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# ИЗ ИСТОРИИ РАЗВИТИЯ АВИАЦИИ

Учебные задания по английскому языку

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Учебные задания предназначены для слушателей отделения референтов-переводчиков I факультета первого года обучения и содержат оригинальные тексты, связанные со специальностью студентов. Учебные задания способствуют развитию навыков устной речи по профессиональной тематике, а также навыков чтения и перевода с элементами аннотирования и реферирования. Выполнены на кафедре иностранных языков.

Печатаются по решению редакционно-издательского совета Самарского государственного аэрокосмического университета имени академика С.П.Королева

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# U N I T I

Task 1.

1. Read and memorize the following words and word combinations:
   soar (v.) - парить, высоко летать
   setback (n.) - неудача
   remedial (adj.) - лечебный
   succeed (v.) - добиваться успеха
   stipulation (n.) - условие
   to stay aloft - держаться в воздухе
   trial run - испытательный полёт
   ominous - зловещий, угрожающий
   lurch (v.) - крепиться
   scrutinize (v.) - внимательно изучать, проверять

2. Read Text I.

## Aviation First Setback

In 1908, flying was a miracle that had suddenly become solid reality. After centuries of dreams it was at last for man a fantastic escape from the limitations of earth-bound existence. Aviation enthusiasts let their imaginations soar, and it seemed at first that all the most formidable obstacles had been overcome.

Then, on September 18, 1908, the newspapers headlined: "Wright Plane Falls. Army Lieutenant, a Passenger, Killed".

It was a shocking blow, espacially to all flying enthusiasts, who had been expecting a perhaps slow but steady growth of flying techniques which would carry man, step by step and mile by mile, farther and higher into the firmament-those wide reaches that symbolize all that is above our hopes on earth. For the visionary business man it meant a setback to an incalculably vast new industry. For the experimanters whose imagination and time and energy had been devoted to making flight possible, it was a keenly felt disappointment. For the skeptic, it meant another, "I told you flying machines would never really work."

Nowadays, many years later, the crash of a plane brings into play the detective and remedial efforts of hundreds of specialists, months of detailed study, the sifting of bits and shreds of metal, engines, instruments, weather and flight techniques, and all the relevant human factors that could have any bearing on why any single elaborately designed and skillfully operated plane of the thousands in the air at that moment should have gone down.

Up to September of 1908, after four years of work on the Wright and other machines, despite many minor mishaps, not one drop of passenger blood had been spilled. The Wright's was a do-it-yourself project, requiring intelligence, stubbornly maintained imagination, observation, and skill, carried on with extremely limited funds. The brothers had succeeded where many others with greater backing had failed. The first Wright plane flown was a simple contraption, and no one knew better than Orville and Wilbur that it was a primitive type of a better machine yet to come. But it flew, and with each minor refinement and each test it flew better and farther.

The world's first powered flight took place on December 17, 1903 - a straight-away run of about a hundred feet. It was followed by developments in the control of balance, and with practice the Wrights learned to make banked turns, teaching themselves to guide their ungainly machine through the vagaries of air currents. With a slightly more powerful engine they felt the machine could bear the weight of another seat and a passenger.

By 1908, Wilbur had taken one plane to Europe for demonstrations, and Orville, using a sister plane, prepared for a series of tests at Fort Meyer, Virginia, to prove to somewhat skeptical Army officers the machine's ability to meet government contract specifications. One of the Army's stipulations was that it must carry a passenger a certain distance and return to the starting point.

Some days before the test, Orville had managed to stay aloft for an hour and five minutes - then the world's record - and he had carried Lieut. Frank Lahm on a shorter flight.

On the afternoon of September 17 Lieut. Thomas Selfridge of the U.S. Army was given permission to take part in one of Wright's trial runs. He scaled 173 pounds, which was a greater weight than the plane had ever carried. But Wright's craft left the launching rail easily, and by the time it had made three circuits of the parade grounds it had reached an altitude of about one hundred and twenty-five feet.

At that height, Wright suddenly heard an ominous tapping sound behind him. He turned his head to look back over his shoulder and through the birdcage structure saw that a propeller blade had splintered and cut vital control wires.

With his critical controls gone, Wright was helpless. The machine lurched upward for a second, turned and then dived in a sweeping plunge. However, some of the shock was absorbed by the elevators which were set on a framework forward so that Orville suffered only broken ribs and a fractured left leg and pelvis, although Selfridge was pinned beneath the engine and fatally injured.

The twisted tangle of wood, cloth, and wire was roped off from the curious mobs that gathered and was carefully scrutinized by Army people. There were no aviation experts then; Wright and Charley Taylor, who had helped build the engine and the airplane, were the only men on the the spot qualified by experience to judge the cause of the accident. Wright, after his quick backward glance, had surmised instantly where the seat of the trouble lay.

Notes to the text:

firmament - (поэт.) небо, небосвод
ungainly - неловкий, неуклюжий
vagaries - причуды, капризы

3. Find synonyms:

firmament test flight

| | |
|---|---|
| setback | to investigate |
| remedial | to roll |
| stipulation | medical |
| to stay aloft | condition |
| trial run | sky |
| to lurch | failure |
| to scrutinize | to keep in the air |

4. Read Text 1 again, find sentences with the words to memorize and translate these sentences.

5. Make up sentences of your own with the words to be memorize.

6. Use in the short situation of your own:
   a) trial run, to stay aloft, to lurch ominous, setback;
   b) to scrutinize, stipulation, contraption, to succeed, ungainly.

7. Speak on: a) the Wright brothers first plane;
   b) the test flight of September 17, 1908.

Task 2.

