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

2 Si descriva l'architettura di un payload a scelta fra le seguenti tipologie: osservazione della terra oppure telecomunicazioni oppure navigazione.

3 Il candidato descriva sinteticamente il ruolo del Organismo di Valutazione (OIV) per come riportato nello Statuto dell'Agenzia.

13.1.3 Criteria for Selecting Communications Architecture

Individual users will assign different priorities to the criteria for selecting a communications architecture. For example, a commercial company will try to reduce cost and risk, but the military may make survivability the top priority. The factors which affect the criteria are explained below:

Orbit: The satellite orbit determines how much time the satellite is in view by the ground station and the potential need for intersatellite links. The satellite altitude determines the Earth coverage, and the satellite orbit determines the delay between passes over a specified ground station. Together, orbit and altitude set the number of satellites needed for a specified continuity of coverage (see Sec. 7.2). Transmitter power and antenna size depend on the distance between the satellites and the ground stations (see Sec. 13.3). Satellite view time determines the signal-acquisition and mission-control complexity (see Chap. 14).

In the satellite-cellular systems described above, intersatellite links are not necessarily used. Instead, the constellation is designed so that at least one satellite is in view by the gateway and every user at all times, so that there are no "outages." Coverage is determined by the number of satellites, the inclination of their orbits, the latitude of the gateway and user, and the number of gateways located around the world, if intersatellite links are not used.

If intersatellite links are used, then the number of gateways and their location becomes much less critical, as many satellites can connect to a single gateway through intersatellite links. Various systems proceeding now have used different philosophies with respect to intersatellite links, which can have great effect on the capital cost of the system. Intersatellite links make the satellites more expensive, but eliminate the need for many fairly expensive ground stations (gateways), for example.

There are many systems proposed in various frequency bands which use not only the geostationary orbit, the low-Earth orbit discussed above, and also what is called a medium-Earth orbit (MEO), which ranges in altitude from about 10,000 to 20,000 km. These are typically inclined with respect to the equator as the LEOs are, and can address users with small, hand-held UTs, but can see a much larger portion of the Earth at one time, so that only 10 or 12 of them are required to give nearly complete Earth coverage.

RF Spectrum: The RF carrier frequency affects the satellite and ground station transmitter power, antenna size and beamwidth, and requirements for satellite stabilization. In turn, these factors affect satellite size, mass, and complexity. The carrier frequency also determines the transmitter power needed to overcome rain attenuation (see Sec. 13.3). Finally, it is necessary to apply for and receive permission to use an assigned frequency from a regulatory agency such as the International Telecommunication Union, the Federal Communications Commission, or the Department of Defense's Interdepartmental Radio Advisory Committee, and every nation's regulatory agency. These agencies also allocate orbit slots for geostationary satellites (Chap. 21).

Data Rate: The data rate is proportional to the quantity of information per unit time transferred between the satellite and ground station (see Sec. 13.2). The higher the data rate, the larger the transmitter power and antenna size required (Sec. 13.3). Processing the spacecraft-generated data on board the satellite reduces the data rate without losing essential information, but makes the satellite more complex (see Sec. 13.2).

Duty Factor: The fraction of time needed for operation of a satellite link is the *duty factor*, which is a function of the mission and the satellite orbit. A low duty factor

Bando 30/2021 - Profilo UIC1

Il candidato a partire dalla tabella di seguito riportata (che sarà fornita all'interno del file excel denominato **cartel3**) provveda alle seguenti azioni:

	2020			2021			2022		
	luce	gas	acqua	luce	gas	acqua	luce	gas	acqua
gennaio	55	36	43	67,65	36,828	43,559	137,5	144	49,45
febbraio	54	14	27	66,42	14,322	27,351	135	56	31,05
marzo	42	44	56	51,66	45,012	56,728	105	176	64,4
aprile	41	47	43	50,43	48,081	43,559	102,5	188	49,45
maggio	56	14	39	68,88	14,322	39,507	140	56	44,85
giugno	56	15	45	68,88	15,345	45,585	140	60	51,75
luglio	35	31	53	43,05	31,713	53,689	87,5	124	60,95
agosto	18	40	24	22,14	40,92	24,312	45	160	27,6
settembre	40	44	51	49,2	45,012	51,663	100	176	58,65
ottobre	54	32	45	66,42	32,736	45,585	135	128	51,75
novembre	33	43	31	40,59	43,989	31,403	82,5	172	35,65
dicembre	15	29	43	18,45	29,667	43,559	37,5	116	49,45

1) Per il 2022 calcolare il costo mensile per servizio (riga) aggravato del 20% di IVA e il costo totale per servizio(colonna)

2) Fare il grafico (scegliendolo tra quelli disponibili) che mostri per ciscun mese l'impatto sui costi dei diversi servizi

3) Aprire un file power pointword e copiare la tabella intitolando opportunamente il documento "costi mensili 2021"

4) Salvare i file xls e word generati, 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 cosa si intende per roadmap di sviluppo tecnologico in ambito spaziale e si fornisca qualche esempio.

3 Il candidato illustri le principali finalità del Piano Triennale delle Attività (PTA) attualmente vigenti e indichi il collegamento con il DVS.

spectrum. The same phenomena explain the reddish color of the sky near dawn and sunset. At these times, shorter green, blue indigo, and violet wavelength signals are greatly attenuated as they travel farther through the atmosphere than when the Sun is overhead.

