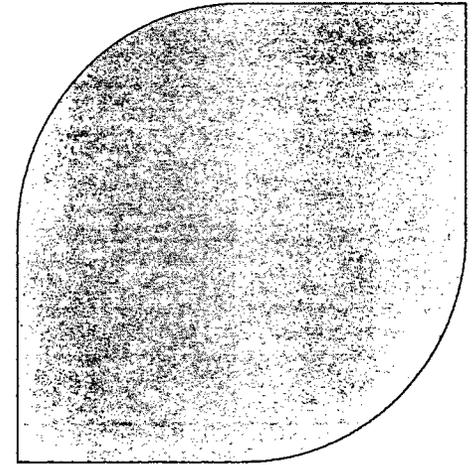


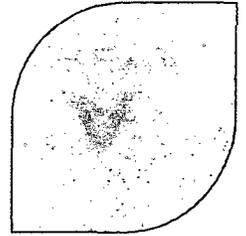
AREVA

Decision Making Process for PACS Module

Chris Doyel
I&C Technical Manager
August 4, 2009



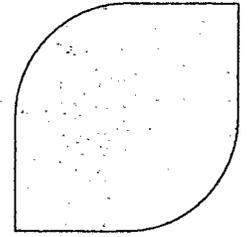
NRC concerns with Original PACS Design (AV 42)



► NRC issues

- ◇ **NRC letter dated January 8, 2009 to AREVA NP, INC. – Review Status of the AV42 Priority Actuation and Control Module Topical Report – ANP 10273P (Tac No. MD3867)**
 - 100 % testing per ISG 4, Item 2 was not satisfied
 - Decomposition testing was found not acceptable when compared to the ISG requirement
 - Independence between safety and non safety components was not satisfied
 - Non safety related Profibus Controller on the same board as the safety related PLD

Kepnor Tregoe (KT) Used



► Options Identified:

- ◇ Option 1- Non-Diversified Electronics-Based Priority
- ◇ Option 2 - Diversified Electronics-Based Priority
- ◇ Option 3 - Relay Based Priority (Discrete Components)

► Structured decision making process to achieve the best possible option among the 3 options

► Each option was evaluated by a global inter-disciplinary team based on the following criteria:

- ◇ Regulatory Requirements (Must meet)
- ◇ Design Objectives (weighted)
- ◇ Solution Risks (weighted)

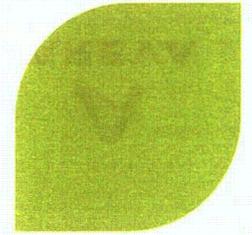
Global inter-disciplinary team led NRC issue resolution



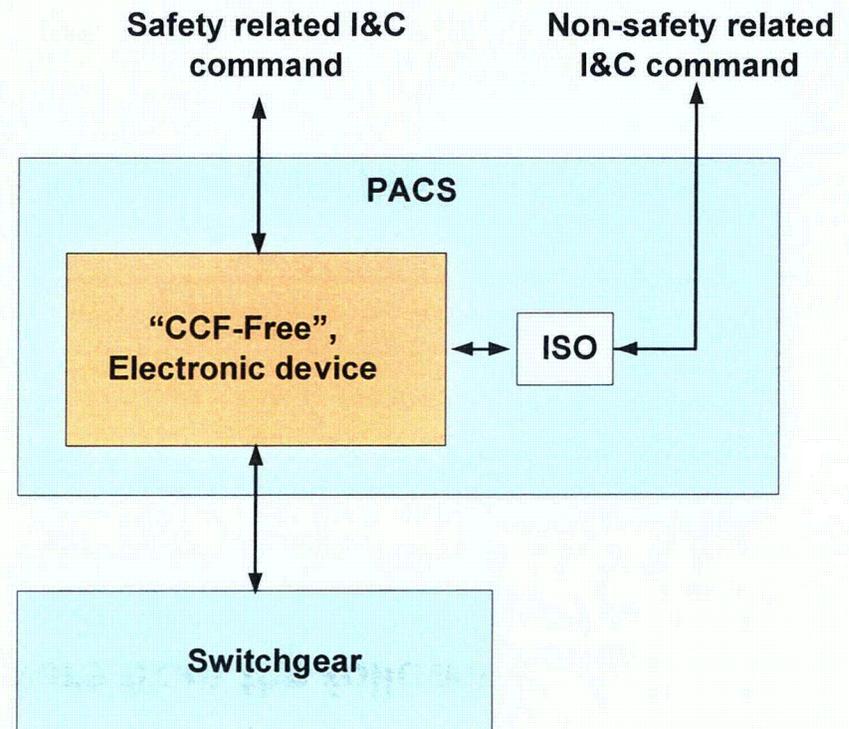
► **Members of team that participated were from the following areas:**

