Министерство науки и высшего образования Российской Федерации
Федеральное государственное бюджетное образовательное учреждение
высшего образования
«Оренбургский государственный университет»

Н.В. Еремина, В.В. Томин

ПРАКТИКУМ ПРОФЕССИОНАЛЬНО-ОРИЕНТИРОВАННОГО ПЕРЕВОДА НАУЧНО-ТЕХНИЧЕСКОЙ ЛИТЕРАТУРЫ

Учебное пособие

Рекомендовано ученым советом федерального государственного бюджетного образовательного учреждения высшего образования «Оренбургский государственный университет» для обучающихся по образовательным программам высшего образования по направлениям подготовки 09.04.01 Информатика и вычислительная техника, 15.04.01 Машиностроение, 15.04.04 Автоматизация технологических процессов и производств, 15.04.05 Конструкторско-технологическое обеспечение машиностроительных производств, 24.04.01 Ракетные комплексы и космонавтика, 24.04.04 Авиастроение, 27.04.03 Системный анализ и управление, 27.04.04 Управление в технических системах

Оренбург
2019

УДК 802.0 (076.5)
ББК 81.2 Англ 7
Е 70

Рецензент – доцент, доктор педагогических наук Л.В. Мосиенко

Еремина, Н.В.
Е 70 Практикум профессионально-ориентированного перевода научно-технической литературы [Электронный ресурс] : учебное пособие / Н.В. Еремина, В.В. Томин. – Оренбург: ОГУ, 2019. – 159 с.
ISBN 978-5-7410-2362-4

Целью пособия является развитие межкультурной компетенции студентов-магистрантов Аэрокосмического института, а также предназначено для работы в неязыковых группах, обучающихся по программе профессиональной переподготовки «Переводчик в сфере профессиональной коммуникации» Аэрокосмического института с использованием текстового материала, заимствованного из оригинальной английской научно-технической литературы.

Теоретические материалы сопровождаются практическими модулями, помогающими правильному пониманию и закреплению учебного материала. Курс позволяет студентам познакомиться со стилем научно-технической литературы, развить навыки перевода научно-технических текстов. Подбор текстов, разработка лексических и грамматических упражнений выполнены с учетом навыков и знаний английского языка, приобретенных студентами в течение двух лет обучения по программе академического и прикладного бакалавриата.

Предусмотрено свободное применение технологических приемов со стороны педагога для развития кросскультурного взаимодействия.

УДК 802.0 (076.5)
ББК 81.2 Англ 7

ISBN 978-5-7410-2362-4

Содержание

Введение

Практикум по профессионально ориентированному переводу представляет собой специальный курс для студентов в рамках теории и практики развития их профессиональной компетенции. Данный курс предназначен для магистрантов аэрокосмического института, обучающихся по направлениям подготовки 09.04.01 - Информатика и вычислительная техника, 15.04.01 – Машиностроение, 15.04.04 - Автоматизация технологических процессов и производств, 15.04.05 - Конструкторско-технологическое обеспечение машиностроительных производств, 24.04.01 - Ракетные комплексы и космонавтика, 24.04.04 – Авиастроение, 27.04.03 - Системный анализ и управление, 27.04.04 - Управление в технических системах, а также для работы в неязыковых группах бакалавров, обучающихся по программе профессиональной переподготовки «Переводчик в сфере профессиональной коммуникации» аэрокосмического института.

Данное пособие призвано помочь в подготовке студентов, развитию у них умений и навыков по анализу различных сложных элементов текста и их правильной передачи средствами другого языка. Подобранные оригинальные материалы сопровождаются системой упражнений, помогающей в правильном понимании и закреплении учебных материалов. Тексты позволят студентам познакомиться со стилем научно-технической литературы, получить навыки по переводу. Подбор текстов, разработка лексических и грамматических упражнений выполнены с учетом навыков и знаний английского языка, приобретенных студентами в течение двух лет обучения по программе академического и прикладного бакалавриата.

Обучение профессионально-ориентированному переводу отражает, в целом, технологию обучения иностранным языкам в специальных целях. Интегративность в этом случае является основополагающим принципом, лежащим в процессе овладения иностранным языком в специальных целях. В цели практического курса перевода входит отработка следующих умений:

-осуществлять переводческий анализ текста, определять цель перевода и тип переводимого текста;

-выбирать общую стратегию перевода с учетом его цели и типа оригинала;

-осуществлять письменный перевод текстов, относящихся к сфере основной профессиональной деятельности;

-использовать основные способы и приемы достижения смысловой, стилистической адекватности;

-правильно оформить текст перевода в соответствии с нормами и типологией текстов на языке перевода;

-профессионально пользоваться словарями, справочниками, базами данных и другими источниками дополнительной информации;

-интегрировать переводческие навыки со специальными знаниями в основной профессиональной деятельности.

Пособие построено по дидактическому принципу – от простого к сложному и содержит много дополнительного материала, который может быть рекомендован как для аудиторных, так и для самостоятельных занятий.

1 Теоретические аспекты технического перевода

1.1 Технический перевод и обмен научно-технической информацией

Современное состояние переводческой деятельности характеризуется преобладанием информативных переводов, повышенными требованиями к точности и адекватности перевода, тематическим и стилистическим разнообразием материалов, подлежащих переводу, специализацией и технизацией переводимых текстов, широким использованием технических средств в процессе перевода. Основной акцент в переводческой деятельности переместился в область бизнеса, банковского дела, совместных предприятий, значительно развиваются международные контакты. Все это создает новые предпосылки для развития и совершенствования переводческой деятельности в общем и профессионально-ориентированном переводе.

Существует распространённое мнение, что технический перевод (ТП) – это перевод «технических» текстов. Это мало что говорит хотя бы потому, что понятие «технический» текст очень расплывчато. Так, например, начав с чисто «технических» текстов, описывающих различное производственное оборудование, можно незаметно перейти к текстам, описывающим хирургическое оборудование, т.е. к медицине, а она, как известно, тесно связана с биологией, а это уже область естествознания, которое в свою очередь является основой философии, а философия – основа политики и т.д. В художественной литературе, особенно в научно-фантастической, можно встретить немало страниц, подходящих под общепринятое понятие технических текстов.

Как видите, круг замкнулся, а чёткой границы между технической и художественной литературой нет.

Тем не менее, обычно виды специального (нехудожественного) перевода определяются характером материала, обрабатываемого переводчиком. Например, существует так называемый «военный перевод», и существуют учебные заведения, готовящие военных переводчиков, являющихся разновидностью технических переводчиков. Но ведь ясно, что переводчику, работающему в области «военного перевода», нередко приходится иметь дело с совершенно «невоенными» текстами (при допросе военнопленных и т.д.).

Таким образом, дело не столько в том, что переводится, а в том, как переводится и для чего.

Технический перевод – это перевод, используемый для обмена специальной научно-технической информацией людьми, говорящими на разных языках.

Из этого определения следует, что технический переводчик – это посредник, без которого этот обмен был бы невозможен. Из него же следует, что технический переводчик, так же, как и переводчик художественной литературы, должен знать два языка, одним из которых он должен владеть достаточно свободно для точного, ясного и грамотного воспроизведения содержания оригинала.

Часто в своей работе переводчик имеет дело с самым новым материалом (зачастую никому у нас неизвестным), для восприятия которого нужна определённая подготовка, нужны специальные знания.

Какими же качествами, знаниями, умениями должен обладать человек, занимающийся техническим переводом?

Прежде чем ответить на этот вопрос, необходимо подробнее остановится на сущности и формах технического перевода.

Научно-техническую литературу, поступающую к нам можно разделить на 3 потока:

1) патентная литература (т.к. всё новое в области науки и техники официально оформляется в виде патента);

2) периодика (отраслевые бюллетени, содержащие рефераты, аннотации; отраслевые научно-технические журналы; библиографические указатели с названием тем, изобретений, тематические обзоры работ);

3) различные периодические и непериодические издания (специальные журналы и книги, рекламные материалы, инструкции и т.п.).

Технический перевод охватывает несколько форм или способов обработки оригинального текста. Каждый из них имеет свои особенности и законы. Они не зависят от сферы специализации, и поэтому каждый технический переводчик должен быть знаком со всеми видами технического перевода.

В зависимости от практической ценности поступающие к нам материалы обрабатываются по-разному. Существует несколько форм перевода, но их можно сгруппировать в два вида перевода:

– полный письменный перевод;

– сокращенный вид перевода в форме рефератов, аннотаций, перевода заголовков и т.д.

Вся практически используемая информация обычно обрабатывается в форме полного письменного перевода, являющего основной формой технического перевода.

Информация, накапливаемая по определённой системе в качестве справочного и подсобного материала, а также так называемая сигнальная информация обрабатывается в форме сокращённых видов технического перевода, таких как, реферативный перевод, аннотационный перевод, перевод заголовков и т.д.

Технический переводчик должен практически знать все виды обработки первичной информации, и при этом располагать определенной суммой специальных знаний, помимо хорошего владения иностранным языком.

Последнее обстоятельство является причиной весьма распространённого мнения о том, что технический переводчик должен знать технику, быть инженером. Но это не всегда возможно.

Если же переводчик не имеет узкоотраслевой подготовки, он должен систематически изучать специальную литературу, следуя за новинками в данной области.

Но даже и узко специализирующийся переводчик технической литературы должен быть готов к переводу материала из незнакомой области, т.к. все отрасли науки взаимосвязаны.

В автомобилестроении это металлургия, обработка металлов, производство сплавов, химия, электроника…

Таким образом – умение пользоваться рабочими источниками информации – самое главное условие успешной работы технического переводчика.

Активный терминологический словарь существенно экономит его рабочее время. Такой словарь накапливается постепенно, в процессе работы, т.е. у каждого переводчика накапливается свой собственный специальный словарь.

Профессионально ориентированный и технический перевод, в частности, характеризуются рядом специфических особенностей, отличающих его от художественного и научно-публицистического. Эти особенности распадаются на две категории: лексические и структурно-грамматические. Лексические особенности заключаются в употреблении специальной терминологии, состоящей в свою очередь, из обще специальных терминов, узкоспециальных терминов и профессиональных жаргонизмов.

К структурно-грамматическим особенностям профессионально ориентированного перевода следует отнести:

– преобладание в текстах оригинала видовременных форм пассивного залога по сравнению с другими жанрами, сочетающими употребление активного и пассивного залогов;

– наличие беспредложных номинальных групп;

– изложение содержания в изъявительном наклонении;

– преобладание эпистемической модальности изложения материала;

– использование цифрового, графического и изобразительного материала;

– употребление видовременных форм нарративного характера из области «мира описываемого»; для английского языка — это видовременные формы present indefinite, past indefinite, present continuous, past continuous.

Ссуммируя сказанное, мы приходим к выводу, что технический переводчик должен:

1) знать хотя бы один иностранный язык в степени достаточной для понимания;

2) знать другой язык (обычно родной) в степени, достаточной для грамотного изложения;

3) уметь пользоваться рабочими источниками информации;

4) уметь делать различные виды технического перевода;

5) обладать терминологическим минимумом.

1.2 Рабочие источники информации

Все рабочие источники информации, можно подразделить на общие, с которыми работают все переводчики, и специальные, которыми пользуется технический переводчик.

Общие источники информации подразделяют на словари общего назначения и общие энциклопедии.

Словари:

1) двуязычные (англо-русские, русско-английские фразеологические)

2) одноязычные (толковые словари иностранных слов)

3) вспомогательные одноязычные словари (синонимов, антонимов, орфографические)

4) энциклопедические словари общего назначения.

Специальные источники информации

Специальные словари Специальные энциклопедии Специальная литература

Специальные словари подразделяют на двуязычные (политехнические, отраслевые, вспомогательные, специальные) словари и одноязычные специальные словари.

Специальные энциклопедии: политехнические и отраслевые.

Прочими источниками информации служат собственный опыт переводчика, накопленный при переводе других, подобных материалов.

Рабочие источники информации: общие, специальные.

I Общие двуязычные словари (ОДС)

Для успешного пользования ОДС необходимо выполнить следующее:

1) любой ОДС (кроме фразеологического) даёт не перевод слов, а только возможные эквиваленты каждого данного слова, и, далеко не все. Словарь только даёт намёк на то, что слово может выражать в определённом контексте;

2) чтобы быстро найти нужное слово, надо хорошо знать алфавит.

Для быстрой ориентации в словаре необходимо помнить, что в середине англо-русского словаря – L, в середине первой половины – D, в середине второй – S. Это легко запомнить с помощью искусственного слова DI LO SE, показывающего что слова в начале II-ой четверти словаря начинаются с сочетания DI, слова в начале III-ей четверти – с LO, а слова в начале последней четверти – с SE;

3) нужно хорошо знать смысл всех условных обозначений, сокращений, знаков, различных шрифтов и знаков препинания, используемых в словарных

статьях, а для этого необходимо прочитать статью о пользовании им и списком сокращений.

Примером фразеологического двуязычного словаря может служить «Англо-русский фразеологический словарь» проф. А.В. Кунина.

Словарь содержит устойчивые словосочетания (фразеологические единицы), которые легко выделяются из контекста как единое целое, состоящее из нескольких слов, в отличие от свободных сочетаний слов, где каждое слово самостоятельно.

Фразеологический словарь, в отличие от двуязычных словарей, даёт не только эквиваленты, но и перевод, когда словосочетание однозначно (е.д. пословицу, цитату, афоризм и т.д.).

Фразеологические единицы располагаются в словаре не по 1-му слову, а по главным в смысловом отношении словам сочетания, причём эти главные слова, в свою очередь, располагаются в алфавитном порядке.

В конце словаря даётся список тех же фразеологических единиц в алфавитном порядке по первому слову со ссылкой на страницу, где они подробно объясняются.

Перед этим списком помещён словарик иностранных выражений (обычно латинских и французских), использующихся в английском языке без перевода.

II Общие одноязычные словари.

ОС – это словари, объясняющие на том же языке значения слов, понятий или предметов, с помощью определений, описаний, примеров, а также с помощью синонимов и антонимов.

Сюда относятся:

а) Толковый словарь русского языка (объясняется значение слов современного русского языка);

б) Словарь иностранных слов (объясняет русские слова иностранного происхождения). Это прежде всего слова и термины из элементов

древнегреческого и латинского языков. Этот словарь не содержит грамматических сведений.

в) Словари синонимов и антонимов.

г) энциклопедические словари (содержат краткие сведения о понятиях и терминах, носят биографический, географический и социально-экономический характер). Ценности для тех. переводчика не составляет.

III Специальные политехнические двуязычные словари.

Эти словари дают эквиваленты общетехнических, и общенаучных терминов, а также и многих обычных слов, используемых в языке науки и техники.

Например: «Англо-русский политехнический словарь» под. ред. А.Е. Чернухина, 1974.

Термины политехнического словаря относятся ко всем отраслям науки и техники (поли (греч.) – много).

Для указания отрасли используются специальные сокращения, ед.: свт. – светотехника, ак. – акустика. Они набираются курсивом.

В конце словаря имеется полный список этих отраслевых сокращений.

Такие словари обычно имеют приложения, где можно найти такие сведения, как обозначаются в английской и американской технической литературе футы, дюймы, десятичные дроби и т.п., греческий алфавит, римскую нумерацию и т.д. Здесь же приведены таблицы для перевода разных английских и американских мер в десятичные.

Всё это экономит время переводчика и исключает ошибки при пересчёте.

IV Двуязычные отраслевые словари (ОТС).

ОТС отличаются от политехнических тем, что в них можно найти больше терминов и эквивалентов, относящихся к данной отрасли. Их сейчас насчитывается около 200.

V Вспомогательные двуязычные словари.

Например: «Словарь английских и американских сокращений». Нужно помнить, что часто сокращение похоже на обычное слово, ед. pet (от petrol), bob (от bobbin) и др., если искать их в словаре (обычном), то эквиваленты не будут совпадать по контексту pet – любимец (бензин), bob – маятник (шпуля, катушка, бобина).

VI Одноязычные специальные словари.

Это специальные словари, в статьях которых описываются различные устройства, объясняются специальные термины, даются сведения о различных производственных процессах, способах обработки и т.д. многие статьи, иллюстрированные чертежами, рисунками и т.д.

VII Специальные энциклопедии.

Построены также, как и общие энциклопедии, но отличаются от них только содержанием, е.д. медицинская, химическая и т.д.

VIII Справочники.

Справочники предназначены для специалистов различных отраслей техники и промышленности и промышленности и содержат различные сведения, технико-экономические показатели, цифровые данные и т.д.

Найти соответствующий справочник при переводе материала из малознакомой области – значит получить самое необходимое для успешной работы. В них же иногда даются списки специальной литературы по отдельным вопросам.

IX Специальная литература.

К ней переводчик обращается тогда, когда энциклопедия не содержит достаточной информации по интересующему его вопросу, когда нет соответствующего справочника. Её можно достать в технической библиотеке.

X Другие источники информации (опыт).

1.3 Порядок пользования источниками информации

Порядок пользования источниками информации обычно совпадает с порядком, в котором они классифицируются.

Как только переводчик встречает незнакомое слово в тексте, он прежде всего должен обратиться к общему двуязычному словарю.

Здесь возможны следующие случаи:

1 Словарь даёт эквивалент, подходящий по смыслу контекста → Он сразу используется в переводе.

2 Словарь дает эквивалент, значение которого непонятно переводчику. → Обращаемся к толковому словарю языка, на который делается перевод.

Например: двуязычный словарь для слова *nave* даёт эквивалент *«ступица»*. А что это такое? «Толковый словарь русского языка» даёт трактовку: *«Ступица – это центральная часть колеса, с отверстием для оси…»* Если этот смысл подходит – его можно использовать.

3 Двуязычный словарь даёт непонятный эквивалент. Толковый словарь не имеет такого слова. Можно предположить, что такое слово иностранного происхождения. → Ищем его в «Словаре иностранных слов».

Например: copyholder – *«тенакль» (подставка для рукописи, используемая наборщиком)*.

4 Двуязычный словарь даёт непонятный эквивалент, его нет ни в толковом словаре, ни в «Словаре иностранных слов» → см. любой энциклопедический словарь.

5 Если нет нигде из вышеперечисленных → смотрим в алфавитном указателе в БСЭ и найти соответствующие статьи в энциклопедии.

6 Общий двуязычный словарь даёт непонятный эквивалент с пометкой «тех.» → см. «Политехнический словарь», а если и там нет – к политехнической энциклопедии.

7 Двуязычный словарь даёт непонятный эквивалент с пометкой, относящей его к определённой отрасли науки и техники («хим.», «астр») → нужно начать с «Политехнического словаря», но, если и здесь его нет, смотрите соответствующую отраслевую энциклопедию.

8 Если то, что было описано в пп. 6 и 7 не подходит, то следует смотреть в отраслевых энциклопедиях списки специальной литературы.

9 Эквивалент с отраслевой пометкой (как в п.7) можно попытаться отыскать в справочнике по данной отрасли.

10 Если в случаях, разобранных в пп. 6, 7 и 9, эквивалент не объясняется ни в энциклопедиях, ни в справочниках, то нужно обратиться к специальной литературе, начиная поиск с предметного каталога.

11 Если специальная литература в соответствии с пп. 8 и 10 отсутствует, или пользование ею затруднительно, необходимо обратиться за помощью к специалисту, подробно объяснив ему общее содержание текста.

12 Искомое слово отсутствует в общем двуязычном словаре. Следует предположить, что это спец. термин → см. в двуязычной политехническом словаре или в соответствующем отраслевом словаре.

13 Искомое слово отсутствует как в общем, так и в политехническом двуязычных словарях. Если отрасль неизвестна, придётся смотреть все отраслевые словари, но прежде следует проверить, не является ли слово сокращённым, т.е. обратиться к «Словарю английских и американских сокращений»

14 Если искомое слово отсутствует во всех источниках, упомянутых в пп. 12 и 13, можно отыскать его в одноязычном словаре языка оригинала, в словаре синонимов и антонимов этого языка, в энциклопедических словарях и энциклопедиях языка оригинала.

15 Если искомым является не одно слово, а целое сочетание, легко выделенное из контекста, то поиск нужно начинать с «Фразеологического словаря».

16 Если слово нигде не найдено, но смысл его ясен из контекста, переводчик имеет право после консультации со специалистом предложить новый термин.

Здесь можно пользоваться тремя путями:

I Введение нового термина

Этот путь имеет две ветви:

А) Изобретение термина

Например: для scanning → “развёртка” (радио электрон)

Push-pull → «двухтактный» (радио)

Fading → «замирание» (радио) и т.д.

Б) Калькирование, т.е. конструирование нового термина в соответствии с формой и составными частями оригинала например: lawn-mower – «газонокосилка» (от lawn – газон и mow – косить); sky-scraper – «небоскрёб» (от sky – небо и scrape – скрести).

II Описание

Этим путём термин scanning может быть описан как «облегание экрана лучом», термин fading как «ослабление сигнала на входе в результат интерференции».

Repeater – промежуточный усилитель

Titromatic analyzer – автоматическая установка для периодического титрования

Piggyback – перевозка автофургонов на ж/д платформе.

III Транскрипция или транслитерация

Уже знакомый нам термин scanning может быть представлен в соответствии с этим путём как «сканирование», fading как «федингˮ, ppiggyback как “пигибак”.

Bulldozer – бульдозер

Air lift – эрлифт.

Транскрипция отличается от транслитерации тем, что первая передаёт звуки оригинального слова, а транслитерация – буквы, но практически разница между ними невелика.

Следует иметь в виду, что III путь, хотя и самый лёгкий, далеко не лучший, т.к. построенные по нему термины несут мало информации, часто требуют дополнительного объяснения, вызывают путаницу и засоряют язык.

Бывают случаи, когда переводчик может пользоваться вне разобранной системы, это те случаи, когда переводчику нужен только один вполне определённый источник информации. Вот эти случаи:

1 Переводчика интересует грамматическая форма какого-либо слова языка, на который делается перевод. Например нужно узнать, как будет множественное число от слова «дно». Ответ можно найти в орфографическом словаре: дно – донья.

2 Нужно перевести какие-либо неметрические меры в метрические.

Например: ˚F → ˚C. Сразу же обращаемся к двуязычному политехническому словарю.

3 Переводчик встретил слово, которое явно является сокращением → обращаемся к словарю или списку сокращений.

4 Переводчик встречает слово в латинском написании,

Например: ex ad verso → см. в списках иностранных слов или словаре иностранных слов.

1.4 Особенности профессионально ориентированного технического перевода

Технический перевод характеризуется рядом специфических особенностей, отличающих его от художественного и научно-публицистического. Это лексические и структурно-грамматические

особенности. Лексические особенности технического перевода заключаются в употреблении специальной терминологии, состоящей в свою очередь, из общеспециальных терминов, узкоспециальных терминов и профессиональных жаргонизмов.

Знание специальной терминологии сопряжено с принципом профессиональной направленности материала. К структурно-грамматическим особенностям профессионально ориентированного перевода следует отнести:

– преобладание в текстах оригинала видовременных форм пассивного залога по сравнению с другими жанрами, сочетающими употребление активного и пассивного залогов;

– наличие беспредложных номинативных групп;

– употребление простых синтаксических конструкций;

– изложение материала в изъявительном наклонении;

– преобладание эпистемической модальности изложения содержания;

– использование цифрового, графического и изобразительного материалов;

– употребление видовременных форм описательного характера; для английского языка это формы Past Simple, Present Progressive, Past Progressive.

В целях достижения адекватного перевода необходимо осуществить синтаксический анализ переводимого предложения, средством которого является грамматический анализ, то есть умение выделять главные и второстепенные члены предложения, опираясь на присущие им формальные признаки.

Грамматический анализ иностранного текста и грамматический анализ текста на родном языке – понятия разноуровневые. В то время, как смысл текста на родном языке раскрывается в процессе чтения, смысловое содержание иноязычного текста заключается в совокупности формальных

признаков, присущих языковым единицам данного языка. Формальные признаки это:

- порядок слов в предложении;
- наличие либо отсутствие флексий;
- служебные и строевые слова.

Грамматический анализ, сводимый к определению формальных признаков, является средством развития логически осмысленного чтения и, следовательно, понимания и перевода текста.

Логика грамматического анализа подразумевает некую последовательность действий, первоначальным из которых является деление предложений на смысловые группы. На практике смысловые группы оформляются фразовым ударением и формальными признаками, в виде артиклей, предлогов, указательных местоимений, средств пунктуации.

Деление иноязычного текста на смысловые группы позволяет установить синтаксические связи между словами и принадлежность слов к определенной части речи. Перевод английского предложения целесообразно начинать с определения именных смысловых групп, которые начинаются со служебных слов, а также разного рода местоимений, количественных числительных. Окончание именной смысловой группы маркировано:

- служебными словами;
- сказуемыми, выраженными личной формой глагола;
- -ing и –ed причастиями;
- инфинитивом, инфинитивной группой.

Именная смысловая группа может быть маркирована также существительным во множественном числе, оформленным окончанием –s (-es).

Выделение сказуемого является вторым важным этапом переводческой деятельности. Сказуемое в предложение выражено личными формами глагола в соответствующих видовременных отношениях активного и пассивного залогов. Наиболее оптимальным следует считать способ

выделения сказуемого по наличию прямого дополнения. В английской традиции сказуемое стоит перед прямым дополнением. Формы выражения прямого дополнения могут быть самыми разнообразными: от существительных и местоимений до неличных форм глагола.

Второй способ нахождения сказуемого по подлежащему релевантен только в тех случаях, когда последнее выражено личным местоимением. Подобные случаи весьма редки в техническом тексте и, следовательно, не могут быть характерными языковыми образцами.

В некоторых случаях английское сказуемое оформлено наречием, стоящим в препозиции. Как правило, эти наречия выражают неопределенное время: often, never, sometimes.

В технических текстах довольно употребительно повелительное наклонение, следовательно, нахождение сказуемого, выраженного глаголом в повелительном наклонении, является релевантным переводческим приемом в этих случаях.

Одной из особенностей научно-технического текста является широкое употребление пассивного залога. Надо заметить, что в английском языке пассивная конструкция употребляется гораздо чаще, чем в русском. Вместо форм страдательного залога в русском часто употребляется неопределенно-личная форма в действительном залоге, т.е. форма, лишенная подлежащего.

Как правило, английская пассивная форма переводится прямым эквивалентом пассивной формы в русском языке. В случае невозможности перевода английского пассивного оборота прямым русским соответствием целесообразно употреблять только неопределенно-личные предложения.

Грамматический анализ предложения подразумевает также определение подлежащего по его формальным признакам. Обнаружение подлежащего является опосредованной процедурой после нахождения сказуемого. Традиционно, подлежащее занимает место перед сказуемым. Следует помнить, что, как правило, подлежащее выражено беспредложной именной группой. Таким образом, наличие последней и есть формальный

признак подлежащего. Кроме того, подлежащее может быть выражено личным местоимением в именительном падеже, что, однако, не свойственно стилю научной прозы и техническим текстам в целом.

Наличие препозитивных определений, выраженных существительными, является особенностью научной и технической литературы в английском языке. В русском языке подобные определения отсутствуют, поэтому их перевод с английского языка представляет собой определенную трудность. Формальным признаком таких определений является их расположение между артиклем и определяемым существительным. Главным словом в именной группе является последнее слово – ядро, а стоящее перед ним является определениями к нему. Осмысление содержания всей группы и, далее, перевод следует осуществлять с последнего слова в группе.

Например:

quick rising pipe-heater

3 2 1

Быстро нагревающаяся трубка.

Особенностью английского языка также является неличная форма – герундий, отсутствующая в русском языке. Перевод герундия и герундиальных оборотов, в связи с этим, представляет некоторые затруднения.

Основные рекомендации по переводу герундия на русский язык:

- инфинитивом;
- отглагольным существительным;
- деепричастием;
- придаточным предложением.

Сочетания герундия с притяжательным местоимением или существительным в притяжательном падеже представляют собой эквиваленты придаточных предложений и переводятся придаточными предложениями.

1.5 Виды технического перевода. Полный письменный перевод

Полный письменный перевод - основная форма технического перевода.

Современный переводчик, за редким исключением, переводит и устно, и письменно. Однако устный перевод требует разной расстановки акцентов. Если в устном переводе на первом месте – скорость и линейность речи, то в письменном переводе скорость требуется редко (срочный перевод), а линейность не играет роли: письменная речь не спонтанна, поэтому не однонаправлена, сбивчивую фразу можно исправить. Зато требования эквивалентности в письменном переводе значительно выше, а ошибки в содержании не допустимы вовсе.

В техническом переводе ППП является основной формой т.к.:

1 Вся практически используемая научно-техническая информация (патент, инструкция) обрабатывается в форме ППП.

2 Все остальные виды технического перевода являются производными формами полного ПП, его сокращёнными вариантами.

Работа над ППП состоит из последовательных этапов, которые составляют правила ППП.

Нарушение последовательности этих этапов или совмещение их во времени ведёт к непроизводительной затрате труда переводчика и к снижению качества перевода.

Правила полного письменного перевода

1 Ознакомиться с оригиналом, просмотрев его. Если в результате ознакомления переводчик решит, что текст не может представлять интереса для заказчика, то он должен немедленно изложить ему свои соображения.

