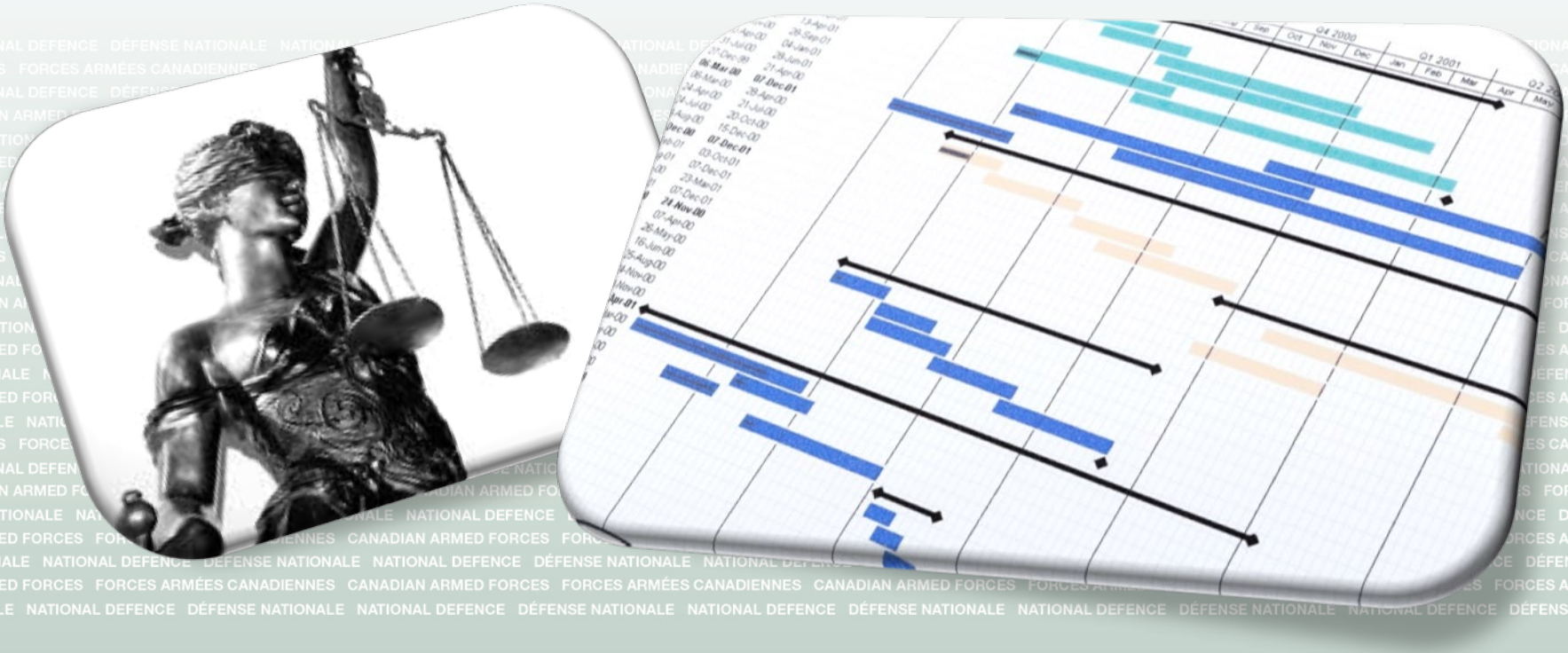
Is This Schedule Credible?



Who is Jonathan Shriqui?

