Jeffrey R. Charles

Proposals (independently generated on own time) in (about) June 1995.

This document includes material generated during time J. Charles was not working at JPL.
Material that was not in the original archive file is shown in [square brackets].
Costing information and the names of some persons and organizations have been removed.
None of the proposals shown in this document were funded.

Concept Paper No. 1 (6/1995)

Very Large Adaptive Surface Inflatable Antenna (VLASIA)

Investigator: Jeffrey R. Charles

FY96 Participants:

* Jet Propulsion Laboratory - Task management, feasibility, materials, thermal, surface dynamics, site, and weather studies, definition and implementation plan for other project phases, preliminary systems engineering; mission identification, system specification, and operational concepts. ([names of personnel deleted]: studies, sys. eng., writing)
* Goodyear - Materials feasibility, availability, cost, and bonding technique proposal.
* Japan - PBO material feasibility, availability, cost, and bonding technique proposal.
* TBD - Transmitter and other hardware proposals, motion and valve control proposals.
* TBD - Metalized film proposals, inflatable antenna and housing structure proposals.
* Additional vendors would be contacted for materials, subsystem, assembly, and component info.

VLASIA Description:

A very large inflatable antenna would be an elegant and relatively inexpensive tool for enhanced space observation and communications requiring high gain and/or transmission power. Such an antenna would be invaluable for atmospheric research, space missions, and the continued pursuit of [] and radio astronomy including the detection, location, and radar imaging of orbital space debris and asteroids.

The very large adaptive surface inflatable antenna (VLASIA) is a large aperture (100~200 meter) inflatable antenna with lifting gas assisted adaptive reflective segments. It is envisioned that VLASIA will be housed under an inflatable cover similar to that used over some stadiums and that its primary reflector will be enclosed within a spherical envelope that facilitates pointing, support, and shielding of the reflector from external forces such as drafts. The surface accuracy of VLASIA is expected to facilitate the use of frequencies up to at least 35 GHz. Additionally, the design can be scaled and some variants of the concept are applicable for airborne and spaceborne deployment.

VLASIA is a "spin-off" technology from the ALAT (Airborne Large Aperture Telescope) proposal that was presented by Jeffrey R. Charles on 8 December 1993 and 8 May 1995. It is based on the ALAT platform's proposed integral inflatable antennas and its various attributes were conceived between 1993 and the present time. The FY96 task would include studies by the participants shown above and explore feasibility and design issues. VLASIA is the cost effective way to provide the high performance antennas required to facilitate extended research and enhance communications.

<u>Impact on Future Missions</u>:

VLASIA will lessen requirements for [2004 comment: e.g. simplify implementation of] spaceborne antennas and assist in the detection of orbital space debris and earth orbit crossing asteroids. System may be deployable by FY2001.

Synergies with Commercial Industry and other [organization name deleted] programs:
Inflatable structure development, development and use of new materials and bonding techniques.

<u>Cursory Analysis of Estimated Costs for "Fast Track" Schedule</u>:

* FY1995 Limited FY95 funding would facilitate soliciting vendor proposals for long lead items and facilitate the processing of related NTRs, which cannot be processed without a charge number.

* FY1996 Studies, limited systems engineering	JPL = $[deleted]	Vendors = $[deleted]
* FY1997 Studies, systems engineering, demo implementation plan	JPL = [deleted]	Vendors = [deleted]
* FY1998 Studies, 12m demo system acquisition, testing, operation	JPL = [deleted]	Vendors = [deleted]
* FY1999 Studies, demo system operation & evaluation, phase 2 implementation plan, awarding of vendor contracts for facilities, antenna, and instrumentation, demonstration phase final report.	JPL = [deleted]	Vendors = [deleted]
* FY2000+ Studies, construction, deployment, staffing, licensing, etc.	JPL = $TBD	Vendors =$TBD

[Subsequent remarks:
One embodiment of a VLASIA is shown as a "spin-off" technology in Jeffrey R. Charles' Airborne Large Aperture Telescope (ALAT) paper, which was published in the 1995 JPL "Innovative Space Mission Applications for Thin Films and Fabrics" conference proceedings, and (with the results of additional independent work) in 1996 at www.versacorp.com. The specific location of the referenced VLASIA concept illustration is page 46 of the PDF file at:
http://www.versacorp.com/vlink/jcart/alatapix.pdf]

Concept Paper 2 (6/1995)

Orbital Debris Removal Initiative (ODRI)

Investigator: Jeffrey R. Charles

FY96 Participants:

* Jet Propulsion Laboratory - Task management, feasibility, materials, erosion, and thermal studies, definition and implementation plan for other project phases, mission planning and preliminary systems engineering including system specification and operation concepts. ([names of personnel deleted]: studies, sys. eng., platform I.F., writing)
* Vendors would be contacted for materials, subsystem, assembly, and component info.

