

To: **ESO**

## **EURONEAR - PROJECT PROPOSAL**

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### **1. INTRODUCTION**

Near Earth Asteroids (NEAs) are defined as the asteroids with a perihelion distance ( $q$ ) less than 1.3 AU. Potentially Hazardous Asteroids (PHAs) are the NEAs having a Minimum Orbital Intersection Distance (MOID) less than 0.05 AU and the absolute magnitudes ( $H$ ) less than 22 mag, which corresponds to objects larger than about 200 m. This limit in size represents asteroids large enough to cause, in some sense, global damage on impact (Marsden, 1997).

According to ASTORB database (Bowell 2007), there are almost 400,000 catalogued asteroids known today. Quoting the NEO website (NASA/JPL 2007), there are close to 5,000 known NEAs and almost 1,000 PHAs. During the last decade these two numbers have increased dramatically, while in the last years they have grown by at least 500 new NEAs and more than 70 new PHAs discovered every year (EARN 2007). The increase is mainly due to five major NEA discovery programs in progress, all funded and operated during the last decade in the U.S. Although there have been some similar European initiatives, there is no European program dedicated to work full-time as a NEA survey today. We are aiming to contribute in this direction via EURONEAR, hoping to raise more efforts in order to work together against the asteroid impact hazard.

## 2. SCIENCE MOTIVATION

Since 1990, the international community started to raise concerns regarding the asteroid impact hazard (e.g., Chapman & Morrison, 1994). Various scientific and public interest groups were established in several nations, mostly associated with the Spaceguard Foundation, an organization established in 1996 in Rome having the goal to find 90% of the entire NEA population larger than 1km in one decade.

Despite official notice taken by several countries and international bodies (e.g., the Council of Europe), little serious attention and almost no funding was allocated to deal with the NEO impact hazard (e.g., Chapman and Durda, 2001). In 1998 NASA and U.S. Air Force took over the Spaceguard goal and have become the only major contributors with a few million dollars per year in the direction of the NEO research. In this sense, there have been five major programs devoted to discovery of NEAs: LINEAR, NEAT, SPACEWATCH, LONEOS and CATALINA. Based entirely on US funding (although CATALINA also runs the Siding Spring Survey in Australia), these projects are using 1m class telescopes to discover NEAs.

Besides the five major U.S. surveys dedicated to NEAs, some other programs have run mostly part-time on temporary basis in Europe (CINEOS and Sormano in Italy, OCA-DLR in France & Germany, UKAPP in the UK and Ireland, Ondrejov and Klet in the Czech Republic) or elsewhere (AANEAS in Australia, BSGC in Japan, SCAP in China, Pulkovo in Russia). A few programs were run as national entities of the international Spaceguard Survey, while most implied individual initiative of some local groups or individuals. Despite these efforts during the last two decades, Europe has failed to raise its support and funding for at least one single dedicated program in the NEA direction. One year before the Spaceguard deadline, the U.S. is pushing ahead alone with the original Spaceguard aim, having discovered more than 720 NEAs larger than 1km (NASA/JPL, 2007).

Two new ambitious survey programs have been led by the U.S. in the last years: Pan-STARRS and LSST. The first project dedicated recently its 1.4 giga-pixel camera in Hawaii which thus has become the largest CCD camera in operation in the world. The completion of the whole Pan-STARRS project is expected to include four 1.8m telescopes and become operational in a few years. The second survey is under planning to be installed around 2015 in Chile. With a projected mirror of 8.4m diameter, LSST is expected to cover the entire visible sky every three nights, having a camera of about 3.2 giga-pixels and a field of 10 square deg. Both these projects come into the direction of the NASA Authorization Act of 2005 (known as the "George E. Brown, Jr. NEO Survey Program") whose objectives are to detect, track, catalogue, and characterize the physical characteristics of NEOs equal to or larger than 140 meters in diameter, achieving 90% completion of the survey within 15 years.

## 3. A LOOK AT SIMILAR PROJECTS

A comparative study of current and planned NEO surveys compared some characteristics of the existing surveys and planned NEA projects (Maury, 1999). Based on data available online (some possibly outdated), we updated this list in Table 1.

