1 Descriva brevemente la sua esperienza professionale e formativa in relazione all'attività richiesta dal bando.

2 Se si volesse garantire l'utilizzo di un applicativo sviluppato in c++ o altro linguaggio di programmazione, quale potrebbe essere l'approccio migliore per fornirne l'accesso, in sicurezza, per un utente esterno alla rete CEF? Ritiene che un particolare linguaggio sarebbe più adeguato?

3 Si identifichi almeno un regolamento di cui si è dotata l'Agenzia Spaziale Italiana per autoregolarsi e se ne descriva brevemente le finalità.

20.3.2 Software Costs

Table 20-10 presents software costing relationships for flight and ground software. It also provides factors for various programming languages. Section 16.3.3 discusses software development costs further. Flight software is assumed to cost more (per KLOC) because there is more testing required to meet mission criticality. If software reuse is employed, the heritage factors in Table 20-8 apply.

TABLE 20-10. Software Development Costs. RDT&E costs only (in FY00$K). See Sec. 16.2.2 for estimates of the lines of code.

Flight Software	435 × KLOC
Ground Software	220 × KLOC
KLOC = Thousand of Lines of Code; cost without fee	
FACTORS FOR OTHER LANGUAGES	
Language	**Factor**
Ada	1.00
UNIX–C	1.67
PASCAL	1.25
FORTRAN	0.91

20.3.3 Ground Segment and Operations Costs

Ground segment costs vary significantly depending upon the purposes of the ground stations. For most ground station cost estimates, we must state requirements for square footage of facilities, and an equipment list of specific items (computers, RF equipment, and so forth) which are typically not determined during the concept development stage of a program.

For this model, the costs for various elements of a ground station will be based upon typical distribution of costs between software, equipment, facilities and wraps, as Table 20-11 indicates. The distribution is fairly representative of a number of space projects. For preliminary mission design, this may be translated into estimated costs as follows. First, compute the software costs from Table 20-10. Then estimate other ground segment costs as a percent of software costs using the representative distributions of Table 20-11. A column to simplify this calculation has been added to the table.

The operations and support costs during the operational phase of the ground segment consist primarily of contractor and government personnel costs as well as maintenance costs of the equipment, software, and facilities. Table 20-12 presents expressions for these costs. The labor rates include overhead costs and other typical expenses associated with personnel. For smaller Earth terminals, Table 20-13 provides some typical costs of communications equipment for commonly used frequency bands.

Bando 30/2021 – Profilo UIC2

Il candidato a partire dalla tabella di seguito riportata (che sarà fornita all'interno del file excel denominato **cartel2**) provveda alle seguenti azioni:

Programma	Progetto	attività	2018	2019	2020
PROG A	P 1	A 1.1	500	0	500
PROG A	P 1	A 1.2	800	50	600
PROG A	P 1	A 1.1	250	100	350
PROG A	P 2	A 2.1	300	200	300
PROG A	P 2	A 2.2	500	700	500
PROG B	P 3	A 3.1	800	500	600
PROG B	P 3	A 3.2	250	700	350
PROG B	P 3	A 3.3	300	150	300
PROG C	P 4	A 4.1	500	300	500
PROG C	P 4	A 4.2	800	500	600
PROG C	P 5	A 5.1	250	700	350
PROG C	P 5	A 5.2	300	150	300
PROG C	P 6	A 6.1	1000	300	1000

1) Calcolare il totale nel triennio di ciascuna attività e ordinarli in modo decrescente

2) Salvare il file generato sul desktop del PC nominandoli con nome cognome

1 Descriva brevemente la sua esperienza professionale e formativa in relazione all'attività richiesta dal bando.

2 Si riporti in breve la distinzione tra server e client e si indichino le caratteristiche per cui è più opportuno utilizzare l'uno o l'altro per eseguirvi applicativi. Si indichino le funzionalità specifiche, anche attraverso esempi.