ODRI Description:

Orbital debris and outdated satellites would be removed by intercepting them at appropriate velocities with sheets or nets of film and/or fabric (some supported with inflatables or semi-rigid structures) ranging between 30 and 9000 square meters, depending on the size of the debris. Once intercepted, the atmospheric drag on the deployed material will slow the orbit of the subject debris and accelerate reentry. It is envisioned that the material would be launched on an intercept orbit having a relatively slow closing speed from a robotic spacecraft or the shuttle. The shuttle is preferable for the initial missions because it will allow better initial [on orbit] observation of the debris removal material [deployment]. Some deployments could include integral bumpers and thrusters and the capability to launch additional material [into different orbits]. This roving and appropriate debris deflection capability [(particularly where one launch can deploy many separate debris interceptors)] could lower the unit cost for orbital debris removal. These concepts will facilitate the removal of debris from orbit with minimal the risk of the debris being broken into smaller particles.

Impact on Future Missions:

Removal of orbital debris will enhance the safety and long-term effectiveness of all [earth orbiting] space missions and lower the cost of orbital debris tracking. Limited system may be deployable by FY2000.

Synergies with Commercial Industry and other [organization name deleted] programs:

Project would utilize a "space gel", which some have proposed for removal of small particles of debris. Most instrumentation and materials would be obtained from commercial sources.

Cursory Analysis of Estimated Costs:

* FY1995 Limited FY95 funding would facilitate soliciting vendor proposals for long lead items.
* FY1996 Feasibility studies, mission planning, limited sys. eng. JPL = [deleted], Vendors = [del]
* FY1997+ TBD, pending FY96 feasibility study.

Concept Paper 3 (6/1995)

Proposed JPL/NASA Project(s)

High Altitude High Resolution Coronal Structure Analysis (HARCSA)

Investigator: Jeffrey R. Charles

FY96 Participants:

* Jet Propulsion Laboratory - Task management, feasibility, materials, thermal, platform and weather studies, definition and implementation plan for other project phases, mission planning and preliminary systems engineering including system specification and operation concepts. ([names of personnel deleted]: studies, sys. eng., platform I.F., writing)
* Loral Electro-Optical Systems - Optical payload proposal (ALAT demo payload may be suitable).
* Sagebrush Technology - Payload mounting proposal (ALAT demo payload may be suitable).
* Additional vendors would be contacted for materials, subsystem, assembly, and component info.

HARCSA Description:

Spectroscopy and high resolution observation of the solar atmosphere (chromosphere and corona) in optical and other wavelengths over an extended period of time during a total solar eclipse event will provide valuable information about subtle changes in the solar atmosphere that occur over periods of minutes or hours. On the ground, a total solar eclipse cannot last much more than about 7 minutes (2-5 minute eclipses are typical) and [ground] observations are affected by atmospheric conditions. In a total solar eclipse, the shadow (or umbra) of the moon usually moves rapidly across the earth from [(generally)] west to east, and the eclipse is only total within the narrow path traveled by the umbra. A total eclipse usually lasts longest when the sun and moon are at the local meridian because the rotation of the earth counteracts some (up to about half if near the equator) of the moon's orbital velocity. The SR-71 "Blackbird" aircraft has an air speed that can equal or exceed the velocity of the moon's shadow at eclipses which occur relatively near the equator. HARCSA would utilize the SR-71. Fortunately, most of the eclipses in the next decade occur reasonably close to U.S territory, have high elevation angles to better utilize the platform's top [optical observation] window, and occur mostly over the ocean (which will minimize the platform's sonic effects on "ground based" eclipse observers [and others]). Applicable eclipses include:

Feb. 26, 1998 over the Pacific, Caribbean, and Atlantic, elevation angles up to 76 deg.;
June 21, 2001 over the south Atlantic, elevation angles up to 55 deg;
Dec. 4, 2002 over the Indian ocean, elev. angles up to 72 deg (this eclipse may be too far away);
April 8, 2005 over the equatorial eastern Pacific, elevation angles up to 70deg;
Mar. 29, 2006 over the equatorial Atlantic, elevation angles up to 67deg.
The velocity of the moon's shadow is too fast for the SR-71 at other eclipses during this period.

Since the SR-71 platform can follow the moon's shadow, virtually continuous observations can be made for a period of ~2 hours; therefore, the predicted duration of the eclipse [on the ground] is not an issue. In fact, the eclipse of 2005 will transition from annular to total due to the curvature of the earth and have a total phase that is predicted to last a maximum of 42 seconds. From the SR-71, this eclipse would offer an unprecedented opportunity to observe the lower solar atmosphere at any point on the solar limb. A total solar eclipse also provides unique circumstances for high altitude atmospheric research. [Observations for] this can be conducted from inside or near the [lunar] umbra. The FY96 task would include platform, payload, and logistics studies. If possible, instrumentation may be borrowed or leased for the experiments.

Impact on Future Missions:

HARCSA will enhance solar observation by providing a wealth of coronal and chromospheric data over an uninterrupted ~2 hour period. System may be deployable in FY98.