2 Если таких соображений не возникает, то нужно прочитать весь текст, пользуясь по мере надобности рабочими источниками информации. Работу со специальной литературой можно начать и до полного прочтения текста, если заранее известна тематика оригинала.

3 Сделать черновой перевод текста, последовательно работая над логически выделяемыми частями оригинала по следующей схеме:

а) выделить законченную по смыслу часть текста (предложение, абзац, период) и усвоить его содержание;

б) перевести выделенную часть текста, т.е. передать её содержание по-русски в письменной форме, не глядя в оригинал и постоянно следя за стилем, логикой изложения.

в) сверить переведённую часть текста с соответствующим местом оригинала, чтобы восполнить пропущенное.

4 Окончательно отредактировать перевод, прочитав его про себя для проверки качества и логики изложения и внести необходимые поправки.

5 Перевести заголовок.

Рассмотрим теперь этапы перевода более подробно.

Этап 1

Прежде, чем начать собственно перевод, необходимо (и может быть не один раз) прочитать весь текст. Почему?

Например: научная статья.

В начале статьи автор может сформулировать какую-либо проблему, которую надо решить → перечислить попытки решения этой проблемы → анализ причин неудач его предшественников в её решении → свой вариант решения и его обоснование.

Но, автор может усомниться в правильности его решения или прийти к выводу, что решение этой проблемы невозможно.

Этого не может знать переводчик, если он прежде всего не прочитал статью от начала до конца. Но если читатель, может иметь свою точку зрения на проблему, то переводчик такой свободы не имеет. Его долг – стать полностью на сторону автора.

Весь текст читаем и потому, что слова и отдельные предложения имеют определённый смысл только в контексте.

Этап 2

Выделяя часть текста для перевода, нужно иметь в виду, что величина этой части определяется тремя факторами: смысловой законченностью, сложностью содержания и возможностями памяти переводчика.

Такой частью может быть предложение, абзац и т.д., но она должна быть законченной по смыслу.

Чем сложнее текст, тем меньше должна быть часть, чем лучше память переводчика – тем больше.

Когда содержание части усвоено, его нужно выразить по-русски. Здесь следует полностью отвлечься от оригинала.

В противном случае возможны стилистические и смысловые ошибки, т.к. читать, думать и писать на двух языках невозможно. Законы разных языков противоречат друг другу (н-р. порядка слов или закон построения отрицания).

Например: *никто никогда ничего не узнает* (4 отрицания), *Nobody will ever be wise to it (1отрицание).*

Затем следует сверить перевод с оригиналом, чтобы не проверять ошибки, а заметки того, что он пропустил при переводе и восполнить пропущенное. Переводя последующие этапы нужно всё время помнить о содержании предыдущих частей и о форме изложения. Например: если в начале часть корпуса прибора была названа «дном», то так и должно быть далее. Если при повторном упоминании названия чего-либо, его можно сократить. Например: вместо предохранительный клапан, писать «клапан» (если в устройстве нет других клапанов).

Этап 3

Отредактировать перевод – обработать его в целом стилистически.

В техническом переводе под термином «стиль» понимают следующее:

1 Стиль как совокупность индивидуальных языковых особенностей оригинала, могущих повлиять на качество перевода.

2 Стиль как качество изложения (точность, краткость и простота выражения мысли).

Порой, если автор оригинала многословен, повторяется, неясно излагает свои мысли, злоупотребляет архаизмами, профессиональным жаргоном и т.д., переводчик должен сделать так, чтобы эти особенности языка автора не нашли отражения в переводе, т.е. он должен изложить всё более кратко, ясно и просто.

Следует также указать на принципы, которыми нужно руководствоваться при работе над качеством изложения.

1 Мысли следует выражать как можно короче.

2 Если слова иностранного происхождения можно без ущерба для смысла заменить русским словом, то это обязательно нужно сделать.

3 Все термины должны быть строго однозначны.

При выполнении всех требований редактирования технический перевод может получится по качеству изложения лучше оригинала.

Этап 4

Заголовок в специальной литературе должен выражать самую суть содержания статьи, книги и т.д., а потому от него не требуется особого благозвучия. По правилам технического перевода заголовок «Тихий Дон» должен был выглядеть так: «Эпизоды истории гражданской войны на Дону, показанные на примере судьбы казака Григория в художественной форме».

Заголовок должен переводится в последнюю очередь, т.к. из них составляются библиографические указатели, карточки каталоги и т.д. таким образом он должен нести вполне определённое содержание.

1.6 Реферативный перевод и аннотация

Прежде чем говорить об особенностях и правилах реферативного перевода (РП), необходимо ещё раз напомнить, что основным видом ТП

является ППП. Все остальные виды ТП есть его производные, его сокращённые варианты.

Эти виды перевода используются в процессе обмена научно-технической информацией для обработки материалов, которые не подлежат немедленному практическому использованию, но имеют определённую практическую ценность для информирования специалистов, работающих в сфере науки и техники, работников патентной службы, решающих правовые вопросы, а также для целей накапливания и систематизации поступающей из-за рубежа научно-технической информации.

Одним из таких сокращённых вариантов ППП является реферативный перевод.

Его название происходит от слова «реферат».

Реферат – это краткое изложение сущности какого-либо вопроса. Однако, способы краткого изложения сущности вопроса может быть разными.

В области ТП определились три формы составления реферата, которым соответствуют 3 самостоятельных вида ТП:

1 Реферативный перевод.

2 Перевод типа «экспресс-информация».

3 Сигнальный перевод главных пунктов формулы изобретения (в переводе патентных рефератов).

РП – это полный ПП заранее отработанных частей оригинала, составляющих связанный текст.

Как правило, РП должен быть значительно короче оригинала (раз в 5-10 и более), т.к. в процессе работы на РП требуется вывод (выброс всей избыточной информации, количество которой, прежде всего, зависит от характера оригинала).

Под характером оригинала понимают важность и доступность излагаемого материала, а также манеру изложения, ед. многословность, лаконичность, склонность к повторениям и экскурсам и смежные области.

Работа над РП состоит из следующих этапов:

1 Предварительное знакомство с оригиналом, просматривание специальной литературы для ознакомления с данной областью и её терминологией, внимательное чтение всего текста.

2 Разметка текста с помощью квадратных скобок, для исключения его второстепенных частей и повторений (исключаемые части текста берутся в скобки).

3 Чтение оставленных мест и устранение возможных диспропорций и несвязанности.

4 ППП части оригинала, оставшейся за скобками, которая должна представлять собой связанный текст, построенный по тому же логическому плану, что и оригинал.

Примечание: если в оригинале имеются чертежи, рисунки и другой иллюстративный материал, то переводчик отбирает наиболее важные и подробно объясняемые в тексте своего перевода, где должна быть помещена та или иная копия иллюстрации, например, с помощью прямоугольника, в котором обозначена страница и номер рисунка.

Оформление перевода иллюстративного материала научных статей (таблиц, графиков, схем, рисунков).

Таблицы в переводе должны иметь тот же вид, что и в оригинале. Если в оригинале элементы информации отделены друг от друга линиями, то и в переводе должно быть тоже самое. Чертит всё сам переводчик.

Содержание таблицы переводят полностью, даже если в них приводятся только цифровые данные.

Обычно вместе с оригинальным текстом переводчик получает и ксерокопии графиков, схем и рисунков, содержащихся в статье.

В этом случае аккуратно вырезанная из ксерокопии иллюстрация наклеивается на лист перевода, и все, что в оригинале было напечатано по-английски, переводчик впечатывает/или вписывается чёрным цветом по-русски, именно там, где эти надписи были размещены в оригинале.

Если же ксерокопии нет, то в оригинале около каждой отдельной надписи ставится арабская цифра от 1 и выше, а затем в тексте перевода сначала указывается № рисунка и его название, а затем – каждая арабская цифра и по-русски обозначаемое ею содержание.

Аннотационный перевод – это вид технического перевода, заключающийся в составлении аннотации оригинала на другом языке.

Аннотация статьи или книги – это краткая характеристика оригинала, излагающая его содержание в виде перечня основных вопросов и иногда еще и критическая оценка оригинала.

Итак, главное отличие аннотации от других видов перевода статьи или книги – это характеристика оригинала.

Работая над составлением аннотации, желательно придерживаться определенных требований:

1 Аннотация должна быть доступна для усвоения при первом же прочтении, но при этом отражать все наиболее важные моменты содержания оригинала.

2 Аннотация должна быть научно грамотной и не представлять собой субъективную оценку автора.

3 Язык аннотации должен быть лаконичным и точным, и в тоже время достаточно простым.

4 Употребление терминологии, сокращений, условных обозначений должно соответствовать нормам, действующим в конкретной области знаний.

5 Аннотация должна раскрывать, а не повторять, иными словами, содержание оригинала, ее объем зависит от аннотируемого материала.

6 Стиль аннотации отличается большой свободой и определяется только целью – дать краткую характеристику оригиналу.

1.7 Перевод технической документации и патентов

При переводе научно-технической литературы важное место занимает перевод технической документации. Сюда относятся:

– техническая документация (формуляры, паспорта, технические описания, инструкции по эксплуатации и ремонту и др.);

– товаросопроводительная документация (накладные, упаковочные листы, талоны комплектации и др.);

– проектная документация (чертежи, расчеты и др.);

– рекламные материалы.

Все эти материалы, как правило, характеризуются предельной лаконичностью, краткостью, отсутствием развернутых объяснений. Часто приходится иметь дело с переводом специальной терминологии, употребляемой вне всякого контекста или в ограниченном контексте (спецификации, список запасных частей и деталей, чертежи и т.д.). При выполнении такого рода перевода необходимо:

1) соблюдать принцип унификации терминологии, т.е. не допускать разнобоя терминологии;

2) обращать особое внимание на правильное и аккуратное оформление перевода;

3) избегать описательного перевода;

4) использовать только стандартные, принятые в данной отрасли обозначения;

5) выдерживать единый стиль, характерный для данного типа документов;

6) правильно и точно использовать стандартные сокращения;

7) использовать типичные и устойчивые выражения и обороты, относящиеся к этим документам.

Как уже отмечалось ранее, технический перевод — это перевод с целью обмена научно-технической информацией, основной формой которого являются патенты. Перевод патентов может выполняться в виде полного письменного перевода или аннотационного перевода. Правила полного письменного перевода, рассмотренные выше, в полной мере относятся и к переводу патентов. Однако перевод патентов имеет свои особенности, свой стиль. В области технического перевода словом «патент» обозначают то, что подлежит переводу. Патент как официальное свидетельство не переводится и существует в единственном экземпляре, а описание изобретения копируется и рассылается. Патент состоит из:

– титульной части и заголовка;

– предварительного описания, где обозначена цель изобретения, краткая формулировка существа изобретения;

– полного описания;

– патентной формулы;

– иллюстративной части.

Титульная часть содержит данные, необходимые для регистрации, хранения и отыскания патента, номер патента, название страны, выдавшей патент, дату подачи заявки и дату выдачи патента, классификационные индексы (условные цифровые и буквенные обозначения разделов систем классификации изобретений в Международной классификации изобретений и национальной классификации изобретений); указывается число пунктов патентной формулы, фамилия автора изобретения, а также фамилия владельца патента и его адрес.

Заголовок патента переводится после перевода самого патента, а перевод выполняется в соответствии с определенными требованиями. Заголовок используется для составления систематических каталогов патентов и информации о новых изобретениях. Этот перевод должен выражать в форме назывного предложения суть изобретения и, если возможно, то отражать то новое, что отличает данное изобретение от уже известных.

Поэтому перевод заголовка должен быть предельно насыщен информацией, необходимой для специалиста.

Дополнительно к тому, что уже говорилось об особенностях перевода заголовков патента, следует отметить стиль. Следует придерживаться следующих рекомендаций:

– не следует употреблять слова «новый, улучшенный, усовершенствованный», т.к. изобретение уже совершенно новое;

– нельзя повторять предлоги и союзы (например, шарнир для кардана для заднеприводных автомобилей);

– не следует быть многословным;

– не рекомендуется употреблять сокращения, имена собственные.

Предварительное описание представляет собой вводный абзац, где может излагаться анализ состояния техники в данной области, предпосылки к созданию изобретения.

2 Практикум технического перевода

2.1 Модуль 1

Лексико-грамматические темы:

1 Перевод словосочетаний, образованных по наиболее распространенным моделям.

2 Перевод терминологических сочетаний.

3 Слова общего корня в английском и в русском языках.

4 Past Indefinite и Participle II нестандартных глаголов.

Термины

highway *зд.* - дорога

elapse - проходить, протекать

the state of the arts - современный уровень (состояние) развития науки или техники

ccomplement - дополнять

vehicle - (авто) транспортное средство; летательный аппарат

patrol - охранять

assess - определять, оценивать

mapping - картографирование

competitive - соперничающий, конкурирующий

short haul air route - авиалиния малой протяженности

vertical takeoff and landing aircraft -самолет вертикального взлета и посадки

profitable - выгодный, доходный

scheduled services - полеты по расписанию, регулярные рейсы

aeronautical technology - авиационная техника

power plant - силовая установка

wind load - аэродинамическая или ветровая нагрузка

aero elasticity- аэроупругость

short takeoff and landing aircraft - самолет короткого взлета и посадки (с коротким разбегом и пробегом)

structural analysis – расчет конструкции

Aviation-highway to the future

1 During those years which have elapsed since A. Ph. Mozhaisky built his first aero plane in 1885, aviation has enjoyed phenomenal progress. At present the state of the arts of aviation is such that it influences many aspects of social life.

2 In the dynamic world of today, aviation provides a rapid transportation link between different population centers, complementing a road and rail transportation network.

3 In many places the airplane is the only known vehicle for the large-scale movement of passengers and freight over large distances. The airplane has made it possible to patrol the forests effectively, to fight their fires, to assess their timber resources and to plan their harvesting.

4 It has made an enormous "contribution to the photographing and mapping of the vast territories, to exploring and prospecting for mineral wealth, and to studying and assessing water resources.

5 As for the helicopter, this type of aircraft has proved its value in special applications where vertical or near vertical take-off landing and vertical load - lifting were required.

6 Russia airlines have grown to be one of the foremost in the world. Russia has pioneered in many of the technical advances which have brought aviation to its present state of efficiency.

7 The growth in the popularity of air travel is due to the comfort and services provided by the modern aircraft, to the high speed of reaching the point of destination and to the moderate cost of air travelling.

8 The growth in the number of passengers carried by the world's airlines has been tripling every 10 years. It has been predicted that in the fifties there will be 2 to 3 times as many passenger-miles flown and 2to 3 times as many people using air transportation as there are today. As measured by the number of aircraft and pilots employed, civil aviation is expected at least to double. This expansion of civil aviation will reflect an immense growth in the worldwide business travelling, cargo transportation and tourism.

9 Civil airplanes will be continually improving from the point of view of their speed, comfort and operating cost, but their capital costs will not increase proportionally. Airline fares will tend to decrease, but better service will be given to passengers.

10It has also been predicted that in the fifties it should be possible to design a supersonic transport that could be economically competitive with subsonic transports.

11Short takeoff and landing aircraft will dominate the short-haul air routes up to 1500 miles. But it is unlikely that vertical takeoff and landing aircraft will be economically profitable for scheduled flights.

12In the foreseeable future aeronautical technology will be increasingly employed in non-aeronautical applications. Obvious examples are high-speed trains, marine and industrial power plants.

13Less well known perhaps is the new field of architectural aerodynamics as exploited in the study of the influence of wind flow, in combination with rain, in the design of windows for tall buildings and the forecasting of wind loads on roofs of large buildings.

14 The techniques of aircraft structural analysis and aero elasticity are finding increasing industrial applications, a typical case being of a bridge design.

15 There are no doubts about the continuing importance of aviation and the dynamic nature of its development in succeeding years.

16 Civil aviation will continue to flourish in the year ahead contributing to the economic growth, scientific and technical development, and forming a sound basis for international relationships between countries.

Упражнения

1.1 *Переведите словосочетания «существительное + существительное». Обратите внимание на последовательность расположения слов в английских и в русских словосочетаниях*.

1 2 1 2

Образец 1: test flight *испытательный полет*

sound barrier, depth bomb, smoke bomb, altitude engine, carburetor engine, piston engine, altitude flight, trial flight, aviation fuel, aviation medicine, sea mine.

1 2 2 1

Образец 2: wing thickness *толщина крыла*

airplane aerodynamics, helicopter aerodynamics, propeller aerodynamics, aileron area, flap area, rudder area, wing area, airplane body, airship body, bomb body, bank indicator, course indicator, direction indicator, range indicator, speed indicator, yaw indicator, fin spar, tail plane spar, wing spar.

1 2 2 1

Образец 3: cloud flying *полет* в *облаках*

ski landing, water landing, crosswind takeoff, instrument takeoff, water takeoff, compression test, creep test, fatigue test, flutter test, reliability test, simulator test, tower test, water test.

1.2 *Переведите словосочетания «существительное + существительное + существительное». Обратите внимание на последовательность расположения слов в английских и в русских словосочетаниях*.

1 2 3 3 2 1

Образец 1: flight control system *система управления полетом*

engine speed indicator, missile range measurement, shaft rotation speed, aircraft control system, aircraft escape system, target identification system, antenna rotation switch

1 2 3 3 2 1

Образец 2: sea-level temperature *температура* на *уровне моря*

sea-level ejection, sea-level pressure, missile-movement information, target position information, parachute-test missile, sea-level velocity, moon exploration vehicle, motor test vehicle

1.3 *Переведите словосочетания «прилагательное (причастие) + существительное + существительное». Обратите внимание на последовательность расположения слов в английских и в русских словосочетаниях*.

1 2 3 1 3 2

Образец 1: total wing' area *общая площадь крыла*

critical escape altitude, effective wing area, gross wing area, automatic flight control, automatic temperature control, automatic fighter direction, automatic bomb release, effective aircraft thrust, effective propeller thrust

1 2 3 3 1 2

Образец 2: boundary layer control управление *пограничным* слоем

ballistic flight control, guided missile control, spatial attitude control, vertical speed indicator, boundary layer measurement, magnetic field measurement, variable pitch propeller, aerial defence[1] system, automatic stabilization system, interplanetary communications system, interplanetary navigation theory, supersonic wing theory, free flight trajectory, maximum range trajectory, free fall velocity, free flight velocity

1 2 3 3 1 2

Образец 3: straight wing aircraft *самолет* с *прямым крылом*

annular wing aircraft, crescent wing aircraft, fixed-wing aircraft, folding-wing aircraft, open cockpit aircraft, reciprocating-engine aircraft, rotary wing aircraft, tilting-wing aircraft, constant-level flight, extreme-altitude flight, high-temperature flight, low-altitude flight, high-acceleration missile, moving-wing missile, free-flight test, high-speed test, low-pressure test, low-speed test

1.4 *Переведите словосочетания со следующими терминами из текста: aviation, pilot, speed, transport*.

army aviation, commercial aviation, naval aviation, military aviation, civil aviation, fighter aviation, passenger aviation, reconnaissance aviation, ambulance aviation, sport aviation, strategic aviation, tactical aviation, transport aviation, training aviation;

acceptance pilot, airline pilot, assistant pilot, automatic pilot, chief pilot, civilian pilot, commercial pilot, first pilot, helicopter pilot, instructor-pilot, jet pilot, second pilot, senior pilot, skilled pilot, test pilot;

actual speed, air speed, climb speed, combat speed, cruising speed, diving speed, flight speed, flying speed, gliding speed, ground speed, high speed, hypersonic speed, landing speed, level-flight speed, low speed, Mach-2 speed, near-sonic speed, slow speed, sonic speed, subsonic speed, supersonic speed, transonic speed, ultra-high speed;

air transport, cargo transport, commercial transport, freight transport, jet transport, military transport, passenger/cargo transport.

1.5 *Прочтите и запомните: по значению различают три группы слов, имеющих общие корни в английском и в русском языках*:

1 Слова общего корня, значение которых полностью совпадает в английском и в русском языках. Например:

aerodrome ['earadroum] *аэродром*

aero plane ['earaplen] *аэроплан*

antenna [aen'tena] *антенна*

biplane ['baiplen] *биплан*

diameter [dai'emita] *диаметр*

2 Слова общего корня, значение которых лишь частично сов? падает в английском и в русском языках. Например, слово pilot в зависимости от контекста переводят не только пилот, летчик, но и лоцман, опытный проводник, механик-водитель, высококвалифицированный машинист; вспомогательный механизм, система управления, регулирующее приспособление. К этой группе относятся, например, следующие наиболее употребительные слова (их значения следует уточнять в отраслевых терминологических словарях):

activity

apparatus

booster

capsule

compass

conductor

construction

control

course

element

figure

instrument

machine

object

operation

record

section

service

structure

tank

3 Слова общего корня, значения которых совершенно не совпадают в английском и в русском языках. Это так называемые «ложные друзья переводчика». Запомните наиболее употребительные из них:

Слова, имеющие общий корень в английском и русском языках	Правильный перевод	Ошибочный перевод
accuracy	точность	аккуратность
accurate	точный	аккуратный
brilliant	блестящий, сверкающий	бриллиант
contribution	вклад в дело, содействие	контрибуция
data	данные, величины, сведения	дата
decade	десятилетие	декада
fabric	фабрикат, изделие	фабрика
graph	график, диаграмма	графа
instance	пример, требование	инстанция
list	список, перечень	лист
manufacture	изготовление, производство	мануфактура
principal	главный, основной	принципиальный
production	производство, выработка	продукция
prospect	перспектива, изыскание, разведка	проспект

1.6 *Образуйте Past Indefinite и Participle II от следующих нестандартных глаголов.*

cost, cut, hit, let, put, set, shut, spread;

bend, bind, bring, build, burn, buy, dream, feed, feel, fight, find, get, have, hear, hold, keep, lead, learn, leave, lose, make, mean, meet, read, say, sell, send, shoot, sit, spend, spoil, stand, strike, swing, teach, tell, think, understand, win;

beat, blow, break, do, draw, drive, eat, fall, fly, forget, freeze, give, go, grow, hide, know, lie, ride, rise, see, speak, take, tear, throw, wear, write;

run, come, become, begin.

1.7 *Ответьте на вопросы к тексту*

1. When did A. Ph. Mozhaisky build his first aero plane? 2. What is the state of the arts of aviation at present? 3. What does aviation provide in the dynamic world of today? 4. In what way is the airplane used as a vehicle? 5. What can you say about the USSR airlines? 6. How can you explain the growth in the popularity of air travel? 7. What has been predicted about the development of aviation in Russia? 8. Will it be possible to design a supersonic transport? 9. What are the obvious examples of using aeronautical technology in non-aeronautical applications? 10. What can you say about the development of aviation in the years ahead?

2.2 Модуль 2

Лексико-грамматические темы:

1 Перевод терминологических сочетаний

2 Слова общего корня в английском и русском языках.

3 Функции глаголов to be и to have.

Термины

air range - дальность полета;

airborne – бортовой;

airline – авиалиния;

airliner - рейсовый пассажирский самолет; воздушный лайнер;

approach - заход на посадку;

arrival airfield - аэродром посадки;

booster - ракетный ускоритель;

commercial operation - эксплуатация на гражданских авиалиниях;

coupling – сцепление;

cruise - совершать крейсерский полет;

cruising range - крейсерская дальность;

cruising speed - крейсерская скорость;

deicer – антиобледенитель;

departure - отправление; вылет;

domestic airline - внутренняя авиалиния;

failure - отказ; неисправность, авария;

grass air field - грунтовой аэродром;

gross weight - полетный вес;

hold – отсек, помещение;

landing run - пробег при посадке;

leg - стойка (шасси);

load factor - коэффициент загрузки;

low pressure undercarriage - шасси с пневматиками низкого давления;

medium haul aircraft - самолет со средней дальностью полета;

operate – эксплуатировать, работать;

package – отсек;

pod nacelle - гондола на пилоне;

pressurize – герметизировать;

reliability – надежность;

seek – наводить;

short haul - местная авиалиния;

shut-down - выключение *(двигателя);*

slat – предкрылок;

tail assembly - хвостовое оперение;

take-off run – разбег;

turboprop engine - турбовинтовой двигатель;

thrust reversal system - система реверсирования тяги;

ultimate range - максимальная дальность;

thrust-weight ratio – тяг вооружённость;

unpaved field - грунтовой аэродром;

turboprop aircraft - самолет с турбовинтовым двигателем;

wind tunnel - аэродинамическая труба;

working section - рабочая часть.

Russian passenger aircraft

1 Russia was one of the leading aviation powers of the world. The aircraft industry and aviation were developing exceptionally fast. The total length of Aeroflot's civil airlines exceeded 600,000 kilometers and was longer than the air routes of any other country in the world.

2 Modern passenger liners fly over seas and the highest mountains, over the torrid tropics and the frozen Arctic. Each year air communications are becoming more reliable, more economical and more comfortable for passengers.

3 Below is given the description of some Russian passenger aircraft designed by famous designers O. Antonov, G. Beriyev, S. Ilyushin, A. Tupolev and A. Yakovlev.

Antonov Aircraft

4 The group of aircraft constructors headed by Oleg Antonov is known far beyond the Russia for the wide range of machines designed and built by it - from the record-breaking An-15 glider and the baby An-14 plane to the giant An-22 air transport, the world's biggest turbo-prop aircraft, which broke 15 world records during a single flight late in 1967 and lifted more than 100 tons of cargo to a height of 7,800 meters.

5 The An-24V short and medium haul aircraft has excellent take-off and landing qualities, great air worthiness, and high reliability. Its basic (economy) version carries 50 passengers with the baggage, plus 5.5 tons of freight. The cabin of the basic model can be readily converted either into a deluxe passenger aircraft

or into a pure cargo plane. The An-24V's take-off permits it to be used on grass airfields with a ground hardness of six kilograms per square centimeter, or more.

6 The An-24V Mark II combines high cruising speed with good landing and take-off qualities and can be operated from grass airfields. Take-off can be continued even in case of failure or shut-down of one engine. Completely modern navigational and radio equipment, and an effective deicing system enable it to give round-the-clock service even in adverse meteorological conditions. When fitted with auxiliary fuel tanks the An-24V Mark Ц has a cruising range of 2,720 kilometers. On concrete runways its take-off run is under 600 meters.

7 The rear hold of the planes measures 1.4 meters by 2.85 meters, and the front hold 1.1 meters by 1.2 meters.

Beriyev Aircraft

8 The Be-30 has been designed by the design bureau working under G. Beriyev. It is iterated, for carrying passengers, luggage and mail on the local airlines Such features as adequate thrust-weight ratio, low pressure "undercarriage adapted for soft surface airfields, and high-lift with low unit load make the Be-30 suitable for operation from unpaved fields with a runway of 550-600 m.

9 The Be-30 is designed to carry 15 passengers. It can easily be re-equipped into a freight version or ambulance.

10 The plane is powered by two turbo-prop engines developing 950 hp each. They can be started either from the airborne or a ground electric starting system. The fuel system of the plane is simple in design and reliable in operation. The four wing tank compartments hold 1,000 kg of fuel giving the plane a non-stop range of 1,300 km. The aircraft is equipped with a rigid dual-control system. It also has an effective deicer.

11 Such features as low take-off and landing speeds and the ability confidently to proceed with the take-off and horizontal flight even in the event of failure of one engine make for high reliability and safety. Modern flight and navigational equipment, radar and radio apparatus have made the plane an all-weather round-the-clock machine. The equipment makes possible automatic

approach for landing when the cloud height is only 50 m from the ground and the visibility 500 m.

The Be-30 cruises confidently at 480 km/hr.

Ilyushin Aircraft

12 The constructors of Sergei Ilyushin's bureau have built many first-class planes. The Il-12, Il-14, and I1-18 ranked among the best passenger planes of the period.

13 In 1968 the Il-62 went into commercial operation, carrying 186 passengers, plus mail and freight, non-stop over 9,200 kilometers at a cruising speed of 900 kilometers per hour.

14 The great economy of this giant, aerodynamically perfect aircraft, ensures a high load factor (payload and fuel make up 57 per cent of its speed gross weight) and relatively low fuel consumption, with high speed and long range. The plane is easy to service, and the roomy baggage holds (48 cubic meters) make it possible to take an extra cargo when there are few passengers. The flying life of the Il-62 is between 25,000 and 30,000 hours.

15 The Il-76 jet transport appeared over Moscow on March-25, 1971, for the first time.

16 It is powered by economical turbo-fan engines with the latest thrust reversal system and is equipped with high-lift wings. The Il-76 is characterized by low take-off and landing speeds. The undercarriage is a-multi-wheel device to ensure higher ground negotiability. When the "legs" are in the down position the compartments in which they are housed in the air are completely closed. The. take-off and landing runs are short. This jet transport can be operated both from concrete runways of limited length and from unpaved airfields.

17 The take-off weight is 150 tons, flight altitude 13,000 m and cruising speed 850-900 km/hr.

18 The flight and navigational equipment, radar and radio apparatus enable the plane to fly on different routes at any time of the year and round the clock. The

airborne computer makes it possible to perform automatic flight along the route and automatic approach for landing.