Two main capabilities are the most important factors to set the efficiency of a survey: the collecting area of the primary mirror, and the area of sky imaged in one frame. A common figure was adopted in the literature to fulfill both requirements. This is the "etendue" ( $A\Omega$ ), defined as the product between the telescope collecting area expressed in square meters and the camera field of view expressed in square degrees.

One important factor to set the efficiency of a survey is the focal ratio F/D. The imaged area is inverse proportional to the square of the F/D ratio of the telescope. This shows the importance of a small F/D ratio (a "fast" system) for any survey. Another important factor having a direct impact on the sky imaged area is the camera pixel size, which must be chosen in conjunction with the F/D. Ideally, the pixel size should under-sample the seeing in order to resolve better the astrometry and photometry (around 1"), while remaining large enough in order to accommodate for the fast apparent speed of most NEAs observed closer to Earth (as high as a few "/min).

Table 1 lists some basic characteristics of the major existent NEA surveys and the two ones in development. Most existing facilities are old, being refurbished and automated in order to serve to NEA research. We include in the table the diameter of the telescope (D in meters), the focal ratio (F/D), CCD pixel size (in microns), pixel scale (in arc seconds), the camera size (in pixels), field of view (FOV in arc minutes), the angle square (in deg<sup>2</sup>), and the etendue (in m<sup>2</sup> deg<sup>2</sup>).

Survey	D (m)	F/D	Pix size (mm)	Pix scale ("/pix)	CCD (pixels)	FOV (')	FOV (deg <sup>2</sup> )	AW
LINEAR	2x1	2.2	48	4.5	1960x2560	65x111	2.0	1.6
NEAT Maui	1.2	2.2	15	1.5	4096x4096	102x102	2.8	3.2
NEAT Palomar	1.2	2.2	15	1.0	3 4080x4080	3 68x68	3.8	4.3
SPACEWATCH	0.9	3.0	24	1.0	4 4608x2048	4 34x77	2.9	1.8
SPACEWATCH *	1.8	2.7	24	1.0	2048x2048	34x34	0.3	0.8
LONEOS	0.6	1.9	13.5	2.5	2 2048x4096	171x171	8.1	2.3
CATALINA CSS	0.7	1.6	15	2.5	4096x4096	171x171	8.1	3.1
CATALINA MLSS *	1.5	2.0	15	1.0	4096x4096	68x68	1.3	2.3
CATALINA SSS AU	0.6	3.0	15	1.8	4096x4096	123x123	4.2	1.2
CATALINA SSS AU *	1.0	8.0	24	0.6	2048x2048	21x21	0.1	0.1
PAN-STARRS I **	1.8	4.0	11.5	0.3	4096 600x600	180x180	9.0	13.3
LSST **	8.4	1.2	10.0	0.2	200 4096x4096	210x210	9.6	320

Table 1 - Characteristics of similar projects. Legend: \* used mostly for follow-up observations; \*\* proposed also for other science than asteroids

As one can observe, all the existing projects use relatively small apertures for discovery (between 0.5 and 1.2m diameter) and larger mirrors for recovery and follow-up work. Also, all surveys employ fast telescopes (F/D < 3), including most follow-up telescopes. As a follow-up project, EURONEAR does not intend to compete in etendue with any of the well established surveys focused on discovery. Instead, we aim to focus our project in fast response and accurate astrometry.

#### 4. EURONEAR PROPOSAL TO ESO

Since May 2005, the PI is a research associate of IMCCE based on a NEA project proposed in collaboration with M. Birlan (IMCCE Paris). Part of this project, we conducted two observing runs in France at Pic du Midi using the 1m telescope (9 nights in May 2006 to observe 13 NEAs) and Haute Provence using the 1.2m telescope (6 nights in May 2007 to observe 18 NEAs). In a recent observing run we employed the 0.84m telescope at Cerro Armazones, Chile to observe 6 NEAs (2 nights in Nov 2007). Other very modest telescope (0.25m) has been used by one of us (B. Sonka) at Urseanu Observatory in Bucharest to

observe 5 NEAs in 2006 & 2007, and the equipment is expected to be upgraded soon. Other runs on 1-2m class telescopes are expected soon in Chile (2.2m ESO/MPG in La Silla, 1m in Cerro Tololo, 0.84m in Armazones, etc), while others will take place next year in France and Romania (Cluj-Napoca and Bucharest).

