FIELD TESTING OF REMOTE SENSOR LEAK DETECTION SYSTEMS

Pipeline R&D Forum 2005

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PRESENTATION OUTLINE

- ***Objective of Testing Program***
- ***Test Facility and Plan***
- ***Experimental Results***
- ***Lessons Learned***
- ***Technology Gaps***

TESTING PROGRAM OBJECTIVE

- ***Conduct field testing of remote sensor leak detection systems***
  - ***Systems developed with funding provided by DOE or OPS***
  - ***"Demonstration" project, not an evaluation by DOE***

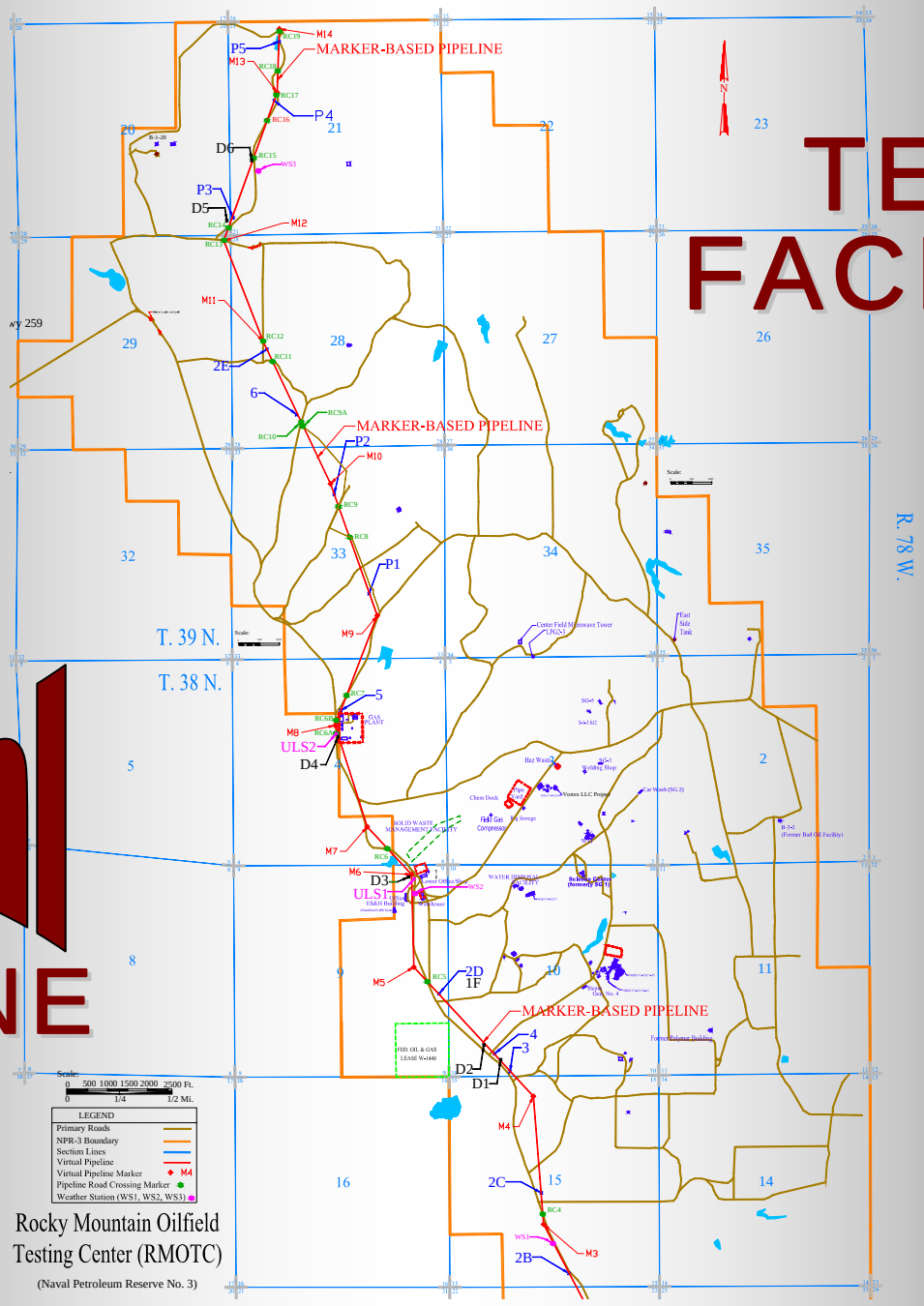
EQUIPMENT PROVIDERS

- ***En'Urga***
- ***ITT Industries***
- ***LaSen***
- ***Lawrence Livermore Laboratories (LLNL)***
- ***Physical Sciences Inc. (PSI)***

