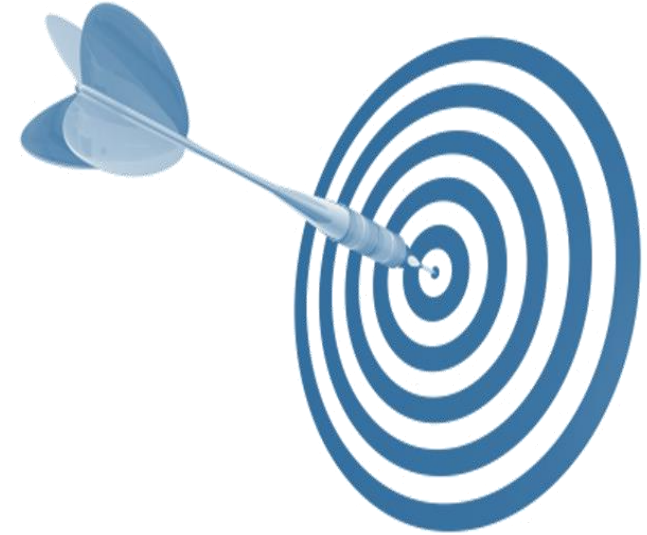# PRESENTATION ON EVM & VVPAT

20 May 2017

AGENDA

1. History
2. Doubts Cast- Glance
3. Technical Security
4. Administrative safeguards
5. VVPAT
6. Doubts Cast- Explained
7. Aspersions & Doubts
8. Technical Expert Committee (TEC)
9. International Experience
10. Past Judgements

HISTORY OF EVM

40 CREDIBLE YEARS

HISTORY OF EVM – 40 CREDIBLE YEARS

1977 — CEC- S L Shakdar talked about introducing an Electronic machine

1980-81 — EVMs developed and demonstrated by ECIL and BEL.

1982-83 — EVMs used in 50 polling stations of Parur LA in Kerala. Used in 11 Assembly Constituencies:8 states, 1UT

1984 — Usage of EVMs suspended: SC ruling-EVMs had no legal sanctity

1988 — RP Act amended: allowing the use EVMs wef 15.03.1989

- **Since 2000, EVMs have been used in all elections. 3 Lok Sabha and 107 State Legislative Assemblies.**

Hacked EVM

Altered software code

Remotely Altered Control Unit Display

Memory Manipulation

Replaced Microcontroller or Memory chips

Vote Stuffing after Poll Closure
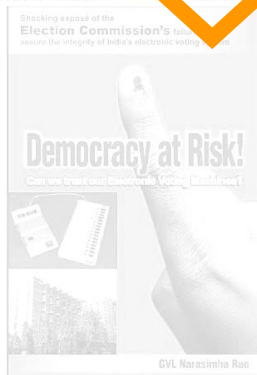
TECHNICAL EXPERT COMMITTEE

INDEPENDENT EVALUATION

T E C- HISTORY & ROLE

1st Technical Expert Committee (TEC) formed

TEC constituted for evaluation of upgraded EVMs Submitted an Evaluation Report in 2006