With the number of known NEAs in continuous growth, and more close encounters to Earth during the last years in the news, we consider that a few observing runs could not contribute significantly to the NEA research. In July 2006 while attending an observing run in La Silla together with Rami Rekola (Turku University), the PI had the idea to refurbish a dormant telescope in La Silla and dedicate it for permanent use to our project.

The European Near Earth Asteroid Research project (EURONEAR) was founded in June 2006 in Paris, based on the research interests of the PI in conjunction with his collaboration with IMCCE. EURONEAR is a project which envisions to establish a coordinated network which will follow-up, recover and discover NEAs and PHAs using two automated dedicated 1 metre telescopes located in both hemispheres and other facilities available to the members of the network.

In this context, in July 2006 the EURONEAR Committee of Initiative was formed of 6 people based in France, Romania and Finland to propose ESO to take over a 1m dormant telescope to refurbish and dedicate it to the EURONEAR project. In Oct 2006 ESO identified the 1m telescope in La Silla as suitable for this project. In Aug 2007 three of us inspected the telescope and performed some test observations using a visiting camera.

## **5. THE COMMITTEE OF INITIATIVE**

The EURONEAR Committee of Initiative was formed in July 2006, and included six people. As of November 2007, the Committee includes 10 people. We list here their names, present affiliation, and the date of joining our project:

- Dr. Ovidiu VADUVE SCU, IA/UCN Antofagasta Chile, IMCCE Paris France (May 2006);
- Dr. Mirel BIRLAN, IMCCE Paris France (May 2006);
- Dr. Francois COLAS, IMCCE Paris France (May 2006);
- Alin NEDELUCU, IMCCE Paris France & IAAR Bucharest Romania (May 2006);
- Adrian SONKA, Urseanu Observatory Bucharest Romania (May 2006);
- Dr. Rami REKOLA, Turku University Finland (July 2006);
- Dr. Vlad TURCU, IAAR Cluj-Napoca Romania (January 2007);
- Valentin GRIGORE, SARM Targoviste Romania (March 2007);
- Prof. Carlos Pon SOTO, IA/UCN Antofagasta Chile (June 2007);
- Dr. David ASHER, Armagh Observatory UK (Nov 2007).

In addition to these, we have other collaborators from Romania, Spain, France, the Czech Republic, Chile, and the list is growing. To date, the participating institutions collaborating in our project are IMCCE (France), ESO (Europe & Chile), and IA/UCN (Chile).

## **6. MAJOR AIMS OF EURONEAR**

Despite the competition from other projects focused on discovery, and with the increased threat from the incoming surveys to start in a few years, there are advantages from running a dedicated follow-up project. Most discovery surveys set their cadence, exposures, and observed fields simply by focusing on maximizing their efficiency (i.e., discovery rate). Incidentally, they image and reduce positions of other objects which appear randomly in the observed fields. Nevertheless, such surveys could not allow the flexibility of a dedicated

follow-up project focused on target selectivity, rapid answer, and accurate astrometry and photometry.

The major aim of EURONEAR will be to observe NEAs in an optimized fashion. This will be achieved via a dedicated server which will query on a permanent basis (every hour or so) the entire known asteroid population in order to select the most important targets, and prioritize observations. Data will be reduced using an automated pipeline and will be reported to Minor Planet Center (MPC) in almost real time.

Astrometry and rapid follow-up will be the main focus of our project. In this respect, we will concentrate first on recovering and securing the orbits of newly discovered objects. Second, we will contribute with follow-up astrometry and photometry of NEAs and PHAs in most need of data. Additionally, EURONEAR is expected to discover many new asteroids and NEAs.

Besides these pragmatic driven science aims, we hope to reach a more human goal related to the passion to keep looking at stars, using old telescopes. That is, via EURONEAR we aim to refurbish at least one retired telescope and re-open to life one of the many sadly closed domes in La Silla. Besides other external projects in La Silla, we hope to contribute keeping this site alive, once a prime legend for ESO and the European astronomical community.