9.4.1 Candidate Sensors and Payloads

Electro-optical imaging instruments use mechanical or electrical means to scan the scene on the ground. Spacecraft in geostationary orbits perceive very little relative motion between the scene and the spacecraft, so an optical instrument needs to scan in two dimensions to form an image. A common approach for geostationary imaging spacecraft, such as ESA's meteorological spacecraft, METEOSAT, involves placing a large scan mirror in front of the instrument's optics to perform the north-south scan. Rotation of the spacecraft around a north-south axis performs the east-west scan. Three-axis stabilized spacecraft in geostationary orbits frequently use a two-axis scan mirror in front of the optics to scan the scene in two dimensions. Alternatively, we can use a two-dimensional matrix imager, which maps each picture element (pixel) in the imager to a corresponding area on the ground. Scanning the scene then becomes a process of sampling the two-dimensional arrangement of pixels in the imager.

Spacecraft in low-Earth orbits move with respect to the scene. The sub-spacecraft point moves along the surface of the Earth at approximately 7,000 m/s (see Chap. 5). This motion can replace one of the scan dimensions, so the scanning system of the optical instrument needs to perform only a one-dimensional scan in the cross-track direction. *Whiskbroom sensors* scan a single detector element that corresponds to a single pixel on the ground in the cross-track direction. Fig. 9-14A illustrates this technique. Whiskbroom scanners can also use several detectors to reduce the requirements compared to a single detector. Each detector element corresponds to a pixel on-ground (see Fig. 9-14B), and the dwell time per pixel is multiplied by the number of detector elements used.

Push broom scanners use a linear arrangement of detector elements called a line imager covering the full swath width. The name "push broom" comes from the read-out process, which delivers one line after another, like a push broom moving along the ground track. Each detector element corresponds to a pixel on-ground. Fig. 9-14C illustrates this technique. The ground pixel size and the velocity of the sub-spacecraft point define the integration time.

Step-and-stare scanners use a matrix arrangement of detector elements (matrix imager) covering a part or the full image. Each detector element corresponds to a pixel on-ground. Fig. 9-14D illustrates this technique. Step-and-stare systems can operate in two basic modes. The first mode uses integration times that are chosen as in the case of the push broom sensor for which the ground pixel size and the velocity of the sub-satellite point determine the integration time. Thus, no advantage with respect to the integration time is achieved, but a well known geometry within the image is guaranteed. We need a shutter or equivalent technique, such as a storage zone on the imager to avoid image smear during read-out. The second mode allows a longer integration time if the image motion is compensated to very low speeds relative to the ground. We can do this by shifting the imaging matrix in the focal plane or by moving the line of sight of the instrument by other means to compensate for the movement of the sub-spacecraft point. Step-and-stare sensors require relatively complex optics if they must cover the full image size. An additional complexity is that the fixed pattern noise has to be removed from the image, since each pixel has a somewhat different responsive

Bando 30/2021 – Profilo UIC1

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

	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
2) Fare il grafico (scegliendo opportunamente fra quelli disponibili) dei dati Min e Medio di duelli rispetto al tempo
3) Aprire un Word e Copiare all'interno il grafico fornendo un titolo allo scritto "confronto Min e media nel tempo"
4) Salvare i file xls e doc generati sul desktop del PC nominandoli come **nome_cognome**

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

2 Si descrivano le principali caratteristiche tecniche peculiari delle missioni spaziali di esplorazione lunare o planetarie rispetto a quelle in orbita terrestre.

3 Il candidato descriva sinteticamente gli Strumenti a disposizione dell'Agenzia per adempiere ai suoi compiti istituzionali, come riportato nello Statuto dell'Agenzia.

Bando 30/2021 – Profilo UIC1

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

Distretto	Anno 2001	Anno 2002	Anno 2003	Anno 2004	Anno 2005	Anno 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 il totale di condannati per distretto (riga) e per l'anno 2004 si identifichi rispetto al totale calcolato l'impatto percentuale per ogni distretto

2) Graficare (scegliendo opportunamente il tipo) per il 2004 la percentuale vs i distretti

3) Aprire un file power point e copiare il grafico intitolando opportunamente la slide "delitti 2001-2006"

4) Salvare i file, xls e ppt, generati sul desktop del PC nominandoli **nome_cognome**

Chapter 10

Spacecraft Design and Sizing

Emery I. Reeves, ***United States Air Force Academy***

Over the past four decades the engineering design of spacecraft has evolved from infancy to well-defined techniques supported by analysis tools, manufacturing technology, and space-qualified hardware. This chapter summarizes these techniques, with emphasis on the conceptual design of the spacecraft vehicle. The following two chapters present more detailed design and manufacturing information. To design a spacecraft, we must understand the mission, including the payload's size and characteristics, plus significant system constraints such as orbit, lifetime, and operations. We then configure a space vehicle to carry the payload equipment and provide the functions necessary for mission success. The design process shown in Table 10-1 involves identifying these functions, choosing candidate approaches for each function, and selecting the best approaches. This chapter presents design methods with rules of thumb that will help us roughly estimate the spacecraft design [Agrawal, 1986; Chetty, 1991; Griffin and French, 1991].

An unmanned spacecraft consists of at least three elements: a payload, a spacecraft bus, and a booster adapter. The *payload* is the mission-peculiar equipment or instruments. The *spacecraft bus* carries the payload and provides housekeeping functions. The payload and spacecraft bus may be separate modules, or the vehicle may be an integrated design. The *booster adapter* provides the load-carrying interface with the boost vehicle. The spacecraft may also have a propellant load and a propulsion kick stage. The *propellant*, either compressed gas, liquid or solid fuel, is used for velocity corrections and attitude control. A *kick stage,** if used, is a separate rocket motor or liquid stage used to inject the spacecraft into its mission orbit.