January, 1990

December 2005

April 1990

November 2010

Recommended use of the EVMs unanimously

Latest reconstitution
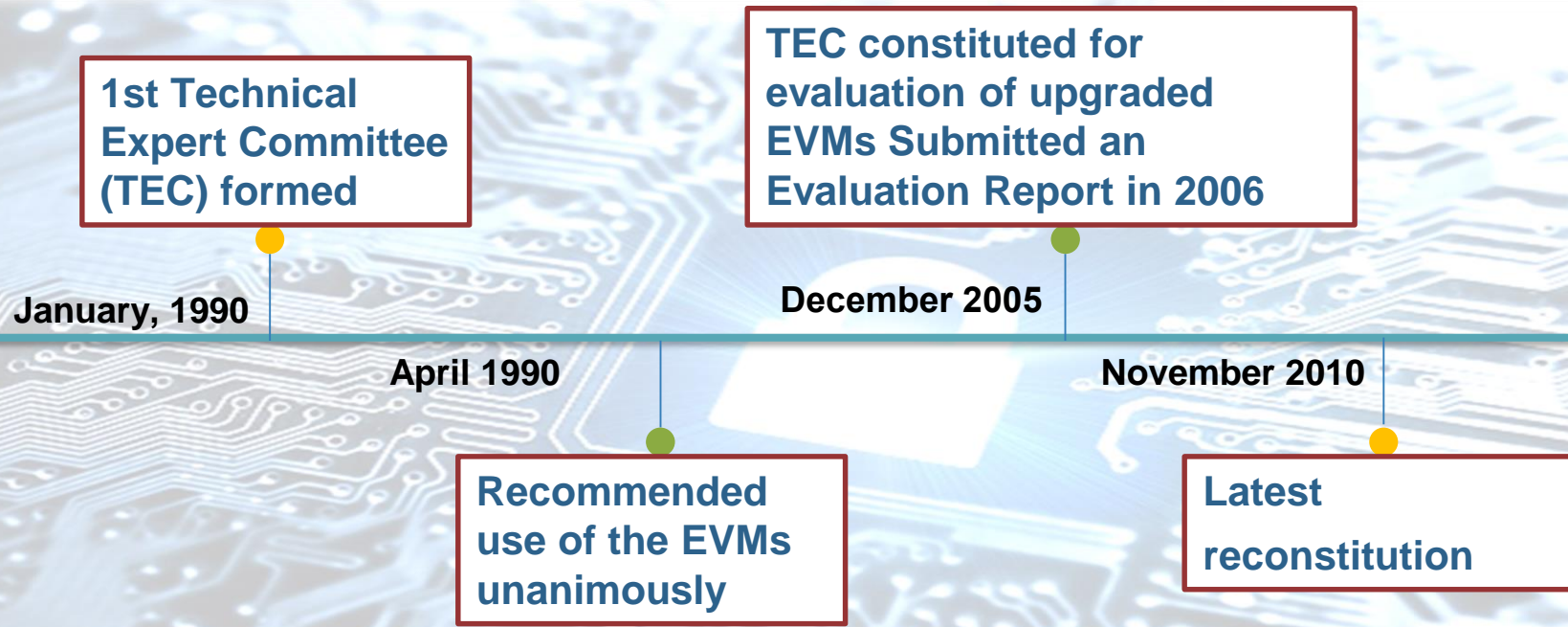
ROLE OF TEC

- Give technical advice to build specifications and design of newer versions of EVMs/VVPATs

- Examine design proposals of manufacturers on EVMs and offer recommendations for improvement

- Mentor design process

- Examine concerns raised on EVMs tamperability.

- Any other advice or technical work that Commission may seek

TECHNICAL SECURITY

DESIGN, PROCESS, ENVIRONMENT

Under Dept of Atomic Energy

Under Ministry of Defence

Both PSUs deal with **manufacturing of sensitive equipment** critical to the safety and security of the Nation and have **strong security protocols**

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Standalone Machine

No Radio Frequency transmission or reception possible- No wireless communication possible

One Time Programma ble (OTP) chip

Dynamic Coding of Key Press

Real Time Clock for time and date stamping key press

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3. SECURE DEVELOPMENT PROCESS

The software is designed/approved by TEC **NEVER subcontracted**.

Software validation is carried out as per the **System Requirement Specification (SRS)**, by an Independent Testing Group.

4. SECURE MANUFACTURING FACILITY

Secure Factory Premises

➢ Monitored Entry and Exit

➢ Regular frisking at gates and all important junctions

➢ CCTV surveillance

➢ Entry of electronic gadgets like mobile, Laptop, USBs restricted

4. SECURE MANUFACTURING FACILITY

➤ Physical Security -CCTV surveillance and movement control
➤ Well defined and calibrated process flow of EVM manufacturing
➤ 3 Level Physical access to various stages / processes
➤ Access Data and Process Data logging, alarm and alert generation during manufacturing
➤ Third Party Testing by STQC as per Standards & Quality Process set by TEC

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➢ Evolution of **technology**

➢ EVM Models

    Pre 2006: M1

    2006-2010: M2

    From 2013: M3

- One Time Programmable Controller
- Standalone Machine

➢ Evolution of **technology**

➢ EVM Models

Pre 2006: M1

2006-2010: M2

From 2013: M3

- Dynamic coding of every key press for communication from BU to CU
- Real time clock
- Time stamping of key presses

➤ Evolution of **technology**

➤ EVM Models

Pre 2006: M1

2006-2010: M2

From 2013: M3

- Digital certificate based mutual authentication amongst all components
- Automated Self diagnostics
- Battery life predicationC

ADMINISTRATIVE SAFEGAURDS

ADMINISTRATIVE SECURITY OF EVM

ADMINISTRATIVE SAFEGAURD

1. Stakeholder Participation
2. Allocation & Movement
3. First Level Checking
4. Candidate Setting
5. Randomization
6. Mock Poll
7. Poll Day Checks
8. Poll Closure & Transportation
9. Storage & Security
10. Counting Day Protocol

Active Participation of Political-Parties/Candidates in **All Processes**

Opening & Sealing of EVM Warehouses & Strong-rooms.