## **7. SCIENCE-BASED REQUIREMENTS**

EURONEAR requires flexibility in order to follow-up and recover NEAs and PHAs on a daily basis. We are planning to observe asteroids in an optimized fashion which will allow us to reach targets of interests as soon as possible after discovery or re-appearance. Such flexibility would be difficult to reach by most dedicated projects focused on discovery, due to their fixed observing schedules, time constraints, required observing cadence, and other specific factors.

Certain procedures and general guidelines are expected to drive the operations of EURONEAR, in coordination with some recognized international forums maintaining asteroid databases updated on a daily base based on the daily discoveries. That is, to select our daily observing sample, we are taking into account databases maintained at the Minor Planet Center (MPC), Near Earth Objects Dynamic Site (NEODYS), Spaceguard Central Node, etc.

First, following the discovery of a new object, its recovery and confirmation are the subsequent steps to be taken during following nights, in order to secure its orbit and avoid the loss. A very rapid response system (capable of responding on an hourly basis) would be very important in this respect. This would imply an automated script to check for new objects, a robotic facility to observe the prioritized list of targets, and an automated pipeline software and hardware necessary to reduce the astrometry.

Second, recovery of objects in most need of data (e.g. one-opposition objects returning at their second opposition), will collect data necessary to secure the orbit of the NEAs/PHAs. This data will drive the science around the fine tuning of the various effects (e.g. gravitational, Yarkovsky) necessary to take into account in order to predict future encounters with the Earth. A relatively large aperture ( $D \sim 1\text{m}$ ) would be necessary in order to reach moderately faint objects ( $V < 20$ ), doubled by a fast F/D system and a CCD camera capable to offer a large field of view ( $\text{FOV} > 20'$ ) necessary to maximize the probability of recovery of unsecured objects ( $\sigma \text{ in ephemeris} > 1'$ ).

Third, long time photometry of NEAs and PHAs (typically about 10 hours time-span) will be the main tool to derive physical parameters of selected targets (rotation periods,

multiplicity, color, albedo, taxonomic class, size). This task will be achieved in coordination with other projects and people working in photometry and light-curves of asteroids (Ondrejov, Geneve, Helsinki, Hunters Hill, etc).

Finally, an additional by-product of EURONEAR will be the discovery of other Main Belt Asteroids (MBAs) and NEAs/PHAs, including NEAs missed by other dedicated surveys.

## 8. TWO CLASSES OF OBSERVING FACILITIES

EURONEAR will include two classes of observing facilities.

**The first class** is planned to comprise of two "dedicated" 1-m robotic telescopes located in both hemispheres, each planned to work in two modes: "automated robotic", and "remotely assisted". The South facility has been identified in Chile, namely the ESO 1m telescope in La Silla, which we plan to upgrade first. Regarding the North facility, we are taking into account other retired telescopes in Spain, Canary or France.

**The second class** of observing facilities will include a "network" of telescopes located around the globe, available temporarily for classic observing runs to the EURONEAR members. During the last two years, five such facilities were employed by us in France, Chile and Romania, these being the first placed on the EURONEAR constellation network. To strengthen this network, we will provide some observing and data reduction tools to its members to be used in a concentrated effort in the NEA research.

## 9. TWO MAIN PRIORITIES: ASTROMETRY AND PHOTOMETRY

Two major science priorities are expected to be met by EURONEAR: astrometry and photometry of NEAs and PHAs.

First, astrometry will be aimed at newly discovered bodies and objects in most need of observations at their first or second opposition. That is, EURONEAR will observe first asteroids flagged by MPC as "urgent" and "desirable", VIs (Virtual Impactors), PHAs, and NEAs (in this order), aiming to secure their orbits via rapid recovery and follow-up observations. A larger FOV of the system would help to recovery objects having larger uncertainties in ephemerides.

The most important objective of EURONEAR is the rapid answer to secure orbits of newly objects (discovered by other similar projects or by EURONEAR). This which will require planning the observations on an hourly basis by some dedicated software which will coordinate observations in correlation with major databases available online. The second objective is the accurate astrometry, which requires a FOV sufficient to hold a decent number of catalog stars necessary for data reduction.