SYSTEMS TESTED

Virtual PIPELINE

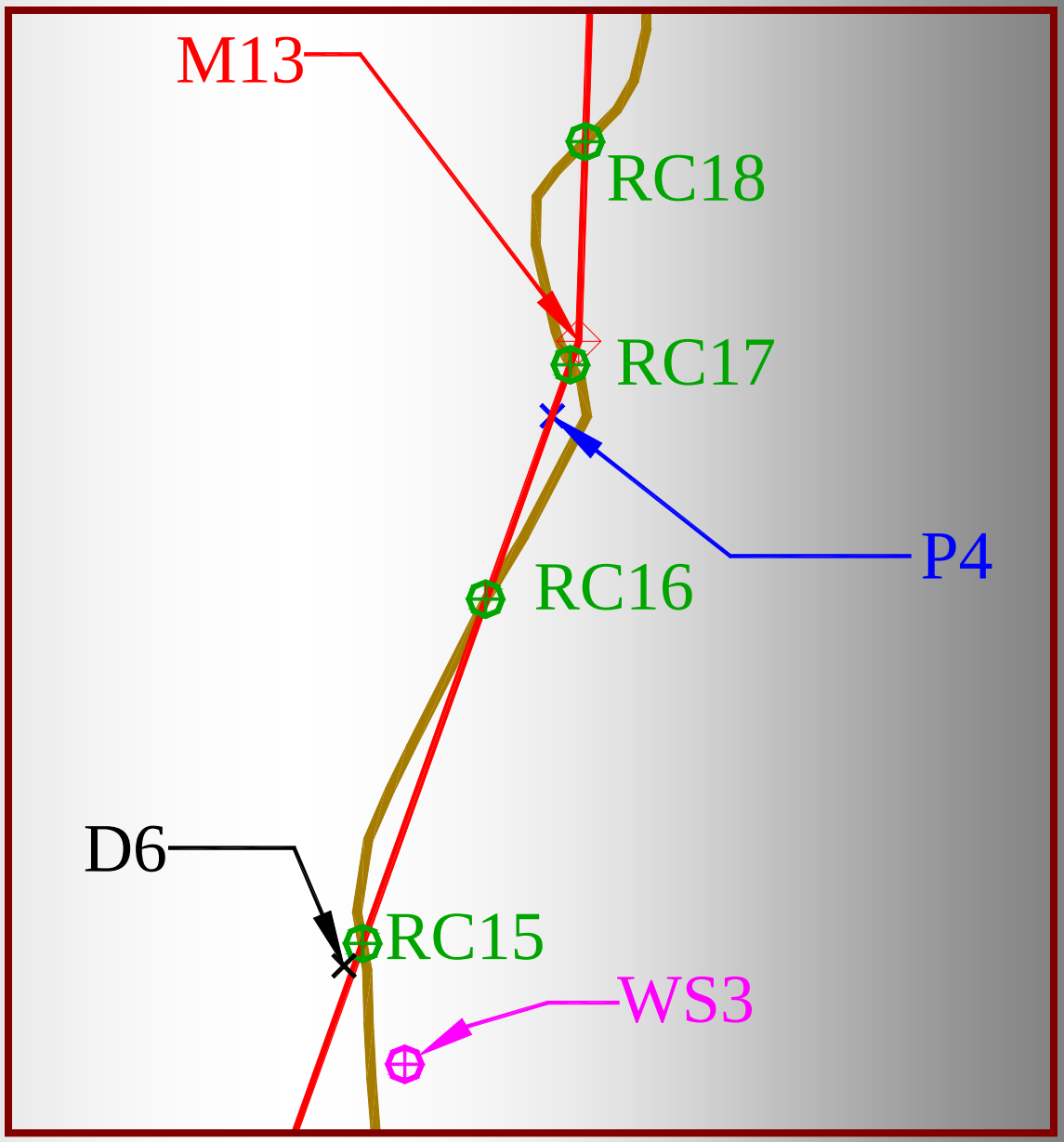
TEST FACILITY



Virtual

PIPELINE

CLOSEUP



TEST FACILITY

Leak Site	Gas Source	Leak Type	Distance from Leak Site to Center of Road (ft)	Side of Road
1	RMOTC gas	Below ground	36	East
2A	Cylinder	Below ground	76	West
2B	Cylinder	Below ground	78	West
2C	Cylinder	Below ground	122	East
3	RMOTC gas	Aboveground	44	East
4	RMOTC gas	Below ground	90	East
2D/1F	Cylinder	Below ground	100	East
5	RMOTC gas	Below ground	59	East
P1	RMOTC gas	Side-drilled	78	West
P2	RMOTC gas	Side-drilled	240	West
6	RMOTC gas	Below ground	170	West
2E	Cylinder	Below ground	74	East
P3	RMOTC gas	Side-drilled	116	West
P4	RMOTC gas	Side-drilled	66	West
P5	Cylinder	Side-drilled	39	West