1

2 First Level Check (FLC) & Candidate Setting.

3 List of EVMs after first & second randomization

Conduct mock poll and receive mock poll results

5

4 Sign on Paper Seals on BUs and CUs after all important processes

Participation During FLC

Planned Allocation

EVMs are allocated to poll going State by the Commission

Received by DEO who is personally responsible for secured storage

EVM Tracking Software for inventory management of all EVMs nationwide.
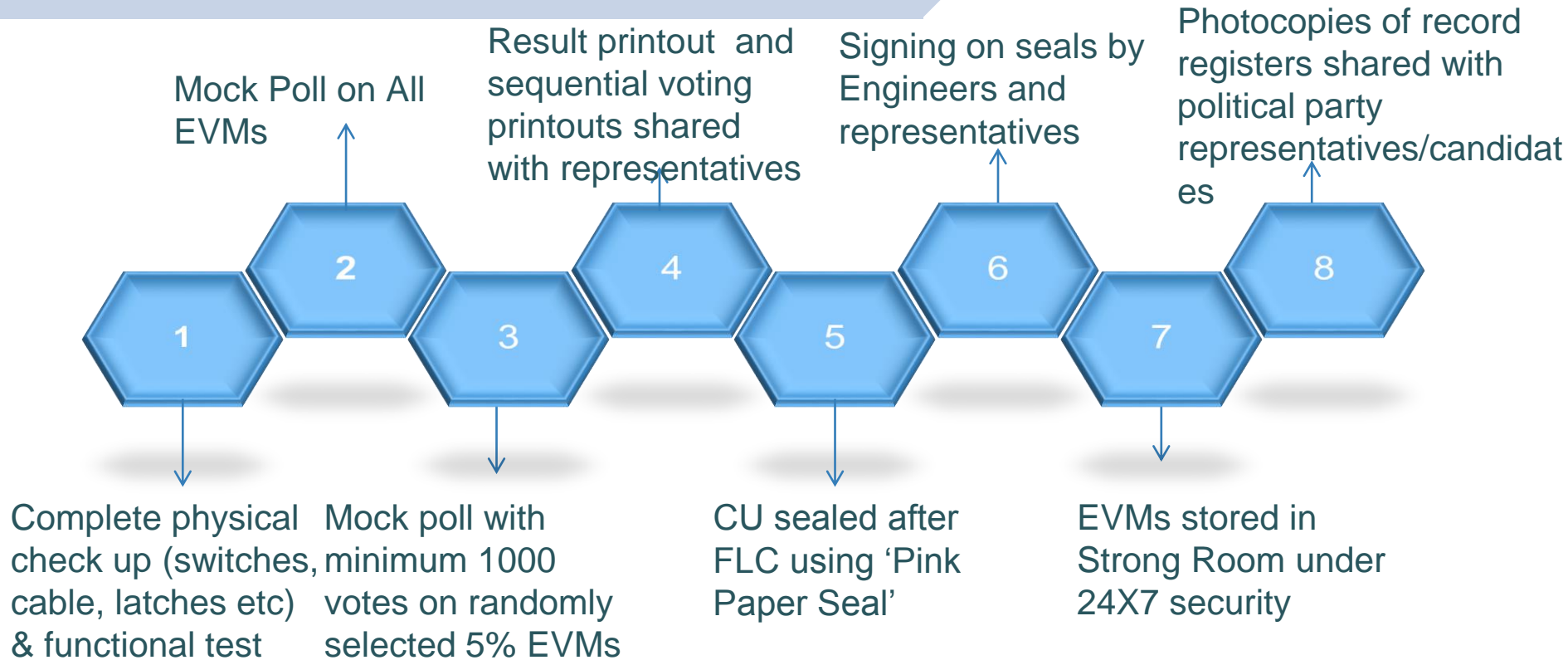
Secured Transportation

EVMs are always transported under 24/7 Police Escort irrespective of the destination