3 Descrivere in maniera sintetica le finalità e i contenuti del documento di Visione Strategica (DVS) dell'ASI vigente.

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Il candidato a partire dalla tabella di seguito riportata (che sarà fornita all'interno del file excel denominato **cartel1**) provveda alle seguenti azioni:

classe	gennaio	febbraio	marzo	aprile	maggio	giugno	luglio	agosto	settembre	ottobre	novembre	dicembre
Blu	25	16	20	28	30	18	30	16	27	23	23	24
Verde	30	11	2	5	3	6	30	31	28	17	22	23
Viola	24	24	110	30	21	15	24	31	28	22	91	19
Giallo	30	26	8	8	25	0	18	26	1	4	26	6
Arancio	18	12	21	15	29	19	30	21	27	40	72	39
Rosso	23	29	19	20	31	45	30	28	26	24	14	16

1) Calcolare i totali di ciascuna riga e di ciascuna colonna

2) Fare un grafico che rappresenti l'andamento dei totali nei mesi

3) Salvare i file generati sul desktop del PC nominandoli con nome cognome

TABLE 18-2. **Weight Parameter Definitions.** These are the key elements of a weight budget. Performance charts for launch vehicles usually list only payload performance capability.

Weight Parameters	Comments
1. *Spacecraft Dry Weight*	Weight of all spacecraft subsystems and sensors, including weight growth allowance of 15–25% at concept definition
plus Propellant	Weight of propellant required by the spacecraft to perform its mission when injected into its mission orbit
Yields	
2. *Loaded Spacecraft Weight*	Mission-capable spacecraft weight (wet weight)
plus Upper Stage Vehicle Weight	Weight of any apogee or perigee kick motors and stages added to the launch system
Yields	
3. *Injected Weight*	Total weight achieving orbit
plus Booster Adapter Weight	May also include airborne support equipment on the Space Shuttle
Yields	
4. *Boosted Weight*	Total weight that must be lifted by the launch vehicle
plus Performance Margin	The amount of performance retained in reserve (for the booster) to allow for all other uncertainties.
Yields	
5. *Payload Performance Capability*	This is the payload weight contractors say their launch systems can lift

Occasionally this happens, but more often the spacecraft's weight grows beyond projected weight growth allocations. Make sure the spacecraft weight is within the launcher capability and that the weight growth is within the allocated weight growth margin (see Table 10-10). The longer the wait to reduce weight, the more it costs. Do it early!

If the launch system does not have sufficient performance capability, discussions with the launch vehicle manufacturer can frequently result in some augmentation to the performance, selection of a higher performance launch system, or, if necessary, reevaluation of the spacecraft design and its requirements. These trades are part of the selection process whereby we continuously reevaluate cost, schedule, and risk.

We further evaluate the candidate launch systems which pass the performance "gate" based on their available payload fairings. The fairings must be physically large enough to house and protect the spacecraft during ascent, and the interfaces to the spacecraft, both structural attachment and other services such as cooling (see Sec. 18.3), must be acceptable to the spacecraft.

We must also consider the launch schedule and whether the preferred launch system will be available. Given the required launch date and window, we discuss availability with contractors of launch services. Schedule considerations should include the launch site's availability as well as the use of any unique facilities for ground processing. For example, on the requested launch date, the launch pad may be available but activities nearby may keep us from launching for safety or security reasons. Thus, we have to examine the entire infrastructure, including items such as ground-support equipment and networks for tracking and communications. Several off-site facilities are available for processing—commercially and through agreements

1 Descriva brevemente la sua esperienza professionale e formativa in relazione all'attività richiesta dal bando.

2 Se si volesse sviluppare un software a corredo dei singoli sottosistemi della CEF, quale sarebbe il linguaggio migliore in base alla tua esperienza per lo sviluppo, affinché il podotto finale non sia necessariamente vincolato al sistema operativo o comunque di facile aggiornamento? Quale è il modo migliore per rendere l'applicativo disponibile ad un utente che opera da fuori CEF?

3 Elencare i principali organi dell'Agenzia e desriverne brevemente le funzialità.

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Il candidato a partire dalla tabella di seguito riportata (che sarà fornita all'interno del file excel denominato **cartel2**) provveda alle seguenti azioni:

Programma	Progetto	attività	2018	2019	2020
PROG A	P 1	A 1.1	500	0	500
PROG A	P 1	A 1.2	800	50	600
PROG A	P 1	A 1.1	250	100	350
PROG A	P 2	A 2.1	300	200	300
PROG A	P 2	A 2.2	500	700	500
PROG B	P 3	A 3.1	800	500	600
PROG B	P 3	A 3.2	250	700	350
PROG B	P 3	A 3.3	300	150	300
PROG C	P 4	A 4.1	500	300	500
PROG C	P 4	A 4.2	800	500	600
PROG C	P 5	A 5.1	250	700	350
PROG C	P 5	A 5.2	300	150	300
PROG C	P 6	A 6.1	1000	300	1000

