U.S. ELECTION ASSISTANCE COMMISSION

Voting System Testing & Certification Division

1ST COST OF TESTING SUMMIT

APRIL 30, 2007 – MAY 1, 2007

MEETING SUMMARY

1st Cost of Testing Summit

MEETING SUMMARY

AGENDA

Day: April 30, 2007

- 8:15am – 9:00am Continental breakfast
- 9:00am – 9:30am Introductions and Overview (Hancock)
- 9:30am – 10:45am Election Official Session (Arp, Finley, Lowder, Miller, Nighswonger, Steinbach, Thomas)
- 10:45am – 11:00am Break
- 11:00am – 12:15pm Test Lab Session (Coggins, Nilius, Saunders)
- 12:15pm – 1:30pm Lunch
- 1:30pm - 2:00pm Continuation of Test Lab Session (Coggins, Nilius, Saunders)
- 2:00pm – 3:15pm Manufacturer Session (Chung, Hunsacker, Iredale, Smith)
- 3:15pm – 3:30pm Break
- 3:30pm – 4:45pm Interest Group Session (Stewart, Cugini, Smith)
- 4:45pm – 5:00pm Setting the Scene for Day 2 (Hancock)

Day Two: MAY 1, 2007

- 8:15am – 9:00am Continental breakfast
- 9:00am – 9:45am Conclusions from Day 1 (Hancock)
- 9:45am – 11:00am Federal/State Testing Session (Berger, Freeman, King, Mehlhaff)
- 11:00am – 11:15am Break
- 11:15am – Noon "Looking Through a Different Mirror: Product Testing for the Nevada Gaming Commission." – Joe Bertolone, Technology Division Chief Nevada Gaming Commission
- Noon – 1:30pm Lunch
- 1:30pm – 2:30pm Group Discussion: How to balance quality testing & reasonable cost?
- 2:30pm – 4:00pm Conclusions: Next Steps in Determining and Controlling the Cost of Voting System Testing

MEETING PARTICIPANTS

1. Andy Rodgers
2. Brian Hancock
3. Brian Phillips
4. Carolyn Coggins
5. Christopher Thomas
6. Dan Kopelman
7. Dawn Mehlhaff
8. Ed Smith
9. Gail Audette
10. Gavin Gilmour
11. Holly Z. Lowder
12. Jeannie Layson
13. Jim Nilius
14. Joe Bertolone
15. John Cugini
16. John Gardner
17. Kassie Keller
18. Katherine Morrissey
19. Ken Carbullido
20. Kevin Chung
21. Laiza N. Otero
22. Lowell Finley
23. Mary Saunders
24. Matt Masterson
25. Merle S. King
26. Michelle M. Shafer
27. Neil McClure
28. Nelson Hastings
29. Pamela Smith
30. Pat Arp
31. Paul Miller
32. Peggy Nighswonger
33. Sandy Green
34. Sandy Steinbach
35. Santosh Chokhani
36. Scott W. Hunsaker
37. Stacie Fabre
38. Stephen Berger
39. Steve Freeman
40. Steve Pearson
41. Talbot Iredale
42. Thomas Watson
43. Warren Stewart

SUMMARY

Overview

From April 30th – May 1st, 2007 the U.S. Election Assistance Commission (EAC) conducted a meeting on the cost of testing voting machines and the effects of those costs on elections. The summit represented the first time that representatives for every major stakeholder gathered to discuss issues involving the cost of federal and state voting machine testing. The meeting had representatives from: EAC, National Institute of Standards and Technology (NIST), the voting machine manufacturer community, voting system test labs, EAC technical reviewers, election officials, and voter advocacy groups. The meeting represents the first of a series of meetings the EAC intends to hold in order to explore the issues presented by federal testing and certification and possible solutions to many of those issues.

On the first day of the summit each stakeholder group presented their thoughts on questions that were posed to them prior to the meeting. After each member of the group presented, a free flowing discussion of the issues presented followed resulting in deeper discussion of the issues. At the end of the first day an EAC representative summed up many of the issues and solutions that had been discussed and set the stage for the discussion on the second day.

The second day began with further group discussion with presentations from federal and state testers. In the afternoon a representative from the Nevada Gaming Commission gave a presentation entitled "Looking Through a Different Mirror: Product Testing for the Nevada Gaming Commission." Finally, the participants spent the remainder of the afternoon having an open discussion of how to best balance the need for Federal and State testing and the costs associated with the testing.