19 The cabin is suited for carrying various freight in containers. Special means of mechanization help cut down the ground time of the plane at the airport. The large freight cabin of the Il-76 is pressurized.

Упражнения

2.1 *Переведите словосочетания со следующими терминами из текста: aircraft, airline, airliner, altitude, airfield, landing, range, take-off.*

ambulance aircraft, amphibian aircraft, bomber aircraft, cargo aircraft, civil aircraft, combat aircraft, enemy aircraft, friendly aircraft, general-purpose aircraft, heavier-than-air aircraft, high-altitude aircraft, high-speed aircraft, hypersonic aircraft, lighter-than-air aircraft, long-range aircraft, low-speed aircraft, medium-range aircraft, military aircraft, multi-purpose aircraft, passenger/cargo aircraft, research aircraft, short-haul aircraft, short-range aircraft, subsonic aircraft, transoceanic aircraft;

cargo airline, domestic airline, internal airline, international airline;

helicopter airliner, long-haul airliner, long-range airliner, passenger airliner, short-haul airliner, supersonic airliner;

ceiling altitude, cruising altitude, flight altitude, maximum altitude, medium altitude, minimum altitude, operational altitude, safe altitude, sea-level altitude;

arrival airfield, departure airfield, factory airfield, grass airfield, ice airfield, landing airfield, natural ground airfield;

all-weather landing, automatic landing, good landing, night landing, safe landing, ski landing, water landing;

air range, aircraft range, cruising range, flight range, flying range, gliding range, non-stop range, operational range, ultimate range;

blind take-off, instrument take-off, subsonic take-off, vertical take-off, water take-off.

2.2 *Назовите русские слова, имеющие общий корень со следующими английскими словами*.

comet, carburetor, catapult, classification, combination, compass, component, compressor, configuration, correction, section;

cylinder, center, circulation, deficit, glycerin, incident, medicine, officer, official, process, specialist;

generator, apogee, gas, gravitation, navigation, original, perigee, regulator;

fuselage, budget, dirigible, drainage, engineer, longeron, ogival, regime, tonnage;

mechanism, character, chord, chronograph, epoch, mechanic, scheme, techniques;

parachute, chassis, chauffeur, echelon , machine;

thermometer, author, cathode, isotherm, mathematics, method, theorem, theory, zenith;

phase, diaphragm, graphic, philosophy, phonograph, phosphor, photography, physics, sphere;

equivalent, equator, quadrant, quantitative, quartz;

maximum, approximation, axiom, complex, experiment, export, reflex.

2.3 *Переведите предложения, обращая внимание на перевод глагола to be в различных функциях*.

a) 1. Engines of modern airplanes are in the wing. In case of thin wing sections engines are in pod nacelles beneath the wing. 2. The geometrically similar, model of the aircraft is in the centre of the wind-tunnel working section. 3. The landing gear is under the fuselage.

b) 1. Mach number is the ratio of air speed to the local velocity of sound. 2. Fatigue is not a new problem. In fact, it is a very old problem. 3. The main parts of a vehicle structure are tanks, engine, guidance and payload compartments. 4. The external source of heat is solar radiation. 5. The principal

characteristics of the atmosphere are its density, temperature composition, and time variations. 6. The most interesting feature of Saturn is the presence of the rings. 7. The first principal objective of space flights is the scientific exploration of space, the planets, and, later, the stars. 8. Decelerations are oppositely acting accelerations.

c) 1. Air is compressible. 2. The density of Mercury is high. 3. Conditions for life on Mars are not very favorable. 4. Above 30,000 feet oxygen equipment for men is essential. 5. Jupiter is the largest of all planets. 6. Shielding of spaceships is necessary, but the weight penalty is costly.

d) 1. The first task in the study of a rotor is to find the airflow surrounding it. 2. The aim of this paper is to illustrate the significance of the heating problem. 3. The plan of the chapter is to present first a brief discussion of noise factor. 4. The next problem is to maintain adequate cabin pressure. 5. The next step in the design sequence is to estimate the major characteristics of the vehicles. 6. The purpose of the landing gear is to support the airplane on the ground and provide take-off and landing. 7. The purpose of the tail assembly is to stabilize the airplane.

e) 1. The airplane is to reach the point of destination in two hours. 2. This new helicopter is to carry eight passengers. 3. These scientists were to take part in the conference on vertical take-off and landing problems. 4. More experimental results are to be obtained to reach definite conclusions. 5. Hydrogen is to be used in several advanced propulsion systems. 6. The flight is to be made from Moscow to Leningrad. 7. The resistance of the atmosphere is certainly not to be neglected.

f) 1. Air currents are constantly moving with respect to the Earth. 2. The large missile-type booster was firing a piloted rocket-plane into space. 3. Final launch preparations are conducted at the launch pad area. 4. The pilot in flight is aided by a computer and the ground radar. 5. The surface of Venus is perpetually shrouded by dense white clouds.

2.4 *Переведите предложения, обращая внимание на перевод глагола to have в различных функциях*.

a) 1. Mars has two very small satellites. 2. The Moon has a completely airless environment. 3. Mercury has no satellite, so far as it is known. 4. The test pilot must have a strong heart, good lungs, eyesight and hearing much above average and quick reflexes. 5. Unlike the Earth, the Moon has no atmosphere.

b) 1. The aircraft mechanic has to make vibration measurements more carefully. 2. On landing the undercarriage wheels have to take very large loads. 3. Two kinds of antennas have to be designed specifically for space communications applications. 4. The unknown velocity functions have to be determined from the following conditions. 5. Designers and scientists have had to solve many of the problems of flight in space. 6. Before flight the airborne equipment has to be thoroughly checked.

c) 1. The reporter has already referred to the substantial variation in the density of the atmosphere. 2. Many experiments have been carried out to control the temperature distributions. 3. Attempts have been made to explain solar-flare increases. 4. Turbojet engines have been built in many sizes, ranging from a few hundred pounds of thrust to many thousands of pounds.

2.5 *Найдите в тексте модуля (абзацы 11-14) нестандартные глаголы. Назовите три формы этих глаголов и их значение*.

2.6 *Найдите в тексте модуля (абзацы 5, 10 и 15) глаголы to be и to have. Определите их функцию в предложении и переведите на русский язык.*

2.7 *Ответьте на вопросы к тексту*.

1. What turbo-prop aircraft is the biggest in the world? 2. What cruising range has the An-24 Mark II aircraft? 3. How many passengers can the Be-30 aircraft carry? 4. At what speed does the Be-30 cruise? 5. When did the Il-62 go into commercial operation? 6. What is the cruising speed of the Il-62? 7. When did the Il-76 appear over Moscow for the first time? 8. From what runways can the Il-

76 be operated? 9. What is the take-off weight of the Il-76? 10. What is the flight altitude of the Il-76? 11. What is the cruising speed of the Il-16?

2.3 Модуль 3

Лексико-грамматические темы урока:

1 Перевод терминологических сочетаний.

2 Слова общего корня в английском и в русском языках.

3 Функции глаголов to be и to have (повторение)

Термины

advisory route - заданный маршрут

airframe - планер

attachment - крепление

power unit - силовая установка

design - конструкция; предназначать

scheduled route - маршрут регулярных

digital computer - цифровая вычислительная машина полетов

ferry route - перегоночный маршрут

flight deck - кабина экипажа

gangway - проход (между рядами кресел)

specific fuel consumption - удельный расход топлива

start up – запускать

structural design - расчет на прочность

guide rail - рельсовая направляющая

tail unit - хвостовое оперение

intake - воздухозаборник

tail plane - хвостовое оперение

long distance flight - полет на большую дальность

multi-purpose aircraft - многоцелевой самолет

terminal airdrome - конечный аэродром

thrust reverser - реверс тяги

turbo-fan engine - турбовентиляторный двигатель

nozzle - сопло

performance characteristics - летные данные

piston-engined - aircraft самолет с поршневым двигателем

Russian passenger aircraft

(continued)

Tupolev Aircraft

1 The magnificent planes built by the designers working under Andrei Tupolev have long been world-famous. Back in the twenties and thirties his planes performed several spectacular long-distance flights, including the first non-stop flight from Moscow to the USA - across the North Pole. In 1956 the world's first jet liner, the Tu-104, was introduced into service in the USSR. From it have been developed the Tu-124, Tu-134, and Tu-154 civil airliners.

2 The Tu-134, designed for hauls between 600 and 3,200 kilometers, is powered by two outboard turbo-fan engines, each with a thrust of 6,800 kilograms. This power, combined with the powerful mechanization of the "clean" wing, and the advanced aerodynamic design, give the plane excellent take-off and landing characteristics. Its maximum fuel load is 13,500 kilograms, its maximum take-off run 2,100 meters.

3 The positioning of the engines in the tail unit of the fuselage and the well-thought-out attachment have reduced the level of noise and vibration in the passenger cabin (seating 72 passengers) below the accepted international standards.

4 The Tu-154 is a multi-purpose jet aircraft designed for routes from 500 to 5,500 kilometers and is available in an economy version (seating 158 to 164

passengers), tourist-class version (seating 146 to 152 passengers), and a combined first-class and tourist version (providing 24 first-class seats and 104 tourist-class places).

5 The aircraft is powered by three rear-mounted engines, two located at the base of the tail and one in the fin. Each develops a thrust of 9,500 kilograms. Specific fuel consumption at cruising speed at an altitude of 10,000 meters is 0.79 kilograms per kilogram of thrust per hour. Its normal take-off weight is 80 tons.

6 This airliner can fly on two engines without losing altitude and can continue flight at altitudes under 5,000 meters on only one engine. The airframe has great structural strength, all main systems are duplicated, and some are triplicated.

7 The finish of the passenger saloons meets all the demands of modern industrial design. The ventilation, pressurization, and heating systems provide a pleasant microclimate, while the high cruising speed of 1,000 kph and the rear positioning of the engines practically eliminate noise and vibration on the passenger deck.

8 To enable the aircraft to operate from underequipped airdromes, -the Tu-154 has been fitted with an auxiliary power unit to start the engines and provide air-conditioning to the cabins while grounded, and for checking systems without starting up the main engines; also, with a fuel tank filling system, and a semi-automatic system for loading and unloading containers of baggage.

9 The transport version of the Tu-154 can carry 30 tons of cargo over 1,700 kilometers. It has a freight door on the port side measuring 2,100 millimeters by 3,400 millimeters. Guide rails for loading containers or separate items of freight up to 4 tons weight, are provided on the reinforced floor of the hold.

10 The flight-control, navigational, radio, and electronic equipment of the Tu-155 ensure automatic control of flight in any weather conditions and automatic approach for landing. The crew of the aircraft consists of three men. Provision is made on the flight deck, however, for a navigator and an additional pilot.

11 The supersonic, intercontinental Tu-144 airliner has ushered in the era of supersonic passenger flight. The airliner has no tail plane since its variable-geometry swept-back wing gives it good stability and control at both subsonic and supersonic speeds. Its cruising range of 6,500 kilometers enables the plane to cover the distance between Moscow and Khabarovsk in three hours.

12 The Tu-144 has two passenger saloons, one accommodating 18 first-class passengers, and the other 80 tourist-class passengers. The first-class cabin, however, can be converted without difficulty to accommodate 40 tourist-class passengers. For summer flights of under two hours' duration it is possible to re-seat the plane for 130 to 135 passengers.

13 The crew for the supersonic Tu-144 includes two pilots and a flight engineer. The nose section of the fuselage can be depressed for better visibility during take-off and landing, and the location of the equipment section immediately behind the flight deck facilitates access to assemblies during flight and for preflight servicing.

14 The plane is powered by four separately controlled turbojets whose air intakes are automatically adjusted to flight conditions and whose nozzles are also adjustable. Each engine is fitted with a thrust reverser. All these features ensure very economical operation and full flight safety. A semi-automatic system for loading baggage is fitted, which greatly reduces turnaround time. Operationally tested high-strength aluminum alloys and titanium are used in the aircraft's construction.

Yakovlev Aircraft

15 The Yak-40 has been designed by the design bureau working under Alexander Yakovlev. It is designed to replace the obsolescent fleet of piston-engined aircraft. It is equipped with reliable engines, collapsible passenger gangways and all-weather round-the-clock navigation equipment.

16 Characteristics: overall length - 20 m, wing span - 25 m, wing area - 70 sq. m, maximum range - 1,650 km, cruising speed – 550-600 km/hr, flying altitude - 4,000-6,000 m, payload - 2,500 kg, seats (main version) - 24, seats (tourist

version) - 31, take-off and landing run - 340-360 m, power plant-3 engines, each developing a thrust of 1,500 kg.

17 17. It is a fact that operating aircraft from unpaved airfields is characterized by certain specificities. These have been considered in the design. The Yak-40 engines are arranged at a sufficient height from the ground. The air intakes are so arranged that the wing protects the engines from pebbles and mud thrown up from the ground by the undercarriage wheels. The pressure in the tires does not exceed 4 kg per sq. cm. This makes it possible for the aircraft to take off from runways whose hardness is about 5 kg per sq. cm.

Упражнения

3.1 *Переведите словосочетания со следующими терминами из текста: airdrome, characteristics, design, equipment, load, route*.

Civil airdrome, helicopter airdrome, landing airdrome, main airdrome, marine airdrome, reserve airdrome, sea airdrome, terminal airdrome, underground airdrome, water airdrome;

aerodynamic characteristics, air characteristics, aircraft characteristics, flight characteristics, flying characteristics, landing characteristics, maneuvering characteristics, military characteristics, performance characteristics, take-off characteristics;

aerodynamic design, clean aerodynamic design, poor aerodynamic design, structural design, wing section design;

aeronautical equipment, aircraft equipment, airfield equipment, airport equipment, aviation equipment, emergency equipment, navigation equipment, training equipment;

aerodynamic load, air load, cargo load, commercial load, flight load, fuel load, full load, passenger load, pay load, useful load;

advisory route, air route, domestic route, ferry route, intercontinental route, passenger route, scheduled route.

3.2 *Назовите русские слова, имеющие общий корень со следующими английскими словами*.

parameter, center, cylinder, filter, manometer;

propeller, adapter, booster , container, emitter;

accumulator, collector, commutator, compressor, detector, generator, indicator, modulator, regulator;

classification, approximation, communication, gravitation, ioni-sation, navigation, operation, orientation , vibration;

correlation, accumulation, calculation, circulation, modulation;

transmission, commission, discussion, emission, precession;

corrosion, collision, diffusion, division , erosion;

aeronautics, acoustics, astronautics, dynamics, electronics, technics, statics;

astronomy, artillery, chemistry, geometry, philosophy, energy, laboratory, theory, trajectory;

aluminium, calcium, cadmium , plutonium, radium, strontium, vanadium;

profile, automobile, console, dipole, module.

3.3 *Переведите предложения, обращая внимание на перевод глаголов to be и to have в различных функциях.*

1. Compared with Jupiter, Saturn is somewhat smaller and less dense. It rotates more slowly, and its axis of rotation is much more inclined to its orbit. Its distance from the Sun is twice that of Jupiter. 2. The digital computer is the most powerful ally of our thinking available at present. 3. Titanium has a melting point of 3074°F. 4. Laser using very powerful and narrow beams of light is a promising means of communication. 5. The purpose of the wing is to support the aircraft in the air. 6. At present, one of the two planned launch pads are under construction, and design of the other is nearing completion. 7. The modern airplane has evolved from a primitive structure of wood, wire, fabric and dope to a very complex structure. 8. In the latest three-engined airplanes two engines are mounted on each

side of the aft fuselage and one engine is inside the extreme rear of the fuselage. 9. In the past wood has been widely used in aircraft construction. 10. The cause of the boundary layer is the friction between the surface of the wing and the air. 11. The control of all international and world records is through the medium of the International Astronautical Federation. 12. Instruments necessary for space experiments have to have high sensitivity.13. The Earth is wider at the equator than it is at the poles.

3.4 *Найдите в тексте модуля (абзацы 6-10) нестандартные глаголы. Назовите три формы этих глаголов и их значение*.

3.5 *Найдите в тексте модуля (абзацы 11 и 12) глаголы to be и to have. Определите их функцию в предложении и переведите на русский язык*.

3.6 *Ответьте на вопросы к тексту*.

1. When was the Tu-104 introduced into the service? 2. What versions is the Tu-154 available in? 3. What engines is the Tu-154 powered by? 4. What is the normal take-off weight of the Tu-154? 4. What airliner has ushered in the era of supersonic passenger flight? 5. What is the cruising range of the Tu-154 airliner?

2.4 Модуль 4

Лексико-грамматические темы:

1 Перевод терминологических сочетаний.

2 Слова общего корня в английском и в русском языках.

3 Времена группы Indefinite, Continuous, Perfect и Perfect Continuous действительного залога.

Термины

accommodate - размещать

payload - полезная нагрузка

coaxial rotors - соосные несущие винты

piston engine - поршневой двигатель

cut out - выключать *(двигатель)*

strut - стойка; подкос

free-turbine engine - двигатель со свободной турбиной

suspension platform - подвесная платформа

hinged seat - откидное сиденье

tail rotor - хвостовой винт

life-support system - система жизнеобеспечения

touchdown - приземление; касание

Russian helicopters

Kamov Helicopters

1 Long experience in Russia with helicopters with coaxial rotors has proved their main advantages - great maneuverability, small size, high payload, and great effectiveness. The coaxial system has also enabled the designers to dispense with a tail rotor (which usually consumes about 10 per cent of the power developed by the engine).

2 These qualities are particularly in evidence in the Ka-26 multipurpose helicopter developed by Nikolai Kamov's group of designers.

3 For passenger and freight carriage a comfortable cabin can be fitted with heat and sound insulation and a heating and ventilation system. In this version the helicopter seats six passengers with their baggage, while a seventh passenger can be accommodated beside the pilot. The deck of the cabin is fitted with a hatch through which passengers can be embarked or landed by the machine's hoist without touchdown.

4 The Ka-26 is adapted for crop spraying by replacing the cabin with a 900-litre plastic-glass tank for liquid insecticides and weed-killers, with a maximum rate of spray of ten liters per second. For bulky loads up to 900 kilogram's, the helicopter can be fitted with a suspension platform; and as a "flying crane" for construction jobs, and to carry tubes, containers, and other large-sized loads up to 900 kilograms for short distances, it is fitted with a cargo sling and hook.

5 The Ka-26 is powered by two reliable and economical air-cooled, 9-cylinder piston engines, each rated at 325 hp. Average fuel consumption at cruising speed is between 210 and 230 grammas per horsepower per hour. In the event of failure of one engine, the helicopter can continue horizontal flight; if both engines cut out it descends and lands safely by autorotation. With two auxiliary fuel tanks the machine has a range of 1,200 kilometers.

6 The crew of the helicopter normally consists of the pilot only, but provision can be made for dual controls, if required. The radio and navigational equipment fitted permits the Ka-26 to be used round-the-clock in any kind of weather. The latest reliable and durable materials are extensively used in its construction, the rotor blades, for example are made of glass plastic.

Mil Helicopters

7 The team of constructors led by Mikhail Mil is well known around the world for their helicopters.

8 The V-8 helicopter is built in two versions - all-passenger, and combination passenger/freighter. The first accommodates 28 to 32 passengers in soft, comfortable seats. Large rectangular windows, giving a good view, an efficient system of air conditioning, ventilation and heating, a low level of vibration, and excellent sound insulation provide comfortable, non-fatiguing flight. The passenger/freighter version has a hold of 23 cubic meters for four tons of cargo and is fitted with 24 hinged seats along the sides.

9 A special hatch and on-board steps are provided at the stern end of the cabin. Large-dimension loads can be carried by means of a special sling. Both

versions of the V-8 can be quickly converted for medical use carrying 12 stretchers, with a seat for a medical attendant.

10 The navigational equipment installed, auto-pilot, and deicing system enable a crew of two to operate the helicopter day or night and in any kind of weather. Its designed cruising speed is 250 kph with a take-off weight of 11.1 tons, and 220 kph with a weight of 12 tons. Its cruising range at 11.1 tons (with 2.6 tons of payload) is 455 kilometers, and at 12 tons (with 3.45 tons of payload) 440 kilometers.

11 The Mil team has also developed a family of heavy helicopters - the Mi-6, V-10, and V-10K.

12 The Mi-6 - the biggest and most powerful helicopter in the world - holds fourteen world records and has been called the "king" of helicopters in the Western press. It can be used for all types of operation. In its transport version it has a cargo hold of 80 cubic meters, big enough to accommodate an omnibus or outsize freight measuring 11.5x2.3x2.6 m and weighing up to 12 tons.

13 In addition, it is fitted with external suspension equipment and can carry 8-ton spans, bridges, or other bulky loads. Hinged seats along the sides of the hold provide accommodation for 65 passengers where required. It can also be quickly converted for ambulance service, with accommodation for 41 stretchers.

14 The Mi-6 is powered by two 11,000 hp turbo shaft free-turbine engines. The turbines allow the revolution speed of the main rotor to be altered independently of the operating speed of the engines.

Output at each speed remains unchanged up to an altitude of 3,000 meters even in high atmospheric temperatures. Its navigational equipment, improved radio apparatus, and automatic pilot ensure safe flying in adverse weather conditions, day or night.

15 The Mi-6 is served by a crew of five, develops a maximum speed of 300 kph and has a cruising speed of 250 kph. With a fuel load of 9,805 kilogram’s, it has a cruising range of 1,050 kilometers.

16 A successor, to the Mi-6 was developed in the V-10 in 1965. It has set two world records by lifting 25 tons of cargo to an altitude of 2,830 meters, and five tons to an altitude above 7,000 meters.

17 The V-10 helicopter has a four-strut undercarriage with a track of more than six meters and a ‘ground clearance of 3.75 meters. Outsize loads weighing to 15 tons can be lifted on a special platform (8.5 mx x3.5 m) attached beneath it by special hydraulic grips. In addition, it is fitted with special suspension gear for transporting loads up to eight tons.

The freight hold has a capacity of 60 cubic meters and is fitted with 28 hinged seats. The V-10 is operated by a crew of three. In field conditions its main engines are started by a turbo-generator.

18 The V-10K is a short-legged variant of the V-10. It can lift to 11 tons of cargo attached to a long steel cable. An additional cabin fitted under the fuselage enables the pilot to control the helicopter during erection work and to watch the behavior of suspended cargo.

19 A special automatic pilot maintains the machine in a definite position to prevent the cargo swinging and thus reduces erection time.

Упражнения

4.1 *Переведите словосочетания со следующими терминами из текста: blade, helicopter, hold, rotor, seat, tank, undercarriage*.

airscrew blade, all-metal blade, fixed blade, helicopter blade, main-rotor blade, propeller blade, rotor blade;

all-purpose helicopter, ambulance helicopter, amphibious helicopter, civil helicopter, commercial helicopter, compound helicopter, high-performance helicopter, hospital helicopter, jet helicopter, marine helicopter, multipurpose helicopter, one-man helicopter, production helicopter, research helicopter, single-seat helicopter, training helicopter, transport helicopter;

baggage hold, cargo hold, forward hold, freight hold, luggage hold, nose hold, rear hold;

coaxial rotors, folding rotor, front rotor, helicopter rotor, high-speed rotor, lifting rotor, main rotor, rear rotor, single-bladed rotor, three-bladed rotor, twin-bladed rotor;

belt seat, cabin seat, cockpit seat, ejection seat, forward-facing seat, rearward-facing seat, tip-up seat, triple seat, twin seat;

fuel tank, gas tank, gasoline tank, liquid tank, oil tank, oxidant tank, oxidizer tank, oxygen tank, petrol tank;

bicycle undercarriage, fixed undercarriage, hydro ski undercarriage, main undercarriage, nose undercarriage, retractable undercarriage, seaplane undercarriage, ski undercarriage, ski-wheel undercarriage, tail undercarriage, tricycle undercarriage, wheel undercarriage.

4.2 *Назовите русские слова, имеющие общий корень со следующими английскими словами*.

stabilize, centralize, localize, normalize, specialize, standardize;

modify, classify, electrify, gasify, identify, intensify, qualify

vibrate, demonstrate, evacuate, integrate, regulate, simulate, ventilate;

active, effective, extensive, negative, passive, primitive, positive;

experimental, continental, functional, global, local, orbital, radial, universal, visual;

electrical, cosmic, conical, mechanical, technical, theoretical, automatic, hydraulic, metallic, seismic.

4.3 *Переведите предложения, обращая внимание на перевод сказуемых, выраженных глаголами в различных временах группы Indefinite действительного залога*.

1. The term "moon" denotes, in general, a natural satellite of any planet. 2. The Moon shows only one face to the Earth. 3. Air flows over and under the wing

of an airplane. 4. The rocket engine does not take in any atmospheric air. 5. The decrease in air density results in a corresponding decrease of air pressure. 6. Galileo discovered the telescope in 1609.7. K. E. Tsiolkovsky, the father of Russian astronautics, gave solutions concerning the weightless state before the turn of the century. 8. On October 4, 1957, the Soviet Union put *Sputnik 1* into orbit. It weighed 184 pounds and travelled in an elliptical orbit. 9. Space flights to the Moon open the possibility of flight to near-by planets. 10. The manned orbital laboratory will weigh several hundred tons. It will rotate slowly to provide an artificial gravity field. It will provide a unique capability for a great number of experiments. 11. Satellite investigations will refine our understanding of the gravitational attraction of the Earth. 12. Interplanetary flights will be essentially the same as trips to the Moon. 13. In this section we will discuss jet propulsion systems. 14. Experts will watch a trial firing of a ballistic missile.

4.4 *Переведите предложения, обращая внимание на перевод сказуемых, выраженных глаголами в различных временах группы Continuous действительного залога*.

1. At present the design of the aircraft is nearing completion. 2. During rotation, two basic forces are acting upon the main rotor blades of the helicopter. 3. Titanium alloys are finding extensive applications as structural materials in aircraft. 4. Fatigue of materials is assuming more and more importance. 5. Scientists are trying to develop new means of communication. 6. Some stars are moving away from the Earth, and some towards the Earth. 7. Space flight is no dream of the distant future. It is happening already every day. 8. The equipment on board the space station is functioning normally. A special command and measuring complex is controlling the flight of the automatic station. 9. Many volunteers are subjecting their bodies to "g" forces in the cabins of centrifuges. These tests are giving information about man's reaction to "g" force. 10. Some scientists are working to improve pressure suits. Others are working to improve ejection

techniques. 11. Witnesses reported that the airplane was flying east and then turned and started to fly west. At that moment the plane was flying at a constant speed.

4.5 *Переведите предложения, обращая внимание на перевод сказуемых, выраженных глаголами в Present Perfect и Present Perfect Continuous действительного залога*.

a) 1. Wind tunnels have played an important part in the development of airplanes. 2. The main objective of every aircraft designer has always been - "more thrust - less drag" and "more lift - less weight". 3. This new experimental airplane has reached speeds more than 4,000 mph and altitudes above 125,000 ft. 4. The thin wall has become the most important structural element of advanced aircraft, missiles, and space vehicles. 5. Aerodynamic forces during the launch flight are of great concern and have been the cause of many launch failures. 6. Several hundred years of telescopic exploration of the universe have resulted in the cataloguing, naming, and numbering of thousands of the observable millions of stars. 7. The rapid advances in the field of astronautics have made possible the serious planning of space exploration. 8. Cosmic rays have played a tremendous role in nuclear physics since their discovery early in this century. 9. The computer has brought about the most profound revolution in our scientific processes since the appearance of the *homo sapiens.* 10. From the earliest clays of science fiction, manned space travel has been the goal of astronautics.

b) 1. Since the launching of the first man-made satellite, scientists all over the world have been discussing the vital question of re-entry. 2. During recent years the problem of re-usable space vehicles has been attracting much attention. 3. Over the past decade the laboratory has been developing different life-support systems.

4.6 *Найдите в тексте модуля (абзац 10) нестандартные глаголы. Назовите три формы этих глаголов и их значение.*

4.7 *Найдите в тексте модуля (абзацы 7-9) глаголы to be и to have. Определите их функцию в предложении и переведите на русский язык.*

4.8 *Ответьте на вопросы к тексту.*

1. What are the main advantages of helicopters with coaxial rotors? 2. By what engines is the Ka-26 helicopter powered? 3. What is the range of the Ka-26 with two auxiliary fuel tanks? 4. What materials are used in the Ka-26 construction? 5. In how many versions is the V-8 helicopter built? 6. What provides comfortable, non-fatiguing flight in the V-8 helicopter? 7. What are the main characteristics of the V-10 helicopter? 8. What helicopter is the biggest and most powerful in the world? 9. What ensures safe flying of the Mi-6 helicopter in adverse weather conditions? 10. What undercarriage has the V-10 helicopter?

2.5 Модуль 5

Лексико-грамматические темы:

1 Перевод терминологических сочетаний.

2 Слова общего корня в английском и в русском языках.

3 Сопоставление глагольного управления предлогами в английском и в русском языках (действительный залог).