---

* Also called *apogee boost motor*, *propulsion module*, or *integral propulsion stage*.

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

2 Si descrivano le tipiche fasi di un progetto spaziale e quali sono i principali obiettivi associati.

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

Bando 30/2021 – Profilo UIC1

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

	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 ciascuna riga (Moschettiere) il valore minimo e massimo di duelli e per ciscuna colonna (anno) la media di duelli

2) Fare il grafico Moschettiere vs Min e Max (duelli)

3) Aprire un Word e Copiare all'interno il grafico fornendo un titolo allo scritto

4) Salvare i file xls e doc generati sul desktop del PC nominandoli come **nome_cognome**

11.3.3 C&DH Basics

This section is a list of details of great concern to command and data handling system design and operation. Many of these concerns are of absolute necessity when determining C&DH requirements and generating procurement specifications. Emphasis is placed on the command system because of the severity of the effects if these guidelines are not followed. Data handling basics such as data rates and the number of bits per sample are covered in Sec. 13.2.

Interfaces to other equipment must be protected so that their faults do not propagate into the command decoder.

It is paramount that no commands or any transient signals appear on command outputs during application or removal of prime power, or during under/over prime power voltage conditions.

It is a basic philosophy of command decoder designs that if the integrity of a command message is in doubt, the command is not issued. It is rejected! This is especially true when firing an ordnance device or the spacecraft is launched from a manned vehicle. It is for this reason that received command messages are not corrected, although the capability exists, using error check bits.

For safety concerns, operations such as firing ordnance, an engine, or thruster, require multiple commands configured in series forming a logical AND function. No single command causes the operation to occur. In a typical ordnance application, three commands are required: safe, arm, and fire. In this case, safe and arm are relays that enable a high level discrete command, fire. The commands must (shall) be isolated within the command decoder such that no single component or physical failure results in inadvertent function execution. To achieve this, the Hamming distance of controlling command messages must be two or greater (for isolation in the decoding scheme), and command outputs must be physically isolated to the greatest extent possible using different decoding circuits and interface connectors.

It is advised not to have any commands that turn a command decoder off during flight. In addition, there should be no commands that interrupt the uplink source to the command decoder.

In redundant applications, where command outputs are cross strapped, the interface circuits and interconnection have to be designed such that no single component or physical failure prevents the active output from functioning. Along the same lines, where telemetry inputs and serial interface outputs are cross strapped, the interface circuits and interconnections have to be designed such that no single component or physical failure prevents the interface from functioning.

The rising and falling edges of discrete command and serial telemetry outputs are often limited in frequency content so that they are not a source of noise emissions on the spacecraft.

11.3.4 A Final Note

The C&DH subsystem is often one of the last on the spacecraft to be defined. It is a tool, used to configure, control, or program the payload and other spacecraft subsystems. It is the spacecraft's senses reporting internal environment, health, and status information. C&DH equipment cannot be completely defined until the requirements of other systems have been established. The mission designer's main task is that of listing the command, telemetry and other data needs for each spacecraft system. The list must also include the rate at which commands are issued and telemetry is gathered for determination of composite data rates. Issues such as data format, encoding, and

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

2 Si descrivano le principali attività di verifica di un satellite a scelta fra le seguenti tipologie: EMC oppure meccaniche oppure termiche.

3 Il candidato nell'ambito del diritto penale descriva brevemente la differenza tra reato di concussione e di abuso di ufficio.

10.5.2 Lifetime and Reliability

Reliability is a parameter under the designer's control. We should consider its potential effect on spacecraft sizing during conceptual design by examining failures from wear-out and random causes. In other words, we should identify the ways in which the spacecraft may fail and tailor the design to eliminate or limit failures to acceptable levels. This implies identifying components or functions which can wear out and designing the system so that they meet the mission's lifetime requirements. Propellant supply and battery-cycle life are examples of these components. If equipment does not wear out, we must evaluate how each part's failure affects the mission and modify the design to eliminate any single-point failures. Then, we use statistics to compute the probability of mission success and tailor the design to acceptable levels. This process is not exact, but careful attention to reliability gives us the most balanced and able system possible.

To design for reliability, we must understand what constitutes success. The more specifically and numerically we can state the success criteria, the easier we can translate these criteria into design requirements. After defining success, we should list the smallest amount of equipment or number of functions that will provide it. We can begin by placing these functions in a signal flow or block diagram. In this basic form, most functions involve only one path or set of equipment. For this reason, we sometimes call it a *single-string reliability model*. Later in the design process, we can add multiple paths or backup modes to improve the probability of success, taking care to understand both the reliability enhancement and the cost.

By understanding the functions needed for a successful mission, we understand the factors which limit mission life or threaten that success. Often a new mission depends on developing or exploiting new technology, so we need to know the technology and the factors that stress the components of our system. By reducing our knowledge to a set of specifications and applying the stresses to our design, we improve our ability to produce reliable hardware.

One of the key steps in design for reliability is to numerically predict the probability of success. To do so, we must differentiate failures from wear-out and failures from random causes. Classic reliability models depict the rate of failure when plotted against time as a "bathtub"-shaped curve. Early on, systems fail at high rates because of *infant mortality*; late in life, they fail because of wear-out. We can eliminate failures from infant mortality with careful construction, testing, and burn-in. We can avoid wear-out by understanding and eliminating the factors that cause it or by providing enough hardware to replace worn-out equipment. Between the extremes of infant mortality and wear-out, the failure rate is more or less uniform and attributed to random effects.

Wear-out shortens a mission. Random failures kill a spacecraft with accumulated effects. A successful design copes with them by providing enough backup components to cover them. Because we cannot determine when they will occur, our design must allow us to detect and correct them. Also, a good design tolerates some failures and remains useful in a degraded mode.

