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

2 Si esponga il livello di TRL al quale ci si trova nella fase di test di qualifica spaziale su un apparato o un sistema di volo e si descrivano le principali tipologie di verifiche.

3 Si descrivano brevementei principali Strumenti messi in atto per raggiungere gli Obiettivi dell'Agenzia Spaziale Italiana per come è riportato nello Statuto.

We can analyze the failure modes of our equipment in several ways. For example, the all-part method simply analyzes each of the spacecraft's parts to determine the effect of its failure. On a large spacecraft this method is a lot of work but is straightforward and easy to do. The all-part method requires us to analyze shorts and opens —systematically searching for wires or printed traces on circuit boards that can cause failure if opened or shorted together. We can also use scenarios to find potential failure modes. To do so, we simulate the spacecraft's launch, deployment, and operation to ensure that telemetry can detect failures and that the command system can correct them. This simulation normally occurs when operational procedures are being prepared, but it can more effectively detect design flaws if done earlier.

Another way to identify failure modes is the jury method. In many cases new designs do not have a lot of experience behind them, but people have had experience with similar equipment. We can poll them as part of a formal design review or in a separate meeting, thus using their experience to identify likely failure modes and probable effects.

10.6 Examples

In this section, we discuss three examples of spacecraft sizing. First we develop a preliminary estimate of the FireSat spacecraft and then review two actual systems —FLTSATCOM and HEAO-B.

The drivers for the FireSat spacecraft design are the FireSat payload design (Sec. 9-7, Table 9-15) and the orbit and ΔV requirements (Table 7-3). We will use these to get a broad estimate of the overall size, weight, and power for FireSat and then to break this down into approximate subsystem allocations. The results of the top-level process are summarized in Table 10-30. Keep in mind that these are crude estimates that allow us to begin the process of spacecraft design. We must continually evaluate and refine the requirements and resulting design and perform a variety of system trades to arrive at an acceptable, consistent design.

Our first estimate of the spacecraft mass and power come directly from the payload estimates of Sec. 9-7 (Table 9-15). As given in Table 10-5, the payload mass is between 17% and 50% of the spacecraft dry weight with an average of 30% (see also Appendix A). We know very little about FireSat at this time, so we will add margin by estimating the payload at 20% of the spacecraft mass, well below the average percentage. However, FireSat was scaled **down** from a flight unit. This implies that the bus will probably be a larger fraction of the spacecraft dry weight. Our knowledge of the weight is poor at this time because we have not yet done a preliminary weight budget. When we allocate the mass to subsystems below we will hold the margin at the system level to allow us to apply it as needed to various subsystems.

Similarly, our initial power estimate is based on the payload power of 32 W and the estimate from Table 10-9 that for moderate size spacecraft, the payload represents 40% of the spacecraft power. Our spacecraft is small with significant control and processing requirements. Therefore, we will again be conservative and assume that the payload represents only 30% of the power requirement for FireSat. Here the knowledge is very poor, because we have not yet budgeted the power and have not determined what payload duty cycle should be used—that is, should we turn the payload off over the poles and oceans? Because we will have to contend with eclipses (Sec. 5.1, Example 1), the solar array output will be estimated at 170 W to provide 110 W to the spacecraft which then provides 32 W to the payload.

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Il candidato a partire dalla tabella di seguito riportata (che sarà fornita all'interno del file excel denominato **cartel5**) provveda alle seguenti azioni:

Distretto	2001	2002	2003	2004	2005	2006
Torino	16735	15132	15303	15563	14624	13754
Milano	25691	21027	22644	26351	19578	20865
Brescia	7017	4341	5343	6579	5609	4563
Trento	1527	1824	2718	2825	1831	1708
Bolzano	1965	1872	2545	2491	1712	1413
Venezia	16104	13466	13627	12882	11975	12076
Trieste	5561	5753	5188	6355	4744	4926
Genova	10527	9739	10517	11900	9473	7459
Bologna	14454	11570	12561	13091	12014	13542
Firenze	14803	14853	13761	13427	13782	13322
Perugia	3014	2762	2724	3508	2602	2219
Ancona	4664	4412	3546	4677	5026	3886
Roma	25762	19475	20555	25496	27098	25380

1) Calcolare la media di condannati per anno (colonna)

2) Graficare (scegliendo opportunamente il tipo di grafico) il numero medio di condannati vs anni

3) Salvare il file xls generato sul desktop del PC nominandoli **nome_cognome**

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

2 Si descriva in quali fasi di un progetto spaziale vengono tipicamente effettuati i presviluppi degli apparati di bordo e i passi necessari per raggiungere la maturità tecnologica richiesta dalla missione.

3 Il candidato illustri le principali differenze fra il Documento di Visione Strategica (DVSS) e Piano Triennale delle Attività (PTA) attualmente vigenti e descriva brevemente i contenuti di uno dei due a scelta.