General Electric

Energy - Manufacturing Cost Analyst

LOCKHEED MARTIN

Defence - Financial Planning & Analysis

BMT

Defence - Project Control Consultant

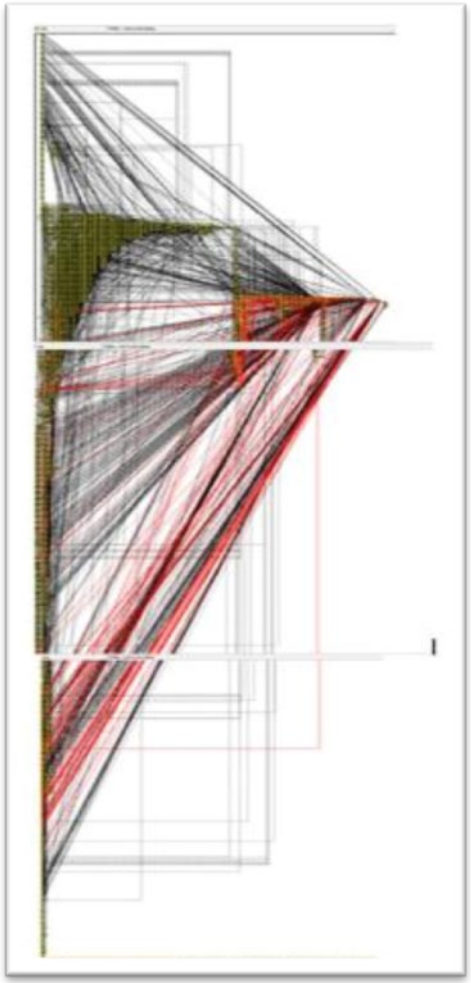
National Defence | Défense nationale

Defence - Project Control Management Specialist - EVM

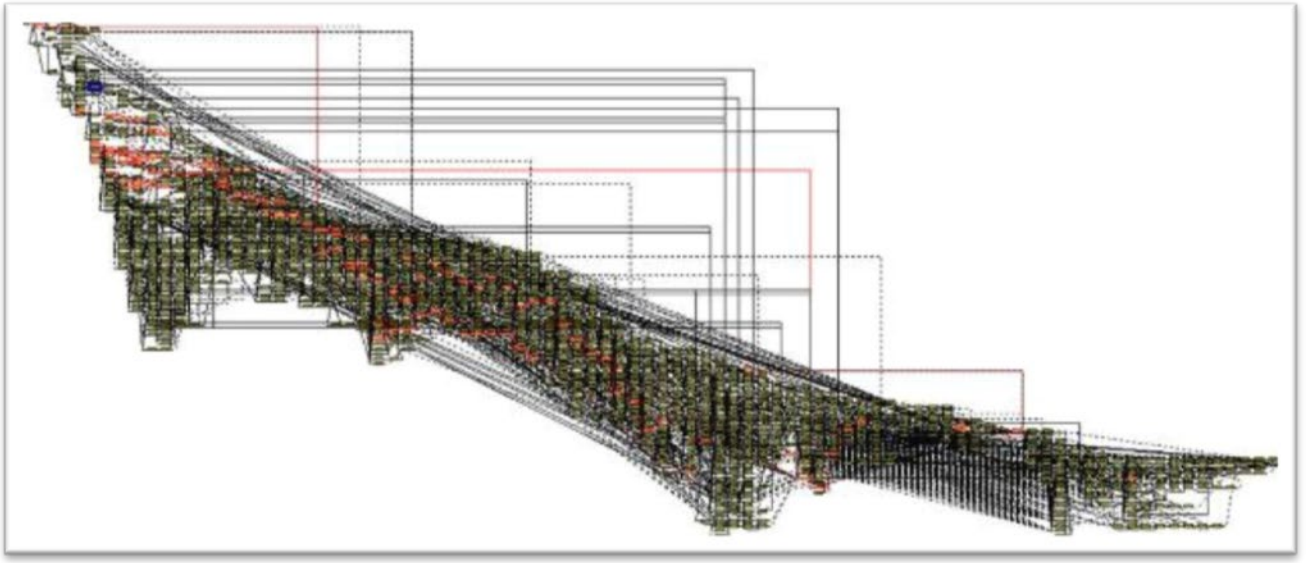
What is a project schedule?

- A schedule is **not** a checklist!
- A schedule, *or an Integrated Master Schedule* (IMS), is a **system** which integrates logically sequenced project work, cost and resources to accomplish project objectives.
- A schedule is a living, breathing & **dynamic** document.
- Is the **focal point** of program management.
- It is the **foundation** of Earned Value Management (EVM).

Checklist or Schedule?



Checklist
(no or little logic)



Schedule
(logic)

IMS Architectures: IMP & WBS

Integrated Master Plan - IMP (Leadership View)

An **EVENT** based plan ("How") that should set the foundation for the IMS.

- Level 1 : ***Significant Events*** (Testing Complete)
- Level 2 : ***Significant Accomplishments*** (Road Test Complete)
- Level 3 : ***Accomplishment Criteria*** - (Acceleration Test Complete)
  - (Braking Test Complete)

Work Breakdown Structure (Project Team View)

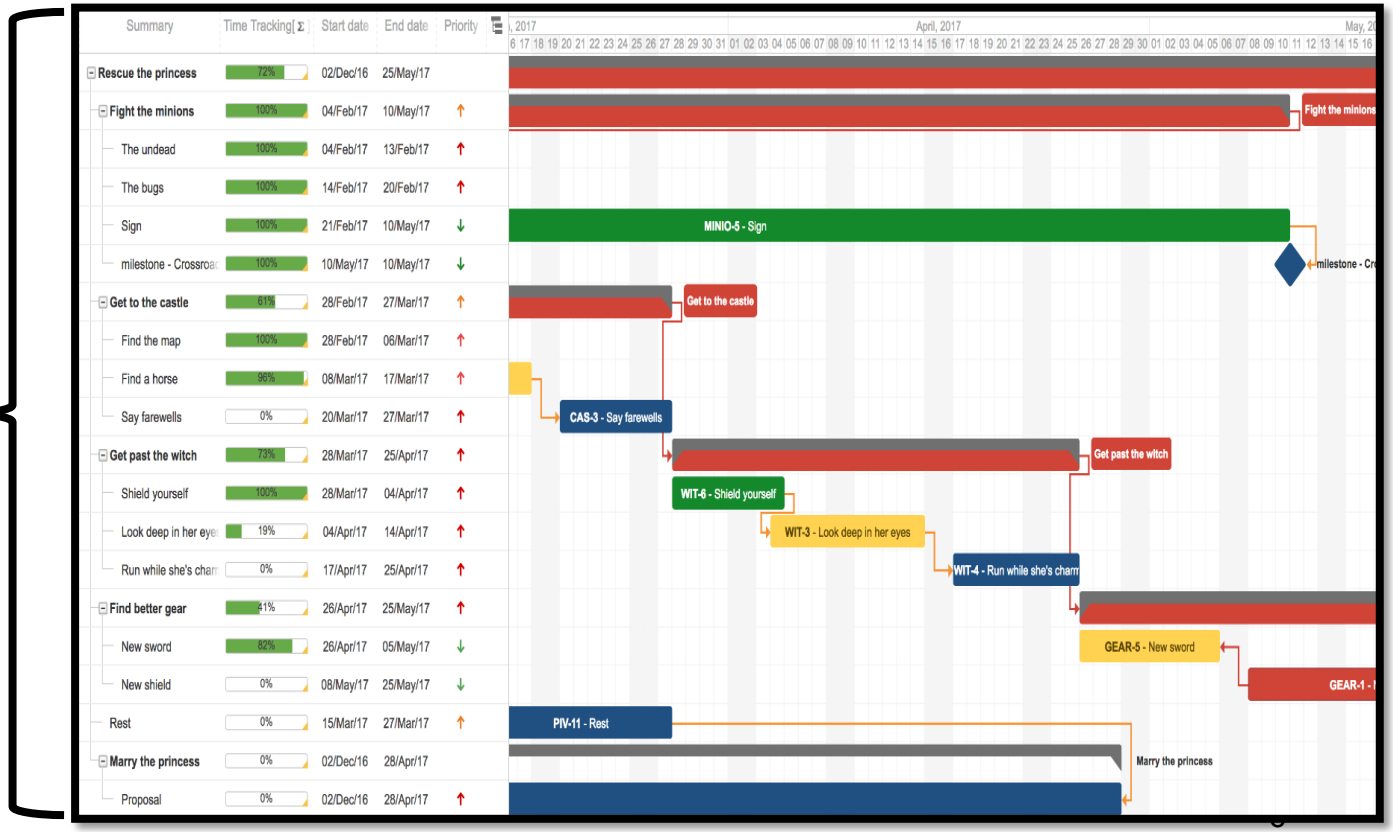
DELIVERABLE-BASED oriented based plan ("What") which depicts the task required to complete the product.

