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Advanced Tethered Application and Related Technologies

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"ADVANCED TETHERED APPLICATION AND RELATED TECHNOLOGIES"

E. VALLERANI, G. VIRIGLIO, F. BEVILACQUA

APPLICATION OF TETHERED SYSTEMS ARE SUBJECT OF A NUMBER OF FEASIBILITY STUDIES BEING ACTUALLY PERFORMED BOTH IN US AND IN ITALY.

THE ITALIAN PSN (PIANO SPAZIALE NAZIONALE) HAS AWARDED TO AERITALIA A LARGE STUDY FOR THE IDENTIFICATION OF THESE APPLICATIONS THAT INDICATE PROMISES OF SCIENTIFIC AND APPLIED RESEARCH AND FOR THE DEFINITION OF THE GOALS OF DEMONSTRATION FLIGHTS FOR TESTING THE FUNDAMENTAL FEATURES OF THE SELECTED POTENTIAL CONCEPTS.

AMONG THE VARIOUS USES OF TETHERS WE ARE IN PARTICULAR CONCENTRATING ON THREE MAJOR APPLICATIONS.

A) VARIABLE MICROGRAVITY LEVEL FACILITY

A FACILITY MOBILE ALONG THE TETHER, WITH A LARGE RANGE OF POSSIBLE LOCATIONS, EACH ASSOCIATED WITH A DIFFERENT MICROGRAVITY LEVEL, PROVIDES AN INTERESTING FEATURE FOR THE SCIENTIFIC COMMUNITY INTERESTED IN MICROGRAVITY RESEARCH.

THE FACILITY NAMED "SPACE ELEVATOR" IS ABLE TO FULLY UTILIZE THE SPACE STATION SUPPORT.

B) ELEVATOR AS TRANSPORTATION FACILITY

THE IDEA OF USING LARGE TETHERED PLATFORMS CONNECTED TO THE SPACE STATION BY POWER LINE AND COMMUNICATION LINK (VIA TETHER TECHNOLOGY) MAKES UNREALISTIC FREQUENT OPERATIONS OF DEPLOYMENT AND RETRIEVAL.

ON THE OTHER HAND, THE PLATFORM MAY REQUIRE EASY ACCESS FOR MAINTENANCE.

SUPPLY OF CONSUMABLES, MODULE AND EXPERIMENT EXCHANGE. THE TETHERED ELEVATOR, AS TRANSPORTATION FACILITY ABLE TO MOVE ALONG THE TETHER TO AND FROM THE PLATFORM, MAY BE THE TOOL FOR RAPID TRANSPORT REPLACING LENGTHY RETRIEVAL PROCEDURES.

C) TETHERED ELEVATOR BASED RE-ENTRY VEHICLE

FOR SCIENTIFIC OR TRANSPORTATION APPLICATIONS, SYSTEMS COULD BENEFIT IN TERMS OF FUEL MASS, FROM THE ELEVATOR CAPABILITY TO MOVE THE FULL LENGTH OF A DEPLOYED TETHER, ALLOWING FINELY TUNED ADJUSTMENTS OF THE REENTRY TRAJECTORY, AND COULD BE INSTRUMENTED FOR ATMOSPHERIC SCIENCE RESEARCH, OR USED TO FERRY-BOTH SPACE STATION AND TETHERED EXPERIMENT SAMPLES TO THE EARTH.

THESE REENTRY APPLICATIONS CAN BE SEEN AS THE ULTIMATE COMPLEMENTARY COMPONENTS TO A VERSATILE TETHERED RESEARCH SUPPORT FACILITY. THEY COMPLETE THE FULL CIRCLE OF TETHER BENEFITS, BY ALLOWING ACCURATE STUDY OF UPPER-TO-MIDDLE ATMOSPHERE, AS WELL AS PROVIDING A MUCH-NEEDED AUGMENTATION TO THE SPACE STATION CAPABILITY TO RETURN SAMPLES AND DATA TO THE GROUND AT POSSIBLY LOWER COST.