

# TOC World® 2002

~ a legendary conference ~  
November 4-7





Armament Development Authority

BY AIR

**Virtual Multi-level Critical Chain (VMCC)**

for

**System-of-Systems Decision Control**

based on

**TOC Project Management Methodology – CCPM**

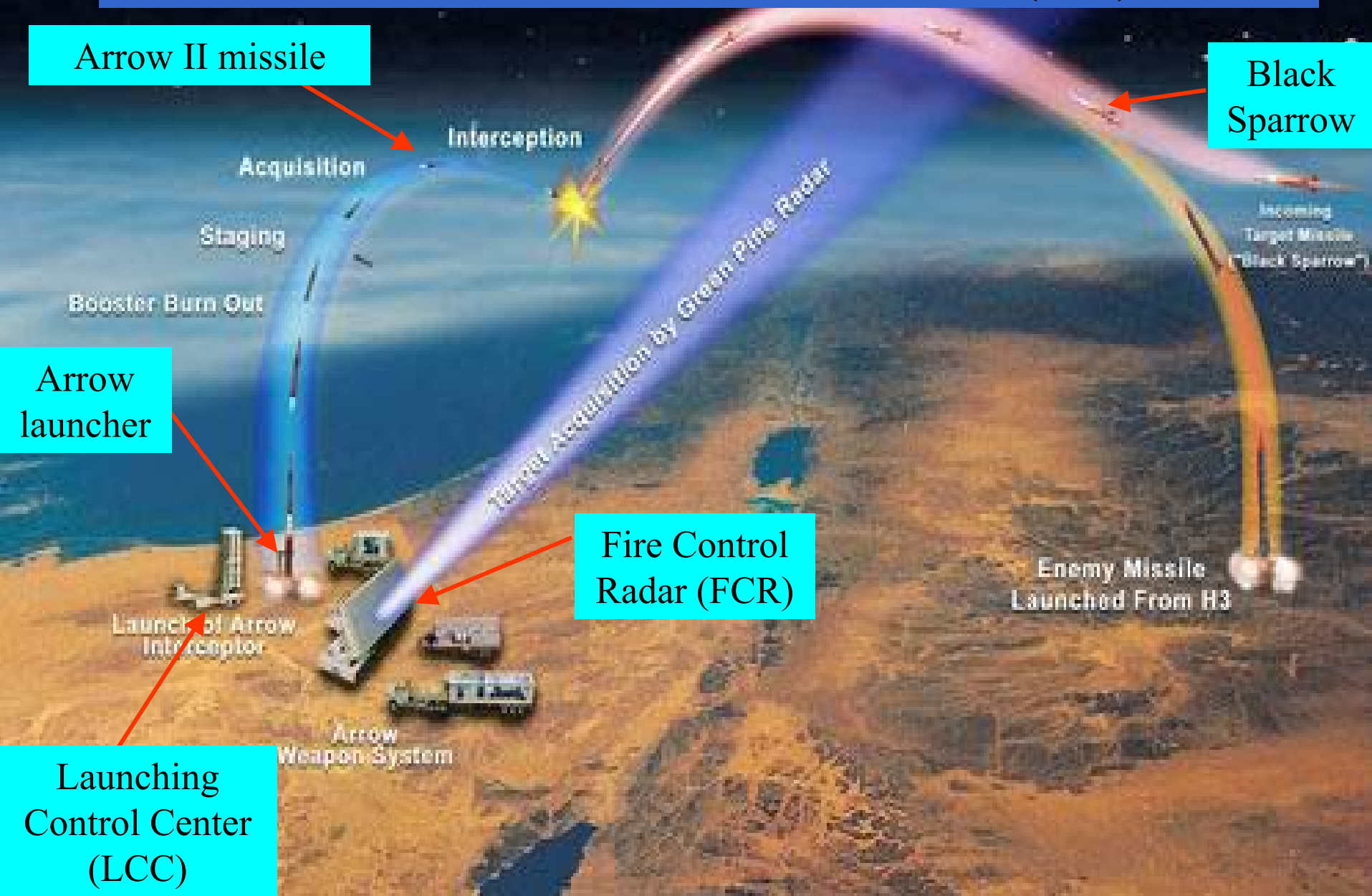
AT SEA

**Yossi Peleg**  
**Rafael**

## System-of-Systems (SoS) Definition I

- An integrated array of units designate to achieve a specific target. For example: An Israel Aircraft Industries (IAI) product, the *Arrow Weapon System (AWS)*.
- A System of Systems is defined as a Project, as such it should have a Project plan. This project plan is constructed of Sub-Projects plans.