1. Read Text 2.

Biography of a Reluctant Subject
(On "Einstein. The Life and Times"
by R.Clark)

Every biographer of Einstein must be uncomfortably unaware of the potentially disapproving judgement implicit in a remark from Einstein's own "Autobiographical Notes":"That which is essential in the life of a man of my sort lies in "What he thinks", and "How he thinks", and not in what he does or suffers". "This can be read as casting doubt on the whole biographical enterprise, and we do know that Einstein was not particularly enthusiastic about any of the biographies written about him while he was alife. It can also be read as a challenge to the biographer".

The great thing in his life - its very core - was his scientific work, and it is up to the biographer to make this real to us. To do so takes much more than exposition, popular or technical, of Einstein's scientific achievement as they appear from the standpoint of present-day physics. We have to see his ideas developing, his work in progress, and to see this work in the context of the scientific problems of his time. The goal is to grasp or at least to appreciate what Einstein meant when he wrote, "But the years of anxious searching in the dark, with their intense longing, alternations of confidence and exhaustion, and the final emergence into the light-only those who have experienced it can understand that". This is not to deny the legitimacy of our interest in the personal or the public life of Einstein. It could hardly be otherwise: this man whose scientific achievements are the only parallel to Newton's was an extraordinary human being in many other ways as well. Of course we want to know as many details as we can find about how he lived and what his relationships with his family and friends were like and what he did day by day, all in the hope of understanding how this particular instance of supreme human achievement came about. And Einstein's unique role as a public figure is both part of the history of our times and a major aspect of his life after 1919. It is the easiest part of his life to document, and the natural favourite of popular biographers.

Clark in his book recognizes and says repeatedly that Einstein's scientific work meant more to him than anything else in his life, but his book does not often show us Einstein at work. Being not a scientist himself, Clark is simply not able to handle Einstein's physics with the understanding and assurance that are as much needed for popularization as they are for teaching. He is in no position to make an independent apprisal of the scientific importance of Einstein's paper and the judgements he does express are often misleading.

The real interest in Clark's book lies in the wealth of material that he presents concerning Einstein's external life. He follows Einstein's concern for peace from his dissenting opinion on the German war effort in 1914 to his advocacy of armed collective security against Hitler and his fight for nuclear disarmament after 1945.

Notes to the text:

to deny - отрицать
to handle - (здесь) разбираться, обсуждать
challenge - вызов
to grasp - схватить суть, постичь
to anaware of - не осознавать, не отдавать себе отчёта в ...
to be in progress - развиваться
to be in no position - не иметь права
to cast doubt - бросить тень сомнения
the very core of - самая суть
merely - просто, только
appraisal - оценка

2. Make sure you understand everything properly. Read the text again or use a dictionary if necessary.

3. When everything is perfectly clear, try to say: a) Why is it particularly difficult to write a biography of a scientist? b) How do you interpret the title of the text?

Task 3.

1. The following text is the first part of "747 Accident". Translate it orally or in writing (as your teacher recommends you) using an English-Russian Aviation Dictionary.

2. Give the title to this text.

3. Render its contents in few written sentences in English.

747 Accident

The accident was notified to the Accidents Investigation Branch at 19 10 hr. (All times in this report are GMT based on a 24-hr. clock) on Dec.27, 1979 and an investigation commenced

that night. The United States Accredited Representative together with his advisers arrived in London the following day and participated fully in the investigation.
The accident happened while the aircraft was being landed on runway 23 at London's Heathrow Airport. At touchdown the No.4 pylon forward bulkhead, which supports the front of the engine began to break free of the pylon because of weakening by fatigue and other preexisting damage.
The resulting downwards movement of the engine during the landing roll ruptured the engine fuel feed pipe and several other connections with the engine including engine monitoring and fire warning circuitry. The high volume of fuel issuing from the ruptured fuel pipe caused a severe fire to develop under the No.4 pylon. The fire continued until the crew physically observed the fire as the aircraft was being turned off the runway at block 77(O), at which point the fire drill was carried out. This resulted in the closure of the fuel shut-off valve in the wing. The aircraft was brought to a halt and the airport fire service quickly brought the residual fire under control.
The report notes that the No.4 engine was involved in a collision with a baggage container (igloo) at Chicago Airport three years prior to the accident. It concludes that this collision may have been the initiating event in the chain of structural breakdown which culminated in the separation of the pylon forward bulkhead, which was the direct cause of the accident.
The report analyzes the bulkhead failure and concludes that the failure of the bulkhead did not arise from any defect of design or deficiency in the certification process. However, deficiencies in the approved maintenance inspection procedures are considered to have contributed to the defect in the forward bulhead progressing to the point of failure.
The report reviews the concept whereby the pylon is designed to separate cleanly at a predetermined load level in order to protect the wing structure from damage. The concept itself is not questioned, but the lack of any form of automatic fuel shut off that would operate coincidentally with pylon

or nacelle separation is criticzed and a recommendation is made to that effect.

(To be continued)

# U N I T  II

Task 1.

1. Memorize the following words and word combinations:
   1. minute(adj) - мелкий, незначительный
   2. malfunction - неисправная работа, отказ
   3. to handle - (зд.) управлять
   4. to put in force - вводить в действие
   5. flyability - пригодность к полётам
   6. to amend - исправлять, улучшать
   7. freight - груз
   8. consecutive - последующий
   9. fallibility - подверженность неисправности
   10. crate (жарг.) - самолёт, автомобиль
       old crate (амер.) - драндулет(об автомобиле)
       гроб (о самолёте)
2. Read the following text:

Today before a plane is allowed to go into service on the world's airlines, it must be certified to make sure that no minute part shows a sign of weakness that could interfere with safe operation, and later regular inspection by a bevy of experts is required, so that any indication of malfunction can be corrected at once. Experts check each crew's ability to handle the type of craft it is to fly. And when an accident does occur, a special trained group - detectives of the air - move in to ferret out the cause, and new regulations are put in force to prevent that kind of trouble from reoccurring.