4 Перфектный инфинитив в сочетании с модальными глаголами

Термины:

accessories - вспомогательные агрегаты

off cabin - кормовая кабина

airfoil - профиль крыла

aspect ratio - относительное удлинение

brace - расчалка

cantilever - консоль

component - агрегат

continuous aileron - неразрезной элерон

electric aileron - с электроприводом

elevator - руль высоты

empennage - хвостовое оперение

flight control - система управления самолетом

floatation gear - поплавковое шасси

framework - рама

in-flight trimming - балансировка в полете

control stick -ручка управления

cowling - капот

landing gear – шасси

dihedral - поперечное

lift - подъемная сила

diving rudder - руль высоты

lifting surface - несущая поверхность

drag - лобовое сопротивление

mount - установка

nacelle- мотогондола

rudder - руль направления

pitch - тангаж; выполнять движение тангажа

pontoon - поплавок

trailing edge - задняя кромка

power plant - двигатель; силовая установка

vorticity - завихренность

yaw rudder - руль направления

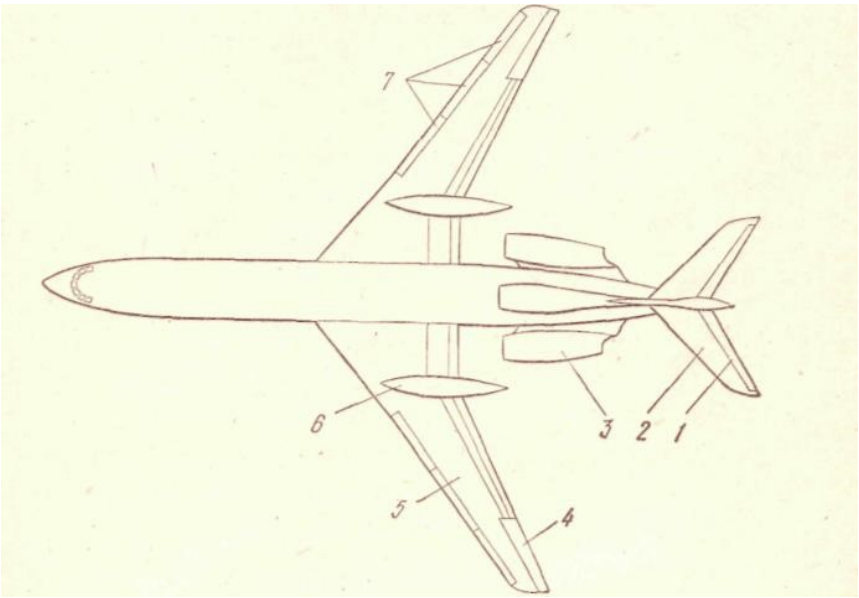
reposition - изменять положение

up-going aileron - отклоняющийся вверх элерон

Airplane components

1 The major components of airplanes can be divided into six main parts: fuselage, wings, empennage, flight controls, landing gear or floatation gear, and nacelles. (See Fig. 1.)

2 The fuselage is the main body of the airplane and contains the pilot's compartment (cockpit) and passenger and baggage compartments. The cockpit contains the flight controls and instruments. The larger part of the fuselage contains passenger seats or cargo space and usually some provision for baggage.



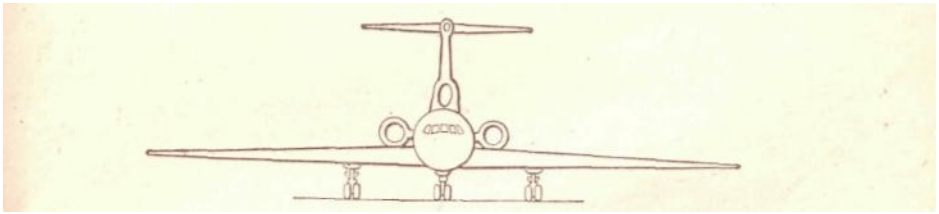


Figure I – Turbojet Airplane Components

1- elevator; 2- stabilizer; 3 - engine nacelle; 4 - aileron; 5 – wire; 6 - housing; 7 - leading edge flaps; 8 - fuselage; 9 - fin; 10 - rudder; 11 - main undercarriage wheels; 12 - nose wheels; 13 - crew's canopy

3 The wings are the main lifting surfaces which support the aircraft in flight, and they are attached to a strongly-built or stressed section of the fuselage.

4 The empennage, more commonly known as the tail section, consists of a vertical stabilizer and rudder and the horizontal stabilizer and elevators.

5 The three basic flight control surfaces are the ailerons, the elevators, and the rudder.

6 The ailerons are located at the trailing edge and near the tips of the wings. When one is raised, the other lowers, and the airplane banks or rolls. The lowered aileron increases lift causing the wing to rise, while the raised aileron reduces lift, causing that wing to drop. These modifications to the airfoil impose additional drag. The lowered aileron presents a relatively greater amount of drag than the raised aileron, resulting in a tendency to skid. To overcome this, a differential control mechanism causes the up-aileron to move a greater distance than the down-aileron for a given control movement.

7 The elevators are hinged to the horizontal stabilizer and control the airplane's movement up and down about the lateral axis. When the control stick is moved forward, the elevators lower, and the airplane dives, and vice versa. Because more force is necessary to climb than to descend, on most airplanes the maximum number of degrees the elevators can be raised is greater than the maximum number of degrees they can be lowered. Thus, the stick can be pulled back farther than it can be pushed forward. Where necessary, the pilot is aided in moving this control by a differential mechanism. Many newer aircraft possess a different method of controlling pitch. This method combines the horizontal stabilizer and the elevators into a single surface known as the controllable horizontal tail. This surface gives easier maneuvering of the aircraft at transonic speeds. The whole surface can be repositioned from the cockpit when in-flight trimming is necessary.

8 The rudder is hinged to the vertical stabilizer (fin), and it controls the movement of the airplane around the vertical axis. The right pedal moves the rudder and the aircraft to the right. The left pedal works similarly.

9 The main landing gear or wheels are attached by struts and braces to the fuselage and often to the wings outboard of the fuselage. Usually a smarter wheel supports either the nose or tail of the airplane.

10 Flotation gear for landing on water consists of pontoons or floats. Some airplanes are equipped with skis for landing on snow.

11 Nacelles are compartments housing the power plant or engine and its accessories. The nacelle is usually covered with a detachable cowling and contains a framework or engine mount which is attached to the fuselage or airframe.

Упражнения

5.1 *Переведите словосочетания со следующими терминами из текста: aileron, cabin, elevator, flap, fuselage, landing gear, nacelle, pod, rudder, stabilizer, wing:*

balanced aileron, continuous aileron, down-going aileron, drooped aileron, electric aileron, external aileron, fixed aileron, lowered aileron, moved-up aileron, outer aileron, powerful aileron, power-operated ailerons, simple aileron, slotted aileron, tapered aileron, unbalanced aileron, up-going aileron, wing-tip aileron;

aft cabin, air-conditioned cabin, airtight cabin, baggage cabin, cargo cabin, clear-view cabin, closed cabin, conditioned cabin, crew cabin, enclosed cabin, hermetic cabin, luggage cabin, open cabin, passenger cabin, pilot's cabin, pressure cabin, pressurized cabin, single-seat cabin, soundproofed cabin, two-seat cabin;

down-elevator, lowered elevator, outer elevator, up-elevator; brake flap, full-span flap, high-lift flap, landing flap, lowered flap, manually operated flap;

aft fuselage, center fuselage, drooping-nose fuselage, front fuselage, lift fuselage, monocoque fuselage, pressurized fuselage, rear fuselage, round fuselage, semimonocoque fuselage, sharp-nosed fuselage, soundproofed fuselage, supersonic fuselage, upper fuselage;

bicycle landing gear, extended landing gear, fixed landing gear, four-wheel landing gear, multiple-wheel landing gear, nonretractable landing gear, nose-wheel

landing gear, retractable landing gear, single-wheel landing gear, ski landing gear, tail-wheel landing gear, tricycle landing gear, wheeled landing gear;

cockpit nacelle, engine nacelle, inboard nacelle, inner nacelle, outboard nacelle, outer nacelle, pod nacelle, single-engine nacelle, two-engine nacelle;

cargo pod drop pod, engine pod, jet pod, nacelle pod, passenger pod, power pod, rocket pod, under fuselage pod, under wing pod, wing-mounted pod, wing-tip pod;

aerodynamic rudder, diving rudder, electric rudder, fixed rudder, neutralized rudder, yaw rudder;

adjustable stabilizer, horizontal stabilizer, mechanical stabilizer, movable stabilizer, vertical stabilizer;

arrow wing, cambered wing, cantilever wing, crescent wing, delta wing, dihedral wing, double-cambered wing, double-delta wing, high wing, high-aspect-ratio wing, high-lift wing, highly swept wing, high-speed wing, lifting wing, long wing, low wing, low-aspect-ratio wing, low-drag wing, low-lift wing, low-mounted wing, low-speed wing, main wing, minimum-drag wing, multispar wing, nonlifting wing, one-piece wing, port wing, sharp leading-edge wing, single-spar wing, starboard wing, straight wing, subsonic wing, supersonic wing, swept wing, sweptback wing, swept forward wing, tapered wing, transonic wing, upswept wing, untapered wing, zero-aspect-ratio wing, zero-span wing.

5.2 *Назовите русские слова, имеющие общий корень со следующими английскими словами*:

aviator, cosmos, instrument, material, meridian, meteor, moment, motor, proton, radiator, start;

problem, attack, bomb, cabin, chord, comet, mass, matrix, orbit, platform, rocket;

atmosphere, amplitude, capsule, figure, machine, minute, molecule, phase, structure, turbine, zone;

aeroplane, aerodrome, anode, biplane, cosmodrome, course, ellipse, gyroscope, meteorite, parachute, satellite.

5.3 *Переведите предложения, обращая внимание на перевод следующих глаголов в различных временах действительного залога.*

to affect *воздействовать на;* to approach *приближаться к;* to encounter *сталкиваться с, входить в;* to follow *следовать за;* to influence *влиять на;* to mention *упоминать о;* to orbit *вращаться вокруг;* to enter *входить в; выходить на;* to rely *полагаться на.*

1. Science affects our life today and tomorrow. 2. The rotation of the Earth affects the movement of the air. 3. Changes in air density affect the flight of an airplane. 4. Many factors affect the heating of a missile. 5. The airplane approached the runway and landed safely. 6. Under these conditions the Reynolds number approaches very large values. 7. When a spaceship encounters the atmosphere, the friction of the gas molecules against the surface of the ship generates heat. 8. The artificial satellite entered the Earth's atmosphere and burned. 9. At a preset time the artificial satellite entered the orbit around the Moon. 10. The reentry phase of the space vehicle flight follows a ballistic trajectory. 11. The fluid follows the contour of the tank very closely. 12. The selection of the propulsion engine influences the over-all characteristics of the vehicle. 13. On October 4, 1957, the event occurred that will greatly influence the future of all mankind. This event will affect us not only from a technical, scientific and military point of view, but also socially, politically and economically. 14. The previous reporter did not mention the following details of the inertial guidance system. 15. The Moon orbits the Earth about once a month. 16. As the spacecraft orbits the Earth, the centrifugal force balances the force of gravity. 17. Unmanned spacecraft rely completely on - automatic instrumentation to gather scientific data.

5.4 *Переведите предложения, обращая внимание на перевод перфектного инфинитива в сочетании с модальными глаголами*.

1. The aerodynamicists must have carried out the aerodynamic analysis of the aircraft. 2. Some of the largest meteorites, such as the Sikhote-Alin meteorites of 1947, must have had masses of 70 tons or more when they entered the Earth's atmosphere, and the meteorites that created some of the large craters, such as the one in Arizona, must have been even bigger. 3. The dark side of Mercury may have been one of the coldest places in the solar system. This situation must have produced some very interesting effects on the geology of the planet. 4. The pilot may have lost the control. 5. Viscous forces may have produced vorticity. 6. As you may have learned at school, the speed of sound in air varies with the temperature. 7. Most readers may have heard of the variety of ideas to produce artificial gravity.

5.5 *Найдите в тексте модуля (абзац 6) нестандартные глаголы. Назовите три формы этих глаголов и их значение*.

5.6. *Найдите в тексте модуля (абзацы 7-11) глагол to be. Определите его функцию в предложении и переведите на русский язык*.

5.7. *Ответьте на вопросы к тексту.*

1. What are the major components of an airplane? 2. What does the fuselage contain? 3. What are the wings attached to? 4. What does the empennage consist of? 5. Where are the ailerons located? 6. What do the elevators control? 7. What does the rudder control? 8. What supports the nose or tail of the airplane? 9. What are some airplanes equipped with for landing on snow? 10. What do nacelles house?

2.6 Модуль 6

Лексико-грамматические темы:

1 Перевод терминологических сочетаний.

2 Слова общего корня в английском и в русском языках.

3 Слова, образованные путем конверсии, чередования ударения, чередовании звуков.

4 Различные времена действительного залога *(повторение)*

Термины:

board - подниматься на борт

bogie - тележка шасси

brake - тормоз

check pilot - летчик-инспектор

fail - отказывать; выходить из строя

flap - закрылок

flight engineer - бортинженер

fore and aft axis - продольная ось

ingest - засасывать

jet efflux - реактивная струя

reaction control jet - струйный руль

roll - крен; движение крена

safety belt - привязной ремень

section - секция; отсек; сечение

shield - защищать

span - размах

spoiler - интерцептор

steady - установившийся

steer - поворачиваться

tip-up seat - откидное сиденье

tricycle - трехколесный

yaw - рыскание; движение рыскания

The TU-154 aircraft design

1 To illustrate the modern aircraft design the Tu-154 aircraft is used.

2 The Tu-154 is a short-haul aircraft equipped with three turbo-fan engines. They are situated at the tail, two outside and one inside the fuselage with the air intake above.

3 There are several advantages obtained from grouping the engines tightly round the fore and aft axis of the airframe. For example, if an engine fails, the roll and yaw moments are reduced to a minimum. Also, the wings are kept aerodynamically "clean" and the designer has simpler lift and drag problems, and the whole span of the wings can be used to take such wing-shape altering devices as flaps and slats.

4 There are also several advantages in having the engines right at the back of the airframe. The engines have less area of fuselage to damage with the force and temperature of the jet efflux. Because they are high off the ground and shielded by the wings from material thrown up by the wheels, the engines are less likely to have water and stones ingested. Finally, passengers in the cabin do not hear so much engine noise.

5 The wings are constructed on a framework of three main spars. The ailerons are normally effective at cruising speeds but are assisted by the outer spoilers at lower speeds. The middle spoilers are used as air brakes in flight, and the inner spoilers are used as air brakes both in flight and on landing.

6 The tail unit has the horizontal part on top of the vertical (the so-called "T" design) to give greater aerodynamic efficiency. The tail plane is movable and is deflected on take-off and landing. A single elevator is assisted by a slight adjustment of the tail plane can control the aircraft.

7 The undercarriage is tricycle and the twin nose wheels can steer 55° either side. The six-wheeled bogie main undercarriage was designed to give a good take-off run and good braking in wet and snowy conditions.

8 The flight deck can accommodate up to five crew. The normal crew includes two pilots and a flight engineer, but a navigator can be carried for routes that are poorly equipped with navigation aids. The fifth seat can be used for relief crew or for a check pilot.

9 There are tip-up seats with safety belts for the six members of the cabin crew. The passenger cabin is divided into two sections. The forward one can be used as a first-class cabin. It will take.54 tourist/economy seats and 24 first-class seats arranged in pairs either side of the aisle.

10 The rear section normally takes 104 economy-class seats mainly in threes either side of the aisle, so that an all economy-class configuration gives a total of 158 seats and a mixed-class configuration gives a total of 128 seats.

11 The pitch of the economy-class seats is normally 750 mm (29 1/2 in.). Despite such a small pitch between the rows of seats they are very comfortable. The back can tilt 26°.

12 Passengers board the aircraft through two doors. They are both on "the port side of the fuselage, forward of the wings. One door leads into the centre vestibule and the other into the forward vestibule. Each vestibule has coat hanging space.

13 There are three baggage compartments. Two are pressurized and are big enough to take containers so that loading time can be reduced. A third smaller compartment is unpressurized.

Упражнения

6.1 *Переведите словосочетания со следующими терминами из текста; compartment, configuration, drag, lift, pitch, roll, section, span, spar, yaw.*

baggage compartment, cargo compartment, crew compartment, flight compartment, luggage compartment, passenger compartment, pilot compartment;

airplane configuration, canard configuration, high-wing configuration, low-wing configuration, mid-wing configuration, tail-first configuration;

aerodynamic drag, air drag, airfoil drag, body drag, engine drag, fuselage drag, helicopter drag, tail drag, wing drag;

aerodynamic lift, aileron lift, air lift, airfoil lift, blade lift, body lift, horizontal tail lift, profile lift, section lift, tail lift, vertical tail lift, wing lift;

nose-down pitch, nose-up pitch, steady pitch;

aileron roll, steady roll, wing roll;

after section, body section, centre section, cockpit section, engine section, instrument section, nose section, power section, power-plant section, rear section, tail section, tank section;

airfoil span, tail plane span, total wing span, wing span;

aileron spar, auxiliary spar, box spar, centre spar, fin spar, front spar, leading-edge spar, main spar, rear spar, rudder spar, tail plane spar, trailing-edge spar, wing spar, wooden spar;

aerodynamic yaw, aileron yaw, negative yaw, positive yaw, steady yaw.

6.2 a) *Переведите без словаря следующие английские слова из текста, имеющие общий корень с русскими словами. temperature n, tourist n, typical a, vertical n, vestibule n.*

aerodynamic *a,* aerodynamically *adv,* aileron *n,* cabin *n,* center *u,* class *n,* comfortable *a,* configuration *n,* construct *v,* container *n,* effective *a,* engineer *n,* equivalent *a,* fuselage *n,* grouping *n,* horizontal *a,* illustrate *v,* material *n,* minimum *n,* moment *n,* navigation *n,* passenger *n,* pilot *n,* problem *n*

b) *Уточните значение нижеприведенных слов в словаре. В тексте урока их рекомендуется перевести следующим образом:*

Абзац 3: lift *n* подъемная сила.

Абзац 5: normally *adv* обычно.

Абзац 6: control *v* управлять; elevator *n* руль высоты.

Абзац 8: navigator *n* штурман; section *n* отсек; салон.

6.3 *Переведите следующие слова.*

a) существительными и глаголами:

Образец: model - модель; моделировать

control, fight, guide, house, land, launch, lift, load, machine; man, manufacture, mark, mount, name, record, result, rivet, screw, seat, ship, sound, space, start, support, taxi, track, travel, turn, twist, view;

b) прилагательными и глаголами:

Образец: slow - медленный; замедлять

clean, clear, complete, correct, double, dry, empty, narrow.

6.4 *Прочтите следующие слова, значение которых зависит от места ударения. Выучите эти слова наизусть*.

contract - соглашение

con’tract - сжимать, сокращать

decrease - уменьшение

de'crease - уменьшать

increase - увеличение

in'crease - увеличивать(ся)

detail - подробность

de'tail - подробно излагать

extract - извлечение, выдержка

ex'tract - извлекать

forecast - прогноз

fore'cast - предсказывать

import - ввоз

im'port - ввозить

object - предмет; цель

ob'ject - возражать

perfect - совершенный

per'fect - совершенствовать

produce - продукт

pro'duce - производить

progress - успех, развитие

pro’gress - продвигаться вперед, развиваться

project - проект

pro'ject - проектировать

protest - протест

pro'test - протестовать

record - запись; отчет; рекорд

re'cord - записывать

subject - тема; подверженный,

sub'ject - подвергать (воздействию), подчинять

transfer - передавать, переносить

transport - перевозка

trans port - перевозить

6.5 *Переведите следующие слова (прилагательное - существительное - глагол).*

deep- depth - deepen, wide - width - widen, broad - breadth, broaden, long - length - lengthen, strong - strength - strengthen, high - height - heighten, short - shortness - shorten, weak - weakness - weaken, dark - darkness = darken.

6.6 *Переведите предложения, обращая внимание на перевод сказуемых, выраженных глаголами в различных временах действительного залога).*

1. This book deals with the theory of the universe structure, 2. This book opens with a review of the propulsion problem. 3. This chapter has discussed some

of the many possible applications of the air cushion principle. 4. Many factors have affected the heating of an airplane. 5. Navigation in space required the determination of position and velocity relative to the desired path. 6. Man has succeeded in soft-landing on the Moon. 7. In future meteorological communi-cations, and navigational satellites will continue to play an important role. 8. This laboratory has been operational since May 1966. 9. Satellites are already helping map-makers to plot the Earth's shape more precisely. And they are helping to prepare the way for further manned flights by gathering information about outer space. 10. Equipment on board the interplanetary space station is functioning normally. 11. Aircraft engines have become more complicated. 12. Pilots and technicians can perform their duties better if they know the characteristics and limitations of an airplane.

6.7 *Ответьте на вопросы к тексту.*

1. How many engines has the Tu-154 aircraft? 2. Where are the engines of the Tu-154 aircraft situated? 3. What are the advantages obtained from grouping the engines tightly round the fore and aft axis of the airframe? 4. What are the advantages in having the engines right at the back of the airframe? 5. In what manner are the wings constructed? 6. When is the tail plane deflected? 7. Whom does the normal crew include? 8. Into how many sections is the passenger cabin divided? 9. In what way do passengers board the aircraft? 10. How many baggage compartments are there in the Tu-154 aircraft?

2.7 Модуль 7

Лексико-грамматические темы:

1 Перевод терминологических сочетаний.

2 Слова общего корня в английском и в русском языках.

3 Слова с префиксами отрицательного значения.

4 Слова с прочими префиксами.

5 Времена группы Indefinite страдательного залога.

6 Infinitive Indefinite Passive в сочетании с модальными глаголами.

Термины:

blade stall - срыв потока с лопасти

carrier-airplane - самолет-носитель

compound helicopter - комбинированный вертолет

copter - вертолет

craft - летательный аппарат

hover - зависать

production - производство

repeater satellite - ретрансляционный спутник связи

retractable - убирающийся

running landing - посадка с пробегом

stall - потеря скорости

tilting propeller - воздушный винт с изменяемым наклоном

tilt-prop - с поворотным несущим винтом

tilt-wing - с поворотным крылом

vehicle - летательный аппарат

vertical riser - аппарат вертикального взлета

water airplane – гидросамолет

VTOL aircraft

1 Vertical take-off and landing aircraft (VTOL) are all those machines including the helicopter, that can rise or descend vertically and to hover in midair. They include compound helicopter, tilt-prop and tilt-wing, jet VTOL, and a few other more exotic specimens as well. It is significant that almost all the VTOL are also capable of making a running take-off that requires only the shortest of

runways. In fact, when space is available the running take off is always preferred, since it is less of a strain on the aircraft and the engines and permits a greater payload. The VTOLs have the ability to land by descending vertically or by making a running landing with a very short forward roll. It should be noted that only the oldest of the VTOLs, the well-tried helicopter, has ever been in regular service, at least up to the date of this writing. Despite years of research and testing, the other aircraft are still in the trial stage.

2 Short take-off and landing (STOL) aircraft, on the other hand, are simply specialized fixed-wing airplanes, unrelated to helicopter or other vertical risers, designed with aerodynamic features that provide high lift and good control at very low airspeeds. The STOLs can take off and land at extreme angles and require only the shortest of runways; for some of the smaller machines as little as 200 or 300 feet may be enough. During take-off the STOL airplane requires only a short run to reach the low airspeed at which its wing will begin to lift. While landing, a STOL can fly so slowly, without stalling, that when it touches down it can be stopped easily after a short forward roll. The STOLs, as a class, are not to be considered as experimental aircraft; numbers of them are in production in various parts of the world. Nor is the concept especially new.

3 There are many advantages to the STOL airplane. It is less complicated and therefore less expensive than VTOL aircraft. The wings are fixed, and there are no rotors or tilting propellers - no pivoting or rotating system such as those needed for the vertical flight of the VTOLs. But it is seriously lacking in one critical area: it is incapable of vertical flight or hovering and must always keep moving in order to keep flying, however slowly. The larger STOLs, for example could be expected to require at least 60 miles per hour of airspeed during an approach. In addition, the STOL has to have a runway on which to land, and, perhaps more important, it must have an adequate amount of clear airspace in which to maneuver and line up on the runway.

4 Returning to the VTOLs, the true vertical-risers, we find that, despite their very great differences in outward appearance, we can reduce them to four primary

types: standard helicopter, compound helicopter, tilt-prop airplane, and jet VTOL. Each of the four will be discussed in turn, with an eye to method by which each achieves vertical flight and its individual advantages and disadvantages.

5 First in the line-up is the standard helicopter. With this aircraft, the rotor is the heart of the flight mechanism, actually serving two purposes: it provides the direct lift needed to make the machine rise vertically and to support the ship in flight, and at the same time, by "leaning forward" slightly, it propels the craft through the air. The helicopter is superior to other VTOLs in its ability to pull itself straight up or to hover in the air, it is primarily a direct-rising and hovering aircraft. This is because a helicopter rotor offers the lowest thrust-to-weight ratio for vertical take-off of all the various VTOL types; it can lift the most weight for the least amount of engine power. However, the copter has to pay for its superiority as a hovering machine; it is the slowest of all the VTOLs.

6 The fastest speed to be expected of a helicopter with a conventional rotor system - even the most powerful of the turbine-powered machines - is rarely over 200 miles per hour. The problem is that when the high-speed limit of the helicopter is reached, a phenomenon termed "blade stall" occurs. This creates so much extra drag that a great deal of extra power is required, excessive vibration may be experienced, and there will be a troublesome - if not dangerous - loss in control as well. This is not to say that ultimately new rotor systems may not be developed to the point where this limitation can be overcome; considerable research has been underway in this area. Another point to be considered is that if some form of direct thrust is provided - such as added jet engines mounted on the fuselage - the aircraft may then be forced to higher speeds despite the limitations of blade stall.

(to be continued)

Упражнения

7.1 *Переведите словосочетания со следующими терминами из текста: airplane, maneuver, propeller, ratio, thrust.*

attack airplane, carrier airplane, delta-winged airplane, general-purpose airplane, high-aspect-ratio wing airplane, high-flying airplane, high-wing airplane, jet airplane, low-aspect-ratio wing airplane, prototype airplane, research airplane, rocket airplane, STOL airplane, straight-wing airplane, swept-wing airplane, tailless airplane, tar-get airplane, tilt-prop airplane, tilt-wing airplane, training airplane, vertical take-off and landing airplane, VTOL airplane, water airplane; aerial maneuver, air maneuver, down maneuver, flight maneuver, pitching maneuver, rolling maneuver, up maneuver, yawing maneuver;

aerodynamic propeller, aircraft propeller, all-metal propeller, multiblade propeller, single-blade propeller, variable-pitch propeller;

aspect ratio, cargo-passenger ratio, compression ratio, density ratio, drag-lift ratio, drag-weight ratio, fineness ratio, high-aspect ratio, lift-drag ratio, low-aspect ratio, thrust-to-weight ratio, weight-to-thrust ratio, wing thickness ratio;

air thrust, airscrew thrust, available thrust, backward thrust, cruise thrust, effective thrust, engine thrust, flight thrust, forward thrust, propeller thrust, propulsive thrust, resultant thrust, reverse thrust, rocket thrust, rotor thrust.

7.2 *a) Переведите без словаря следующие английские слова из текста, имеющие общий корень с русскими словами*.

aerodynamic *a,* class *n,* critical *a,* experimental *a,* fixed *p.p.,* fuselage *n,* individual *a,* maneuver *n,* mechanism *n,* method *n,* mile *n,* regular *a,* sort *n,* special *a,* standard *n,* system *n,* turbine *n,* vertical *a,* vibration *n;*

b) *Уточните значение нижеприведенных слов в словаре. В тексте урока их рекомендуется перевести следующим образом*:

Абзац 1: machine *n* летательный аппарат; helicopter *n* вертолет; exotic, *a* необычный.

Абзац 2: airplane *n* самолет; lift *n, v* подъемная сила; создавать подъемную силу; control *n* управление; production *n производство*.

Абзац 3: propeller *n* воздушный винт.

Абзац 5: support *v* поддерживать.

Абзац 6: rotor *n* несущий винт; problem *n* задача; limit *n. предел*; limitation *n* недостаток; phenomenon *n* явление.

7.3 *Переведите слова с префиксами отрицательного значения*.

anti- antiaircraft, antiatom, antibomb, antibody, antifreeze, antigravitation, antiicer, antimissile, antirocket, antisubmarine

counter- counter-action, counteraircraft, counter-attack, counter-blow, counterfighter, counter-intelligence, countermeasures, countermine, countermissile, counterradar, counterrocket

de- deatomize, decentralization, decompose, decompression, deconcentration, deicer, demagnetize, demilitarize, demine, demobilize, depressurize

dis- disadvantage, disappear, disarmament, disconnection, discontinuity, disintegrate, dislocation, disorder, disorientate, disorganization

in- inactive, incombustible, incontrollable, incompressible-incorrect, independent, ineffective, insensitive, instabilized, invisible, invulnerable

im- immovable, impatient, imperfection, impersonal, impossible, impermanent, impure

ir- irregular, irrelative, irresistible, irrespective, irresponsible, irreversible, irrotational

non- nonaggressive, nonatomic, nonaxial, noncombat, noncontrolled, nonlinear, nonmilitary, nonnuclear, nonregular, nonstandard, nonstationary, nontcctical, nonturbulent, nonviscous, nonvortex, nonuniform

un- unaccelerated, unarmed, unbalanced, uncontrolled, uncorrected, undamped, unguided, unidentified, unlimited, unmanned, unpowered, unstabilized;

unacceptable, unaggressive, uncertain, unequal, unexplosive, unstable, unswept, unsymmetrical.