# SoS Sample: The Arrow Weapon System (AWS) of the Israel Aircraft Industries (IAI)



## Unit Definition II

- An integrated array of Systems designate to achieve a specific target where system is sub-unit and unit is sub SoS.

At Rafael, every Unit is a project that is constructed of numerous systems. Each system owns an MS-Project plan.

# Units Samples: List of Units in AWS System

1. The Arrow II Interceptor
2. Arrow II Launchers
3. Hazelnut Tree System - Launch Control Center (LCC)
4. Green Pine System - Fire Control Radar (FCR)
5. Target Missile System – Black Sparrow
6. A Theater Ballistic Missiles (TBM) detect and identify system
7. Software
8. ILS
9. System Engineering



# System Definition III

- Sub Unit.

An integrated array of Assemblies designate to achieve a specific target. For example: the booster of the missile, the engine of the missile etc.

At Rafael every System owns a plan (a single MS-Project file) consists of goals, objectives, risks, budget, well defined work to be done, deliverables, schedule, milestones. Each plan is assigned a leader from one of the divisions or vendors that is responsible for the system and its plan.

# TOC in Rafael

- The implementation of TOC at projects in Rafael was a gradual process.
- Rafael has cooperated with the Goldratt Institute (Israel) in introducing the CCPM methodology. A team lead by Dr. Alex Klarman, who works with us for many years, was our partner at that endeavor. The phases of the implementation process were:
  1. Single project management, according to *CCPM*.
  2. Multi-project management, using ***DRUM***
  3. Virtual Multi-level Critical Chain (*VMCC*) project Management.