There are today over 1700 United States airlines of a dozen different typescarrying passengers across the United States airlines of a dozen different types carrying passengers across the U.S.

and overseas under the strictes. observation, and supervision applies also to innumerable foreign carriers landing in the U.S., which must be registered for flyability.

The United States government agencies responsible for controlling this multiple traffic of the skies are the Civil Aeronautics Administration - CAA - under the Secretary of Commerce, which issues licenses for aircraft and their crews and provides facilities for control over the country's airways, and the Civil Aeronautics Board - CAB. Both were brought into being by the Civil Aeronautics Act of 1938 - amended for greater effeciveness later.

The CAB derives its authority directly from Congress as an independent agency with quasi-judicial powers including the initiation of legislative acts; promulgates into law all U.S. Civil Air Regulations under which all commercial aviation in the country operates. Thus it enforces all safety rules for all air carriers of any sort - either passenger or freight - and it is the Bureau of Safety which investigates and analyzes accidents. Although it brings in, either officially or unofficially other experts from every field of airplane manufacture, it is this board which handles every minute factor involved.

The 1986 U.S. safety record for air carriers is a continuation of a consecutive six-year period in which there occured less than one fatality per 100 million passenger miles flown. In contrast to this there were about two and a half per 100 million for private automobile travel; 0.21 fatalities per 100 million passenger miles in railroad transport; and about 0.40 per the same equation for busses.

The number of safe flights relative to the accident toll is apt to go unnoticed by the average individual, since so large a proportion of the flights follow their airy courses in darkness and far, far away. For instance, nearly ninety loaded planes cross the Atlantic Ocean in any given twenty-four hours. According to the Director of Flight Safety Research of the U.S.Air Force, the American military alone keeps between

1100 and 1200 planes in the worldwide air twenty-four hours round the clock. And traversing much the same air space, an even greater number of commercial and private air carriers are simultaneously aloft.

The need for controls in this traffic volume is obvious and has for a long time been one of the major subjects for study and rulings by responsible agencies. Transport accident, involved as it is with both occasional human error and the fallibility of working parts under extreme conditions, is and always has been one of the difficulties of advancing civilizations.

It is recognized that air accidents are due to three main causes: weather; structural or design failure, and human error. The pilots who flew the open-air crates that had barely evolved from the primitive Wright models in World War I, and the test pilots who since that time, have flown the experimental planes of the recent past, know all too well the extent of structural and design improvement that have brought us today's magnificent jets and massive transports. But the flying age has been one of almost precipitous progress and demand for what in the Wrights' day would have been considered superhuman technological flying achievements. It is no wonder then that flying craft, which were at first endowed with mysticism in the lay mind should sometimes nowadays seem almost too complex for the welfare of mankind. Actually, in this period, the remembered fantasy of the air battles of the two great wars of our day have probably done as much as anything else to perpetuate the public's feelings toward flying. In reality, the manufacture and flight control of present day air transports is as well-conceived and regulated a business as the building and running of trains and ships by railroad and shipping companies. The interrelation among the three main causes of the air accidents that do occur to planes creates a problem for the CAB and all those responsible for flight safety, and it is the CAB's job to discover what one failure or combination of failures brought about each crash. Because some small structural failure or human error occasionally leaves no recognizable trace, the origin of a disaster may never be determined, but there have been very few accidents whose causes could not be explained, and even when the determining factor in the disaster cannot be proved any suspected source of trouble is dealt with as though it were responsible for the trouble and the suspected weakness is eliminated in all planes of the same type.

Notes to the text:

1. to perpetuate - увековечивать, сохранить навсегда
2. bevy(n) - компания, собрание
3. to ferret out - разведывать, разузнавать
4. legislative acts - законодательные акты
5. to promulgate - обнародовать, распространять
6. precipitous - стремительный

3. Find synonyms:

| | |
|---|---|
| minute | to investigate |
| bevy | air worthiness |
| malfunction | cargo |
| to handle | to improve |
| to ferret out | minor |
| flyability | to control |
| to amend | failure |
| freight | group |

4. Find the proper equivalents to the words:

| | |
|---|---|
| to perpetuate | make smth known to the public |
| crate | coming one after the other; |
| to promulgate | an old automobile or plane |
| consecutive | to prevent smth or smb from being forgotten |

5. Make up a situation in which you might use the following words:
minute, malfunction, to ferret out, flyability, to amend, fallibility, crate.

6. Speak on:
   a) the main administrative bodies responsible for air traffic in the USA;
   b) reasons for greater traffic controls;
   c) causes of air accidents.

7. Give the title to Text1.

Task 2

1. Read Text 2.

Manned Station in Space - Will It Fly?

A space station has long been on NASA's wish list, but many potential users are unenthusiastic. The National Academy of Sciences , for example, sees "no scientific need for a space station in this century," contending it would consume funds for such ventures as unmanned planetary probes.

Analysts at the Office of Management and Budget content that NASA's 8-billion-dollar project estimate is far too low. OMB experts testified that costs might hit 20 billion.

NASA argues that the project could lead to a lucrative factory in the sky making such products as electronic crystals and superstrong metals that can be manufactured only in weightlessness.

