

Project Management: Lessons from Annual Linac Replacements

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About Sunnybrook

- 1946 opens as veterans' hospital
- 1966 University of Toronto teaching hospital
- 1982 Toronto-Bayview Regional Cancer Centre
- 2007 Odette Cancer Centre











Funding Context

- Single insurer
- Secure capital funding via provincial health agency (Ontario Health – Cancer Care Ontario)
- Credible five-year funding horizon
- Operational funding on a per case basis (with targets)
- Vendor-of-record model
- Local purchasing decisions









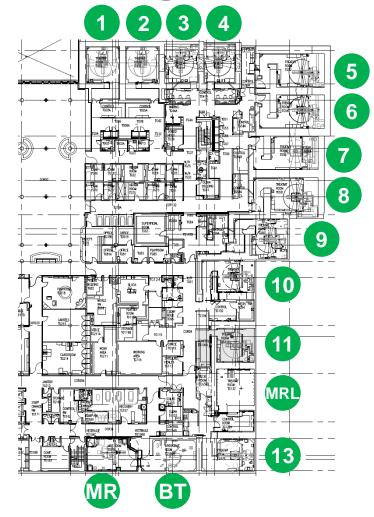


Radiation Treatment Program

- 12 linacs
- 1 MR-Linac
- 1 Gamma Knife™
- 1 HDR
- 4 CT-Sims
- 2 MR-Sims

Replacement Intervals

- linacs 12 y
- Gamma Knife[™] 15 y
- CT-Sims 9 y
- MR-Sims 10 y









Deming System of Profound Knowledge

Appreciation for a system

Understand the complexities and interactions of the system you are studying or working in.

project management

statistical process control

Knowledge of variation

Variation has two causes, common and special, which should never be confused.

Theory of knowledge

Use a scientific approach to testing theories. This is encapsulated in the plan-do-study-act cycle.

continuous improvement

ergonomics and human factors

Psychology

Treat people with dignity and respect. They are not cogs in a machine.

W. Edwards Deming, *The New Economics for Industry, Government and Education*, Massachusetts Institute of Technology, 1994







understand the work we do







Quality Tools

Decision Matrix

Gantt Chart

Roles and Responsibilities Matrix (RACI)

	Weight	Ver	dor 1	Ven	dor 2	
		Score	Weighted Score	Score	Weighted Score	
	[1-5]	[1-5]		[1-5]		
Support for growing patient volume with an short booking times, high clinical uptime.	3	4	12	5	15	
Integrated volumetric imaging, online image-guided radiotherapy. Motion management and precise remote couch motion	5	4	20	5	25	
Support for adaptive radiotherapy program. Accessories and immobilization systems compatibility	5	3	15	5	25	
Specialized quality assurance phantoms and devices must be included.	2	5	10	5	10	
Connectivity with our existing Radiation Oncology Information System. Interoperability with Pinnacle (Phillips) treatment planning system and other TPSs	5	5	25	3	15	
Safety, quality, automation, ergonomics.	4	3	12	4	16	
Score			94		106	



	Role 1	Role 2	Role 3	Role 4	Role 5
Task 1	R	R,A	С	•	T.
Task 2	1	R,A			
Task 3	R,A	C	R	R	1
Task 4	Α	R			1
Task 5	Α	R			







Decision Matrix Example

Evaluation of 5-year linac RFP

- Departure from replace-with-like model
- Decision to undertake fleet management approach
- No longer focus on technical parameters of linac
- Focus on satisfying program requirements
 - Patient volumes
 - Treatment techniques
 - Alignment with vendor roadmap







Multi-factor decision-making

Situation:

Decision to enter an extended agreement for linac procurement

Constraint:

Must procure via Request for Proposals

Problem:

How to select one option when multiple factors must be considered?