Searching for and identifying the ways in which equipment can fail is a basic part of design for reliability. This process, called *Failure Modes Effects and Criticality Analysis* (*FMECA*) assumes that we can identify the ways in which equipment can fail and analyze the effect. Key to this process is identifying and eliminating single-point failure modes—failures that by themselves can kill the mission. If we cannot eliminate them, we must control their probability of occurrence.

Bando 30/2021 – Profilo UIC1

Il candidato a partire dalla tabella di seguito riportata (che sarà fornita all'interno del file excel denominato **cartel7**) 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 tipologia di attività e successivamente ordinarli in modo decrescente

2) Aprire un file power point e copiare la tabella all'interno del power point intitolando opportunamente la slide "Valori attività nel triennio"

3) Salvare i file xls e ppt e generati 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 descrivano le principali caratteristiche che contraddistinguono le tecnologie utilizzate per il segmento spaziale da quelle utilizzate per il segmento di terra.

3 Si descrivano brevemente i principali reati dei pubblici funzionari contro la Pubblica Amministrazione e di quelli identificati se ne scelga uno e lo si dettagli.

11.1 Attitude Determination and Control

John S. Eterno, *Ball Aerospace & Technologies Corporation*

The *attitude determination and control subsystem (ADCS)* stabilizes the vehicle and orients it in desired directions during the mission despite the external disturbance torques acting on it. This requires that the vehicle determine its attitude, using sensors, and control it, using actuators. The ADCS often is tightly coupled to other subsystems on board, especially the propulsion (Chap. 17) and navigation (Sec. 11.7) functions. Additional information on attitude determination and control can be found in Wertz [1978, 2001], Kaplan [1976], Agrawal [1986], Hughes [1986], Griffin and French [1990], Chobotov [1991], and Fortescue and Stark [1992].

We begin by discussing several useful concepts and definitions, including mass properties, disturbance torques, angular momentum, and reference vectors. The mass properties of a spacecraft are key in determining the size of control and disturbance torques. We typically need to know the location of the center of mass or gravity (cg) as well as the elements of the inertia matrix: the moments and products of inertia about chosen reference axes. (See Sec. 11.6 for examples of moment of inertia calculations.) The direction of the principal axes—those axes for which the inertia matrix is diagonal and the products of inertia are zero—are also of interest. Finally, we need to know how these properties change with time, as fuel or other consumables are used, or as appendages are moved or deployed.

A body in space is subject to small but persistent disturbance torques (e.g., 10^{-4} N·m) from a variety of sources. These torques are categorized as *cyclic*, varying in a sinusoidal manner during an orbit, or *secular*, accumulating with time, and not averaging out over an orbit. These torques would quickly reorient the vehicle unless resisted in some way. An ADCS system resists these torques either passively, by exploiting inherent inertia or magnetic properties to make the "disturbances" stabilizing and their effects tolerable, or actively, by sensing the resulting motion and applying corrective torques.

Angular momentum plays an important role in space, where torques typically are small and spacecraft are unconstrained. For a body initially at rest, an external torque will cause the body to angularly accelerate proportionally to the torque—resulting in an increasing angular velocity. Conversely, if the body is initially spinning about an axis perpendicular to the applied torque, then the body spin axis will precess, moving with a constant angular velocity proportional to the torque. Thus, spinning bodies act like gyroscopes, inherently resisting disturbance torques in 2 axes by responding with constant, rather than increasing, angular velocity. This property of spinning bodies, called *gyroscopic stiffness*, can be used to reduce the effect of small, cyclic disturbance torques. This is true whether the entire body spins or just a portion of it, such as a momentum wheel or spinning rotor.

Conservation of vehicle angular momentum requires that only external torques change the system net angular momentum. Thus, external disturbances must be resisted by external control torques (e.g., thrusters or magnetic torquers) or the resulting momentum buildup must be stored internally (e.g., by reaction wheels) without reorienting the vehicle beyond its allowable limits. The momentum buildup due to secular disturbances ultimately must be reduced by applying compensating external control torques.

Bando 30/2021 – Profilo UIC1

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

Distretto	Anno 2001	Anno 2002	Anno 2003	Anno 2004	Anno 2005	Anno 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) e se ne indichi per ciscun anno se ve ne sono più a Roma o a Milano (usando opportuna funzione)

2) Graficare (scegliendo opportunamente il tipo) per i primi 2 distretti , il numero medio di condannati per ciscun anno

3) Aprire un file Word e copiare il grafico intitolando opportunamente "delitti 2001-2006"

4) Salvare i file xls e word e generati 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 il processo che porta a definire i requisiti tecnici di un sistema spaziale.

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

doublet, and the Cassegrain telescope is a reflective implementation of a tele-optic lens. The Three-Mirror Anastigmatic system is comparable to the lens triplet with respect to all the aberration corrections, but with an all-reflective design. Reflective optical systems generally are free from chromatic aberrations. However, reflective systems typically have a much smaller field of view than their refractive counterparts.

In reality, optical systems for space remote sensing are far more complex because the technologies for manufacturing the lenses and mirrors are limited and other effects such as thermal distortions and radiation effects can alter the performance of the instrument. Thermal distortions can limit the performance of an optical system, even if the operating temperature range is regulated within a few degrees for high performance optical systems, and cosmic radiation effects can degrade the transparency of most optical glass over time. Figure 9-10 shows the lens cross section of the high-resolution optical lens system of the German-built Modular Optoelectronic Multispectral Scanner (MOMS 2P) instrument designed to achieve 6 m resolution on the ground.