Already, engineers at NASA and eight aerospace companies have designs on the drawing boards. Plans call for a station resembling a Tinkertoy arrangement of manned modules, fuel cells, platforms and solar panels. It wpuld be built in stages at an altitude of nearly 250 miles. Once completed, it would house six to eight persons who would stay in orbit for up to six months.

A key to its success is the space shuttle, which would ferry astronauts and supplies to it.

Several law makers are against funding to start the project. Senator William Proxmire (D-Wis.) denounced the plan as a "white elephant". Representative Bruce Vento (D-Minn) declared that Reagan is "willing to spend billions to house astronauts in space, but he won't support housing for needy Americans on earth".

Notes to the text:

lucrative - прибыльный, доходный
to ferry = to carry
lawmakers - законодатели
"white elephant" - "белый слон"-почётный,но очень обременительный дар

2. Find English equivalents for:
   беспилотный
   пилотируемый
   обитаемый (жилой) отсек
   сверхпрочные материалы
   невесомость

3. Answer the following questions:
a) What organizations and individuals were involved into the discussiong concerning the space station?
b) Who of them supported it and what were their reasons?
c) Who was against the station and why?

Task 3

1. This part of the text is to be translated orally.
2. Write an English annotation of it.

747 Accident

FACTUAL INFORMATION

History of the flight.

The aircarft was engaged in a sheduled international cargo flight from JFK airport. New York, to London's Heathrow. The only occupants were the three flight crew members, namely the commander, copilot and flight engineer. The aircraft departed from New York at 1201 hr. on Dec.27 and after an uneventful flight, was landed manually by the commander on runway 23 at Heathrow at 1839 hr.

After a heavy touchdown, the commander applied reverse thrust and the flight data recorder (FDR) readout indicated that maximum reverse engine pressure ratio (EPR) was obtained on all four engines. Shortly afterwards the flight engineer reported that the exhaust gas temperature (EGT) was approaching

limits on No.4 engine, whereupon the commander began to reduce reverse thrust on all engines. As he did so, he felt the No4 thrust lever give a sudden jerk and thereafter become immovable.
After reverse thrust had been canceled on the other three engines, it became apparent to the crew that No.4 was not delivering reverse thrust, notwithstanding the position of the thrust lever. All the instrument indications were that the engine had run down and flamed out. The FDR read out showed that No.4 engine had ceased to deliver reverse thrust some 15 sec. after selection and some 10 sec. before reverse was canceled on the other three engines.
The indicated air speed (IAS) at the time reverse thrust was lost on No.4 was 80 kt. While the aircraft was moving slowly clear of the runway to the right, the copilot observed a large fire in the region of No.4 engine, although there was no fire warning indication of this on the flight deck. The copilot immediately reported the fire to air traffic control (ATC) who had by then already activated the crash alarm. The crew carried out the engine fire drill and stopped the aircraft clear of the runway on a link taxiway at Block 77(0). The other engines were shut down.
The fire was brought rapidly under control by the airport fire service which arrived on the scene as the aircraft cleared the runway. An emergency evacuation was therefore considered by the commander to be unnecessary.
Injuries to persons. None.
Damage to aircraft . There was substantial damage to the No.4 engine support structure and also fire damage to the outer starboard wing, engine and pylon fairings.
Other damage. None.
Personnel Information. Commander: Male, age 58. License: Airline Transport Pilot issued on Nov. 19, 1976. A first-class medical certificate was last issued on July 17, 1979. Aircraft ratings: DC4, DC8, C46, B707, B720, B727, B747. Flying experience: Total on all types: 29,900 hr. Total on the B747: 1,423 hr.

Copilot: Male, age 44. License: Airline Transport Pilot issued on Apr. 26, 1973. A first-class medical certificate was last issued on July 12, 1979. Aircraft ratings: DC8, B707, B720, B 747. Flying experience: Total on all types: 8,159hr. Total on the B747: 3,559 hr.

Flight engineer: Male, age 56. License: Commercial Pilot issued on Apr. 1, 1965. Flight Engineer issued on Apr. 12, 1967, rated for turbojet powered aircraft. A second-class medical certificate last was issued on Mar. 16, 1979. Flying experience: Total on all types: 18,634 hr. Total on the B747: 4,642 hr.

Rest and duty periods: Each crew member had been on duty for 7 hr. 39 min. at the time of the accident. Prior to reporting for duty at New York, each crew member had had a rest period of at least 24 hr.

Aircraft information. General information:

Type: Boeing 747-121 - Freight Transport. U.S. Registration: N771PA. Serial No:19661. Date of manufacture:Aug. 1, 1970. Registered owner: Pan American World Airways, Inc., since Aug.20, 1970.Certificate of Airworthiness: dated Aug.1, 1970. Validity subject to the aircraft being maintained in accordance with approved maintenance procedures. Conversion to cargo configuration: May 30, 1975. Total airframe hours: 34,615. Total cycles: 9,505. Total cycles : 9,505. Total hours No.4 pylon: 34,615. Type of engines: Four Pratt and Whitney JT9D--7D. No. 4 engine:Serial No.662388. Manufactured: Feb.9,1970. Installed in N771PA:Sept. 2,1979. Hours since installation: 1,269. Hours since major overhaul: 1,269. Hours since new: 27,924.

Aircraft weight and loading: The maximum takeoff weight was 749,000lb. and the maximum landing weight was 630,000 lb. Actual weights were 743,000 lb. and 547,000 lb. respectively. The permitted range of the center of gravity (CG) was between 15% and 31% of mean aerodynamic chord (MAC).CG position was 21% MAC at landing.