3. FIRST LEVEL CHECKING (FLC)

➢ FLC in the presence of representatives of political parties.
➢ Fully sanitized hall under videography and full security
➢ Full functionality and behavioural check is done.
➢ Defective EVMs are kept aside and not used in election

FLC PROCESS

Mock Poll on All EVMs (2)

Result printout and sequential voting printouts shared with representatives (4)

Signing on seals by Engineers and representatives (6)

Photocopies of record registers shared with political party representatives/candidates (8)

Complete physical check up (switches, cable, latches etc) & functional test (1)

Mock poll with minimum 1000 votes on randomly selected 5% EVMs (3)

CU sealed after FLC using 'Pink Paper Seal' (5)

EVMs stored in Strong Room under 24X7 security (7)

4. CANDIDATE SETTING

The Process

Insert ballot paper in the Ballot Unit & Set Number of Candidates	→	Seal Ballot Unit	→	Mock Poll on Every EVM + 1000 vote on 5% EVMs

BALLOT PAPER SCREEN

Security Measures

1 **Done after finalization of the names of contesting candidates**

2 **Fully sanitized hall under videography and full security.**

3 **Done in the presence of candidates or their agents.**

5. RANDOMIZATION

➢ EVMs are **Randomized twice** using EVM Tracking Software (ETS).

➢ Only FLC approved EVMs recorded in ETS get picked up for first randomisation

<u>**1st Randomization**</u>   <u>**2nd Randomization**</u>

- Done after FLC
- To allocate EVMs available in district, randomly, to a particular AC.
- In presence of representatives of political parties.
- List of AC-wise Randomized CU/BU and the training EVMs shared with political parties.

5. RANDOMIZATION

➤ EVMs are **Randomized twice** using EVM Tracking Software (ETS).

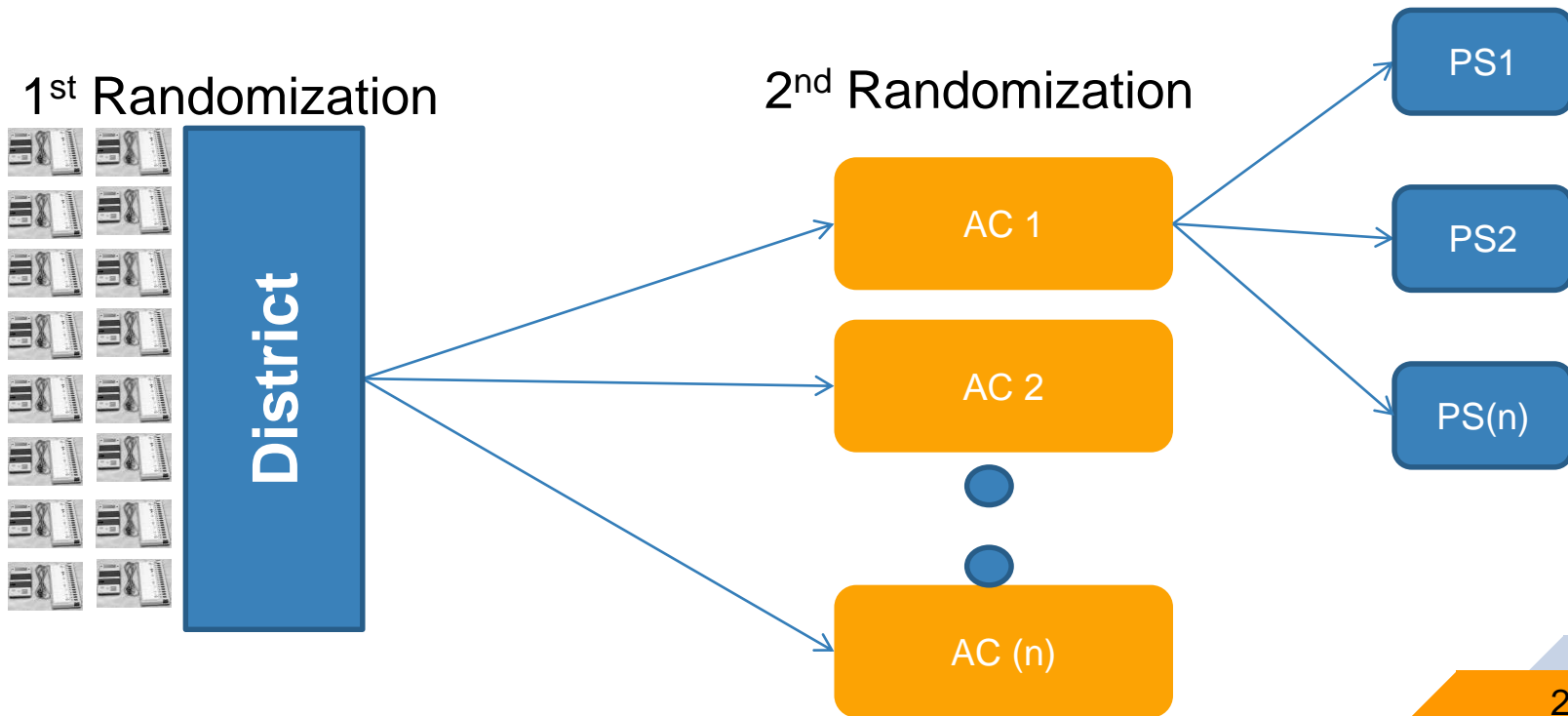➤ Only FLC approved EVMs recorded in ETS get picked up for first randomisation