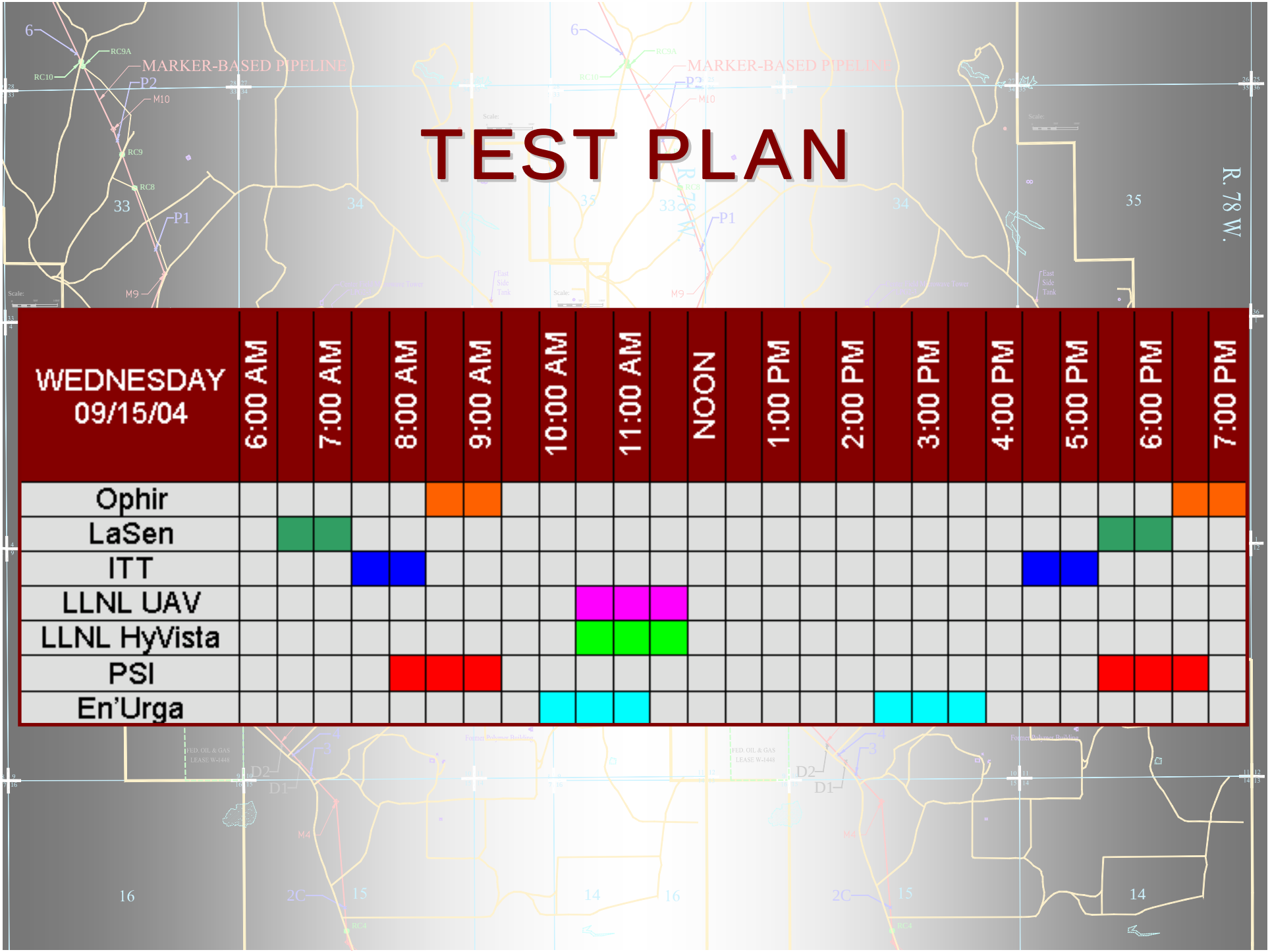
LEAK SITES

TEST SITES

TEST PLAN

Daily Leak Rate Plan			Leak Rates (scfh)				
Leak Site	Gas Source	Leak Type	9/13/04	9/14/04	9/15/04	9/16/04	9/17/04
1	RMOTC gas	Below ground	5,000	1,000	500	100	15 & 5,000
2A	Cylinder	Below ground	0	0	0	0	15
2B	Cylinder	Below ground	15	0	0	0	0
2C	Cylinder	Below ground	0	0	15	0	0
3	RMOTC gas	Aboveground	1,000	2,000	100	2,000	500
4	RMOTC gas	Below ground	100	500	2,000	1,000	2,000
2D	Cylinder	Below ground	0	15	0	0	0
1F	Cylinder	Below ground	0	0	15	0	15
5	RMOTC gas	Below ground	2,500	5,000	5,000	0	5,000
P1	RMOTC gas	Side-drilled	1,000	1,000	1,000	1,000	1,000
P2	RMOTC gas	Side-drilled	100	100	100	100	100
6	RMOTC gas	Below ground	500	100	1,000	500	1,000
2E	Cylinder	Below ground	0	0	0	15	0
P3	RMOTC gas	Side-drilled	10	10	10	10	10
P4	RMOTC gas	Side-drilled	500	500	500	500	500
P5	Cylinder	Side-drilled	1	1	1	1	1

TEST PLAN



WEDNESDAY 09/15/04	6:00 AM	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	NOON	1:00 PM	2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	7:00 PM
Ophir														
LaSen														
ITT														
LLNL UAV														
LLNL HyVista														
PSI														
En'Urga														