- ◆ I&C New Builds Technical lead
- ◆ TXS Systems Lead
- ◆ SICS System Engineer/HFE
- ◆ PICS System Engineer/HFE
- ◆ PS System Engineer
- ◆ SAS System Engineer
- ◆ PAS System Engineer
- ◆ PACS System Engineer
- ◆ ATMEA I&C Engineers
- ◆ HFE Discipline Lead
- ◆ I&C Technology Development
- ◆ Electrical Engineering
- ◆ PRA
- ◆ Fire safe shutdown analysis
- ◆ Licensing
- ◆ Engineering Integration – I&C

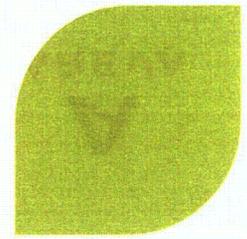
Option 1 – Non-Diversified Electronics-Based



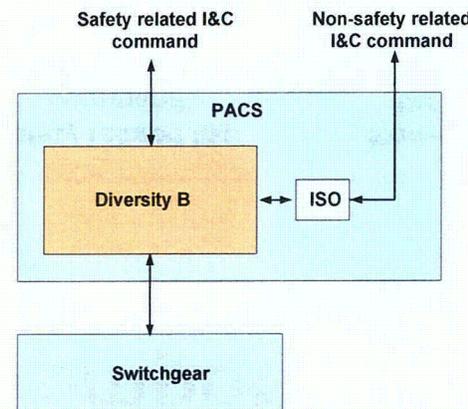
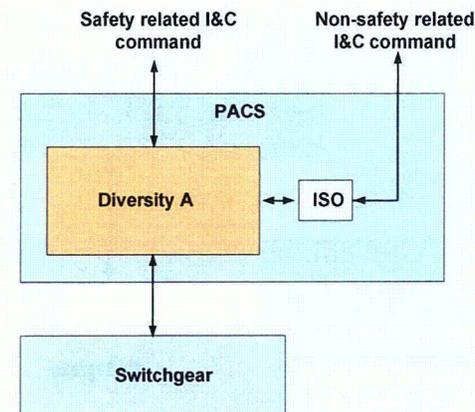
- ▶ Develop simple priority PLD
- ▶ Minimize functionality of PLD as possible
- ▶ Demonstrate 100% testability



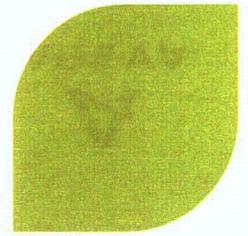
Option 2 – Diversified Electronics-Based



