Re-Generative Filtration Development for the Expeditionary Fighting Vehicle (EFV)

Brendon Clingensmith
Edgewood Chemical Biological Center
(410) 436-8213
brendon.clingensmith@us.army.mil

Briefing Overview

- Objective
- Major Tasks of Program
- Program Deliverables
- Program Description
- Challenges
- Summary

Program Objective

- **Objective**
  - **Integrate NBC regenerative filtration system into EFV**
- **Execution under Memorandum of Understanding (MOU) between the Joint Program Manager, Collective Protection (JPM-CP) and Direct Reporting Program Manager, Advanced Amphibious Assault Vehicles (DRPM-AAAV)**
- **POTENTIAL BENEFITS OF RE-GEN FILTRATION**
  - **No filter change required pre- or post- attack**
  - **Reduced logistics burden for filter replacement**
  - **Regenerative during operational life**
  - **Full protection against known CW agents, protection against several Toxic Industrial Chemicals (TICs)**
  - **Total life cycle cost reduction (Operation & Maintenance)**

EFV Re-Gen Development Program

- **Major Tasks**
  - **System Requirements Review**
  - **Science & Technology (S&T) Optimization**
    - **EFV integration trade off analysis**
    - **Component characterization**
  - **System Development & Demonstration (SDD)**
    - **Prototype Design and Fabrication**
    - **Prototype T/E**
    - **EFV integration**
    - **Performance Specification**

Phase 1

Phase 2

Program Deliverables

- **Phase 1**
  - **3 prototypes (Developmental Testing & Operational Assessment / integration)**
- **Phase 2 Performance specification**

System Requirements Review

- **Evaluate existing NBC / Environmental Control System design per current requirements**
  - **EFV threat**
  - **Resources allocated and required**
  - **Excess Capabilities**
  - **ECS components and interfaces to NBC filter**
  - **Chemical filtration performance**
  - **Size/weight**
  - **Costs**

Science & Technology Optimization

- **Identify and evaluate components that require additional maturity**
  - **Analysis of interfacing points**
  - **Identify alternative designs**
- **Evaluate potential benefits of an integrated ECS and Re-Gen system**
  - **Estimate size, weight, costs of ECS components**
  - **Review heating, cooling, and chemical protection requirements specific to EFV**
  - **Propose configurations**

System Development & Demonstration - Testing

- **Leverage historical and existing Re-Gen test methods / protocols**
  - **ColPro Test Readiness Evaluation (TRE) Program**
  - **Comanche PSA**
- **Prototype integration for full-scale chemical testing**
- **Edgewood Chemical Biological Center capabilities**
  - **Filter Test Facility**
    - **Full Scale (200-2000 SCFM)**
  - **Prototype Test Facility**
    - **Quarter Scale (20-200 SCFM)**
  - **Laboratory hoods**
    - **Lab Scale (0.25 to 5 SCFM)**

SDD – Testing (cont'd)

- Concept demo in ECS test stand
- Prototype integration for environmental testing
  - MIL-STD-810
  - Mock-up ECS test stand built to simulate EFV design
  - NBC interface connections with EFV system components