Decision matrix

Evaluates and prioritizes a set of options

Step 1: Identify criteria for decision

Step 2: Weight criteria

Step 3: Score options for each criterion

Step 4: Sum scores and rank options

			Options							
		weight	1	2	•••	N				
	1	w_1	S _{1,1}	S _{1,2}		S _{1,N}				
Criteria	2	W_2	S _{2,1}	S _{2,2}		S _{2,N}				
Crit	:		:	:	•	:				
	M	W _M	S _{M,1}	<i>S_{M,2}</i>		S _{M,N}				
		Scores	$\sum_{m=1}^{M} w_m s_{m,1}$	$\sum_{m=1}^{M} w_m s_{m,2}$		$\sum_{m=1}^{M} w_m s_{m,N}$				







Decision Matrix must match RFP criteria

Functionality and	Value-add and	Service, Warranty,
features	Innovation	Training

operations

innovation

sustainability







Functionality and features

Value-add and Innovation

Service, Warranty, Training

Must support growing patient volumes

Short booking times

Integrated volumetric imaging

Some units with motion management, precise motion

Specialized quality control phantoms included

Connectivity with existing infrastructure

Ergonomic design







Functionality and features

Value-add and Innovation

Service, Warranty, Training

- Alignment with research program
- Strategic relationship options
- Options for practice management
- Creative workflow management







Functionality and features

Value-add and Innovation

Service, Warranty, Training

Training program (RTs, MPs, service)

Educational program

Consultation on product integration into program

Warranty coverage

Total cost of ownership

Maintenance, upgrades, and service

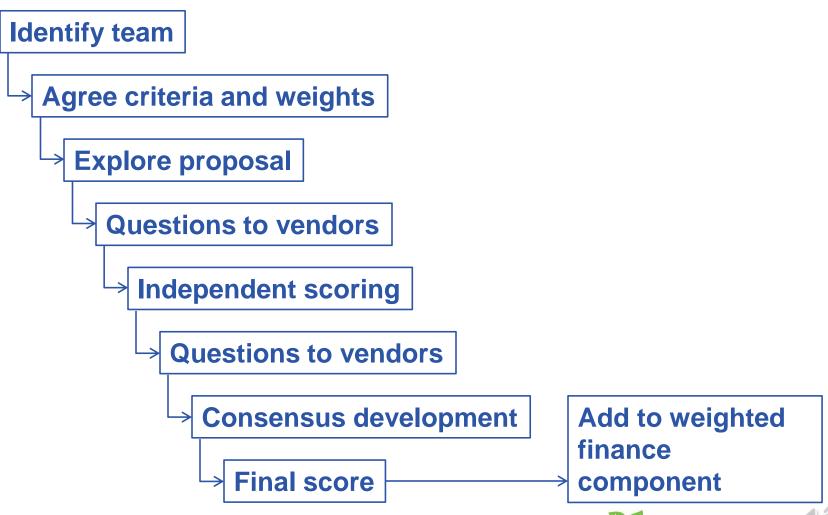
OEM warranty







Evaluation process









Linac RFP evaluation

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Safety, quality, automation, ergonomics.	4	3	12	4	16
Score	9		94		106







Decision matrix: the big wins

- Forces value statements
- Structure enables development of consensus







Quality Tools

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Task 2	1	R,A			
Task 3	R,A	C	R	R	1
Task 4	Α	R			1
Task 5	Α	R			







