Costing: The Final Frontier

FMI Costing Workshop 2018

Please silence your phone…

…but don’t turn it off.

Financial Officer Competencies

B Negotiation and Persuasion	Using information provided in a cost estimate to construct a persuasive argument.
F Planning and Resource Management	Identifying and using credible cost estimates to inform financial decision-making.
L Collaborate with Partners and Stakeholders	Working with allied professionals in costing, project management, procurement, and elsewhere to advance the financial decision-making process.

Learning Objectives

This workshop is intended for people who will be participating in the development of cost estimates for the purpose of decision-making.

Through participation in this workshop, you will:

F 1. Gain knowledge of the cost estimating process;

F 2. Learn to identify the elements of a credible cost estimate; and,

B L 3. Apply knowledge in order to formulate feedback and advice to stakeholders and partners.

Agenda

1	Cost estimating basics
2	The case
3	Ground rules and assumptions
4	Locating the launch pad
5	Building the service
6	Setting the price

Cost Estimating Basics

Introduction

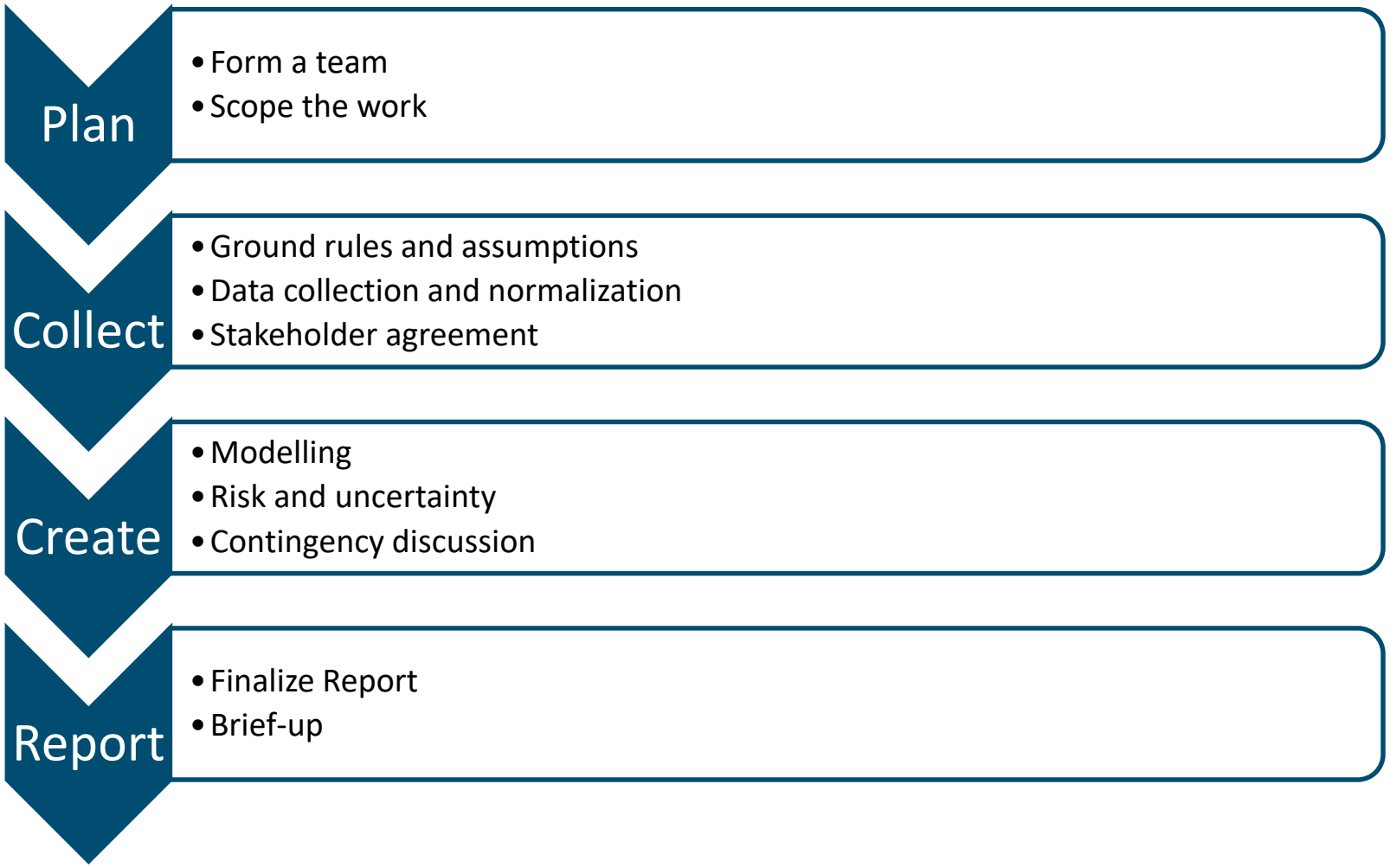
What is cost estimating?