<u>**1st Randomization**</u>   <u>**2nd Randomization**</u>

- Done just before 'candidate setting'.
- To allocate EVMs available in an AC to specific polling stations.
- In presence of candidates/election agents and list shared.

RANDOMIZATION- THE FOUNDATION OF EVM SECURITY

- Till first randomization no one knows **which EVM is going to which AC**

- Till nomination finalisation no one knows **the sequence of names on the ballot paper**

- Hence till candidate setting **no one (not even RO/DEO/CEO/Commission) knows which button on which BU will be assigned to which candidate**, making even an attempt to tamper absolutely futile.

- Till 2nd Randomization no one knows **which EVM will go to which PS**

- Added to this is the **3 stage Randomization** of polling station officials.

POLL DAY MOCK POLL

➤ Before start of actual poll, Mock poll with at least 50 votes in the presence of candidates/their agents.

➤ Mock poll data is erased and shown to the agents.

➤ The Presiding Officer issues the Mock Poll Certificate with signature of the representatives of candidates.

7. POLL DAY CHECKS

- Polling Agents

- CAPF, Micro-Observers, Webcasting/CCTV

- Frequent visits by Sector Officers and other senior officers, including Observers

- 2 hourly reporting of votes polled

- Media

8. POLL CLOSURE & TRANSPORTATION
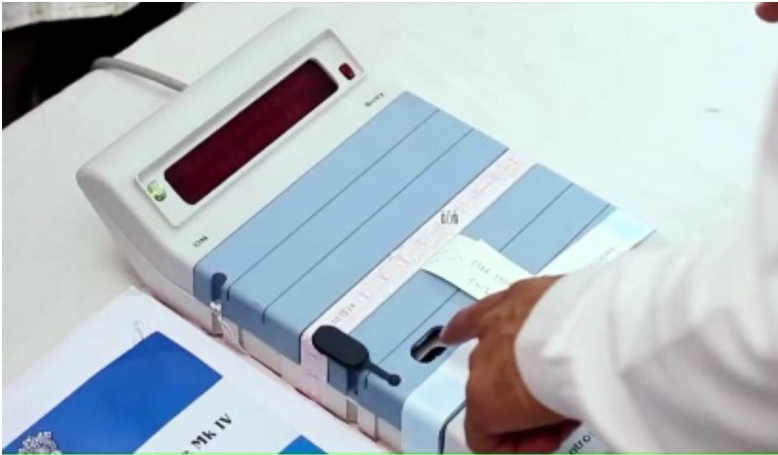
Poll Closed on EVM by pressing CLOSE button on CU

8. POLL CLOSURE & TRANSPORTATION

EVMs sealed in carrying cases and polling agents sign on them.