Gantt Chart

A bar chart that shows

- Tasks
- Order of execution
- Accountable
- Duration of task
- Current state

Time

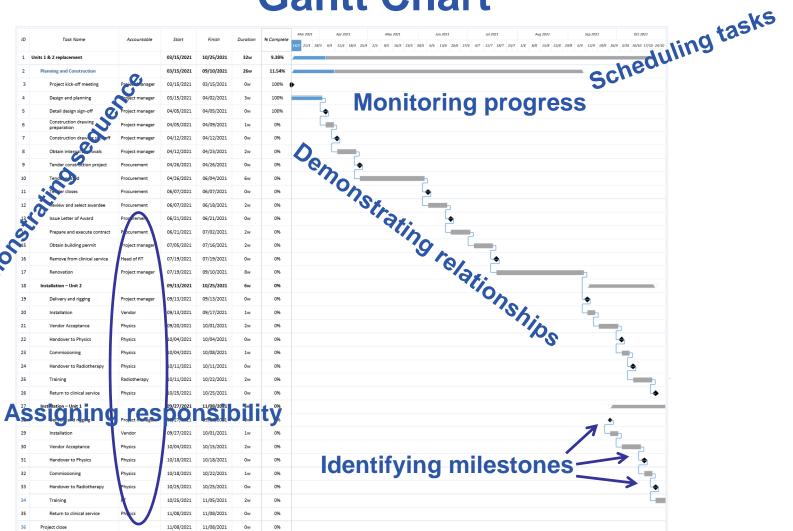
Tack	Name		Mar 202	21 Apr 20
D Task	Nume		28/2 7/3 14/3	21/3 28/3 4/4 11/4
1 Select ven	ndor			
2 Design and	d planning			
3 Detail des	sign sign-off			
4 Prepare co	onstruction			
5 CD signoff	f			
6 Post tende	er			







Gantt Chart









Example: A busy two years

- Major capital projects
 - Replace one linac in FY2020/2021
 - Replace adjacent linac in FY2021/22
 - Replace a CT in FY2020/2021
 - Reload Gamma Knife in FY 2020/2021







