



Space Systems Engineering Professional Development & Certification

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Background

- The space race created a surge in scientists and engineers
- Aerospace workforce reduced in 1990s
 - Collapse of the Soviet Union – military cutbacks
 - Rise of the “dot-coms”
 - Acquisition Reform
- Government hiring of engineers was significantly reduced
- Today, the government workforce is short of engineers and scientists
 - Reduces the government’s ability to assess the quality of contractor efforts



Today's Situation

- Need for technical competence is high
- Space systems are much more complex than in the past
- Systems must perform in concert with many other systems, instead of as independent systems
 - No control over legacy system interfaces
 - Evolving requirements
- Demand for perfection, the first time



NRO Risk Over Time

Era	Time Frame	NRO Willingness To Take Risks	Oversight Tolerance for Failure
Intelligence Imperative	1960-1970	High	High
Technology Driven	1970-1990	Medium	Medium
Peace Dividend	1990-2002	High	Low
War on Terrorism	2002-?	Medium	None



What is different about Aerospace ?



- High risk environment
- Complex systems
 - Launch
 - Space
 - Ground
- Much longer timeline for development
 - Causes designers to “push” the technology envelope
- Significant increase in failure of satellites and launches in late 1990s



Greybeard Findings

- National security space acquisition process is seriously flawed
- The government had moved away from the application of rigorous proven engineering practices
- Cost estimates should be based on 80% confidence vs. 50%
- The government must retain adequate talent to be a “smart buyer”
- Requirements growth is a major cause of cost growth and schedule delays
- Many problems caused by failure to conduct adequate systems engineering studies
- Previous attempts at acquisition reform had the unintended consequence of focusing on cost versus mission success



Response

- DoD Policy for:
 - Robust systems engineering
 - Systems Engineering Plan (SEP)
- Call for “Systems Engineering Revitalization” by many government organizations



NRO Approach

- Develop a basic systems engineering training program
- Follow up with a certification program for systems engineers
 - Training program based on our specific needs
 - Minimize business impact
 - Training needs to be practical with frequent student participation