Maintenance: A review of the Maintenance history of N771PA found that the aircraft had been maintained in accordance with approved maintenance programes under existing Federal Aviation Regulations. All applicable airworthiness directives were recorded and had been complied with, and service difficulty reports and mechanical interruption summary reports were in order.

The aircraft maintenance logs were examined in detail for a period of six months prior to the accident. The review noted a number of discrepancies recorded relating to No.4 engine reversal. Also on Aug.9, 1978, the forward and aft upper mount fittings were found to possess "excessive" play during the preinstallation inspection of No.4 engine.

On Jan.6, 1979, during the engine preinstallation inspection of No.4 pylon the inspector observed a missing bushing and excessive play in the forward mounts and that excessive play existed in the aft upper mount fitting.

The aircraft was cleared to fly in this condition until the next engine change. An unscheduled engine change was carried out on Aug.26, 1979, when a "loaner" engine from another airline was installed as a result of high exhaust gas temperature on No.4 engine.

On Sept.12, 1979, the aircraft returned to JFK where the "loaner" engine was removed and replaced by the unit which remained in service until the accident. At this time, the aft engine mount was found to be beyond manufacture's limits and a repair was carried out involving the installation of new bolts and bushings in the pylon strut aft mount to reduce the play within permissible limits. A replacement aft engine mount fitting was ordered, which was programmed for installation at the next scheduled engine change.

The Pan American maintenance inspection schedules with respect to the pylon structure require it to be inspected both externally and internally, but the forward "doghouse" fairing, which covers the front face of the forward bulkhead, was not scheduled for removal preliminary to these inspections. The interior of the pylon was inspected via the nacelle equipment access doors (NEAD), and these permit the rear face of the forward bulkhead only to be viewed. The forward fairing is scheduled for removal for the internal inspection of the fairing itself and also its latching mechanism, part of which is located on the forward face of the forward bulkhead.

The locking mechanism of the bolts on the forward mount are "key pointed" during this inspection. There is no structure inspection of the forward bulkhead that specifically addresses the forward side of the forward bulkhead. However, it is understood that it is frequently examined on an opprtunity basis, together with other areas of the aircraft's structure at times not necessarily dictated by the inspection schedule.

The inspections scheduled during power plant removal/replacement do call for a detailed structural inspection of the horizontal and vertical firewalls, i.e. the forward bulkhead and the forward spar web, and these are carried out approximately every 2,575 flight hr., this being the average engine removal time.

The NEADs were removed during the B19 check on Dec. 12, 1979, during which time no discrepancies were noted. The forward fairing was last removed during a C-7 inspection on June 8, 1979, again with no recorded discrepancies. The aircraft had not been included in the Pan American strut sampling program during the six-month period prior to the accident.

The Boeing 747 Maintenance Program Development (BMPD) is derived from the Handbook Maintenance Evaluation and Program Development MSG - 1 and the FAA MRB Report, Boeing 747/747SP Maintenance Program. The airline maintenance program is, in turn, derived from the BMPD. The BMPD requires a number of inspections of the forward bulkhead region and these are as follows:

- Check engine mount support fittings and thrust links via the NEAD.
- Check nacelle strut interiors, firewalls and sealant (ribs, spars and fittings) electrical, tubing etc. via the NEAD.
- A leak check of the horizontal fire walls at 20,000 hr.
- Check fail safe bolts (forward mount).
- Check engine mounts, fireseal, cowl support structure,

component heat shielding and drag struts.

## U N I T III

Task 1.

1. Memorize the following words and words combinations:
   1. ditch - кювет
   2. to cause - быть причиной
   3. disaster - беда,несчастье,катастрофа
   4. scrutiny - внимательное изучение
   5. pinpoint - точно определять, указывать
   6. shortcoming - недостаток, слабое место
   7. to remedy - исправлять
   8. assigned - заданный
   9. r.p.m. = revolution per minute
   10. dial - (зд.) прибор
   11. needle (зд.) - стрелка прибора
   12. manifestly - очевидно , явно
   13. bevel gear - коническое зубчатое колесо
   14. to decouple - отсоединять
   15. to err -ошибаться

2. Read Text 1.

### Mechanical Faults

Non-air-minded car owners sometimes say:"If anything happens to my car I can pull over to the side of the road and fix it. But an airplane...". This isn't literally true, of course; mechanical failures do drive cars into ditches. But it is true that mechanical failure in the air is justly viewed with considerably more than ordinary seriousness both by the industry and passengers. Small defects can cause disasters, and unfortunately, after such air disaster the length of time that a board of inquiry sometimes takes to track down the cause tends to clothe the matter in an aura of mystery which compounds the disturbing effect. When any new type, or new model of an older type of aircraft is developed, both the manufacturer and the licensing boards painstakingly test every mechanical and structural part to assure its capacity for reliable performance. When, despite this pre-service scrutiny and testing, a fault does make trouble it is the safety investigators' duty to pinpoint where the trouble lies. In some cases, although the faulty part may be minute and apparently beyond suspicion, an inquiry into the accident it has caused can be just as long-drawn-out as when an accident is due to the failure of one of the plane's larger systems. Mechanical malfunctions are often detected in flight and can usually be corrected in the air. The"squawk" sheet the crew brings back from each flight points out shortcomings to be remedied by the maintenance men on the ground. It is only the uncorrected malfunctions that we hear about.

In July of 1956 a Trans-Canada Air Lines plane was on its way from Chicago to Montreal with thirty-one passengers.While it was cruising at 19,000 feet above Flat Rock, Michigan, one of its propellers began to act strangely and presently went out of control.