1) Costruire una tabella che evidenzi i totali, per ciascun anno del triennio, per programma e progetto

2) Salvare il file generato sul desktop del PC nominandoli con nome cognome

Chapter 20

Cost Modeling

Henry Apgar, *MCR International, Inc.*
David Bearden, *The Aerospace Corporation*
Robert Wong, *TRW, Inc.*

Cost is an engineering parameter that varies with physical parameters, technology, and management methods. A system's cost depends on its size, complexity, technological innovation, design life, schedule, and other characteristics. It's also a function of risk tolerance, methods for reducing risk, management style, documentation requirements, and project-management controls, as well as the size of the performing organizations. Analyzing and predicting program cost is becoming increasingly important, often critical, to determining whether a program proceeds. At the same time, sponsors, responding to budget reductions, and contractors, realizing that allowing technical performance alone to drive the design usually leads to a more expensive system, are systematically redefining the business of space, making it more difficult to accurately predict cost.

These trends dictate a changing role for cost estimation. In traditional, performance-only driven programs, cost modeling was primarily used to validate contractor cost estimates or give funding organizations an independent estimate of probable cost. Cost estimation was, to some extent, a self-fulfilling prophecy. Often, a space system would actually cost as much or more than what the budget allowed. However, this role is giving way to the more complex tasks of *design-to-cost* and *cost as an independent variable*, where performance is maximized subject to cost constraints. This entails a more proactive and interactive role for the cost estimator with involvement from the

1 Descriva brevemente la sua esperienza professionale e formativa in relazione all'attività richiesta dal bando.

2 Descriva sinteticamente il concetto di database, quindi si identifichino i possibili database operanti nei diversi sistemi operativi e se ne descriva in breve il funzionamento e l'architettura e le misure per salvaguardare la confidenzialità dei dati.

3 Descriva brevemente la missione e gli obiettivi della dell'Agenzia Spaziale Italiana.

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Il candidato a partire dalla tabella di seguito riportata (che sarà fornita all'interno del file excel denominato **cartel1**) provveda alle seguenti azioni:

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Viola	24	24	110	30	21	15	24	31	28	22	91	19
Giallo	30	26	8	8	25	0	18	26	1	4	26	6
Arancio	18	12	21	15	29	19	30	21	27	40	72	39
Rosso	23	29	19	20	31	45	30	28	26	24	14	16

1) Calcolare la media per riga e per colonna
2) Fare il grafico colore vs media per riga
3) Salvare i file generati sul desktop del PC nominandoli con nome cognome

The *payload* consists of the hardware and software that sense or interact with the subject. Typically, we trade off and combine several sensors and experiments to form the payload, which largely determines the mission's cost, complexity, and effectiveness. The subsystems of the *spacecraft bus* support the payload by providing orbit and attitude maintenance, power, command, telemetry and data handling, structure and rigidity, and temperature control. The payload and spacecraft bus together are called the *spacecraft*, *space segment*, or *launch vehicle payload*.

The *launch system* includes the launch facility, launch vehicle and any upper stage required to place the spacecraft in orbit, as well as interfaces, payload fairing, and associated ground-support equipment and facilities. The selected launch system constrains the size, shape, and mass of the spacecraft.

The *orbit* is the spacecraft's path or trajectory. Typically, there is a separate initial parking orbit, transfer orbit, and final mission orbit. There may also be an end-of-life or disposal orbit. The mission orbit significantly influences every element of the mission and provides many options for trades in mission architecture.

The *communications architecture* is the arrangement of components which satisfy the mission's communication, command, and control requirements. It depends strongly on the amount and timing requirements of data to be transferred, as well as the number, location, availability, and communicating ability of the space and ground assets.

The *ground system* consists of fixed and mobile ground stations around the globe connected by various data links. They allow us to command and track the spacecraft, receive and process telemetry and mission data, and distribute the information to the operators and users.

Mission operations consist of the people, hardware, and software that execute the mission, the mission operations concept, and attendant policies, procedures, and data flows. Finally, the *command, control, and communications* (*C^3*) architecture contains the spacecraft, communications architecture, ground segment, and mission operations elements.