1.1- Frame
1.2- Engine
1.3- Transmission
1.4- Body

IMS Architecture: IMP & WBS

IMP
The "How"

WBS
The "What"



Basic Schedule Elements

- **Project milestones**
  - Leadership and/or high level reporting
- **Schedule Tasks** (Schedule Activities)
  - Lowest level of a finite scope of work that is traceable to a WP, CA, WBS
- **Resources**
  - Internal vs external (subcontractor)
- **Durations**
  - Milestone do not have durations
- **Logic Relationships** (F-S, F-F, S-S, S-F)
  - Foundation of the schedule network
- **Constraints (Hard/Soft)**
  - Date restriction based on a factor (i.e.: contractual obligation)

Schedule Duality

Baseline Schedule

- Initial IMS development
- Should be set within **60 - 100 days** of contract award
- Representative of all scope of work
- Under configuration control
- Accepted by customer and contractor
- Foundation for EVM
- Changes to milestone requires leadership/contractual approval.

Forecast (Current) Schedule

- Updated periodically to program performance and a path forward.
- The task durations is what differentiates the Baseline to the Forecast

Each task in the IMS has both baseline and forecast dates.

Generally Accepted Scheduling Principals

Purpose	GASP	Interpretation
Valid	Complete	The schedule captures the **entire** authorized project effort from start through completion.
	Traceable	The schedule network logic is horizontally (IMP) and vertically (WBS) **integrated** to key documents.
	Transparent	The schedules provide visibility to assure it is complete, traceable, has documented assumptions and provides **full disclosure** of program status and forecast.
	Statused	The schedule (forecast) has **accurate progress** throughout the status date.
	Predictive	**The schedules provide meaningful critical paths & accurate forecast for the remaining work through program completion.**
Effective	Usable	The schedule is an indispensable tool for timely and effective **management decisions and actions**.
	Resourced	The schedule aligns with actual and projected **resource availability.**
	Controlled	The schedule is built, baselined & maintained using a stable, **repeatable and controlled process**.

Various Schedule Point Assessments (PA)

DCMA 14PA

DCMA
DEFENSE CONTRACT MANAGEMENT AGENCY

Defense Contract Management Agency (US)

GOA 11PA

GAO

Government Accountability Office (US)

NASA 15PA

NASA

National Aeronautics & Space Administration

DCMA – 14 PA

- Identify **potential logic problem** areas with a schedule
- Discrete tasks only, analysis **excludes**:
  - *Completed tasks*
  - *LOE tasks*
  - *Milestones*
  - *Summary tasks*

- Not "pass/fail", drive discussion & comprehension
- Standard health check in Primavera and other tools

- ***EVMS Program Analysis Pamphlet (DCMA-EA PAM 200.1)***
  - *Section 4.0 – 14 Point Schedule Metric for IMS Analysis*
  - https://www.dcma.mil/Portals/31/Documents/Policy/DCMA-PAM-200-1.pdf?ver=2016-12-28-125801-627

DCMA 14 PA good, but not perfect…

Does not account for:

- Conducting a Schedule Risk Analysis
- Quantity of near critical tasks
- Summary tasks with dependencies
- Tasks that are manually scheduled
- Tasks with undefined durations
- Tasks not associated to the baseline
- Relationship ratios
- Number of parallel tasks
- Quantity of soft constraints

PROS & CONS

- **Advantages of a compliant schedule**
  - More dynamic schedule
  - Presents a viable critical path
  - Enables a level of integrity
  - Enables a better use of Schedule Risk Assessment tools (ex: Monte Carlo)
  - Reduction in unforeseen schedule slippage
  - Enables better analysis of “ what if ” scenarios

- **Disadvantages of a compliant schedule**
  - Higher number of tasks (larger schedule)
  - May require a change in scheduling practices & culture
  - Greater stakeholder engagement