Election Official Session

The first group to present was comprised of election officials from around the country. These officials represented both state and local election officials. Several themes developed as the election officials answered the questions presented to them. First was the continued overlap between state and federal testing. Many of the election officials felt that the constantly moving target of developing federal standards, combined with the prior federal testing system used, and increased scrutiny of election procedures had led states to require more rigorous testing and therefore greater costs. With the development of the EAC's testing and certification program and the passage of the 2005 Voluntary Voting System Guidelines (VVSG 2005) the overlap of state and federal testing increased. Many of the election officials suggested that a matrix needed to be created showing the requirements of federal testing and the testing that many of the states conduct. The matrix could then be used to decide what tests are used by both and what tests would be best handled in the federal program instead of state programs. The election officials agreed that the goal of state testing should be to get the voting machines ready for what that specific state needs and not to fully retest the voting machine.

Second, many of the states agreed that the smaller states and larger states do not share the same issues or challenges when it comes to testing. For the smaller states resources are the major challenge. Many of the counties do not have the money or people necessary to conduct the tests necessary to run an election. Local acceptance testing was cited as being the major issue for the counties in the smaller states. Because of a lack of resources many of the counties in the small states turn to the vendors to help them run acceptance tests, a practice that all concede is not ideal. The larger states do not lack the resources necessary to conduct the necessary testing, but do face challenges that come with high volume use of the machines and issues that arise from the increased scrutiny of elections. In order to combat the dichotomy between small and large states several election officials suggested that the EAC work to create a coalition of smaller states in order to spread the cost of testing across several states. This coalition would allow small states to work together to create a method of testing that serves their needs while sharing the costs for that testing among the states. A

suggestion of geographic coalitions to accomplish this same goal was met with mixed reviews because it would place small and large states in the same coalition which does not solve the problem completely.

Finally, the one topic that all the election officials agreed about was the need to fully fund HAVA. Many of the states do not have the money necessary to meet the growing demands of federal certification. When posed with the question of whether money was the answer to many of the problems many of the election officials agreed it would not fix everything but that it would help a great deal. Many election officials felt that the requirements created by HAVA and the EAC were a good thing for elections but without the proper funding they simply could not be properly implemented.

Federal Testing Lab Session

The next group to present was comprised of representatives from EAC accredited testing labs and NIST's National Voluntary Laboratory Accreditation Program (NVLAP). At the time of the summit two labs were accredited by the EAC and seven other labs were being evaluated by NVLAP for recommendation to the EAC. Under NVLAP's current program, labs have between 1,000-1,200 requirements to meet. The initial NVLAP assessment process was estimated to cost around $20,000. In order to receive NVLAP accreditation laboratory competence is determined by the labs competence to test to the standard required, therefore the testability of the standard is extremely important to the evaluation process. In the end the labs agreed that in general they spent about 1500 hours preparing for NVLAP and EAC accreditation process at a cost of around $75,000-$100,000. However, most of these costs for accreditation were seen as long term investments and not passed along to the manufacturers.

The laboratories cited several factors that affect the cost of testing both at the federal and state levels. The scope of testing as defined by the EAC was one factor. This is an area that the labs indicated that costs could be cut if the scope of the EAC's testing is understood by states and not required to be repeated by state testing. How ready the product is for testing also impacted costs. The more mature the system or product the less hours that must be spent on it and therefore the less the cost of testing the system. The number of lines of code that need to be reviewed was singled out by the labs as the number one factor effecting cost. Because of the amount of time and expertise necessary to evaluate code the more lines of code that need to be checked the more expensive the process. The labs also pointed to the amount of document review required for each system as being a major contributor to cost.

The testing labs agreed that time and materials determine the price of testing. Hardware testing pricing could -- in general -- be done by project pricing, although factors like test chamber time and availability would affect the pricing. Software testing is less easy to price because it depends largely on the number of lines of code to review and the amount of documents for review.

The labs cited a couple different areas where the testing process could be improved in order to save costs. The labs agreed that there were inefficiencies in the testing processes at both the federal and state levels. The labs, like the election officials, pointed to the repetitiveness of some testing as being a huge contributor to cost. The labs recommend moving many tests up to the federal level in order to eliminate this overlap. That way many states could change their procedure to test for only those things which are unique to that state.

