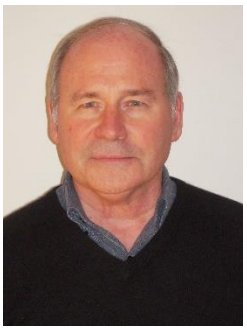

Ray Catlett Information

Forty+ years in electrical power design (69kV-480V), maintenance technical support and system analysis for petrochemical plants, offshore platforms, power plants, data centers, power utilities, and pulp & paper mills. Prepared power system analyses, equipment specifications, standards development, medium voltage motor applications and technical support to operations and maintenance in utility powerplants, refineries and industrial facilities. Performed in the roles of design engineer, project manager, corporate technical consultant and maintenance supervisor.

During his 40+ career he worked for the following firms:

Retired from ABB Inc., St. Louis, MO.

Positions held: PPMV - Senior Technical Consultant; MVS - Technical Service Consultant; PTSS - Senior project engineer.

Responsibilities included: provided alternate proposals to marketing/packaging groups; performed technology assessment relative to system re-configuration and/or optimization; marketing efforts. Provided technical support to field technicians, customers and sales/marketing channels. Project management including equipment specification, project financials and activities tracking.

PC & E, Inc. St. Louis, MO.

Position held: Power Applications - Group Leader; Principal Engineer

Responsibilities included: electrical power system design and analysis for industrial facilities, including equipment specification, computer assisted analyses, and estimating. Third party consultant to a large chemical firm and new 115KV - 23KV substation, located in Thailand. Analysis, design, control, specification and field commissioning of (4)-9000HP, 2-speed, induction motor drives for an induced draft fan application in a coal fired utility power plant. Technical feasibility study of induced draft fan prime driver types. Expert witness support to two industrial accidents involving litigation.

Shell Oil Company, Wood River, Illinois

Positions held: Plant Engineering - Technical Lead Engineer; Major Projects Organization - Field Electrical Engineer.

Responsibilities: Electrical technical support to three strategic business units. Developed long range and short-term contingency plans (team effort). Provided technical support to field electricians and operations; training of crafts, operators, technicians. Supervised, provided performance appraisals

and salary administration of technicians and electrical engineers. Responsible for QA/QC for a $250 million plant expansion; supervised 3 inspectors.

M.D. Anderson Hospital, Houston Texas

Position held: Plant Maintenance Electrical Engineer

Responsibilities: Support to daily operations and maintenance activities.

Brown & Root, Houston, Texas

Position held: Marine Division - Design Engineer; Engineering Technical Services Group - Engineer

Responsibilities: Project design of electrical power distribution up to 15KV; performed power system analysis and technical support to all business divisions; equipment procurement specifications, motor acceleration and power system impact studies.

US Army, El Paso, Texas

Position held: Electronic Technician - honorable discharge.

Co-authored and presented the following IEEE, peer-reviewed, technical papers:

- "A Case Study of Replacing Steam Turbines with LCI Type Variable Speed Drives" at the IEEE/IAS/PCIC conference, September 1989. This technical paper won third place position. Published in the IEEE/IAS Transactions Nov/Dec 1990.
- “Customer Advantages of Three Cycle Breaker Applications” at the IEEE/IAS/PCIC conference, September 2003. Published in the IEEE/IAS Magazine Sept/Oct 2005.
- “MV System Design: A Paradigm Shift” at the IEEE/IAS/PCIC conference September 2010.
- “Improving Relay Protection Levels in Medium Voltage Switchgear” at the IEEE/IAS/PCIC conference September 2012; published in the IEEE/IAS Transactions, May/June 2014.
- “Reducing Tripping Times in Medium Voltage Switchgear” at the TAMU protective relay conference, April 2013.
- “Novel Approach to Arc Flash Mitigation for Low Voltage Equipment” at the IEEE/IAS/ESW conference, Feb 2016, published in the IEEE/IAS Transactions, Nov/Dec 2016.
- “Considerations for the Application of a MV High Speed Grounding Switch for Arc Flash Mitigation of LV Equipment” at the IEEE/IAS/PPFIC, June 2016, won 2nd place award, published in the IEEE/IAS Transactions, March/April 2017.
- “Optimization of MV Distribution System Designs” at the IEEE/IAS/PPFIC, June 2017, published in the IEEE/IAS Transactions Jan/Feb 2018.
- “MV Motor Optimization” at the IEEE/IAS/PCIC conference September 2018.
- “Technology Change Management, Assessment, and Organizational Behavior” at the IEEE/IAS/PCIC conference September 2018.

Key Skills - Technology Assessment (TA):

The TA is a class of policy studies which systematically examine the effects on industry that may occur when a technology is introduced, extended or modified. The TA studies the range of potential effects of proposed technological developments. The results can provide the user with a higher level of "look before you leap" decision as to the proper field marriage of products.

We ask the following question. If a user performs a TA of multiple products relative to a proposed project, can they be blended such that one product's original design purpose can be applied for other solutions if field married properly for the total designed system benefit?

It is very possible that a product designed for a singular application can have multiple applications. The project TA must be performed correctly so that the total system benefits are realized. The TA needs to be supported by accurate analyses. The table below provides snapshot of these ideas.

PRODUCT APPLICATION MATRIX

Application	Product A	Product B	Product C
Protection	P	-	-
Motor starting	S	-	-
AF mitigation	S	P	-
Power quality	-	S	-
Load switching	-	-	P
Harmonic mitigation	-	-	S (A+C)

Note:

P=primary device application;

S=secondary device application

Some TA examples of the above:

- Can a power transformer's specifications be changed to affect a MV motor's capital cost, efficiency and maybe frame size? Yes
- Can a power transformer's fluid type be changed improving reliability? Yes.
- Can a product developed to protect a system from high fault levels, also be applied to improve system stability and provide MV harmonic mitigation? Yes.
- Can a "crowbar" combined with another product improve power quality? Yes.
- Is there a need for 35kV distribution anymore if that same load can be distributed at 15kV? Yes, but depends on three parameters.
- Can HV-MV transformation levels be decreased by including an additional product in MV switchgear? Higher user ROI? Yes.

Languages

English

Certifications, Degrees & Diplomas:

- Ranken Technical Institute, St. Louis, Missouri, Industrial Electronics Certificate
- BS Electrical Engineering, University of Missouri-Rolla
- Washington University, St. Louis, Missouri. Masters in Engineering Management
- Registered Professional Engineer, States of Texas (in-active)
- Institute of Electrical and Electronics Engineers (IEEE) – Life Senior Member
- 1993 IEEE/IAS/PCIC Conference, Local Committee Member
- 1998 IEEE/IAS International Conference, General Chair
- Inducted into the Academy of Electrical and Computer Engineering, MO University of Science and Technology.
- WG member of IEEE "Red Book", chapter 3, upgrade to P3001
- Former WG member of IEEE standards 1584 (Guide for Performing Arc-Flash Hazard Calculations) & 1814 (Recommended Practice for Electrical System Design Techniques to Improve Electrical Safety)