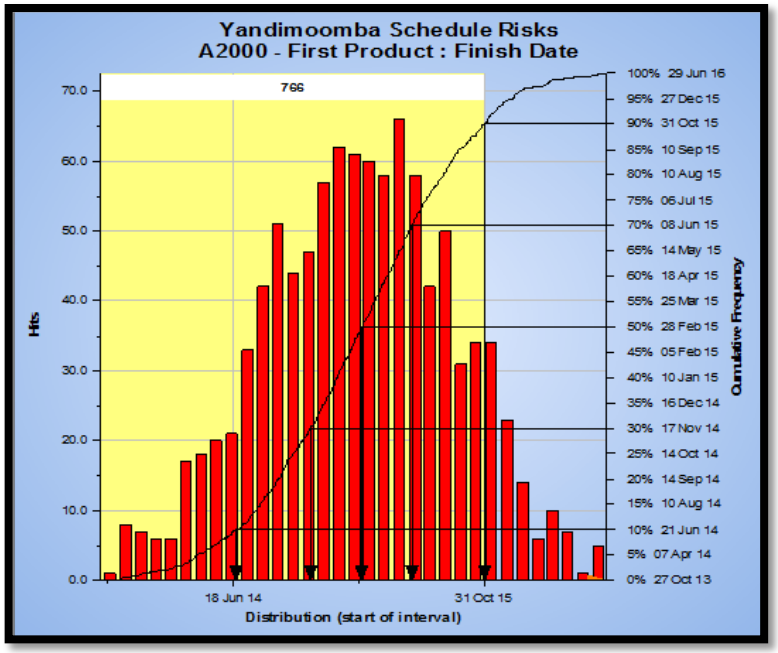
Integrity vs Credibility

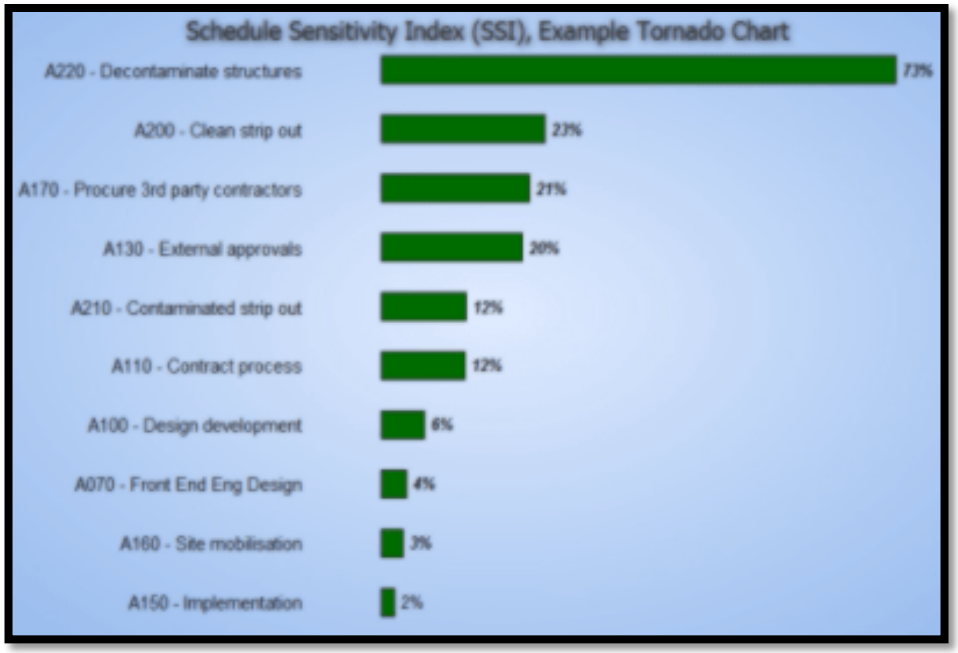
- **Scheduled Integrity**
  - Respect the GASP
  - Is the schedule dynamic?

- **Schedule Credibility**
  - How realistic are the forecasted milestone dates?
  - Results of an SRA, including a Monte Carlo assessment

Credibility requires integrity

Schedule Risk Assessment





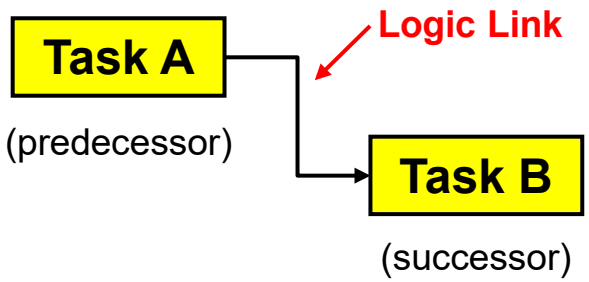
Monte Carlo Simulation

Sensitivity Analysis (Tornado graph)

DCMA 14 PA Metric Overview

METRIC NAME	REQUIREMENT	TYPE
1- Logic	< 5%	IMS LOGIC
2- Leads	< 5%	IMS LOGIC
3- Lags	< 5%	IMS LOGIC
4- Relationship Types	> 90%	IMS LOGIC
5- Hard Constraints	< 5%	IMS LOGIC
6- High Float	< 5%	IMS LOGIC
7- Negative Float	0%	IMS LOGIC
8- High Duration	< 5%	IMS LOGIC
9- Invalid Dates	0	IMS LOGIC
10- Resources	0	CAPACITY
11- Missed Tasks	< 5%	PERFORMANCE
12- Critical Path Test	600 Days	IMS LOGIC
13- Critical Path Length Index	1.0	PERFORMANCE
14- Baseline Execution Metric	> 95%	PERFORMANCE

Metric # 1 – Missing Logic



Task A has a logical impact on Task B

Description

Identifies incomplete tasks with missing logic links (predecessor/successor).

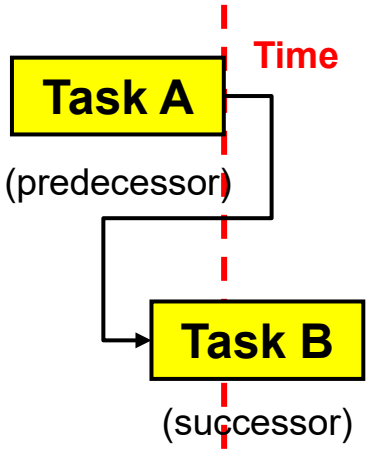
Purpose

Helps identify how well or poorly the schedule is linked together. Without valid activity dependencies, a schedule cannot present a credible Critical Path.

A schedule without logic is a "checklist".

$$Missing\ Logic\ \% = \frac{\#\ of\ task\ missing\ logic}{\#\ of\ incomplete\ tasks} \times 100 \rightarrow < 5\%$$

Metric # 2 – Leads (Negative Lag)



The successor is scheduled to start prior to completion of predecessor

Description

Identifies the number of logic links with a lead (negative lag) in predecessor relationships for incomplete tasks.

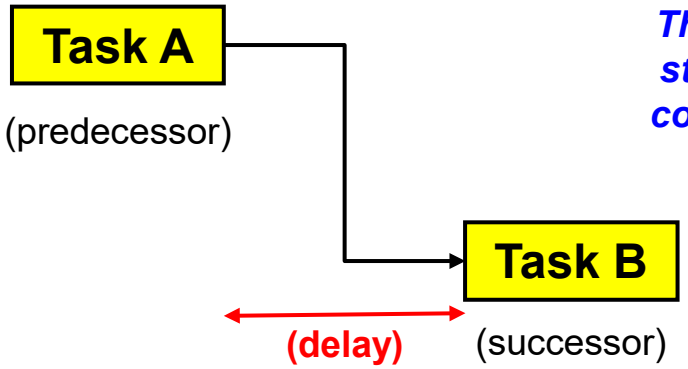
Purpose

Leads can distort the scheduling flexibility tasks have, leading to schedule and resource conflicts and unpredictable performance.

Construction before design completion.

$$Lead\ \% = \frac{\#\ of\ logic\ links\ with\ leads}{\#\ of\ incomplete\ tasks} \times 100 \rightarrow$$ **<5%**

Metric # 3 – Lags (Positive Lag)



The successor task is scheduled to start after an intentional delay post completion of the predecessor task. (i.e.: curing of concrete)

Description

Identifies the number of lags in predecessor logic relationships for incomplete tasks.