# Rafael's OBS

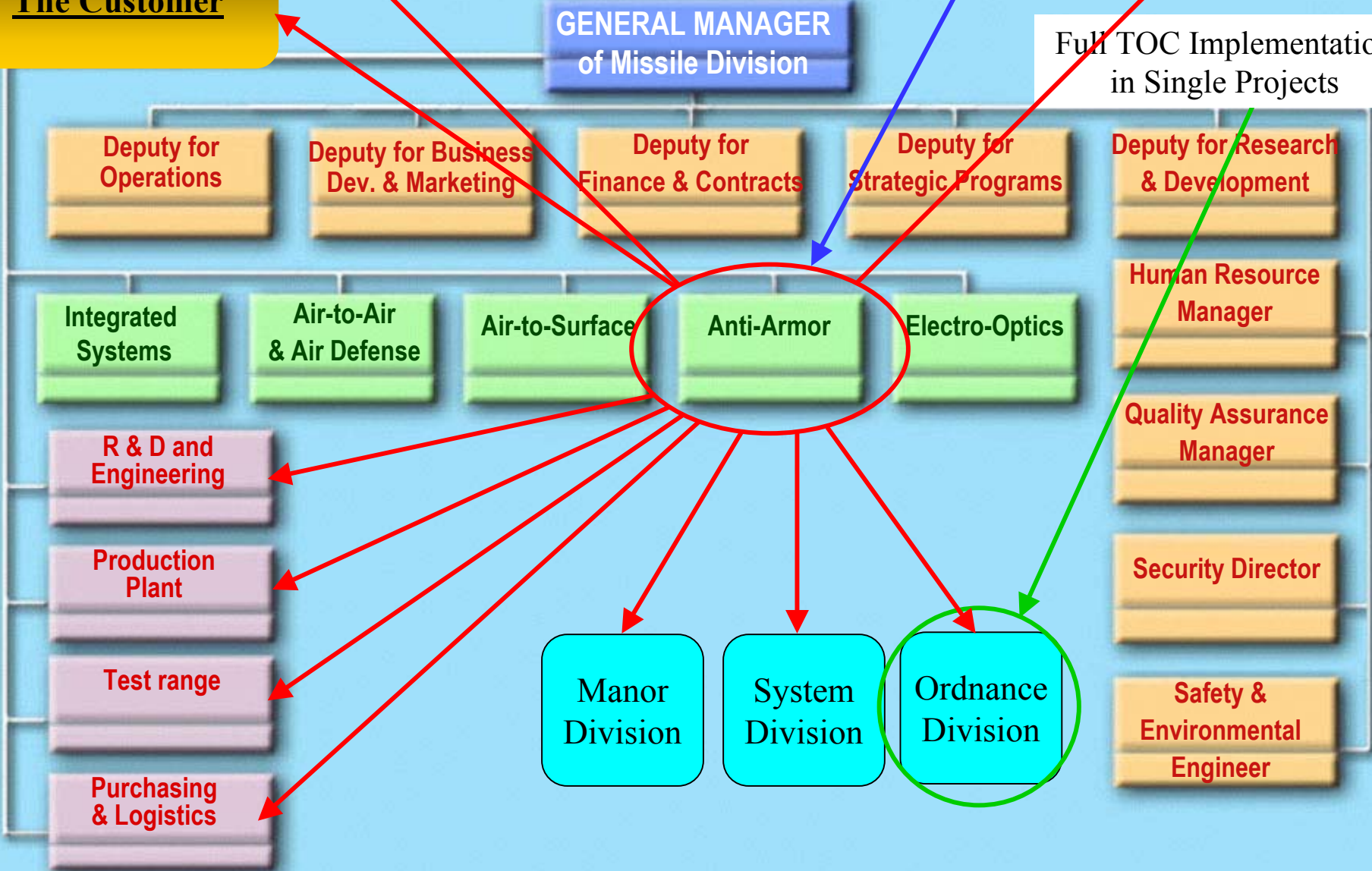
Out Sourcing / Partners

Rafael Management

The Customer

VMCC – A Project Decision Control Environment Based on TOC - CCPM

Full TOC Implementation in Single Projects



# Virtual Multi-level Critical Chain (VMCC) Projects Management

TOC methodology with independent multi projects files connected together using 5 types of buffers, addition of Project to Project (P2P) Buffer:

1. Critical Chain Completion (project) Buffer.
2. Feeding Buffers.
3. Contractual Milestones Buffers.
4. Capacity Buffer Management.
5. P2P Buffer.

The infrastructure is MS-Project and Concerto

## **Project Managers Responsibilities**

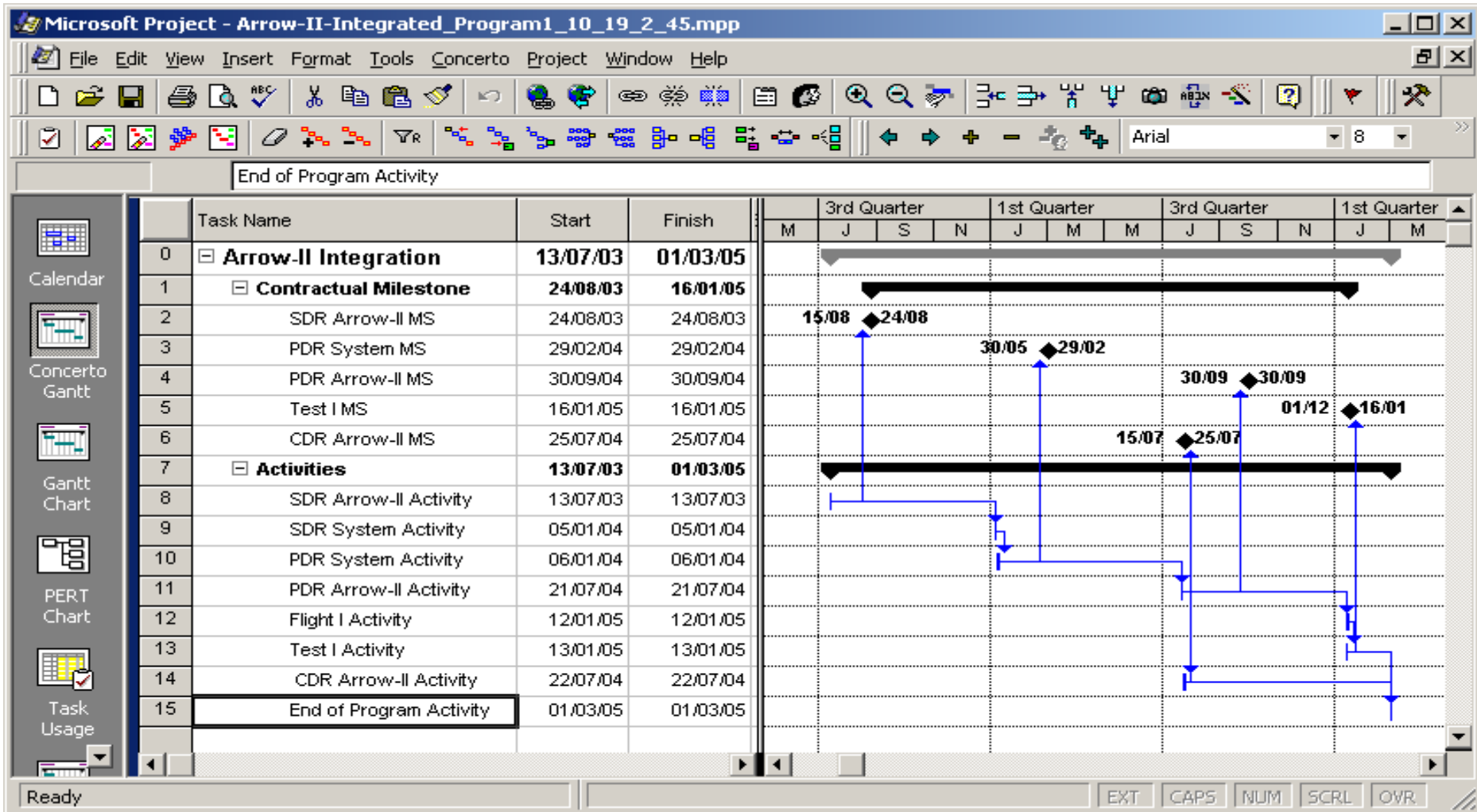
- The SoS manager shall be responsible for the customer deliveries and the SoS budget and performances.
- The unit manager reports to the SoS manager regarding issues of budget and performance.
- The Sub-Unit manager reports to executing division and shall be responsible to deliver quality units components on time within budget range.