Voting System Manufacturer Session

The voting system manufacturers were next to present. The manufacturers felt that the creation of the EAC's testing and certification program has had a huge impact on the development and costs of voting systems. The biggest factor mentioned by the manufacturers adding to the cost is the EAC's requirement that all voting systems must be tested under the program in order to be certified. In other words no voting systems will be grandfathered in from previous programs. Also, any system that has been changed in more than just a *de minimis* way must be submitted for testing. This creates a testing system in which manufacturers

must decide when to submit machines based on major changes needed for the machines. It lessens the amount of machines that they put through testing and makes it difficult to decide when to submit a machine for testing. In essence the voting system market is dictated by the certification process. Also, the manufacturers suggested that large amount of documentation required by the EAC's program adds a great deal of man hours and therefore contributes to the cost. Many of the manufacturers also singled out poorly worded standards for source code review in the 2005 VVSG as being a specific source of problems and cost increase. Despite the extra costs and time associated with the EAC's testing and certification program many of the manufacturers felt that the program is good for voting systems and election integrity.

Several manufacturers estimated that testing to the 2002 Voting System Standards (2002 VSS) increased testing by two times from the previous testing. They estimated that systems tested to the 2005 VVSG would increase costs four to eight times greater than testing to the 1990 standards. Also, some vendors predicted a cost of testing increase ten times greater than in 1990 for the next iteration of the VVSG. One manufacturer stated that they had spent over one million dollars getting a voting system ready to be tested to the 2002 VSS under the EAC's program. The same manufacturer estimated that the cost of state and federal testing combined had increased two hundred twenty-five percent since 2003.

The manufacturers made several suggestions on how to reduce the cost of testing. As with the other groups they pointed to duplicate testing as being a major contributor to cost. They suggested that the EAC must streamline their process to incorporate common state tests in order to improve the speed of testing and lessen the duplication of tests. One area they singled out as being particularly expensive was source code review. They considered the review of source code as being the most time intensive and expensive portion of testing. One manufacturer stated that seven states currently require a full source code review as part of their state certification, despite the fact that the EAC's program requires the same kind of source code review. The manufacturers also suggested clearer standards would help to reduce the cost of testing. The more clear and testable the standard the quicker the lab is able to make an assessment and issue a decision. Finally, the manufacturers felt that they should have a greater voice in the development of the next iteration of the VVSG. Because Congress did not give manufacturers a spot on the Technical Guidelines Development Committee (TGDC) it has been difficult for them to make comments during the development of the VVSG. Many felt that the TGDC and the EAC needed to reach out to the manufacturers to fully understand the impact of the next iteration of the VVSG and the costs associated with the new requirements it creates. They suggested that the manufacturers could work with labs and voting officials to help the EAC create a cost benefit analysis of the next iteration of the VVSG in order to fully understand the full impact of the document.

Interest Group Session

Representatives from various voter interest groups were the next to present. They pointed to voters as being the primary stakeholders in this process. Because voters are the primary stakeholders, transparency in all parts of the process is critical. It was their sense that the reason for much of the voter mistrust about the process is because voters are not being made aware of all the information. They cited a crisis of voter confidence in the system. However, they felt that the EAC's program and posting of all information on their website is a good first step in helping to regain the voters trust. They recognized that the voting industry is unique because it is a business and there is a demand for an open and transparent industry. They also recognized that there needs to be a balance struck between the need for secure voting systems and the need to keep the systems affordable and useable. It is vital that small jurisdictions are not pushed out of the market because of the increasing costs of voting machines. They recognized that the cost per voter was increasing but suggested that perhaps we have been under spending on elections for too many years and it was time to invest in democracy.

The voter interest group representatives made several recommendations. First, like the other groups they agreed that much of the testing needs to be moved to the federal level in order to reduce the costs on states

and create more transparency. Second, they agreed with the election officials' proposal that the EAC needs to work with the states in creating a consortium of smaller states to do state testing and disperse the costs across the several states. Third, they suggested that the EAC should create a best practices guide for state testing in order to inform states what testing is being done on the federal level and what testing would be most helpful for the states. Fourth, they suggested that states work with their counties in order to create county consortiums that would help to combine the resources of several counties in order to make it possible for the smaller counties to conduct the testing necessary to run an election without vendor involvement. Finally, they suggested that penetration testing and post election audits would be critical to improving voter confidence.