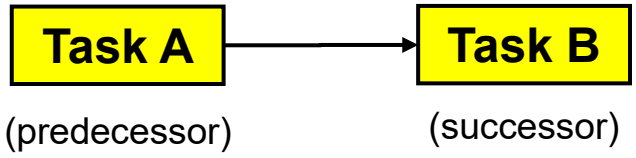
Purpose

Positive lags can distort scheduling flexibility, providing arbitrary delays and adversely effect the critical path as well as schedule float.

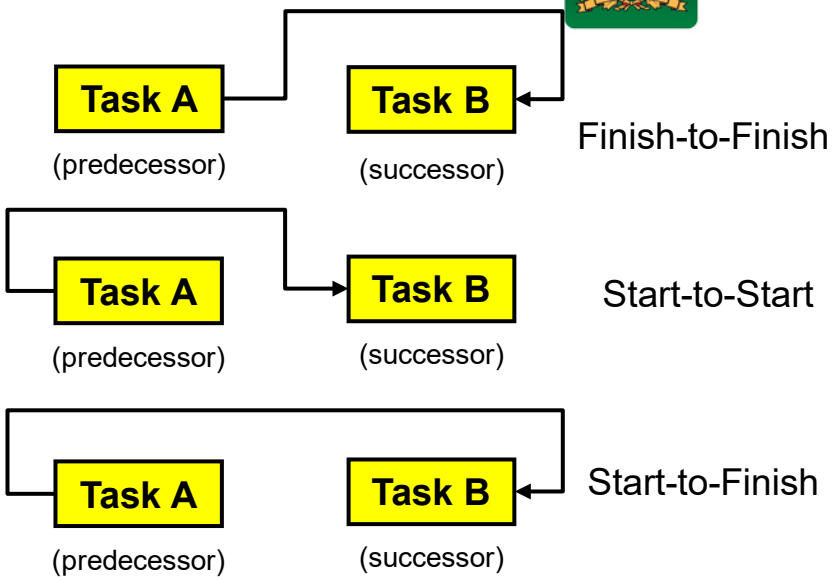
Letting concrete cure before building.

$$Lag\ \% = \frac{\#\ of\ logic\ links\ with\ lags}{\#\ of\ incomplete\ tasks} \times 100 \rightarrow$$ **<5%**

Metric # 4 – Relationship Types



Finish-to-Start (FS) Relationship
The predecessor must be completed before the successor can start



Description

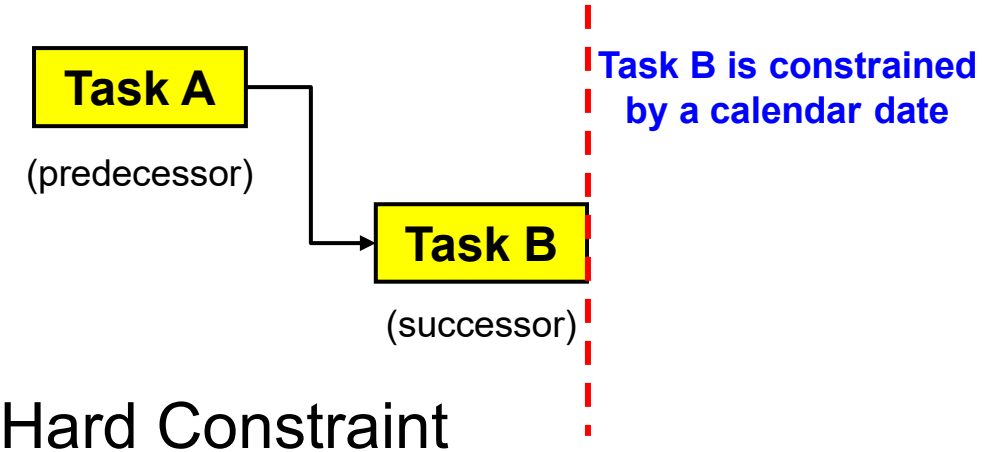
Provides a count of incomplete tasks containing each type of logic link. FS relationships provides a logical path through the program.

Purpose

FF, SS and SF relationships may distort scheduling logic, increase schedule complexity and adversely effect the critical path.

$$\%\ FS = \frac{\#\ of\ logic\ links\ with\ FS}{\#\ of\ logical\ links} \times 100 \quad \rightarrow \quad > 90\%$$

Schedule Constraints



Hard Constraints
Mandatory Start
Mandatory Finish

Soft Constraints
Start On or After
Finish On or Before

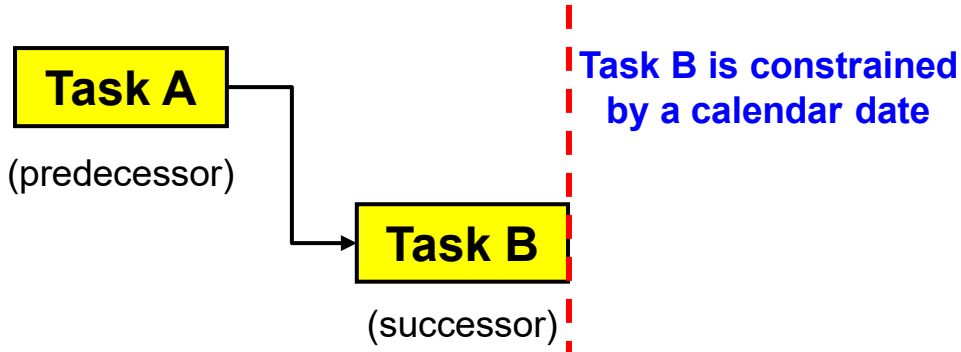
Hard Constraint

They can break relationships. An activity that has a Mandatory Start or Finish date becomes fixed to that date. Relationships to that activity are ignored and the activity will not move even if its predecessors push it out.

Soft Constraint

A soft constraint is one that logic will try to adhere to, but relationships take priority, and may result in the **constraint not being met**.

Metric # 5 – Hard Constraint (HC)



Hard Constraints
Mandatory Start
Mandatory Finish

Soft Constraints
Start On or After
Finish On or Before

Description

Provides a count of incomplete tasks with hard constraints.