The airliner, a Vickers Viscount, was a relatively new type of ship on the North American routes; built in England, it was powered by four Rolls Royce Dart jet engines driving propellers, and it had received thoroughgoing flight reliability tests in Europe before being certified for service in the U.S. and Canada.

The Viscount which found itself in trouble over Michigan had been in service a little more than a year and in that time had spent 2500 hours in the air. It had that morning made the trip from Montreal to Chicago and was on its way back again.

The weather was good and there had been no intimation of anything wrong. The two pilots, men with long airline experience, had had about 300 hours on Viscounts. The second pilot had been certified as an aircraft commander, but on this day he was being cheked out by the ship's captain over that particular route - a rule of airline administration before a pilot takes command of his own ship over a course with which he is not completely familiar. The captain was occupying the co-pilot's seat for the flight.

The plane had been moving smoothly aloft at its'assigned altitude when the right outboard engine began to lose speed, and dropped well below its normal 13,600 rpm for cruising. As the dial registered this aberration in No.4's speed, the two men fixed their attention on it and were relieved when the needle swung back to normal and remained there for five minutes. But as they watched, they saw the engine revolutions rise to 14.000, and realizing after a short time that some element of the engine was manifestly not functioning properly, they attempted to "feather" the propeller of that unit. They were appalled to find it impossible to stop the runaway overspeed by either automatic or manual methods.

Faced now with an unquestionably dangerous situation and with the urgency of maintaining flying speed, they increased the power of the three remaining engines, but this did nothing to lessen the alarming rate at which No.4 continued to accelerate. A quick radio plea to Traffic Control Center at Detroit gave the crew permission to make an emergency landing at Windsor, Ontario.

Making an Unusually rapid descent from 19,000 feet, the captain ordered the cabin depressurized. At 9000 feet real trouble overtook the craft. No.4 propeller wrenched loose and one of its blades hurtled into No.3 jet engine, passed completely through the engine's oil cooler, and a portion of it crashed into the passenger cabin wall near the first row of seats. For the next nine minutes the two captains were wholly occupied trying to control the newly shattered No.3 engine, dealing with the fire hazard in that power plant, and struggling to get the plane down safely. Not until they were on the ground did they discover that the propeller blade had sliced into the fuselage, killed one of the passengers, and injured five others.

So obscure was the cause of the propeller's disintegration that it was not until eight months later that the Canadian and CAB investigators were able to issue a report explaining it.

The trouble had begun with the failure of a set of bevel gears to fulfill their functions - to drive the fuel pump, propeller control-unit, and oil pump - which caused oil starvation in the parts the gears were there to serve. Aeronautical annals showed no record of any malfunction of that kind before.

Unfortunately, however, the ultimate catastrophe of the sheared propeller was not, the investigators believed, an inevitable outcome of the trouble that developed with the engine's sudden overspeed.

It had been a natural and ordinarily correct reaction of the pilots to try to get their craft to the ground at the earliest possible moment. But by pushing the airspeed in the rapid descent to make a landing from an altitude of 19,000 feet, they had, in fact, said the experts on the two investigating boards, aggravated the condition that began in the failure of the gears. If the ailing propeller had been "feathered" immediately, when it began to behave abnormally, the controls actuating the feathering unit would still have worked. In the beginning, the propeller withstood the pressure of what was very nearly maximum rotational speed, but as the airspeed increased, a strain was put on the propeller which it was not designed to stand. And this strain created a hazard that would not have existed if the craft had not been brought down at an emergency rate of descent.

The final report, in which both the U.S. and Canadian boards concurred, was arrived at after searching study of the engine parts and of the broken propeller components which were recovered along the plane's course. Its official language read: "... the probable cause of this accident was the inflight separation of the No.4 propeller as a result of excessive loads induced by a descent at too high an airspeed while the propeller was wind-milling decoupled from the engine and its rpm was known to be uncontrolled".

When the investigators' work is done, the question in many minds remains: Who was to blame? In most cases of accidents to aircraft it would be unjust to place the blame on the acts of any specific individual; more often it is the conjunction of the sudden elements of mulfunction, time pressure, and the force of an habitual reaction that comes from excellent training in handling flight troubles. For, trained as a crew may be to meet all kinds of possible emergencies the unforeseeable factor exists as in all things. A pilot in one instance may err by doing what in ninety-nine cases out of a hundred would be the right thing.

Notes to the text:

an aura of mystery - покров тайны
painstakingly - старательно, тщательно
"squawk" sheet - отставший кусок
intimation - намёк, признак
to be revived - испытать облегчение
to be appalled - испытать испуг, потрясение
to hurtle - нестись со свистом, шумом
to shatter - разбивать вдребезги
to blame - винить

3. Find synonyms:

| | |
|---|---|
| to cause | to make mistake |
| disaster | to disconnect |
| painstakingly | clearly |
| shortcoming | catastrophe |
| to remedy | disadvantage |
| manifestly | thoroughly |
| to decouple | to lead to |
| to err | to repair |

4. In Point 1 and in the Notes to Text 1 find the words corresponding to the explanations:
- to break into small fragments;
- to move at tremendous speed;
- to find smth (e.g. on the map or plan) accurately;
- a narrow channel made at the side of the road to carry off water;

- great or sudden misfortune, terrible accident.

5. Think of short situations in which you could use the following words and word groups:

a) shortcoming, to cause, disaster, to err, manifestly;

b) dial, needle, to decouple, to remedy, assigned.