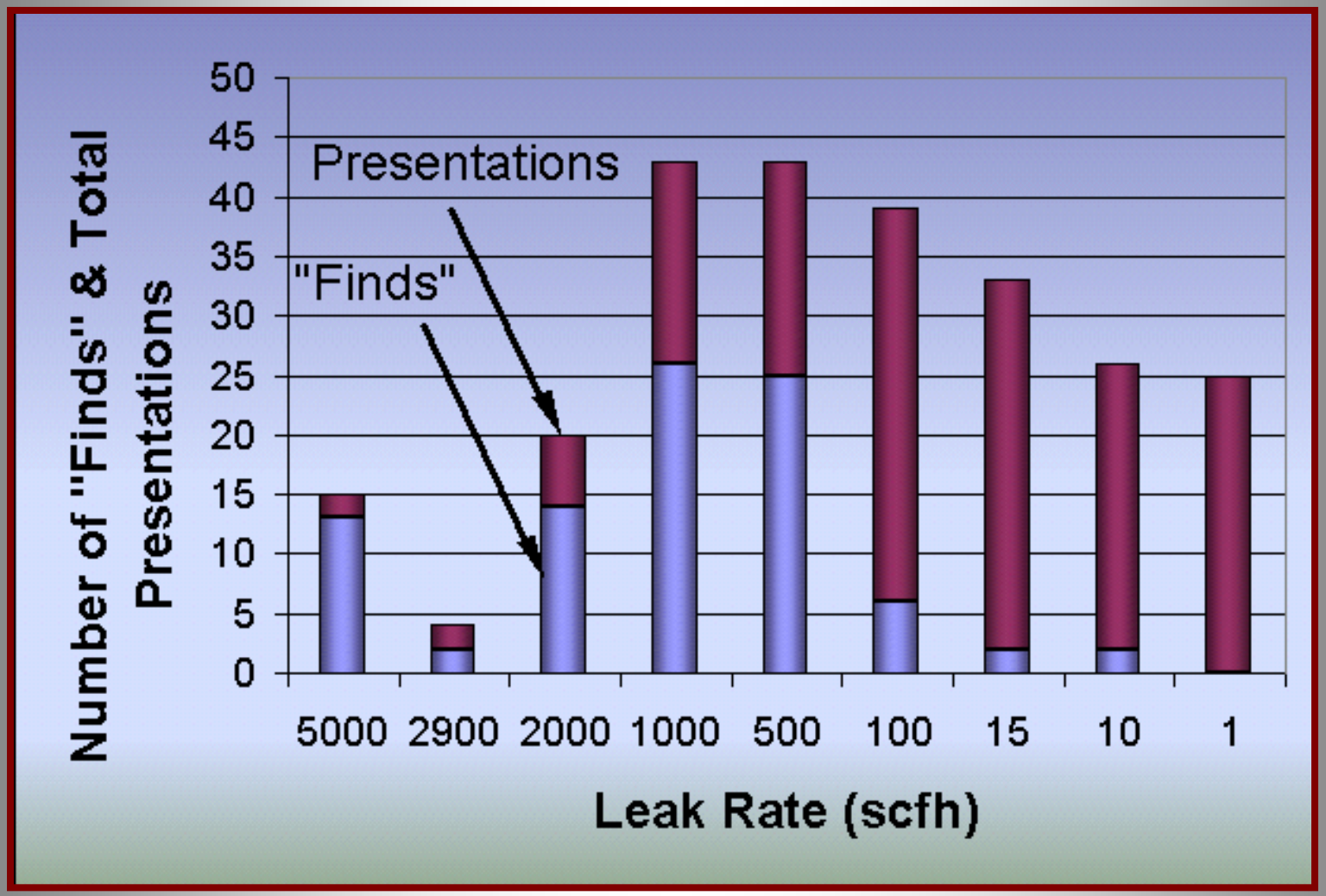
RESULTS – LEAKS FOUND

Summary of Leaks Detected by Each Equipment Provider

Leak Rate	Number of Actual Leaks Detected/Presented					
	En'Urga	ITT	LaSen	LLNL	PSI	Total
5,000	1/3	3/3	5/5	N/A	4/4	13/15
2,500	0/2	0/0	0/0	N/A	2/2	2/4
2,000	0/3	3/4	5/7	N/A	6/6	14/20
1,000	0/8	3/7	11/13	0/1	13/14	27/43
500	0/9	3/7	10/12	0/1	14/14	27/43
100	0/10	1/6	0/10	0/1	4/12	5/39
15	1/6	0/6	0/11	N/A	1/10	2/33
10	0/5	0/4	0/7	0/1	2/8	2/25
1	0/5	0/4	0/7	0/1	0/8	0/25
Totals	2/51	13/41	31/72	0/5	45/78	92/247

