



Task Name

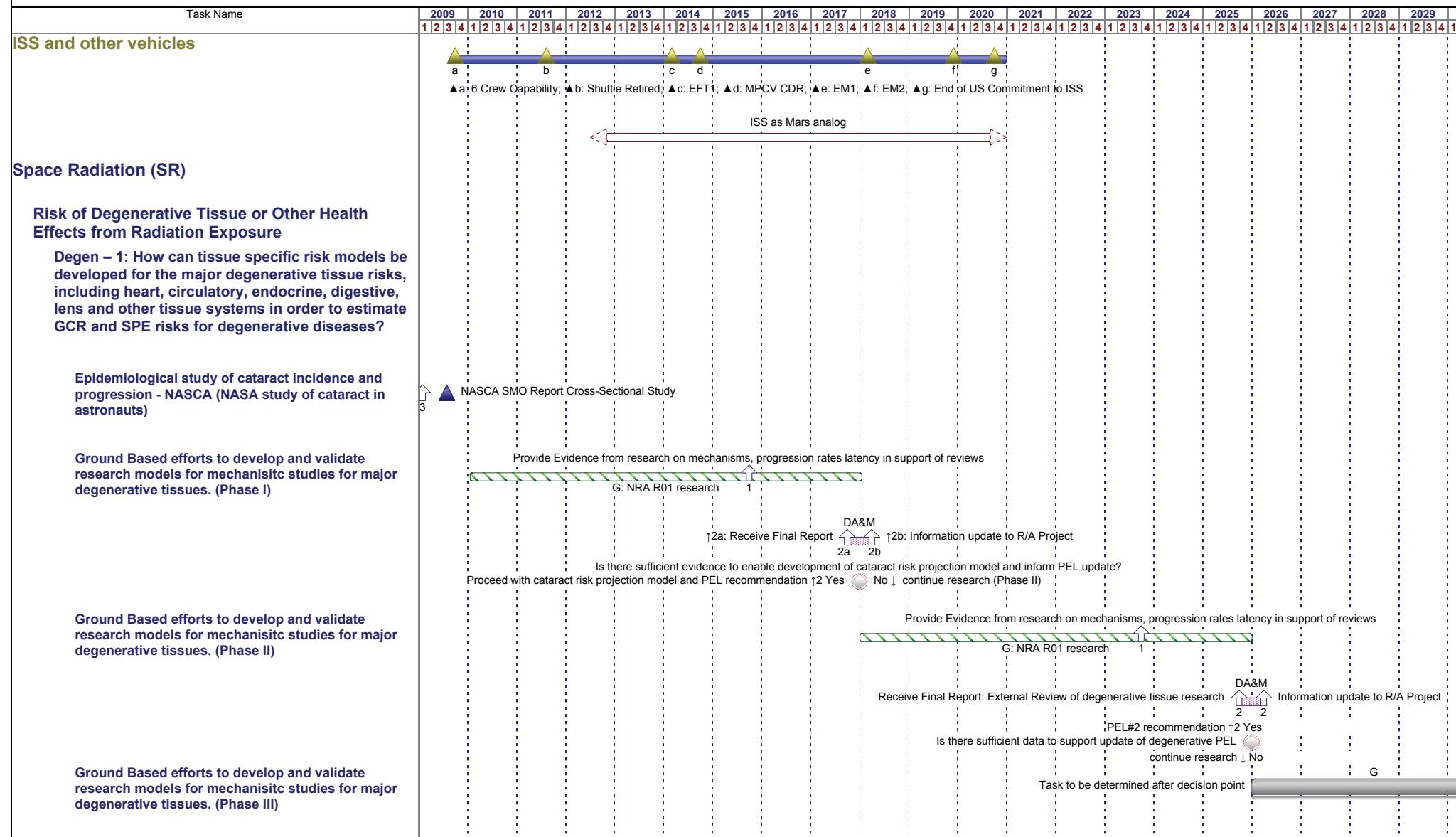
Task Name	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4		
ISS and other vehicles	a	b	c	d	e	f	g															
	ISS as Mars analog																					
Space Radiation (SR)																						
Risk of Degenerative Tissue or Other Health Effects from Radiation Exposure																						
Integration/Evaluation of Research Results																						
Degen PEL #1 Update Recommendation																						
Integration of Research Results																						
Independent Review of degenerative tissue research results including NSCOR, NRA and DOE Low Dose																						
PEL #1 Recommendation																						
Heart Risk Projection Model V.1																						
Cataract Risk Projection Model V.1																						
Degen PEL #2 Update Recommendation																						
Integration of Research Results																						
Independent Review of degenerative tissue research results including NSCOR, NRA and DOE Low Dose																						
PEL #2 recommendation																						
Heart Risk Projection Model V.2																						