The machines are transported back to the reception centres under proper armed escort. Candidates' representatives are allowed to follow them

8. POLL CLOSURE & TRANSPORTATION

- ➢ EVMs are kept in strong room, sealed in the presence of the Candidates and Observer

- ➢ Facilitation for Candidates to watch the Strong Room 24/7

- ➢ *Starting from FLC of EVMs to Counting of votes, EVMs are kept in Strong-room with full 24/7 security*

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Non- Election Period   **Election Period**   **Post- Election Period**

- EVM storage warehouse with **only one entry point**.
- Other doors or windows **sealed using brick-masonry** or concrete.
- Entry secured by a **double lock system**.
- The keys held jointly by two separate officers, nominated by the DEO.
- **24X7 security** arrangement.
- Annual Physical Verification of entire stock by ECI and tracked through ETS

Non- Election Period   **Election Period**   **Post- Election Period**

- EVMs are stored in a strong room in the presence of representatives of Political Parties, under videography.
- Training EVMs are kept in a separate strong room
- After Candidate Setting EVMs are again stored in Strong Room
- EVMs are taken out only on the day of dispersal of polling parties.
- Candidates or their agents and ECI Observers are present through out this process and minutely monitor the same.

9. STORAGE & SECURITY

Non- Election Period   **Election Period**   **Post- Election Period**

- EVMs are escorted back to the strong room post poll and remains under double lock
- Candidates allowed to put their **own locks**
- **Two cordoned** round the clock security arrangements for the strong rooms having polled EVMs
- The CPF secures the innermost perimeter immediately outside the strong room and the State Armed Police secures the outer perimeter.
- **24/7 security arrangement** for unused EVMs also.

10. COUNTING DAY PROTOCOL

- On the day of counting, strong room opened in the presence of Candidates, RO and Observer under videography.
- Round-wise CUs are brought to the counting tables.
- Unique ID number of the CU & the signed seals are verified and shown to the polling agents.

- EVMs are stored back in Strong Room in the presence of candidates/their representatives.
- Where VVPATs used, paper slips are transferred to a black envelop which is sealed and kept in a separate plastic box and securely stored along with EVMs in Strong Room. **VVPATs free for reuse**.

ELECTION PETITION PERIOD

REGISTERING COMPLAINT

Election Petitions can be filed within 45 days of result declaration

EVMs (BU+CU) and only Paper Slips of VVPATs remain under sealed conditions till EP position is ascertained.

EVMs under EP are moved to a separate Strong Room with the approval of the High Court.

Remaining EVMs are now free for re-use.

DOUBTS CAST-EXPLAINED!

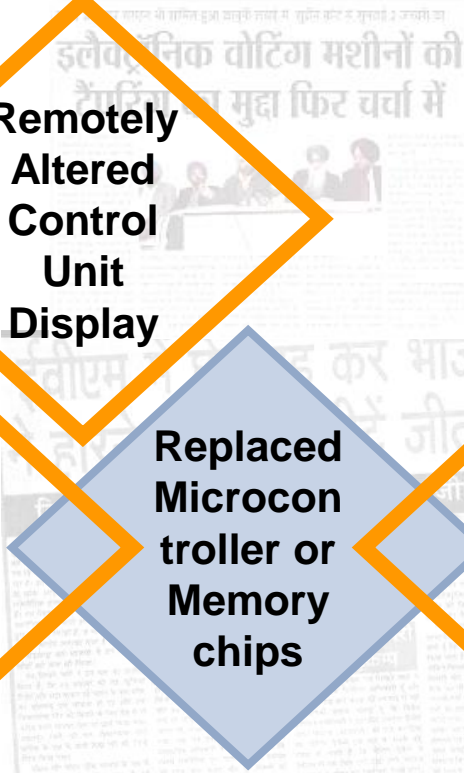CLARIFICATION OF ALL DOUBTS

Hacked EVM

Vote Stuffing after Poll Closure

Remotely Altered Control Unit Display

Memory Manipulation

Replaced Microcontroller or Memory chips

Altered software code
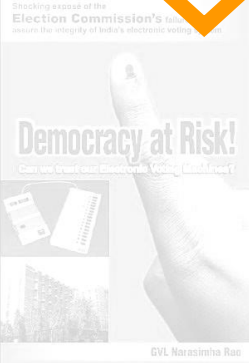
Hacking' is unauthorised access to or control over computer network security systems for some illicit purpose

In the case of ECI EVMs, the word '**Hacking' is not applicable** for following reasons:

➢ The EVM is a **stand alone** machine and is not connected to any network through wire or wirelessly

➢ The SW programme in the OTP Microcontroller can **neither be read nor modified**

REMOTELY ALTERED CU DISPLAY THROUGH WIRELESS COMMUNICATION

➤ Aspersions hav been raised that this can be done by either replacing the original display module with another display fitted with a wireless device or inserting an extra circuit board which can communicate with an external unit via a wireless device and tamper the result by controlling the CU display used for declaring the result