6. Speak on:

a) how the flight of the Vickers Viscount was going on;

b) how the crew behaved during the flight;

c) who you think was to blame;

d) who the author believes to be guilty.

Task 2

1. Read Text 2.

Building a Space Station

By 1998, people will work and live on NASA's way station to the stars.

Building the 19 billion space station Freedom will be an adventure in itself. Between 1995 and 1998, 20 shuttle flights will lift parts of the half-million-pound station into Earth orbit . Like kids with Tinkertoys, astronauts will assemble 16-foot carbon-fiber tubes into a 236-foot truss to form the basic structure. At each end, huge, power generating solar panels will swivel to face the sun. A mobile servicing centre, a sort of remote-control travelling crane, will inch along the truss. Its Canadian-made arm will manoeuvre heavy pieces, such as the habitation module and three laboratory pods from the U.S., Japan and European Space Agency.

Once Freedom is ready, eight international crew members will spend 90-day tours on board to study the effects of microgravity, make exotic new materials and observe the universe. Each will have a bedroom (the"bed" is a sleeping bag strapped to a wall). They'll exercise on a treadmill and eat microwaved food. Showers will consist of a quick squirt, soap and rinse; a vacuum will suck up the drops for recycling. And a rescue vehicle is being designed in case of emergency. NASA added the lifeboat after Challenger exploded.

Notes to the text:

to inch - медленно передвигаться, ползти
treadmill - тренажёр, "беговая дорожка"
squirt - тонкая струя
rinse - полоскание, смывание

2. Answer the questions:
a) When main parts will the station consist of?
b) What will be the living conditions for the crew?

3. Use the information of this text and text 2 from Unit II and give as many details as you can concerning the space station.

Task 3

Now turn to the next part of "747 Accident". Follow the teacher's instructions in oral or written translation. Write down some sentences to give the summary of the part. Try to minimize the number of the sentences.

747 Accident

The BMPD defines a check as a thorough examination of an item, component and/or system for general condition, as applicable, with special emphasis, inter alia, on proper attachment, fasteners, obvious damage and cracks.

The leak check referred to in the BMPD schedule involves the flooding of the lower forward firewall area in order to check the integrity of the joints between the spar web and the adjacent chord members. This inspection did not form part of the Pan American inspection schedule until mid-1978. It had not been performed on N771PA up to the time of the accident, though it was scheduled to be carried out at a later date.

B747 engine and strut design criteria: The ultimate design load factors for the JT9D engine and pylon installation in every case exceed those set out in Part 25 of the Federal

Aviation Requirements (FAR). In the case of landing loads, the structure is assessed as "not critical" against the FAR Part 25 requirement of 10 FPS vertical velocity.

The nacelle and pylon structure was designed to accept reverse thrust loads multiplied by a factor of 2.5. The maximum design load of the front engine mount on an outboard pylon is 61,700 lb, in the downwards direction.

A typical vertical load peak on touchdown is approximately 10,000 lb.,which increases with the application of reverse thrust to approximately 15,000 lb. The greatest in-flight loads on the forward mount in the downwards direction are met during the descent when the engine thrust is at a minimum.

Previous incident: The aircraft was in collision with a baggage igloo at Chicago airport on Nov.5, 1976, resulting in light damage to the No.4 engine nacelle. At the time the aircraft had flown 22,696 hr. and 6,295 cycles.

Meteorological information: After the accident, the Meteorological Office provided a description of the weather at Heathrow for the relevant period. The description contained the following information:

General situation: Warm sector conditions with a strong moist SW airflow over the London area.

Weather: Moderate rain.

Cloud: 8 / 8 nimbostratus at 1,500 ft with varying scattered to broken stratus at 1,000 ft, below the nimbostratus.

Visibility: 5 km(3.11 mi.)

Wind: The anemometer readings from the site nearest the point of touchdown indicated a relatively steady wind in the period immediately preceding the landing. Average wind values measured at 30-sec. intervals for the two min. leading up to the moment of touchdown were as follows:

203 deg./24 kt.

202 deg./20 kt.

204 deg./18 kt.

200 deg./18 kt.

A gale warning was in force as was significant meteorological information (Sigmet ) regarding occasional severe turbulence.

The latter was included in the broadcast by the Automatic Terminal Information Service (ATIS) which the crew had received before commencing their approach to land. After the accident, the crew reported that wind and turbulence had not presented any problem during the approach and landing.

The accident occurred during the hours of darkness.

Aids to navigation. Not relevant.

Communications. Before the aircraft's approach ATIS information had been satisfactorily received and communications established in turn with Heathrow Approach on 199.5 MHz., Heathrow Tower on 118.7 MHz., the latter frequency being the one in use at the time of the accident.

After they had closed the engines down the crew were advised that the Flight Deck/Fire Service Communication Frequency of 121.6 MHz was available, but although they acknowledged this message, no communication on that frequency was subsequently established, presumably because the flight deck was evacuated shortly afterwards.

Aerodrome and ground facilities. Heathrow Airport is at an elevation of 80 ft. and has three runways, 28L/10R, 28R/10L and 23/05. At the time of the accident single runway operation was in force, using Runway 23, but with Runway 28L available on request, Runway 23, the one used by N771 PA, is 2,357 meters (7,733ft.) long and 91 meters (299ft.) in width, with the whole length available for landing. Construction is of concrete. Approach lighting consists of high-intensity center-line lights with four cross-bars. Threshold lights are low-intensity greens, and runway lights are high-intensity bidirectional edge lights. Visual Approach Slope Indicators (VASIs) and three-bar VASIs are both installed, and both set at 3 deg.