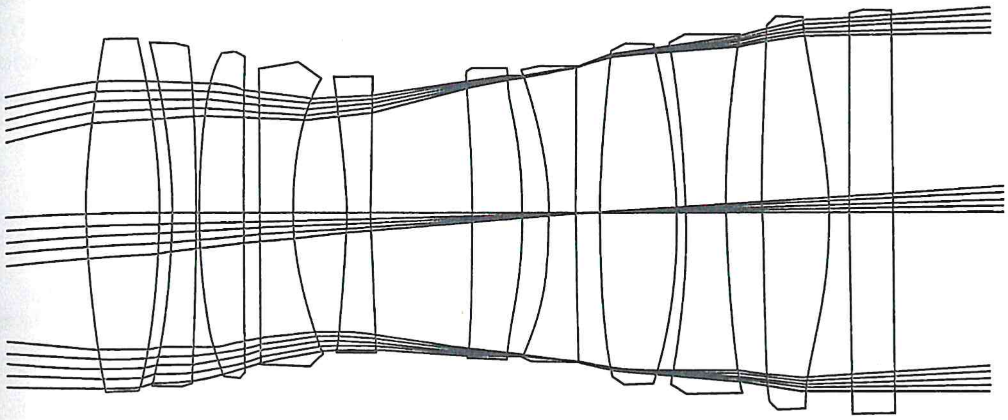

Fig. 9-10. Lens Cross Section of the Panchromatic Objective of the MOMS 2P Instrument. The sensor has a focal length of 0.66 m and an aperture size of 0.15 m. The complexity of this optical system is representative of sophisticated remote sensing payloads.

9.3.3 Diffraction Limited Resolution

The *resolution* of an optical system is its ability to distinguish fine detail. In general resolution is expressed in angular terms. Thus, a telescope that can just distinguish or *resolve* two stars which are very close together is said to have a *resolving power* equal to the angular separation of the stars. For Earth observing systems we are more interested in the ability to see or resolve fine detail on the surface. Thus, for these systems resolution is commonly expressed in terms of the size of an object on the Earth that can just be distinguished from the background. To read this page requires a resolution of about 0.1 mm, whereas you may be able to distinguish a large newspaper headline with a resolution of 1 cm.

No matter how good the quality of the lens or mirror, a fundamental limitation to resolution is *diffraction*, the bending of light that occurs at the edge of the optical system. Even for a perfect optical system, diffraction causes the image of a point source of light, such as a distant star, to appear not as a point on the focal plane but as a series of concentric circles getting successively dimmer away from the center, as shown in

Bando 30/2021 – Profilo UIC1

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

	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 massimo di duelli e il totale annuo, rispetto al totale calcolare la percentuale di duelli di Athos
2) Fare il grafico (scegliendo opportunamente fra quelli disponibili) della percentuale di duelli di Athos per anno.
3) Aprire un power point e Copiare all'interno il grafico fornendo un titolo alla slide "percentuale di duelli nel tempo"
4) Salvare i file xls e ppt generati sul desktop del PC nominandoli come **nome_cognome**

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

2 Si descrivano le varie modalità di monitoraggio della pianificazione di un programma di sviluppo per un sistema spaziale.

3 Il candidato illustri le principali finalità del Documento di Visione Strategica (DVS) in corso di validità e illustri il collegamento con il PTA.

where R is the number of errors per bit day, a and b are device surface dimensions in µm, c is the device depth in µm, and Q_c is the critical charge in pC. These two equations have been shown to predict upset rates in the geosynchronous orbit for solar minimum conditions with reasonable accuracy. Scale factors for estimating error rates for other orbits and other calculational methods may be found in Petersen [1995].

Single-event upset rates in complex devices such as microprocessors, or single-event latchups or burnouts in any devices, cannot be reliably predicted. We must resort to predictions based on simulated accelerator test observations and flight performance of similar devices.

Galactic cosmic rays can also generate background noise in various satellite subsystems such as star sensors, infrared detectors, and components employing charge-coupled devices. In addition to increased noise signals, these rays create spurious events which can masquerade as real signals. The spurious signals can affect satellite subsystems depending on the genuine signals' frequency of occurrence, time duration, and repetition, as well as the sophistication of the sensor system. Galactic cosmic rays are a potential source of background noise which must be taken into account when designing a satellite system. It should also be noted that, while this section addresses effects of galactic cosmic rays, similar effects are caused by high energy protons and must be considered for orbits in the range of 1,000–10,000 km altitude.

8.2 Hardness and Survivability Requirements

Paul Nordin, ***The Boeing Company***
Malcolm K. Kong, ***TRW Systems & Information Technology Group***

Survivability is the ability of a space system to perform its intended function after being exposed to a stressing natural environment or one created by an enemy or hostile agent. *Hardness* is an attribute defining the environmental stress level which a space system can survive. As an example, a satellite or spacecraft which can withstand an X-ray fluence of 1.0 cal/cm^2 or absorption of 10^7 rads (Si) of total dose (a rad of absorbed dose is approximately 100 ergs/g) has a hardness of that amount. (*Fluence* is the time integral of flux. *Flux* is the flow of energy per unit time and per unit cross-sectional area.)

In the aerospace industry we now consider both natural and hostile environments in the definition of hardness and survivability. Well-developed technologies, evolved over the last 35 years, make it possible to design satellites to withstand natural and modest levels of hostile environments. Although technologies for hardening against hostile military threats and for natural survival of satellites overlap, they are distinct and are usually treated separately except in the areas of survivability to total dose due to the Van Allen belts, single-event effects (SEE) caused by galactic cosmic rays and high energy protons, and space/bulk charging due to naturally occurring space plasmas. The latter phenomena must be treated synergistically in the design of satellites.