Legend:

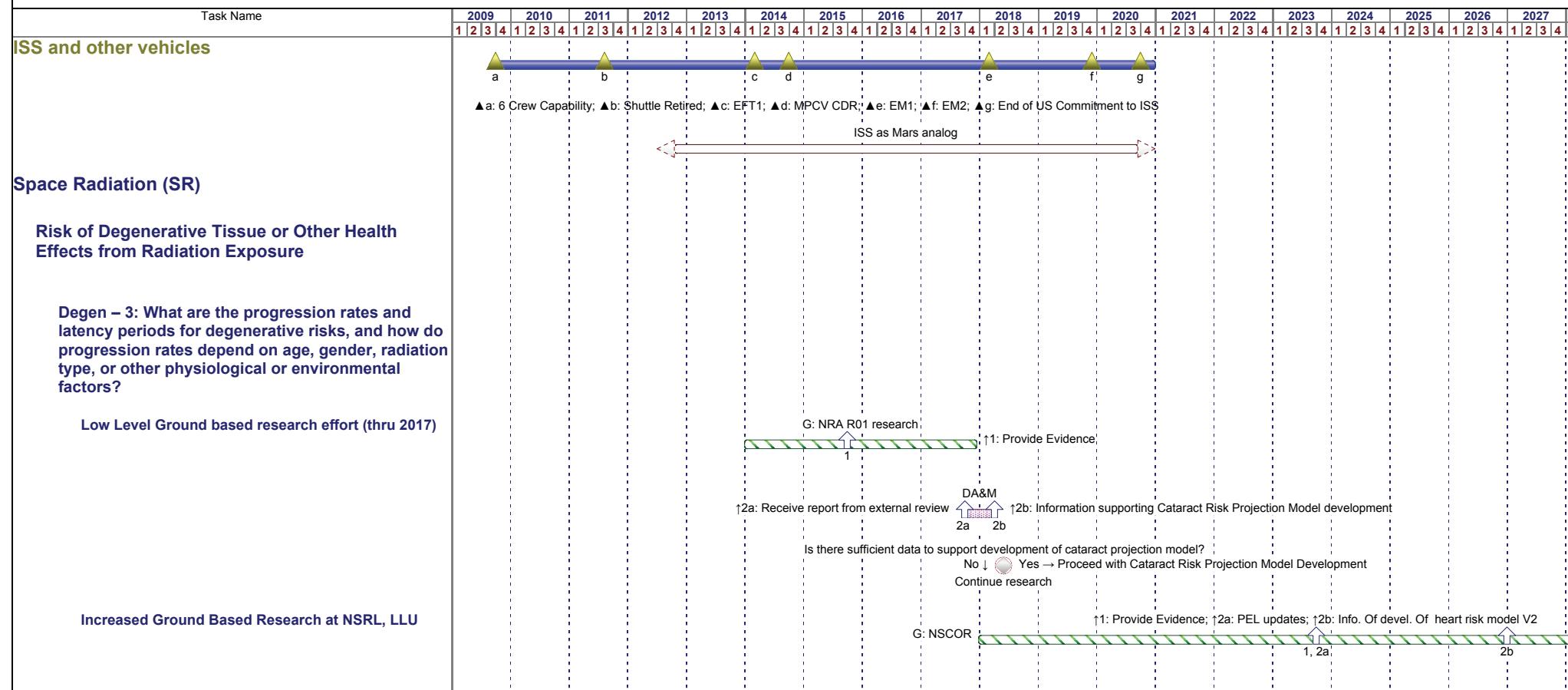
- ▲a: 6 Crew Capability
- ▲b: Shuttle Retired
- ▲c: EFT1
- ▲d: MPCV CDR
- ▲e: EM1
- ▲f: EM2
- ▲g: End of US Commitment to ISS