At the time of the accident all lighting systems were operating and serviceable. The runway was wet.

Flight Recorders

Flight data recorder (FDR). The aircraft was fitted with a Lockheed 209 digital flight data recorder, to Arine 573 standard. It was mounted in the aft equipment bay in the pressurized cabin. Twenty parameters plus 27 discrete switch positions were recorded. Readout was carried out at the premises of the National Transportation Safety Board in Washington D.C., as facilities did not exist in the U.K.

The whole 25-hr. record was replayed, outputting a limited number of parameters, in order to check if any heavy "g" loads had been encountered and in fact none had. A full replay of all parameters was carried out for the descent on the accident flight. The replays obtained were of very good quality with few "dropouts".

The FDR indicates that the aircraft touched down with about 1.5 deg. of nose-up pitch and 4 deg. of bank angle to starboard and at a speed of 140 kt. IAS. The peak normal acceleration recorded on touchdown was 1.55 g, although as the sampling rate was only 4 per sec. it is possible that the maximum normal acceleration experienced was sightly higher than this. A hard landing is one involving a normal acceleration in excess of 1.7 g. The peak lateral g recorded was 0.12 to port and the descent rate on touchdown (from the radio altimeter) was 540ft./min.

By some 3-4 sec. after touchdown all four thrust reversers had been deployed and maximum reverse engine pressure ratio was obtained some 6-9 sec. after touchdown. Between 12,5 and 16.5 sec after touchdown No.4 engine's pressure ratios reduced and the reverser position indications for that engine reverted to stowed, without any in-transit indications. The aircraft continued its run with three engines in reverse thrust until some 26-28 sec. after touchdown when the pressure ratio was reduced and the reversers on engines one and three were stowed by 50 sec. after touchdown. The indications were that engine two's reverser remained in the deployed position.

Cockpit voice recorder (CVR). A Fairchild A100 CVR was fitted to the aircraft and was mounted beside the FDR. The last 3 min. of the recording, which was of fair quality, were transcribed.

(To be continued)

Supplementary text

## X - Wing Aircraft

The X-Wing is the mystery ship of the convertiplane world It is designed to land and take off like a helicopter. In forward flight, the rotor is stopped and the aircraft accelerates like a fixed-wing aeroplane. Its success depends on the combination of many techniques, including circulation-controlled lift; flight control by means of cyclic variation of lift, rather than blade pitch; higher-harmonic control to damp vibration; application of composites to produce a virtually rigid four-blade rotor/wing; forward-sweep aerodynamics; use of offset engine efflux to replace the normal antitorque tail rotor; and a compound engine to produce both forward thrust in wing-borne flight and shaft drive in the helicopter mode.

The idea has been under development for more than a decade by Kaman and Lockheed. Boeing Vertol has been investigating the rotor and control system since 1980. Sikorsky is testing a full-scale X-Wing and will fit one to one of the Rotor Systems Research Aircraft (RSRA), which should fly in two years time, or later.

Circulation-controlled lift applied to rotors was first developed by the National Gas Turbine Establishment in Britain and applied to the X-Wing by the US David Taylor Naval Ship Research and Development Centre. X-Wing is now a joint venture shared between the Defense Advanced Research Projects Agency and the US Navy.

The X-Wing has four thick blades , each with a symmetrical oval aerofoil section and very precise spanwise slots above both the leading and trailing edges. The ratio of slot width to chord is critical. Air from an engine-driven blower passes via the rotor hub into the blade roots through a stationary ring of ports (whose area can be individually regulated by valves). These ports control the cyclic distribution of the airflow which is then ducted to the slots in the blades. Boeing employs 16 ports. Sikorsky more. The blown air varies the lift of the blade to produce control without mechanical pitch change.

Some researchers believe that the Coanda effect, on which the circulation-control effect, develops shock-waves close to the blowing slots, which so reduce the theoretical lift coefficients of the blades as to make them unacceptably inefficient. Boeing Vertol claims that the losses are not great enough to invalidate the concept.

The X-Wing compares well with a normal helicopter. Rotor tip-speed is about 700ft/sec (213m/sec), some ten per cent slower than average in helicopters. The disc loading is 15lb/ft$^2$ (73kg/m$^2$), which is little more than of a CH-53E, but less than that of the JVX. The equivalent flapping hinge off-set, which determines the control response (or over-response) is a very large 50 per cent, compared with 30 per cent for the rigid rotor Sikorsky ABC and five per cent or less for a normal single-rotor helicopter. This requires the X-Wing to have automatic stabilization and to aplly higher-harmonics control in the rotor to damp the 3/rev and 5/rev vibrations, in order to reduce blade-root moments, and the 4/rev vibration in order to damp vertical oscillations. The blowing ports in the rotor hub can be operated to superimpose this frequency control over the normal cyclic blowing variations.

If 4,000HP is needed for rotor shaft drive during hover, it takes a further 500HP to drive the compressor supplying the air jets. As forward speed builds up, required shaft power declines, but blower power increases. However, the overall power requirement declines steadily, until some 2,500HP is sufficient for both shaft and blower drive at 200kn (370km/h).

Although the X-Wing blades normally have no hinges at all application in the form of a trimming control of from $1^1/2°$ to $6^1/_2°$ of collective pitch could improve hover performance by ten per cent.

The most difficult flight phase is conversion, which is performed at around 200kn (370km/h). An X-Wing has been stopped in the NASA Ames full-scale tunnel, with all controls operating, in eight seconds using a rotor brake.

ИЗ ИСТОРИИ РАЗВИТИЯ АВИАЦИИ

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