"The process of collecting and analyzing historical data and applying quantitative models, techniques, tools, and databases to predict the future cost of an item, product, program, or task."

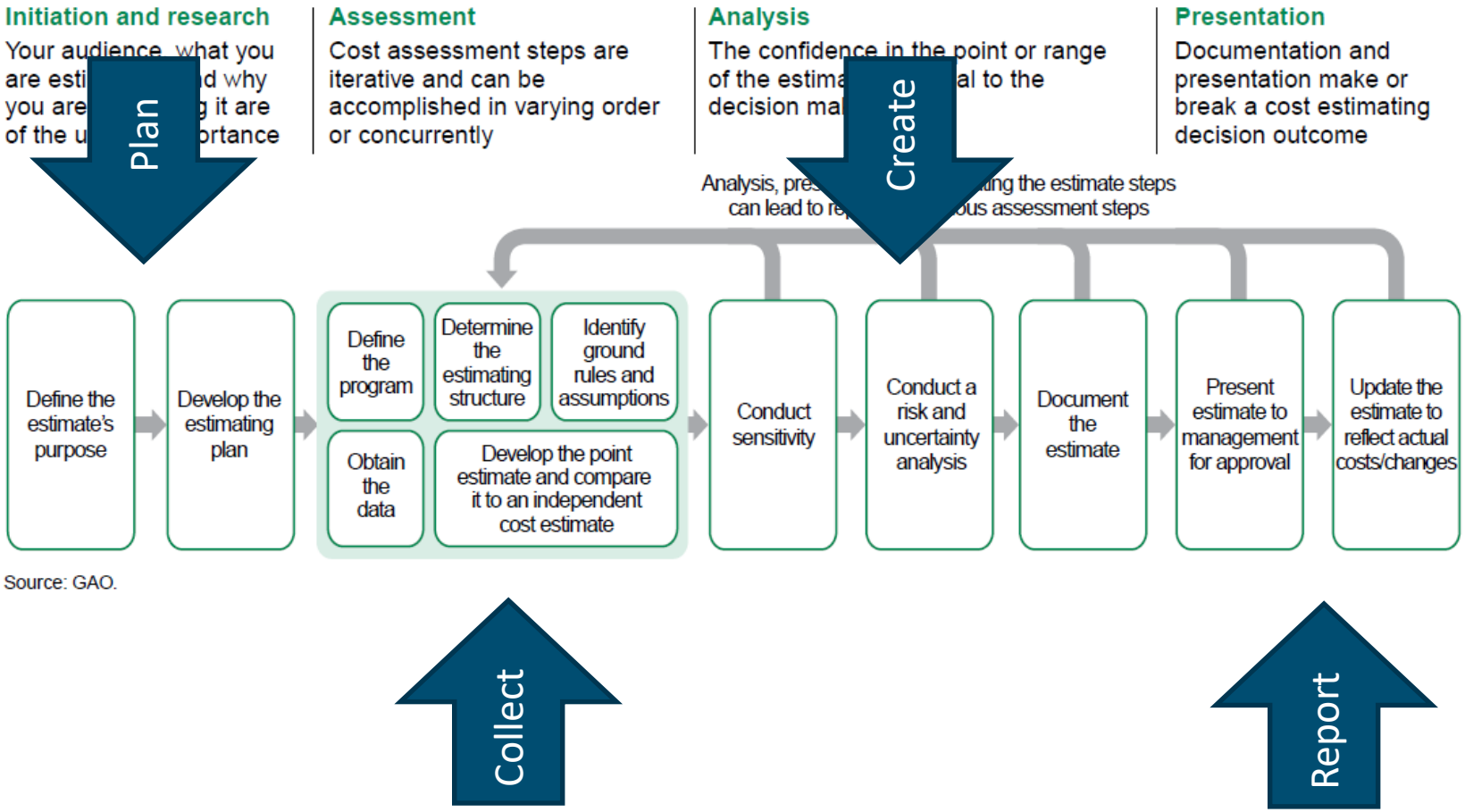
The *cost estimate* is the result of this process.