SE-501

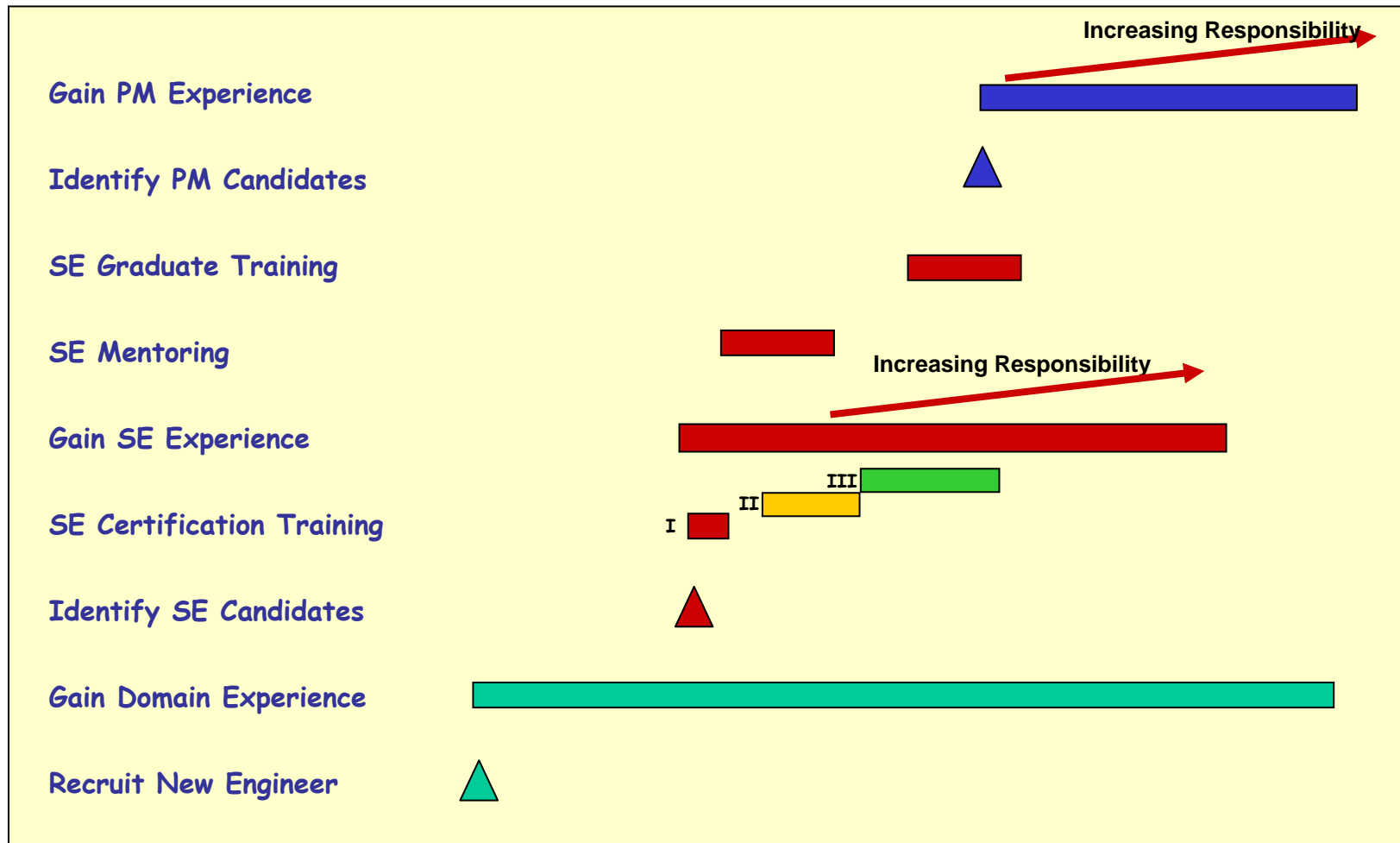
Acquisition Systems Engineering



- **Eight class days, each separated by two weeks**
- **Threaded exercise throughout course**
 - Team project with assigned responsibilities
 - Required deliverables and presentations each day
- **Response very positive**
- **Evolution of course design:**
 - Course changed to five days in a single week and three days a month later
 - Class taught by cleared instructors so that real program problems could be discussed
 - Added Best Practices day with program Chief Systems Engineers sharing their experiences



SE Career Path





NROI 65-4



- **NRO Instruction signed 9 June 2004**
- **Implements 3-level SE certification**
- **Requirements are a combination of experience and training**
- **DDSE is certifying authority**
- **NRO Joint Systems Engineering Team (JSET) Representatives are responsible for review and assessment of directorate personnel applications**



SE Certification Requirements



Level	Experience	Training
I	2 yrs. SE	SE-501 Acquisition Systems Engineering and SE-502 Designing Space Missions or 6 SE-related graduate credits
II	4 yrs. SE	Complete 4 from below: Requirements Development/Management Risk Management Measurement & Analysis Concept & Architecture Development Formal Decision Making Integration, Verification & Validation or 12 SE-related graduate credits or 6 after Level 1
III	7 yrs. SE	INCOSE Certification or or 18 total SE-related graduate credits or 6 after Level 2

•All levels require a baccalaureate degree in engineering, physics, chemistry, mathematics, computer science or a related field.