High-level plan

Multi-linac RFP

Unit 2 replacement

Unit 1 replacement

Gamma Knife _____source replacement

					_	
D	Taik Name	Start	finale	Duration	heparable	G 20 G 20
1	Multi-line NP	08/05/3000	06/06/2000	17w	-	Jan Mar Mar Ayr Map Am Jan Map Map Mar Mar
	Multi-lines RFP meeting	GBUCE/3000	GE/GE/0000	Der Der	_	
		GB/05/3000	GB/GB/0000			•
4	Prepare draft Innovation EFP			Bur		
*	Pot line: HP	94/01/2020	04/08/5000	Our		•
5	NP pecial	94/08/2020	24,496,0000	3 or		Ġ
6	NP Cam	25/08/2020	25/08/0000	Ow	Funes	<u>_</u>
7	Review and select tender	25,037,2020	14/04/2020	3w	Breen	- <u>-</u>
8	Obtain Board Approvals	15,04/3020	25,/04/0000	2 ar	Fuses	<u> </u>
,	Prepare and execute contract.	22,/04/2020	05/05/0000	2w	Funes	رق
0	Intradion to CHSD	06/05/2020	06/05/0000	Own	Breen	•
11	Unit 2 replacement	29/06/2020	12/07/2021	Ster		~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~
2	Construction phase	29/06/2020	26/06/2021	25 w		V 7
3	Prepare project estimate document	29/06/2020	30/57/2020	2w		D ₁
4	Flanning & construction drawing preparation	13/07/2020	92/30/2000	2w		
5	Obtain Internal approvals	05/30/2020	36/30/0000	2w		
6	Tender construction project	19/30/2020	29/20/2020	Ow		5
7	Tenderspooled	18/30/2020	20/11/0000	See		Ġ
9	Tender closes	23/11/2020	23/11/2020	Ow.		5
9	Review tenders and select contractor	23/11/2000	04/12/0000	Our 2m	-	9
0		07/12/2000	58/12/0000 58/12/0000	2w		- W
	Propers and execute contract					-
1	Obsein building permit	21/12/2000	05/06/0025	2w	_	- m
2	Remove Franciscal service	04,61/3021	04/05/0001	Out	_	•
9	Construction	04/01/2021	26/09/0021	2w		ر ا
4	Installation phase	29/08/3021	12/09/3021	15w		▽ ▽
s	Unit 2 delivery	29/09/3021	29/09/0003	Ow		ي ا
٠	Intelligion	29/08/3021	07/06/0023	(ter		
2	Acoptance leading	10/06/3021	54/06/0003	3m		<u></u>
8	Handover to Physics	17,06/3021	17/06/0021	Our		
,	Commissioning	17/06/2021	25/06/0023	fur.		
0	Handover to Eadlethenpy	28,06/3021	26/06/0023	Ow		-
1	Training	28/06/2021	08/07/0023	24		Ę.
•	Return to dirical service	13,00/3021	12/09/0001	Ow.		-9
1	CT-Sim 1 replacement	22/06/2020	06/06/0021	SA.2w	_	-
	Sourcing Phase	22/04/3030	05/07/2020	20w		7
		22,04/2020	05/05/0000	24		
•	Propert CT-Sen REP					В
8	Post CT-Sim RFP	06/05/2020	06/05/0000	Own		5
7	CT-Sim HFP posted	06/05/2020	36/08/0030	3w		Lag.
8	Close CT-Silm RFP	27,08/2020	27/08/0000	Out		<u> </u>
9	Raview and select vendor	27/05/2020	09/09/0000	2w		L _B
ю	Obtain Board approvals	10/06/2020	96/06/0000	244		<u> </u>
ı	Prepare and execute contract	17/06/2020	30/06/0000	2w		Ğ.
2	Instruct CMD to proceed with planning	01/07/2020	05/07/2000	Own		<u> </u>
9	Construction Phase	05/07/2020	30/30/2021	25w		V
×	Prepare project extinute	01,07/2020	\$4,697,0000	2w		لق
8	Planning / construction drawing preparation	15/07/2020	06/30/0000	12w		L
6	Obtain internal plan approvals	07/30/2000	20/30/0000	2w		C _D
7	Tender construction project	21/30/2020	21/30/0000	Ow		'
	Tender posted	21/30/3020	24/11/2020	Sw		
0	Tender closes	25/11/2020	25/11/0000	Ow		5
0	Review tender submissions	25/11/2020	08/12/0000	2w		Ġ
	Prepare and execute contract	08/12/2020	22/12/0000	2w		E
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۰	Commissioning	26/04/2021	28/04/0021	.fw		5
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ı	Training	29,04/2021	08/08/0023	3m		_
2	Return to diskul service	04/05/2021	06/06/0023	Our		-
8						
4	Garana Krife Source reload project	29/06/2020	17/07/2020	lur.		VMV
8	Update purchase agreement	29,06/2020	17/07/2000	3w		
	Update purchase agreement Flanning and construction drawing properation	07/12/2020	08/08/2021	21.2w		
,	Prepare construction estimate	07/12/2000	18/12/0000	2w		
8	Construction preparation and tendering	21/12/2000	96/01/0021	24		<u> </u>
1			GK/GK/0021 GK/GR/0021			<u> </u>
1	Tender project	19/01/2021		3w		7
0	Review and select tender	09/02/2021	05,08,0021	3w		
1	Prepare and execute contract	02/08/2021	22,08,0021	3w	_	-
2	Obtain building permit	23/09/3021	12,04,0001	2w		ل
9	Source loader pethway construction	13/04/2021	03/05/0021	2w		-
	Clinical downtime	35/00/3021	14/04/2021	2w		W
	Remove from clinical services	31/09/2021	31/08/0001	Out		•
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_	Garrena Kriffe Source Delivery				_	
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5	Acceptance testing	05/04/2021		.tw Ow		4
5	Acoptance testing				Elekto GK tearn	ц, •

Extradepartmental audience







Detailed plan

▮				L	
24	Installation phase	29/03/2021	12/07/2021	15w	∇
25	Unit 2 delivery	29/03/2021	29/03/2021	0w	→
26	Installation	29/03/2021	07/05/2021	6w	
27	Acceptance testing	10/05/2021	14/05/2021	1w	<u>_</u>
28	Handover to Physics	17/05/2021	17/05/2021	0w	
29	Commissioning	17/05/2021	25/06/2021	6w	
30	Handover to Radiotherapy	28/06/2021	28/06/2021	0w	<u> </u>
31	Training	28/06/2021	09/07/2021	2w	L_B_
32	Return to clinical service	12/07/2021	12/07/2021	0w	└ ◆

