

# INFORMATION AND TASK CARD FOR THE R&D TEAMS



THANK YOU FOR JOINING THE RAKIA MISSION TO DEVELOP AN ANTENNA FOR A COMMUNICATION SATELLITE. YOUR TEAM WAS FORMED TO TEST AND RECOMMEND THE MOST SUITABLE MATERIAL FOR THE ANTENNA. YOU HAVE A VARIETY OF MATERIALS AT YOUR DISPOSAL TO CHOOSE FROM.

THERE ARE THREE PARTS TO THE TASK:



## PART A (20 MINUTES)

TEST WHAT THE MOST SUITABLE MATERIAL IS FOR CONSTRUCTING AN ANTENNA

CHECK THE PROPERTIES OF THE MATERIALS. THE MATERIAL USED TO CONSTRUCT THE ANTENNA MUST ENABLE IT TO WORK OPTIMALLY DURING THE LAUNCH, OPENING, AND OPERATION IN SPACE.

**THE LAUNCH:** THE ANTENNA MUST BE ABLE TO FOLD INTO A SMALL BOX ATTACHED TO THE SATELLITE. YOU MUST FIND THE MATERIAL THAT FOLDS THE MOST EFFICIENTLY. IN OTHER WORDS, BEING ABLE TO FOLD AS MUCH AREA AS POSSIBLE INSIDE. AS SMALL A BOX AS POSSIBLE. THE CHALLENGE MAY INCLUDE DIFFERENT WAYS OF FOLDING AND FINDING THE MOST EFFECTIVE WAY TO FOLD. FOR A MORE ADVANCED CHALLENGE, LOOK FOR A NUMERICAL INDEX:

- MEASURE THE DIAMETER OF THE OPEN "ANTENNA".
- MEASURE THE LENGTHS OF THE COMPONENTS OF THE FOLDED SURFACE.
- DIVIDE THE DIAMETER BY THE LENGTH OF THE COMPONENT, THEN CALCULATE THE AREAS AND DIVIDE THE OPEN ANTENNA AREA BY THE AREA OF THE FOLDED ANTENNA.

THIS WILL GIVE US A NUMERICAL INDEX OF THE TASK'S SUCCESS. THE HIGHER THE RATIO, THE GREATER THE SUCCESS.

**OPENING IN SPACE:** FLEXIBILITY AND RETURNING TO ITS ORIGINAL SHAPE.

YOU MUST FIND THE MATERIAL THAT CAN RETURN TO ITS ORIGINAL SHAPE WITH THE GREATEST EASE.

**OPERATION IN SPACE:** LONG-TERM STABILITY WHILE OPEN.

YOU MUST FIND THE MATERIAL THAT WILL BE THE MOST STABLE IN ITS OPEN FORM, SO THAT THE DEPLOYED ANTENNA WILL REMAIN ROBUST.

## PART B (15 MINUTES)

MAKING A DECISION

YOU NEED TO MAKE A DECISION AFTER CHECKING THE MATERIALS: WHAT MATERIAL DO YOU RECOMMEND FOR CONSTRUCTING THE ANTENNA? DECIDE ON THE MATERIAL THAT BEST MEETS ALL THREE CRITERIA, WRITE A BRIEF EXPLANATION OF YOUR CHOICE, AND PREPARE THE MODEL FOR PRESENTATION

## PART C (15 MINUTES)

PREPARING A PRESENTATION OF THE FINAL PRODUCT

PREPARE TO PRESENT YOUR FINAL PRODUCT TO THE OTHER TEAMS: YOUR RECOMMENDATION OF THE MATERIAL USED TO CONSTRUCT THE ANTENNA, THE REASON FOR YOUR RECOMMENDATION, THE MODEL YOU BUILT, AND 2-3 QUESTIONS THAT AROSE WHILE WORKING WITH THE TEAM.

## SOME INFORMATION ABOUT SATELLITES AND ANTENNAS

NANO-SATELLITES ARE TINY SATELLITES (AROUND THE SIZE OF A SHOEBOX. IN GREEK, "NANO" = TINY). THEY ORBIT THE EARTH AT HIGH SPEED AND CIRCLE IT SEVERAL TIMES PER DAY. THESE SATELLITES CAPTURE INFORMATION FROM SENSORS ON EARTH AND THEN RELAY IT ELSEWHERE. THEY HAVE NUMEROUS APPLICATIONS FOR MONITORING- AIR POLLUTION DATA, AGRICULTURAL FIELDS, ECOLOGICAL STUDIES, TRANSPORTATION DATA, NUCLEAR REACTORS, AND MORE. THEIR SMALL SIZE CONFERS HUGE ADVANTAGES SINCE THEY ARE RELATIVELY INEXPENSIVE TO BUILT AND THEN LAUNCH INTO SPACE. BUT THERE ARE ALSO DISADVANTAGES: THEIR ASSEMBLIES MUST ALSO BE SMALL. BUT... THE QUALITY OF THE ANTENNA'S RECEPTION AND TRANSMISSION DEPENDS ON ITS SIZE. THE LARGER THE ANTENNA, THE BETTER THE QUALITY OF ITS RECEPTION AND TRANSMISSION. THIS IS WHERE YOUR TASK BEGINS.