CEBoK

Draft TB Guide to Costing



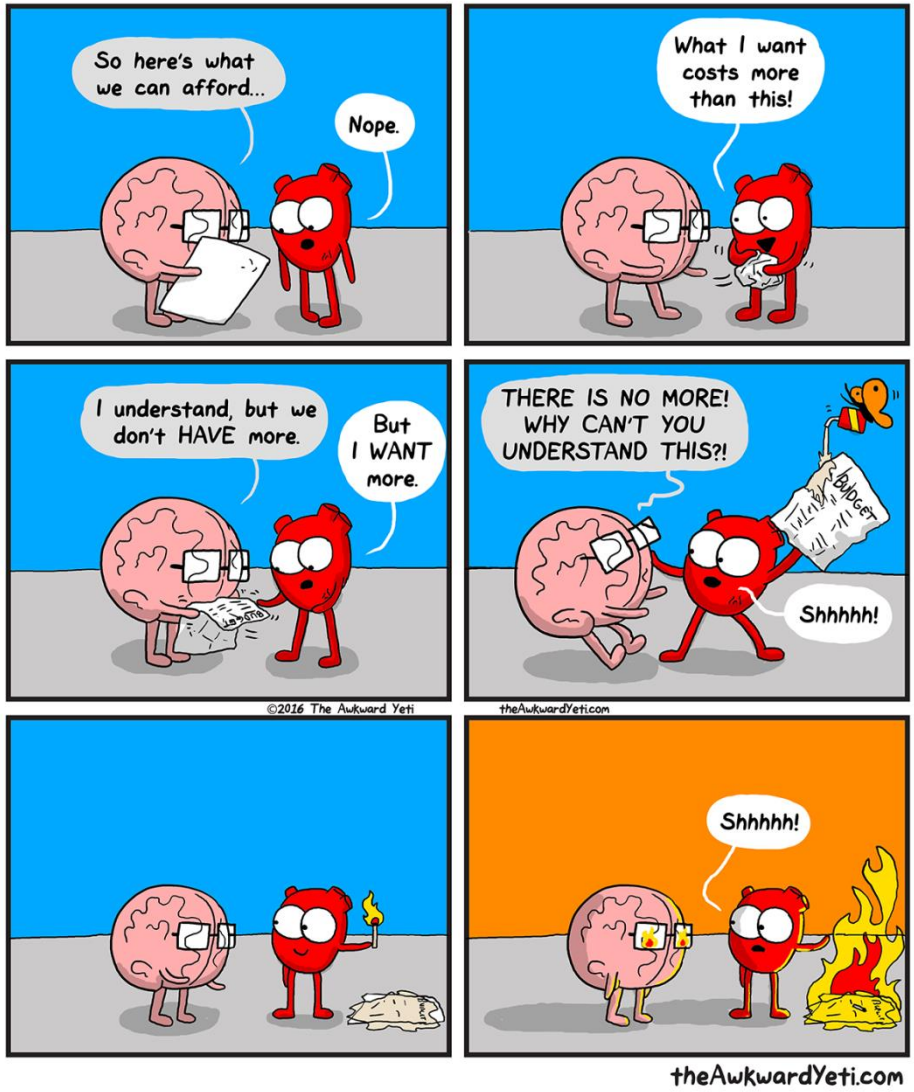
GAO's Cost Estimating Process



Source: GAO.

Cost Estimating is not Cost Accounting

Cost Estimate ≠ Budget



If Cost Estimate > Budget

→ Higher risk of failure

→ May need to re-baseline

If Cost Estimate < Budget

→ Lower risk of failure

→ May miss investment opportunities due to "tied-up" funding

The Case

It’s all rocket science

Falcon Heavy Launch

Scenario

It's 2088 and new space shuttle technologies have changed many facets of Canadian industry. In response to the growing demand for shuttle launches, the Department of Futuristic Transportation has been tasked to develop a strategy to expand government shuttle launches to serve Canadian industry and private citizens.

Building the business

- The government is considering three options for delivering the new launch service:
    - Department of Futuristic Transportation
    - A new department
    - A new crown corporation

- Which should they choose?

- Why?

Ground Rules and Assumptions

Reaching a common understanding with stakeholders

Ground rules

"**Ground rules** are constraints or boundaries that have been set by a decision-maker. For example, an acquisition subject to the Industrial and Technological Benefits Policy includes a constraint that requires winning bidders to make investments in Canada."

Things to consider:

- Laws
- Policies
- Priorities
- Cabinet decisions
- Operational requirements
- Safety requirements
- Etc.