Synergies with Commercial Industry and other JPL programs:

Utilization of SR-71 and other applicable high altitude platforms. Most instrumentation would be obtained from commercial sources.

Cursory Analysis of Estimated Costs for "Fast Track" Schedule:

* FY1995 Limited FY95 funding would facilitate soliciting vendor proposals for long lead items.

* FY1996 Studies, mission planning, limited systems eng.	JPL = $[deleted]	Vendors = $[deleted]
* FY1997 Studies, system acquisition and testing	JPL = [deleted]	Vendors = [deleted]
* FY1998 Studies, operation & testing, use at 1998 eclipse, dcmnt'n	JPL = [deleted]	Vendors = [deleted]
* FY1999+ Studies, system operation and evaluation, future mission implementation plans, mission and system final reports.	JPL = [deleted]	Vendors = [deleted]

[Late June 1995 (date approximate) remarks:
** It was later determined that the SR-71 would be too costly (given the value of the anticipated results) to use for HARCSA in cases where its base facilities would have to be temporarily moved from Edwards AFB. The estimated cost of temporarily moving the resources required to facilitate deployment of the SR71 from another airport exceeds $[deleted]. Other approaches (such as [deleted]) for use of the SR-71 at eclipses far from U.S. territory are also prohibitively expensive.*]

[Subsequent remarks:
** It was determined (later in 1995) that a more practical approach (than the SR-71) may be to use a fighter jet or other supersonic aircraft that can be stationed on an aircraft carrier, provided that the experiment can be coordinated to utilize an aircraft carrier that is already in the general area of a given total eclipse.*]

[Later remarks (1997, 1998, or 1999):
** With Russian versions of the supersonic Concorde aircraft (e.g. Concordsky) possibly becoming available for research, they are a platform that should be investigated in more detail.*]

Concept Paper 4 (12/1993, 6/1995)

ARDOC - Airborne Relay for Deep-Space Optical Communication,

which is integrated into:

ALAT Airborne Large Aperture Telescope,

an airborne telescope that resides on a multiple function lighter than air platform which is also suitable for:

STRATCOM - Stratospheric Observation and Communication

Investigator: Jeffrey R. Charles

FY96 Participants:

* Jet Propulsion Laboratory - Task management, feasibility, materials, erosion (from air and particulates, etc.) and thermal analysis. [(Other organizations TBD)]

Description:

A multiple function telescope for astronomical observation and other applications including:

* ARDOC - Airborne Relay for Deep-Space Optical Communication

* ALAT resides on a multiple function lighter than air platform which is also suitable for:

* STRATCOM - Stratospheric Observation and Communication

[Remarks:]

(My prior ground based research (of the lunar umbra during solar eclipses) indicates [about] 72k feet [would be a good minimum altitude] for atmospheric [and other] study from air [platform])

[*The airborne telescope work was all independently generated by Jeffrey R. Charles. In 1996 (when Mr. Charles was not associated with JPL in any capacity) these concepts were further developed and independently published at www.versacorp.com. (In later 1995 work and in the printed and web publications, "Stratcom" was changed to "Stratocom", with indication in the web publication that it is a Versacorp TM.) URLs are http://www.versacorp.com/vlink/jcart/alatjplt.htm (text only) and http://www.versacorp.com/vlink/jcart/alatapix.pdf (text and illustrations). Continuation of the work with resources that could be applied by [deleted] would be beneficial.*]

Draft 4 (Rest of page in work)

Why an Airship Instead of a Conventional Balloon?

* Reliable recovery of payload and helium = less risk and lower long-term cost
* Ability to maintain constant position in spite of prevailing wind simplifies command and data transmission and facilitates use for commercial broadcasting and communications, atmospheric study, surveillance, and other applications
* Ability to maintain constant attitude facilitates extended astronomical observations and simplifies tracking routines and cable wrap design
* Transportable and controllable - can be deployed at a specific time and place for observations of rare events
* Storage and rapid deployment from existing airship hangars - payloads can remain relatively undisturbed between missions
* Longer time aloft

Concept Paper 5 (6/1995)

Umbral Projection Altitude Research (OPAR)
and
Projection Altitude of the Lunar Umbra (PALU)

Investigator: Jeffrey R. Charles

FY96 Participants:

* Jet Propulsion Laboratory [- TBD]

[Remainder of this concept paper is in work.]

[*Remarks*:

This experiment was conducted independently by Jeffrey R. Charles in October, 1995 (when not associated with JPL in any capacity) but the data has only been partly reduced to date. Initial observations (which were not as successful) were independently conducted by J. Charles in 1991 and 1994, and the results were presented in 1992 and 1995. Current results indicate a relatively prominent projection altitude of 72,000 feet and have an uncertainty of about plus or minus 11 percent. These results were published in February, 1997 at the www.eclipsechaser.com web site and linked to the www.versacorp.com web site. Continuation of ground based umbra observations at future eclipses would be beneficial, as would airborne observations.]