## Benefits of SoS from the VMCC PM environment

1. Provides an integrative synchronous SoS plan that enables easy and accurate Management control.
2. Supports management decision making.
3. Enables buffer P2P and Mile-Stones Management control.
4. Supports easy debrief problems by projects managers.
5. Supports autonomic original plans management by every Leader.
6. Full commitment of the leaders to their plans.
7. Minimum cost of ownership is needed to implement and maintain VMCC PM environment (it is based only on MS-Project and Concerto).

- Infrastructure
  - SoS master plan based on the contract.
  - Integration and Test Plan based on Risk plan.
  - Units plans with internal Mile-Stones based on Project Master Plan.
  - Systems plans based on Project Master-Gantt.
- Outcome
  - SoS warnings.
  - Projects warnings.
  - Debriefing a Problems.

# Arrow II Integrated Plan in MS Project



# Arrow II Integration Plan in Concerto (after BM run)

Concerto 3.0 - Microsoft Internet Explorer

עורה בלים מועדפים תצוגה שריכה קובץ

http://olap-test/conweb/gr.htm

**Speed to Market** | Logout | User Admin | Data Admin | Task Update | Execution Views | Resource Portal | P2P Planning

Portfolio: .All Portfolio  
 Business Unit: .All Business Unit  
 Customer: .All Customer  
 Project Manager: .All Project Managers  
 Projects: Arrow-II-Integrated\_Program1

Project Status:  
 New  Being modified  
 Regular  Completed  
 Contractual Milestones  
 P2P Buffers  
 Feeding Buffers