Poll

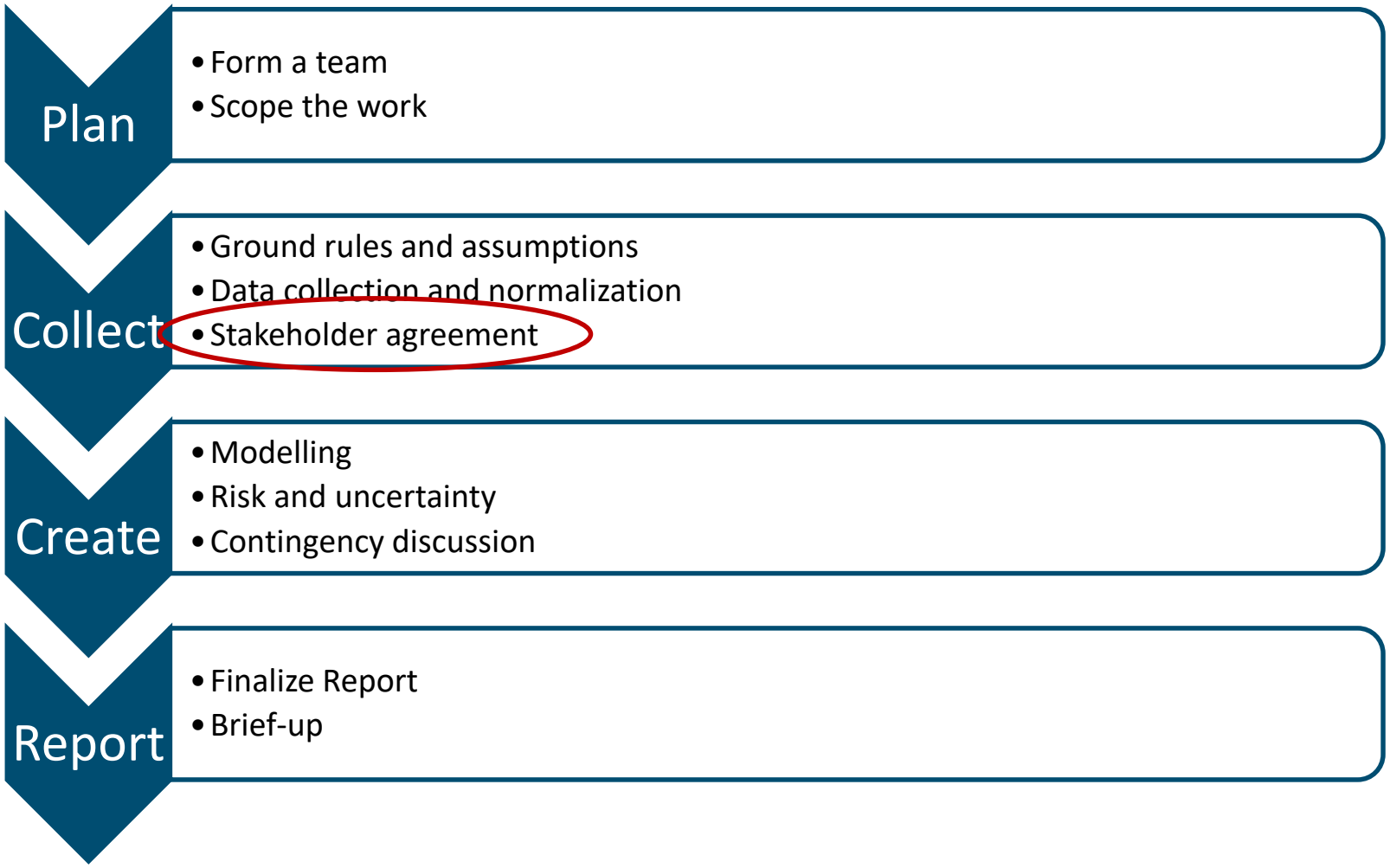
- Consider again the three options being proposed:
  - Department of Futuristic Transportation
  - A new department
  - A new crown corporation

In one word, what ground rule would impact your recommendation?

TEXT “fmipdweek” to 37607

And then text your answer to 37607

Why is it not unanimous?



Intergalactic Crown Corporation (ICC)

Assumptions

"Assumptions are used to fill the gaps between the ground rules and the data. For example, it can be assumed that an asset will be acquired in Canada in order to avoid the management fees associated with the Industrial and Technological Benefits Policy. Typically, assumptions are used at the beginning of the cost estimate process when:

- there is less certainty
- fewer decisions have been made"

Things to consider:

- Inflation and exchange rates
- Overhead and profit
- Who pays for what
- Other missing data or information

The difference between ground rules and assumptions

Ground rules *generally* stay the same while assumptions evolve with time.

"As maturity increases, assumptions are generally replaced by ground rules and data. Assumptions will often be based on subject matter expert opinion; however, it is important that these opinions be:

- reasonable,
- consistent with one another
- supported by data, whenever possible"

Group activity

Brainstorm a list of relevant assumptions that would impact the cost / profitability of operating a new crown corporation.

Data Collection and Normalization

Comparing apples to apples

Poll

Three sites have been proposed for the location of the launch pad.

- Vancouver Island
- Baffin Island
- Saskatoon, SK

What data would you need to make this decision?

TEXT your answer to 37607

What is data normalization?

