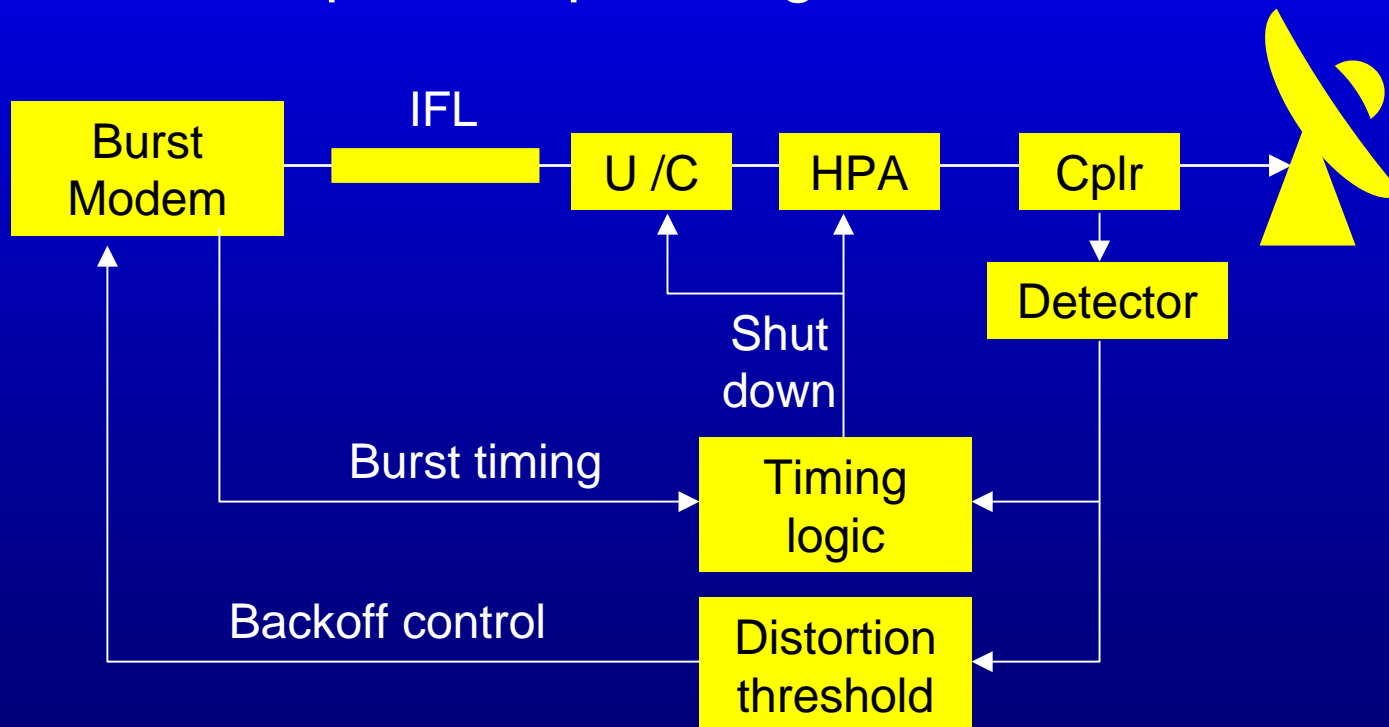


Fiducial mark for repeatable plus/minus delta allows for accurate peaking by equalizing the main lobe edges

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?

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- 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

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