Bando 30/2021 – Profilo UTC2

Il candidato a partire dalla tabella di seguito riportata (che sarà fornita all'interno del file excel denominato **cartel 6**) provveda alle seguenti azioni:

Genere	TV pub 1	TV pub 2	TV pub 3	TV priv 1	TV priv 2	TV priv 3	TV priv 4	TV priv 5
Film	881	501	981	700	585	1057	2945	4000
Sport	245	472	921	300	46	547	61	50
Varietà	1923	1158	1201	2000	1436	848	1310	300
Musica	40	35	59	30	52	266	156	200
Inchieste, documentari	198	376	911	102	155	16	307	54
Telegiornali	1359	738	2169	1400	2422	476	1021	500
Programmi culturali	1001	1270	500	100	154	1	273	46

1) Calcolare il totale delle ore di trasmissione per le reti private.

2) Creare un grafico a barre che metta in relazione le ore di programmazione delle tv private vs il Genere.

3) Salvare il file xls generato sul desktop del PC nominandoli **nome_cognome**

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und Interface.

5. Report No.

Center. 1984.
Guide. STDN

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Chapter 16

Spacecraft Computer Systems

L. Jane Hansen, ***HRP Systems***
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Craig H. Pollock, ***TRW, Inc.***

Mission-supporting computer systems include the computers onboard the spacecraft, as well as those on the ground, as illustrated in Fig. 16-1. On board the spacecraft, computers have become an integral part of the overall system, as well as being part of most spacecraft subsystems. Ground station computer systems are used to support daily operations after launch, and may be derived from systems originally used for developing and testing space-based elements. Thus, computer systems cross traditional subsystem and organizational boundaries.

In previous chapters we have described the various spacecraft subsystems. Through spacecraft evolution, most subsystems now contain elements of a computer system as shown in Fig. 16-2. This means that the computer system resource estimation process takes on a larger scope than in the past. In this chapter we discuss how to generate computer system resource estimates, refine the computer system requirements, estimate the effort in terms of resources, and define the tasks associated with developing computer systems onboard the spacecraft. Additionally, we will briefly examine the requirements for ground-based computer systems throughout the life-cycle development process.

As outlined in Table 16-1, we discuss the iterative process used to estimate computer resources, based on mission requirements. We will accomplish this by first discussing the computer system specifications and the task of creating a baseline computer system from top level requirements. Figure 16-3 shows that the computer

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

2 Si descriva una tecnologia di frontiera, evidenziandone anche i benefici rispetto allo stato dell'arte, in uno dei seguenti settori applicativi spaziali a scelta: osservazione della terra, telecomunicazioni, navigazione, esplorazione, trasporto spaziale e sistemi orbitali e robotici, sistemi software, GNC, avionica e intelligenza artificiale.

3 Il candidato descriva sinteticamente il ruolo del Presidente per come riportato nello Statuto dell'Agenzia.

Bando 30/2021 - Profilo UTC2

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

colleghi lavoro	gennaio	febbraio	marzo	aprile	maggio	giugno	luglio	agosto	settembre	ottobre	novembre	dicembre
Bianchi	25	16	20	28	30	18	30	16	27	23	23	24
Rossi	30	11	2	5	3	6	30	31	28	17	22	23
Neri	24	24	110	30	21	15	24	31	28	22	91	19
Blu	30	26	8	8	25	0	18	26	1	4	26	6
Ecru	18	12	21	15	29	19	30	21	27	40	72	39
Biondi	23	29	19	20	31	45	30	28	26	24	14	16

1) Calcolare la media annua (riga) e mensile (colonna) per ciascun collega

2) Per **Bianchi** fare il grafico (scegliendo opportunamente fra quelli disponibili) "ore di lavoro" vs "mese"

3) Salvare il file xls generato sul desktop del PC nominandoli come **nome_cognome**

Spacecraft Operations sends requests to Activity Planning for engineering activities to be converted into timed commands in an integrated sequence. They often review activity plans before uplinking to make sure they don't violate flight rules from spacecraft engineering and that they meet operational peculiarities and constraints of the subsystems. Reviews can be simple for missions that execute a routine daily set of standard commands and for missions that have invested in simulation software which automatically checks constraints. But they can be time consuming for missions that have a high percentage of new or unique activities every day, that can't simulate activities and constraints, and that have subsystems which strongly constrain operations.

Spacecraft Operations delegates to Mission Control the responsibility for real-time monitoring of the spacecraft's health and performance (such as monitoring telemetry alarm limits). This delegation allows Spacecraft Engineering to concentrate on more deliberative, non-real-time tasks, such as analyzing performance and predicting long-term trends. It also often allows them to staff only 8 hours per day, 5 days per week.