The process of stripping out the effects of certain external influences from a set of data to improve consistency so that:

- comparisons and projections are more valid
- the number of data points can be increased

Data are gathered from a variety of sources and often come in many different forms. They need to be adjusted before they can be used for comparative analysis or as a basis for projecting future costs. Data can be normalized by items such as:

- fiscal year
- currency
- cost per unit
- size or weight
- key groupings
- technological maturity (that is, adjusting for productivity improvements)
- homogeneous groups

Group exercise

What needs to be done to normalize this data?

Lunch

Building the Service

Building a cost model

Cost Breakdown Structure

A **Cost Breakdown Structure** is a hierarchical structure that:

- provides an overview of the cost estimate and ensures its completeness
- is used to break down an investment into lower levels and smaller pieces
- is aligned with the intended scope of the cost estimate being developed
- incorporates the start and end dates of the life cycle of the investment
- matures as the investment matures
- is an aide for planning
- provides a common reference point for communication
- helps with data gathering for future investments

Often same as Work Breakdown Structure (WBS)

PRICE CBS Example

Group activity

Build a CBS using puzzle pieces

Parametric Modeling

A parametric model is built using cost drivers and cost estimating relationships (CERs) based on historical data.

- Strengths
  - Easily traceable and objective
  - Can be easily adjusted for changes
  - Statistical results relating to model
- Challenges
  - Difficult to ensure consistency and validity of data
  - Must constantly review relationships to ensure reflect current status of relevant programs, technology and other factors

Cost drivers & CERs

Cost drivers: A factor or unit of activity that causes a change in cost.

For example, the number of assigned full-time equivalents or the level of effort typically drives the cost more than the rate of pay. Sensitivity analysis is a useful tool for identifying major cost drivers.

Cost drivers are the parameters or independent variables in the **CERs** which can be shown to *drive* cost: cost, the dependent variable in the equation, changes as the input parameters change.

Demonstration

A shuttle costing model using PRICE Systems.

Setting the Price

Considering risk and uncertainty

Risk and Uncertainty

The precision (or lack thereof) of various estimating techniques is addressed by adding an **uncertainty** range - a “plus or minus” in layman‘s terms.

Risk, by contrast, addresses the inherent bias of estimates by performing a calibration of sorts to ensure that the estimates are more accurate, (that the distribution of possible outcomes is centered in the right place)

Uncertainty = Range of possible estimates

vs

Risk = Calibration of point estimate

Scenario

Shuttle technology has come a long way, but it is still not perfect. The engineers have cautioned you that shuttles are only good for 7.3 launches before they are at an increased rate of failure and 2.7 refits before they must be scrapped.

Poll

Based on the information provided, how many launches would you recommend before refitting the CSS Valkyrie?

6, 7 or 8?

TEXT your answer to 37607

Group activity

It has been decided that each shuttle will need to be refit after 6 launches and is obsolete after 2 refits.

Use the statistical output to propose a service price.