Legacy

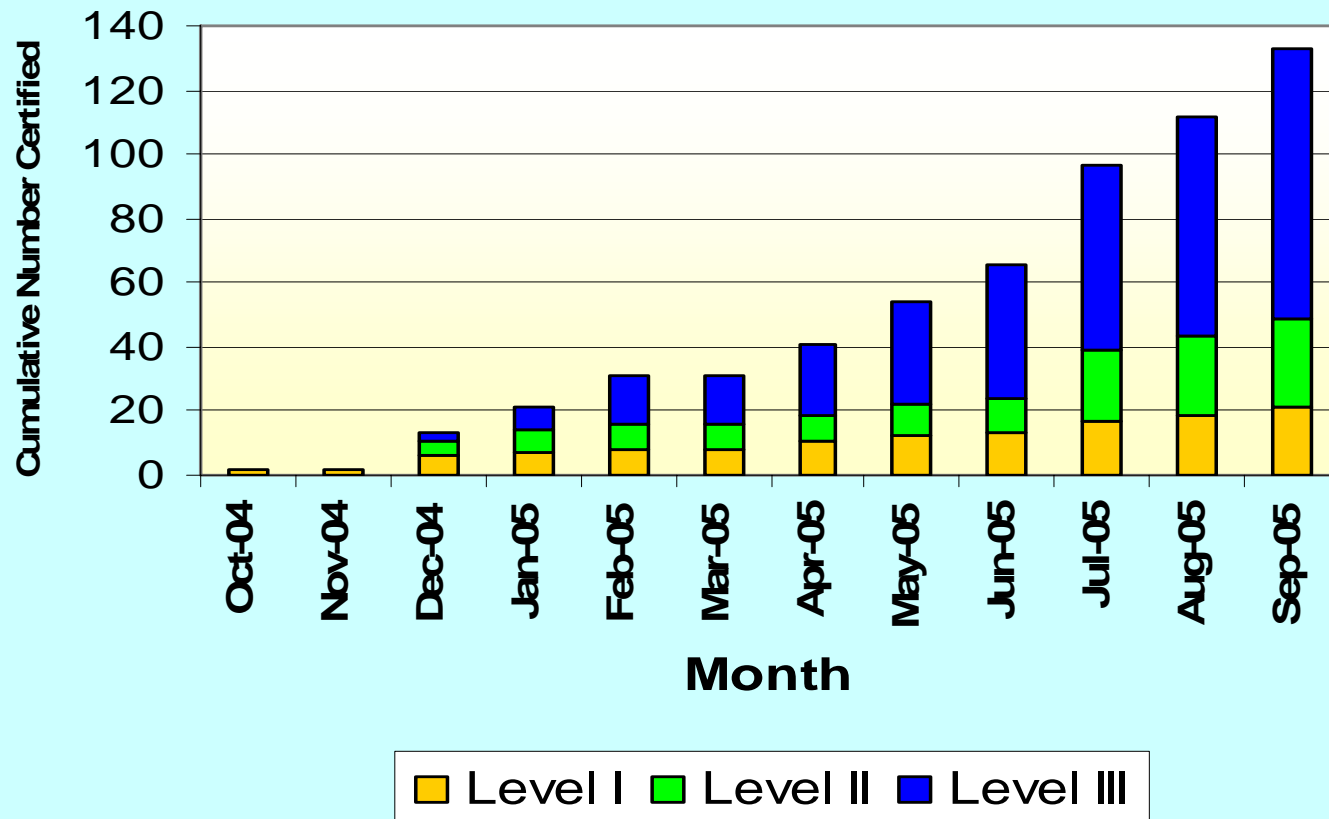


- Legacy certification offered for those who have been in systems engineering positions for a significant time
- Twelve-month application period after rollout or first assignment to NRO
- Recommended experience requirements:
 - Level I – 4 years
 - Level II – 8 years
 - Level III – 12 years
 - plus
 - Attendance at an SE Executive Overview Course (3 days)



FY05 Results

Cumulative Systems Engineers Certified by Level





Other Initiatives

- Increase awareness of systems engineering tools and their applicability to NRO systems engineering activities
- Acquaint NRO SEs with the SE graduate school programs available in Washington Metropolitan Area
- Develop a joint SE-PM course
 - Detail the duties of each
 - Develop the partnership essential to program success