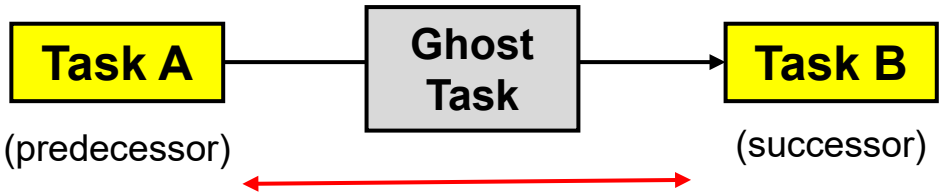
Purpose

A schedule's ability to be dynamic will be limited with the use of hard constraints as task do not have the ability to "float" freely. Hard constraint should be justified in IMS.

With HC schedule logic is less dynamic.

$$HC\% = \frac{\#\ of\ incomplete\ task\ with\ HC}{\#\ of\ incomplete\ tasks} \times 100 \rightarrow < 5\%$$

Metric # 6 – High Float



Quantity of days of slippage without affecting the Critical Path > 44 days

Total Float: amount of time an activity can be delayed from the early start/finsh without changing **the completion date of the project**.

Free Float: amount of time an activity can be delayed from the early start without changing **the start date of the successor task**.

Description

Provides a count of incomplete tasks with total float greater than 44 working days.

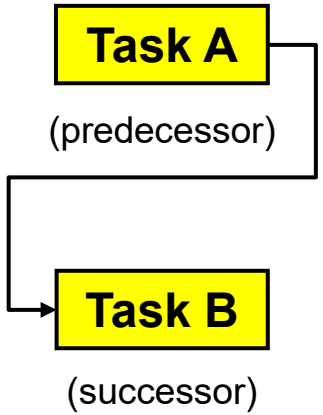
Purpose

Activities with high float may indicate incorrect logic or absence of relevant predecessor or successor activity. This may lead to unpredictable schedule performance and limit the schedule's ability to be dynamic.

Schedule logic may be less predictive.

$$HF\ \% = \frac{Total\ \#\ of\ Incomplete\ Tasks\ with\ High\ Float}{Total\ \#\ of\ Incomplete\ Tasks} \times 100 \rightarrow < 5\%$$

Metric # 7 – Negative Float (NF)



Negative Float: **amount of time an activity is missing to complete the work in accordance with a dependency (i.e.: a constraint)**

Description

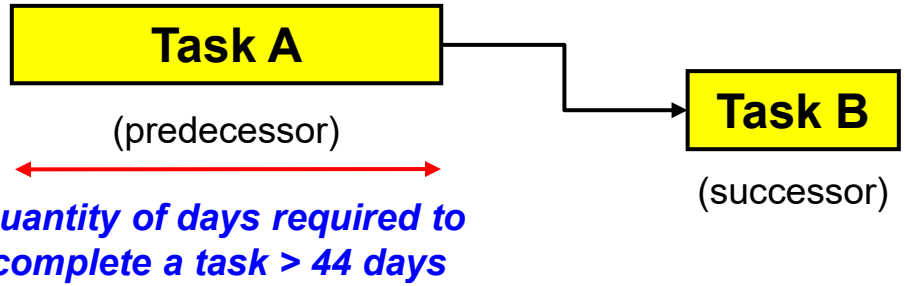
Provides a count of incomplete task with negative float.

Purpose

Negative Float indicates that an activity's scheduled dates do not support the dates required to meet project goals. Good indicator that schedule slippage will occur if the logic is not resolved. Usually the result of using schedule constraints.

$$NF\ \% = \frac{Total\ \#\ of\ Incomplete\ Tasks\ with\ NF}{Total\ \#\ of\ Incomplete\ Tasks} \times 100 \rightarrow 0\ \%$$

Metric # 8 – High Duration (HD)



Description

Provides a count of incomplete task with total duration greater than 44 working days.

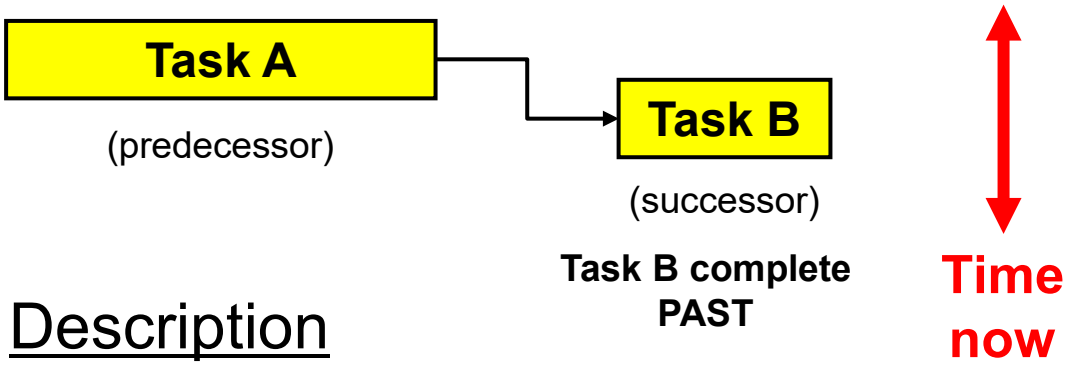
Purpose

Tasks with a high duration are challenging to objectively assess progress and estimates for completion. Usually an indicator that a task should be broken into two or more tasks which makes the schedule more manageable and dynamic.

Keep it simple.

$$HD\ \% = \frac{Total\ \#\ of\ Incomplete\ Tasks\ with\ HD}{Total\ \#\ of\ Incomplete\ Tasks} \times 100 \rightarrow < 5\%$$

Metric # 9 – Invalid Dates



Task B has a forecast date prior the status date

Description

Incomplete tasks that have a forecast start/finish date prior to the IMS status date, or have an actual start/finish date beyond the IMS status date are included in this metric.

Purpose

Invalid date information may cause schedule logic issues and limit the schedules ability to be dynamic.

You can't have "started" work in the future. You can't "forecast" completion in the past.

DCMA recommendation: 0

Metric # 10 – Resources

Description

This metric provides verification that all tasks with durations greater than zero have dollars or hours assigned.