A military space system or commercial satellite must be survivable if we will need its services in times of high stress, such as a nuclear war. To do this, we must understand what may cause the system to malfunction and then design it to protect against failures. Survivability requirements include identifying the environments and their intensities and, in most cases, designing the space system so it will continue to perform its intended function for a specified time after exposure.

Bando 30/2021 – Profilo UIC1

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

colleghi	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 il totale di viaggi annuo per ciascun collega (riga) e per Neri se ne valuti l'impatto mensile in termini percentuali

2) Attraverso grafico (scelto opportunamente tra quelli proposti), si mostri l'impatto in percentuale mensile dei viaggi di Neri per l'intero anno.

3) Aprire un Word, Copiare all'interno il grafico e fornire un titolo alla slide

4) Salvare i file xls e ppt e generati sul desktop del PC nominandoli come **nome_cognome**

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

2 Si descrivano i principali elementi di un sottosistema o di un apparato di bordo a scelta che ne determinano l’affidabilità nell’ambiente spaziale, e si individuino le tipiche attività di verifica da effettuare prima del lancio.

3 Si descrivano brevemente i principali obiettivi statutari dell'Agenzia Spaziale Italiana e gli strumenti messi in atto per raggiungerli.

The factor K should be 2 when R is less than 0.5, and 1 otherwise. This reflects an additional factor of 2 in weight and power for increased margin when scaling the system down by a factor of more than 2. When the system grows, the R^3 term will directly add a level of margin. For instruments more than a factor of five smaller than those listed in Table 9-13, scaling becomes unreliable. We recommend assuming a mass density of 1 gm/cm^3 and power density of 0.005 W/cm^3 for small instruments. An example of these computations for FireSat is in Sec. 9.6.1.

9.5.4 Evaluate Candidate Payloads

Multi-attribute performance indices can be defined for comparing optical instruments with similar performance characteristics. For high-resolution spatial instruments three basic values describe the quality (corresponding to the information content) in the image. The three defining features are the signal-to-noise ratio at spatial frequency zero (high SNR corresponds to high information content), the MTF of an instrument at the Nyquist frequency (high MTF corresponds to high information content for sampling rates between zero and the Nyquist frequency), and the ground sample distance GSD (small GSD corresponds to high information content). We define a *relative quality index* (RQI) to allow straightforward quantitative comparisons with a reference instrument denoted by the suffix ref.

$$RQI = \frac{SNR}{SNR_{ref}} \frac{MTF}{MTF_{ref}} \frac{GSD_{ref}}{GSD} \tag{9-22}$$

This relative quality index allows the designer to trade requirements with respect to each other. For example, a higher SNR can compensate for a lower MTF at the Nyquist frequency for a given GSD. Such comparisons allow for first-order insights into the relationships between complexity, performance, and cost of candidate sensors. For example, suppose we define a reference instrument to have an SNR of 512, and an MTF of 0.5 and a GSD of 25 m. If we then compute design parameters for a particular mission, we can generate a relative quality index, or score, for our design with respect to the reference instrument. For instance, if our design choices lead us to an instrument with a SNR of 705.2, a MTF of 0.47 and a GSD of 30 m, then the RQI for this system will be 108%. This index offers a straightforward method for comparing several competing sensors across three key performance measures.

9.5.5 Observation Payload Design Process

Table 9-15 contains the details of the design process for visible and infrared systems. We begin with basic design parameters such as the orbital height, minimum observation angle and ground resolution. We then compute the quantities that describe the performance of the instrument. In particular, we determine the pixel processing parameters and system data rate, the size of the optics for a given pixel size, and the radiometry of the sensor. Sample computations for the FireSat payload are given in the third column.

The data rate required for observation payloads depends on the resolution, coverage, and amplitude accuracy. With the maximum look angle, η, spacecraft altitude, h, and cross-track pixel size, X, we have to image $2\eta h / X$ pixels per swath line (cross-track). With the spacecraft ground-track velocity V_g and the along-track pixel size Y we have to scan V_g / Y swath lines in one second. If we quantify the intensity of each pixel by b bits (2^b amplitude levels) we generate a data rate, DR, of

Bando 30/2021 – Profilo UIC1

Il candidato a partire dalla tabella di seguito riportata (che sarà fornita all'interno del file excel denominato **cartel4**) provveda alle seguenti azioni:

	Anni accademici							
Corsi di laurea	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Astrologia	212	234	285	330	346	234	410	437
Ufologia	248	237	201	146	333	66	270	200
Demonologia	41	59	38	35	123	54	65	25
Briscologia	60	51	47	54	34	21	70	100
Fanatismo applicato	202	290	338	310	55	332	562	380
sessuologia applicata	780	771	726	812	764	654	987	1200

1) Calcolare il numero totali di iscritti per anno di laurea (colonna), il Max, il Min e la Media per anno

2) Fare il grafico (scegliendo tra quelli disponibili) dei valori di Max, Min e Media per anno

3) Aprire un file power point e copiare il grafico intitolando opportunamente la slide "Max, Min, Media per anno"

4) Salvare i file xls e ppt e generati 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 il processo per stabilire i requisiti tecnici di una missione spaziale in funzione della fase di sviluppo, la loro propagazione nella documentazione progettuale e le varie tipologie di verifica.