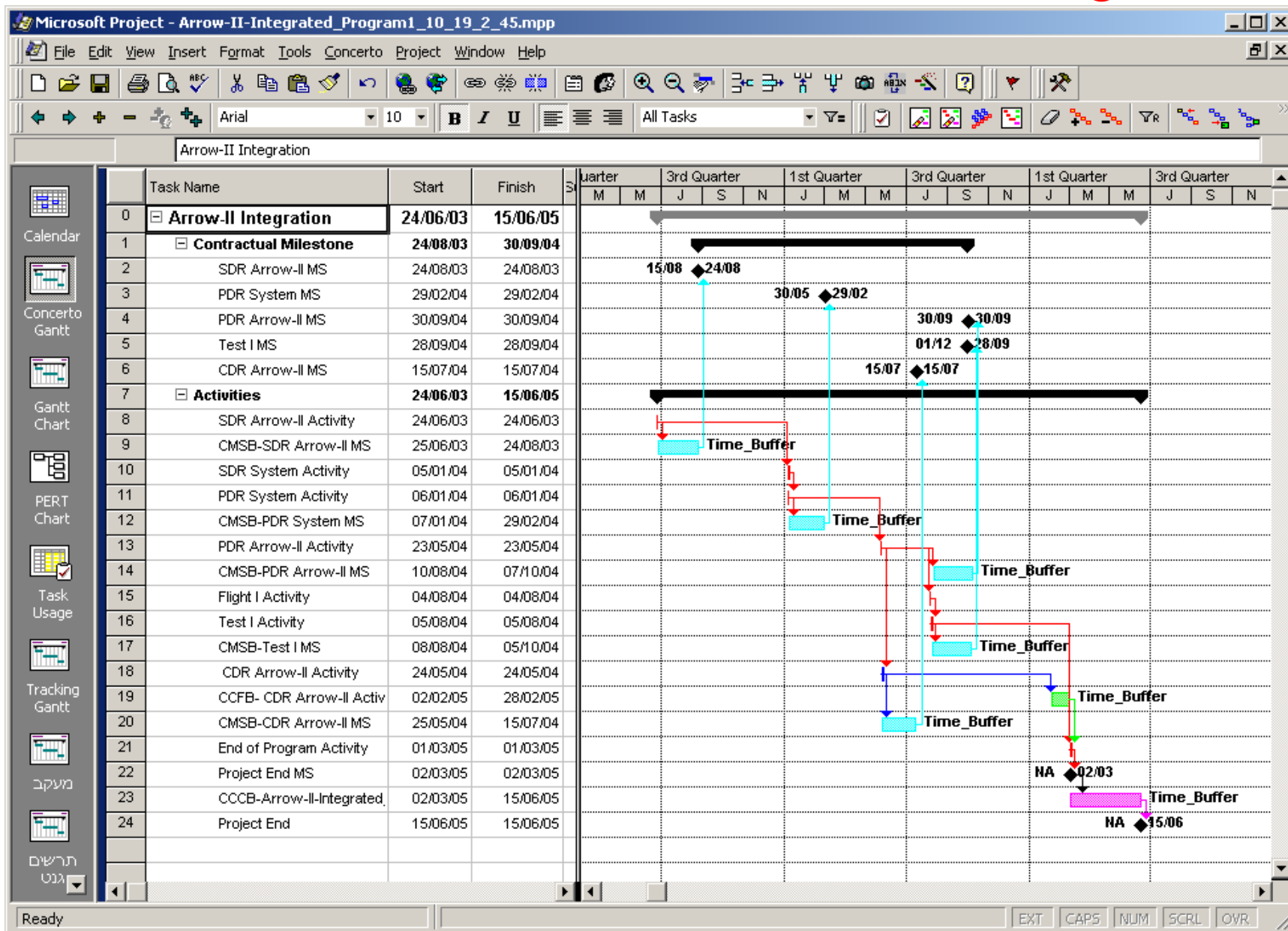
Print Preview  
 Export to Excel  
 Advanced Sort

Create Report

Description	Due Date	Projected Date	Buffer Consumed	Longest Chain Complete	Penetrating Task	MSP ID	Task Mgr	Last Update	Comments
Project: <a href="#">Anow-II-Integrated_Program1</a> Project Mgr: <i>Jacob</i> Status: <i>Regular</i> Due Date: <i>15/06/2005</i>									
SDR Missile MS	15/08/2003	24/08/2003	34%, 14d/41d	0%, 0d/2d	SDR Anow-II Activity	8	Jacob		
PDR System MS	30/05/2004	29/02/2004	0%, 0d/41d	0%, 0d/4d		NA			
CDR Missile MS	15/07/2004	25/07/2004	113%, 46d/41d	0%, 0d/6d	PDR Arrow-II Activity	13	Jacob		
PDR Missile MS	30/09/2004	30/09/2004	0%, 0d/41d	0%, 0d/5d		NA			
Test I MS	01/12/2004	16/01/2005	302%, 122d/41d	0%, 0d/7d	Flight I Activity	15	Jacob		
Project End	15/06/2005	15/06/2005	0%, 0d/81d	0%, 0d/8d		NA			

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# Arrow II Int. MSP Plan with buffers after Integration



# Summary

- VMCC-PM is based on TOC methodology and gives all the advantages of buffer management.
- VMCC-PM is a new way to create virtual projects build of activities from multilevel structure of MS-Project plans.
- With VMCC-PM environment the SoS management can control and synchronous the project.
- With VMCC-PM environment the SoS management is capable to make the right decision on time.