Federal/State Testing Session

The final group to present was a group comprised of the EAC's technical reviewers and state testing experts. They pointed to several factors that impact cost including duplication, acceptance testing procedures, states lack of trust in the previous federal testing system, and a lack of efficiency in both levels of testing. They also felt that the system is becoming increasingly more expensive by necessity and that might just be a reality of situation at this point. The fact is that as the system matures and grows the testing will become less expensive and more efficient. They stated that the key is to realize what both levels of testing are for. Let the federal testing do the bulk of the testing and evaluating of the systems. This means however that states need to trust that the federal system is doing what it is supposed to and there is no need to retest the machines; then state testing programs can focus on testing for state specific requirements.

Several recommendations were offered by the federal/state testing group. They recommended that local acceptance testing needed to be fully funded, resourced, and made a simple and affordable as possible. They also suggested that as the EAC's testing and certification program develops, confidence in it will grow, and states will be able to scale back their testing requirements and costs will drop. From their experience an overall improvement in procedures at both the federal and state level would save a great deal of money. Communication between labs, manufacturers, EAC, and election officials needs to be improved in order to understand what needs to be tested and when. Approaching the problem in a more efficient way could lead to cost savings and more effective testing.

Nevada Gaming Commission Presentation (PowerPoint attached)

A representative from the Nevada Gaming Commission spoke about the similarities between certification in elections and the gaming industry, but was quick to point out that he was not trying to equate gambling with voting, only that both industries had similarities in terms of fundamental goals and objectives, issues and challenges of regulating an industry and testing and compliance. He noted that stakes were high in both areas regarding trust and confidence, the proper implementation of innovation, and the proper implementation of security. As background he noted that:

- Revenues collected by the Gaming Commission generate 32% of the budget for the State of Nevada.
- The Gaming Commission was responsible for the continuing certification of 215,000 slot machines, and other gaming devices from 12 major manufacturers and hundreds of smaller manufacturers.
- The Gaming Commission was responsible for over 2,400 casino operators and /or locations.

He stated that the Gaming Commission is a part-time board making final approval on all gaming matters with a full time staff of 405 individuals, including 60 in the Technology and Testing branch, 120 auditors, and 60 investigators. The Commission has found from 50 years of experience that new system approval takes between 6 and 18 months depending upon individual circumstances with a fixed testing cost of $150 per hour.

He pointed to several challenges that the voting community will face based on his experiences. For example, innovation will be hampered by regulatory process and the challenge is to control that limitation in order to get the best machines as quickly as possible. Also, as the process matures the adoption of best practices will lead to a more efficient and cost effective system. In the end all parties have a vested interest to make the process work and therefore all must work together to improve the process as it matures. To make it all work the Gaming Commission notes that no one aspect of oversight is enough. They must rely on compliance with technical standards, examination of people and organizations, continue to verify people, organizations and systems, and continually examine the physical security component of all systems.

Conclusion

Meeting participants proposed the following solutions in response to the discussion held during the two-day meeting:

- A matrix between federal testing requirements and state testing requirements needs to be created so that the overlap can be remedied and the amount of duplicative testing lessened.
- Cooperative agreements between states for state testing would save a great deal of money and make testing more feasible for smaller states. The same kind of agreement could be applied at the county level within states.
- Software coding requirements need to be looked at to make sure they are efficient and effective. This problem is being addressed in the next iteration of the VVSG but needs to be closely examined.
- It is in the best interest of everyone to make as much of the testing and certification process open and transparent so that the voters can have confidence that their vote will be counted.
- As the EAC's testing and certification process matures the EAC should work to develop best practices for state testing and certification with an eye towards reducing costs while maintaining an effective process.
- The EAC needs to continue to work with all stakeholders to keep the lines of communication open and active.

In addition, two things were apparent from the discussions at the meeting: 1) greater efficiency needs to be created between state and federal testing and 2) more discussions and meetings need to be held as the EAC's testing and certification program matures in order to ensure an efficient and cost effective system. It is for this reason that the EAC plans on holding similar meetings in the future in order to make sure all the major stakeholders involved in the program have a voice in the continuing development of the program.

EAC Summit Meeting

An Exploration of Factors Effecting Voting Systems Testing Costs

Joe Bertolone
Chief Technology Officer
Nevada Gaming Control Board
Nevada Gaming Commission

To Start…

- Not suggesting that Gambling is the same as Voting;
- However, many similarities between the industries in terms of:
  - Fundamental Goals and Objectives
  - Issues and challenges
  - Regulating
  - Relationships between business partners
  - Testing & Compliance

The Stakes…

- Trust & Confidence;
- Innovation;
- Security;
- The "Playback" rules;
- Capturing the fundamental shift that technology brings;
  - Moving from manual process to automated –back & forth
  - Moving from definable, known human processes to hardware, software, networks and digital issues.