7.4 *Переведите слова со следующими префиксами*.

inter- interaction, interatomic, interchangeability, interconnection, intercontinental, international, interplanetary, intersection, interspar;

over- overbalancing, overbank, overboil, overcompensation, overexpansion, overflight, overflow, overheat, overland, over-stability, oversea, overweight;

under- underarmed, underbalancing, underbelly, under-cooled, underestimate, underground, underpressure, undersea, under -snow, understable, undersurface, underwater, underwing;

sub- subassembly, subbase, subcooled, subcritical, subdivide, subgroup, submarine, subnormal, subpressure, subsonic, substation, substratosphere, subtropical;

super- superaerodynamics, superalloy, superaltitude, superbomb, superbomber, supercooled, superfighter, superfluid, supersonic, supervelocity;

re- reaction, recirculation, recompression, reconstruct, redistribution, reentry, reevaluation, refuel, regeneration, reorganize, replace, reproduce, restart.

7.5 *Переведите предложения, обращая внимание на перевод сказуемых, выраженных глаголами в различных временах группы Indefinite страдательного залога.*

a) 1. Venus is covered by a thick layer of clouds. 2. The climate of Mars is relatively well known. 3. Most present-day aircraft are equipped with three-point retractable landing gears. 4. Thrust is provided by the engine and propeller. 5. Each part of a missile is tested thoroughly before it is used in actual flight. 6. The density of the atmosphere is measured by balloons below 30 km. 7. Any vehicle in space is exposed to the hazards of collision with meteorites. 8. In the conventional rocket engine a fuel and an oxidizer are mixed and ignited in a combustion chamber.

b) 1. The satellite was launched into a 1500-km circular orbit. 2. The cosmic rocket was launched from the satellite at a pre-determined point on the orbit. 3. With the advent of a supersonic flight new problems were introduced. 4. The accuracy of the airplane flight control system was considerably improved. 5.

Till recently very little was known about Venus, despite its proximity to the Earth. 6. Mid-course velocity corrections of the satellite were made in due time.

c) 1. The aerodynamic heating problem will not be discussed further here. 2. Permanent bases on the Moon and Mars will be established for many reasons. 3. Several types of vehicles will be developed and used for space flights. 4. The term "planet" will be applied here to nine celestial bodies orbiting around the Sun. 5. The space station will be equipped for research in geophysics, meteorology and astronomy. 6. The geometrical properties of the circular orbit are well known and, therefore, will not be discussed in this article.

7.6 *Переведите предложения, обращая внимание на перевод Infinitive Indefinite Passive в сочетании с модальными глаголами.*

1. Airplanes can be used as launch platforms for space carrier vehicles. 2. The speed and range of an aero plane can be predicted with considerable accuracy. 3. The rocket engine can be used in the air, under water, or in the vacuum of space. 4. The general character of the Moon's surface features can be studied by direct telescopic observation and photography. 5. Mercury cannot easily be observed because of its closeness to the Sun. It can be seen only for a short while. 6. The Moon's history may be arbitrarily divided into several epochs. 7. A rocket propulsion system may be used as a primary or as an auxiliary power plant of an airplane. 8. Orbital launchings may be made from space stations. 9. Satellites may be used in two ways to extend our capabilities for continental and world-wide communications. First, passive satellites may be employed as reflectors of signals between two ground points; and, second, active repeater satellites can be used for the reception and storage of a message over one ground point, and subsequent delivery on command during transit over a second ground point. 10. Food for space crews must be well packaged and protected. 11. Materials for a space vehicle must not be selected based on isolated properties.

7.7 *Ответьте на вопросы к тексту.*

1. What specimens do VTOL aircraft include? 2. Why running take-off is preferred? 3. Are all types of VTOL aircraft in regular service now? 4. What aerodynamic features have STOL aircraft? 5. What run does the STOL airplane require during take-off? 6. Are the STOLs in production now? 7. What are the four primary types of the VTOLs? 8. What purpose does the rotor of the helicopter serve? 9. What is the fastest speed of a helicopter? 10. What phenomenon occurs when the high-speed limit of the helicopter is reached?

2.8 Модуль 8

Лексико-грамматические темы:

1 Перевод терминологических сочетаний.

2 Слова общего корня в английском и в русском языках.

3 Существительные с суффиксами.

4 Существительные латинского и греческого происхождения в единственном и множественном числе.

5 Времена Present Continuous и Present Perfect страдательного залога.

Термины:

ascent - набор высоты; подъем

development - разработка

freewheel - авторотация несущего винта вертолета

ground-effect machine - аппарат на воздушной подушке

pivot - шарнирная опора

rate - скорость

reconnaissance-fighter airplane - истребитель-разведчик

simulator - моделирующая установка; имитатор; тренажер

structure - конструкция

top speed - максимальная скорость

VTOL aircraft

(continued)

1 A variation of the standard helicopter is the compound helicopter. In the last few years there has been, a revival of interest in the compound type, basically standard helicopter redesigned with a propeller (or a jet engine) to give it added push; usually a small lifting wing is also part of the configuration. The rotor is used for vertical take-off; after reaching altitude, power to the rotor is then reduced or stopped entirely and it can freewheel as the ship goes into forward flight. With the rotor thus unloaded it is possible to obtain a cruise speed considerably greater than that attainable with the rotor under power. For vertical descent, the rotor is clutched in and, in effect, the machine is converted back to a helicopter.

2 The compound helicopter can be thought of as a kind of helicopter that can partially convert while in flight to an airplane configuration by unloading the rotor. The intention, of course, is to combine the superior vertical flight and hovering characteristics of the helicopter with the high cruise speed available from use of an unloaded rotor. However, in some ways the compound helicopter must pay for its higher rate of speed. There is a decrease in its vertical take-off and hovering capability, since the wing interferes with the airflow through the rotor; then, too, the added weight of this structure reduces the payload.

3 The third type of VTOLs is the tilt-prop airplane, a complete break from the tradition of the helicopter. If the compound helicopter can be thought of as a kind of helicopter that can partially turn itself into an airplane, the tilt-prop machines may be considered as airplanes that can turn into helicopters. The tilt-prop, basically, is an airplane that has oversized propellers, or fan-like rotors, mounted on pivots so they can be shifted to point either straight up or straight ahead. With some aircraft of this type the wings tilt along with the propeller, and these have been referred to as "tilt-wings". The term tilt-prop is perhaps more

suitable, since it covers both configurations. The tilt-prop airplanes have no rotors, there is only a small wing to support the machine in forward flight.

4 The reason for this design approach, again, is to achieve higher speed than with the helicopter. The tilt-prop designs are another step forward on the speed scale; the large ones should be capable of cruising speeds in the 300- to 400-mile-per-hour range, perhaps more. However, currently they seem to be inferior to both the helicopter and compound helicopter in vertical take-off and in hovering ability; their propellers are not as efficient as rotor systems. Presumably, control in hovering flight may not be as good, and the payload that can be lifted vertically is much less (for the same power) than with a helicopter. Another point to be considered is that the vertical takeoff of the tilt-prop can be more of-a strain on the engines than it would be with a helicopter.

5 The last type we will consider is the jet VTOL, basically a jet airplane with the ability to rise vertically. Several aircraft of this type are currently in various stages of development. All have one important point in common: to rise vertically the flow from the turbojet engines is directed downward so a lifting force is created. Since all are jets, these aircraft are the fastest of any of the VTOLs. In fact, several reconnaissance-type airplanes have been built along these lines. However, most jet VTOL designs - particularly those intended for development into transport-type aircraft - are still the experimental stage, are complex, and generally do not have lift-off and hovering characteristics that are equal to the helicopter or other VTOLs.

6 Each of these VTOL types represents a different compromise between the ability to rise vertically, lifting the most weight for the least power, and the ability to cruise at a high forward speed. At one end of the spectrum we have the helicopter. Because of the superior lifting capability of its rotor, which provides the most lift for the least power - as compared to the other VTOL systems - the copter is the best hovering and lift-off machine. However, because of the high drag created by the rotor when in forward flight, it has relatively poor speed. At the other end of the spectrum we have the tilt-prop airplanes, where the situation is

reversed. And then, more or less in between (though closely related to the helicopter) we have the compound helicopter, which has a lift-off capability nearly equal to the standard helicopter but a top speed that is considerably greater.

7 Concerning the lift-off and hovering characteristics of the new VTOL types, there is one fact to be considered. These aircraft are completely dependant upon the perfect functioning of their engines and control systems, unlike the helicopter (or compound helicopter) which has an inherent safety factor in the auto rotational capability of the rotor. If a serious power failure or a failure in the control system is experienced while the VTOL is being supported by the thrust from its engines, obviously, a crash is almost inevitable. There have been several disastrous crashes of experimental VTOLs (a tilt-prop, a lift-fan, and a jet) due to trouble while the aircraft was in the slow flight or hovering condition.

(to be continued)

Упражнения

8.1 *Переведите словосочетания со следующими терминами из текста: ascent, control, copter, descent, failure, force, machine,* rate.

ballistic ascent, elliptic ascent, powered ascent;

aileron control, air control, aircraft control, aircraft engine control, airplane control, air traffic control, autopilot control, bank control, cabin pressure control, cabin temperature control, constant Mach number control, elevator control, engine control, flap control, flight control, flying control, landing-gear control, lateral control, longitudinal control, manual control, pitch control, radio control, range control, roll control, rudder control, speed control, tail control, tail plane control, thrust control, undercarriage control, velocity control, yaw control;

cargo copter, transport copter, turbine copter, utility copter;

flat descent, gliding descent, parachute descent, powered descent, steep descent, uniform descent, vertical descent;

autopilot failure, catastrophic failure, engine failure, fatigue failure, power failure, random failure, receiver failure;

aerodynamic force, air force, brake force, centrifugal force, centripetal force, component force, downward force, drag force, external force, friction force, G-force, gravity force, inertial force, lateral force, lift force, longitudinal force, propulsive force, reactive force, side force, total force, upward force, variable force;

fixed-wing machine, flying machine, ground-effect machine, research machine, training machine;

rate of climb, rate of descent, angular rate, initial rate, maximum rate of climb, negative rate of climb, positive rate of climb, rotation rate, sea-level rate of climb.

8.2 a) *Переведите без словаря следующие английские слова из текста, имеющие общий корень с русскими словами*.

autorotational *a,* characteristics *n,* compromise *a,* configuration *n,* efficient *a,* experimental *a,* fact *n,* factor *n,* functioning *n,* interest *n,* machine *n,* mile *n,* spectrum *n,* standard *a,* system *a,* tradition *n,* transport *n,* type *n,* vertical *a,* vertically *adv;*

b) *Уточните значение нижеприведенных слов в словаре. В тексте урока их рекомендуется перевести следующим образом.*

Абзац 1: variation *n* вариант; helicopter *n* вертолет; propeller *n* воздушный винт; rotor *n* несущий винт.

Абзац 2: combine *v* объединять; interfere *v* взаимодействовать; structure *it* конструкция.

Абзац 3: propeller *v* воздушный винт; rotor *n* несущий винт; support v *поддерживать*.

Абзац 4: reason *n* причина; forward *adv* вперед; control *n* управление.

Абзац 5: complex, a сложный.

Абзац 6: situation *n* положение.

Абзац 7: control *n* управление; support *v* поддерживать; condition *n* режим.

8.3 *Переведите существительные со следующими суффиксами.*

-*er*: builder, commander, controller, designer, leader, manufacturer, organizer, worker, adapter, analyzer, bomber, booster, carrier, container, cruiser, fighter, glider, oxidizer, receiver, stabilizer, trainer, transformer;

-*or* : constructor, contractor, director, inspector, inventor, navigator, operator, sailor, accumulator, alternator, collector, compressor, detector, detonator, elevator, generator, indicator, interceptor, protector, regulator, separator, simulator;

-*tion***:** action, combustion, completion, connection, construction, consumption, correction, deflection, destruction, direction, ejection, ignition, injection, insertion, inspection, instruction, interception, intersection, perfection, reflection;

-*(at)ion***:** adaptation, application, classification, computation, deformation, determination, exploration, formation, identification, inclination, information, installation, magnetization, observation, accumulation, approximation, calculation, communication, concentration, detonation, deviation, formulation, generation, indication, insulation, modulation, navigation, orientation, oscillation, rotation**;**

-*sion*: collision, corrosion, decision, division, explosion, inclusion, provision;

-*(ss)ion*: compression, discussion, expression, submission, transmission; ,

-*ment***:** accomplishment, achievement, adjustment, arrangement, attachment, department, development, displacement, employment, equipment, fulfillment, movement;

-*ance***:** appearance, assistance, disturbance, endurance, guidance, insurance, performance, resistance

-*ence*: dependence, difference, existence, insistence, occurrence, reference;

-*ness*: blackness, darkness, effectiveness, hardness, roughness, thickness, -usefulness, weightlessness;

-*ity*: activity, conductivity, density, extremity, equality, humidity, intensity, productivity, rigidity, sensitivity, accessibility, availability, capability, controllability, flexibility, possibility, reliability, visibility, vulnerability.

8.4 *Прочтите и запомните слова латинского и греческого происхождения*.

Единственное число	**Множественное число**
-um, -on	**-a**
continuum континуум	continua
criterion критерий	criteria (-ions)[1]
datum данная величина	data
equilibrium равновесие	equilibria
maximum максимум	maxima (-urns)
medium среда	media (-urns)
minimum минимум	minima (-urns)
momentum количество движения	momenta (-urns)
phenomenon явление	phenomena
quantum квант	quanta
spectrum спектр	spectra (-urns)
stratum слой, пласт	strata
symposium симпозиум	symposia (-urns)
vacuum вакуум	vacua (-urns)
-is [is]	**-es**
analysis анализ	analyses
axis ось	axes
basis базис; основа	bases
crisis кризис	crises
hypothesis гипотеза	hypotheses
parenthesis скобка	parentheses
synthesis синтез	syntheses
-us [as]	**-i**
calculus исчисление; математический анализ	calculi (-uses)
focus фокус	foci

locus геометрическое место точек	loci
modulus модуль	moduli (-uses)
nucleus ядро	nuclei (-uses)
radius радиус	radii (-uses)
-a	**-ae**
abscissa абсцисса	abscissae (-as)
corona корона	coronae (-as)
formula формула	formulae (-as)
hyperbola гипербола	hyperbolae (-as)

Идентичные формы единственного и множественного числа

apparatus аппарат, прибор	apparatus
headquarters штаб	headquarters
means средство	means
news новость	news
series ряд	series
species вид	species

8.5 *Переведите предложения, обращая внимание на перевод сказуемых, выраженных глаголами в Present Continuous страдательного залога*.

1. Passive and active radio waves are now being used to explore the Moon. 2. For weather forecasting vast sums of money are being spent on meteorological satellites. 3. Incompressible flows are now also being studied intensively by aerodynamicists. 4. New titanium alloys are being introduced into production rapidly. 5. This type of battery is being developed along two lines. 6. Many different types of guided missiles are being developed. 7. New discoveries are constantly being made in the field of astronautics.

8.6 *Переведите предложения, обращая внимание на перевод сказуемых, выраженных глаголами в Present Perfect- страдательного залога.*

I. Venus has been called the Earth's twin sister. 2. The visible features of the Moon's surface have been discussed by astronomers. 3. Several ideas have been

put forward to account for the appearance of the surface of the Moon. 4. Photometric and other methods have been used to determine the nature of the material of the Moon's surface. 5. The atmosphere and surface of Mars have been studied more than those of any other planet. 6. Many types of simulators have been constructed for the study of space problems. 7. Several different methods have been proposed to utilize nuclear energy for rocket propulsion. 8. Man's view of the Universe has been enormously expanded during the last decades. 9. Fantastic advancements have been made during the past decades in the performance of gas-turbine power plants. 10. Wheeled vehicles have been more thoroughly analyzed than any other type. 11. Since that time many experiments have been made. 12. Since that time a great many papers have been written about perturbations due to the Earth's oblations. 13. Since the use of X-rays and radium in medicine, men have been exposed to much larger quantities of radioactivity than before. 14. Since 1820, sunspot activity on the Sun has been recorded by astronomers. It has been determined that every 11 years sunspot activity is maximum.

8.7 *Ответьте на вопросы к тексту.*

1. What variation of the standard helicopter do you know? 2. What is used for vertical take-off of a compound helicopter? 3. What is done with the rotor for vertical descent of a compound helicopter? 4. Why is there a decrease in the vertical take-off and hovering capability of a compound helicopter? 5. What propellers has the tilt-prop airplane? 6. Have the tilt-prop airplanes rotors? 7. Have they wings? 8. What is the range of cruising speeds of tilt-prop airplanes? 9. Why is the copter the best hovering and lift-off machine? 10. In what case a crash of VTQL is almost inevitable?

2.9 Модуль 9

Лексико-грамматические темы:

1 Перевод терминологических сочетаний.

2 Слова общего корня в английском и в русском языках.

3 Прилагательные с суффиксами.

4 Сопоставление глагольного управления предлогами в английском и в русском языках (страдательный залог).

5 Глаголы с послелогами в страдательном залоге.

6 Глагольные фразеологические сочетания в страдательном залоге

Термины:

freewheeling rotor - самовращающийся несущий винт

full throttle - полностью открытый дроссель

gross payload - полная полезная нагрузка

lifting wing - несущее крыло

operating cost - стоимость эксплуатации

power setting - положение рычага управления двигателем

run - разбег; пробег

service - обслуживание; эксплуатация; служба

scheduled service - полет по расписанию

shut down - выключать двигатель

speed - скорость; набирать скорость

streamline - по потоку

survival - спасение; выживание

trail – укладывать

VTOL aircraft

(continued)

1 An important characteristic of most VTOLs is their capability for STOL operations from short runways while making airplane-type running take-offs and landings. When operating this way, they can take off and climb out at quite severe angles, using little runway, with high payloads and without placing undue strain on the engines. This is true of the helicopter, compound helicopter, and the tilt-prop. Of these three types of VTOLs, the new tilt-props are the aircraft that might stand to benefit most from the STOL type of operation. They are the fastest in forward flight and therefore offer the most from the viewpoint of speed and range. However, they seem to be the poorest hovering machines of the three types and might be operated as short take-off airplanes - with the propellers in the horizontal position - whenever possible with certain important benefits. The vertical take-off ability could then be saved for special situations where it would be needed. This might be where a take-off would be made in the short take-off airplane configuration with a maximum gross payload. At the end of the flight after enough fuel had been used up, the ship might then be light enough to make a vertical descent landing easily at a heliport.

2 This description of how a tilt-prop VTOL might be operated as a short take-off airplane to increase its payload on a crucial point: the question of whether these aircraft have any reasonable chance of economic survival, particularly if they are used for carrying passengers in scheduled service. The outstanding fact that has been learned from the experience of most helicopter airlines in the last decade is that operating costs are too high; as a result, fares are too high and passenger volumes too small. Whether faster, larger VTOLs and STOLs are the answer, or even part of the answer, remains to be seen. For the most part, the development of these aircraft has been funded by the military, and they have been designed for military requirements. This consideration, as well as many economic and technical factors, makes it impossible to do justice to the question here. It may be helpful, however, to outline a few of the important technological trends now under way.

3 One trend is toward an increase in the size of transport helicopters, for very much the same reason that transport airplanes have grown steadily in size in

the last twenty to thirty years. All things being equal, the larger the helicopter, the lower the cost per seat mile; the cost of operating new, larger aircraft ordinarily does not rise in the same proportion as the increase in passenger capacity. A forty-passenger helicopter can operate with only a pilot and copilot - the same number of flight crew members as a twenty-passenger machine. Here, the capacity has doubled, but the crew cost is the same

4 Another basic trend, as we have noted, is the consistent effort to reduce drag so that a higher cruise speed is possible, while retaining the high-lift capability, needed for vertical take-off and hovering. The examples include the compound helicopter, with its freewheeling rotor and additional means of thrust; the tilt-prop airplanes that can convert to a low-drag high-speed airplane configuration for forward flight; and the jet VTOL airplanes. Any number of other experimental configurations have been proposed, and several involve the complex stopped-rotor concept. This would consist of an aircraft furnished with a lifting wing in combination with a rotor that could be slowed down, and then stopped entirely while in flight. For high forward speed the rotor would then form a fixed lifting surface. Still another somewhat similar - though more complicated - approach would have the rotor stopped, the blades nearly folded and trailed aft in a streamline position, and then the entire bundle stowed away in the top of the fuselage while the aircraft sped along on the lift of its wing.

5 There has also been a particularly strong engineering effort in another area: the creation of new turbo-shaft engines that are lighter and more powerful - in other words, the most power for the least ' weight. This, of course, benefits any type of aircraft, but it is particularly vital for VTOL machines that need great levels of thrust for a take-off that is a direct struggle against gravity. Part of the engine designer's problem is that the vast power needed for take-off is not needed for an economic cruise speed. Then, too, there is the fact that turbo-jet engines run best at full throttle; they cannot run with any efficiency at partial power settings. For this reason, various VTOL designs have been proposed with ultra-lightweight extra

engines to be run at full power at take-off and landing and then shut down completely during cruise flight.

Упражнения

9.1 *Переведите словосочетания со следующими терминами из текста: ability, capability, capacity, climb, run, service.*

climbing ability, load-carrying ability, range ability, speed ability, weight-lifting ability;

airfield capability, altitude capability, blind-landing capability, escape capability, speed capability, water landing capability;

airport capacity, baggage capacity, cargo-passenger capacity, carrying capacity, hold capacity, lift capacity, payload capacity, runway capacity, seating capacity, total capacity, traffic capacity;

flat climb, full-throttle climb, initial climb, maximum climb, normal climb, optimum climb, shallow climb, steady climb, subsonic climb, supersonic climb;

ground run, landing run, level run, record run, take-off run;

aeronautical service, airfield service, flight service, maintenance service, traffic service, weather service

9.2 *a) Переведите без словаря следующие английские слова из текста, имеющие общий корень с русскими словами.*

characteristic *n,* combination *n,* configuration *n,* experimental *a,* fact *n,* factor я, fuselage *n,* horizontal *a,* machine *n,* maximum *n,* mile *n,* operation *n,* passenger *n,* pilot *n,* problem *n,* proportion *n,* result *n,* technical *a,* transport *n,* type *n,* vertical *a;*

b) Уточните значение нижеприведенных слов в словаре. В тексте урока их рекомендуется перевести следующим образом.

Абзац 1: helicopter *n* вертолет; position *n* положение; heliport *n вертодром*.

Абзац 2: economic, *a* экономичный; service *n* эксплуатация, полеты; decade *n* десятилетие; economic, *a* экономический; technological, *a* технический.

Абзац 4: rotor *n* несущий винт; complex, *a* сложный; position *n* положение; lift *n* подъемная сила.

Абзац 5: gravity *n* тяготение; economic, *a* экономичный.

9.3 *Переведите прилагательные со следующими суффиксами.*

-*able* : adjustable, allowable, changeable, considerable, favourable, movable, reliable, remarkable, steerable, valuable, variable;

-*ible* : admissible, convertible, permissible, responsible, reversible;

-*ant* : ascendant, descendant, espectant, important, resistant;

-*ent* : dependent, different, existent, insistent;

-*ive* : active, attractive, constructive, corrective, creative, detective, effective, expressive, initiative, intensive;

-*al* : accidental, agricultural, centrifugal, continental, experimental, formal, frontal, fundamental, global, industrial, normal, operational, orbital, sectional, structural;

-*ic(al)***:** algebraic, atomic, ceramic, climatic, organic, metallic, ohmic;

analogic(al), astronomic(al), biologic(al), economic(al), geographical), graphic(al), harmonic(al), historic(al), rneteorologic(al), metrical), periodic(al), technologic(al);

-*ful***:** careful, doubtful, helpful, meaningful, peaceful, powerful, successful, truthful, useful, watchful, wonderful;

-*less:* aimless, careless, doubtless, endless, helpless, hopeless, meaningless, moonless, motionless, nameless, powerless, shapeless, soundless, useless, weightless;

-*ous*: advantageous, adventurous, dangerous, famous, spacious;

-ary: disciplinary, elementary, evolutionary, fragmentary, momentary, planetary, primary, reactionary, revolutionary, segmentary, stationary, supplementary.

9.4 *Переведите предложения со следующими глаголами в различных временах страдательного залога*

a) to affect *воздействовать на;* to follow *следовать за;* to influence *влиять на;* to report *сообщать о;* to track *следить за.*

1. The speed of sound is not affected by a change in atmospheric pressure because the density also changes. 2. A rocket engine was unaffected by its environment. 3. The first two chapters of the book give elements of kinematics and of dynamics and are followed by a study of the motion of rocket- and jet-powered vehicles. 4. The first rocket has been followed by several smaller rockets. 5. The dynamic of the flow may be profoundly influenced by different effects. 6.Choice of the diameter of the vehicle is influenced by many factors. 7. Radio waves are influenced by the troposphere and the ionosphere in their passage to or from the Earth's surface. 8. The spacecraft design is obviously strongly influenced by the environment of space. 9. Drop tower experiments at high Bond numbers were not reported**.** 10. The early space vehicles have been tracked by ground-based radar and controlled by telemetered guidance commands. 11. The flight of the automatic interplanetary station is being tracked by a special centre. 12. The satellite flight must be tracked continuously by radar.

b) to account for *объяснять;* to arrive at *достигать чего-либо;* to deal with *иметь дело с;* to insist (on) upon *настаивать на;* to refer to *ссылаться на;* to rely on (upon) *полагаться на;* to send for *посылать за;* to speak about (of) *говорить о;* to write about *писать о.*

1. Flight results must be accounted for**.** 2. In this report gravity is satisfactorily accounted for**.** 3. The idealized structure of the fuselage was finally arrived at**.** 4. After all these calculations the gravitational attraction of Mars must be dealt with**.** 5. The preflight inspection of the airplane was insisted upon by the

flight engineer. 6. The high cost of engine development was referred to at the beginning of this article. 7. Venus is sometimes referred to as the "twin planet" of the Earth. 8. The critical acceleration level is referred to as the "stability limit". 9. Liquid motions are generally referred to in the literature as capillary waves. 10. Such a device cannot be relied upon. 11. This rapid trajectory calculation can be relied upon. 12. The equipment for this experiment was sent for. 13. The satellite defense problem was much spoken about. 14. The lunar exploration program has been much written about.

9.5 *Переведите предложения, обращая внимание на перевод следующих глагольных фразеологических сочетаний в различных временах страдательного залога.*

to take account of *учитывать;* to take advantage of *воспользоваться, использовать;* to make application of *применять;* to call attention to *привлекать внимание к, обращать внимание на;* to confine attention to *ограничиваться;* to draw attention to *привлекать внимание;* to give attention to *уделять внимание;* to pay attention to *обращать внимание на;* to take care *заботиться, позаботиться;* to draw a conclusion *делать вывод;* to give consideration to *рассматривать, обсуждать;* to place emphasis on *подчеркивать, выделять; придавать значение;* to make mention of *упоминать;* to make provision *предусматривать, обеспечивать; принимать меры.*

1. Account should be taken of the boundary layer oscillations. 2. In planning the development of bases on the Moon account must be taken of environmental conditions. 3. In dropping the parachutists account should be taken of the local surface conditions. 4. Advantage is often taken of the effect of the solar radiation. 5. Advantage was taken of this newly-discovered phenomenon. 6. Application should be made of this new design of a swept wing. 7. Attention has been called to these specific features of the turbofan engines. 8. Our attention was confined to a brief description of the experiment. 9. Attention is confined here to considering the simplest shapes of airplane wings. 10. Attention has been drawn to some of the

more specific problems of the parachute recovery. 11. Attention will now be given to the incompressible fluids. 12. In this book attention is also given to a review of the propulsion systems. 13. Attention must be given by the author to the sound problem. 14. Special attention has been paid to the laboratory investigations. 15. Care is taken not to overheat this fluid. 16. Care was taken to minimize the air drag effect. 17. Care should be taken to minimize the friction effect. 18. Certain general conclusions can be drawn from a study of fig. 2. 19. Careful consideration was given to the selection of suitable vibration frequencies. 20. Consideration is given to the following onboard systems. 21. Consideration was also given to a rectangular wing. 22. Careful consideration must also be given to exact positional relationship of the space stations. 23. Emphasis is placed chiefly on low frequencies. 24. Mention has already been made of the aircraft high performances. 25. So far, no mention has been made of the Moon's topographical details. 26. Mention has been made of the possibility of using approximation method. 27. Provisions must be made to minimize the jamming of emergency exits in an airplane.

9.6 *Ответьте на вопросы к тексту*.