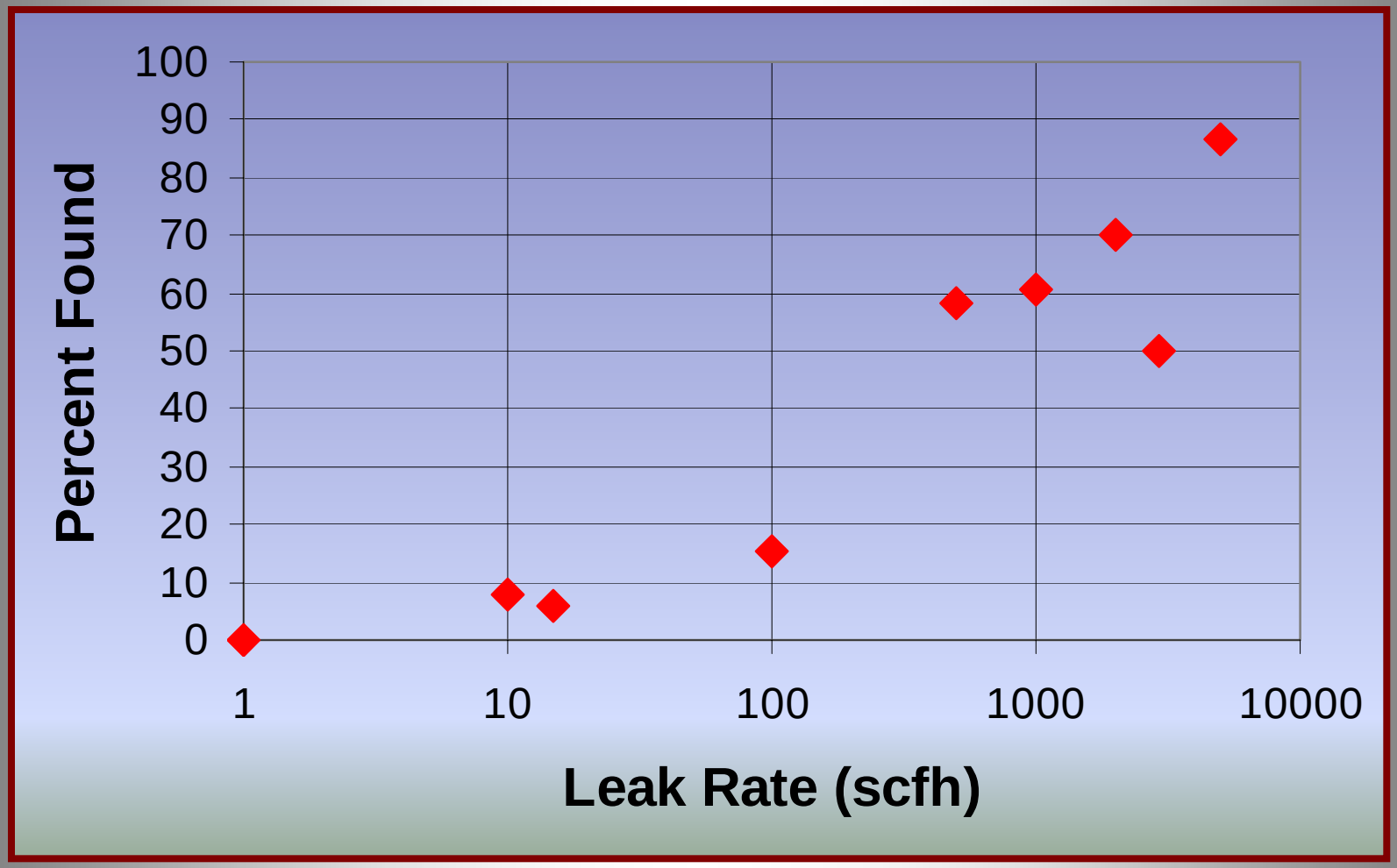
RESULTS – LEAKS FOUND

Instrumentation Sensitivity to Leak Rates – Bar Chart



RESULTS – LEAKS FOUND

Instrumentation Sensitivity to Leak Rates – Percent Found



RESULTS – FALSE POSITIVES

"False Positive" Leaks Reported by Equipment Providers

Test Day		En'Urga		ITT		LaSen		LLNL		PSI	
		Reported	False	Reported	False	Reported	False	Reported	False	Reported	False
Mon	am	2	2	—	—	—	—	—	—	6	1
	pm	2	2	—	—	—	—	—	—	5	0
Tue	am	3	3	—	—	—	—	—	—	7	1
	pm	2	1	20	17	4	1	—	—	6	0
Wed	am	3	2	—	—	9	3	4	4	7	0
	pm	—	—	32	29	9	3	—	—	9	2
Thu	am	—	—	—	—	6	2	—	—	8	2
	pm	—	—	26	22	5	0	—	—	8	0
Fri	am	—	—	—	—	6	1	—	—	—	—
	pm	—	—	14	11	6	1	—	—	—	—
Totals		12	10	92	79	45	11	4	4	56	6

LESSONS LEARNED

- ***Develop separate data collection areas for transmission- and distribution-based systems***
- ***Add more leaks***
- ***Industry advisors***
- ***Potential future test (August 2006)***

ACKNOWLEDGMENTS

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Report at www.rmotc.com

(last report under “Library” tab)

TECHNOLOGY GAPS

- ***"Demonstration" vs. "Development" testing***
- ***Detection of leaks below 500 scfh***
- ***Detection of minor leaks (0.02 scfh)***
- ***False positives***
- ***Accuracy/Cost tradeoff***

GAPS – DOE PERSPECTIVE

- ***Remote sensing is on the verge of becoming a commercial commodity***
- ***Advantages are range and extent of search***
- ***Wrapping up funding of low-altitude remote sensing***
- ***High altitude remote sensing is current focus***

GAPS – INDUSTRY PERSPECTIVE

- ***Development satellite-based systems***
  - ***High-resolution***
  - ***Multi-band***
  - ***Able to follow narrow corridors***
- ***Satellite systems offer savings and centralized databases***
- ***Need research to develop high resolution sensors operating in increasingly challenging platforms***

GAPS – INDUSTRY PERSPECTIVE

- ***Gap is in the process of developing, accepting, and improving tools***
- ***The challenge is to choose technologies that are close to becoming viable***
- ***Priority funding should be given to funding these technologies***
- ***Regulations language needs to embrace these technologies***
- ***Technology improvements can then be funded***