➤ Such a modification would require unfettered access to the EVM after FLC – **Ruled out.**

MEMORY MANIPULATION

- It is alleged that voting data can be altered by clipping a Memory Manipulator IC to the memory chip where Vote data is stored. This would need,
  - Full and free access to CUs after the Polling is over- **Ruled Out !!**
  - Breaking the seals and locks of the strong room in the presence of two layers of security plus the representatives of the candidates camping near the strong room- **Ruled Out !!**

Administrative Safeguards

- Chip replacement would require access to EVM Warehouses – **Ruled Out**

- Any chip replacement before FLC will get caught during FLC
- Chip Replacement after FLC would require access to Strong Rooms and breaking of EVM Pink Paper seals– **Ruled Out**

Technical Security

- BUs and CUs communicate only amongst themselves and go into error mode if connected to any other machine. Thus, **any modified EVM (with microcontroller /memory changed) would not be usable** even if someone is able to hypothetically bypass security arrangements and modify EVM

TAMPERED SOURCE CODE "TROJAN"

- It is alleged that Trojan Horse (malicious software) to manipulate results can be introduced in following manner

    - by reprogramming the chip, or

    - by the chip manufacturer during fusing of the software.

- Re-programming **Ruled Out** as these are OTP chips.
- Code tampering by the chip manufacturer **Ruled Out** as it will get caught during the code integrity check.

VOTE STUFFING AFTER POLL CLOSURE

Administrative safeguards
- Poll closed by pressing the "CLOSE" button on the CU after last vote, Representatives of candidates who are present signs on the seals
- EVM seals checked on counting day

What if seals broken and votes stuffed while transporting?
- EVM does not accept any votes after CLOSE button pressed in CU

What if CLOSE button not properly pressed and Votes Stuffed while transporting?
- Poll Closure time recorded in the PO's diary and any votes polled in the EVM after this time can be identified due to time stamping of key presses

ASPERSIONS VS CONFIDENCE

SINCE 11TH MARCH

Sl. No.	Aspersions/ Allegations	Fact Check/ Reality
1.	Unauthorized Access to EVMs	ECI-EVMs inaccessible. Kept in warehouses/ strong rooms under high physical security. Each machine has a unique number. Stolen EVMs cannot re-enter.
2.	Pressing multiple buttons leads to multiple votes	The button pressed at first, followed by a long beep sound, is counted as one vote. Next vote can be cast only after the Presiding Officer presses the ballot button in the Control Unit. No chances of casting multiple votes.
3.	Tampering the Hardware	First Level Check of each and every EVM is done by engineers of ECIL & BEL in presence of political parties' representatives before elections.
4.	The Software Chip	One Time Programmable Chip. No extra port or chances of any network connectivity in ECI-EVMs.
5.	Dishonest Polls, after Honest Mock Polls	At least 1000 votes are cast by political parties' representatives in 5% of randomly chosen EVMs from warehouses. Mock polls are also done in presence of stakeholders.

Sl. No.	Aspersions/ Allegations	Fact Check/ Reality
6.	Low Tech Seals	Security seals from Nasik Printing Press are used. Sealing of EVMs and strong rooms/ warehouses are done in presence of political parties' representatives.
7.	Bhind, Madhya Pradesh, 2017: All buttons allegedly voted BJP	Only during the demo on 31st March, 4 votes were cast and all 4 correctly went to respective candidates and printed respective slips. However, the VVPAT was used in UP elections 2017 and the memory was not rebooted before being used for the demonstration.
8.	The Dholpur Incident: All buttons allegedly voted BJP	Ten EVMs were found defective, but none gave any wrong results.

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Commission's enquiry found 4 buttons of BU pressed in the following order and VVPAT printed corresponding slips

Button no	Symbol	Name of Candidate
03	Handpump	Raju Pal
04	Lotus	SatyaDev Oanchori
03	Handpump	Raju Pal
01	Hand	Ambuj Shukla

It is pertinent to mention here that is it completely false to say that the multiple times slips of lotus were printed during the demo on 31st March as alleged

It was alleged that in 18 EVMs votes went to only one Party irrespective of the buttons pressed. However no specific complaint received till date by the Commssion. 10 BUs and 10 CUs found defective and replaced.