1. What is an important characteristic of most VTOLs? 2. What VTOLs can take off and climb out at severe angles? 3. What VTOL aircraft are the fastest in forward flight? 4. What VTOL aircraft are the poorest hovering machines? 5. What has been learned from the experience of most helicopter airlines in the last decade[0] 6. How can you explain the technological trend toward an increase in the size of transport helicopters? 7. Does the cost of operating new larger aircraft rise in the same proportion as the' increase in passenger capacity? 8. What is another basic technological trend? 9. What is the purpose of a strong engineering effort in creating new turbo shaft engines? 10. Can turbo-jet engines run with any efficiency at partial power settings?

2.10 Модуль 10

Лексико-грамматические темы:

1 Перевод терминологических сочетаний.

2 Слова общего корня в английском и в русском языках.

3 Наречия с суффиксами.

4 Различные времена страдательного залога *(повторение).*

Термины:

air-breathing engine - воздушно-реактивный двигатель

burner - форсунка

canopy - фонарь

centrifugal compressor - центробежный компрессор

compression ratio - степень сжатия

drive shaft - приводной вал

exhaust gas - выхлопной газ

forward flight - прямолинейный горизонтальный полет

ground speed - путевая скорость

hub - втулка

impeller - рабочее колесо

input - подводимая мощность

propulsive efficiency - тяговый к. п. д. двигателя

ram-air pressure - скоростной напор

reduction gearing - редуктор

rotating blade – рабочая лопатка

turbojet турбореактивный - двигатель

twin-spool engine - двигатель с двухкаскадным компрессором

vane - лопатка

Types of aircraft gas-turbine engines. Turbo jets

1 Gas-turbine engines for aircraft come in many types and sizes, each of which has its advantages and its limitations. The most common type is the uncomplicated turbojet. Because they have no added features such as a fan, propeller, or free turbine, turbojets are sometimes referred to as straight jets.

2 Most turbojets operate best at relatively high altitude, in the 25,000 to 40,000-foot range, although they can go very much higher, if need be. There is no simple explanation for the fact that turbojets are so well suited to high-altitude operation. The high-altitude capability of a turbojet is due to several reasons, some of which are rather complex. For one thing, this capability is designed into an engine at the time the plans are first laid down on a drawing board. For another, the cold temperature of the air at high altitude gives an engine extra thrust. More importantly, the rarified atmosphere at high altitude reduces airplane drag (which may be thought of as the air resistance of flight). Low drag means that the Mach number selected for cruising can be attained at a low engine thrust setting. This, in turn, results in a relatively low fuel consumption for the airspeed attained - a feature that makes for economical operation.

3 But, good as they are at their optimum altitude, high thrust at low airspeed is not a turbo-jet characteristic. To be at their best, turbojets need the ram-air pressure at their inlet which comes only with speed, 'therefore, they require very long runways for take-off.

4 Turbojets are classified according to the kind of compressor they use. For years, they had only centrifugal compressors because this was the type that designers knew best how to build. Centrifugal compressors operate by taking in air near a hub at the centre and rotating it with an impeller.

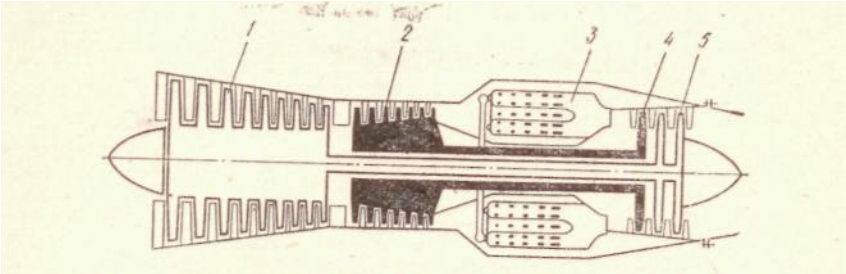


Figure 2 – Dual-axial Compressor Turbojet

1 - low-pressure compressor; 2 - high-pressure compressor; 3 - combustion chamber; 4 - turbine for the high-pressure compressor; 5 - turbine for the low-pressure compressor

5 As the impeller whirls the air at high speed, centrifugal force carries the air to the perimeter of the impeller at a considerable velocity. Here the air is collected in a diffuser to increase the pressure, then led to a manifold which, in turn, feeds it to the engine's burners.

6 The early centrifugal compressor turbojets were both reliable and simple. But the amount of thrust they can produce is relatively low because their compression ratio is not very high. Nevertheless', there are several turbo-prop and turbo-shaft engines now in current production that employ a compressor arrangement using one or more centrifugal-type compressors. The improved design of these engines makes them far superior to the centrifugal-compressor power-plants of several years ago.

7 Most of today's turbojets use an axial compressor. Axial compressors are used, especially in the larger engines, because they can produce high compression ratios, sometimes as high as 13: 1, or more. An axial compressor, as the name implies, compresses air as it flows in an axial direction through an engine.

A series of rotating blades and stationary vanes work on the air as it passes through a series of stages inside the compressor. Each stage adds to the compression process.

8 There are two types of axial-compressor engines, those with so-called single compressors and those with dual compressors. In dual-compressor engines (sometimes called twin-spool engines), there are two compressors that are mechanically independent of one another, although they are related as to airflow (see Fig. 2). Each compressor has its own turbine. The turbine for the forward, or low-pressure compressor, is the rear turbine. It is connected to the low-pressure compressor by a drive shaft that passes through the hollow drive shaft for the high-pressure compressor and turbine unit.

Turboprops

9 If a gas generator (turbojet) turns an aircraft propeller through a system of gears, it becomes a turboprop (see Fig. 3). The propeller-drive reduction gearing may be driven by the shaft from the same turbine that rotates the compressor, or the gearing may be driven by a shaft from a so-called free turbine that rotates independently in the exhaust gas stream of the basic gas generator. In either case, the gas venerator for a turboprop might be either a single- or dual-compressor type, although, as this is written, there are no dual-axial compressor turboprops in production.

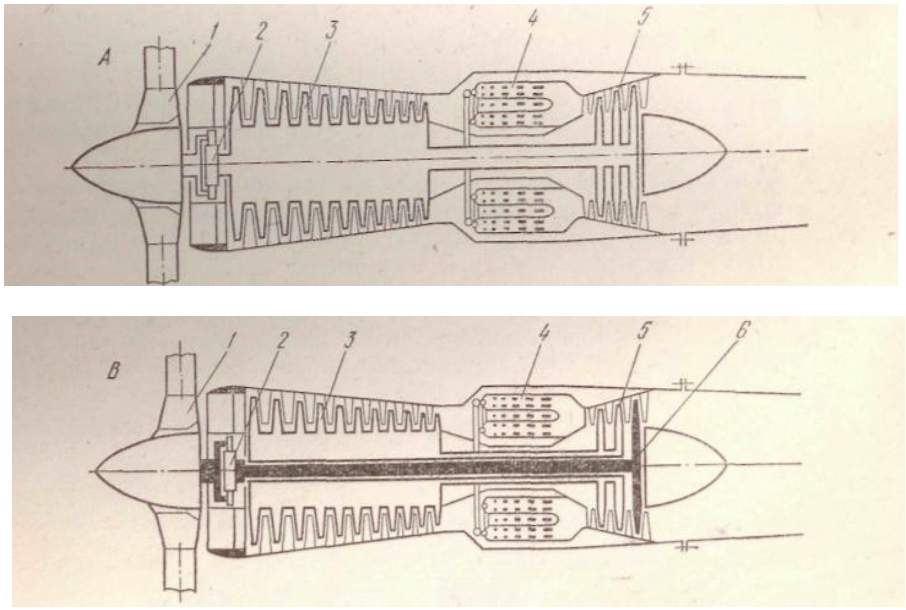


Figure 3 – Single-axial Compressor Turboprop

A - direct-drive turboprop; B - free turbine-drive turboprop; 1 - propeller; 2 - reduction gear; 3 - compressor; 4 - combustion chamber; 5 - compressor turbine; 6 - propeller turbine

10 Although a turboprop is more complicated and heavier than a turbo-jet engine of equivalent size and power, it will deliver more thrust up to medium-high subsonic airspeeds. However, the advantage decreases as flight speed increases. In normal cruising-speed ranges, the propulsive efficiency (output divided by input) of a turboprop remains constant, whereas the propulsive efficiency of a turbojet increases rapidly as airspeed increases. The spectacular performance of a turboprop during take-off and climb is the result of the ability of the propeller to accelerate a large mass of air while the aircraft is moving at relatively low ground and flight speed.

Упражнения

10.1 *Переведите словосочетания со следующими терминами из текста: engine, power plant, turbine, turbojet, turboprop.*

air-breathing engine, aircraft engine, aircraft rocket engine, airplane engine, copter engine, diesel engine, gasoline engine, gas-turbine engine, helicopter engine, internal-combustion engine, jet engine, jet-prop engine, liquid-cooled engine, liquid-fuel rocket engine, petrol engine, piston engine, plasma engine, prop-jet engine, pulse-jet engine, ram-jet engine, reciprocating engine, rocket engine, turbine engine, turbo-fan engine, turbo-jet engine, turbo-prop engine, turbo-shaft engine;

air-breathing power plant, auxiliary power plant, helicopter power plant, nuclear power plant, power plant, rocket power plant, turbine power plant, turbo-fan power plant, VTOL power plant;

air-cooled turbine, axial-flow turbine, cooled turbine, gas turbine, high-pressure turbine, propeller turbine, single-stage turbine;

axial flow turbojet, by-pass turbojet, centrifugal-flow turbojet, nuclear turbojet;

free-turbine turboprop, two-spool turboprop.

10.2 *а) Переведите без словаря следующие английские слова из текста, имеющие общий корень с русскими словами*.

airplane *n,* atmosphere *n,* centre *n,* classify *v,* compressor *n,* diffuse *n,* equivalent a, fact *n,* gas *n,* generator *n,* mass *n,* mechanically *adv,* normal *a,* optimum *a,* plan *n,* result *n,* system *n,* temperature *n,* turbine *n,* type *n*\

б) Уточните значение нижеприведенных слов в словаре. В тексте урока их рекомендуется перевести следующим образом.

Абзац 1: limitation *n* недостаток; propeller *n* воздушный винт.

Абзац 2: results in.… приводит к.…; economical, *a* экономичный.

Абзац 3: characteristic n характерная черта.

Абзац 6: production n производство.

Абзац 7: series *n* ряд; stationary, *a* неподвижный.

Абзац 10: constant, a *постоянный*.

10.3 *Переведите наречия со следующими суффиксами.*

-*ly* continuously, completely, experimentally, manually, permanently, simply, slowly, smoothly, substantially, permanently, alternatively, badly, directly, fairly, hardly, incidentally, necessarily, nearly, occasionally, previously, properly, readily, really, unfortunately, aerodynamically, aeronautically, astronautically, astronomically, geographically, mathematically, mechanically, physically, physiologically, scientifically, symmetrically, technologically, theoretically-ward backward, forward, downward, upward, northward, southward, westward, eastward;

-*wise*: clockwise, counter-clockwise, crosswise, likewise, otherwise.

10.4 *Переведите предложения, обращая внимание на перевод наречий*.

a) 1. The great majority of space vehicles are aerodynamically unstable. 2. This function represents geometrically an optimal surface. 3. The lift of an airfoil can be determined mathematically. 4. For each test, velocity data were obtained photographically. 5. Physically, this type of problem arises when a material changes its state. 6. The two-spar construction of the wing is not technically suitable for this kind of airplane.

b) 1. Characteristically, all spacecraft are as small and light as it is practical to construct them. 2. Tests are currently in preparation at the laboratory. 3. Distance travelled is directly proportional to speed. 4. At a height of 36,000 ft or more, the air temperature remains constant at about - 56°C. 5. This is a simple theorem. 6. Akteorites differ greatly amongst themselves in size, weight and velocity. 7. A successful investigation of an aircraft accident largely depends on good organization. 8. The rocket engineer is mostly interested in getting as much thrust as he can. 9. There are many flows in which these coefficients are nearly constant. 10. Obviously, the optimum design is not necessarily the cheapest one. 11. Theories proposed for the origin of the Moon necessarily involve the origin of the entire solar system. 12. The missile returns to its original position readily. 13. The chosen propellants must be readily available. 14. The company tested a 38-passenger, 10-ton air cushion vehicle -for river operation. 15. In a suitably arranged high-speed wind tunnel shock waves can be photographed. 16. This, unfortunately, is not the case. 17. The dark markings on the face of the Moon were variously considered to be seas, forests, etc.

10.5 *Переведите предложения, обращая внимание на перевод сказуемых, выраженных глаголами в различных временах страдательного залога (повторение):*

1. Nuclear rockets will not be used for some time for transporting people because of the obvious radiation hazards. 2. Rocket engines can be classified as follows. 3. The electric conductivity of a plasma is influenced by the intensity of the gravitational field. 4. The combination of a spacecraft and its launch vehicle is

called a space vehicle. 5. This chapter is concerned with the exploration of the planets, satellites and asteroids. 6. The aircraft with a total seating capacity of more than 5 persons must be provided with at least one emergency exit. 7. Different types of unguided missiles have been developed. 8. Our Sun and its planets are called the solar system. 9. In this chapter emphasis is placed upon fuselages, wings, and control surfaces, and considerable attention is given to cockpits, cabins, compartments, canopies, windows, landing gears and power-plant structural parts. It is not intended to describe the details of all aircraft or all the details of any particular aircraft. 10. Launch vehicles are usually made up of several stages. 11. A full scale model of the astronaut's space suit has been constructed and tested. 12. The behavior of the system is strongly influenced by gravity.

10.6 *Ответьте на вопросы к тексту.*

1. What is the most common type of the gas-turbine engine? 2. In what altitude range do most turbojets operate? 3. According to what are turbojets classified? 4. In what way do centrifugal compressors operate? 5. Do the majority of today's turbojets use an axial or a centrifugal compressor? 6. What are compression ratios of axial compressors? 7. How many types of axial-compressor engines do you know? 8. In what case does a turbojet become a turboprop? 9. What engine is more complicated and heavier, a turboprop or a turbojet? 10. What can you say of the propulsive efficiency of a turboprop and a turbojet in normal cruising-speed ranges?

2.11 Модуль 11

Лексико-грамматические темы:

1. Перевод терминологических сочетаний.
2. Слова общего корня в английском и в русском языках.

3. Глаголы с суффиксами.

4. Составные глаголы.

5. Существительные, соответствующие составным глаголам.

6. Функции инфинитива.

Термины:

axial-flow fan - осевой вентилятор

carry aloft - поднимать в воздух

case – кожух

chamber – камера

circumnavigation - навигация по замкнутому маршруту

combustion chamber - камера сгорания

commercial – гражданский

discharge - истекать; выпускать

drop off – падать

duct - канал; труба; трубопровод; подавать, нагнетать по трубопроводу

duct-enclosed fan - вентилятор в кольцевом обтекателе

exhaust - выпускать газ

fanjet - турбовентиляторный двигатель

gear-driven propeller - воздушный винт с редукторным приводом

guided - управляемый

inlet - вход; впуск; входное отверстие

internal engine - двигатель внутреннего сгорания

launch – запускать

propellant – топливо

pulsejet - пульсирующий воздушно-реактивный двигатель

ram air - воздух, сжатый за счет скоростного напора

ramjet - прямоточный воздушно-реактивный двигатель

shutter - пластинчатый клапан

stage - ступень

steering - управление

Types of aircraft gas-turbine engines

(continued)

Turbofans

1 Fanjets and turbofans are one and the same thing. In principle, the turbofan (or fanjet) is the same as the turboprop except that the ratio of the secondary airflow (i.e., the airflow through the fan or propeller) to the primary airflow through the basic engine is less. Also, in the turbofan, the gear-driven propeller is replaced by a duct-enclosed, axial-flow fan whose rotating blades and stationary vanes are considerably larger but otherwise like the blades and vanes of an axial compressor (see Fig. 4).

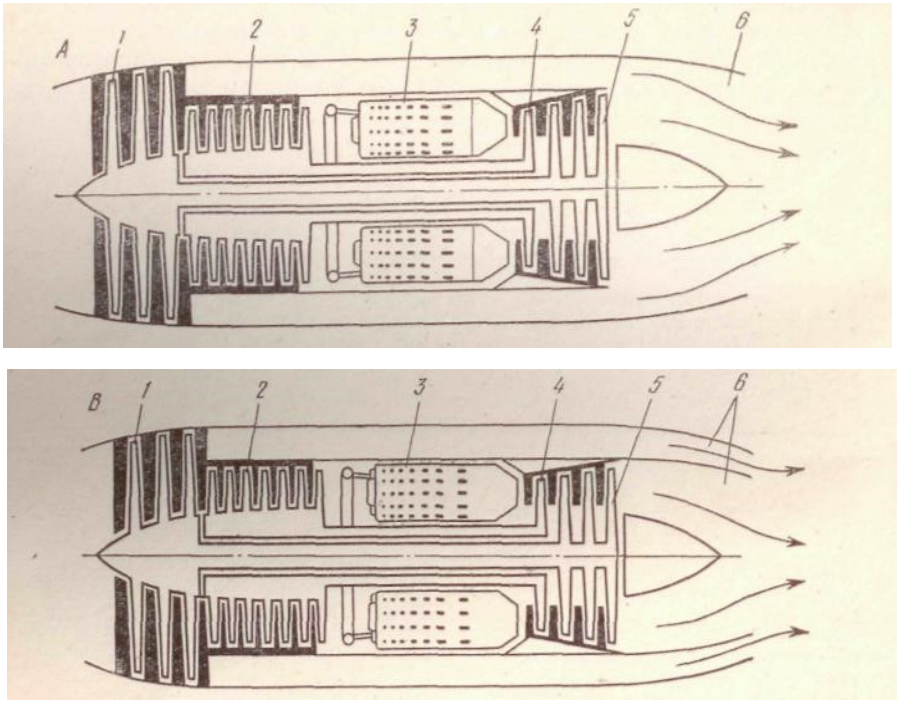


Figure 4 – Turbofans

A - forward turbofan with mixed exhaust; B - forward turbofan with non-mixed exhaust; 1 - fan; 2 - compressor; 3 - combustion chamber; 4 - compressor turbine; 5 - fan turbine; 6 – nozzle

2 There are two principal configurations for a turbofan, each of which has several variations. In one configuration, the fan is placed at the front of the engine where it is an integral part of the compressor. When the engine is a dual-compressor type, it is a part of the forward, low-pressure compressor. In the other configuration, the fan is mounted at the rear of the engine where it forms the rim, or outer perimeter, of a free turbine that rotates by itself in the exhaust gases discharged from the engine. These two turbo-fan designs are called forward-fan and aft-fan engines, respectively.

3 In both turbo-fan configurations, the fan makes a substantial contribution to the total thrust. Over and above the thrust produced by the basic engine, the fan accelerates the air passing through it to generate thrust of its own in the manner of the propeller of a turboprop. The fan air is exhausted without passing through the engine; it is not burned with fuel or used for internal engine cooling.

4 Two different duct designs are used with forward-fan engines. Either the air exhausted by the fan may be ducted overboard directly after it leaves the fan, or it may be ducted along the outer case of the basic engine to mix, or not mix (depending upon the design), with the turbine exhaust gases before the gases pass through the jet nozzle.

5 The fundamental difference between a turbofan and a turboprop is that the airflow through the fan is controlled by the design of the engine in such a manner that the air velocity through the fan blades is not affected very much by the speed of the aircraft. (How this is accomplished will be explained later.) This means that the loss of operational efficiency at high air speeds that limits the airspeed capability of turbo-prop aircraft is eliminated in turbo-fan aircraft. Indeed, supersonic aircraft not only can, but are being powered by turbofans.

6 Turbofans are rapidly becoming the most widely used of all the types of jet engines, particularly in large multi-engine aircraft. The turbofan is, in effect, a compromise between the good operating efficiency and high-thrust capability of a turboprop and the high-speed, high-altitude capability of a turbojet. At cruising

altitude, the engine-propeller combination of a turboprop loses efficiency rapidly at airspeeds above 400 knots. (knot - морской узел, мера длины.)

7 Not only does the turbofan have no such limitation but it is much simpler than a turboprop.

8 The complexity and weight of the propeller reduction gearing and the intricate propeller-governing feature of a turboprop are completely eliminated in a turbofan. The turbofan is therefore not only lighter than a turboprop but can never be plagued by any of the malfunctions to which a propeller and its associated systems are susceptible.

9 The fact that the fan air does not pass through the basic engine enables a turbofan to achieve relatively low specific fuel consumption. In addition, because it accelerates a large mass of air to relatively low velocity, even at very low aircraft speeds, a turbofan, like a turboprop, produces much more thrust than a turbojet during takeoff and the initial climb.

10 Another advantage of the turbofan is a lower noise level, which is an important feature at all commercial airports, the lower level of noise occurs because a turbo-fan engine has at least one additional turbine stage to drive the fan. Extraction of more power iron engine exhaust gases as" they pass through the additional turbine (or turbines) serves to reduce the velocity of the engine exhaust. Less velocity through the jet nozzle results in less noise.

Ramjets and Pulsejets

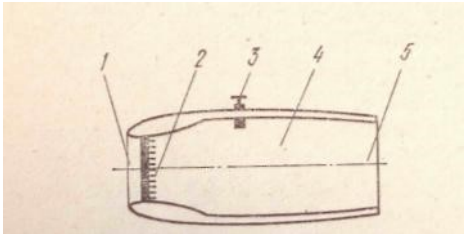


Figure 5 - Ramjet Engine

1- air inlet; 2 - fuel nozzles; 3 - igniter; 4 - combustion chamber; 5 - jet nozzle

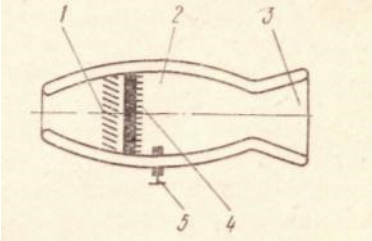


Figure 6 – Pulse-jet Engine

1 - shutters; 2 - combustion chamber; 3 - jet nozzle; 4 - fuel nozzle; 5 - igniter

11 The simplest jet engine of all is the ramjet (Fig. 5), which has no moving parts. Such an engine is but little more than a pipe equipped with a fuel metering and injection system. Because a ramjet must be accelerated by some means other than the engine's own power to a very high speed before it will operate, the engines have limited use. They have principally been employed in guided missiles that must be carried aloft and launched by a conventional aircraft

11 A pulsejet (Fig. 6) is a ramjet with a set of shutters, spring- loaded to remain in the closed position normally, placed across the engine's air inlet. When the engine is launched at a speed sufficient to maintain operation, ram air pressure forces the shutters open. Fuel is injected and burned continuously in the combustion chamber. As soon as the combustion chamber pressure equals the ram air pres sure, the shutters close. The combustion gases are ejected through the jet nozzle at the rear, generating thrust. When the pressure in the combustion chamber drops off, the shutters open again, admitting more air. The cycle repeats itself with great rapidity.

Rocket Motors

12 The solid fuel rocket motor is the oldest and most widely known jet-propulsion device. The body consists of a cylinder in which a solid fuel thoroughly mixed with a solid oxidizer is carried. When the fuel, called a propellant, is burned with the oxidizer, the rocket develops thrust

by accelerating the gases of combustion through a jet nozzle. There are also liquid propellant rockets (Fig. 7) which operate much in the same manner.

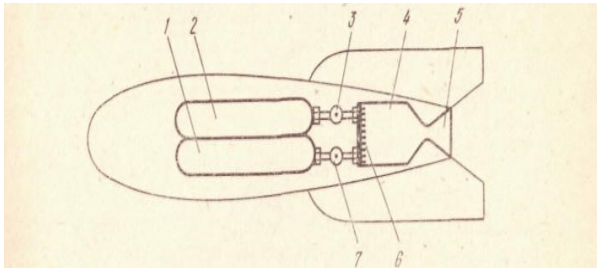


Figure 7 – Liquid Propellant (Fuel) Rocket Motor

1 - liquid oxygen (oxidizer); 2 - liquid hydrogen (fuel); 3 - fuel valve; 4 - combustion chamber; 5 - jet nozzle; 6 - fuel and oxidizer injection and mixing nozzles; 7 - oxidizer valve

Упражнения

11.1 *Переведите словосочетания со следующими терминами из текста: chamber, compressor, fan, fuel, inlet, motor, nozzle, propellant*.

altitude chamber, combustion chamber, cooling chamber, engine chamber, gas chamber, pressure chamber;

air compressor, axial compressor, centrifugal compressor, high-pressure compressor, low-pressure compressor;

axial-flow fan, centrifugal fan;

alcohol fuel, aviation fuel, gas fuel, hydrogen fuel, kerosene fuel, liquid fuel, nuclear fuel, petroleum fuel, rocket fuel, solid fuel;

air inlet, nozzle inlet, variable inlet;

electric motor, hydraulic motor, jet motor, liquid motor, pulsejet motor, rocket motor, turbine motor;

adjustable nozzle, aerodynamic variable nozzle, exhaust nozzle, exit nozzle, fixed-area nozzle, rotating nozzle, vectorable nozzle;

gaseous propellant, liquid propellant, solid propellant.

11.2 а) *Переведите без словаря следующие английские слова из текста, имеющие общий корень с русскими словами.*

compressor re, configuration re, cycle *n,* cylinder *n,* efficiency re, fact *n,* fundamental *a,* gas *n,* perimeter *n,* position *n,* principle re, rocket *a,* standard a, system *n,* turbine *n,* type *n.*

б) *Уточните значение нижеприведенных слов в словаре. В тексте урока* их *рекомендуется перевести следующим образом*:

Абзац 1: propeller n воздушный винт.

Абзац 2: principal, *a* основной; variation *n* вариант; front *n* передняя часть; integral, *a* неотъемлемый; form *v* образовывать

Абзац 3: contribution n влияние; total, a полный; generate и создавать; propeller n воздушный винт.

Абзац 5: control o регулировать; operational, a эксплуатационный; limit o ограничивать.

Абзац 6; limitation n недостаток.

Абзац 7: complexity / сложность.

Абзац 8: specific, a удельный; accelerate и ускорять.

Абзац 9: commercial, a гражданский.

Абзац 10: injection /г впрыск; accelerate *v* разгонять(ся); operate *v* работать; limited *p.p.* ограниченный; principally adv главным образом.

Абзац 11: operation *n* полет; inject *v* впрыскивать; eject *v* выбрасывать; generate v *создавать*.

Абзац 12: motor *n* двигатель; operate *v* работать.

11.3 *Переведите глаголы со следующими суффиксами.*

-ize: characterize, crystallize, magnetize, organize, revolutionize, standardize, summarize, vaporize; centralize, generalize, localize, neutralize, normalize, realize, specialize;

-ify: gasify, classify, qualify; amplify, electrify, intensify, justify, purify, rarify, simplify, solidify;

-en: frighten, hasten, heighten, lengthen, lighten, strengthen, blacken, brighten, broaden, fasten, harden, soften, stiffen, straighten, tighten, weaken, widen, worsen;

-ate : accelerate, actuate, complicate, create, decelerate, deviate, duplicate, eliminate, estimate, incorporate, integrate, investigate, regulate, rotate.

11.4 *Прочтите и запомните наиболее употребительные составные глаголы*

bring - приносить	bring about - приводить к (результату)
	bring down - сбивать
	bring up - поднимать (вопрос)
build - строить	build up - создавать, образовывать
carry - нести	carry away- уносить, отводить
	carry on - проводить (опыт)
	carry out - выполнять
do - делать	do away - избавляться
find - находить	find out - выяснять, выявлять
get - получать	get out - выходить
give - давать	give off - отдавать, излучать
	give up - отказываться
go - идти	go on - продолжать
	go over - рассматривать
look - смотреть	look ahead - предвидеть
	look for - искать
	look through - просматривать
	look upon - рассматривать
make - делать	make out - доказывать, выявлять
	make up - устанавливать
put - класть, ставить	put away - убирать, устранять
	put down - записывать
	put forward - выдвигать
take - брать	take away - убирать, снимать
	take off - снимать; взлетать
	take for - принимать за
	take up - браться за
turn - поворачивать	turn off - выключать
	turn on - включать

	turn to - обращаться к
	turn out - оказываться
work - работать	work out - разрабатывать

11.5 *Переведите существительные, соответствующие составным глаголам.*

cut in - включать	cut-in
cut off - выключать	cut-off
cut out - выключать	cut-out
fall away - отделяться	fall-away
flame out - прекращать горение	flame-out
fly off - взлетать	fly-off
lift off - отрываться от земли	lift-off
lock on - захватывать цель	lock-on
nose over - капотировать	nose-over
nose up - поднимать, задирать носовую часть	nose-up
roll off - креиться	roll-off
run in - обкатывать двигатель	run-in
run up - гонять двигатель на больших оборотах	run-up
slow down - снижать (скорость)	slow-down
slow up - снижать (скорость)	slow-up
splash down - приводняться	splash-down
take off - взлетать	take-off
turn about - делать разворот на 180°	turn-about
turn around - делать разворот на обратный	turn-around
warm up - прогревать	warm-up

11.6 *Переведите предложения, обращая внимание на перевод инфинитива в функции подлежащего и дополнения.*

a) 1. To land the airplane at night is rather difficult. 2. To investigate the danger of radiation is quite necessary. 3. To release the undercarriage was impossible and the airplane crashed on landing. 4. To determine the accurate position of the plane is the task of the navigator. 5. To provide an explanation for this phenomenon is the task of the present article.

b) 1. It was essential to solve the problem of aerodynamic stability. 2. It is important to determine the velocity of a rocket. 3. It is necessary to protect the occupants of a space station from the intense solar-particle radiation. 4. At this period of the year it is possible to launch a probe into a circumnavigation trajectory of Mars. 5. It was possible to make only general conclusions from the results of test flying.

c) 1. The pilot decided to use the automatic landing system. 2. Here we should like to discuss some methods of training for manned space flight. 3. The astronaut wanted to ensure the successful coupling of space vehicles in orbit.