3 Il candidato descriva sinteticamente le Missioni e gli Obiettivi dell'Agenzia per come riportato nello Statuto.

Frequently, we add dampers to gravity-gradient spacecraft to reduce *libration*—small oscillations around the nadir vector caused by disturbances. Gravity-gradient spacecraft are particularly sensitive to thermal shocks on long deployed booms when entering or leaving eclipses. They also need a method of ensuring attitude capture with the correct end of the spacecraft pointed at nadir—the gravity-gradient torques make either end along the minimum inertia axis equally stable.

In the simplest gravity-gradient spacecraft, only two orientation axes are controlled. The orientation around the nadir vector is unconstrained. To control this third axis, a small, constant-speed momentum wheel is sometimes added along the intended pitch axis (i.e., an axis perpendicular to the nadir and velocity vectors). This "yaw" wheel is stable when it aligns with the orbit normal, and small energy dissipation mechanisms on board cause the spacecraft to seek this minimum energy, stable orientation without active control.

A third type of purely passive control uses permanent magnets on board the spacecraft to force alignment along the Earth's magnetic field. This is most effective in near-equatorial orbits where the field orientation stays almost constant for an Earth-pointing vehicle.

Spin Control Techniques. *Spin stabilization* is a passive control technique in which the entire spacecraft rotates so that its angular momentum vector remains approximately fixed in inertial space. Spin-stabilized spacecraft (or *spinners*), employ the gyroscopic stability discussed earlier to passively resist disturbance torques about two axes. The spinning motion is stable (in its minimum energy state) if the vehicle is spinning about the axis having the largest moment of inertia. Energy dissipation mechanisms on board, such as fuel slosh and structural damping) will cause any vehicle to head toward this state if uncontrolled. Thus disk-shaped spinners are passively stable while pencil-shaped vehicles are not. Spinners can be simple, survive for long periods without attention, provide a thermally benign environment for components, and provide a scanning motion for sensors. The principal disadvantages of spin stabilization are (1) that the vehicle mass properties must be controlled to ensure the desired spin direction and stability and (2) that the angular momentum vector requires more fuel to reorient than a vehicle with no net angular momentum, reducing the usefulness of this technique for payloads that must be repointed frequently.

It takes extra fuel to reorient a spinner because of the gyroscopic stiffness which also helps it resist disturbances. In reorienting a spinning body with angular momentum, h, a constant torque, T, will produce an angular velocity, ω, perpendicular to the applied torque and angular momentum vector, of magnitude $\omega = T/h$. Thus, the higher the stored momentum is, the more torque must be applied for a given ω. For a maneuver through an angle θ, the torque-time product—an indication of fuel required for the maneuver—is a constant equal to $h\theta$. Conversely, for a nonspinning vehicle with no initial angular velocity, a small torque can be used to start it rotating, with an opposite torque to stop it. The fuel used for any angle maneuver can be infinitesimally small if a slow maneuver is acceptable.

A useful variation of spin control is called *dual-spin stabilization*, where the spacecraft has two sections spinning at different rates about the same axis. Normally, one section, the rotor, spins rapidly to provide angular momentum, while the second section, the stator or platform, is despun to keep one axis pointed toward the Earth or Sun. By combining inertially fixed and rotating sections on the same vehicle, dual spinners can accommodate a variety of payloads in a simple vehicle. Also, by adding energy dissipation devices to the platform, a dual spinner can be passively stable

Bando 30/2021 – Profilo UIC1

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 ciascun genere per reti private, per lo "Sport" se ne calcoli la % di ore di trasmissione per TV privata

2) Creare un grafico a barre che permetta di confrontare il totale delle ore di programmazione per ciascun genere (righe)

3) Aprire un file power point e copiare il grafico intitolando opportunamente la slide "ore trasmissione per TV"

4) Salvare i file xls e ppt e generati 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 descrivano le tipiche modalità di gestione tecnica di una milestone per lo sviluppo di un sistema spaziale.

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

only from low-Earth orbit. In the future, it would be desirable to retrieve satellites as far away as geosynchronous orbit and return them to either the Orbiter or Space Station for refurbishment, repair, disposal, or reuse.

Step 7. Evaluate Constellation Growth and Replenishment

An important characteristic of any satellite constellation is growth, replenishment, and graceful degradation. A constellation that becomes operational only after many satellites are in place causes many economic, planning, and checkout problems. Constellations should be at least partly serviceable with small satellite numbers. *Graceful degradation* means that if one satellite fails, the remaining satellites provide needed services at a reduced level rather than a total loss of service. Section 7.6 discusses further the critical question of how we build up a constellation and how to plan for graceful degradation.

Step 8. Create ΔV Budget

To numerically evaluate the cost of an orbit, we must create a ΔV budget for the orbit, as described in Sec. 7.3. This then becomes the major component of the propellant budget as described in Sec. 10.3.

Step 9. Document and Iterate

A key component of orbit or constellation design is documenting the mission requirements used to define the orbit, the reasons for selecting the orbit, and the numerical values of the selected orbit parameters. This baseline can be reevaluated from time to time as mission conditions change. Because mission design nearly always requires many iterations, we must make the iteration activity as straightforward as possible and readdress orbit parameters throughout the design process to ensure they meet all requirements.

7.2 Earth Coverage

Earth coverage refers to the part of the Earth that a spacecraft instrument* or antenna can see at one instant or over an extended period. The coverage available for a particular location or region is frequently a key element in mission design. In evaluating coverage, two critical distinctions must be made. First, as Fig. 7-1 shows, the *instantaneous field of view*, typically called the *FOV* or *footprint*, is the actual area the instrument or antenna can see at any moment. In contrast, the *access area* is the total area on the ground that could potentially be seen at any moment by turning the spacecraft or instrument. In the case of a truly omni-directional antenna, these two would always be the same. For most operational instruments they are not.