120 Petitions Received

41 alleging wrong results

17 Related to SEC

Evidence Sought from 24

Reply by 3

Evidence by none

PROTOCOL FOLLOWED ON DEFECTIVE EVMs

Defective EVMs

Includes EVMs that fail to function due to any mechanical, structural or physical defect like faulty switches, broken button, faulty connections etc. However, these do not give Wrong Result.

- EVMs are checked for defects during FLC, candidate setting, before start of poll and during poll.
- Serial Numbers and defects of these EVMs are noted and EVMs are sent to the manufacturers for analysis and repair.
- Manufacturers follow same security protocols during repair as they do for manufacturing new EVMs.

INTERNATIONAL EXPERIENCE

INDIAN Vs Foreign EVMs

ECI EVM	Foreign EVM
Standalone	Mostly networked
Manufactured in Premium PSUs	Manufactured entirely by private entities
Verified and certified by an independent Technical Experts Committee	No such robust and independent certification/ checks
Data is stored internally and not transferrable by any device	Voting data recorded in the DRM is transferred by means of CD, etc
Full end to end security protocol and administrative safeguards for the use, storage, transportation and tracking	No such protocols, e.g. in Ireland
Administrative and physical security as per legal framework across the country.	No such legal framework, e.g. in Netherlands
Voter verifiability and auditability of every vote cast	Lack of such facility in the NEDAP machines- un-Constitutional by German Supreme Court as lacked public examinability

PAST JUDGEMENTS

INDIAN Vs Foreign EVMs

Total No. of Court Cases on EVMs: 37

Judgments given: 30

Judgments awaited: 07

In recent election in 5 states out of 690 ACs election petitions filed only in 43 ACs

Madras High Court 2001
"*There is also no question of introducing any virus or bugs for the reason that the EVMs cannot be compared to personal computers.*"

Karnataka High Court 1999
'***This invention is undoubtedly a great achievement in the electronic and computer technology and a national pride***'.

Kerala High Court 2002
In one EP the High Court recorded its appreciation on the efficiency of the mechanism of detecting votes cast by impersonators. Upheld by the Hon'ble Supreme Court in 2003.

VOTER VERIFIABLE PAPER AUDIT TRAIL (VVPAT)

VVPAT

VVPAT- allows the voters to verify that their votes are cast as intended.

VVPAT

- Voter Verifiable Paper Audit Trail is an independent system, attached with the Electronic Voting Machines, that allows the voters to verify that their votes are cast as intended.

- When a vote is cast, the elector shall be able to view through the transparent window of the VVPAT, the printed paper slip showing the **serial no**, **name** and the **symbol** of the candidate of his choice.

- The slip remains exposed through the window for 7 seconds, after which it automatically gets cut and falls in the sealed drop box of the VVPAT.

- Since 2013, VVPATs are being used in selected constituencies in every Legislative and Parliamentary election.

VVPAT Complaint – Rule 49MA

In case a voter complains of wrong printing by VVPAT:

- He will report to Presiding Officer
- Presiding Officer will take a declaration explaining that if found false he can be penalized.
- PO will then record in 17A and permit him to cast a 'test vote' in presence of PO and Polling Agents
- If found false PO will record in 17A and 17C so that the test vote is not counted
- If found true then PO will stop poll and report to RO

VVPAT RECOUNTING PROCESS

- Counting of votes according to Rule 56C of Conduct of Election Rules,1961
- After announcement of result any candidate/ his agent may apply in writing to the RO for counting of paper slips of VVPAT
- The RO shall pass a speaking order on whether the counting will be done or not after considering the following:
  - Whether total number of votes polled in that polling station is more or less than the margin of votes between the winning candidate and the applicant
  - Whether EVM met with any defect and was replaced at that polling station during poll
  - Whether there was any complaint about the VVPAT not printing the paper slips or complaint under rule 49MA by any voter in that polling station during the poll
- VVPATS were used in all 5 states but in Goa alone recount requested and permitted by RO in all 4 requests
- Count exactly matched in all the 4 recounts done

PRESENT STATUS

➢ In the light of technical security features and administrative safeguards, Commission has full confidence on its EVM system

➢ Commission committed to deploy VVPATs in all elections

➢ Orders placed to supply **16.15 lakh VVPATs**, **13.95 lakh BUs** & **9.30 lakh CUs** by Sep 2018

➢ Delivery expected to start from **Aug 2017**

THANK YOU