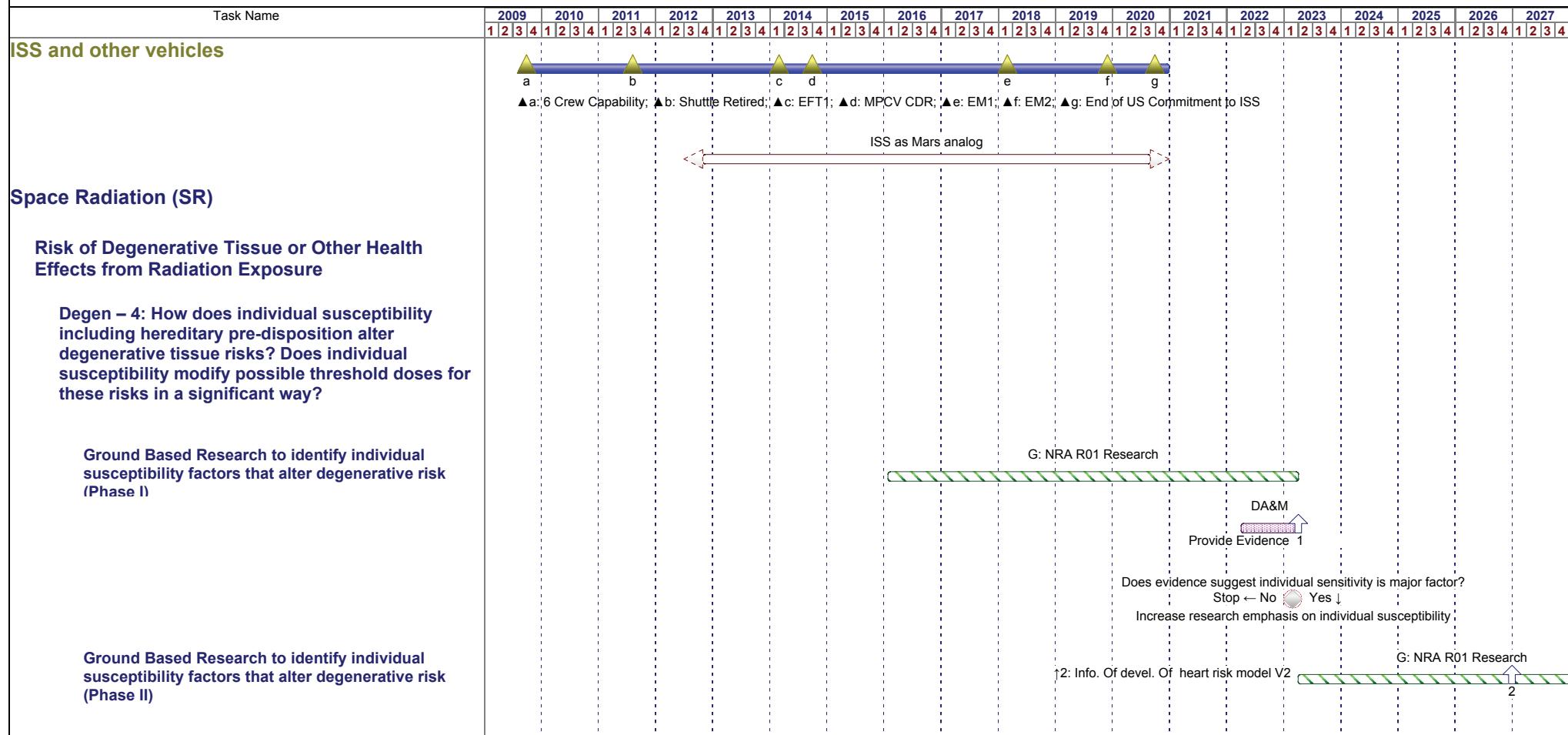
Annotations:

- ISS as Mars analog: A red double-headed arrow spanning from approximately 2011 to 2020.
- Evidence from Gaps 1-3: A callout pointing to DA&M step 1.
- Final Report: A callout pointing to DA&M step 4.
- DA&M: Model updates/Final V&V and documentation
- DA&M: Baseline Heart Risk Projection Model V.1
- DA&M: Model updates/Final V&V and documentation
- DA&M: Beta release of cataract model
- Delivery to Ops
- Is there sufficient data to support update of degenerative PEL? (Decision point)
- Yes → 14: Recommend PEL #1 update
- Is there sufficient data to support development of heart risk model? (Decision point)
- Yes → ▲a, ▲b, 15: Proceed with development of heart risk projection model
- Is there sufficient evidence to enable projection of cataract risk and inform PEL update? (Decision point)
- Yes → 15: proceed with cataract risk projection model and 14 PEL recommendation
- 11a: Evidence from Degen Gap 4, 7; 11b: Evidence from Degen Gap 1, 3
- 11: Information from Degen7 on space flight synergies
- 14: PEL Update #2 recommendation
- DA&M: Model updates/Final V&V and documentation
- 15: Heart Risk Projection Model V.2: delivery to Ops
- Is there sufficient data to support Version 2 of Heart Risk Model? (Decision point)
- Yes → 15: proceed











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ISS and other vehicles

a: ai 6 Crew Capability; b: Shuttle Retired; c: EFT1; d: MPCV CDR; e: EM1; f: EM2; g: End of US Commitment to ISS

ISS as Mars analog

Space Radiation (SR)

Risk of Degenerative Tissue or Other Health Effects from Radiation Exposure

Degen – 5: What quantitative procedures or theoretical models are needed to extrapolate molecular, cellular, or animal results to predict degenerative tissue risks in astronauts? How can human epidemiology data best support these procedures or models?

Low Level Ground based research effort (thru 2016)

G: NSCOR research

DA&M

↑2a: Receive data from Gap2; ↑2b: PEL#1 updates and model development

2a
2b

Is there sufficient data to enable development of a heart risk projection model?
↓ No Yes → Proceed with heart risk projection model V1.
Continue research