In Millions of $

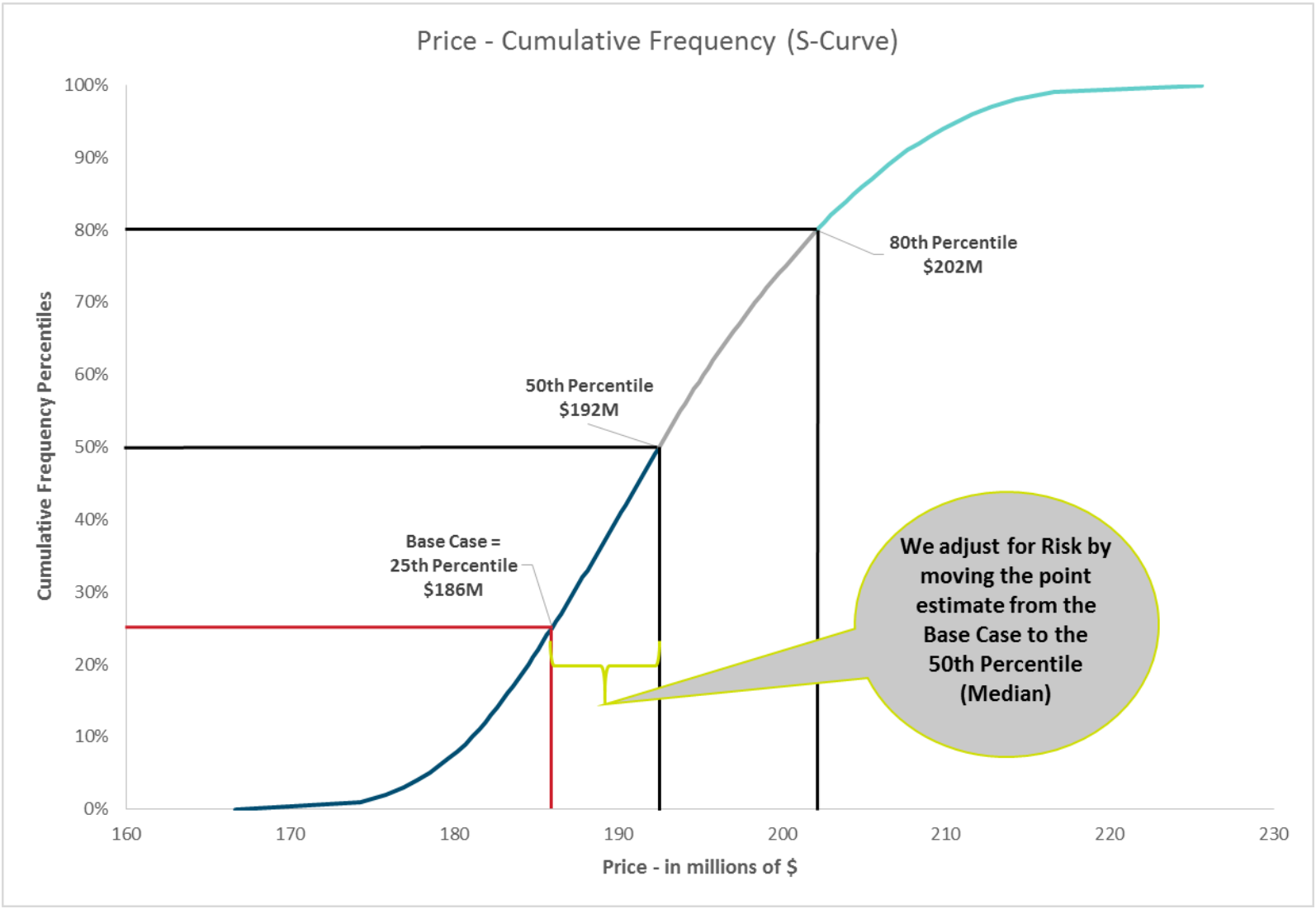
	Cost per piece	Min	Max	Total shuttle
1st stage	100	90	125	300
2nd stage	900	750	1,050	900
Refit	350	250	600	700
Overhead	1,150			1,150