CRITICAL DESIGN REVIEW

- Vehicle integration
- OA
  - USMC evaluation

Re-Gen Integration - Challenges

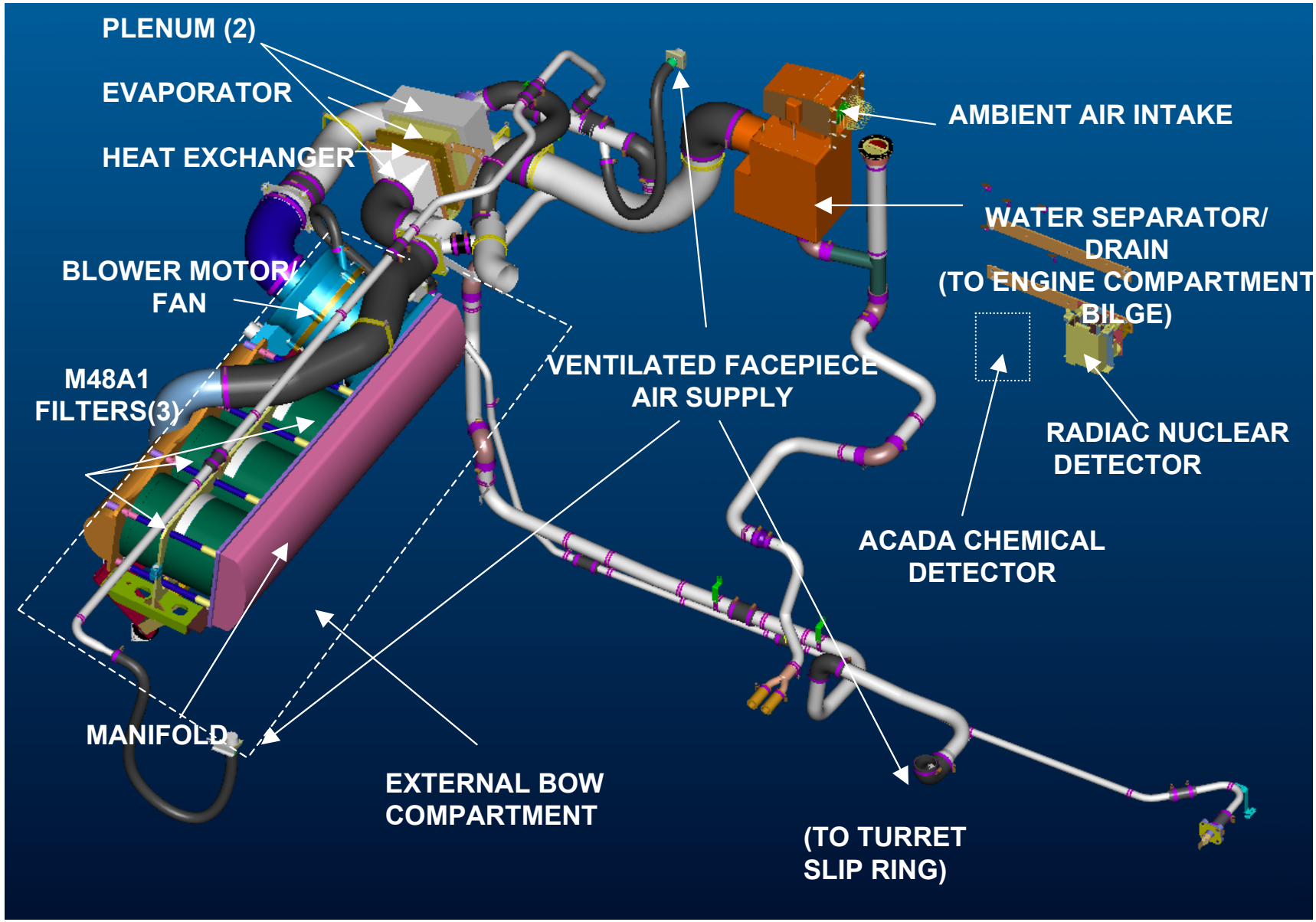
- Single-pass collective protection filtration traditionally ‘plug-in’ systems
- Resources / capabilities needed
- Mechanical design is more complex (filter controls)
- Purge characterization & handling
- Threat design-limiting agents or compounds