- Needs another Gantt Chart
- Medical physicists like detailed plans
- Need to identify individual tests
- Can turn to Guidelines for advice







Mid-level planning

- The most interesting and most challenging
 - Commissioning
 - Detailed plan: how to do each test
 - Mid-level planning: how to fit all tests in schedule
 - High-level planning: get tests on Gantt Chart
 - Training
 - Detailed plan: Session content and staff
 - Mid-level planning: Identify curriculum and trainees
 - High-level planning: Identify scope







Gantt chart: the big wins

- Forces explicit consideration of steps and their relationships
- Consider three levels in hierarchy
 - High-level planning
 - Mid-level planning
 - Detailed planning







Quality Tools

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	Role 1	Role 2	Role 3	Role 4	Role 5
Task 1	R	R,A	С	•	I
Task 2	1	R,A			
Task 3	R,A	C	R	R	1
Task 4	Α	R			1
Task 5	Α	R			







Project charter

Objective

Background

Project Objective

Project Scope Included Excluded

Benefits
Critical Requirements
Assumptions
Issues
Risks
Critical Success Factors

Project Approach Milestones

Roles and Responsibilities Matrix Communications







Who does what?

A RACI chart assigns roles within a project

Responsible	 the ones doing the work
Accountable	manager or delegatorlast reviewer of task
Consulted	domain knowledgedownstream project team
nformed	 kept in the loop







Benefits of a RACI Matrix

Responsible

Accountable

Consulted

nformed

	Role 1	Role 2	Role 3	Role 4	Role 5
Task 1	R	R,A	С	I	I
Task 2	1	R,A	1	1	1
Task 3	R,A	C	R	R	1
Task 4	A	R	1	1	1
Task 5	A	R	1	1	1

- Clarifies complicated projects
- Identifies decision-making
- Helps visualize workload equity
- Informs new team members







Benefits of a RACI Matrix

Responsible

Accountable

Consulted

nformed

	Role 1	Role 2	Role 3	Role 4	Role 5
Task 1	R	R,A	С	I	I
Task 2	1	R,A	1	1	- 1
Task 3	R,A	C	R	R	- 1
Task 4	A	R	1	1	1
Task 5	A	R	1	1	1

One or more Responsible roles per task

Must have only one Accountable role per task







Interpreting the RACI matrix

Column contents

- Too many Rs
- Only Rs and As
- Too many As
- Too many Cs

Risk

- Unbalanced workload
- Staff overload
- Centralized authority
- All talk, no action!

	Role 1	Role 2	Role 3	Role 4	Role 5
Task 1	R	R,A	С	I	I
Task 2	1	R,A	1	1	1
Task 3	R,A	C	R	R	1
Task 4	A	R	1	1	1
Task 5	Α	R	- 1	- 1	- 1







Interpreting the RACI matrix

Row contents

- No Rs
- Too many Rs
- Too many Cs and Is

Risks

- Who's doing the work?
- Complicated task
- Entire team involved
- Slowed work?

	Role 1	Role 2	Role 3	Role 4	Role 5
Task 1	R	R,A	С	I	I
Task 2	1	R,A	1	- 1	1
Task 3	R,A	C	R	R	1
Task 4	Α	R	- 1	I	I
Task 5	A	R	1	1	1







RACI Matrix

Prochenent Admin Associate Responsible **Accountable** Consulted nformed **Prepare RFP** R R,A **Post RFP** R,A R Review RFP; select vendor R,A R **Obtain C-suite approvals** A R **Prepare contract** R







RACI matrix: the Big Win

- Sets expectations for roles
- Clarifies project assignments
- Balances workload







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