Catalog	Nr. stars	Completeness	Mean Error Astrometry (")	Star density (per deg <sup>2</sup> )	Star density (5'x5')	Star density (25'x25')
PPM	468,861	V~10.5	~0.3	11	0.08	2.0
Tycho-2	2,557,501	V~11.5	~0.06	62	0.43	11
GSC 1.1	~15,000,000	B~15.5	~1.5	457	3.17	79
UCAC 2	48,330,571	R~16.0	~0.07	1360	9.44	236
GSC 2.2	~178,000,000	B~19.5	~0.2-0.4	11,050	76.74	1,919
2MASS	470,992,970	K~15.5	~0.12	11,417	79.28	1,982
USNO -A2	526,280,881	V~20.0	~0.25	12,757	88.59	2,215
USNO -B1	~1 billion	V~21.0	~0.20	25,354	176.07	4,402

Table 2: Available star catalogs for data reduction

Table 2 presents major catalogs possible to use for data reduction by our project. As one can observe, the most precise star catalogs available today are Tycho-2 (Hog et al, 2000) and UCAC2 (Zacharias et al, 2004), both including also proper motions. With an average star density of about 11 stars for a 25'x25' (envisioned to reach in the first focus mode), this catalog is the most preferred for our project. Alternatively, USNO-A2, 2MASS or USNO-B1 represent a good alternative with many more stars per field.

In order to plan and prioritize observations, we are preparing some software to select the objects in conjunction with a few well established online resources (MPC, Spaceguard Survey, NEODYS, etc). This tool is expected to help the observer (the automated 1m telescope or an astronomer observing at any facility of the network) to organize an observing night, by prioritizing the objects to be observed according to some constraints, such as the best visibility periods (position and timing), proper motion, position uncertainty, apparent and limiting magnitude of the system, etc. Roughly speaking, every asteroid will be devoted about one hour of observing, which includes the search and recovery, and acquisition of about 20 exposures from which the system will select the best 10 astrometric positions by rejecting those having the largest residuals based on a statistic analysis. The objects in most need of data could be observed a few times per night, every ~2-3 hours.

Second, photometry of NEAs and PHAs, as well as suspected multiple systems (double asteroids) will be the aim of the project. The objects will be selected based on coordinated observations with similar teams and projects (Ondrejov, Geneve, Helsinki, Hunters Hill, etc). Observations of light-curves as long as about 10 hours acquired at a cadence of about 5 minutes are necessary to determine rotation periods of most asteroids. That is, only about two objects could be observed every night in order to acquire such data, by cycling observations between two objects located relatively closely on the sky (in order not to stress the systems). A large FOV would ensure to perform relative photometry (using the same stars in the field). Staring at the same field for a long time could result in discovery of new objects. Dedicated software will check for the new objects.

## 10. ESO 1m TELESCOPE AND THE CCD CAMERA

The actual ESO 1m telescope has a Cassegrain focus  $F/D=13.6$ , which we believe is a very high number for our project. Table 3 lists a few CCD cameras from three companies available on market. We are mostly interested in the camera format, plate scale, and the field of view (FOV), at both the present Cassegrain focus, and the first focus.

Brand	Model	Format	Pixel size (mm)	Scale Cass F ("/pix)	FOV Cass F (')	Scale Prime F ("/pix)	FOV Prime F (')	Price (US\$)
SBIG	STL-1001E	1024	24	0.3	5.8	1.1	18.4	6,000
SBIG	STL-4020M	2048	7.4	0.1	3.6	0.3	11.2	7,000
Apogee	U42	2048	13.5	0.2	6.5	0.6	20.7	30,000
Apogee	U9000	3056	12	0.2	8.7	0.5	27.4	15,000
Apogee	U16	4096	9	0.1	8.7	0.4	27.5	17,000
Proline	PL4240	2048	13.5	0.2	6.5	0.6	20.7	30,000
Proline	PL09000	3056	12	0.2	8.7	0.5	27.4	11,000
Proline	PL16803	4096	9	0.1	8.7	0.4	27.5	12,000

Table 3 - CCD cameras at the Cassegrain  $F/13.6$  focus and the first focus  $F/4.3$  of the ESO 1m telescope