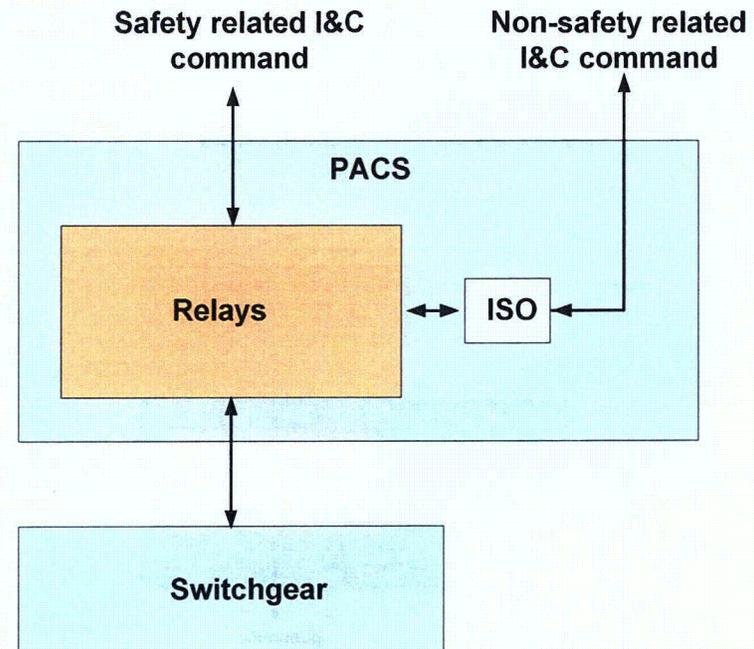
- ▶ Develop diverse Device-A and Device-B
- ▶ Evaluate what functionality to retain or relocate
- ▶ V&V development tools for both Device-A and Device-B
- ▶ Develop diversity rules for plant systems



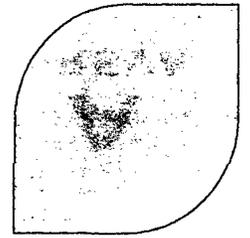
Option 3 –Relay Based Priority (Discrete Components)



- ▶ Move as much functionality of AV42 up into automation systems as possible
- ▶ Use relays for remaining priority logic



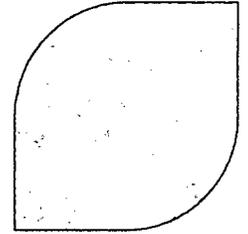
Evaluation Criteria



► Regulatory Requirements (Must meet)

- ◇ **Quality Requirements (ISG 4 Section 2.6) - if software based, the configuration tools should be V&V'd or perform 100% combinatorial testing**
- ◇ **CCF Requirements (ISG 4 Section 2.8) - If software based, to preclude from CCF consideration 100% combinatorial testing OR exclusions justified by applicant**
- ◇ **Independence Requirements - the solution shall demonstrate acceptable independence between safety and non-safety**

Evaluation Criteria (cont)



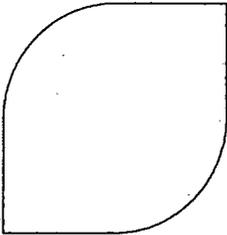
▶ Design Objectives (weighting)

- ◇ Minimize impact to current design (3)
- ◇ Minimize complexity of solution (8)
- ◇ Minimize number of cabinets (6)
- ◇ Minimize wiring (5)
- ◇ Ease of testability (6)
- ◇ Minimize PRA impact (5)
- ◇ Minimize fire/safe shutdown impact (5)
- ◇ Maximize re-usability for global New Builds projects (5)
- ◇ Good HFE design (7)
- ◇ Customer acceptance (5)

▶ Solution Risks (weighting)

- ◇ DCD Schedule (9)
- ◇ DCD Cost (4)
- ◇ DDE Schedule (7)
- ◇ DDE Cost (6)
- ◇ Global New Builds Impact (7)