1.3 Step 1: Definition of Mission Objectives

The first step in analyzing and designing a space mission is to define *mission objectives*: the broad goals which the system must achieve to be productive. Figure 1-4 shows sample objectives for FireSat. We draw these qualitative mission objectives largely from the mission statement. In contrast, the *mission requirements* and *constraints* discussed in Sec. 1.4 are quantitative expressions of how well we achieve our objectives—balancing what we want against what the budget will allow. Thus, whereas we may modify objectives slightly or not at all during concept exploration, we often trade requirements throughout the process. For FireSat to be FireSat, it must detect, identify, and monitor forest fires. As we trade and implement elements of the system during concept exploration, we must ensure that they meet this fundamental objective. An excellent example of the careful definition of broad mission objectives for space science missions is given by the National Research Council [1990].

Ordinarily, space missions have several objectives. Some are secondary objectives which can be met by the defined set of equipment, and some are additional objectives which may demand more equipment. Nearly all space missions have a *hidden agenda* which consists of secondary, typically nontechnical, objectives. Frequently political, social, or cultural, they are equally real and equally important to satisfy. For example, a secondary objective for FireSat could be to show the public a visible response to

1 Descriva brevemente la sua esperienza professionale e formativa in relazione all'attività richiesta dal bando.

2 Descriva brevemente i vari sistemi operativi, le loro caratteristiche e gli strumenti necessari per poterli mantenere aggiornati e in sicurezza.

3 Quali sono gli strumenti utilizzati dall'Agenzia Spaziale Italiana per poter raggiungere i propri obiettivi.

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Giallo	30	26	8	8	25	0	18	26	1	4	26	6
Arancio	18	12	21	15	29	19	30	21	27	40	72	39
Rosso	23	29	19	20	31	45	30	28	26	24	14	16

1) Calcolare l'incidenza annuale complessiva per ciascun colore;

2) Fare un grafico a torta rappresentativo dei risultati

3) Salvare i file generati sul desktop del PC nominandoli con nome cognome

Establish Goals

We must establish goals in the areas of cycle time, quality and cost. In today's competitive environment, these areas are everything. Many times multiple companies have similar ideas and the only differentiating characteristic between their products is which one makes it to the consumer market first and captures the majority of the market share. Missing the time to market goals will cost a company market share, revenue and brand equity. Therefore we need to know up front when our product must be ready for our customer and then determine our cycle time goals to support this overall schedule.

As stated previously, one of the unfortunate aspects of building satellites is that they are usually not field serviceable. If there is a quality problem after we launch the product into space, we have to live with the degraded performance or, in an extreme case, accept that the product does not meet our mission requirements. We must establish quality goals so that we can design our product accordingly. When we choose components for our product and select processes to build and test our product, we determine our resulting quality levels. As we choose components and processes we need to calculate our cumulative quality predictions and track them to our goals. We will then have the visibility to see what components and processes have a positive or negative impact on the overall product quality. With this data we now make informed trade-off decisions. We can determine which components or processes to change to increase the product quality. Often quality drives cycle time. If a product is designed with low quality levels then we should expect to perform more rework and additional testing. This in turn adds cycle time. Hardware designed around robust processes which exhibit low defect rates result in products with fewer defects which leads to less test time, less rework and lower costs.

Most customers desire low-cost solutions. More and more of the traditional "cost plus" projects are being proposed as fixed price contracts. The days of cost-plus contracts and cost overruns being absorbed by the customer are quickly disappearing. Today the contractor carries the burden of performing to an agreed-upon fixed price. Because of this, the contractor must know the cost goals and understand how they are going to perform to these cost goals. Performance to cost goals directly relates to performance to cycle time goals and quality goals. The addition of unplanned cycle time and of effort required to correct quality problems result in increased cost. In general any unplanned work results in additional cycle time and in additional costs.

Involve Manufacturing Early

Manufacturing early involvement may not always be the accepted way of doing business. Early manufacturing involvement allows the design team to be informed regarding the effects of their choices on downstream manufacturing and test operations. It empowers the design team to make informed decisions and predetermine the expected cycle time, quality and cost performance of the assembly and test operations. It allows management to be aware of what to expect when the product reaches assembly and test.

Getting the design team to accept concurrent engineering can be a difficult task. Many times a company needs a culture change for everyone to embrace the early participation of manufacturing. Management must support concurrent engineering and must pay attention to the analysis results created by the manufacturing representatives. The manufacturing and test participants on the concurrent-engineering team must