Summary

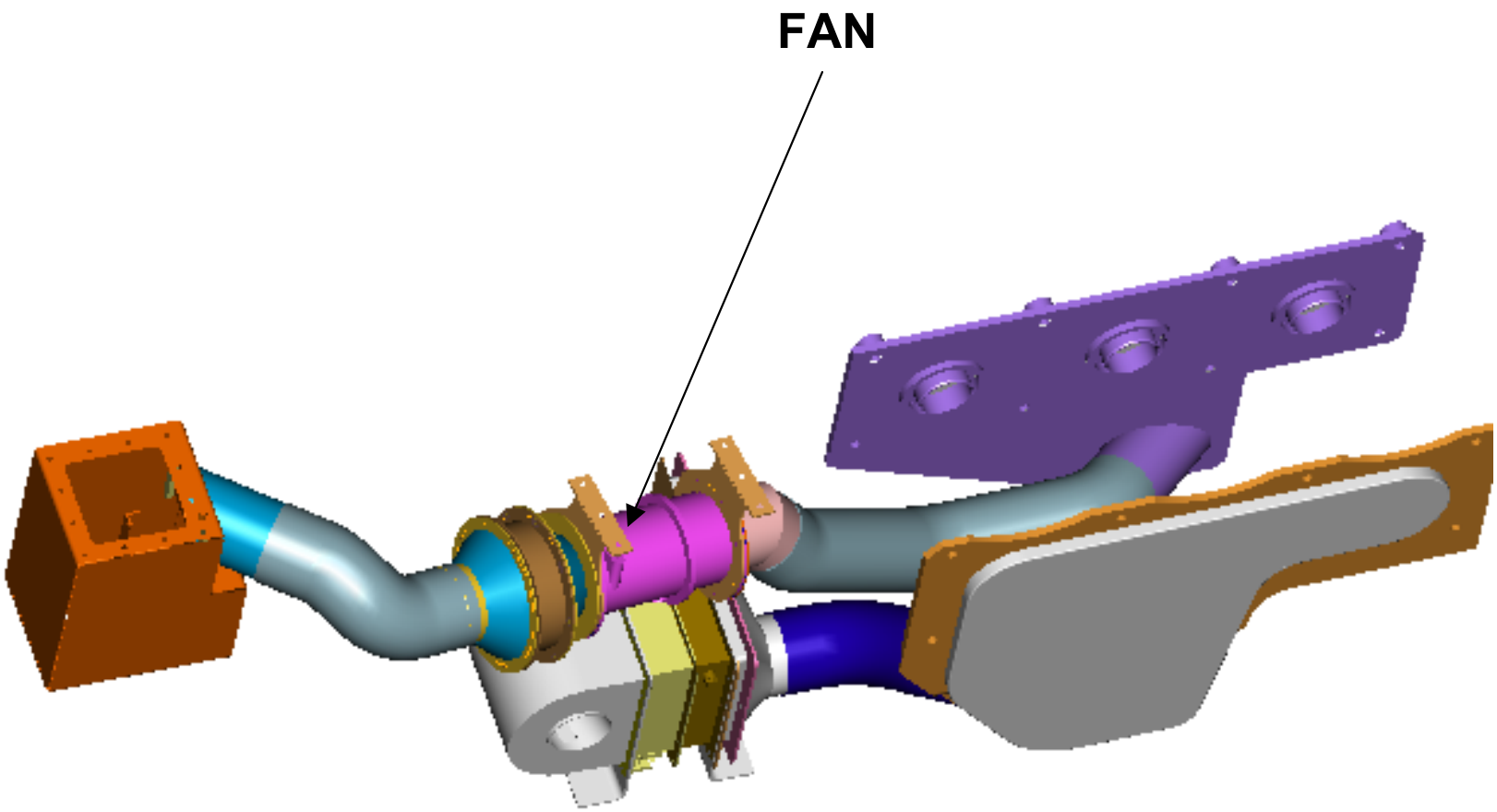
- **Program to deliver prototypes and specification to integrate a regenerative filter into the EFV variants**
  - **Review and evaluate NBC Filter and ECS components**
- **Re-Gen may require additional resources than single-pass filtration**
- **ECBC has test capabilities for lab- to full-scale systems**
  - **Test stand fabrication required to best simulate Re-Gen system integrated in EFV environment**
- **Production decision by DRPM-AAAV**