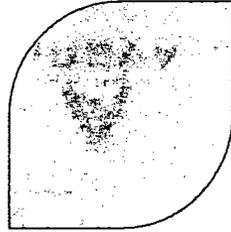
KT Scoring



Design Objectives	Importance	Objective Satisfaction Rating for Option 1	Strength of Option 1	Objective Satisfaction Rating for Option 2	Strength of Option 2	Objective Satisfaction Rating for Option 3	Strength of Option 3
Minimize impact to current design	3	10	30	5	15	3	9
Minimize complexity of solution	8	10	80	3	24	5	40
Minimize number of cabinets	6	10	60	8	48	0	0
Minimize wiring	5	10	50	8	40	0	0
Ease of testability	6	10	60	8	48	4	24
Minimize PRA impact	5	5	25	10	50	0	0
Minimize fire-safe shutdown impact	5	10	50	10	50	5	25
Maximize re-usability for global NB projects	5	10	50	5	25	10	50
Good HFE design	7	10	70	8	56	9	63
Customer acceptance	5	10	50	7	35	3	15
Overall Strength of Option			525		391		226

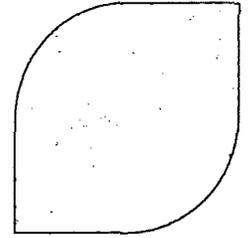


KT Matrix Scoring (cont)



Solution Risk	Importance	Probability of Occurance for option 1	Risk of Option 1	Probability of Occurance for option 2	Risk of Option 2	Probability of Occurance for option 3	Risk of Option 3
DCD Schedule	9	3	27	10	90	0	0
DCD Cost	4	3	12	10	40	3	12
DDE Schedule	7	10	70	5	35	3	21
DDE Cost	6	6	36	8	48	10	60
Global NB Projects	7	6	42	3	21	10	70
Overall Risk of Design			187		234		163

Evaluation Results



▶ **Final Evaluation Score = Design Score – Risk Score**

▶ **Options Summary**

◇ **Option 1 (Simple, 100% Testable Priority)**

- Met requirements
- Score = 338

◇ **Option 2 (Diverse Priority)**

- Met requirements
- Score = 157

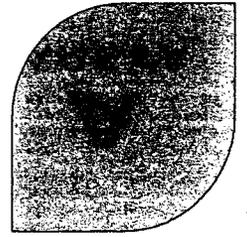
◇ **Option 3 (Relays)**

- Met requirements
- Score = 63

▶ **Selected Option 1**

- ◇ **Rated highest for all design objectives except for PRA**
- ◇ **Major risk is to DDE schedule based on assumption of using a design ITAAC approach for PACS, and the technology would not be demonstrable for 100% testability**

Evaluation Results



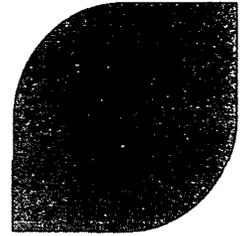
▶ Rejected Option 2

- ◆ Scored low in minimizing complexity of solution

▶ Rejected Option 3

- ◆ Scored low in the following areas:
 - Minimizing the number of cabinets
 - Minimizing wiring
 - Minimizing PRA impact

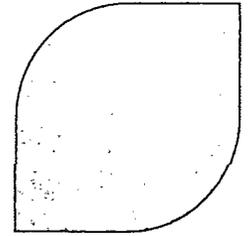
Summary



- ▶ **PS system level manual command design changes are proceeding as described in April meeting and today**
- ▶ **PACS testing approach: AREVA requests NRC to review information presented, and be prepared to affirm suitability of approach in early September meeting.**

AREVA's objective is to resolve open issues in a timely manner to support NRC Chapter 7 review schedule

Next Steps



► Protection System

- ◇ Submit proposed revision of FSAR Section 7.3 based on design changes, August 2009

► PACS

- ◇ Withdraw AV-42 topical report, August 2009
- ◇ Modify FSAR to reflect design changes and testing requirements, August 2009
- ◇ Next meeting on PACS proof of design testing approach, early September 2009

► I&C architecture changes

- ◇ Submit corresponding FSAR changes, August 2009
- ◇ Meeting on D3 confirmatory analysis approach, early September 2009
- ◇ Submit revised D3 technical report including I&C architecture changes, November 2009