Background…The Scope of Gaming in Nevada

- Gaming generates 32% of the State's Budget via taxes;
- Initial certification and continuing verification of 215,000 standalone slot machines;
- Process over 2,000 modification submission to base applications of approved gaming devices;
- Responsible for over 2,400 casino operators and or locations;
- Process over 2,000 modifications to approved systems;
- Responsible for approximately 249 licensed manufacturers;
- Each casino has at least 3 "systems" that we certify…
- Approximately 12 major manufacturers of games and systems

Background…Gaming Control Board & Commission

- Gaming Commission – 5 person, part time Board making final approval or denial of all gaming matters.
- Gaming Control Board – 3 person full time Board making recommendations to Commission on gaming matters.
- Gaming Control Board - Seven Divisions
  - Audit - ~120 Staff
  - Enforcement - ~120 Staff
  - Investigations - ~60 Staff
  - Corporate Securities - ~18 Staff
  - Technology - ~60 Staff
  - Tax & License - ~12 Staff
  - Administration - ~15 Staff

Background…Systems & Gaming in Nevada. Challenges and Issues.

- Innovation was hampered due to regulatory processes;
- Proliferation of legacy systems;
- "If it ain't broke" attitude;
- "Interesting" Industry relationships;
  - Regulators always in the middle of the Manufacturers and Operators no one had clear direction.
- Time to market concerns from Manufacturers;

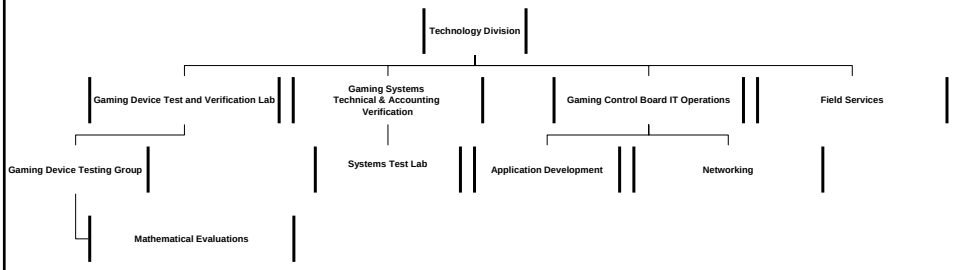
Challenges…

- Technology will continue to become an integral part of gaming operations for regulators, operators and manufacturers;
- We need to gain synergies for approvals, resources and processes amongst all parties;
- Adopt best practices for testing and system development;
- Maintain fiduciary responsibility to State, while allowing growth of industry;
- Integrate legacy systems into modern computing technologies;
- Prepare Board for the next decade, taking advantage of our experiences in the PC, financial and healthcare industries.

Slide in a presentation I made 2 years ago to our industry…

- In order to address these issues, the GCB must balance:
  - A streamlined approval process, not simply throwing people at the problem;
  - Specific, documented compliance metrics for each type of systems;
  - Risk to the State of Nevada;
  - Compliance with NRS, Gaming Regulations, Technical Standards and MICS;
  - Competitiveness of Nevada's gaming industry;
  - Board awareness of the type and scope of systems coming down the pipe;
  - Growth, future staffing and business practices;
  - Specific, yet non-restrictive policies.

Overview of Technology Division - Organizational Structure



Technology Division - Regulatory Functions

Technology Division
- Submission Forecasting
- Policy Development
- Jurisdictional Interface
- Licensee Interface

Gaming Test and Verification Lab
- New Gaming Device Approvals
- Modifications to Gaming Devices
- Patron Disputes
- Technical Standard Compliance Cnsltng
- Regulation Compliance Consulting
- Game Theme Evaluation

Gaming Systems Test and Verification
- Systems Testing - Technical
- Systems Testing - Accounting
- Minimum Internal Control Compliance Cnsltng
- Regulation Compliance Consulting

- EPROM Field Testing
- Machine Configuration Verification
- Patron Disputes

Regulatory Structure – Gaming Devices & System Approvals

- Nevada Revised Statute 463 – Gaming Act
- Nevada Gaming Regulation 14
  - Technical Standards 1,2,3 & 4
    - Technical Policies
- Minimum Internal Control Standards