Backup Slides

Current C Vehicle
NBC System Concept Design

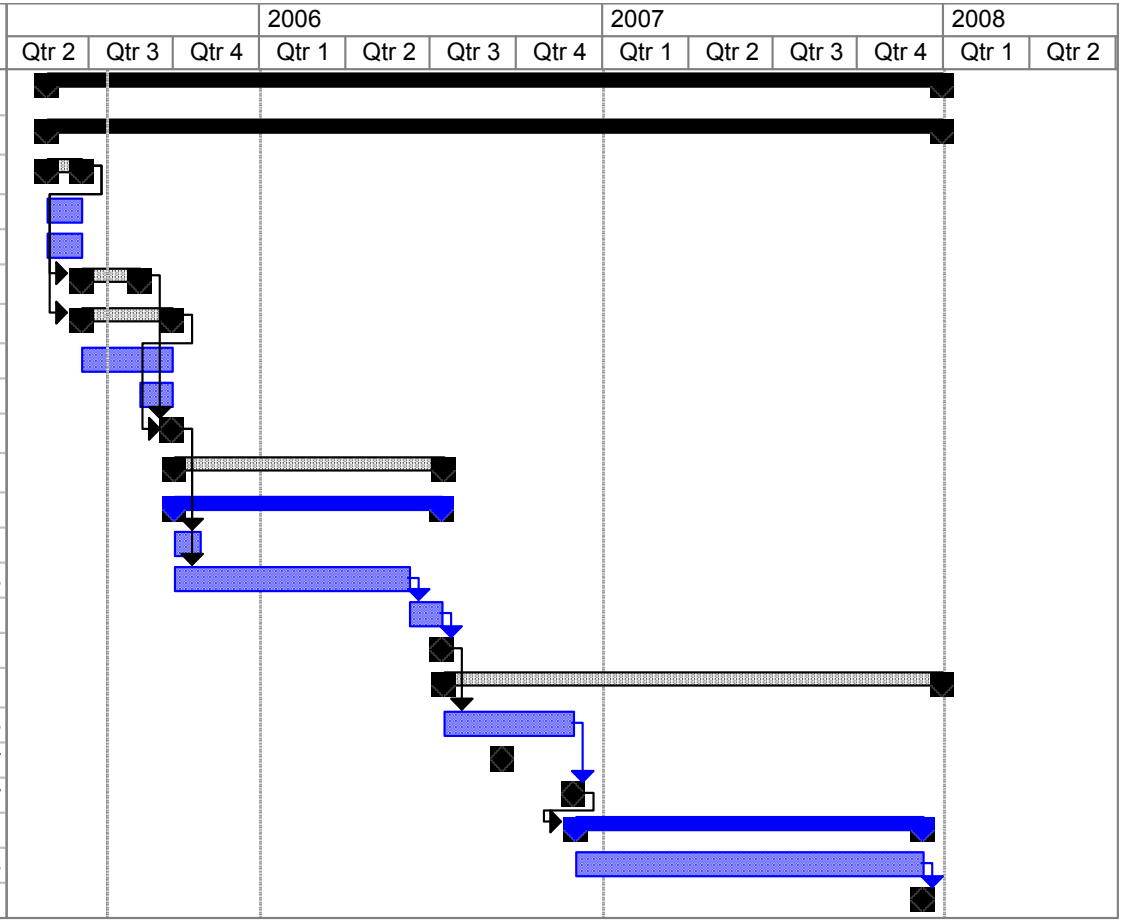


Current P Vehicle
NBC System Concept Design



Phase 1 Schedule

ID	Task Name	Duration
1	**REGEN DEVELOPMENT**	**684 days?**
2	**PHASE I**	**684 days?**
3	**PROJECT PLANNING**	**26 days**
4	Develop POA&M	26 days
5	Develop MOA	26 days
6	**CONTRACT DEVELOPMENT**	**45 days**
7	**SYSTEM REQUIREMENTS REVIEW**	**70 days**
8	EFV Integration Requirements	70 days
9	Assessment of Regen Technology	26 days
10	**DECISION REVIEW**	**1 day?**
11	**S&T EFFORT**	**206 days**
12	**Optimization Study of NBC / ECS System**	**205 days**
13	Identify items not well defined	20 days
14	Research system components and interfacing poir	180 days
15	Development and Evaluation of Alternative Design	25 days
16	**Decision Review**	**1 day**
17	**SDD EFFORT**	**381 days**
18	Preliminary Design of Filter System	100 days
19	**Preliminary Design Review**	1 day
20	**Complete Design**	1 day
21	**Fabrication of Prototype Filter System**	**265 days**
22	Procure, Build, Manage	265 days
23	**Prototype Delivery**	**15 days**



Phase 2 Schedule

ID	Task Name	Duration
24	**PHASE II**	**770 days?**
25	**SDD EFFORT (CONTINUATION OF PHASE I)**	**770 days?**
26	**Modify Test Facility for EFV specific ECS System**	**110 days**
27	Material Procurement	40 days
28	Facility Modification	70 days
29	**Integration of Prototype into Test Stand**	**14 days**
30	Integration of Prototype	14 days
31	**Complete Integration**	**1 day**
32	**Develop test Plan / Procedures**	**45 days**
33	Planning Effort	14 days
34	Test procedure Development	45 days
35	**Chemical Testing at ECBC**	**111 days**
36	Conduct Regen Chemical Testing	90 days
37	Delivery of Test Report	20 days
38	**Conclusion of Chemical Testing**	1 day
39	**Preliminary Design Review #2**	**1 day**
40	**Concept Demonstration**	**60 days**
41	**Set Up Prototype 2 for Environmental Testing**	**20 days**
42	Integration of prototype into Test Stand	20 days
43	**Environmental Testing**	**110 days**
44	Conduct Regen Environmental Testing	90 days
45	Delivery of Test Report	20 days
46	**Conclusion of Environmental Testing**	1 day
47	**Critical Design Review**	**1 day?**
48	**Integration Into EFV**	**71 days**
49	Integrate Into EFV	35 days
50	Special OA	15 days
51	Performance Spec	21 days
52	**Production Decision**	**1 day**