As one can observe from Table 2a, all cameras provide very small plate scales at the Cassegrain focus (0.2-0.3"/pix), producing long trails for most NEAs which become difficult/impossible to measure. Also, all systems in the Cassegrain focus give very small FOV (around 5-8'), insufficient to have a decent number of good catalog stars (around 10) necessary to obtain accurate astrometry and to ensure a good efficiency of the survey (i.e., a good recovery rate and a decent discovery rate). In conclusion, the actual Cassegrain focus (F/13.6) should be avoided. The first alternative would be to use the prime focus of the telescope (F/4.3) and employ a field corrector. The second alternative would be to employ a Focal Reducer which could decrease the focal ratio down to  $\sim F/8$ . By employing the prime focus we could increase the efficiency of the project (at least in regard with the imaged area) by a factor of 10!

Based on our experience with similar 1m telescopes (Pic du Midi T1m and Haute -Provence 1.2m), one has to expose as long as two minutes in order to obtain a decent S/N necessary to measure NEAs as faint as mag  $V=19$ . Adopting an average proper motion of 1 deg/day (2.5"/min) for the entire NEA population, the asteroids are expected to trail by about 5" in two minutes. We could halve this number if the telescope could track the objects at half their proper motion (as we observed successfully at Pic du Midi), which would reduce the trails to 2" in two minutes.

Based on our experience with data reduction (Astrometrica, MIDAS, IRAF), trails longer than about 4 pixels are difficult to measure, especially in the automatic mode. One can conclude that the maximum pixel size necessary to accommodate the 2" trail is 0.5"/pixel. That is, we should look for a system (F/D and CCD) providing around 0.5"/pix. We consider that a 0.5"/pix scale represents a good balance between a large FOV (i.e., larger pixel scale) and an accurate astrometry (i.e., small pixel scale), also subsampling the seeing by about two.

As one can observe from the two columns of Table 3 regarding the Prime Focus, the Apogee and Proline cameras appear to match our requirements (pixel scale  $\sim 0.5$ "/pix and FOV  $> 20'$ ). At this moment, our first preference camera is the U16 from Apogee (around 30,000 US\$ for a Grade 2 chip and 40,000\$ for Grade 1) which gives 0.4"/pix and the largest FOV=27.5'. Other options could be PL09000 from Proline or PL16803 from Proline.

## **11. COMPUTERS AND NECESSARY BANDWIDTH**

For the EURONEAR facility in La Silla, we envision that 4 PCs will be necessary to support the telescope control, data acquisition, and data storage on a daily basis. Regarding the operating system, we prefer Linux. Basically, the first PC will control the dome and the telescope, the second the CCD camera and data acquisition, the third will save the data, while the last will stand as a backup in case one of the three could crash unexpectedly.

To operate EURONEAR in the remotely assisted mode by a user controlling online the observations, and also to reduce the data acquired by the automated robotic mode on a daily basis, we plan to transfer images to a remote server (probably in Paris) in near real time ( $\sim$ one minute).

The size of the CCD array and the average rate at which we plan to acquire images will have a direct impact to the necessary hardware and bandwidth for our project. Assuming a 4k camera operating at 16 bits to provide 33.5 MB for every image, and an average image rate of one image per minute, we will need a storage space of about 25 GB every night (assuming on average 12 hrs observing). This is achievable with one PC equipped with two hard disks (to include backup).

We plan to archive images at a factor of 5-10x (subject of future testing), so every archived image will take about 3-6 MB disk space. As we plan to acquire images every minute or so, we will require a maximum band of about 100 KB/sec (800 Kb/sec). This could decrease by a factor of 4x in case we will decide to use a 2k CCD chip. We consider this bandwidth achievable for an external project in La Silla. Moreover, these are maximum figures which do not take into account failures due to technical problems or bad weather conditions.

## 12. TELESCOPE CONTROL SYSTEM

Following our first inspection in La Silla (O. Vaduvescu, C. P. Soto, F. Colas) and taking into account some discussions we had in La Silla with technical engineers of ESO (G. Ihle, A. Machino, and A. Gilliotte) and a few technical documents regarding the telescope and its control systems, we identified the replacement of the telescope control system (TCS) as the main priority for the upgrade of the ESO 1m telescope. As the market change rapidly in this domain, we will identify the necessary parts as soon as the first financial grants will be accepted.