Profit Rate 10%				305
Price				**3,355**
Price per launch				**186**

Assumptions:

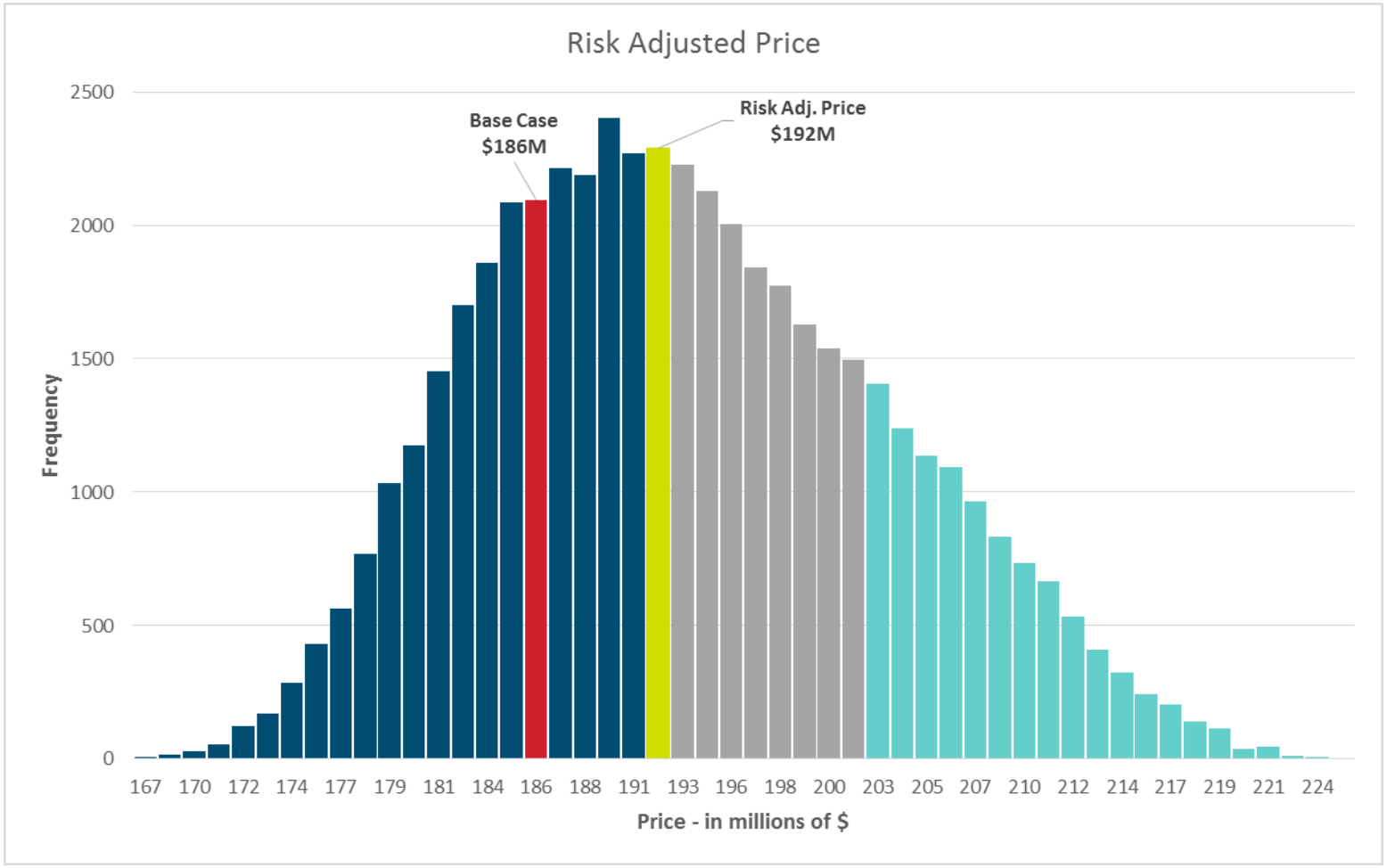
1st stage cannot be refitted and is required new when 2nd stage is refitted