11.7 *Переведите предложения, обращая внимание на перевод инфинитива в составном именном сказуемом*.

1. The aim of this paper is to find basic properties of fluid oscillations. 2. One answer to this problem is to use electronic-beam steering rather than mechanical steering. 3. One of the most important functions of unmanned lunar program will be to find suitable lunar sites. 4. The basic idea is to determine the pressure under zero-gravity conditions. 5. The object of this discussion is to describe some probable future propulsion systems. 6. The objective will be to determine the most promising device for a fuel tank. 7. Our problem is to determine the unknown shape of the fuel tank. 8. The basic problem was to determine the atmospheric conditions. 9. The purpose of the surface-to-underwater missile is to enable the ship to destroy targets. 10. The purpose of this paper is to present a brief description of the spacecraft and its systems and to provide a limited description of the performance of the spacecraft during the manned orbital flight, li. The purpose of this chapter is to apply the basic principles of rocket motion to the various phases of space mission. 12. The main task of each space flight is to overcome the gravitational field and pass through the atmosphere of the Earth or some other planet.

11.8 *Переведите предложения, обращая внимание на перевод инфинитива в функции обстоятельства цели и следствия*.

a) 1. The crystal maser must be held at a very low temperature in order to operate efficiently. 2. Refrigeration units are used in airplanes to cool air. 3. This research airplane is designed to fly at more than 3,600 mph and to reach heights of up to 100 miles. 4. To fly day after day in high-speed airplanes the pilot must be physically and mentally fit. 5. To find the answers to these questions and many others several research rockets were sent into space. 6. To investigate this effect we changed the previously described calculations. 7. To insure a uniform internal temperature inside the generator the engineers designed a special thermal control device.

b) I. Mercury is too small to retain a considerable atmosphere. 2. These laboratory experiments are too difficult or costly to per- form. 3. The mass of an electron is so small as to be neglected. 4. This method was so complicated as to give only little results. 5. The space environment between 200 and 1,000 km from the surface of the Earth can be considered safe enough to establish stable orbits for the various types of space vehicles. 6. The velocities are not high enough to be of major concern. 7. Engines of the carrier rocket must have sufficient power to launch the satellite into the Earth's orbit.

11.9 *Переведите предложения, обращая внимание на перевод инфинитива в функции определения*.

1. There are several hypotheses to account for the Moon's origin. 2. The first living being to experience weightlessness for a long period of time was the dog Laika. 3. Tests to determine properties of propellants are currently in preparation at the laboratory. 4. There are no winds or rain to erode the surface of the Moon. 5. The space vehicles to be discussed in this section can be divided into two broad categories. 6. There are several problems still to be considered. 7. Now we shall discuss the system of units to be used in the next section of the article. 8. Propellant properties are the main two factors to be considered here. 9. The Moon

was the first celestial body to be reached by men. 10. In the experiments to be described in this section, the electric field has a frequency of 400 Hz. 11. For many years to come the solar system will be the arena for Astronautical investigations. 12. The reciprocating engine probably will be retained for many years to come for use in low-speed airplanes. 13. Leonardo da Vinci was the first man to treat aeronautics scientifically. 14. Valentina Tereshkova is the first woman to orbit the Earth. 15. Galileo Galilei was the first to examine the Moon in detail through a telescope and to draw a certain conclusion from what he saw. 16. The Russian scientist Konstantin Tsiolkovsky was the first to understand the use of rockets in space travel.

11.10 *Найдите в тексте модуля (абзацы 3, 4, 8 и 9) по одному инфинитиву и переведите их в тексте.*

11.11 *Ответьте на вопросы к тексту*.

1. Where is the fan mounted in the turbo-fan engines? 2. How are turbo-fan designs called? 3. What is the fundamental difference between a turbofan and a turboprop? 4. In what aircraft are turbo-fans most widely used? 5. What engine is simpler, a turbofan or a turboprop? 6. What engine is lighter, a turbofan or a turboprop? 7. What enables a turbofan to achieve a relatively low specific fuel consumption? 8. Why does a turbo-fan produce much more thrust than a turbojet during take-off and the initial climb? 9. What is the simplest jet engine? 10. What jet propulsion device is the oldest and most widely known?

2.12 Модуль 12

Лексико-грамматические темы:

1 Перевод терминологических сочетаний.

2 Сложные существительные.

3 Инфинитивные обороты.

Термины:

altimeter - высотомер
bar - стержень; полоса
behavior - характеристики
boost pressure - давление наддува
branched pipe - ответвленный трубопровод; патрубок
device - устройство; механизм; приспособление
direction indicator - указатель курса
directional gyro курсовой - гироскоп; гиро полукомпас
encounter - встречать
environment - окружающая среда
gauge - манометр
gyro horizon - авиагоризонт
head - головка
horizon - горизонт; авиагоризонт
induction - впуск; всасывание
mach meter - указатель числа М
master engine - основной двигатель
meter - измерять
propulsion - тяга; силовая установка
sharp turn - крутой разворот
skid - скользить (при развороте)
slip - скользить
straight and level flight - прямолинейный горизонтальный полет
Pitot tube - трубка Пито
turn-bank indicator - указатель крена и поворота
wide turn - пологий разворот

Aircraft instruments

1 Aircraft instruments are basically devices for obtaining information about the aircraft and its environment, and for presenting that information to the pilot in a concise form. Their purpose is to detect, measure, record, process and analyze the variables encountered in flying an aircraft. They are mainly electrical, electronic or

gyroscopic. They are concerned with the behavior of the engines, the speed, height and attitude of the aircraft and its whereabouts. Instruments concerned with the whereabouts of an aircraft are navigation instruments and these are dealt with separately in Lesson 13. Lesson 12 is concerned with instruments that obtain and present information on flight (excluding whereabouts and direction), propulsion, fuel, airframe, electrical and pressure systems.

2 The history of the development of aircraft instruments shows a movement away from instruments that merely obtain and present information to those that automatically do something about the information they receive. For example, at one time an instrument would have told a pilot that his aircraft was nose-down, and it would have been left to the pilot to take corrective action manually if necessary. Nowadays it is often the case that a pilot will "instruct" an automatic system, for example, to fly level, and the appropriate instrument will usually show the "instruction" is being "obeyed" and only exceptionally that something is wrong because the automatic system has failed.

3 A modern aircraft cockpit looks on first sight to consist of a bewildering array of instruments that no human being could ever master or understand. It looks as though so much information presented simultaneously could never be absorbed by a small team of two to four people with any certainty. However, instrument panels are designed in such a way that instruments are grouped logically so that to a pilot it is an "open book".

Instruments Concerned with Flight Information

4 Height. An instrument for measuring and showing height above a level of reference is called an altimeter. It is basically an extremely sensitive aneroid barometer which measures static pressure at the height the aircraft is flying and, according to the difference between mis and the pressure at a predetermined reference level, indicates height above reference level. There are three possible reference levels the first is a theoretical mean sea-level reference which is of no use on landing. The second is true pressure at airfield height so that the altimeter

reads zero on landing. The third is true pressure at sea-level so that the altimeter indicates true altitude on landing

5 A radio altimeter measures height above terrain and so would not help to maintaining a constant flight-level over land. Its purpose can be stated quite simply as that of measuring the depth of air immediately below the aircraft, rather as sounding devices in a ship are used to measure the depth of water beneath its keel.

6 Vertical Speed. The rate of change in altitude is measured and shown by a vertical speed indicator. This indicates the speed of climb (ascent) or descent (dive or glide).

7 Horizontal Airspeed. Horizontal airspeed is measured and shown by an airspeed indicator (ASI). The ASI is an aneroid capsule which measures the difference between static pressure and the pressure inside an open-ended tube, called Pitot tube, usually situated on or underneath the nose of the aircraft. The airspeed indicator tells the pilot what his airspeed would be if he were flying at sea-level under standard atmospheric conditions, temperature 59°F (15°C) and barometric pressure 29.92 inches (760 mm). True airspeed (TAS) may be calculated approximately from indicated airspeed (IAS) by adding 2 per cent to the IAS for everyone thousand feet above sea-level.

8 The mach meter indicates the Mach number which expresses airspeed as a fraction of the speed of sound. It is essential equipment on jet aircraft. ,

9 Turning Characteristics. Aircraft turning characteristics can be measured and shown by a simple device known as a turn-bank indicator. The turn-bank indicator tells the pilot two things Firstly it tells him whether he is doing a tight turn or a wide turn, and whether it is to port or starboard. Secondly, the turn-bank indicator tells the pilot whether, on the turn to right or left, his aircraft is slipping inwards or skidding outwards. In big aircraft information on turning and banking is incorporated in a flight system direction indicator.

10 Attitude. The attitude of an aircraft relative to the surface of the earth is shown by an "artificial" or "gyro" horizon. There is a horizon bar on the instrument that always remains parallel to the surface of the earth. Another small piece of

metal shaped to indicate the aircraft appears above or below the horizon bar if the airplane is in a climbing or gliding attitude. When the aircraft is banked to the left or right the imitation airplane in the instrument appears banked to the left or right.

11 Direction. An elementary direction-measuring instrument is a simple magnetic compass which may, however, be inaccurate by a degree or two in straight and level flight and much more inaccurate in turns. The magnetic compass is used in conjunction with a directional gyro which is not affected by the angles of bank normally employed in airlines.

Instruments Concerned with Propulsion Information

12 Speed. Engine speeds are measured and shown on rpm indicators which measure the revolutions per minute of the main rotor in each engine. Any differences in rpm from a master engine used as a basis for synchronizing are shown on a synchro scope.

13 Temperature. The temperature of each engine on an aircraft is measured and shown on a temperature indicator. Piston-engined aircraft have indicators for cylinder head temperature (CHT). Turbine engines have indicators for jet-pipe temperature (JPT) or turbine-gas temperature (TGT). All types of engines have oil temperature indicators showing the temperature of their lubricants.

14 Pressure. Various sorts of pressure occurring in a piston engine in operation are shown by instruments. A manifold pressure gauge is an instrument for measuring the absolute pressure in the induction system (a branched pipe for distributing air or a mixture to several cylinders) at a point standardized for each engine. Alternatively boost pressure, which is pressure in the induction system at a point standardized for each type of engine may be shown on a boost pressure gauge. Oil pressure is indicated by an oil pressure gauge.

Instruments Concerned with Information about Fuel

15 Fuel Content. Fuel tank contents indicators show how much fuel the aircraft has left at any moment of time. Usually each tank is metered individually, and the amount of fuel is measured in liters or by weight.

16 Fuel Flow. The fuel consumption of each engine is measured by fuel flow meters calibrated in kilos per minute. These are integrated in a device to indicate kilos gone since engines were started.

(to be continued)

Упражнения

12.1 *Переведите словосочетания со следующими терминами из текста: altimeter, device, horizon, instrument.*

airborne altimeter, aircraft altimeter, cabin altimeter, landing altimeter, radar altimeter, radio altimeter;

automatic navigation device, calibration device, sensing device;

approach horizon, artificial horizon, director horizon, gyro horizon;

airborne instrument, aircraft instrument, blind flying instruments, board instrument, electronic instrument, flight instrument, flying instrument, measuring instrument, navigation instrument, performance instruments.

12.2 *Прочтите и переведите сложные существительные. Назовите существительные, от которых они образованы*.

Образец: airspeed (air+speed) воздушная скорость

a) airbus, airflow, airframe, airline, airliner, airscrew;

lifeboat, life raft, lifetime;

radioactivity, radiolocation, radioman, radiosonde, radioelement, radiotelephone;

sideline, side gust, sideslip, side wash;

tail cone, tail hook, tailpiece, tailpipe, tail plane;

windscreen, windshield, Windstream;

b) airplane, floatplane, seaplane, tail plane;

aircraft, spacecraft;

airship, spaceship;

airman, crewman, spaceman, weatherman;

airport, spaceport;

nosewheel, tailwheel;

ampere meter, flowmeter, voltmeter.

12.3 *Переведите предложения, обращая внимание на перевод сложного дополнения, выраженного оборотом «объектный падеж с инфинитивом».*

1. For the illustrative purposes we assume a plasma to consist of three fluids. 2. The designer assumed the form of the tank to be spherical. 3. For simplicity hydrodynamicists believe the two fluids to be in viscid and incompressible. 4. On some occasions scientists may consider the acceleration of gravity to be constant. 5. Physicists consider nuclear energy to be the prime source of heat energy. 6. We may expect this new problem to be qualitatively like that discussed above. 7. We know an incompressible fluid to occupy this cylindrical tank of radius *a.* 8. The astronaut reported spacecraft mean temperature to exceed the designed temperature by 5°C. 9. The early artificial satellites showed the Earth to be surrounded by intense radiation. 10. The author of the paper states these motions to be initially irrotational. 11. Suppose the Earth's orbit to be a circle. 12. Suppose the Earth and Venus to move in coplanar circles. 13. The ancients thought electricity to be invisible fluid. 14. Until quite recently scientists thought the space between the Sun and the Earth and the planets to be "empty.

12.4 *Переведите предложения, обращая внимание на перевод сложного подлежащего, выраженного оборотом «именительный падеж с инфинитивом»:*

a) 1. The velocity at all points is assumed to depend only on *t.* 2. No other forces are assumed to act on the fuel tank bottom. 3. In this analysis the liquid is assumed to be in viscid and incompressible. 4. This condition is assumed to be

valid. 5. The angle between these surfaces is assumed to be 75°. 6. To early man the Earth was believed to be the centre of the Universe. 7. The polar caps of Mars are believed to be ice crystals. 8. Astronautics is considered to be the science and technology of the design and operation of space vehicles. 9. The speed of the aircraft at the time of the explosion is estimated to have been about 300 knots. 10. The first Earth's satellites were expected to stay on their orbits for a month or two. 11. The Sun is known to have a 11-year cycle of activity. 12. The rocket may be said to work on the reaction principle.

b) 1. At present the rocket engine appears to provide the best means for producing the tremendous thrust forces. 2. The artificial satellite appears to an observer on the Earth to remain fixed in space. 3. Two schemes appear to be particularly attractive for emergency landing. 4. The spacecraft appears to have encountered very few micrometeoroids in its travel. 5. The shape of Venus seems to resemble that of the Earth. 6. This wing structure seems to present serious problems. 7. Venus has a shape and surface conditions which seem to resemble those of the Earth. 8. The inner satellites of Saturn seem to be composed primarily of ice.

12.5 *Переведите предложения, обращая внимание на перевод оборота «for+существительное (или местоимение) + инфинитив».*

1. It has been necessary for scientists and engineers to develop new methods of tests. 2. It is important for the pilot to know the airplane construction. 3. The Sun is a power source which makes it possible for man to live on Earth. 4. The noise from the engine was so deafening that it was impossible for the passengers to talk with each other. 5. The Earth is not a perfect sphere. This fact makes it necessary for astronomers to make corrections for the Earth's slight oblations. 6. The necessity may exist for the pilot to reduce the speed of the airplane. 7. For problems to be solved on large computing machines it is better to use symmetric matrices. 8. For such a system to operate efficiently, the propellant must be kept quiescent. 9. The returning spaceship must intersect the beam patterns from two

ground stations for its position in space to be determined. 10. This value must be negative for Eq. (5) to hold. 11. The flow field shows the tendency for surface distortion to occur.

12.6 *Найдите в тексте модлуя (абзацы 1, 4, 6, 9, 11, 13 и 15) по одному словосочетанию и переведите их на русский язык. Обратите внимание на последовательность расположения слов в английских и в русских словосочетаниях.*

12.7 *Ответьте на вопросы к тексту*.

1. What is the purpose of aircraft instruments? 2. What does the history of the development of aircraft instruments show? 3. In what way are instrument panels designed? 4. What instrument is called an altimeter? 5. What is the purpose of a radio altimeter? 6. By what instrument is the rate of change in altitude measured? 7. What does the airspeed indicator measure? 8. What does the mach meter indicate? 9. What instrument shows direction? 10. What does the fuel tank contents indicator show?

2.13 Модуль 13

Лексико-грамматические темы:

1. Перевод терминологических сочетаний.
2. Сложные прилагательные.
3. Инфинитив в различных функциях и оборотах *(повторение).*

Термины:

alert - привести в состояние готовности
buried - утопленный

control column - ручка управления
control panel - панель управления
detector - чувствительный элемент; датчик
duplicate - дублирующий механизм
flight recorder - бортовой самописец
leading edge - передняя кромка
manhandling - управление вручную
margin of safety- запас прочности
pen recorder - самописец пером
pi tot head - приемник полного давления
Prestel - преждевременный срыв потока
recorder - самописец
stick shaker - вибросигнализатор ручки управления
store - запоминающее устройство; хранить
tape recorder - ленточный самописец

Aircraft instruments

(continued)

Instruments Concerned with Information about Conditions on the Outside of the Airframe

1 Temperature. The outside air temperature (OAT) gauge gives the pilot general information about the temperature of the air immediately surrounding the airframe. This will enable him to assess the influence of temperature on certain performance aspects of the aircraft. He needs to know particularly whether the temperature is within certain limits in humid conditions so that there is danger of ice forming. This enables action to be taken to heat the affected areas. Critical parts include the leading edges of the wings, control surfaces of the tail unit, engine air intakes and the pilot head.

2 On the other hand, there are certain parts of the airframe that might possibly become overheated because they are close to something like an engine or a generator producing a lot of heat. The temperature of important zones of the airframe near a heat-producing component, for example the rear spar of a

mainplane containing a "buried" jet engine, is monitored by electrical temperature bulbs.

3 Cabin temperature indicators are normally fitted to modern aircraft to enable the pilot to confirm that the automatic system controlling temperature is in working order. Cabin humidity indicators may be fitted but humidity control systems are rare.

4 Pressure. It is important to know the pressure inside the passenger cabin because it must be neither too high nor too low for human comfort. It is also important to know the difference between the air pressure outside the cabin and the air pressure inside it because it represents a force exerted in normal circumstances in an outwards direction. The difference in pressures must be kept within limits imposed by the strength of the fuselage. The cabin altitude indicator is the instrument monitoring passengers' comfort and the cabin differential pressure indicator monitors the margin of safety.

5 Other pressures concerned with the airframe that must be watched are the hydraulic and pneumatic systems used in powering controls of such moving parts as brakes, undercarriage and so on.

Instruments Concerned with Information about the Aircraft's Electrical System

6 Voltage. Direct current and alternating current voltages are measured and shown by AC and DC voltmeters. Where information is required only periodically from several points it is usual to have only one voltmeter with a device for selecting each point of measurement as required.

7 Current. The instrument that measures an electric current in amperes is called an ammeter.

8 We may summarize the nature of information presented by aircraft instruments as follows:

– it may be continuous presentation, as in the case of a gyro-horizon.

– it may be on-tap presentation, as in the case of moving a switch for a reading on a voltmeter.

– it is always concerned with situations that are expected to change within certain limits, for example temperature.

– most is presented visually.

9 Attempts are made to minimize the heavy demands made on the aircrew's use of their eyes by employing their senses of hearing and touch. Unfortunately, at the same time there are ever increasing demands on hearing coming from the various radio aids now installed in aircraft.

10 However, some of the instruments for alerting aircrew to the fact that something abnormal is happening do employ the senses of hearing and touch. Throughout the aircraft there are various heat, flame and smoke detectors which relay their warnings to the pilots by bell as well as by light. If for some reason or other the undercarriage has not been lowered for an intended landing, in addition to a warning light sometimes a horn is operated by the throttle setting. If the speed of the aircraft inadvertently drops below what is regarded as safe, a mechanical instrument called a stick-shaker, operating from a device on the underside of a wing, gives warning of a pre-stall condition by shaking the control column. On the other hand, warning of excessive speed is given by means of a horn.

11 The history of aircraft development is, among other things, the change from manhandling aircraft to the automatic handling of an aircraft. The history of the development of aircraft instruments shows a movement away from instruments that merely obtain and present information to those that automatically do something about the information they receive. A notable exception to this general trend is a flight recorder which does not present information at the time of obtaining it but stores it away for future reference. The need for flight recording has been recognized in aviation for a very long time. Early methods of meeting this need were by the pilot or observer recording data normally on a notepad, or by relatively crude pen recorders or even a camera photographing the pilots' instruments or duplicates of them.

12 Today, nearly all commercial aircraft are required to carry a recorder whose performance far exceeds the maximum capability of these simpler devices. All the pilot sees of it is a small control panel on which he can set some dials which correspond to the date and flight number. This information is inserted on the recording medium before every flight and the recorder can detect whether the aircraft is flying and. switch itself on or off accordingly. Data collected at any point on the aircraft are transmitted electrically to a central electronic unit where they are converted to a binary code like that used in computers. This ensures that accuracy can be of the order of 1 part in 1,000. It is stored in this form in an almost indestructible store normally consisting of an armored cassette containing about 50 miles of hair-thin magnetic steel wire operating on the same principle as a tape recorder. This cassette can be removed from the aircraft at any time for decoding and analysis. Any lengthy or repetitive analysis work involved is carried out by computer.

Упражнения

13.1 *Переведите словосочетания со следующими терминами из текста: detector, gauge, indicator, recorder.*

angle-of-attack detector, course detector, fire detector, heat detector, ice detector, infra-red detector, smoke detector, vibration detector

air gauge, altitude gauge, angle gauge, barometer gauge, cabin-pressure gauge, fuel gauge, fuel-pressure gauge, gas-density gauge, gasoline gauge, gas-pressure gauge, Mach-number gauge, oil gauge, oil-pressure gauge, oil-temperature gauge, temperature gauge;

airspeed indicator, air-temperature indicator, altitude indicator, angle-of-attack indicator, attitude indicator, bank indicator, bank-and-turn indicator, climb indicator, course indicator, direction indicator, dive-angle indicator, engine speed indicator, flight indicator, height indicator, landing-speed indicator, Mach

indicator, rate-of-climb indicator, rate-of-descent indicator, revolution indicator, speed indicator, temperature indicator;

airborne recorder, airspeed recorder, altitude recorder, course recorder, flight recorder, flight path recorder, pressure recorder.

13.2 *Переведите сложные прилагательные, образованные по модели «существительное + прилагательное».*

Образец: oxygen-rich (oxygen+rich) *с избытком кислорода, богатый кислородом*

temperature-dependent; time-dependent; pressure-dependent; accident-free; air-free; fault-free; friction-free; trouble-free; vortex-free;

combat-ready; flight-ready;

heat-resistant; fire-resistant;

oxygen-sensitive; pressure-sensitive; temperature-sensitive.

13.3 *Переведите сложные прилагательные, образованные по модели «существительное + причастие II».*

Образец: sun-warmed (sun+warmed) **согреваемый** *солнцем*

air-based; earth-based; ground-based; land-based; sea-based; water-based;

air-controlled; ground-controlled; pilot-controlled; radio-controlled; trajectory-controlled; wire-controlled;

air-cooled; gas-cooled; liquid-cooled; water-cooled;

fabric-covered; ice-covered; linoleum-covered; metal-covered, paper-covered, rubber-covered; snow-covered;

air-driven; battery-driven; belt-driven; engine-driven; hand-driven; spring-driven; steam-driven; turbine-driven; water-driven; wind-driven;

ground-guided; radio-guided; wire-guided;

air-launched; ground-launched; fighter-launched; satellite-launched; space-launched;

factory-made; hand-made; machine-made; man-made;

fuselage-mounted; wing-mounted; pod-mounted; truck-mounted;

air-operated; foot-operated.; motor-operated, power-operated; pressure-operated;

battery-powered; engine-powered, jet-powered; man-powered; rocket-powered; sun-powered; water-powered;

jet-propelled; rocket-propelled; steam-propelled;

earth-stabilized; fin-stabilized; position-stabilized; roll-stabilized; space-stabilized.

13.4 *Переведите предложения, обращая внимание на перевод инфинитива в различных функциях и оборотах (повторение).*

1. Since the Moon was first observed by telescope, several ideas have been put forward to account for the appearance of its surface. 2. The major objective of our program is to improve performance without reducing reliability. 3. The light areas of Mars seem to be sand deserts; the dark areas of Mars were formerly believed to be oceans. Now they are proved to be dry. 4. The purpose of tests is to determine the wing loading. 5. We expect the new aircraft to fly this year. 6. To maintain the forward movement of the wing through the air, a force equal to the drag must be constantly exerted. 7. Comets are known to have highly eccentric orbits. 8. A spaceship is designed to sustain a man in a space environment for a given period, to protect him from external heating and acceleration during exit and re-entry, to provide him with means for controlling the attitude of the spaceship, to permit him to perform observations and several experiments in space, and to bring him safely back to Earth. 9. The temperature in the stratosphere is estimated to be as low as 130°K. 10. The problems connected with the construction of large satellites by men in space are chiefly to keep the man alive while outside his spaceship, and to enable him to move in the direction desired. 11. The stabilizer of an airplane is considered to consist of two sections.

13.5 Най*дите в тексте модуля (абзацы 3, 4 и 6) по два словосочетания и переведите их на русский язык. Обратите внимание на последовательность расположения слов в английских и в русских словосочетаниях*.

13.6 Н*айдите в тексте модуля в абзаце 1-девять, в абзаце 11-шестнадцать и в абзаце 12- двадцать слов, имеющих общие корни в английском и в русском языках. Переведите их на русский язык*.

13.7 *Найдите в тексте модуля (абзацы 1, 2 и 4) по два инфинитива. Найдите инфинитивный оборот в абзаце 12. Переведите их на русский язык*.

13.8 *Ответьте на вопросы к тексту*.

1. What information does the outside air temperature gauge give the pilot? 2. Why are cabin temperature indicators fitted to modern aircraft? 3. Why is it important to know the pressure inside the passenger cabin? 4. Why is it also important to know the difference between the air pressure outside the cabin and the air pressure inside it? 5. By what instruments are direct current and alternating current voltages measured? 6. In what units does the ammeter measure an electric current? 7. By what means do various heat, flame and smoke detectors relay their warnings to the pilots? 8. What is operated if the undercarriage has not been lowered for an intended landing? 9. Does a flight recorder present information at the time of obtaining it? 10. Must all commercial aircraft carry a recorder?

2.14 Модуль 14

Лексико-грамматические темы:

1. Перевод терминологических сочетаний.
2. Сокращенные слова.
3. Функции герундия.
4. Отглагольное существительное.

Термины:

aid - оборудование; средство; устройство

astro fix - астрономическая ориентировка

band- полоса частот; диапазон

crosswind - боковой ветер

dead-reckoning navigation - навигация счислением и прокладкой пути

drift - снос

homing - наведение

lane - воздушная трасса

NDB (nondirectional beacon) - ненаправленный маяк

path - траектория

radar device - радиолокационное устройство

rebound отскок

reference - начало отсчета; начальные условия

self-contained - автономный

travel - совершать полет

VOR (very high frequency omnidirectional radio range) - всенаправленный ультракоротковолновый радиомаяк

Aircraft navigation

1 The most elementary form of aircraft navigation is where the pilot looks down from his cockpit on to a familiar terrain and guides his aircraft from one landmark to another. Because the territory is well known to the pilot he requires no device or instrument to assist him. If the territory over which he is flying is not familiar he will require at least a map. In both cases the pilot is using what might

be called the "inductive" method in that he observes features on the surface and obtains an instant "fix" on his position, without having to do any calculations involving past movement of the aircraft.

2 Astronomical navigation is also inductive. The pilot observes the position of celestial bodies and with the help of an accurate clock, and instruments for measuring angles and sensing the vertical, he can compute his position. Calculation is involved but not basically of past movement of the aircraft, although account must be taken of the fact that astro fixes are normally "running" fixes.

3 Another well-known method of navigation, sometimes referred to as the "historical", is based on a record of the movement of the aircraft from a known point. From this record of what has happened before, present position and future movement may be deduced. This might be called the "deductive" method to distinguish it from the "observational" or "inductive" method referred to above. In practice this method is known as dead reckoning navigation. The only aids required in an elementary form of DR navigation are a compass, a clock, an airspeed indicator, a forecast wind and a map. If a pilot knows the direction in which he has been travelling from a known point, and the length of time and speed at which he has been travelling from that known point he can work out his present position and future course.

4 As navigational aids have become more sophisticated, methods are now usually classified by reference to the nature of the aids rather than the inductive or deductive, historical or observational process. So now there is an important distinction, for example, between independent and dependent systems. The independent systems are self-contained onboard the aircraft so that they do not require any assistance from the ground, except of course for maintenance. The dependent systems (sometimes called external reference systems) need the co-operation of ground-based components.