## 13. FINANCING THE PROJECT

We envisioned for EURONEAR about four different resources.

**The first resource** will include the participating institutions involved in this project. The first is ESO, contributing with the ESO 1m telescope in La Silla. The second is IMCCE Paris, contributing with the hardware necessary to process and store the data. The third might be IA/UCN Antofagasta, providing some logistics necessary to upgrade the telescope in La Silla and students to be involved in this project, more exactly we plan for one MSC thesis to be conducted by Prof. C. P. Soto in conjunction with this project). The fourth is expected to be other institution from Europe which will contribute with the North telescope located in Canary or Europe, to be upgraded by EURONEAR.

**The second resource** is expected to come from a few funding applications launched or to be launched in Europe and Chile. Two such applications were submitted (M. Birlan, Jan 2007 in France for 4,000 Euros, and R. Rekola et. al, Apr 2007 in Finland), their resolution being in progress. Others are expected to come soon from Chile (O. Vaduvescu et. al, about 20,000 Euros) and Romania (A. Nedelcu, V. Grigore, about 10,000 Euros). These should suffice to upgrade the ESO 1m telescope (about 30,000 Euros).

**The third resource** will include funding raised from a dedicated EURONEAR Consortium. We envisioned this Consortium to comprise international institutions or individuals interested to join the network and receive observing time and data in exchange for their paid contributions. We expect to include as institutional members universities, astronomy departments, colleges, high schools, planetaria, observatories, astronomy clubs, amateur organizations, accommodating also for individual astronomers, amateurs interested to join EURONEAR. We plan to publish a formal Call for the EURONEAR Consortium soon.

Besides research, we envisioned EURONEAR to be used in the education and public outreach. In this respect, members of the Consortium will conduct science and obtain data which can be used in the educational process (assignments, conferences, papers, thesis, etc). Besides the default observing program, members of the consortium could conduct their own observing programs proposed in the field of the asteroid research and approved by the EURONEAR Committee. In exchange for their paid contributions, they could be granted some proprietorship access to data acquired using the EURONEAR facilities.

We are proposing a fee to access the automated ESO 1m telescope of 25 Euros per observing hour and a minimum time of 100 hours for an institution or organization (2,500 Euros) and 20 hours for an individual (500 Euros) to become a member of our project. The Consortium is expected to raise about 10,000 Euros per year by granting about 50 nights to our members. These figures are still in the discussion phase in our Committee.

**The fourth resource** plans to open our project to private initiative. In this respect, we are hoping to encourage sponsorship by proposing to the IAU to name minor planets after the names of major EURONEAR contributors. Up to date, we (V. Grigore and A. Sonka) are in discussions with two possible sponsors in Romania.

At a first glance, the upgrade of the ESO 1m telescope is expected to require about 30,000 Euros. We are hoping to raise this funding based on a few applications launched or to be launched soon in Europe and Chile.

To operate the project in La Silla for five years, we require collaboration and some minor technical support from ESO. To ensure financing, we plan to launch a dedicated application for an European FP7 project asking for about 100,000 Euros. These should suffice for the operation of the telescope for five years (about 15,000 Euros per year, 70,000 Euros for five years), and accommodate for one postdoc position for the first year (about 30,000 Euros).

#### **14. PROJECT EXECUTION PLAN**

Our original plan (July 2006) envisioned running a first phase of EURONEAR starting with Sep 2007. Unfortunately this plan has been delayed, in principal due to the move of the PI from South Africa, to Romania, and later Chile, due to job requirements. Another aspect would be the insufficient implication of the members of the Committee of Initiative, in the PI opinion at least.

We envision to start running EURONEAR operations in La Silla with about one year delay. The actual date depends on first funding necessary to automate the telescope. Two major applications for funding are taken into account at this stage. The first envision a GEMINI proposal in Chile to automate the telescope (about 20,000 Euros, deadline in Dec 2007). The second will aim at European sources, namely a dedicated FP7 proposal to envision the operation of the project for 5 years (about 100,000 Euros).

#### **15. EURONEAR WEBSITE:**

For additional information and some references about our project, please check:  
<http://euronear.imcce.fr>

A document written by

O. Vaduvescu, on behalf of the  
EURONEAR Committee of Initiative

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