Nevada Gaming Regulation 14

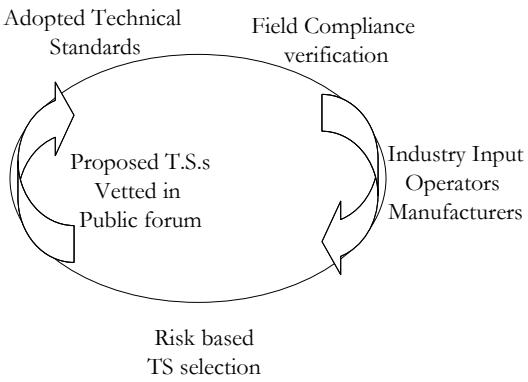
- Governs these areas:
  - New Gaming System approval activities
  - Modifications to Gaming Devices & Systems
  - Associated Equipment - Peripherals
  - Inappropriate Themes
  - Distribution of Gaming Devices Outside of Nevada
  - Technical Standards
- Regulation clearly spells out submissions, trial and approval processes.
- Definitions are key and fundamental
- Minimum Internal Control Standards

Technical Standards & Policies –how do they impact approvals?

- Technical Standards 1 & 2 – Generally physical integrity, "Shake and Bake", data security/encryption
- Technical Standards 3 & 4 – Generally on demand metering, system requirements and wireless
- Technical policies allow the GCB to establish broad policies for new technology development;
- Allows for flexibility, as policies may change based on marketplace or regulatory requirements, "or approved by the Chairman"
- Guides new product development

Technical Standard Change Cycle

- Technology moves way faster than Statues and Regs;
- Collaborative Process
  - Operators
  - Regulators
  - Manufacturers
- 12 – 18 Month Cycles
- Risk Based Selection
- Constant Vetting of issues



Process for New Gaming System and Device Approvals

- Past practice demonstrates new platforms approvals take 6 – 18 months for approvals.
  - Interactions with manufacturers vary;
  - Approvals involve a great deal of informational exchange, requested fixes and re-submissions;
  - Each manufacturer has various resource levels, turnaround times and market pressures which determine the timely outcome of testing.

Step 1: Compliance Consulting

- Purpose: To ensure a concept is acceptable, complete and accurate compliance report is in place before testing begins.
- Mfg's Seek conceptual approvals;
- Testing resources not allocated until reasonable assurance that documentation, operations and compliance to technical standards in place;
  - This step was put in to place due to many insufficient submissions;
- Compliance report includes manufacturer detailed response to **how** compliance is achieved to each technical standard.

Step 2: Device Testing Functional and operational

- Purpose: To thoroughly test the device for technical compliance
- This includes interoperability with peripheral devices such as currency counters
- Physical examination and testing of device including physical security, display instruments, e.g. glass or secondary, bonus or help screens;
- Mathematical verification including pay table examination, theoretical hold calculations, etc;

More on the testing aspect…

- Characteristics;
  - Stratify Systems
    - Major releases
    - Minor releases (Mods)
  - Critical/Non Critical examination – Risk based
    - Fix now
    - Fix in six months or next major release, then verify
  - Penetration, Load, What ifs;
  - Interpretation appeal process
    - Happens quickly, preferably in the consulting stage;
  - Squash Issue/Fix cycles as much as possible.

More on the testing aspect…

- Costs
  - $150/Hour
  - Systems Major Release turn in 90 – 120 day
  - System Minor Releases turn in 30 days
  - Major Device/System Platforms – 6 – 18 months
  - Modifications to platforms – 30 days

Steps 3 & 4: Field Trial & Final Approvals

Field Trial: To thoroughly test device in a real gaming environment;

- Timing – No less than 60 days, no more than 180.
  - Chairman may require an additional 90 days
- Technology & Enforcement divisions monitors new device in field including

Final Approval: To adhere to the prescribed Board and Commission approval process.

State Gaming Control Board
How we communicate with the industry…

- Industry Letters to all MFGs and Distributors
- Website. Gaming.nv.gov
- Training Classes provided by GCB to the Industry
- Industry Workshops
- Steering Committees
- Meetings, Meetings, Meetings
- Increased use of Electronic Media – Email, Web etc.
- What/How else can we do this ?

What makes it all work?

- Taken alone, no one aspect of oversight is enough…
- Compliance with baseline Technical Standards;
- Examination of the people and organizations first;
- Continued verification of organizations, people and systems;
- Physical security component.