

	Case Name: <b>Patient Transport System</b>	Sector	IT (Medical)
	<b>OR-AS</b> Operations Research - Applications and Solutions <a href="http://www.or-as.be">www.or-as.be</a> <a href="mailto:info@or-as.be">info@or-as.be</a>	<b>Baseline Schedule</b> Schedule with resources Schedule with costs	
Submitted by	Els Van Impe	<b>Risk Analysis</b> Random simulation One of nine std. scenarios User defined distributions	
Date	December 16, 2011		
File Name	C2011-07 Patient Transport System.p2x	<b>Project Control</b> Automatic tracking Tracking based on user input	

## 1. Project description

Project authenticity

Design, installation (including staff training) and evaluation of an ICT-supported patient transport system in the general hospital Sint-Jan in Bruges (Belgium).

The project consists of activity, resource and cost data that were obtained directly from the actual project owner.

## 2. Project properties

### 2.1. Baseline Schedule

General	
# Activities	49
Planned Duration (PD)	389 days*
Budget At Completion (BAC)	180.759 €
Renewable Resources	5
Consumable Resources	-

\* standard eight-hour working days

Network topology	
Serial/Parallel (SP)	70%
Activity Distribution (AD)	70%
Length of Arcs (LA)	7%
Topological Float (TF)	8%

### 2.2. Risk Analysis

Random simulation by ProTrack was performed using the default symmetric triangular risk distribution profiles.

	Cost sensitivity		
	avg [%]	std dev [%]	skew [-]
CRI-r	12.8	12.3	1.5
CRI-rho	15.5	13.5	1.4
CRI-tau	16.9	17.7	2.5

	Resource sensitivity		
	avg [%]	std dev [%]	skew [-]
CRI-r	44.2	23.8	1.5
CRI-rho	42.0	25.2	1.7
CRI-tau	29.6	21.8	1.7

	Time sensitivity		
	avg [%]	std dev [%]	skew [-]
CI	71.4	45.2	-1.0
SI	74.6	40.6	-1.0
SSI	3.7	13.8	6.8
CRI-r	9.6	13.9	5.4
CRI-rho	11.0	14.2	4.8
CRI-tau	17.9	16.7	2.0

### 2.3. Project Control

### 2.3.1. Simulated forecasting accuracy

The accuracy of time and cost forecasting methods has been evaluated based on Monte Carlo simulation runs using the risk profiles described in section “2.2. Risk Analysis”. Based on these risk profiles, the Mean Absolute Percentage Error (MAPE) and Mean Percentage Error (MPE) have been calculated to evaluate the expected accuracy of the time and cost predictions, EAC(t) and EAC, respectively.

Simulated EAC(t) accuracy		
method - PF	MAPE [%]	MPE [%]
PV - 1	11.5	9.5
PV - SPI	17.5	1.2
PV - SCI	25.0	-23.6
ED - 1	10.1	7.6
ED - SPI	16.3	-0.3
ED - SCI	20.3	-13.2
ES - 1	8.5	6.7
ES - SPI(t)	10.4	-0.2
ES - SCI(t)	16.0	-12.8

Simulated EAC accuracy		
method (PF)	MAPE [%]	MPE [%]
1	11.3	11.3
CPI	5.8	-0.2
SPI	13.7	3.6
SPI(t)	9.9	4.6
SCI	14.3	-10.2
SCI(t)	11.7	-8.7
0.8 CPI + 0.2 SPI	5.6	1.3
0.8 CPI + 0.2 SPI(t)	5.1	1.2

According to the MAPE values<sup>1</sup> the best performance for time forecasting can be expected from the unweighted Earned Schedule method. For cost forecasting the CPI-weighted method and the two methods using a composite performance factor should yield the best results.

### 2.3.2. Tracking description

Manual tracking was performed over 23 tracking periods with a length of approximately one month. The Real Duration and Real Cost mentioned in section “2.3.3. Earned Value Management” are based on manual user input.

Tracking authenticity

The tracking information obtained from the project owner and introduced in ProTrack includes actual activity start dates and durations, but no actual activity costs.

<sup>1</sup> The MAPE gives the best indication for the forecast accuracy (the lower the MAPE, the more accurate the method) since all deviations from the targeted real duration (real cost) are cumulated, whereas for the MPE underestimates can be compensated by overestimates and vice versa, possibly leading to an overly positive evaluation of a certain method. However, the MPE can provide useful information about the nature of the deviations, i.e. does the method rather underestimate or overestimate the real duration (real cost)?

### 2.3.3. Earned Value Management

#### 2.3.3.1. Performance metrics

	CV [€]	SV [€]	SV(t) [d]	CPI [-]	SPI [-]	SPI(t) [-]	p-factor [-]
avg	-3.897	-15.44	-41.17	0.96	0.79	0.84	0.97
std dev	3.567	18.479	40.17	0.02	0.23	0.17	0.04
final	-10.306	0	-56.00	0.95	1.00	0.87	1.00

#### 2.3.3.2. Time forecasting

PD	389 days
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Real Duration	445 days
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Late	14.40%
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EAC(t)		Real Accuracy		
method - PF	avg [d]	std dev [d]	MAPE [%]	MPE [%]
PV - 1	422.23	39.78	9.0	-5.2
PV - SPI	557.29	237.44	37.3	25.1
PV - SCI	584.14	248.86	38.8	31.2
ED - 1	441.35	47.54	8.9	-0.9
ED - SPI	563.99	233.61	36.1	26.6
ED - SCI	579.06	245.75	38.1	30.0
ES - 1	430.09	40.02	8.0	-3.4
ES - SPI(t)	493.61	138.42	20.0	10.8
ES - SCI(t)	505.10	145.38	20.8	13.4

#### 2.3.3.3. Cost forecasting

BAC	180.759 €
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Real Cost	191.065 €
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Over Budget	5.70%
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EAC		Real Accuracy		
method (PF)	avg [€]	std dev [€]	MAPE [%]	MPE [%]
1	184.657	3.567	3.4	-3.4
CPI	189.385	3.021	1.2	-0.9
SPI	247.417	94.638	32.2	29.5
SPI(t)	220.595	56.065	18.0	15.5
SCI	225.208	100.838	34.9	33.6
SCI(t)	227.049	60.265	20.1	18.8
0.8 CPI + 0.2 SPI	195.428	9.337	3.9	2.3
0.8 CPI + 0.2 SPI(t)	193.215	7.216	2.7	1.1