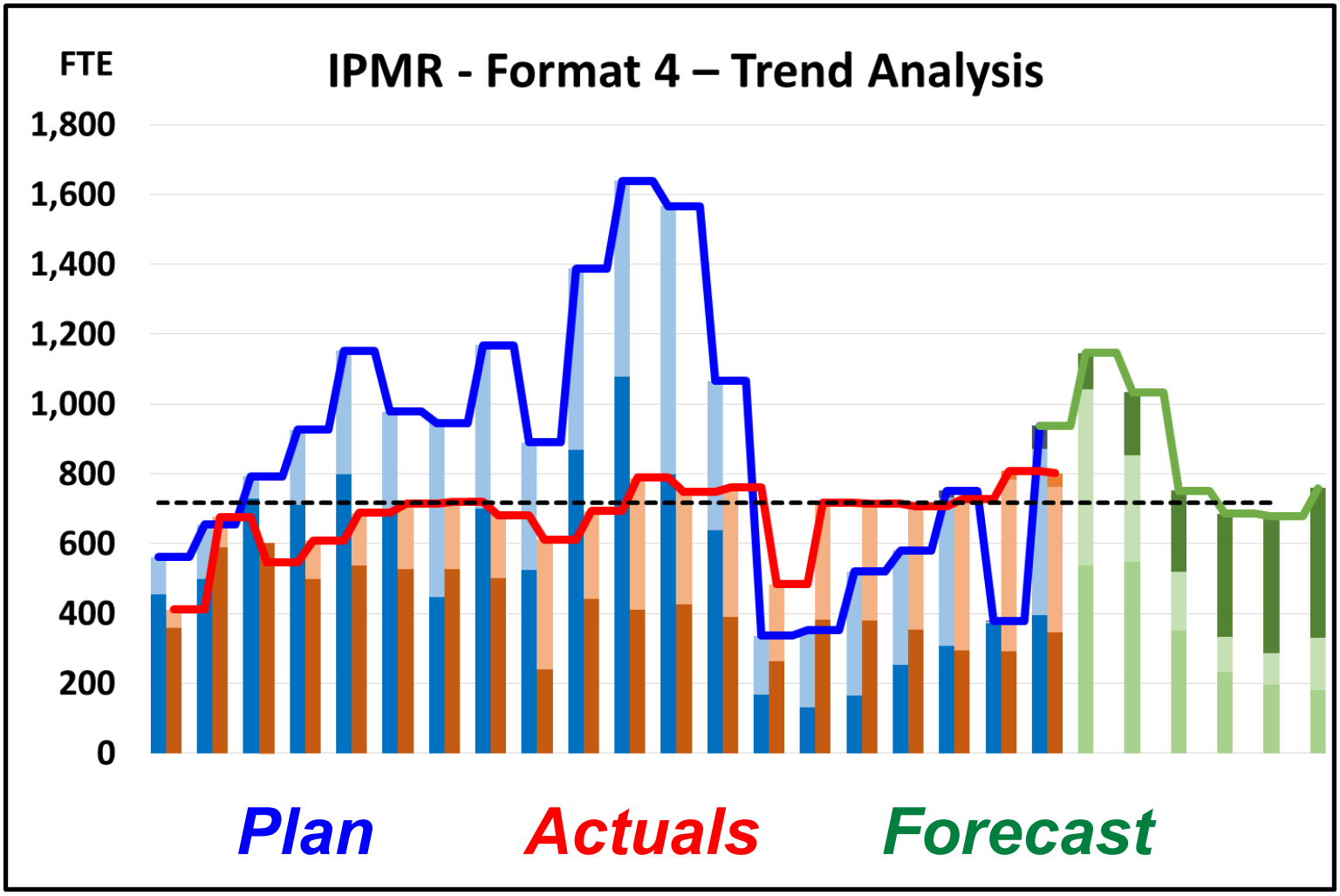
Purpose

An activity without resources may result in activity being scheduled without awareness of resource conflicts – causing delays.

Presence of resources
≠
right or sufficient resources

DCMA recommendation: 0

Resources – Trend Analysis



Not part of the DCMA 14 PA

Metric # 11 – Missed Tasks (MT) (Late Tasks)

Description

A task is included in this metric if it is supposed to be completed already (baseline finish date on or before the status date) and the actual finish date or forecast finish date (early finish date) is after the baseline finish date.

Purpose

This metric helps identify how well or poorly the schedule is meeting the baseline plan.

How many tasks are late in relationship to the status date and baseline?

$$MT\% = \frac{\#\ of\ tasks\ with\ actual/forecast\ finish\ date\ past\ baseline\ date}{\#\ of\ tasks\ with\ baseline\ finish\ dates\ on/before\ status\ date} \times 100$$

DCMA recommendation: < 5%

Metric # 12 – Critical Path Test

Description

Insert a 600 day delay on the critical path. If the project completion date is not delayed in direct proportion (assuming zero float) to the amount of intentional slip that is introduced into the schedule as part of this test, then there is broken logic somewhere in the network. Broken logic is the result of missing predecessors and/or successors and/or incoherent logic on tasks where they are needed.

Purpose

The purpose is to test the integrity of the overall network logic and, in particular, the critical path.

Overall, is the schedule logic dynamic?

DCMA recommendation:

The IMS passes the Critical Path Test if the project completion date shows a negative total float number or a revised Early Finish date that is in direct proportion (assuming zero float) to the amount of intentional slip applied.

Metric # 13 – Critical Path Length Index

Description

A measure of required schedule efficiency to complete a project. It is defined as the sum of the remaining project duration (number of working days on the current critical path) and total float, divided by the remaining project duration. Total float in this instance is the variance between the forecast and baseline finish date of the Project Finish milestone.

Purpose

A CPLI above 1.00 indicates that there is remaining schedule margin, while a CPLI below 1.00 indicates that the team must overachieve to meet the baseline finish date. A CPLI is typically the result of hard constraints and negative float.

$$CPLI = \frac{CPL + TF}{CPL} \rightarrow > 0.95$$

Metric # 14 – Baseline Execution Index

Description

The BEI is the ratio of the number of tasks that have been completed to the number of tasks that where planned to be completed in the baseline. BEI does not provide insight into tasks completed early or late (before or after the baseline finish date).

Purpose

Calculates the efficiency with which tasks have been accomplished when measured against the baseline tasks. In other words, it is a measure of task throughput not efficiency. To measure efficiency the use of the ***Hit Tasks*** is recommended. Comparing ***BEI*** to ***Hit Task*** can provide insight into schedule performance.