DA&M

↑2a: Receive data from Gaps 1-3; ↑2b: PEL#1 updates and model development

2a
2b

G: NSCOR research

↑ 2: PEL#2 updates and model development 2

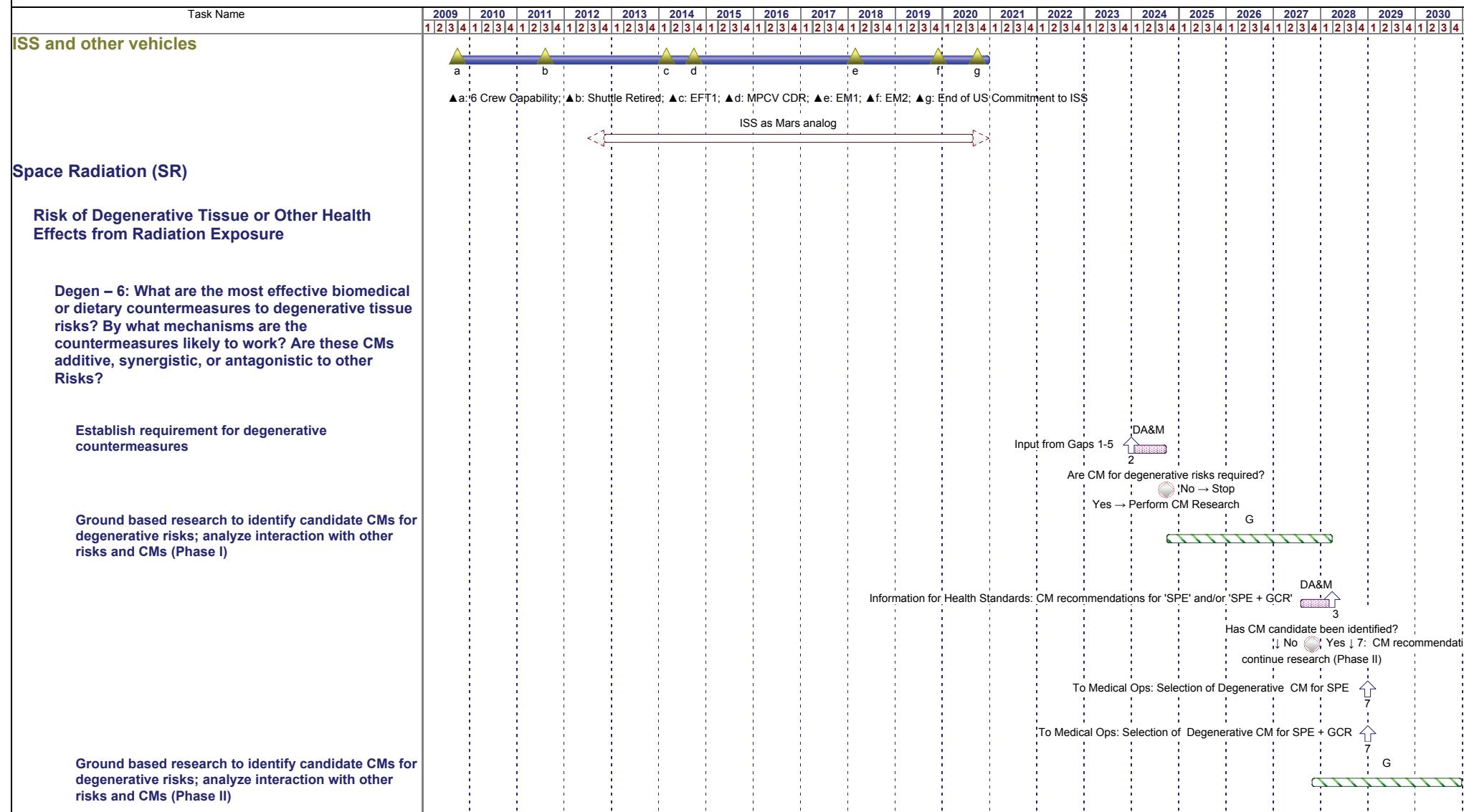
DA&M: Integration of Research Results from Gaps

↑ 2a: Inputs from independent review; ↑ 2b: Inputs from Degen 2,3,4

2a
2b

Is there sufficient data to support Version 2 of Heart Risk Model?
↓ No Yes → Proceed with heart risk projection model V2.

Ground Based Research NSRL





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▲ a: 6 Crew Capability; ▲ b: Shuttle Retired; ▲ c: EFT1; ▲ d: MPCV CDR; ▲ e: EM1; ▲ f: EM2; ▲ g: End of US Commitment to ISS

Space Radiation (SR)

Risk of Degenerative Tissue or Other Health Effects from Radiation Exposure

Degen – 7: Are there significant synergistic effects from other spaceflight factors (microgravity, stress, altered circadian rhythms, changes in immune responses, etc.) that modify the degenerative risk from space radiation?

Establish significance of synergistic effects

Conduct ground based research to determine influence of other spaceflight factors on development of degenerative tissue effects- Phase 1

Conduct ground based research to determine influence of other spaceflight factors on development of degenerative tissue effects- Phase II

Degen - 8: Are there research approaches using simulated space radiation that can elucidate the potential confounding effects of tobacco use on space radiation circulatory disease risk estimates?

Conduct ground based research on circulatory disease risks to understand nature of interaction bewteen smoking and space radiation

Information Exchange with HHC on possible Synergies with other factors

DA&M 8

G

Data update on synergies to RAP

DA&M 2

Updates supporting Degen PEL #2

Do spaceflight factors modify degenerative risk?
Stop → No *Yes → continue research on synergies

Task to be determined after decision point

12: Research updates in support of risk modeling

G 2