There are two styles of fault detection and anomaly analysis. The first—a *detect-respond* style—is less expensive. Operators watch for alarms or other unexpected failures, analyze them, and prepare strategies to correct or work them. The second—a *predict-prevent* style—costs more. Planners predict trends and performance, trying to forecast faults before they might occur and then plan preventative action. This task can involve elaborate models for telemetry, power, thermal, dynamics, and other systems and can require significant calibrations and performance tests during a flight. Detect-respond fault operations are characteristic of space missions that can handle occasional unplanned down times to recover from faults. Often these missions have single-string hardware configurations with limited options for recovering from failures. Predict-prevent fault operations are characteristic of space missions with engineering or science events, for which an unplanned down time could cause loss of a mission or loss of mission critical science data that we can't recover. Often these missions have block redundant hardware, allowing operators to select a back-up component when trending data suggests a possible future failure in the main on-line, component.

Failure analysis sometimes requires using test beds on the ground that allow analysts to simulate or recreate problems observed in flight. Spacecraft Operations runs and maintains them, which can become a significant operations cost for test-bed hardware (usually, engineering models for flight hardware) and managing and updating software.

Spacecraft Operations also maintains and fixes flight software, then continues to develop it after launch. Missions with long flight times, changing mission goals, or major anomaly recovery work-arounds will often require significant software re-development during flight. Some missions that have long flights to targets may even deliberately postpone developing target-related software until after launch. Software test and validation becomes another use for the flight-system testbed and another potential expense for Spacecraft Operations.

7. Payload Operations

This operations function has similar interfaces as the Spacecraft Operations function, but with responsibility for the payload instead of the spacecraft. Payload operators send measurement goals and activity requests to Mission Planning and Activity Planning respectively, which convert payload requests into mission timelines and integrated command loads. Some designs for mission operations try to simplify these interfaces by allowing payload controllers to directly command the payload's configuration and method of returning data, sometimes from sites located remotely from the

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

2 Si descrivano le principali differenze nello sviluppo di tecnologie tra il segmento di terra e quello spaziale in uno dei seguenti ambiti applicativi a scelta: osservazione della terra, telecomunicazioni, navigazione, esplorazione, trasporto spaziale.

3 Il candidato nell'ambito del diritto penale descriva brevemente la differenza tra reato di corruzione e istigazione alla corruzione.

engineers focus on technical-interface agreements, such as data formats, procedures, and protocols. Management focuses on program interfaces such as funding agreements. System engineers develop and maintain operations concepts to help design and refine system architecture, team responsibilities, and operations interfaces. Operations concepts include scenarios, timelines, and product flows that capture the operations system performance requirements, design constraints, and requirements derived from the design.

System Engineering also plans for contingencies, resolves anomalies, and handles failure recoveries. System engineers coordinate anomaly analysis that involves interaction among several engineers or teams and provide technical approval of engineering change requests to develop fault repairs or work-arounds.

During operations, the Integration and Test task supports development by testing new or redelivered capabilities. It also supports testing of system interfaces when new institutional capabilities get delivered. Teams must develop test schedules to fit operational schedules. Engineers have to save previous versions of software to permit return to a known good system whenever testing shows the new version has problems. Independent verification and validation, i.e. assigning the Integration and Test task to engineers different from those in Development is a common practice to ensure independent, objective testing.

11. Computers and Communications Support

This function entails designing and buying or building hardware for the end-to-end information system. Because space missions typically produce so much data in electronic form, mission operations planners must ensure data moves efficiently. To do so, we prepare data-flow diagrams, requirements for computers or workstations, requirements for networking and data communication (within the control center and around the world), and requirements for voice communications. Having accurate data-flow diagrams (see Sec. 2.2.1) is the starting point for designing the hardware. From mission objectives, we learn how much data must flow, between which nodes, and how frequently. We use this information to diagram the data flow and allocate data-handling processes to software and hardware. From the diagrams, we list the numbers and types of computers, workstations, and other hardware. Knowing the communications architecture and organizational design helps us choose the hardware correctly. For example, a decentralized organization for mission operations requires us to connect dispersed staff members, which usually means preparing a communications network.

The networking requirements also come from the data-flow diagrams and usually require more support equipment. Other networking factors are availability, capacity, and security for mission data.The final piece of communication support is the voice and video-teleconferencing requirements. Early in design, we must establish any need for these special links so the operations organization can communicate efficiently during the mission.

Because of the proliferation of modern computing and communication equipment, planning for their support may be no more complex than ordering from industry catalogs. Designing and building unique hardware usually isn't cost effective, but special requirements may drive us to do trade-offs in this area. Finally, maintaining and administering the computer and communication hardware throughout the mission is a vital concern. Good designs allow us to repair and replace equipment and allocate staff for this activity.

Bando 30/2021 – Profilo UTC2

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

	Anno						
Moschettieri/ N. duelli	**1625**	**1626**	**1627**	**1628**	**1629**	**1630**	**1631**
Athos	51	55	52	59	70	75	30
Porthos	62	48	51	55	50	10	35
Aramis	48	46	57	40	64	56	24
d'Artagnan	32	43	54	65	37	43	17

1) Calcolare per ciascun anno (colonna) il valore minimo di duelli e la media nel tempo (riga)
2) Graficare, per d'Ardagnan e Aramis, i duelli vs anni
3) Salvare il file xls generato sul desktop del PC nominandoli come **nome_cognome**