5 Yet behind this new classification we can see the old one. Self-contained systems operate by not getting lost. For example, the Doppler system starting from

a known point deduces present position from a record of velocity over the ground. External reference systems on the other hand often provide an immediate fix.

6 Independent (Self-contained) Systems of Navigation. Under this category we must include those systems where information is obtained either by human eyes or by radar on geographical features (on the ground or in the air) to determine present position.

7 Thus, the simplest form of navigation described above is both independent and observational. A radar device that tells a pilot he is a mile from a mountain would also come in this category.

8 Doppler is at present the most widely used self-contained aid working on dead reckoning-principles. It sends radio signals of a known frequency to the ground below and measures their frequency on the rebound. By using the principles of the "Doppler" effect it then measures the aircraft's ground speed. The principle referred to is that to a moving observer the frequency of a radiation appears to shift by an amount proportional to the velocity of the observer. So, starting from a known point and a difference in radio frequencies the system deduces present position through ground speed, and aircraft heading (in other words: -aircraft velocity).

9 The next most widely used self-contained aid working on dead reckoning principles is the inertial system. This is since if a vehicle starts from a known point and is equipped with extremely sensitive means of measuring accelerations along precisely defined paths this can be related to time, and distance travelled to present position. Basically, the instrument consists of gyros and accelerometers.

10 Dependent (External Reference) Navigation Systems. There are invisible roads built into the skies over Europe, America and many other parts of the world where the air traffic is dense enough to justify the expense of maintaining them. These airways, sometimes called air traffic lanes, are commonly constructed of beams of radio waves.

11 A beam of radio waves is just as real to the pilot as a road of concrete is to the motorist. But a radio beam is not a two-dimensional path like a road; it is

three-dimensional like a tunnel. The idea of an airplane flying through a tunnel is helpful except that the walls offer no construction in a radio beam. The airplane can stray through the walls. It does not have to wait until it reaches the end to get out.

12 At the end of each tunnel is some sort of radio transmitter. This sends out the radio signals that form the tunnel. To be able to make use of the airway the pilot must tune a radio receiver in the cockpit to the frequency of the radio transmitter.

13 Nowadays, most airways are defined by VOR station, though many are still using non-directional beacons (NDBs). NDBs are comparatively cheap and simple but have several major disadvantages: (1) they operate in the overcrowded "medium frequency" band, which is subject to static interference; (2) as the name indicates, the radiation from an NDB does not give the pilot a positive "tramline" but only an indication that it is now on a certain bearing from the aircraft. Whilst the aircraft is heading towards the NDB, its path may describe a parabola, due to drift caused by the local wind effect on the aircraft.

14 The VOR (Very High Frequency Omnidirectional Radio Range) does not suffer from these disadvantages. It does provide a static-free "tramline" down the centre of the airway, which it is easy for an aircraft to follow regardless of crosswind effect.

15 Whichever system of defining airways is used, it is nowadays common practice to present the information visually in the cockpit on dials.

Упражнения

14.1 *Переведите словосочетания со следующими терминами из текста: aid, navigation, navigator, reference*.

air-navigation aids, long-distance aids, radar aid, radar-navigation aid, radio aids, radio-navigation aids, short-range aids;

aerial navigation, air navigation, celestial navigation, dead-reckoning navigation, enroute navigation, flight navigation, ground navigation, independent navigation, long-range navigation, medium-range navigation, radar navigation, radio navigation, self-contained navigation, short-range navigation, star navigation, terrestrial navigation;

air navigator, automatic navigator, bombardier-navigator, Doppler navigator, robot navigator, second navigator;

attitude reference, azimuth reference, directional reference, heading reference.

14.2 *Переведите сокращенные слова, построенные по модели: «начальный элемент первого слова+целое второе слово». (Такие слова читаются слитно).*

Образец: radnote (radio+note) *радиограмма*

A-bomb (atom+bomb);

H-bomb (hydrogen+bomb);

ammeter (amper+meter);

helipad (helicopter+pad);

heliplane (helicopter+ plane);

heliport (helicopter+port);

helitaxi (helicopter+taxi);

midair (middle+air);

mid-chord (middle+chord);

midspan (middle+ span);

midwing (middle+wing);

navaid (navigation+aid);

paraboy (parachute+boy);

paradiver (parachute+diver);

paradoctor (para-chute+doctor);

paradrpp (parachute+drop);

paranurse (parachute+ nurse);

parawing (parachute+wing);

radome (radio+dome);

ramark (radio+mark);

velocimeter (velocity+meter).

14.3 *Переведите сокращенные слова, образованные по модели «начальный элемент первого слова + конечный элемент второго слова». (Такие слова читаются слитно).*

Образец: avionics (aviation+electronics) *авиационное электронное оборудование*

elevon (elevator+aileron);

flaperon (flap+aileron);

motivator (motion+elevator);

naviation (naval+aviation);

naviator (naval+ aviator);

neutron (neutral+electron);

pibal (pilot+ball);

positron (positive+electron);

radiotronics (radio+electronics);

transceiver (transmitter-(-receiver);

transponder (transmitter-Fresponder).

14.4 *Переведите сокращения, состоящие из начального элемента слова. (Такие сокращения читаются как несокращенные слова.)*

approx approximate MAX; max maximum

Fig; fig figure OX; OXY; oxy oxygen

GAL; gal gallon PROP; prop propeller

IN; in inch sec section, secondary

LAB; lab laboratory tac tactical

14.5 *Переведите сокращения, состоящие из согласных букв. (Такие сокращения читаются как несокращенные слова.)*

APRX; aprx approximately KN; kn knot

FT; ft foot Mk mark

H; h hour mm. millimeter

KG; kg kilogram YD; yd yard

KM; km kilometer

14.6 *Переведите сокращения, состоящие из начальных букв сокращенных слов. (Каждая буква читается как в алфавите.)*

A	attack, airplane	NASA	National Aeronautics and Space Administration
B	bomber		
C	cargo airplane	USAF	United States Air Force
F	fighter	USN	United States Navy
H	helicopter	RAF	Royal Air Force
M	missile carrier	RN	Royal Navy
R	reconnaissance airplane	NA	North American
T	trainer	GE	General Electric
U	utility airplane	RR	Rolls-Royce
W	weather airplane	HS	Hawker Siddeley

14.7 *Переведите предложения, обращая внимание на перевод подлежащего, выраженного герундием*.

1. Solving these complex equations can require a digital computer. 2. Landing on the Moon is considerably different from landing on the Earth because of the lack of atmosphere on the Moon. 3. Flying over the ice in polar regions is extremely difficult. 4. Landing on the planets will vary according to atmospheric

conditions. 5. Launching a man or a crew into space can be accomplished in several ways.

14.8 *Переведите предложения, обращая внимание на перевод составного именного сказуемого, выраженного герундием.*

1. The main point of a transformer is raising or lowering voltage. 2. The advantage of the new equipment is functioning under wide changes of temperature and pressure. 3. The purpose of the satellite was lifting the airborne instrumentation to a vertical distance of 250 miles from the surface of the Earth. 4. The main advantage of the rocket engine is operating independent of its environment medium. 5. The designation of the wind shield made of highly tempered glass is withstanding almost 1,000 degrees Fahrenheit. 6. The first task is predicting accurately the remaining time of powered flight until thrust termination. 7. The main purpose of an active communication satellite is receiving a signal, amplifying it and returning it to the surface of the Earth. 8. The principal interest of the author of the paper was verifying the shift of resonance frequency with amplitude.

14.9 *Переведите предложения, обращая внимание на перевод дополнения, выраженного герундием*.

1. The automatic landing system must ensure landing the passenger airplanes at night. 2. The aircraft designer suggested testing this equipment under altitude conditions. 3. The test engineer avoided using this new instrument under high temperatures. 4. Capillary forces prevent air from entering the tube. 5. The film serves to demonstrate a new approach-in using the computer. 6. The rocket engine differs from the air-breathing engine in carrying its own oxidant as well as its fuel. 7. Our scientists succeeded in solving the problem of landing the airplanes at night. 8. Many pilots dream of going to the Moon and distant planets. 9. For years men have dreamed of placing large platforms in orbit around the Earth. 10. Our proof will depend on showing that X= 0,11. The radar homing types are all based upon

receiving some detection and tracking signal from the target. 12. These complex problems are associated with maintaining the health of the astronaut.

14.10 *Переведите предложения, обращая внимание на перевод определения, выраженного герундием*.

1. The idea of flying has existed in men's minds from time immemorial. 2. There is no doubt that aviation is a safe means of travelling. The risk of flying by an airplane is not very much greater than the risk of going by train or bus. 3. Scientists are trying to develop better ways of lifting space vehicles from the Earth. The problem of escaping from the Earth is essentially a matter of-overcoming the gravitational field of the Earth. 4. The task of flying to the Moon is not an easy one. 5. There is little hope of discovering, from the Earth, another member of our solar system. 6. Space orbital rendezvous is the technique of bringing together in orbit two or more spacecraft. There are several methods of accomplishing the rendezvous maneuver. 7. This article gives a simple method for estimating pressure distribution. 8. There are two principal methods for determining the distances and velocities to the stars. 9. The rocket offers a means for escaping the Earth and for creating a research station in space. 10. Systems for detecting, inspecting, and, if necessary, attacking enemy satellites and space vehicles can be either ground- or space-based. 11. Another interesting device for testing materials at high temperatures and speed is hypersonic shock tube.

14.11 *Переведите предложения, обращая внимание на перевод обстоятельства, выраженного герундием.*

1. Peak temperatures occur after heating the test specimen. 2. The astronaut orbited the Earth 22 times before guiding his spacecraft safely back to a landing in the Pacific Ocean. 3. In preparing man for space flight care should be taken of his health. 4. In returning from the Moon, the spacecraft must be accelerated to a velocity greater than "escape velocity". 5. Upon eliminating *w* from *Eq.* (2) we obtain the following results. 6. Man can live on liquid foods for weeks without

losing his weight. 7. It is not possible to understand the reasons for all these shapes of the wing without first understanding the reason for sweepback itself. 8. The velocities of stars can be determined by examining the spectrogram of the light which comes from them. 9. The principle of a satellite is very simple. A good analogy may be obtained by tying a stone to a piece of string and whirling it round in a circle. 10."Reliability of the construction can be improved by using additional elements. 11. This task is accomplished by launching a spacecraft and the fuel separately into orbit. 12. Midcourse corrections are made by sending pitch and roll commands from the ground to the satellite. 13. Big rockets have been used for launching satellites into the Earth orbit. 14. As on the surface of the Earth, the magnetic field in space can also be used for determining directions of flight.

14.12 *Переведите предложения, обращая внимание на перевод отглагольного существительного*.

1. The falling of the aircraft began soon after the explosion. 2. Sometimes the buffeting of an airplane occurs only in a Mach number range. 3. The automatic opening of -a parachute increases the chance of the pilot survival. 4. The testing of missile equipment is long and complicated. 5. The heating of an aircraft skin increases rapidly at the higher speeds. 6. The year 1957 saw the launching of the first artificial Earth satellite and the beginning of a new era of scientific exploration in space. 7. The launching of spaceships from the Earth orbit presents several previously unfamiliar technical problems. 8. A galaxy is a grouping of stars, dust clouds, and gases.

14.13 *Найдите в тексте модуля в абзаце 2- двенадцать и в абзаце 3- девятнадцать слов, имеющих общие корни в английском и в русском языках. Переведите их на русский язык*.

14.14 *Найдите в тексте модуля (абзацы 1, 2, 5 и 7) по одному герундию. Переведите их на русский язык.*

14.15 *Ответьте на вопросы к тексту*.

1. What is the most elementary form of aircraft navigation? 2. How can the pilot compute his position? 3. On what is another well-known method of navigation based? 4. What method is known as dead reckoning navigation? 5. Under what conditions can a pilot work out his present position and future course? 6. What are the independent systems of navigation? 7. What are the dependent systems of navigation? 8. On what principles does Doppler navigation system work? 9. On what fact is the inertial navigation system based? 10. Is a radio beam two-dimensional or three-dimensional?

2.15 Модуль 15

Лексико-грамматические темы:

1 Перевод терминологических сочетаний.

2 Паронимы.

3 Функции причастия I и II.

Термины:

escape velocity вторая космическая скорость

manufacturer изготовитель

market рынок сбыта

set up создавать

shock (-wave) drag волновое сопротивление

sonic boom звуковой удар

bow wave - головная волна.

break зд. - преодолевать

build-up - увеличение

challenge - сложная задача; проблема

circumvent - обходить

coast - лететь по инерции с неработающим двигателем

Supersonic flight

1 For many years the figure of 1,223 km per hour has had a special meaning for the people who work in the aviation industry. Within a mile or two it is the speed of sound through the air at sea level. It symbolizes the so-called "sound barrier".

2 To most aviation engineers this figure represented a formidable obstacle in the path of technical progress. Many of them thought that the obstacle was so great that it could never be overcome or circumvented. Others saw it as something different only in degree from the problems they had been facing for decades.

3 Wave drag, or shock drag as it is sometimes called, was the biggest sound barrier problem. These are the names aerodynamicists used to describe the increased resistance of the air caused by abrupt build-up of density at supersonic speeds.

4 When an aircraft is being flown at subsonic speeds, pressure waves moving ahead of it activate the air in its path and the molecules of air move aside to allow the aircraft to pass. These pressure waves move at the speed of sound. When the aircraft itself moves faster than sound the waves get left behind and the air ahead is not made to move out of the way.

5 Consequently, the aircraft strikes the air and sets up shock waves rather like the bow waves made in water by a ship moving at speed. It is formation of these shock waves that causes the sonic boom that is heard on the ground.

6 It appeared obvious to aviation engineers that if ever aircraft were to overcome the problem of shock wave drag much more engine power would be required. Largely because of problems of propeller design piston engines were no

good for breaking the sound barrier. Their efficiency began to fall off as aircraft speed increased above 560 kph.

7 Military aircraft led the way in developing the jet engine. The early jets were much too uneconomical for commercial operation and it was left to the military, who must have higher speeds and better performance with less regard for cost, to support their development.

8 Without doubt the biggest operational problem associated with supersonic flight, yet to be overcome, is the sonic boom. As an aircraft flies at speeds greater than sound it sets up two main shock waves, one at the nose and one at the tail. When these shock waves reach the ground the resulting sudden jump and fall in air pressure (the "over-pressure") is heard as the sonic boom.

9 Normally this sound consists of two distinct booms, heard in rapid succession, but in certain atmospheric conditions the sound merges into one boom. Two main factors influence the intensity of the boom. These are the weight of the aircraft and the height at which it is flying. The heavier the aircraft the louder will be the boom. The higher the aircraft is flying the more the boom will be reduced.

10 A focusing of several shock waves can occur during acceleration to and deceleration from supersonic speed. A supersonic airliner will normally produce the loudest boom during the acceleration phase.

11 During deceleration the boom will be much less intense because, by that time, most of the fuel will have been used up and the weight of the aircraft greatly reduced.

12 As supersonic aircraft are not likely to attain supersonic speed until 160-240 kilometers after take-off, by careful flight planning it should be possible to time the acceleration to supersonic speed so that it occurs over the sea or over sparsely populated land.

13 If the sonic boom will cause supersonic flight to be prohibited over well-populated land, there will still be a market for supersonic aircraft. More than three quarters of the earth's surface is ocean, and more than 40 per cent of the world's long-haul traffic is concentrated on the North Atlantic.

14 Whatever problems face the manufactures of supersonic airliners there is a hope that they will one day be overcome. The supersonic airliner is no longer a dream, no longer a mere challenge to the aviation engineer; it is possibly the airliner of tomorrow. In the 1970s air passengers may be able to travel at a speed of 2,335 kilometers per hour.

Упражнения

15.1 *Переведите словосочетания со следующими терминами из текста: acceleration, flight, flying, resistance*.

acceleration due to gravity, acceleration of gravity, acceleration of the earth, back-to-chest acceleration, backward acceleration, centrifugal acceleration, centripetal acceleration, chest-to-back acceleration, downward acceleration, drag acceleration, earth acceleration, foot ward acceleration, forward acceleration, gravitational acceleration, head-to-seat acceleration, headword acceleration, leftward acceleration, rightward acceleration;

accelerated flight, altitude flight, automatically controlled flight, blind flight, climbing flight, constant-level flight, cruising flight, curvilinear flight, day flight, day-light flight, demonstration flight, diving downward flight, enrooted flight, gliding flight, high-angle-of-attack flight, high-speed flight, high-temperature flight, hovering flight, hypersonic flight, instrument flight, intercontinental flight, jet flight, level flight, long-distance flight, long-range flight, low-altitude flight, low-speed flight, night flight, refueling flight, routine flight, scheduled flight, sea-level flight, sonic flight, spy flight, steady flight, straight flight, subsonic flight, supersonic flight, transonic flight, unsteady flight, VTOL flight;

bad-weather flying, blind flying, cloud flying, development flying, low flying, zero-altitude flying;

aerodynamic resistance, air resistance, frictional resistance, skin resistance, turbulence resistance, wave resistance.

15.2 *Прочтите и запомните наиболее употребительные паронимы (слова, близкие по написанию или звучанию, но имеющие разное значение).*

accept - принимать

adapt - приспособить

addition - прибавление, добавление

affect - воздействовать на, влиять на

also - тоже, также

area - площадь, зона

adopt - принимать, усваивать

except - исключать; исключая, за исключением

edition - издание

case - дело, случай

expand - расширяться

feature - черта, особенность

later – позже

principal -главный

quiet - спокойный; тихий

same - тот же самый

science – наука

vary - меняться, отличаться

effect - совершать, выполнять

although - хотя; несмотря на то, что

era - эра

cause - причина, основание

expend - расходовать, тратить

latter - последний из

quite - вполне, совсем, совершенно

some - какой-то, некий, несколько '

since - с, после; с тех пор; с тех пор как, так как, поскольку

then - тогда, потом, затем

very - очень

15.3 *Переведите предложения, обращая внимание на определение, выраженное причастием I.*

1. The forces acting on an airplane in flight are lift, weight, drag and thrust. 2. Air flowing around the cockpit makes a tremendous noise. 3. Food, water, air and electric supplies in the *Vostok* spacecraft were sufficient for a flight lasting up to 10 days. 4. The term "planets" will be applied here to nine celestial bodies orbiting around the Sun. 5. Tests simulating overland flights at various speeds are of great importance. 6. Decelerations are oppositely acting accelerations. 7. Despite the probable prospects of failure, let us observe existing information. 8. In preceding chapters of this book we have discussed the development and construction of turbo-jet engines.

15.4 *Переведите предложения, обращая внимание на обстоятельства, выраженные причастием I.*

a) 1. Applying the new methods of investigation mathematicians obtained quite extraordinary results. 2. Referring to figure 3 one can see that the airplane is flying straight and level in calm air. 3. Combining these two equations we get the following one. 4. Orbiting at an altitude of 22,300 miles above the Earth, in a synchronous or 24-hr orbit, a satellite has the same period of rotation as the Earth. 5. Neglecting the drag of the air we may write the working equation. 6. Using Autoland approach the performance of the airplane may be improved sufficiently. 7. The airplane cools itself giving off heat to the surrounding air. 8. On large platforms orbiting about the Earth men will live for long periods of time conducting scientific work, observing the heavens or assembling rockets for journeys into space! 9. The water flow rate was monitored visually using a stopwatch. 10. Numerical results have been obtained using equations.

b) 1. When discussing high-speed aerodynamics, we constantly refer to the speed of sound. 2. When describing a turbo-prop, turbo-shaft, or piston engine, the accepted unit for measuring the rate of doing work is horsepower. 3. When dealing with astronomical distances we find the change in gravity to be very significant. 4. When applying these two methods, consideration should be given to the physical phenomenon. 5. When reviewing a year's progress, it is natural to seek out the most significant event. 6. While coasting in Kepler orbits, liquid propellant floats in the tank.

15.5 *Переведите предложения, обращая внимание на перевод причастия II в функции определения:*

a) 1. Escape velocity is the velocity required to depart the gravitational field of an astronomical body. 2. The results of flights made by Soviet *Luna* automatic stations enriched science with new important data on the Moon. 3. High temperatures associated with space vehicle re-entry, and low temperatures associated with cryogenic propellants, present needs for special materials. 4. In a V/STOL aircraft the thrust required for vertical take-off is much greater than the thrust required for level cruise flight. 5. Planes designed to fly above the speed of sound have strong and thin wings.

b) 1. The structures considered are large and complex. 2. According to the data obtained the development flight of the prototype was successful. 3. Satisfactory results were obtained in every case investigated. 4. The masses of meteors are rather uncertain because of the difficulties involved. 5. Because of the cost involved and the high requirements for reliability, it is unlikely that new intermediate types of space launch vehicles will be developed in the next decade. 6. The amount of dry food required will depend upon the duration of a space flight. 7. The case shown characterizes a low-conductivity fluid. 8. The design shown has tapered wings. 9. Table 1 lists the numerical values of the parameters used. 10. Figure 6 is a drawing of the test apparatus used. 11. The results obtained permitted to formulate some

general statements. 12. The amount of heat generated depended on the quality of the fuel used. 13. The methods introduced received general recognition. 14. The temperature of the liquid obtained remained constant.

15.6 *Найдите в тексте модуля (абзацы 2 и 9) по пять слов, имеющих общие корни в английском и в русском языках. Переведите их на русский язык.*

15.7 *Найдите в тексте модуля (абзацы 4 и 5) по одному причастию II. Переведите их на русский язык.*

15.8 *Ответьте на вопросы к тексту.*

1. What figure symbolizes the so-called "sound barrier"? 2. Why did this figure represent a formidable obstacle to most aviation engineers? 3. By what is the increased resistance of the air at supersonic speeds caused? 4. What causes the sonic boom that is heard on the ground? 5. Why were piston engines no good for breaking the sound barrier? 6. At what speed did the efficiency of piston engines begin to fall off? 7. What factors influence the intensity of the boom? 8. When will a supersonic airliner produce the loudest boom? 9. Why will the boom be much less intense during deceleration? 10. At what speed may air passengers be able to travel in the 1970s?

Список использованных источников

1 Белоновская, И.Д. Командное взаимодействие как средство формирования конкурентного ресурса будущего техника / И.Д. Белоновская, Ю.В. Васильева // Современные проблемы науки и образования. - 2015. - №3. - С. 509.

2 Богомолова, А.Ю. Взаимодействие в развитии иноязычной речевой деятельности студентов нелингвистических специальностей / А.Ю. Богомолова, Н.В. Еремина // Интернет-журнал «Мир науки». – 2016. – Т.4. - №2. - URL: http://mir-nauki.com/PDF/50PDMN216.pdf

3 Бондаревская, Е.В. Введение в педагогическую культуру / Е.В. Бондаревская. – Ростов-н/Д, 1995. – 203 с.

4 Бочкарева, Т.С. Формирование иноязычной компетенции студентов в информационном поле кросскультурного взаимодействия / Т.С. Бочкарева // Современные исследования социальных проблем (электронный научный журнал). – 2015. - №6. DOI: 10.12731/2218-7405-2015-6-27

5 Витвицкая, Л.А. Развитие взаимодействия субъектов образовательного процесса университета: монография / Л.А. Витвицкая. - М.: Дом Педагогики, 2009. - 283 с.

6 Еремина, Н.В. Самостоятельная работа студентов с фонематериалом в условиях неязыкового бакалавриата / Н.В. Еремина // Университетский комплекс как региональный центр образования, науки и культуры: Материалы Всероссийской научно-методической конференции. - 2014. - С.2728-2732.

7 Иванова, С.Г. Методика использования подкастов в процессе обучения иностранным языкам в университете / С.Г. Иванова, Е.В. Дмитриева // Вестник Оренбургского государственного университета. - 2016. - №2 (190). - С. 20-25.

8 Кабанова, О.В. Этапы обучения речевому общению будущих инженеров на занятиях по иностранному языку / О.В. Кабанова, Г.В.

Терехова, Т.С. Бочкарева // Современные наукоемкие технологии. - 2017. - №1. - С.99-103.

9 Каган, М.С. Философская теория ценности / М.С. Каган. – СПб.: Петрополис, 1997. – 205 с.

10 Каргапольцева, Н.А. Формирование инновационной образовательной среды взаимодействия общего, дополнительного и профессионального образования в пространстве университетского округа / Н.А. Каргапольцева // Университетский комплекс как региональный центр образования, науки и культуры: Мат-лы Всерос. научно-методической конференции. - 2014. - С. 3746-3750.

11 Кирьякова, А.В. Аксиологический инструментарий развития инновационной образовательной практики современного университета / А.В. Кирьякова, Т.А. Ольховая // Инновации в науке. – 2012. - №9. – С. 62-73.

12 Коломинский, Я.Л. Изучение педагогического взаимодействия / Я.Л. Коломинский // Советская педагогика. – 1991. – №10. – С. 36 – 42.

13 Коротаева, Е.В. Педагогические взаимодействия и технологии / Е.В. Коротаева. - М.: Academia, 2007. - 256 с.

14 Крапивина, М.Ю. Технологические аспекты обучения студентов иноязычному профессионально-ориентированному общению / М.Ю. Крапивина, Т.С. Бочкарева // Дискуссия. – 2016. - №6(69). – С. 130-136.

15 Ксенофонтова, А.Н. Интернет-диалог и медиа-взаимодействие в развитии речевой деятельности студентов / А.Н. Ксенофонтова // Вестник Оренбургского государственного университета: приложение «Гуманитарные науки». - 2005. - № 12. - С. 54-59.

16 Ольховая, Т.А. Субъектно-ориентированные технологии профессионального образования / Т.А. Ольховая // Университетский комплекс как региональный центр образования, науки и культуры. Материалы Всероссийской научно-методической конференции. - 2014. - С. 2642-2646.

17 Рул, А.А. Взаимодействие старшеклассников на уроках иностранного языка нетрадиционных форм, направленных на развитие иноязычной компетенции / А.А. Рул // Филологические науки. Вопросы теории и практики. - Тамбов: Изд-во «Грамота», 2014. - №4. - Ч.3. - С.180-183.

18 Рындак, В.Г. Креативная личность как ценность: научно-этическое сопровождение развития / В.Г. Рындак // Известия Волгоградского государственного педагогического университета. - 2016. - №4(108). - С. 7-14.

19 Сахарова, Н.С. Развитие полиэтнической компетентности студентов университета в процессе кросскультурного взаимодействия / Н.С. Сахарова, В.В. Томин // Вестник Оренбургского государственного университета. - 2015. - №2. - С.144-152.

20 Темкина, В.Л. Речевая образовательная ситуация в формировании лингвокоммуникативной культуры студента в иноязычном деловом общении / В.Л. Темкина, М.Ю. Фадеева // Вестник Оренбургского государственного университета. - 2011. - №11(130). - С. 237-243.

21 Терехова, Г.В. Билингвизм - к вопросу об изучении иностранных языков как средства межкультурной коммуникации / Терехова Г.В. // Вестник Оренбургского государственного университета. - 2002. - № 6. - С.123-128.

22 Терехова, Г.В. Самостоятельная деятельность студентов в условиях уровневого образования / Терехова Г.В. // Университетский комплекс как региональный центр образования, науки и культуры Материалы Всероссийской научно-методической конференции. - 2014. - С. 2768-277.

23 Томин, В.В. Дидактические принципы использования информационного поля в условиях кросскультурного взаимодействия / В.В. Томин // Современные наукоемкие технологии. – 2016. – № 5 (часть 3) – С. 605-609.

24 Томин, В.В. Технологии взаимодействия как фактор развития речевой деятельности студентов: Автореф. дис. … канд. пед. наук. - Оренбург, 2006. - 22 с.

25 Томин, В.В. Формирование межкультурной толерантности студентов как фактор продуктивного кросскультурного взаимодействия / В.В. Томин // Современные проблемы науки и образования: электронный журнал, 2015. - №1; URL: www.science-education.ru/121-17779 (Дата обращения: 31.05.2015)

26 Янкина, Н.В. Взаимосвязь культуры и образования как характеристика современной образовательной парадигмы / Н.В. Янкина // Международный научно-исследовательский журнал. - 2012. - №5-3(5). - С. 62-63.

27 Eremina, N.V. University students' self-development through the online cross-cultural interaction in the foreign language information field / N.V. Eremina // Bulletin of the Orenburg State University. - 2016. - №1(189). - C. 71-75.

28 Stukalova, O. Cultural and educational environment of poly-national scientific creative groups: developing potential and principles of creation // O. Stukalova, T. Ilkevich, S. Ostanina, et al. – Man in India. – 97(14). – 2017. – Pp. 173-183.

29 Terkhova, G.V. Intercultural Adaptation of Students in the Information Field of Cross Cultural Interaction / GV Terkhova, NV Eremina, et al. - Global Media Journal. - 2016, S2: 7.

30 Williams, T.R. Exploring the impact of study abroad on students' intercultural communication skills: Adaptability and sensitivity / T.R. Williams // Journal of Studies in International Education. – 2005. – № 9(4). – Pp. 356 – 371.

31 Zielinksi, B.A.Z. Study abroad length of program influence on cross-cultural adaptability / B.A.Z. Zielinksi // Unpublished master's thesis, Virginia Polytechnic Institute and State University, Blacksburg, VA, 2007. – 58 p.