How many tasks are completed in relationship to the status date and baseline?

Not a measure of schedule performance efficiency

$$BEI = \frac{Total\ \#\ of\ Tasks\ Complete}{\#\ of\ Tasks\ Completed\ Before\ Now + \#\ of\ Tasks\ Missing\ Baseline\ Finish\ Date}$$

DCMA recommendation: BEI > 0.95

Scheduling Resources

- **National Defence Industrial Alliance (NDIA):**
  - ***Planning and Scheduling Excellence Guide (PASEG) V3 2016***
  - Technical document, supports EVMS implementation, relates to DCMA 14PA
  - https://www.ndia.org/divisions/ipmd/division-guides-and-resources
- **United-States Government Accountability Office (GAO):**
  - ***Schedule Assessment Guide (GAO-16-89G) Released 2015***
  - Easy read, best practices, case studies, comparison to others guides
  - https://www.gao.gov/products/GAO-16-89G
- **National Aeronautical & Space Administration (NASA):**
  - ***Schedule Management Handbook***
  - Good explanations and definitions
  - https://www.nasa.gov/pdf/420297main_NASA-SP-2010-3403.pdf
- **United-Stated Department of Defense**
  - ***Integrated Program Management Report DID – (DI-MGMT-81861A)***
  - Format 6 – IMS – Requirements for IMS
  - https://quicksearch.dla.mil/qsDocDetails.aspx?ident_number=278901

NDIA PASEG

Section 3 – Leadership, Buy-In, and Commitment

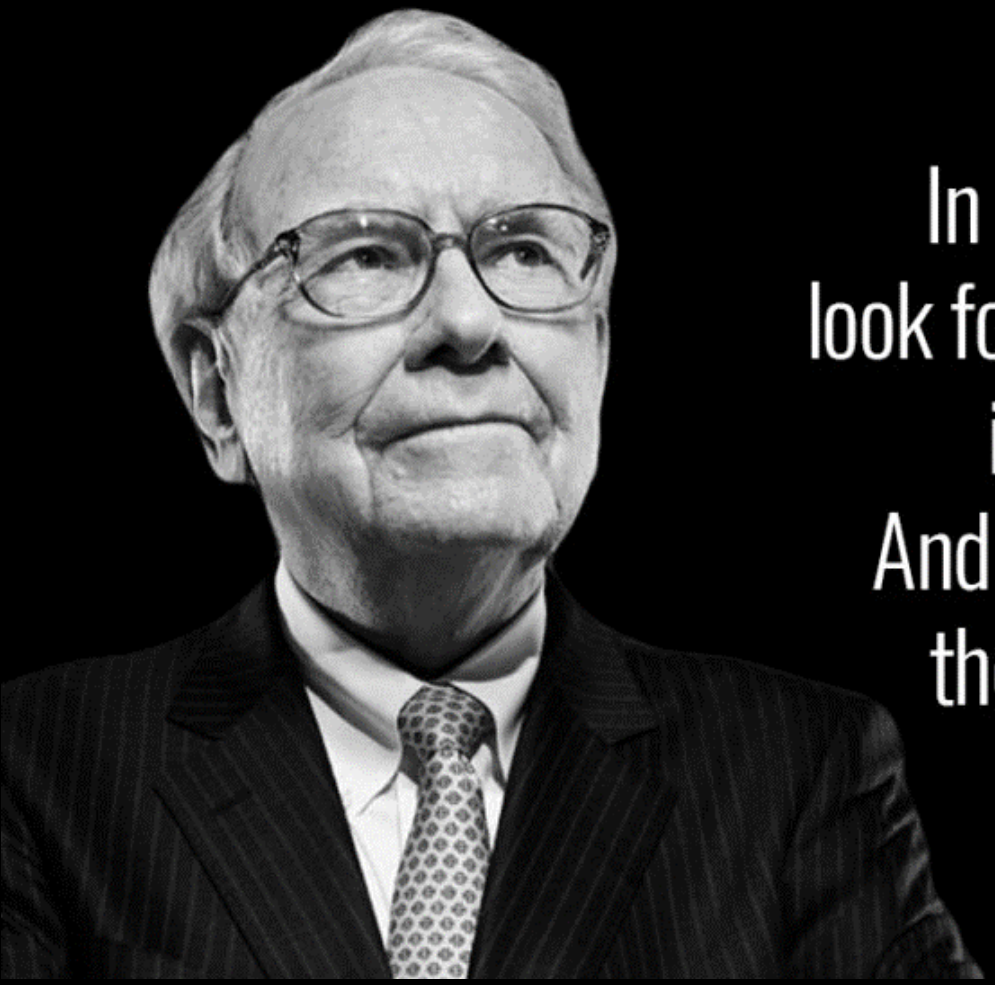
"At all cost, **avoid** the unenviable position of **trying to defend a poorly constructed schedule**. Realize that a poorly constructed schedule is a **program management problem**, and not a planner/scheduler problem. ***A poorly constructed schedule is a result, not a cause***. Find the root cause. A schedule in this condition is due **to poor schedule management practices and processes. Recognize that a schedule cannot be "fixed" when there is an absence of stringent schedule management practices / process and where there is not ownership and accountability for schedule data. Address the cause, the schedule will improve."**

Conclusion

- Overall the DCMA 14PA is meant to drive:
  - Schedule transparency & logic
  - Use of scheduling best practices
  - Catalyst for proactive discussion

- Not "*pass/fail*", understand the "*why*" & impacts
- Does not validate resource allocation
- Does not validate duration estimates

- **Test #12 – Critical Path Test, is a "*test of test*"**
- Schedule Risk Assessment
- Other metric to considers



good schedules

In looking for ~~people to hire~~,
look for **three qualities**: integrity,
intelligence and energy.
And if they don't have the **first**,
the other two **will kill you**.

- *Warren Buffett*

For more information…

- **Thank you for your participation today!**
- **For more information on the contents of this presentation, please feel free to contact me as follows:**

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Department of National Defence

Directorate Project Management Support Organization

ADM(MAT) – COS(MAT)- DMPSO