Overhead is allocated over total life of shuttle

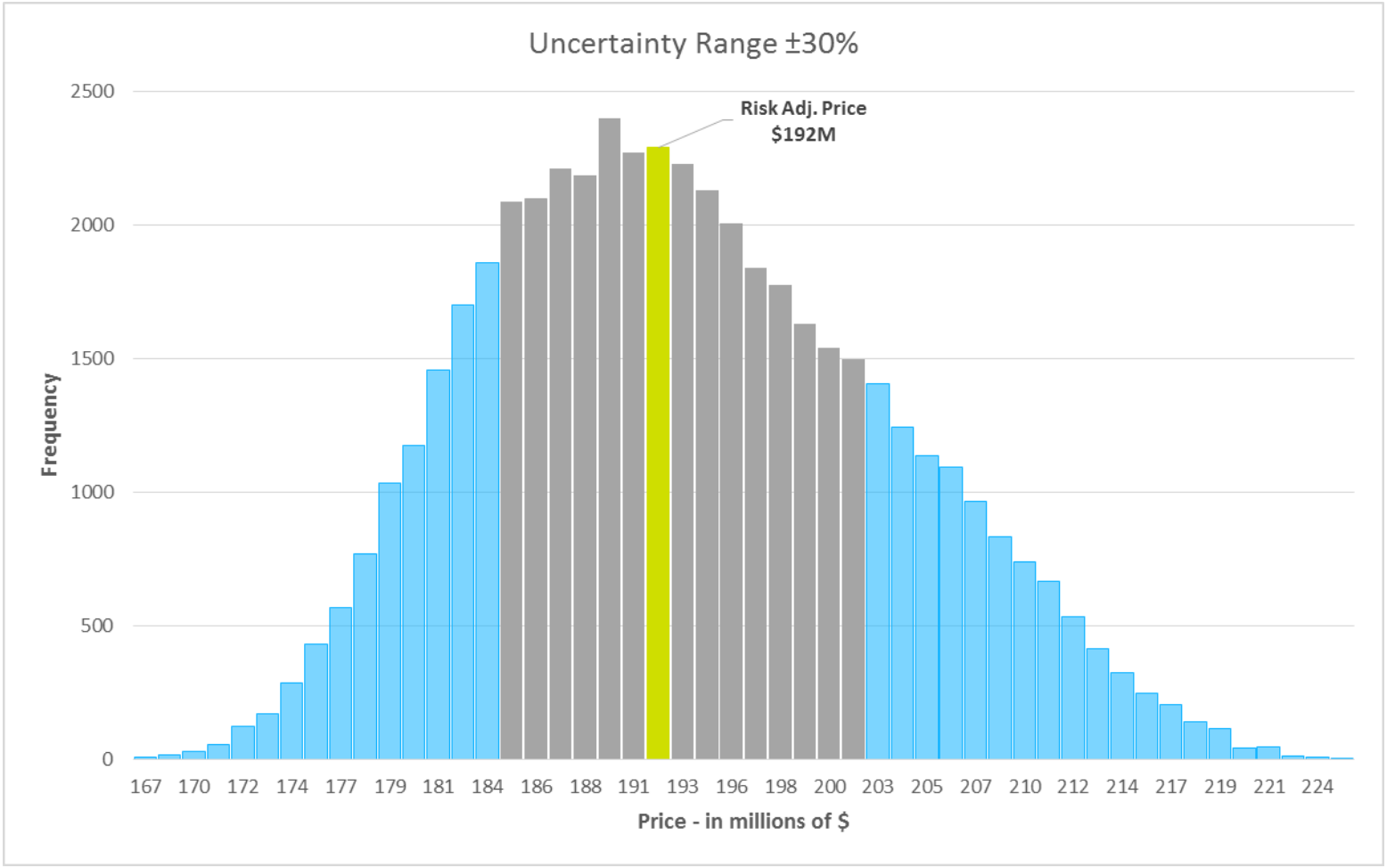
Price per launch



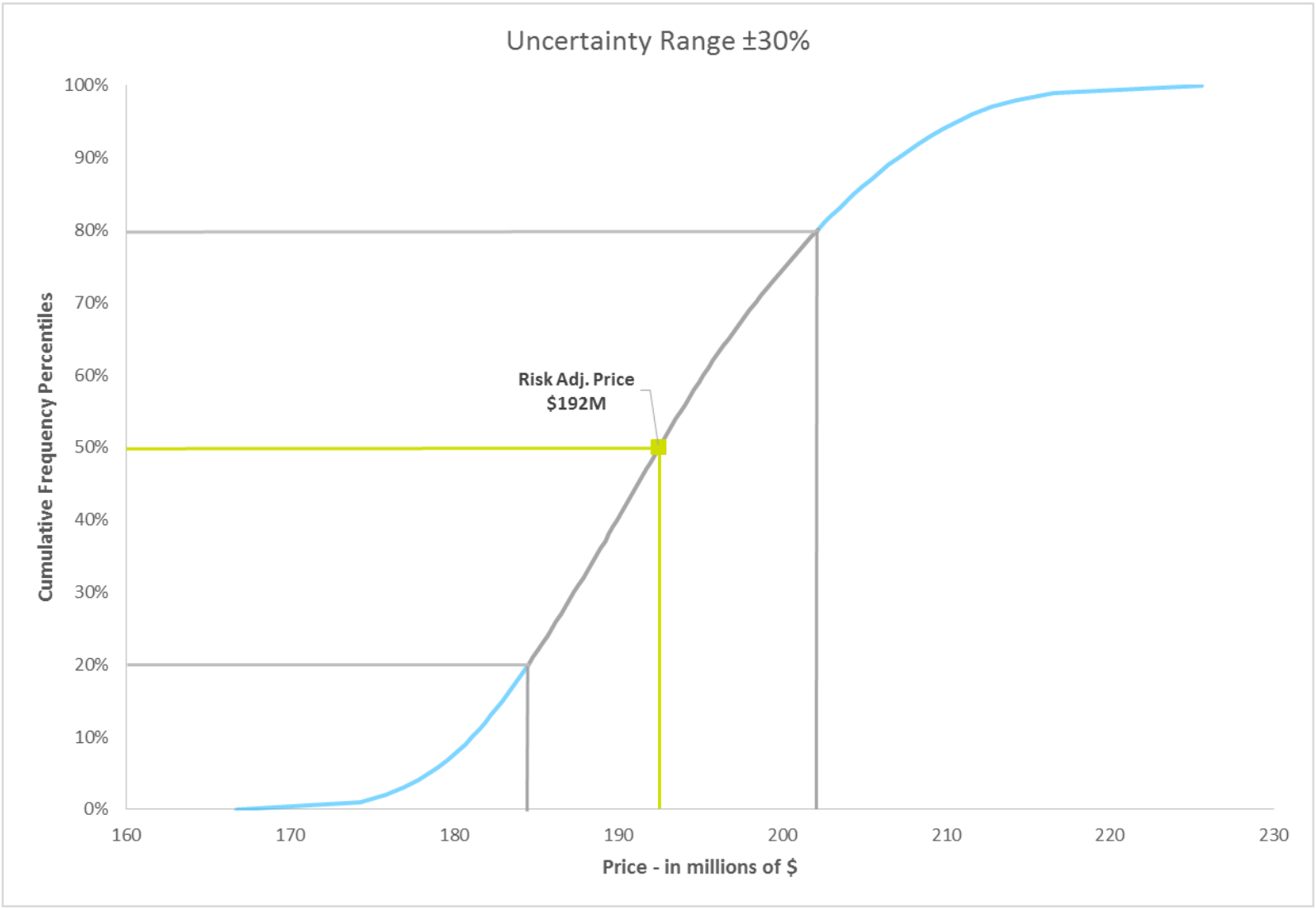
Price per launch



Uncertainty



Uncertainty



Summary

1) Costing is a process
2) Costing requires the involvement of all stakeholders
   - Knowledge
   - Skill sets
3) Costing is relevant at every stage in the lifecycle of an investment

Thank You!

Questions?