The second important distinction is between the area which can be seen at any one instant vs. the rate at which new land comes into view as the spacecraft and instrument move. Both are important, and either can be vital to mission success. In geosynchronous orbit, the instantaneous area is typically most important because the spacecraft is

* Throughout this section we will use *instrument* to refer to any spacecraft sensor or antenna for which we want to compute coverage.

Bando 30/2021 – Profilo UIC1

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 i totali delle ore di trasmissione per ciascuna TV e i totali distinti per le reti private e le reti pubbliche

2) Creare un grafico che permetta di confrontare il totale delle ore di programmazione per le reti, distinguendo tra pubbliche e private

3) Aprire un file power point e copiare il grafico intitolando opportunamente la slide "trasmissione per TV pubbliche/private"

4) Salvare i file xls e ppt e generati 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 sinteticamente la scala del Technology Readiness Level (TRL) per apparati spaziali di bordo, utilizzando esempi pratici.

3 Si identifichino le figure principali all'interno di un team di gestione di Programma/Progetto e si dettagli il ruolo del Responsabile di Programma/Progetto come da regolamento di organizzazione dell'Agenzia.

11.2 Telemetry, Tracking, and Command

Douglas Kirkpatrick, ***United States Air Force Academy***
Adapted from SMAD II, Sec. 11.2 "Communications," by John Ford

The *telemetry, tracking, and command* (*TT&C*) or *communications subsystem* provides the interface between the spacecraft and ground systems. Payload mission data and spacecraft housekeeping data pass from the spacecraft through this subsystem to operators and users at the operations center. Operator commands also pass to the spacecraft through this subsystem to control the spacecraft and to operate the payload. We must design the hardware and their functions to pass the data reliably for all the spacecraft's operating modes. For a discussion of how we collect and manipulate housekeeping and payload data, see Sec. 11.3, Chap. 9, and Chap. 16. Chapter 13 discusses the communication link design, and Morgan and Gordon [1989] provide a wealth of information on spacecraft communications.

The subsystem functions include the following:

- Carrier tracking (lock onto the ground station signal)
- Command reception and detection (receive the uplink signal and process it)
- Telemetry modulation and transmission (accept data from spacecraft systems, process them, and transmit them)
- Ranging (receive, process, and transmit ranging signals to determine the satellite's position)
- Subsystem operations (process subsystem data, maintain its own health and status, point the antennas, detect and recover faults.)

Table 11-18 presents specific subfunctions to accomplish these main functions. Subsystem designers must ensure that all of these functions operate reliability to accomplish the spacecraft mission.

As part of carrier tracking, most satellite TT&C subsystems generate a downlink RF signal that is phase coherent to the uplink signal. *Phase coherence* means that we transmit the downlink carrier so its phase synchronizes with the received phase of the uplink carrier. This process is the *coherent turnaround* or *two-way-coherent mode*. The coherent turnaround process creates a downlink carrier frequency precisely offset from the uplink carrier by a predefined numerical *turnaround ratio*. This is the ratio of the downlink carrier frequency to the uplink carrier frequency.This operational mode can only exist when the transmitter phase-locks to the received uplink carrier. For a given uplink signal, the downlink signal has a constant phase difference. For NASA's GSTDN-compatible transponders, the receiver downcoverts the uplink carrier, and creates a voltage such that the receiver's voltage-controlled oscillator runs at precisely 2/221 times the uplink carrier frequency. The oscillator frequency goes to the transmitter which multiplies it by a factor of 120. Therefore, the composite transmitter downlink is $120 \times 2/221 = 240/221$ times the uplink frequency, which is the turnaround ratio for NASA-compatible transponders. The turnaround ratio for transponders compatible with SGLS is 256/205. The two-way-coherent mode allows the ground station to know more exactly the downlink signal's frequency and to measure the Doppler shift, from which it computes the *range rate* or line-of-sight velocity between the spacecraft and the tracking antenna. This knowledge allows operators to

Bando 30/2021 – Profilo UIC1

Il candidato a partire dalla tabella di seguito riportata (che sarà fornita all'interno del file excel denominato **cartel3**) provveda alle seguenti azioni:

	2020			2021			2022		
	luce	gas	acqua	luce	gas	acqua	luce	gas	acqua
gennaio	55	36	43	67,65	36,828	43,559	137,5	144	49,45
febbraio	54	14	27	66,42	14,322	27,351	135	56	31,05
marzo	42	44	56	51,66	45,012	56,728	105	176	64,4
aprile	41	47	43	50,43	48,081	43,559	102,5	188	49,45
maggio	56	14	39	68,88	14,322	39,507	140	56	44,85
giugno	56	15	45	68,88	15,345	45,585	140	60	51,75
luglio	35	31	53	43,05	31,713	53,689	87,5	124	60,95
agosto	18	40	24	22,14	40,92	24,312	45	160	27,6
settembre	40	44	51	49,2	45,012	51,663	100	176	58,65
ottobre	54	32	45	66,42	32,736	45,585	135	128	51,75
novembre	33	43	31	40,59	43,989	31,403	82,5	172	35,65
dicembre	15	29	43	18,45	29,667	43,559	37,5	116	49,45

1) Determinare per ciscun servizio il costo totale per anno, a quest'ultimo aggiungere il 22% di IVA e calcolare la spesa media di ciscun servizio sui tre anni,

2) Aprire un file power point e copiare tabella all'interno del power point intitolando opportunamente la slide "costi servizi del triennio"

3) Salvare i file xls e ppt e generati sul desktop del PC nominandoli **nome_cognome**